

Influence of Urbanization on the Land Use Change: A Case Study of Srinagar City

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ABSTRACT

Urbanization has caused many impacts on natural resources associated with the reduction and conversion of green space. The land use/land cover pattern of a region is an outcome of natural and socio-economic factors and their utilization by man in time and space and has become a central component in current strategies for managing natural resources and monitoring environmental changes. Land Transformation is a process where changes in land use are observed at different time periods and is one of the important fields of human induced environmental transformation, with an extensive history dating back to antiquity. At present time, remote sensing and GIS are gaining importance as a vital tool for the analysis and integration of spatio-temporal data. The present study focuses on the land use land cover changes in Srinagar City for about 31 years (1979-2010) by the comparison of two satellite images of different dates and other similar information of the intervening years for quantifying the magnitude of land use/land cover change.

Keywords: Urbanization, Land use, Land Cover, GIS, Remote Sensing

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INTRODUCTION

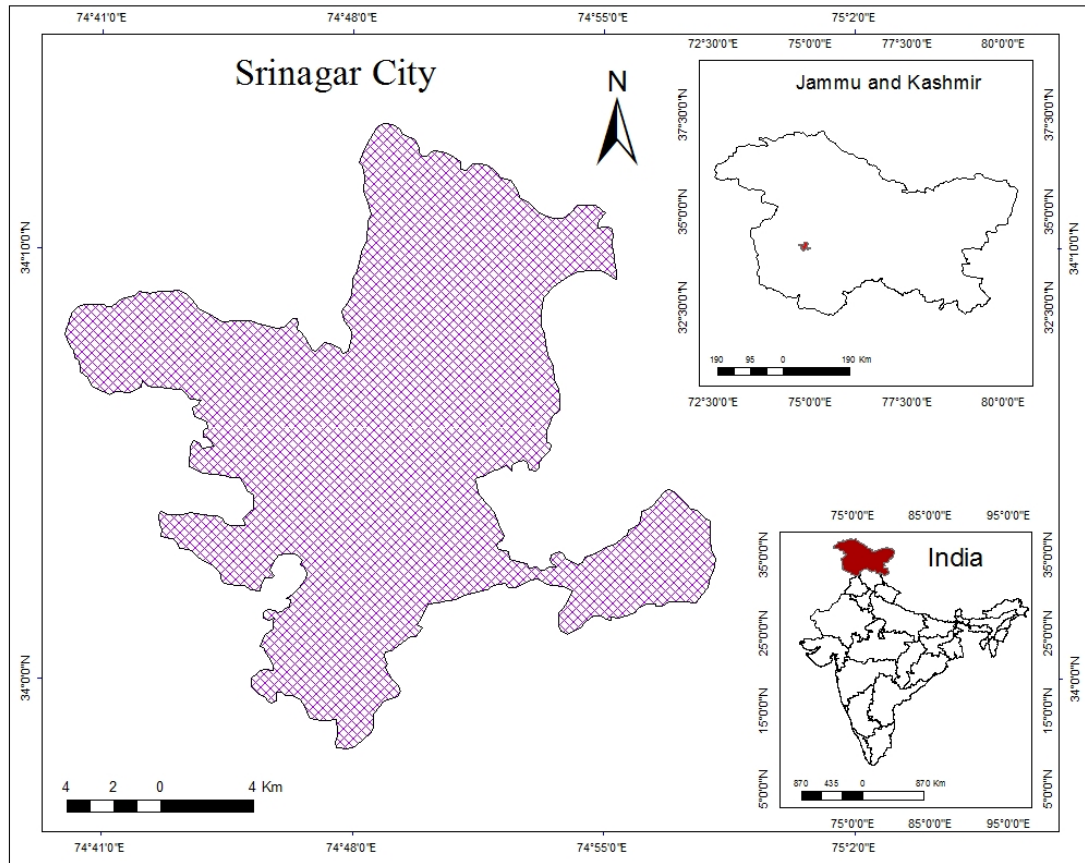
Rapid urbanization has resulted due to the several factors. However, the natural growth of the population, the rural to urban migration is important in it (Bhattacharya, 2002). Rapid urbanization causes disorganized and unplanned growth of the towns and cities. The pressure of an ever growing population becomes the burden on the limited civic amenities which are virtually collapsing; there is the need to balance present requirements of land against future needs. Prevention of agriculture land in the fringe area of expanding cities is a vital for preserving and maintaining open space and therefore environmental qualities (Farooq and Ahmad, 2008). Urban growth has resulted in the conversion of land for urban uses without any systematic development plan and without a corresponding investment in infrastructure. Poor land management has resulted in urban areas with inadequate services, infrastructure and corresponding lack of accessibility, that may prove very costly to resolve in future (Gupta and Sen, 2008). To prevent urban sprawl and leads to an improper development in any city on future, it is necessary to monitor the growth of city for sustainable urban development (Kumar et. al., 2007). It is important to study the and understand these trend of urban sprawl as it is one of the potential threats to sustainable development where urban planning with effective resource utilization and allocation of infrastructure initiatives are the key concerns and would help in effective land use planning in urban areas (Saravanan and Ilangovan, 2010).

