

Analyzing the Effects of Urban Sprawl on the Decrease of Green Cover in Jalandhar City

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Abstract

From the past few years, urban sprawl has increased significantly due to growth of urban population in developing nations. The continued excessive growth of population in the urban areas is due to rapid development in these areas and availability of employment opportunities in urban areas, which has contributed to urban sprawl and due to this cause, the cities losing their actual territories, their borders and creating a range of regional forms that have not taken into account their environmental footprint. Thus, this century experienced a high growth of urban sprawl as the initial primary urban form. Urban expansion and urban development are the challenges, which are facing by the today's urban areas due to the negative social, environmental and economic impacts in the cities.

The rise of population in Punjab is about 13% from 2,45 crore in 2001 to 2,77 crore in 2011. Decadal census shows that the proportion of urban population rose from 33.9 percent in 2001 to 37.5 percent in 2011. According to census data, there was an increase in the percentage of population in urban areas in all districts in Punjab. About two-thirds of Punjab's population lives in rural areas. Nearly half of the urban population of Punjab live in four districts: Ludhiana (59.16%), Mohali (54.76%), Amritsar (53.58%) and Jalandhar (52.93%). In Jalandhar, the compound annual growth rate (CAGR) of the urban population was 2.3% in 1961-71, 3.4% in 1971-81, 1.9% in 1981-91, 3.5% in 1991-2001 and 2.0% in 2001-11 [20]. This positive rate of growth in Jalandhar City is primarily due to the continuing migration of people from rural areas and other parts of the country and from smaller towns to larger cities in search of better opportunities for employment and better living standards. Availability of better infrastructure, education & health facilities, and employment opportunities in urban areas act as pull factors for rural population. Spatial urban sprawl analysis is therefore a prerequisite for curbing unplanned urban growth and ensuring sustainable living. This continues increase in population and migration towards urban areas resulted in the loss of fertile farming lands, open green spaces and vegetation being lost.

Keywords: Urban Sprawl, GIS, Remote Sensing, Urban Forms, NDVI.

1. Introduction:

Urban sprawl or sprawling suburbs primarily relates to uncontrolled expansion across vast areas in several urban areas with residential and commercial buildings, infrastructure improvements and highways, with less regard for urban development and planning. Urban sprawl has several adverse effects on people and the community, like pollution in air and water quality, massive traffic collisions and delays, lack of farming land and capability, increasing in dependency of vehicles and reducing the walkability culture. Increase the usage of resources like as electricity and other physical infrastructure. It also effect badly by increase the pollution in the city and create hindrances in traffic mobility of the city on major roads, as well as a decline in unique and cohesive culture. Urban sprawl relates to the transformation into urban fabric construction of vacant land or natural environment, including the development of residential, industrial and equipment. It mostly happens in urban areas (Shenghe and Sylvia, 2002) [21]. This is the spatial representation of the systemic criteria, basically from agricultural activities to industrial activities (Chan and Kam, 1994) [27]. The sprawl generally

happens along linear direction or along radial direction around a city centre or along highways. Spreading generally takes place on the outskirts of the urban area or along transport routes. Urban sprawl mapping clearly helps to identify areas where environmental and natural resources are at danger and to suggest future directions and vast growth patterns. One such phenomenon is the scale of urban sprawl that drives changes in patterns of land use. During the 1991-2018 periods, an attempt is being made in this study to map urban sprawl and quantify land-use changes in and around Jalandhar City.

While looking at the Earth from space is now crucial to understand the effect of human activities on its natural resources base over time. Earth observations from space provide comprehensive information on human use of landscape when land use changes are rapid and often unrecorded. Facts from remote sensing images have been critical in mapping the earth's features and infrastructures, managing natural sources and analysing environmental changes over the past decade. Urban centre development is a worldwide phenomenon and one of the 21st century's most distressing issues. Built-up areas in the city have seen important changes in land use and size owing to urbanization, fast population growth and a growing need for economic growth. Mainly the urban areas have become more densely populated and suburban sprawls have dramatically enhanced urban limits and have not only displaced agricultural and forestry lands, but also mixed them with rural lands. In many metropolitan regions, high population density exceeds the limit for urban settlement definition [12]. The vibrant effects urban growths are shifting from local to regional and global. This has occurred in various ways, such as urban heat islands, irreversible harm or depletion of natural resources, rising greenhouse gases, increasing urban environmental issues, such as flooding and sprawl [12].

Mainly urban sprawl also effect on the economic development at local level and even urban sprawl has their bad effects on the environment (for people who use to live in the existing environment) by increasing different types of pollution like as land, air and water with increased traffic deaths and delays, loss of agricultural capacity, increased reliance on automobiles etc.

These have been the main problem of domestic and global bodies because they reduce environmental efficiency and threaten human well-being. In Jalandhar City, mainly two different forms of developments are start increasing with continue increase in the population and migration in the Jalandhar City with the passage of time, which are describe as below:-

1.1. Leapfrog Development

Leapfrog's development is a sort of distributed type of urban development when developers build new residential areas some distance from existing urban regions. In other words, by placing vacant lands near the urban built-up area, extenders jump from an urban built-up area to another area. In addition, developers may decide to build new urban areas on less expensive land rather than on more expensive lands nearby (Holcombe & Pope & Bast, 1999) [23].

Multiple factors induce this sort of sprawl development, including physical geographical or geomorphological factors such as raw land, marshes, mineral lands or water bodies etc. (Barnes, & Morgan, & Roberge, & Lowe, 2010) [24]. However, the prices of land outside of an urban area are cheap in these types of projects like as building housing units. In this scenario, many people have taken on longer public transport journeys for simpler and more convenient access to much cheaper residential units. Furthermore, smooth development creates vacant lands where a perfect location for business activities such as offices, shops, cafés and restaurants is generated (Holcombe & Pope & Bast, 1999) [23]. Mainly there are many other variables that encourage the development of leapfrog sprawl, but they are definitely not physical only, for example, distinctive land-use strategies can contribute to the development of "springing" to development. (Barnes, & Morgan, & Roberge, & Lowe, 2010) [24].

According to numerous researches carried out by scholars, the leapfrog development owing to its infrastructure and growth basis led in several issues, such as some extra costs, longer distance traffic and more traffic congestion (Holcombe & Pope & Bascreate T 1999) [23]. Consequently, one of the main problems with leapfrogging is that car dependency increases and people prefer to use the car instead of walking or cycling between the two developed areas [2]. In Jalandhar city mostly on the Hoshiarpur road, Amritsar road, Nakodar road and Kapurthala road has many new areas on developing stage as the example of leap frog development in the Jalandhar City or especially on the periphery areas because the costs of property are smaller, accommodation is more competitive in these towns. In preference for more convenient, cheaper housing, certain individuals agree to accept longer journeys [23].

1.2.Strip or Ribbon Developments

The development of industrial strips is any other type of urban sprawl that works "amazing arterial roads covered with shopping centres, gas stations, fast food locations, power-thru Banks, workplace complexes, parking masses and many major symptoms" (Gillham, 2002, p. 5) [25].

Strip development entails continuous commercial development through a public highway with these of the following features: wide road front, prevalence of single-story buildings, minimal dependence on common road access, lack of connections to any established community either by highway, lack of connections to surrounding land use other than by highway, lack of flexibility with surrounding land use and minimal mobility for pedestrians [26]. This form of growth has its own advantages, including bringing together businesses such as 'fast-food restaurants and big chain shops that depend on heavy vehicle traffic' as well as this sort of sprawl development reduces distances that cars have to move from shopping store to other shops. There is quite little traffic between the main points on suburban roads in this regard. According to recent research, strip development causes several problems, but the main cause is bad planning. Therefore, this sort of widespread development with "spread out" nature, like other types, creates road traffic because customers and employees enter and leave the roads as well as car trips between distributors and pedestrians' needs are not taken into consideration at all (Arbury 2005; Holcombe & Pope& Bast 1999) [2], [23]. The road from Rama mandi to Jandusinga is developing as the example of ribbon development and there are many other examples like as Hoshiarpur road and Ludhiana road (NH 1) in the Jalandhar City. But when this kind of development is going in the outer city areas without proper environment conservation planning process, then it mainly effect badly in the Jalandhar city by reducing the green subways, green walkability paths and even the trees buffer line along the roads.

