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AN ANALYSIS OF URBAN LAND SPATIAL GROWTH AND ITS INFLUENCE ON THE ENVIRONMENTAL CONDITIONS OF JAMMU AND KASHMIR

Vishal Manhas

Research Scholar, Department Of Earth Science, Arni University, Kathgarh Village, Kangra District, Himachal Pradesh, India

Dr. Gagandeep

Guide Designation-Lecturer, Department Of Earth Science, Arni University, Kathgarh Village, Kangra District, Himachal Pradesh, India

ABSTRACT

As a reflection of shifting demographics and housing preferences, urbanisation is a key barometer of societal and economic progress. This research compares Jammu and Kashmir's and India's urbanisation rates and trends from 1911 to 2021. The research uses statistical methods, such as calculating the level of urbanisation, arithmetic growth rate, and exponential growth rate, and is based on secondary data retrieved from Census reports. According to the data, the rate of urbanisation in Jammu and Kashmir rose from 10.62% in 1911 to 28.05% in 2021, while throughout India it rose from 10.38% to 31.61% during the same time span. Urban development shows significant geographical variance, according to district-level study. While Kathua, Udhampur, and Jammu had relatively slower growth rates in the last several decades, Srinagar, Jammu, Leh, Rajouri, Kargil, and Poonch all saw notable shifts in their urban populations. The results shed light on the uneven and progressive urbanisation in Jammu & Kashmir. Regional planners and advocates for sustainable urban development may benefit from the study's findings, which add to our knowledge of urban growth trends.

Keywords: Urbanization, Demography, Migration, Population, Development.

I. INTRODUCTION

The process by which natural landscapes such as marshes, woods, and agricultural land are transformed into built-up regions is known as urban land spatial growth. Rising populations, better economies, more efficient transport systems, and an increase in administrative and commercial activity have all contributed to Jammu & Kashmir's rapid urbanisation in the last few decades. The region's land-use and land-cover patterns have seen significant changes due to the fast spatial expansion of major metropolitan centers like Srinagar, Jammu, Anantnag, Baramulla, and Leh.

As cities in Jammu and Kashmir have grown in size, they have begun to encroach on rural regions around them. The conversion of open regions into urban settlements has been expedited by the rising need for homes, commercial businesses, educational institutions, and infrastructure. Another factor that has contributed to the urban development is the increase of tourism, especially in Srinagar, Gulmarg, Pahalgam, and Leh. This has caused changes to the physical and biological environment due to the substantial expansion of urban limits.

Decreases in arable land and plant cover are two of the most significant negative environmental effects of expanding cities. The formerly fertile farmland around cities now has housing colonies, highways, and shopping malls built on top of it. There are fewer green places and less biodiversity as a result of this shift. Many regions are now more susceptible to soil erosion and ecological imbalance as a result of deforestation and land degradation caused by urban expansion.

Jammu and Kashmir's water supplies have been greatly affected by urbanisation. Natural drainage systems have been changed and the danger of floods has been enhanced due to the encroachment of wetlands, lakes, and floodplains. Urban sprawl, improper waste management, and an increase in human activity have all put a strain on natural sources of water like Dal Lake and Wular Lake. Additional strain on water supplies has resulted from the rising demand for water by urban populations.

The decline in air quality is another significant environmental effect. Air pollution in large cities has been on the rise due to factors such as the proliferation of cars on the road, building projects, and energy use. Solid waste and sewage production have both grown due to urbanisation, posing problems for waste management systems. Public health and environmental quality have taken a hit due to contamination of water and land resources caused by improper

garbage disposal.

With more and more people living in cities, the effects of climate change are also becoming more obvious. One cause of the urban heat island effect—in which cities are hotter than their rural surroundings—is the widespread use of concrete in lieu of natural surfaces. Local climate and biological processes have been further affected by changes in land cover.

Regional prosperity and ecological preservation are two areas that may benefit from well-planned urban expansion, notwithstanding these obstacles. To reduce environmental damage, sustainable infrastructure development, afforestation programs, conservation of wetlands, ecologically sensitive area preservation, and effective land-use planning are crucial. Finding a middle ground in Jammu and Kashmir's urban development requires an appreciation of the interplay between environmental factors and the geographical expansion of urban areas. To prevent further degradation of the area's natural resources and ecological balance, sustainable urban planning regulations should be put in place before any more urbanisation takes place.

