

A Case Study of Integrated Land Use Planning For Sustainable Infrastructure

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Abstract: *Infrastructure development plays an important role in shaping the future of a society. Construction is considered as a backbone in development of any area village, city, district, state, or country. Construction of roads, buildings, bridges, and other basic facilities make life easy to live. The progress of a developing or developed nation is linked with basic development of infrastructure in that country. India is among developing nations of world, and is second largest nation in terms of population and seventh largest in terms of area. Its geography ranges from the majestic Himalayan mountains to tropical shores of southern peninsula. Due to unplanned land use for infrastructure development, rapid transformation of villages, districts, and cities all over India has affected the sustainability at large scale. Although there are some cities which are well planned and are sustainable in nature. Sustainable development means the process of socio-economic development through the judicious utilization of natural resources, keeping in mind the needs of future generations. Here we present a case study of Srinagar city of Jammu and Kashmir on unplanned land use for infrastructure and its effects on sustainability of that area. This thesis is aimed to provide the strategies and policies for developing the sustainable infrastructure in the city.*

Index Terms: *Infrastructure development, Sustainability, Land use management, Urbanisation*

INTRODUCTION

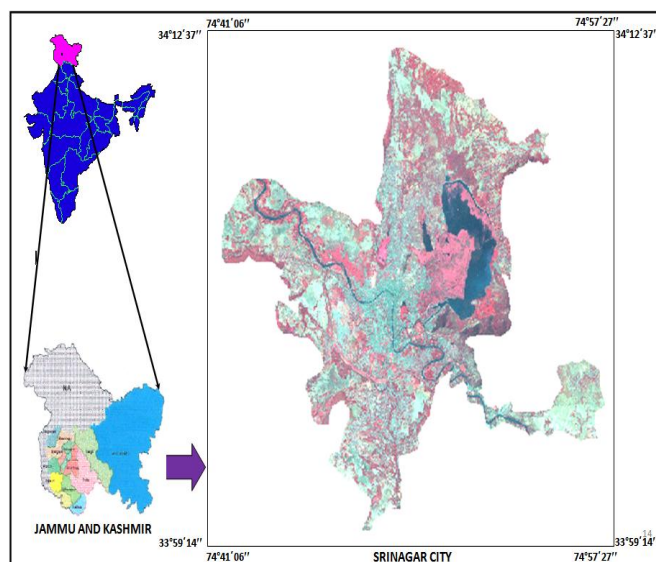
The use and management of land has long been the topic matter of city planners across the globe. As cities and cities area unit growing in size, sources of developable land area unit decreasing chop-chop. This concept of land as a scare resource has prompted planners to introduce the concept of sustainable property in their science in an endeavor to higher accommodate the requirements of current and future population.

The definition of sustainable property is fairly “wide”, a fast Google search reveals variety of definitions as an example “sustainability might be outlined as a capability or capability of one thing to be maintained or to sustain itself. It’s regarding taking what we’d like to measure currently, while not jeopardizing the potential for folks within the future to fulfill their needs”. The United Nations links property with development in its definition “Sustainable development is development that meets the wants of the current while not compromising the flexibility of future generations to fulfill their own needs”.

The concept of “development” can be linked to the science of urban and rural planning in within the context of this research in the sense that planning is concerned with existing and future activities happening on land. Both “sustainability” and “planning” have a temporal dimension, sustainability refers to what we do now, and how this influences the future, planning is an activity where we actually plan for the future. Since urban planning is a function that happens within every city – we can therefore establish that planning can definitely influence the sustainability of a city or town.

There are two very different dimensions to planning, one that deals with everyday activity and another that looks into the future. In most countries, land use planning is a function of same level of government responsible for the delivery of services such as water, sanitation, electricity etc. Local government in turn place a value on land and collect rates and taxes in attempt to fund the provision of service. In many instances, however, the activities of land use planning are not integrated. This leads to inefficient cities and towns that are rapidly developing in a financially unsustainable manner. Land is a limited resource and yet an indispensable resource for meeting the social, economic and environmental demands and targets.