1.3.Study Area

Jalandhar city area is situated in central-northern portion over Punjab in India with location coordinates near to as 31° 19' N latitudes & 75° 18' E longitudes. Jalandhar city is an historic metropolis among the upper Indian ruler on Punjab. It's domestic in accordance with Devi Talab Mandir, a centuries-old Hindu house devoted according to the goddess Durga, along a pond regarded holy through devotees. The whitewashed Gurdwara Chhevin Patshahi is a region concerning reverer because of Sikhs. It stands at 56th function amongst Indian metropolitan cities. The quantity of population in Jalandhar city is 8.62 lakhs as per census 2011. The city varieties piece on the Trans Indo Gangetic plain, topography is virtually lucid or the ground is altogether fertile into the area. It is the hub of Medical institutes and Hospitals in Punjab and also called as the NRI City of Punjab. Maximum temperature varies beside 19.4°C of January (winters) and 40°C in May then June (summers). The minimum temperature varies from 6.2°C within January (winters) and 25°C in May then June (summers). The area received an average annual rainfall concerning as 569 mm. Maximum

rainfall is received beside the southwest monsoon. It is basically said to main hub for all economic activities and Sports goods industries in Punjab [7].

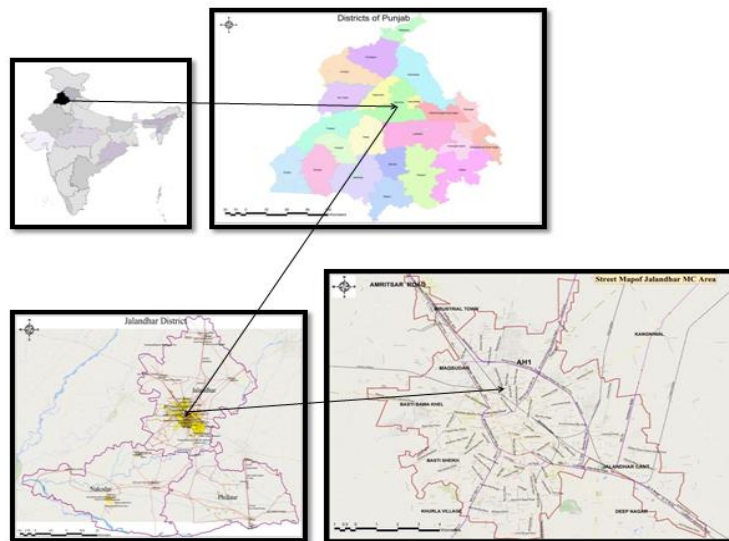


Figure 1: Location of Jalandhar City in India
Source: Maps prepared by the Author itself.

Table 1: Data Used

Data	Path and Row	Year	Spatial resolution/scale (m)	Source
Satellite images				
Landsat TM	148, 038	September, 1991	30	Earth Explorer
Landsat ETM+	148, 038	April, 2011	28.5	Earth Explorer
Landsat ETM+	148, 038	November, 2011	28.5	Earth Explorer
Landsat ETM+	148, 038	December, 2018	28.5	Earth Explorer
Additional Data				
Jalandhar Boundary	-	2011	-	JMC
Road Layer	-	2019	-	Google Earth

2. Aims and Objectives:

The reason for these studies is to create a land use / land cover map of Jalandhar City in separate years to identify changes that have occurred, specifically within the built-up land and finally within the built-up land, and to successively evaluate the urban spread of the different periods of time and to predict population growth and urban growth in the same era (1991-2018).

The objectives of the study are:

- ☐ To analyse Jalandhar City's urban sprawl integrated with vegetation index.
- ☐ Monitoring changes in land use in urban areas between 1991 and 2018 integration with change in vegetation area of Jalandhar City.

3. Data and Methodology:

This research requires satellite imaging for the study region for the years 1991 and 2018. The images are downloaded using the USGS Earth Explorer. For the development of land use/land cover maps, ARGIS software is used to process image and image analysis.

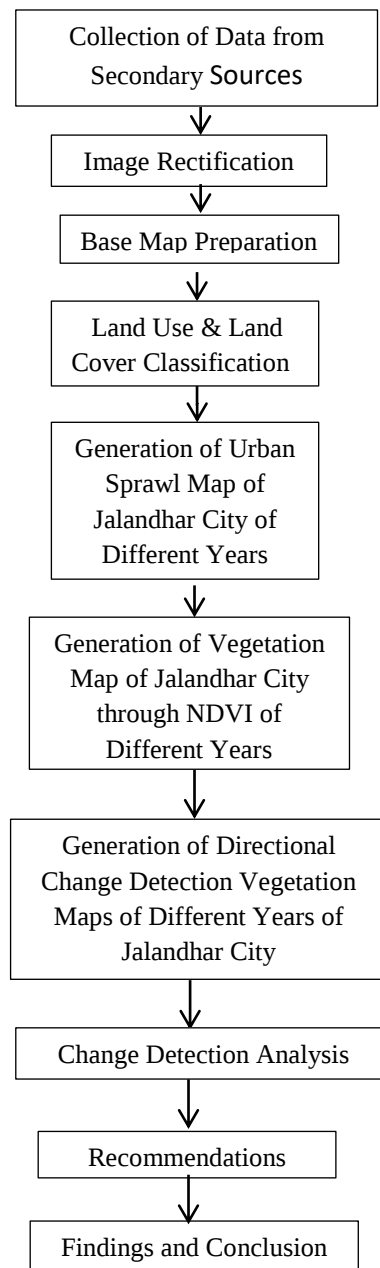


Figure 2: Methodology framework.

First procured the 4-year multi-temporal pictures (1991, 2001, 2011 and 2018) are chosen for urban growth or urban sprawl evaluation and obtained from the U.S. Geological Survey's (USGS) terra Explorer website because it is the sole source of sufficient civilian information. The second reason these pictures were selected was their arrival at similar resolution. There were also few additional facts obtained for the research. All the chosen data information is well provided in table 1. The technical program in GIS software is used with its assessment to classify and process images. The software ArcGIS (10 version) is extremely consistent with spatial analysis software, yet it generates

thematic layers. At the level of the array, the maximum probability algorithm was applied to the images over supervised classification. This algorithm is based on opportunity in order to categorize each pixel according to a specific class. The entire pixels were categorized by generating concentrated regions for each class. At the moment of classification, mainly four categories were regarded: built-up area, vegetation or farmland, open spaces and water bodies (which are well described in table 2).

Table 2. Description of land use/cover classes

Land use/cover	Description
Urban or built-up area	Residential, commercial, and services and industrial, road, other means of transportation and urban features
Vegetation land	Forest, scattered trees, parks
Agriculture	Agriculture, Plantation
Open space/vacant land	Exposed soil, Landfill sites, Area of active excavation, Open space in built-up land
Water body	River, lakes, ponds, reservoirs, etc.

The post-classification technique was mainly used to detect changes in land use / land cover (LULC). To prepare the modification detection map and directional change detection maps using 8 instructions (North, East, West, South, North East, North West, South East and South West) a pixel-based assessment of all the pictures from distinct years using distinct instruments in ArcGIS (Version 10) and quantifying the modifications more effectively. In order to quantify the modifications due to the 28-year period (1991–2018), the use of cross-tabulation matrix was contrasted with classified pictures concerning pairs of exceptional decade's information. The change matrix involves the directional change matrix and with the use of ERDAS software the encroachment map was produced. The shift matrix showed the gains or losses throughout 1991–2018 between each land use/cover training. Field facts have been collected in accordance with two purposes. First, to obtain sample points from fields. The sample points was used to correct the misclassified areas by using ERDAS Imagine alternative recode software Second, to describe the accuracy of the mapping of classified pictures. Table 3 demonstrates the alignment precision results. Mainly, urban development is governed by partial location variables of just as much scale as urban centers or significant highways are morally controlled. As the distance between urban centers and highways reduces, the proximity to the built-up area is quickly increasing [3].