II. REVIEW OF LITERATURE

Mughal, R et al., (2024) The process of urbanisation is significant in the development and growth of human societies because of the far-reaching effects it has on the world's physical and social environments. All four pillars of a society's conventional structure—social, economic, political, and cultural—are affected by and transformed by urbanisation. The physical and social dynamics of urbanisation in India's Jammu area are the primary foci of this study, which also analyses its causes and effects. By combining information from several sources, including as interviews, demographic surveys, and geographical analysis, this study uses a descriptive research strategy to delve into the complex nature of urbanisation. According to the research, urbanisation is happening in Jammu province, but there are a lot of environmental and social issues that have come to light as a result. These include things like environmental pollution, habitat destruction, biodiversity loss, soil degradation, flash floods, haphazard housing provisions, poverty, social unrest, crime, unemployment, poor drainage, drug abuse, confusion in lifestyle and culture, and so on. Planned and regulated development that is ecologically sustainable, commercially advantageous, and socially beneficial is necessary to avoid the negative impacts of urbanisation on society and the environment.

Parry, Jahangeer et al., (2012) In this article, we looked at how Srinagar City's urban facilities are not evenly distributed. One manifestation of inequality in the study region is the uneven

distribution of social facilities across the City's wards, which are municipal entities. Two social amenities—fire stations and schools—were examined for their locational concentration and dispersion. Secondary sources of information were the backbone of the research. To find out how these facilities are distributed geographically, the Z-score variate was utilised. To access and quantify the geographical discrepancy, however, Lorenz Curve was a beneficial tool. The data shows that various wards in Srinagar city have varied levels of access to these services. Inadequate management planning and rapid urbanisation over the last three decades are to blame for the unequal distribution of urban facilities. To guarantee that urban facilities are distributed fairly across the city, the paper argues that the planning authority must keep up with the rate of urban expansion.

Ahmad, Wani Suhail et al., (2024) A complex and ubiquitous phenomena, urbanisation involves changes in land cover and a wide range of environmental factors. Land Use and Land Cover (LULC) has been altered as a result of population growth, urban sprawl, migration, and a rise in the built-up area of Srinagar, Kashmir. Because of this, the Land Surface Temperature (LST) has changed. Using remote sensing, geographic information systems (GIS), statistical analytic methods, and the Landsat 4-5 TM and Landsat-8 OLI datasets, this research assesses the dynamics of LULC in Srinagar city and its impact on LST. The LULC in Srinagar city was examined for the years 2000–2020. Based on satellite remote sensing data of Srinagar city, the research determined the Normalised Difference Vegetation Index (NDVI), LST, Fractional Vegetation Cover (FVC), and Emissivity, and then examined the correlation between them. The study found that from 2000 to 2020, the following areas in Srinagar city had the highest percentage change in LULC: built-up area (75.58), dense forest (– 62.74), vegetation (– 40.2), water bodies (– 25.41%), crop (23.16%), swamp (– 8.22), sparse forest (^ 7.89), and open spaces (– 6.02). For scholars, city planners, and politicians seeking to comprehend urbanisation tendencies and their effects inside the city, the results of this study are very relevant.

Amin, Arshad et al., (2012) A key driver of worldwide change in the previous several centuries has been the rapid urbanisation, which has changed land use and land cover. Ecosystems are vulnerable to changes in land use and cover, which may alter biogeochemical cycles and affect climate on a global and regional scale. This report presents the results of a 31-year study that tracked the effects of land use and land cover changes on biodiversity in the Srinagar city area of the Kashmir Valley (1996-2007). We identified urbanised regions and quantified urban growth in the aforementioned city, Srinagar, using Landsat MSS 1976, ETM 2001, 1990, and IKONOS 2007 (Google Earth) photos. Findings demonstrated substantial changes in land use

and land cover across the study region during the course of the 31-year time frame. From 1990 to 2007, the city's urban area grew substantially. The urban area of Srinagar has grown from 8.065 sq. km in 1976 to 29.23 sq. km in 2007. The loss of forest acreage, open spaces, etc., has been caused by substantial changes in the land use pattern, according to further investigation. In addition to Srinagar city, our research shows that there was a sudden change in land use away from ecologically significant features and toward large-scale developed environments. Therefore, in order to curb the city's anomalous expansion, stringent governmental measures are necessary.