All cities have an image. Infact, it would be truer to say that all cities have, and always have had, a number of images. The only consistent thing about cities is that they are always changing (Verma 2008). Urbanization is one of the dynamic and serious issues at present. Rapid urbanization results the unsystematic and unplanned growth of urban centers. The pressure of an ever growing population becomes a burden on the limited civic amenities which are nearly failing (Emtehani, M R. et al., 2012). Urbanization is a process through which the productive agricultural land, forests, surface water bodies and ground water prospects are being irretrievably lost. Growth of infrastructure has not kept pace with the growth of the population, resulting in disequilibrium in the level of development (Tali, J.A. and Murthy, K. 2012). Rapid growth of cities has posed a threat to their Central Business District (CBD). This is evident from the growing eagerness of the people to seek accommodation in sub-urban areas (Tali, J. A et al., 2012).

Land use and land cover change (LUCC) has been recognized as an important driver of environmental change on all spatial and temporal scales (Turner et al., 1994). Remote sensing techniques have already shown their importance in mapping urban land use/land cover, urban growth trends and to monitor the changes in land use /land cover (Pathan et al. 1993). Monitoring land-use changes is essential for local and regional level planning studies in order to assess urban development trends. The planning studies should be based on accurate and up-to-date land use information. Therefore, the urban planners need a mechanism to detect, monitor, and analyze changes in the urban land use pattern efficiently and effectively. Change detection is a process of identifying differences in the state of a geographic feature by observing it at different times (Singh, 1989). With the availability of multispectral images in digital form and the advances in digital processing and analysis, remote sensing has become a new tool for land-use change detection. A number of automated change detection techniques have been developed, including image differencing (Jensen and Toll, 1982), image rationing (Howarth and Boasson, 1983), post-classification comparison (Howarth and Wickware, 1981), principal components analysis (Byrne et al., 1980), change vector analysis (Malila, 1980), GIS assisted change detection (Peled, 1993; Turker and Derenyi, 2000), and direct multi-date classification (Estes et al., 1982).

Geographical Setting of the City

The city of Srinagar which is located at an elevation of 1800 meters above the sea level, spread over in the midst of an oval shaped valley of Kashmir. It extends from 34°5'23" to 34.08972° North latitude and 74°47'24" to 74.79° East Longitude. The city is encircled by natural walls of mountains (the sub mountain branch of Pir Panjal range). In the East the city is bounded by Zanaskar Mountains with lush green vegetation, locating the famous Dachigam Sanctuary and Mughal gardens on its slope and is environed by the shallow swampy lakes of the Dal and Nagin in the north east, the eminence hillock of Takth-i-Suluiman (Shankaracharya) in the south east, the Kohi-Mareen hillock (Hariparbat) in the centre, Rakh-i-Gandakshah in the west, the Anchar lake and the Palapora boggy in the North West, Nambale-i-Narkura and Karewa Damodar (uplands) in the south east. The city has cradled itself between the hills of Hariparbat and Shankaracharya along the banks of River Jhelum, flows through the heart of the city.

**Fig. 1**

Materials and Method

The study is based on secondary sources of data. The data relating to areal and population growth of Srinagar city has been collected from Srinagar Municipal Corporation (SMC), Srinagar Development Authority (SDA) and Town Planning Authority (TPO). The land use/land cover change detection were carried out by using Landsat MSS 1979, Landsat ETM+ 2010 satellite data has been used. The resampling method have been used to make the pixel size of 1979 satellite image equal to satellite image of 2010 by using ERDAS Imagery in re-projected method. Further for assistance in the process of interpretation Survey of India (SOI) top sheet 1971 have been used to cross check with satellite images to minimize the spatial errors. The city area has been demarcated from the satellite imagery to find out the land use/land cover in the study area. The land use land cover categories were identified and mapped based on post classification comparison method using unsupervised classification. Finally, land use/ land cover

change detection analysis was done by comparing the same land use/ land cover area of two given time periods.