Table 3. Mapping accuracy of land use/cover

Land use/cover	Overall accuracy (%)	Kappa coefficient
1991	84.63	0.7152
2001	86.45	0.7523
2011	83.94	0.7174
2018	82.33	0.7044

Source: Computed Values

4.0. Results and Discussion:

4.1. Land use/land cover images Look at the land use and land cover of the area after pre-processing and managed form showing the classified pictures collected. The red color is the built-up area, the dark green color is the vegetation area, the blue color shows the water bodies and the yellow color indicates the other characteristics [5].

In table 3 general accuracy and coefficient of Kappa for all classified images. Random sets of different samples were produced for better classification results. Classification results were compared

with actual information classes using reference images. Due to coarse classification, only four classes were used in this study; hence higher accuracy was obtained [5].

The results indicate that both profit and loss occurred in the land use / cover pattern of Jalandhar City. The classified land use/cover maps depict that the total built-up area for 1991 was 34.60 sq. km. It increased to 39.29 sq. km by 2001, 48.47 sq. km by 2011 and finally reached 53.36 sq. km in 2018 but on other hand the green cover in year 1991 is near to 19.79 sq.km in Jalandhar City, in 2001 the green cover is decrease to 13.79 sq.km. and in year 2011, the green cover is again decreased up to 12.18 sq.km. and in year 2018, the green cover is again decreased too much up to 6.025 sq.km as shown in table 5. Finally, from year 1991 to 2001, the built up is increased by 4.36 sq.km. in Jalandhar City but the green cover is decreased by 6.008 sq.km then from year 2001 to year 2011, the built up is again increased by 9.18 sq.km but green cover is decreased by 1.61 sq.km from last decade and from year 2011 to year 2018 the built up is again increased by 4.88 sq.km but green cover is decreased by 6.155 sq.km from last decade as shown in table 4, 5 & 6. Which shows that with rapid increase in the rate of built up in the Jalandhar city tends to effect badly by the decreasing of green cover area or vegetation in Jalandhar City. Mainly there are leap frog development and ribbon development is constructing more on the Hoshiarpur road, Nakodar road and Kapurthala road in the Jalandhar City. Which mainly tends to increase the urban sprawl on the main arterial roads, State highways and on the periphery regions of the Jalandhar city. These kinds of developments decreases the walkability paths and pedestrian subways in the city and tends to increasing or boosting the car or four wheeler vehicular system in the city but side by side this thing also effect badly on the green paths, green areas, green subways and vegetation on the periphery of the Jalandhar.

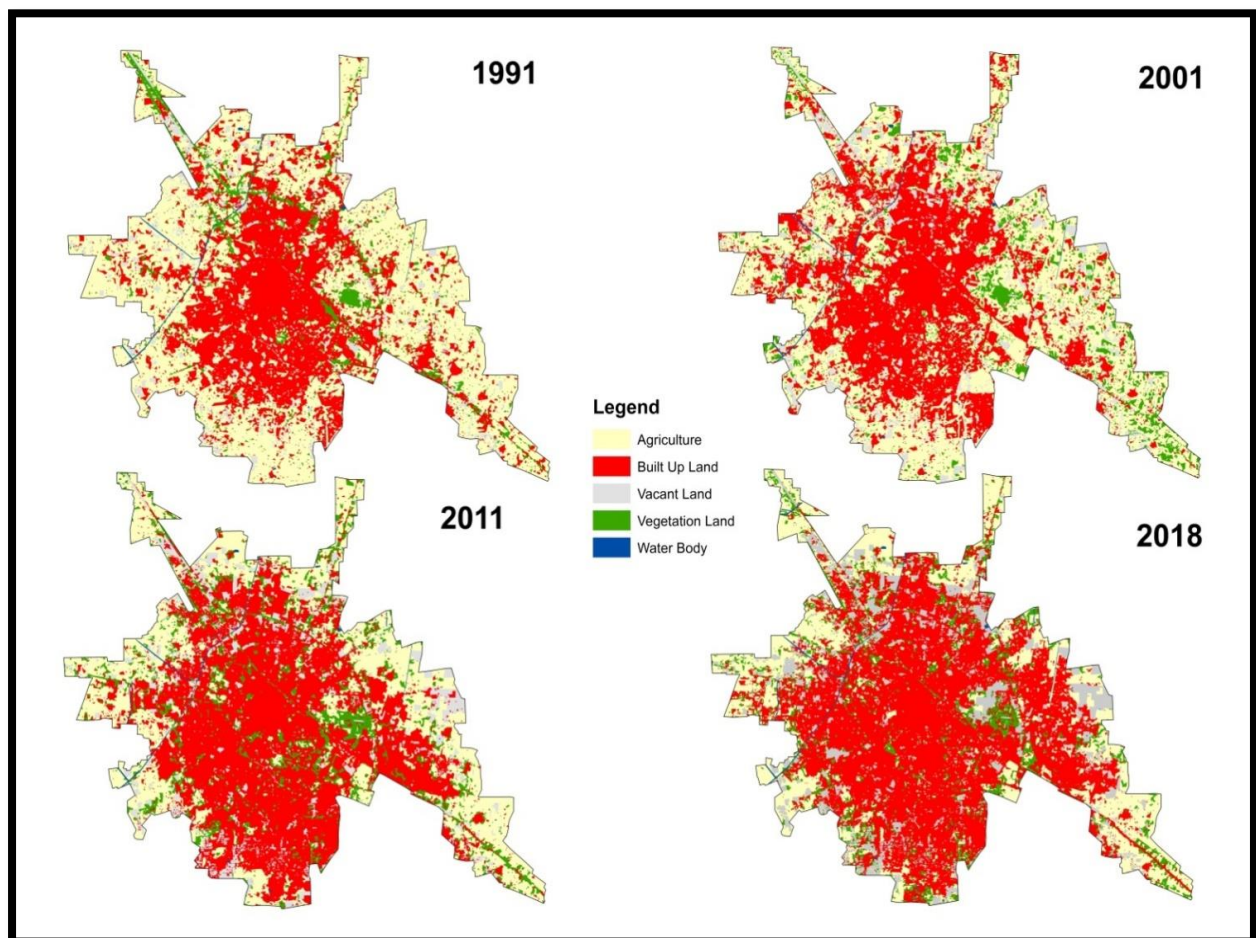


Figure 3. Land use/cover status during 1991–2018 in Jalandhar city.

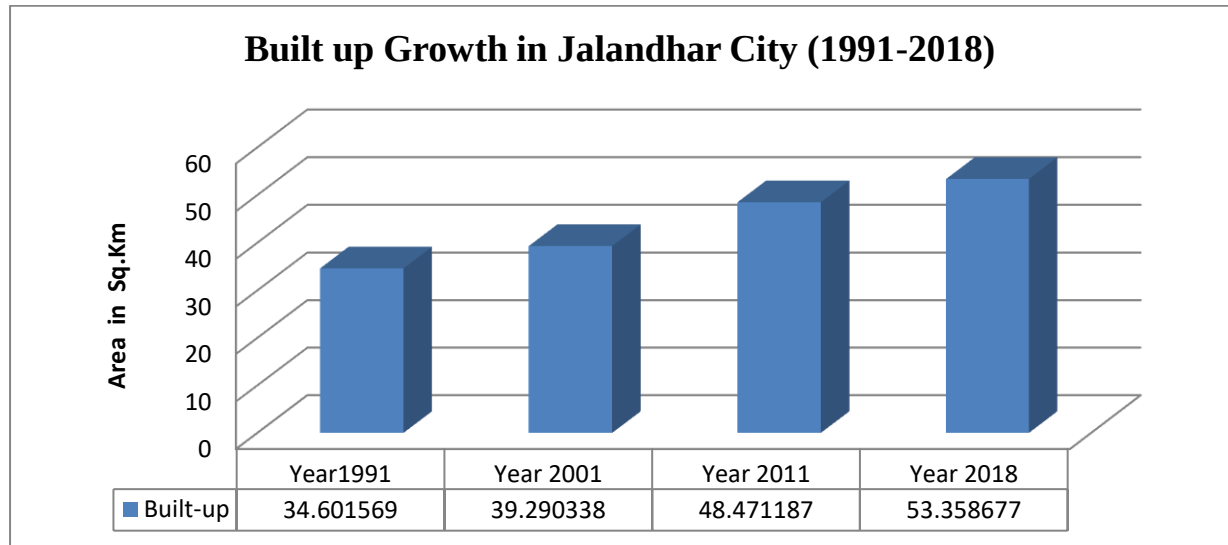


Figure 4.: Increase of Built up areas in Jalandhar City (1991-2018)

Source: Computed Values from Landsat TM and ETM+ satellite data for 1991, 2001, 2011 and 2018.