III. METHODOLOGY

Calculation of Level of Urbanisation

The ratio of the urban to total population is a good indicator of the degree of urbanisation. The level of urbanisation in various areas throughout the research period may be better gauged using this information. The formula that follows will be utilised:

$$\text{Level of Urbanisation} = (P_u / P_t) \times 100$$

In this case, P_t stands for the overall population and P_u for the urban population.

Growth of Urban Population

In order to track how city dwellers have evolved over the years, we shall track their population increase. The rate of expansion of urban centers between census years may be determined using this technique. The following equation will be used:

$$\text{Growth of Urban Population} = [(P_1 - P_0) / P_0] \times 100$$

The population of the base year is P_0 while the population of the current year is P_1 .

Exponential Growth Rate

To evaluate the urban population's consistent trend of increase throughout the research period, the exponential growth rate approach will be used. In the long run, this approach will help us assess population growth patterns more accurately. There will be a formula:

$$P_t = P_0 e^{rt}$$

In this context, P_0 stands for the population in the base year, r for the growth rate, t for time, and P_t for the population at a certain period.

Data Analysis

Using the aforementioned statistical methods, we will examine the gathered census data. The findings will be shown using themed maps, tables, and graphs to show how urbanisation in Jammu & Kashmir has changed over time and space from 2001 to 2021. The research area's urban expansion and regional differences may be better understood with the help of the analysis.

IV. RESULTS AND DISCUSSION

Urbanisation in India

The twentieth century was characterised by rapid urbanisation on a global scale. India has a relatively low level of urbanisation (31.61%) when compared to other countries across the world. How many people live in cities relative to the overall population is a measure of the degree of urbanisation in a certain area. Two ways to put it are (a) the proportion of people living in cities relative to the overall population and (b) the pace of expansion over a decade. It has nothing to do with the average size or quantity of cities. Among the most salient features of urbanisation is its degree of development. The degree of urbanisation is indicative of a nation's level of progress, as has been correctly noted by scholars. It changes depending on where you are in the nation and what area you're in.

Scholars have painted a picture of a very stationary Indian population in the early 20th century. They identified the caste system, coupled families, low levels of education, an agricultural economy, traditional beliefs, and inadequate transportation as the primary causes of immobility. Because of these and other obstacles, villagers were unable to leave their homes and settle in other places. Like rainfall unpredictability, plague, attachment to village life, and famines, numerous academics have noted that these variables contributed to the sluggish rise of urban populations throughout the first half of the twentieth century.

The urban population of India grew from 26.13 million in 1901 to 383.95 million in 2021, with a degree of urbanisation that climbed from 10.93% to 31.61% over the same time period, as shown in Table 1.

Table 1 Volumes and Trends of Urbanisation in India (1901-2021)

Year	Total Population	Urban Population	Percentage of Urban Population (%)	Growth of Urban Population (%)
1901	239,125,640	26,128,450	10.93	—
1911	252,864,785	26,245,370	10.38	0.45
1921	252,016,840	28,564,920	11.33	8.84
1931	279,854,620	34,276,180	12.25	20.00
1941	319,782,150	45,018,760	14.08	31.35
1951	362,154,980	63,215,840	17.46	40.42
1961	437,468,250	80,386,510	18.38	27.16
1971	549,387,430	111,842,760	20.36	39.13
1981	684,715,820	163,785,430	23.92	46.44
1991	848,106,540	222,985,640	26.29	36.15
2001	1,031,248,670	291,468,530	28.26	30.71
2021	1,214,587,390	383,954,780	31.61	31.73