The growing development associated by the growing population and therefore the associated urbanization and industrialization is increasing pressure toward land resource. Land use coming up with and management could be a famed strategy for achieving sustainable property development. The Yankee coming up with association defines coming up with as “a dynamic profession that works to boost the welfare of individuals and their communities by making additional convenient, equitable, healthful, efficient, and engaging places for gift and future generations” A properly ready land use arrange supported sound scientific and technical procedures, and land utilization methods will summarize rationally the longer term demands. This amid a powerful coming up with method, wherever communities and numerous stakeholders square measure concerned, will strengthen the choice creating method on allocation and utilization of natural resources.



OBJECTIVES OF THE STUDY

Due to unplanned and haphazard use of natural resources, land gets more and more littered with the conflicting land uses and competition of reciprocally exclusive uses, besides motion serious considerations and negative impacts. The considerations will even become additional serious in associate rising country like Asian country, that has at the moment over on 2.6% of the world's geographical area living 17% of world's population. Taking geographical position into consideration, the present research details a strategic approach for land use planning for sustainable Infrastructure development in Srinagar city of Jammu and Kashmir, its challenges and future prospects.

. The main objectives of the project are as follows:-

- To determine the causes of change of Land cover of city and its effects on sustainability.
- To determine the strategic approach and comprehensive planning method for sustainable infrastructure development.
- To determine the challenges for integrated land use planning for sustainable infrastructure development.

LITERATURE REVIEW

Iftikhar A Hakim et al. (2018) The planning of Srinagar has to take into account the complexities of the Kashmir region, its fragile ecology, vulnerability to floods, existing settlement pattern, affordable transportation so that the economic development and future growth of the city is ensured without compromising on its fragile ecology. The structured land suitability analysis involving successive elimination of the high slopes, flood absorption basins, vulnerable areas, prime agricultural lands, ecologically fragile areas, wetlands, forests and water bodies leaves very limited availability of land for development purposes.

Zahoor, A. Nengroo, M. Sultan, Bhat Nissar, A. Kuchay (2017) revealed that Srinagar city has effectively been the victim of urban sprawl characterized by low density of population and disproportionate distribution of various urban amenities. The study is first such attempt to measure the sprawl of city and will act as reference work for future research on urban sprawl in ecologically fragile Himalayan city of Srinagar.

Arshad, Amin, Shahab, Fazal (2015) Urbanization process has significantly modified the land use of Srinagar city land its surrounding areas during the study period of 32 years. Built-up area has significantly increased by 158% swallowing the fertile agricultural land (3459 hectares) in the fringe area, where industrial and residential expansions taking place. Similarly for the development of horticulture 12.86% of agricultural land is used. The city has prominently expanded toward northern, southern and western parts, mainly due to the availability of land in these areas. The study further demonstrates that the ecologically fragile land use/cover features i.e., marshy, forest area and water bodies have also decreased in their total area by -71.8%, -55% and -11.6% respectively for agricultural, residential and industrial development of the city. The increasing population leads to the decrease in per capita land availability resulting into shortage of land and increase in rate of land transformation process.

Khalid, Omar, Murtaza (2015) Land use land cover in study area has under gone significant changes over the 39 years; in particular, the areas of forest and agriculture have been decreasing while as built-up and horticulture land have been increasing. The change of land use land cover in Srinagar city is probably driven by the growth of population, reckless deforestation, and unplanned urbanization, changes in quantity and quality of water resources, economic and social developments. Similarly, heritage sites and tourist destination are under constant threat of destruction and environmental degradation due to unplanned management of these resources.

Bhatt et al. (2013) examined the agricultural land use pattern in Pulwama district of Kashmir Valley. The results revealed that the total forest area of the Pulwama district decreased from 732 hectares in 1990-91 to 661 hectares in 2000-01 and 412 hectares in 2010 – 2011. Similarly, area not available for cultivation (barren and uncultivable land and land put to non-agricultural uses) decreased from 1990-91 (14015 hectares) to 2000-01 (12037 hectares) and in 2010-11 (8387 hectares).