Table 4. : Urban growth statistics (Jalandhar city during 1991–2018)

Year	Built-up area (sq. km)	Increase in built-up area (sq. km)	Percentage increase in built-up area
1991	34.60		
2001	39.29	4.36	12.60
2011	48.47	9.18	25.29
2018	53.35	4.88	10.06
1991-2018		19.35	55.92

Source: Landsat TM and ETM+ satellite data for 1991, 2001, 2011 and 2018.

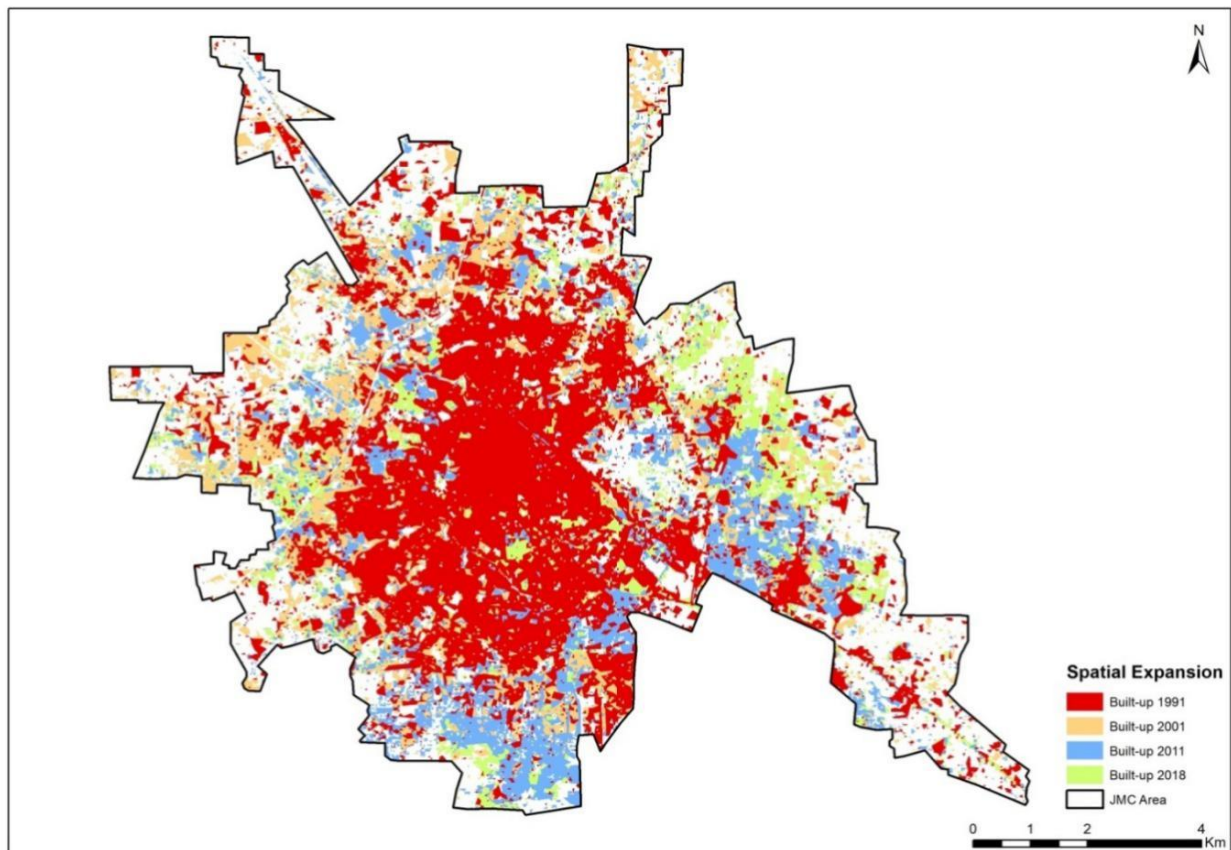


Figure 5. Spatial expansion of built-up area during 1991–2018 in Jalandhar city.

From 1991 to 2018 (28 years) all 8 paths under each category are detected in the region. In which one thing is demonstrated in the east (2.7 sq. km in 1991 and 6.64 sq. km in 2018) and in the south (7.5 sq. km in 1991 and 11.8 sq. km in 2018). Have more development over the previous 28 years in built-up regions or more urban growth relative to other directional change detection. The northern direction (3.1 sq.km in 1991 and 4.1 sq.km in 2018) and the north-eastern direction (2.4 sq.km in 1991 and 3.2 sq.km in 2018) have less urban growth from last 28 years. From 1991 to 2018, most of the agricultural property has been transformed into eastward (4.11 sq. km) and southward (4.5 sq. km) buildings. Thus, from the information obtained from the image classification with directional change detection of Jalandhar city, it is noted that the East and South direction of Jalandhar city have increased urban growth in the last 28 years or 3 decades (from 1991 to 2018). Which effect the directional change in green cover area of the Jalandhar City, which is decreasing since from 1991 with increase in the migration of peoples permanently from the poor states or town in Jalandhar City for finding their appropriate work or jobs. Due to increase in the NRI's (Non Residential Indians) in Jalandhar City and location of the Jalandhar City (located centrally in Punjab State), the high trend commercial places and residential areas are continue increasing in Jalandhar City like as Model Town, GTB Nagar and Football Chowknk etc. as well as people starts to live in this city because it is easily accessible and more approachable city from anywhere and anytime throughout North India by road transportation and Railways. Jalandhar City is also the medical hub of Punjab due to PIIMS medical Hospital and Institute and many other famous hospitals due to which the migration rate of people are increasing day by day for getting their jobs especially in Hospitals or medical fields. Due to these many reasons the Jalandhar City is act as magnetic city for the migrants. But this haphazard increase in built up effect badly the green cover of Jalandhar City.

4.2. Change detection analysis:

The dominant causative factors of the different types of land degradation were acknowledged in this assessment and also collected from the accessible technical documents. Urbanization in the areas studied is the main type of human-induced land degradation. These degradation factors were assessed using multi-date satellite images to demonstrate modifications for human-induced soil degradation that occurred during the 1991 and 2018 period. Built area in 1991 covered 34.60 sq.km. In 2018, the region being built will improve dramatically, covering 53.55 sq.km [5]. Landuse / land cover maps have been prepared and the major changes have been to keep precious and limited green area land, this problem needs serious study across multi-dimensional fields. This problem needs to be studied seriously through multi-dimensional fields in order to preserve useful and limited vegetation and green area land. In this work, the urban sprawl evaluation of Jalandhar City and its surroundings using remote sensing and GIS techniques is demonstrated. Based on this research, the results analyses lead that, the built area covered 34.60 sq.km in 1991, while constructed area is expanded in 2018, covering 53.55 sq.km and other side the vegetation and green area has been decrease from 19.79 sq.km in 1991, 13.79 sq.km in 2001, 12.18 sq. km in 2011 to 6.025 sq.km in 2018. The increase in the built up area in Jalandhar City effect the decease of vegetation and green area land near to 30.44% from 1991 to 2018 as shown in table 6 and table 7.

4.3. Settlement and Built-up Land:

The land with settlement and built-up rose from 34.60 sq.km to 53.55 sq.km rise. Urban sprawl is seen primarily in the northern, north-eastern and eastern hinterland of Jalandhar city as shown in figures 4 and 5.