Results and Discussion

Table 1. Population and Areal Growth of Srinagar city (1901 – 2001)

Year	Area Km ²	Decadal variation of area	Population	Population Density	Decadal Growth Rate of population
1901	12.8	--	122618	9579.53	---
1911	12.85	0.05	126344	9832.22	+3.04
1921	14.48	1.63	141735	9788.33	+12.18
1931	17.6	3.12	173573	9862.10	+22.46
1941	17.6	0	207787	11806.08	+19.71
1951	29.52	11.92	246522	8351.02	+18.64
1961	41.42	11.9	285257	6886.94	+15.71
1971	81.88	40.46	403413	4926.88	+41.42
1981	208.09	126.21	606002	2912.21	+50.23
1991	N.A	N.A	N.A	N A	N.A
2001	278.1	70.01	971357	3492.83	+30.14
2011	416.1	138	1192792	2866.60	22.8

Source: Census of India and Municipal Corporation Srinagar.
NA (Not Available)

Expansion possibilities of Srinagar city – Lateral and Vertical

A. Lateral expansion possibilities.

Though the Srinagar city has shown a significant growth both in its area as well as in population, but the constraints lie in the lateral expansion of the city on its setting as it exists. The areal growth of Srinagar city is found to be 403.3 Km² from 1901 to 2011. If this trend continues, sooner or later, the city would encroach up to the neighboring tehsils of Budgam, Chadora, Pampore and Ganderbal so as to form a State Capital Region. The city is located at the center of Kashmir valley and is bounded by Zabarwan Mountains (sub-mountain range of Pir Panchal Range) on the east and the northern side. On South-East there are uplands of Pampore

karewah and Damodar karewah under saffron cultivation. On the West side there lies flood absorption basin named Hokarsar. On the North-West there lies a vast water body of Anchar Lake. During the past few decades urbanization has taken place on agricultural lands up to Ganderbal on the North, Pampore on the South and Nambal on the West and up to Budgam in South - West. This expansion has taken place along the arterial routes towards Budgam, Baramulla, Pampore, and Ganderbal. The development of Bemina colony on the low lying land and the accelerated building activities in the low lying area of Hyderpora and Nowgam in the south have also opened the a new area of expansion of city limits. Despite the constraints posed by the urban water bodies and the wet land of Dal Lake and the mountains in the East, Nambal (Marshy) land and the Anchar Lake in the North - West, low lying and flood prone area in the South, the city is experiencing urban sprawl in these areas because of rapid urbanization which is evident from the fact that building activities are heavily taking place in and around the Dal Lake and Wet lands of the city.

B. Vertical expansion possibilities.

Since constraints that lie on the expansion of the city in the lateral directions and other hand the agricultural lands are squeezing, government has called a ban on the change of land use from agricultural to residential and saturation point is approaching when there will be left no land for lateral expansion. . The only alternative left shall be the vertical expansion. The present restriction of 50 ft. height for hotels etc. shall have to be relaxed. Construction of high-rise buildings shall have to be made possible by providing the strong designed foundations for the soils generally having low bearing capacity of half a ton per sq. ft. Besides, the physical impediments on lateral and vertical development of Greater Srinagar are reported to be overcome to a great extent by adopting the zonal regulations prescribed in the current Master Plan. It has

been emphasized that in the new areas the preparation of zonal /area development plans shall precede building operation of any kind and no permission shall be accorded unless the zonal/area development plan is approved by the competent authority within the policy framework described in the Master Plan.

Table 2. Land Use/Land Cover Distribution of Srinagar city: 1979 & 2010.