Shah et al. (2013) Studied land use and cropping pattern dynamics being experienced in district Budgam, which is located in central part of Kashmir valley & is mostly dominated by agriculture occupation. The study was based mainly of secondary sources. A multi-temporal analysis was carried out in order to analyze the extent as well as direction of change. The study revealed that an increase of about 628 hectares has been found in non-agricultural land in Chadoora tehsil which may mainly because of the construction of houses, markets, roads, complexes *etc.* due to increase in population.

Innocent et al. (2013) Land is certainly essentially the most important normal resources, since existence and developmental activities use it. Land use is the term for any type of utilization to which human has set the land. It also is the term for evaluation in the land with respect to various normal characteristics. Land use is usually a product associated with interactions concerning a society's cultural background, state as well as physical needs of the one hand and the natural potential of land on the other.

Jin, Yang (2013) Several changes in land cover, such as long-term changes, are as a result of natural causes, human activity increasingly plays an essential role within changing this land cover and land use across the world. The need for characterizing, quantifying, and observation of these changes through remotely sensed and also geospatial data as an extremely important component of the actual land change science have been widely recognized by global and also environmental change studies.

Ajay Singh Tomar, U C Singh (2012) the rapid growth of industrialization in India has demanding suitable place to establish therefore first of all it is necessary to analyze the nature support of the anthropogenic activity that is the relief. In such circumstance the importance of the role of geomorphology is increasing. In the present time, Land use planning is important task for governments and decision makers to provide suitable land for human activities in the study area land use planning need to be developed in comprehensive manner and integrated based on geomorphic study. The modern techniques have been contributed such as Remote Sensing and GIS to identify earth surface and geomorphic units in addition to area mapping because geomorphology could be the base of land use planning.

Brundtland Report (2012) "Sustainable development is development that meets the requirements the wants of the current while not compromising the flexibility of future generations to fulfill their own needs. It contains at intervals it 2 key constructs: the concept of wants, specially the essential wants of the world's poor, to that predominant priority ought to be given; and also the plan of limitations obligatory by the state of technology and structure on the environment's ability to fulfill gift and future needs".

Amita Bhid et al. (2012) in his study, 'Sustainability in India's Urban Area', explain how urbanization is becoming a significant phenomenon urban development mean new opportunities, new realities and challenges. He points out that The Rio conference in 1992 defined sustainability as 'the ability of current generation to develop and meet its needs without compromising the ability of future generations to grow'. India is even now, a predominantly rural country. Furthermore, its urban character is highly diverse with a large majority of smaller townships and an increasing sprawl focused around its major cities as witnessed by the census 2011 figures.

M.C. Ruiz et al. (2012) The planning, design and construction of an industrial area is quite a complicated and long process due to the scope of the action itself. The drive for a new theory on sustainable industrial areas requires acting upon all of the phases of their life cycles. This article analyzes influential location factors and proposes a multi criteria evaluation model aimed at guaranteeing the viability of industrial areas with their surroundings. The spatial character intrinsic to the problem leads to the design and construction of a Spatial Decision Support System (SDSS) based on a Geographic Information System (GIS) platform and the integration of other compatible tools. The system is applied to a district of 646.2 km² located in (Northern Spain). The results are discussed with digital maps which differentiate the zones according to their suitability for industrial area location using sustainability criteria.

S. Kaliraj, V. K. Malar (2012) (Basnet, 2002) Site selection is often a critical choice made by private in addition to entrepreneurs in which has an effect on many activities starting from land use planning to establish of industrial facilities. Site selection regarding building a new capital facility investment is a crucial decision by means of owner as well as investors because it has an effect on profit and loss. Decisions concerning the locations of industrial facilities have an effect on people where they are working, living and also determine the life-style of a community.