Levels and Trends of Urbanisation in Jammu and Kashmir

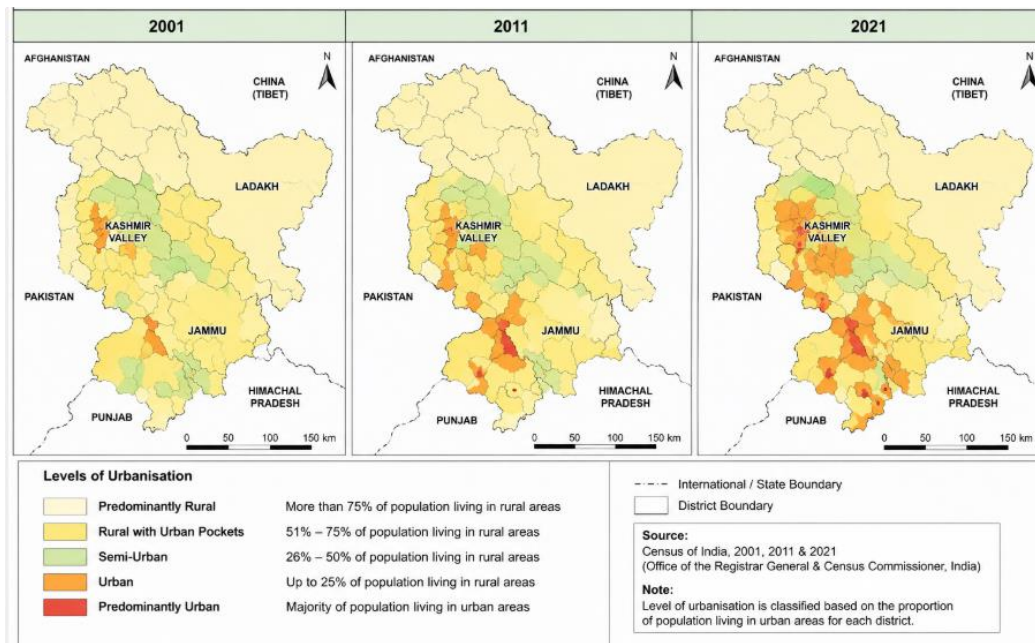
Variation in urbanisation levels throughout time is seen by the trend. For the most part between 1911 and 2021, Jammu and Kashmir's urban population fraction was lower than India's. Jammu and Kashmir's urbanisation rate was somewhat greater than India's (10.62%) in 1911, according to a comparison of the two regions' urbanisation tendencies. India's rate was 10.38%. Jammu and Kashmir's urbanisation rate has been below the national average ever since.

Although only 25.18 percent of Jammu and Kashmiris lived in urban settings in 2001, 28.05 percent did so in 2021. The percentage of Jammu & Kashmiris living in urban areas rose from

10.62% in 1911 to 28.05% in 2021. Despite a rise from 10.38% in 1911 to 31.61% in 2021, the rate of urbanisation in Jammu and Kashmir remained below the national average.

Table 1.2 Levels of Urbanisation in Jammu and Kashmir and India (1911-2021)

Years	Jammu and Kashmir (%)	India (%)
1911	10.62	10.38
1921	10.08	11.33
1931	10.82	12.25
1941	11.78	14.08
1951	12.54	17.46
1961	14.53	18.38
1971	15.92	20.36
1981	17.84	23.92
1991	—	26.29
2001	25.18	28.26
2021	28.05	31.61



Map 1.1 Levels of Urbanisation in Jammu and Kashmir (2001 to 2021)

Some intriguing tendencies surfaced in 2001. The amount of urbanisation declined in Srinagar, Pulwama, Budgam, and Anantnag, with Srinagar remaining at the top in terms of urban population. The outbreak of militancy in the Kashmir Valley in 1989 had a significant impact on migration and tourism, leading to this drop. On the other hand, Jammu was mostly spared from these conflicts, and the city's urban population grew substantially as a result of the migration of many Kashmiri Pandits from the Valley. Consequently, Jammu's urbanisation rate jumped from 30% to 44%. Leh and Anantnag both saw significant increases in their urban populations, with Leh's going from 12% to 24%.

There were 28.05 percent urban residents in the area in 2021. With a growth rate of 25%, the urban population of Srinagar district jumped from 78% to 98%. The urban population of Jammu district remained relatively unchanged. Nonetheless, there were notable shifts in the urban populations of the districts of Leh, Anantnag, Baramulla, and Udhampur over that time.

Growth of Urban Population:

The pace at which a country's population is increasing over a certain time period is known as its population growth rate (PGR), and it is often stated as a percentage. It is a reflection of the whole population of a nation at a given time, including all births, deaths, and migrations.