Land Use Type	Area Hectares (1979)	Percentage	Area Hectares (2010)	Percentage	Change	Percentage Change
Built-up	3430.62	11.58	7723.62	26.08	4293	14.50
Agriculture	20390.89	68.85	14147.72	47.77	-6243.17	-21.08
Plantation/Orchard	1398.44	4.72	5316.48	17.95	3918.04	13.23
Forest	387.93	1.31	194.94	0.66	-192.99	-0.65
Barren	485.26	1.64	349.75	1.18	-135.51	-0.46
Marshy	1635.22	5.52	400.14	1.35	-1235.08	-4.17
Water Body	1887.67	6.37	1483.38	5.01	-404.29	-1.37
Total	29616.03	100	29616.03	100		

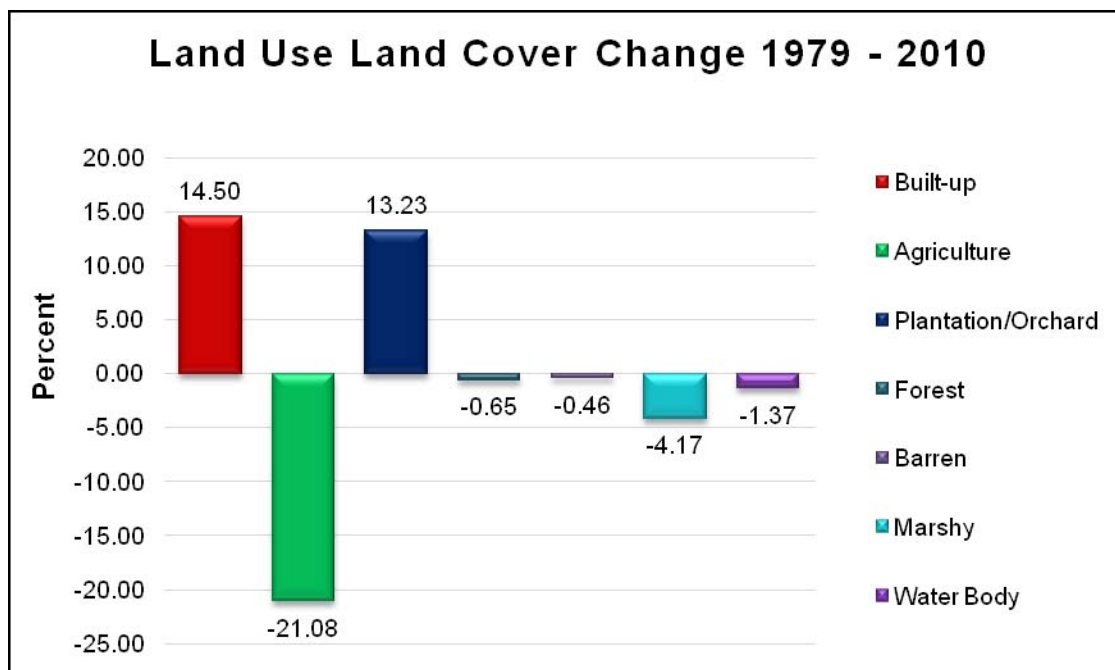


Fig. 2

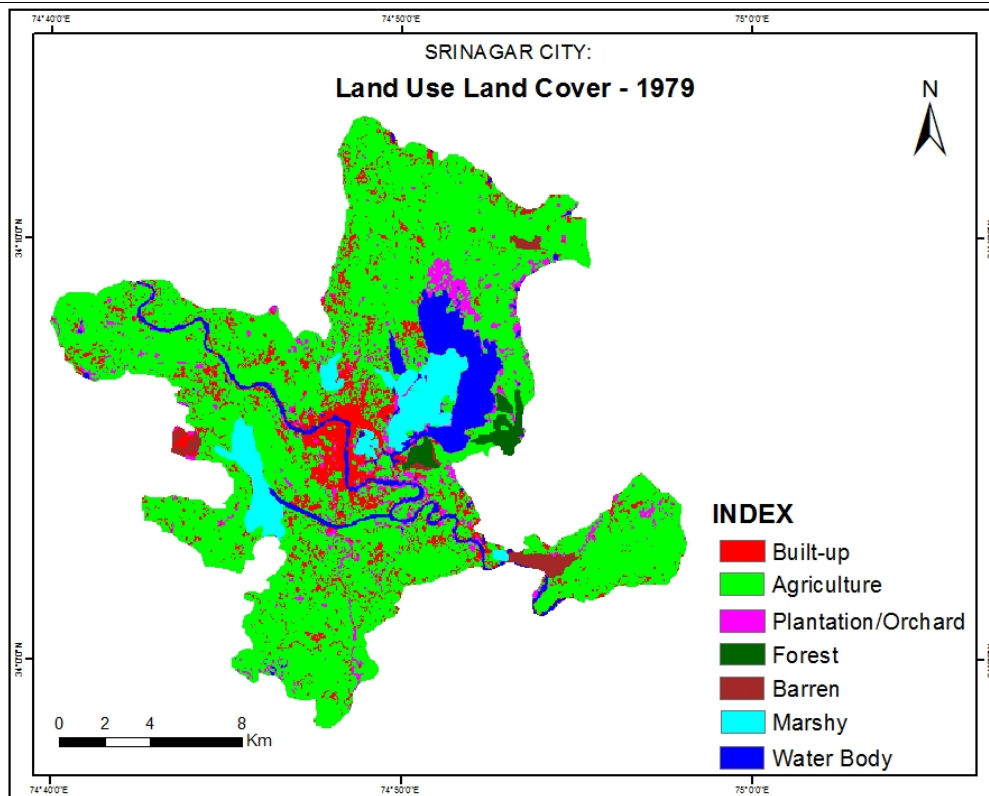


Fig. 3

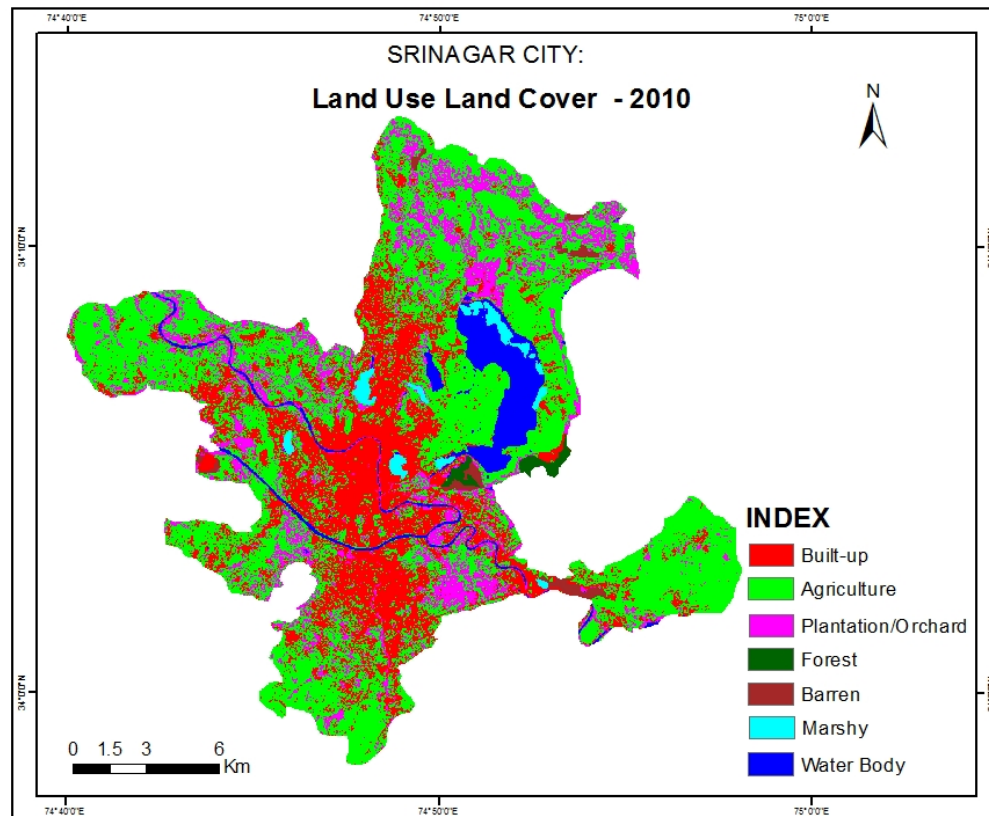


Fig. 4

Findings

The sprawl of the city leaves marked impact on the land use pattern. Cities can be studied and analyzed from a number of standard points. The present study is primarily concerned with the land transformation which has severely affected the aerial extent of agricultural land, water bodies, marshy area etc. Srinagar city is not only the largest urban center both in terms of population and areal extent but also the rapidly growing city among all the Himalayan urban centers (Bhat 2008). During this period due to the increasing population in the city which in turn results the increasing demand of land which resulted the loss in agriculture, Forest area, Marshy lands, Water bodies land and Barren. While as the area under built-up and Plantation & Orchards have increased.