Parag Covardhan Narkhede (2009) in his study, 'Necessity of Comprehensive Planning for Housing in Metro Cities: Case Study of Pune City', revealed that the increase in population has created a demand for additional accommodation. There are several reasons why housing in requisite bulk has not been built. Some of them are: rising cost of building materials and labour, inflated land price, high rates of municipal taxation etc. In addition, old buildings are collapsing every year due to lack of maintenance and are creating a further demand for housing. This is the picture of housing to be found in most of the developing cities of India.

Rahman et al. (2009) India's cities are growing rapidly, resulting in a wide variety of environmental stresses. In this paper an integrated approach using satellite data and GIS techniques in conjunction with socio-economic data is used to assess urban environmental issues in Delhi. Delhi's current population of 13.8 million is growing rapidly, and is projected to reach 22.4 million by 2021. The issues addressed in this paper include: changes in land use/land cover changes in surface temperatures for 2001 and 2005; solid waste generation, collection and its management; and industrial pollution (i.e. air, waste water and

noise). The results show that Delhi is developing very rapidly mainly in the west, south-west and eastern sides. The study shows that a 122% increase in highly dense residential area was recorded during last decade in Delhi. The reduction of (17%) in fertile agricultural land in the fringe areas because of urban expansion. The pollution load has increased in terms of air, water, noise, and solid waste generation and disposal, etc. The Thermal Infrared (TIR) satellite data of Delhi clearly shows that there was a 1-2°C increase in surface temperature in just 4 years that is a subject matter of concern.

Zuber et al. (2006) the actual land use/land cover pattern of a region is an outcome of natural and socio economical factors and their own utilization by human over time. Consequently, information on land use / land cover is critical for the selection, planning an implementation of land use and can be used to meet the increasing demands for essential human needs as well as welfare. This information also assists in monitoring the dynamics of land use resulting from changing demands of escalating population.

Sanjay Mitra et al. (2002) in his study, 'Planned Urbanization through Public Participation', shows that, the land market has vastly raised the premium on the existing co-operatives. The public sector interventions in the land market, fiscal, legislative, regulatory or otherwise, have been counter- productive. Urbanization in India was characterized by a state-led and state-driven approach with a high budgetary impact on problems regarding land assembly, lack of involvement of the local people, widespread speculative and anti-poor land transactions and 'capture' by the middle and upper classes.

Mahan et al. (2000) in their study 'Valuing Urban Wetlands: A Property Price Approach' revealed that to estimate the effects of changes in land use associated with residential development on water quality and the implied ecosystem services at watershed level. Found that transforming forests to urban land uses consistently increases the index of deterioration in water quality. Water quality can have a direct amenity effect on properties that are adjacent or very close to the water body.

Chaurasia et al. (1996) Study focuses on urban designing of the actual land. They said-Urban designing and development may be a continuous method and involves planners, directors, developers, investors and in fact, the residents. so as to realize property urban designing and to see haphazard development, it's necessary that authorities related to the urban development generate such designing models in order that equally of the accessible land is employed in most rational and best means. This needs this and past land use/ land cover info of the realm and pattern of changes with regard to urban settlements and different native resources.

Rakesh Mohan et al. (1992) in his article, 'Housing and Urban Development Policy Issues for 1990s', seeks to bring to the fore the urgent issues concerning urban development. The haphazard growth, increasing congestion in living quarters as well as in the streets, high degree of pollution, existence of slums, high land prices and deteriorating urban services have led us to deplore fast urbanization and in particular the continuing growth of large cities. Large industries would come to be established in particular locations as these locations would become large urban centers, resulting in real estate development and new manufacturing activities particularly suited to the city.

RESEARCH METHODOLOGY

A survey should be designed in accordance with the following stages:

Stage 1: Recognize the subject and locate a few objectives.

Stage 2: Guide a opinion poll to know about what individuals know and what they see as the significant issues.

Stage 3: Catalogue the areas of data needed and filter the objectives.

Stage 4: Re assess the responses to the pilot.

Stage 5: Decide and finalise the objectives.