4.4. Green Area:

Green area land or vegetation land decreased by 19.79 sq.km in year 1991 to 6.025 sq.km in year 2018. Urban sprawl is seen primarily in the northern, north-eastern and eastern hinterland of Jalandhar city as shown in figure 6, 7, 8 and 9. As per the directional change detection through NDVI, it is shown in figure 10, 11, 12 & 13 that East and South East direction are most affected because vegetation is decreases in East direction from 3.38 sq.km in year 1991 to 0.65 sq.km in year 2018 and in South East direction from 3.23 sq.km to 0.84 sq.km due to urban sprawl. South East direction of Jalandhar City includes the areas like as Ramamandi, Birring, Paragpur and Deep Nagar etc., East direction of Jalandhar City includes the areas like as Kaki Pind, Dhilwan, Wazir singh enclave and Ladhewali road etc.

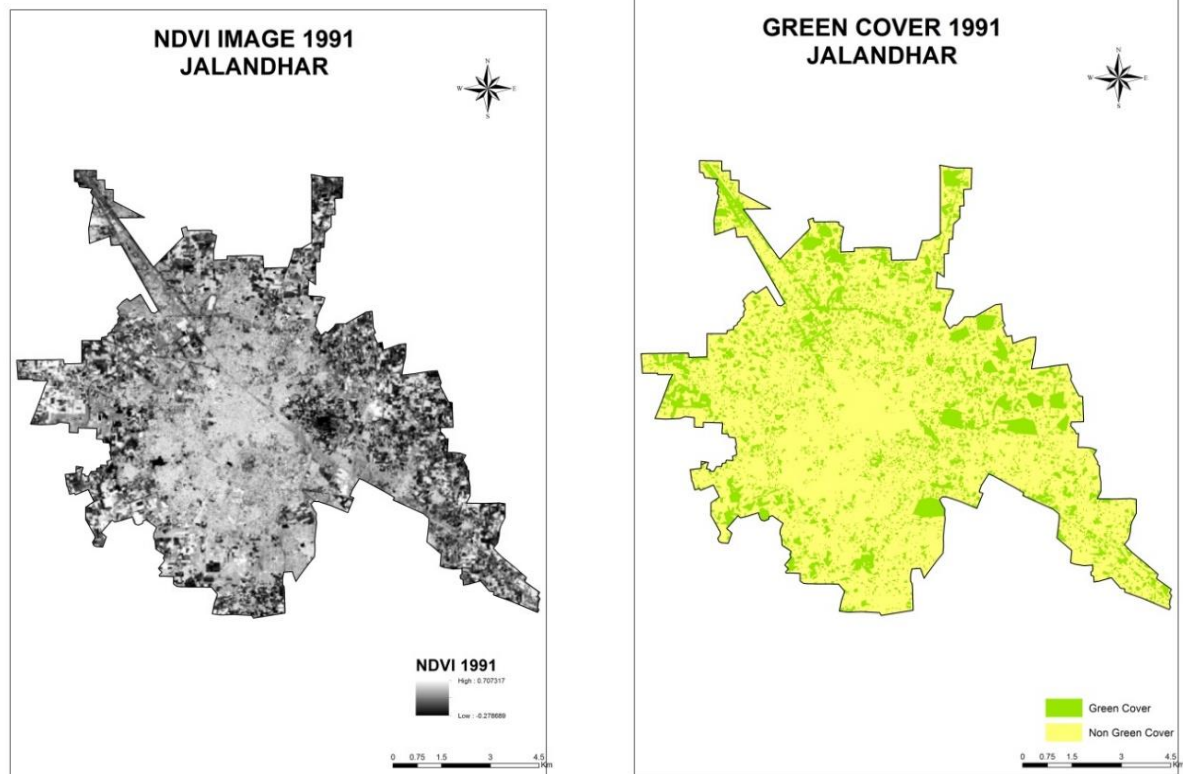


Figure 6. NDVI image of Jalandhar City of 1991

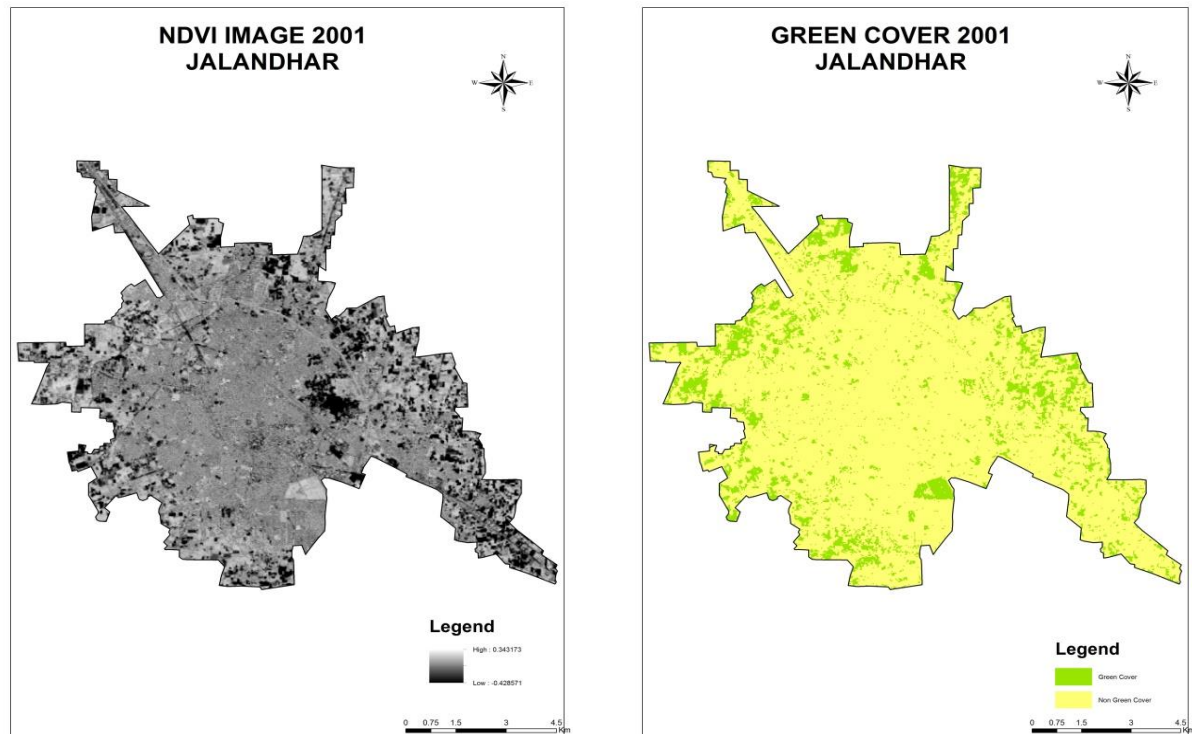


Figure 7: NDVI image of Jalandhar City of 2001

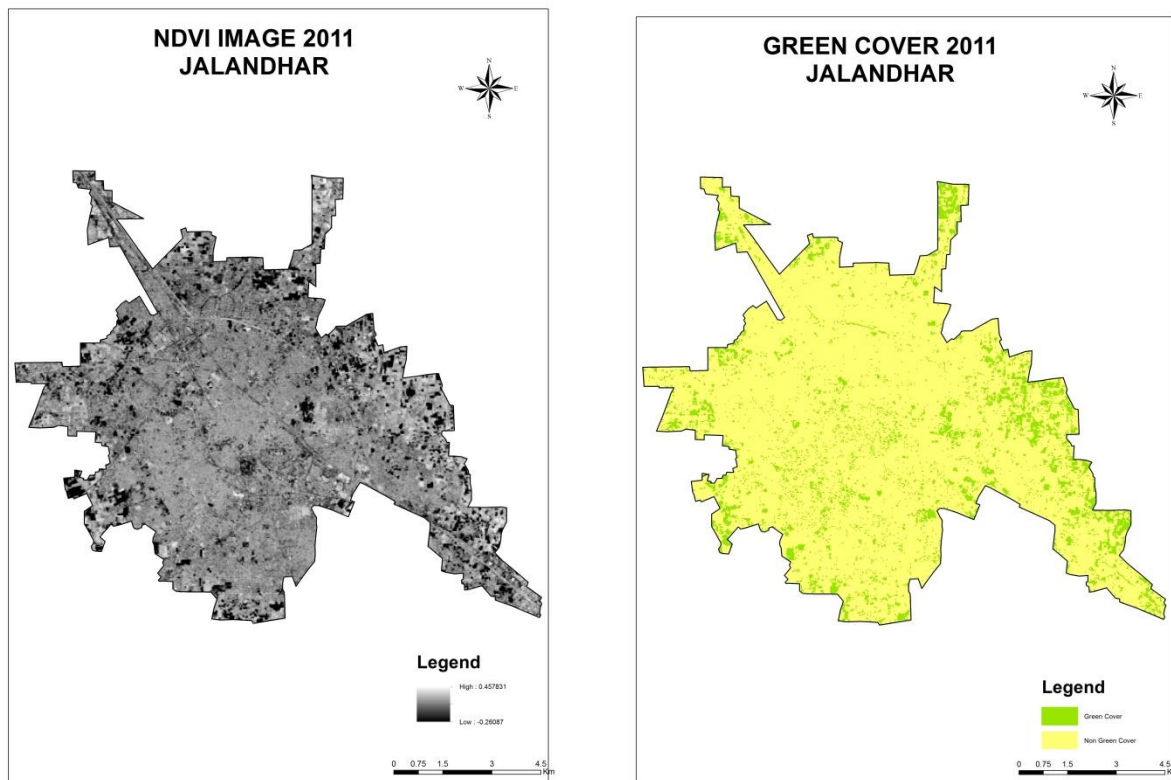


Figure 8: NDVI image of Jalandhar City of 2011

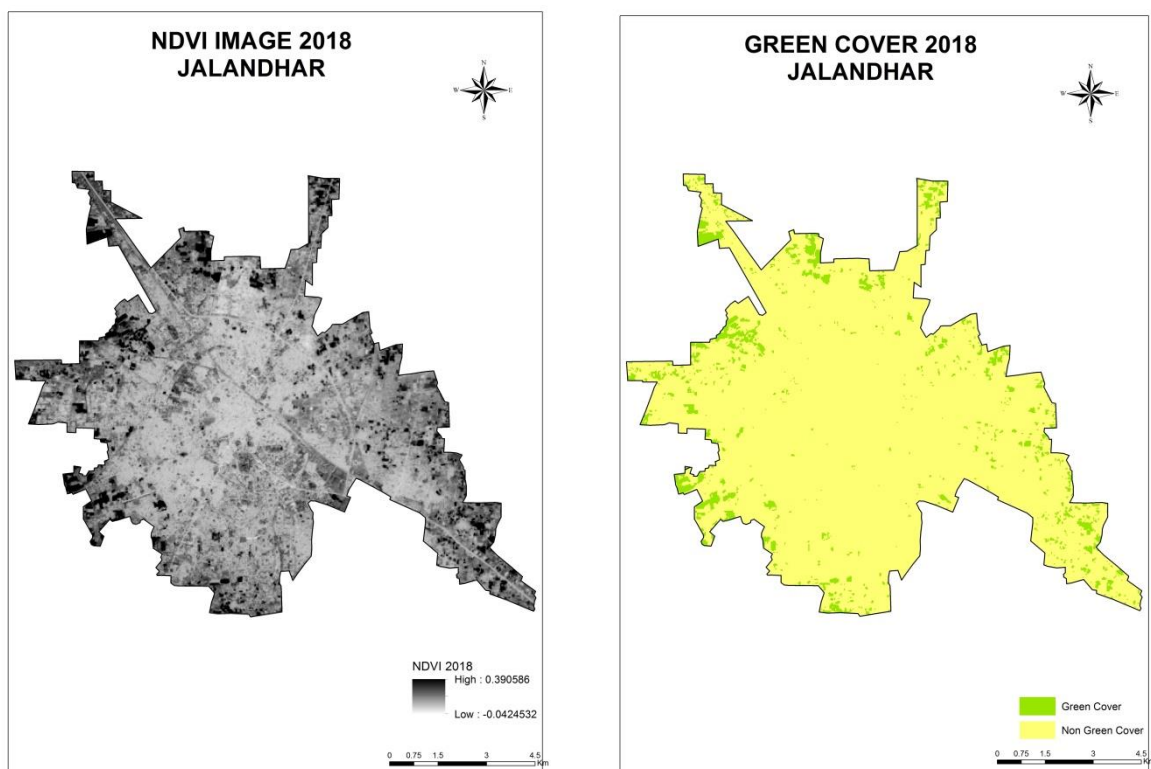


Figure 9: NDVI image of Jalandhar City of 2018