Table 1.3 District Wise Growth of Urban Population in Jammu and Kashmir

Districts	1981 Arithmetic Growth Rate	1981 Exponential Growth Rate	2021 Arithmetic Growth Rate	2021 Exponential Growth Rate
J&K	47.12	3.89	34.82	3.01
Anantnag	37.24	3.19	40.56	3.75
Pulwama	58.92	4.68	41.75	3.52
Srinagar	38.94	3.31	29.24	2.58
Budgam	36.91	3.18	39.08	3.32
Baramulla	46.98	3.88	26.61	2.38
Kupwara	27.46	2.71	37.14	3.21
Kargil	47.93	3.94	53.78	4.33
Leh	58.41	4.63	59.92	4.74
Doda	29.18	2.59	24.83	2.24
Udhampur	52.64	4.26	16.31	1.53
Kathua	67.88	5.21	14.38	1.36
Jammu	46.58	3.84	17.12	1.61
Rajouri	89.13	6.41	55.96	4.48
Poonch	3.04	0.31	61.58	4.84

Jammu & Kashmir began a new demographic transition in 1981, with a lowering growth rate, which led to changes in the population's makeup. The percentage of the state's population living in urban areas was 47.12% in 1981. Due to the outbreak of conflict in the area, Jammu & Kashmir was omitted from the 1991 Census. Only four districts—Rajouri(89.13%), Kathua(67.88%), Pulwama(58.92%), and Leh (58.41%)—had very high arithmetic growth rates, as seen in the table. However, only in Poonch was the urban population increasing at a

pace of 3.04%.

The urban population of Jammu and Kashmir began to expand more slowly in 2021, falling from 47.12% in 1981 to 34.82% in 2021, while there were little changes in the urban population situation. The district with the highest growth rate was Poonch, at 61.58 percent, followed by Leh, at 59.92 percent, from 58.41 percent in 1981. After falling to 89.13% in 1981, Rajouri's urban growth rate slowed to 54.96% in 2021, with Kargil following at 53.78%. Districts like Udhampur, Kathua, and Jammu, which had rapid urbanisation in 1981, had their rates fall to 16.31%, 14.38%, and 17.12% in 2021, respectively.

Jammu and Kashmir's urban growth rate fell from 3.89 percent in 1981 to 3.01 percent in 2021 when comparing the exponential growth rates of the state's urban population in 1981 and 2021. Kupwara (2.71%) and Budgam (3.18%) were the only two districts in 1981 to have reasonably significant exponential growth rates. With 4.74%, Leh outpaced Poonch (4.84%), Rajouri (4.48%), and Kargil (4.33%) in 2021 in terms of exponential development rate. In 2021, the districts of Jammu (1.61%), Kathua (1.36%), and Udhampur (1.53%) had the lowest exponential growth rates.

To summarise, the districts of Rajouri, Poonch, Leh, and Kargil had very high mathematical growth rates in 2021, in contrast to the relatively low rates reported by the districts of Kathua, Udhampur, and Jammu.

V. CONCLUSION

A review of Jammu and Kashmir's urban land spatial expansion reveals how the state's land-use patterns and environmental circumstances have changed dramatically. The rise of urban areas is driven by several factors such as population, economic development, infrastructure improvements, and tourism. Urban centers like Srinagar, Jammu, Anantnag, Baramulla, and Leh have grown physically due to the development of formerly undeveloped regions, forests, marshes, and agricultural land. Because it alters natural drainage patterns, reduces plant cover, and increases demand on land and water resources, this process impacts environmental quality. Rapid urbanisation disrupts natural equilibrium, according to the research, since it leads to more pollution, more waste, and the destruction of ecologically fragile places. Unplanned urban growth is a persistent threat to water bodies, wetlands, and natural areas; increasing building activity and vehicle emissions further worsen the environmental situation. Simultaneously, urbanisation is very significant since it boosts the economy, builds better infrastructure, and

makes services and opportunities more accessible. Thus, in order to keep growth and environmental protection in check, sustainable urban planning is still crucial. Sustainable urban development over the long run is possible with careful planning of land use, stringent environmental regulations, and resource preservation efforts. The research shows that sustainable development in Jammu and Kashmir may be achieved via thoughtful urban design and responsible expansion, which both improve environmental circumstances.

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