Stage 6: Mark the opinion poll or questionnaire.

Stage 7: Repilot the survey and questionnaire.

Stage 8: Settle and finalise the questionnaire.

Stage 9: Code the finalised questionnaire.

The survey design to be used in this instance is both the quantitative and qualitative methods.

SELECTING THE DEPARTMENTS AND AREA OF STUDY:

Hussey and Collis (2003:56) define individuals as "any precisely defined set of people or collection of items which is under consideration". Hussey and Collis (2003:155-160), define a sample as made up of the members of a masses" (the target population), the latter referring to a body of people, or to any other collection of items, under consideration for the research purpose. For this research the population is land cover of Srinagar city and its residents.

Srinagar city was selected for this study. Srinagar which is the first urban agglomeration in Kashmir formed the area for this study. I was motivated to focus on Srinagar because it represented a large city in the Kashmiri context and so provided an opportunity to investigate the problem of land use cause of urbanisation and industrialization.

METHODS OF DATA COLLECTION:

After considering carefully study research questions, the character of the data required for the analysis, examination and the existing conditions on the research field, it became apparent that the finest way to gather satisfactory data and information for the study research would be a amalgamation of the process of both qualitative and quantitative approaches. This is for the reason that some of the information needed were quantitative in nature and could be obtained best with the help of interviews while others were qualitative and thus, could be obtained through questionnaires.

Moreover, features of the information were actually noticeable and might be collected through direct inspection or field examination. There was also a variety of published data and information available like

- Newspapers
- Articles
- Books
- Magazines
- journals

and other different publications that might give useful data and statistics for the study.

From above insights became certain of the worth of combining diverse methods and techniques from both quantitative and qualitative approaches in my effort to collect the information required for this analysis. Their search, hence, employed, field, observation, questionnaires, interviews, and documentary study analysis, depicting upon the potential strength of these various ways and methods to upgrade the worth or legitimacy of the data and information.

ANALYSIS AND INTERPRETATION

City profile (Study Area)

Srinagar town is that the largest metropolis within the whole range region and not solely in Jammu and Kashmir geographical area. Town has been alarmingly growing at abundant quicker pace so indicating in it goodly changes. Town lies at 74° 43' - 74° 52' E meridian & 34° 0' - 34° 14' N latitude. it's concerning at 5200 feet higher than mean water level. the situation map of the study space is shown in fig.4.1 (see page twenty one for fig.4.1). Town encompasses a distinctive physiographic setup with steep hills within the East and North East, low lying paddy fields falling within the flood plain of Jhelum within the South and West, the karewas of Budgam within the extreme South and towards the North area unit set the uplands with moderate slopes. The dal lake is settled within the heart of Srinagar town. Town of Srinagar experiences a Mediterranean sort of climate and receives most of its precipitation throughout the winter.

According to the latest census, Srinagar city has a population of 1.1 million. Srinagar has been listed the tenth worst contaminated town within the world in step with World Health Organization's (WHO's) international urban pollution information. Kashmir's, especially those living in Srinagar, are annoyed about this development. Urbanization process has significantly modified the land use of Srinagar city and its surrounding area. Rapid, unplanned and uncontrolled urbanization causes disorganized growth. The patterns of urban development are changing natural landscapes and their dynamics. In a major push for urban infrastructure development in Jammu and Kashmir, the state's twin capitals Srinagar and Jammu have figured in the list of cities to be developed as "smart cities." Among the 30 cities that made it to the list, Srinagar has bagged the 10th position and Jammu 21st. "The Government of India cleared the proposal of developing Srinagar and Jammu as smart cities". The Smart City Mission—aimed at improving basic urban infrastructure in cities—was launched in June 2015. The program will give a fillip to infrastructure development in the summer capital. "It would address all core components of city development like basic facilities, disaster management, sanitation and urban mobility". The application of smart solutions will improve infrastructure and services in the city. "Area-based development will be undertaken in downtown areas under the program".