The areas or directions like as North East direction areas and South West directions areas has already less vegetation as compare to other directions as shown in tables 6,7,8 & 9. North East

direction has vegetation 1.74 sq.km in year 1991 & 0.37 sq.km in year 2018 and South West direction has vegetation 1.83 sq.km in year 1991 and 0.95 sq.km in year 2018. North East direction includes the areas like as Gurunanak Pura, Chaugitti area, Prithavi Nagar area and Nurpur. South West direction includes Mithapur, Khurla Kingra and Urban Estate etc. In the below 8 directions wise maps of Jalandhar city, these colours are used to show the changes occurred in the green covers in different years:



Table 5: Total area Under Green Cover in Jalandhar City

NAME OF AREA	1991		2001		2011		2018	
	GREEN COVER		GREEN COVER		GREEN COVER		GREEN COVER	
	Sq. Km	(%)	Sq. Km	(%)	Sq. Km	(%)	Sq. Km	(%)
JALANDHAR	19.79	19.82	13.79	13.81	12.18	12.20	6.025	6.033

Table 6 : Change in the Green Cover Area of Jalandhar City:

CHANGE (1991-2001)		CHANGE (2001-2011)		CHANGE (2011-2018)	
GREEN COVER		GREEN COVER		GREEN COVER	
Sq Km	(%)	Sq Km	(%)	Sq Km	(%)
6.00	6.008	1.61	1.61	6.155	6.16