- Despite the constraints posed by the urban water bodies and the wetland of Dal Lake and the mountains in the east, Marshy land and the Anchar Lake in the north-west, low lying and flood prone area in the south, the city is experiencing urban sprawl in these areas because of rapid urbanization which is evident from the fact that building activities are heavily taking place in and around the Dal Lake and Wet lands of the city.
- The city, has experienced slow growth rate from 1901 to 1941 with the increase of 4.8 Km², after 1941 to 1971 the rate of areal increase was fast indicating the increase of 64.28 Km², the areal growth of the city has accelerated after 1971 to 2011 with the increase 334.22 Km².
- The population of Srinagar city has increased from 606002 in 1981 to 1192792 persons in 2011 with its annual growth rate of 24.20 percent.
- The areal growth of Srinagar city is found to be 403.3 square kilometers from 1901 to 2011 if this trend continues, sooner or later, the city would encroach up to the

neighboring tehsils of Budgam, Chadora, Pampore and Ganderbal so as to form a State Capital Region.

- This expansion has taken place along the arterial routes towards Budgam in South West, Baramulla in West, Pampore in South East, and Ganderbal in North.
- The built up area of the city has increased from 3430.62 hectares (11.58%) in 1979 to 7723.62 hectares (26.08%) in 2010 with the increase of 4293 hectares indicating the increasing percentage change of 14.50 percent.
- Due to the expansion of the built up area on fertile agricultural land, due to the occupational shift of the people from primary to secondary and tertiary activities and also due to the shift from crop growing activities to the horticulture activities by many agricultural land owners led to the decrease in the total area under agricultural land use and the area under plantation and orchard has increased.
- The agricultural area has decreased from 20390.89 hectares (68.85 %) in 1979 to 14147.72 hectares (47.77 %) in 2010, indicating the decrease of -6243.17 hectares. While as the area under plantation and orchards has increased from 1398.44 hectares (4.72 % of the total study area) which has increased to 5316.48 hectares (17.95 % of the total study area) in 2010, indicating the increase of 3918.04 hectares during this period.
- The population growth has also shown its influence on the marshy areas and barren area of the city. In the year 1979 the total area under marshy area was 1635.22 hectares (5.52 %) which decreased to 400.14 hectares (1.35%) in 2010, indicating the loss of 1235.08 hectares during this period.
- The barren has also shown a decreasing trend. In the year 1979 the total area under this class was 485.26 hectares (1.64 %) which decreased to 349.75 hectares (1.18 %) in 2010,

thereby losing 135.51 hectares. The decrease in area is attributed to the capturing of barren land by other built-up classes because of increasing demand for land from the growing population.

- The area under forest has also shown a decrease from 387.93 hectares 1.31 percent in 1979 to 194.94 hectares (0.66%) in 2010, indicating the decrease of 192.99 hectares during this period.
- Due to the increase in population the area under water bodies of the city including (the Dal Lake, Nigeen Lake, River Jhelum, Brari nambal, Tailbal Nallah and Harwan water reservoir) have decreased from 1887.67 hectares (6.37%) in 1979 to 1483.38 hectares (5.01%) in 2010, showing the decrease of 1.37 percent. On the one hand the lakes are the centers of tourist attraction adding to the total revenue in tourism industry. But at the same time, these water bodies are getting deteriorated both in area as well as in their quality of water.

Conclusion

It is evident from the above analysis that the population growth has changed the land use pattern of the city. Agricultural land is being gradually converted into built-up land like industrial, residential, commercial and other urban uses without any systematic development plan. Similarly the marshy area has been converted into agricultural and built up area. These problems require immediate attention of the planners and administrators. The sprawl of the city leaves marked impact on the land use pattern, which has shown tilt towards built-up areas, which is growing in an unplanned way along the main roads. The rate, at which agricultural land is being destroyed, needs serious thinking on part of planners and policy makers. The population growth of the city has changed internal morphology of the city. City has a sizeable portion of flood prone and low-lying mostly around the Dal Lake. These areas are not suited for city expansion and development but have experienced widespread residential expansion. Thus, there is an urgent need to look into the unplanned urban expansion not only within the city but also in the surrounding areas.

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