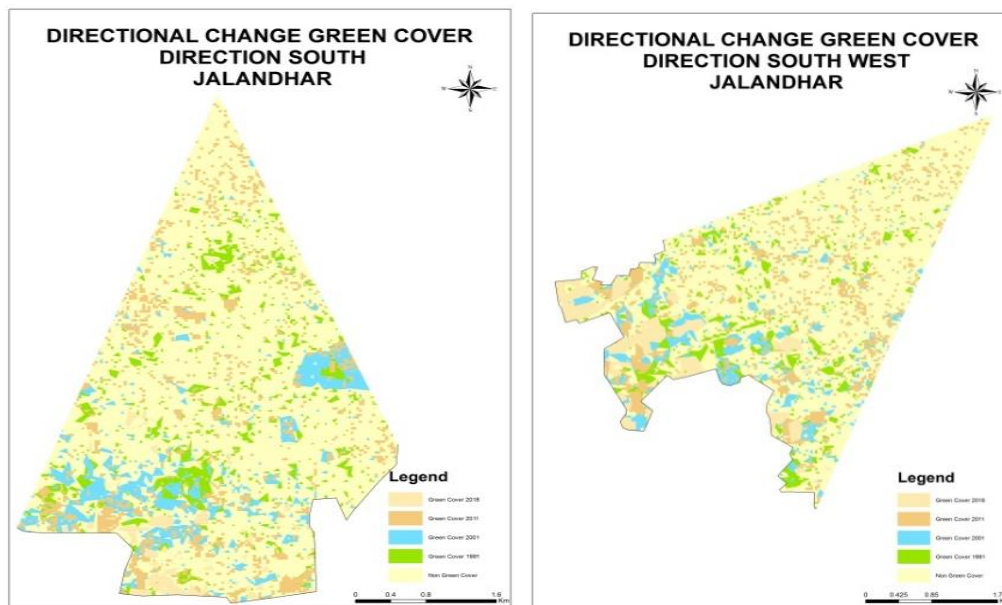


Figure 10: South and South West direction NDVI image of Jalandhar City of 2018

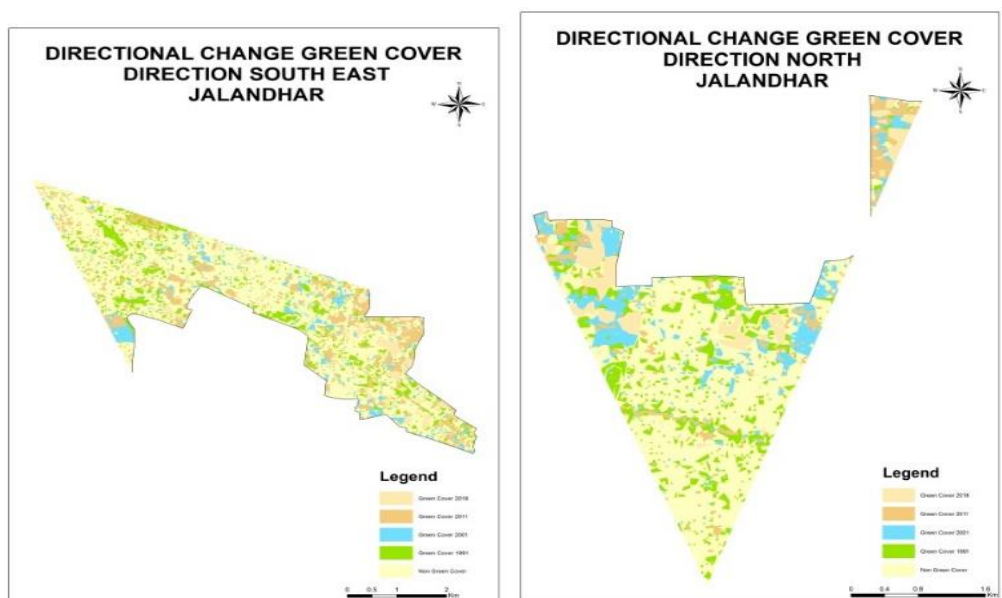


Figure 11: South East and North direction NDVI image of Jalandhar City of 2018

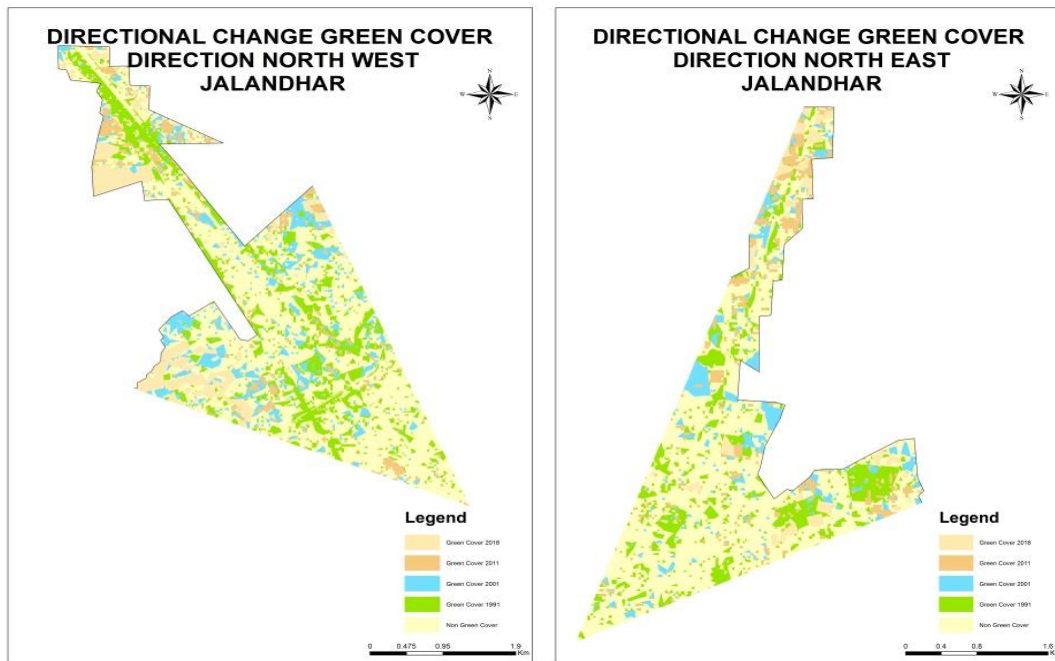


Figure 12: North West and North East direction NDVI image of Jalandhar City of 2018

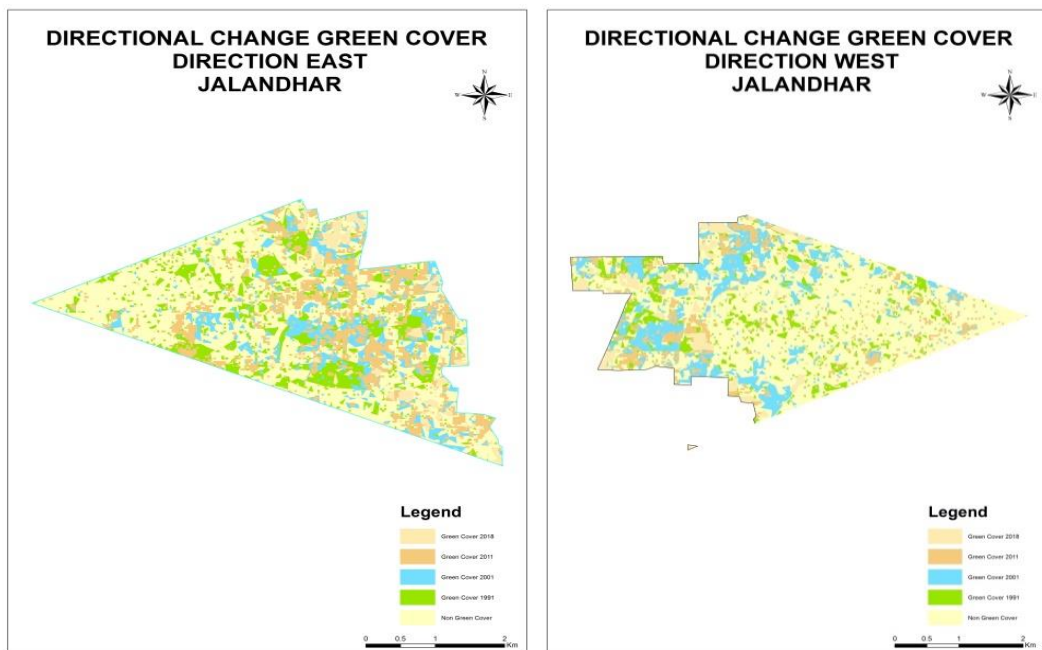


Figure 13: East and West direction NDVI image of Jalandhar City of 2018.

Table 7: Directional Area under the Green Cover of Jalandhar City.

NAME OF THE AREA	DIRECTION	GREEN COVER (in sq.km)			
		1991	2001	2011	2018
	EAST	3.38	2.43	2.69	0.65

JALANDHAR CITY	NORTH	2.17	1.45	0.73	0.89
	NORTH EAST	1.74	0.83	0.64	0.37
	NORTH WEST	2.93	1.72	0.82	1.14
	SOUTH	2.01	1.70	1.56	0.40
	SOUTH EAST	3.23	1.60	2.64	0.84
	SOUTH WEST	1.83	1.43	1.73	0.95
	WEST	2.47	2.56	1.28	0.82

Table 8: Directional Change in the Green Cover area of Jalandhar City.

NAME OF THE AREA	DIRECTION	CHANGE IN GREEN COVER (in sq.km)		
		1991-2001	2001-2011	2011-2018
JALANDHAR	EAST	0.95	-0.26	2.04
	NORTH	0.72	0.72	-0.16
	NORTH EAST	0.91	0.19	0.27
	NORTH WEST	1.21	0.9	-0.32
	SOUTH	0.31	0.14	1.16
	SOUTH EAST	1.63	-1.04	1.8
	SOUTH WEST	0.4	-0.3	0.78
	WEST	-0.09	1.28	0.46

5.0. Effects of Urban Sprawl & Decreasing of Vegetation:

After looking over characteristics and causes of urban sprawl and continued decrease in vegetation area, we are going to consider the positive and negative results of this effect. In this case of urban sprawl in Jalandhar city, along with the positive perspectives, the negative outcomes are also need to be considering as viewpoints. Analysts say that the projects in low population density take up a lot of space, especially land that should be maintained in a pristine state. As per the study of urban sprawl in Jalandhar city, it mainly stretch the distances of traffic and, particularly damage the environment badly. It will address issues such as the prevalence of poverty, the lower quality of infrastructure facilities and the shortage of budgetary resources [17], [23]. In transportation sector, urban sprawl encouraging the more commuting of vehicles and badly effect the walkability, the heavy vehicular traffic in the major junctions of the city like as on Football chownk and Guru Nanak Mission chownk in Jalandhar City, results the long queues of vehicles. It also creates hindrances in

the smooth traffic flow on the major roads. Basically for single-dimensional (i.e. residential land use only) growth, it is often the consequence of zoning regulations. Urban sprawl also restricts mixed land uses flatly. Restrictions against leapfrogging mean that growth on a city's outer wall is also residential, as no business wants to place its commercial set up on the fringes of an urban environment. Restrictions against the construction of stripes or ribbons often keep businesses away from residential zones [23].

At last, one thing is observed through the different studies that the various effects of urban sprawl has their different results at different level of cities and regions like it has different consequences & results in newly developed cities and different in metropolitan cities. Sprawl impact on ancient centres and cities by creation of new issues, which mainly cause to lost competitive power of the city in reference to their development. In newly developed areas, it causes to modern planning frameworks and producing more voyages, expelling agricultural land and reduction of social interactions [19], [23]. Much of these problems arise due to haphazard growth of urban areas along with its stretches because the administration did not control the sole rights to its roads accurately. Mainly the impact of urban sprawl are causing increase in infrastructure costs, decrease of vegetation area in haphazard way, harming to natural resources and assets by increasing the level of pollution in the cities[19], [23].

6.0 Recommendations & Suggestions:

Evidences regarding lack of environmental protection in national and regional planning decisions were illustrated as the basic priority in Jalandhar City is to preserve healthy urban development. Jalandhar MC or ULB should review the plan and consider adopting more planning approaches such as the concepts of the Urban Growth Boundary and the Green area to achieve sustainable urban development. Urban growth Boundaries and green areas are successful in protecting precious habitats and green land, while limiting patterns in development. The idea of the Green area is a green approach used to regulate urbanization/urban development in order to protect pre-urban landscapes. Similarly, view the green area as an indicator of sprawl measurement. This method has been used and proved successful in several places like as in Netherlands. Planning policies for growth management are essential to defending the environment, and local planning authorities can mitigate urban sprawl. Similarly, the boundary of urban growth is another strategy that sets growth boundaries. The factors in urbanisation, land use planning regulations and densification are determined in growing urban areas. The strategy tends to limit suburban growth and promote the growth of natural towns [12]. Especially the continue decrease of green area or cover from the periphery ways of Jalandhar City effects the increase of polluted air from other areas to Jalandhar City. So there is a need to conserve the greenway or green areas on the periphery of Jalandhar City to preserve the air pollutants or smoke to enter in the city from neighbouring regions or areas like as from the industrial areas of Ludhiana. There is need to save the green areas in the urban areas or cities through various legislative measures:

1. The Environment (Protection) Act, 1986 and Vedic view of Environment.
2. New Capital (Periphery) Control the Punjab New Capital (Periphery) Control Act, 1952.
3. The Biological Diversity Act 2002.
4. The Wildlife (Protection) Act 1972.

It has been said in Atharvaveda that "Man's heaven is on earth; this living world is the precious placed of all; it has the benefits of the rewards of nature; live in a beautiful spirit." Earth is our heaven and it is our obligation to secure our heaven. The constitution of India encapsulates the system of security and conservation of nature without which life cannot be delighted in. The information of sacred arrangements with respect to environment security is require of the day to bring more open

support, natural mindfulness, natural instruction and sensitize the individuals to protect ecology and environment [14].

There are several policy choices that each focuses on different aspects of the subject matter and its negative effects in City area as following:

- Regulating the urban sprawl and making urban boundaries in city edges will control urban sprawl. In this respect, development will only be permitted in internal areas and urban boundaries will not be extended [16].
- Control travels: Studies prove that one of the best methods for handling urban sprawl is to reduce the number of private vehicle ownership. The other solution is to increase taxes and tariffs (toll gate) [17].
- Improvement of low-income household's living conditions: One vital portion of inhabitants in suburb is people who move for advancement of their family life. Paying budgetary credits, planning of affordable housing and territorial endowments are a few arrangements for improving their living conditions [16].
- Control development and security of lands: Open spaces and high-value tax commitment to alter land use allows the amount of property improvements to decline [17].
- Sustainable growth relies on urban development and city-built regeneration. In this growth the urban association was described as a mechanism for best use of land and foundations within the built-up area of a city. It interests limitation of utilizing urban lands, diminishment of foundation costs and utilizing of more open transportation [16].
- Sustainable smart growth strategies: Sustainable smart growth relies on urban construction and city-built regeneration [17].
- Urban restructuring: City development has been proposed as a way for more effective land and services use in a city's built-up area. This aims to limit the use of urban land, the infrastructure costs, and increasing the use of public transport [17].
- The initiative is leading to an increase in prices of urban land. Examples of this policy are the use of land and enterprise in abandoned industrial land, illegible commercial parcels and spaces for metro stations, the sentencing of abandoned properties and historic buildings [16] [17].
- Internal-core neighbourhoods' redevelopment: this practice causes an increase in the price of urban land. Sources of this approach include the use of property and industry in old warehouse areas, vacant retail plots and places for metro stations, the restoration of vacant houses and historic buildings [16], [17].
- The implementation of innovative urban reforms would contribute to adequate growth. So, planners must be able to know value and vision of growth and its costs [17].

7.0. Conclusion

In this study of urban sprawl in Jalandhar City, valuable land is being converted for building, enterprise, transport infrastructure, etc. There is an inadequate land may require government support to develop policies for retaining intensive crops and promoting peri-urban agriculture and lack of land use planning may result in land degradation. Unplanned decisions can be the cause of destruction of valuable ecosystems for large sections of the local population. In contrast, vegetated areas were later converted into a built-up site. As a result, the metropolis encountered elevated traffic, pollution, excessive precipitation and unsightly weather. The existing crisis of environment debasement is the coordinate result of this coldblooded misuse and ravishment of nature, as long as a sense of adores and regard for nature is not created. All materialistic efforts of environment security are staying shallow and futile. There cannot be having any planning for the natural emergency without bringing around a fundamental change in our viewpoint [15]. We should develop the open spaces as parks, playgrounds, and nurseries in order to achieve sustainability in urban planning. Spaces should be spared on the roadside to plant trees that provide shade and purify the polluted air. With residential

applications, green areas and water sources should not be abused. Before any construction work is carried out, a shield must be left around them. Both the government and the public should promote water conservation activities to combat the green areas crisis in the future. There is a need to increase the green walkability paths and pedestrian paths with green areas on the different roads of Jalandhar City while constructing the ribbon development or leap frog development in the Jalandhar City. One thing is very clear from the overall view that how regional growth takes place illustrates specific policies to help slow down urban sprawl. Planners believe that from a core urban areas, regional suburbs are dispersed. They believe people want to work in the main cities, even from the outskirts in order to retain the people living and working to core cities, the major policies of project management are going on, which will affect the urban sprawl concept of the city. But this representation of urban areas is not an accurate depiction of the true commuting conditions of today. There is an urgent need of planting the green buffer zone along the arterial roads, sub arterial roads, collector roads and state highways in the Jalandhar City and also development of green areas and green ways integrated with different land uses in the city. Like as the example of some developed countries like Singapore, there is a need to development of green trees zone or trees buffer areas around the industrial land use areas in the Jalandhar City. Specifically integrated and holistic land-use planning and management techniques will monitor the long-term quality of land for human use, the prevention or resolution of land-related social conflicts and the transformation of the ecosystem. Therefore, it is vital to review standard scheduling techniques and to introduce innovative measures such as geospatial techniques for this. The integration of such information into geospatial planning technology will support people and provide a stable livelihood in addition.

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