Population Growth

The vibrant trend in the population intensification of Srinagar city gives an accelerated pace of increase in city's population in upcoming which is made known from the reality that the city has achieved the urban metropolitan status in the year 2008. This expected speedy change in the demographic aspect of the city is bound to fashion an impact on the socio-economic arrangement of the city and may draw attention to the problems of housing insufficiency, land speculations and urban disfigurement and slums.

YEAR	POPULATION FIGURE	SOURCE
1981	6,17,672	Census of India
2011	12,50,000	Census of India
2021	15,00,000	Estimated

Table 1. Population figures of Srinagar city, 1981, 2011 & 2021

Land Transformation in Srinagar City

Land is in a constant state of transformation as a effect of various innate and synthetic processes. Land conversion has been asserted as one of the vital fields of individual induced ecological transformation. An key aspect of change recognition is to establish what is in point of fact to what i.e., which land use set is shifting to the other. This data reveals both the pleasing and unwanted changes and sets that are comparatively firm overtime. This data also serve as a fundamental tool in supervision decisions. Throughout the study phase Srinagar city has not only stretched from its original range but there was noteworthy

transaction of land amid different land use/cover classes. These changes are since of the growth of city resulting in amplified requirement of land for housing commercial, business etc. purposes. This request of land along with site magnetism, functional expediency, purposeful magnetism and the land worth of that meticulous area ultimately manipulate the speed and track of city land transformation.

*Estimated

YEAR	LAND CONSUMPTION RATE	YEAR	LAND ABSORPTION COEFFICIENT
1981	0.004	1981/2011	0.006
2011	0.005	2011/2021	0.005*
2021		0.005	

Table 2. Land Consumption Rate and Consumption Ratio

Areal Expansion

For the duration of past century (1901-2011) rising population due to soaring natural growth pace and in movement for better employment opportunities have lined way for speedy expansion of this city centre. The Table I.I shows the prototype of raise in the area of the city for the duration of last hundred years. It is apparent from these data that there has been a slow spreading out of the city through first fifty years and a very rapid expansion after 1970’s as the total area of the city has amplified from 12 Km² in 1911A.D. to 82 Km² in 1971A.D., 278.1 Km² in 2001A.D. and 416 Km² in 2011A.D. The study of the spatial expansion of the city reveals that enlargement of the city has been an exponential one as reflected in Fig. 3b. The spread out of the city between 1901 and 2011 has been shown in Fig. 1.

Land Use Land Cover Projection for 2021	BUP	PRK	VAC	AGRI	PL/OR	FOR	BAR	MAR	WAT	
2021	Area in Hectares	8051.33	499.33	157.67	9286	3027.66	77.67	467.34	78.34	1801.5
Area in Percentage	34.33	2.12	0.67	39.60	12.91	0.33	1.99	0.33	7.68	

Table 3.Land Use Land Cover Projection for 2021

Srinagar City Areal Expansion (1901-2011)

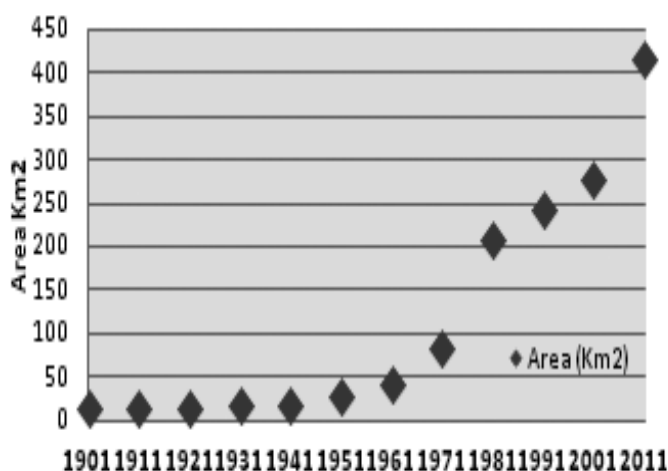


Figure 1.Srinagar city areal expansion

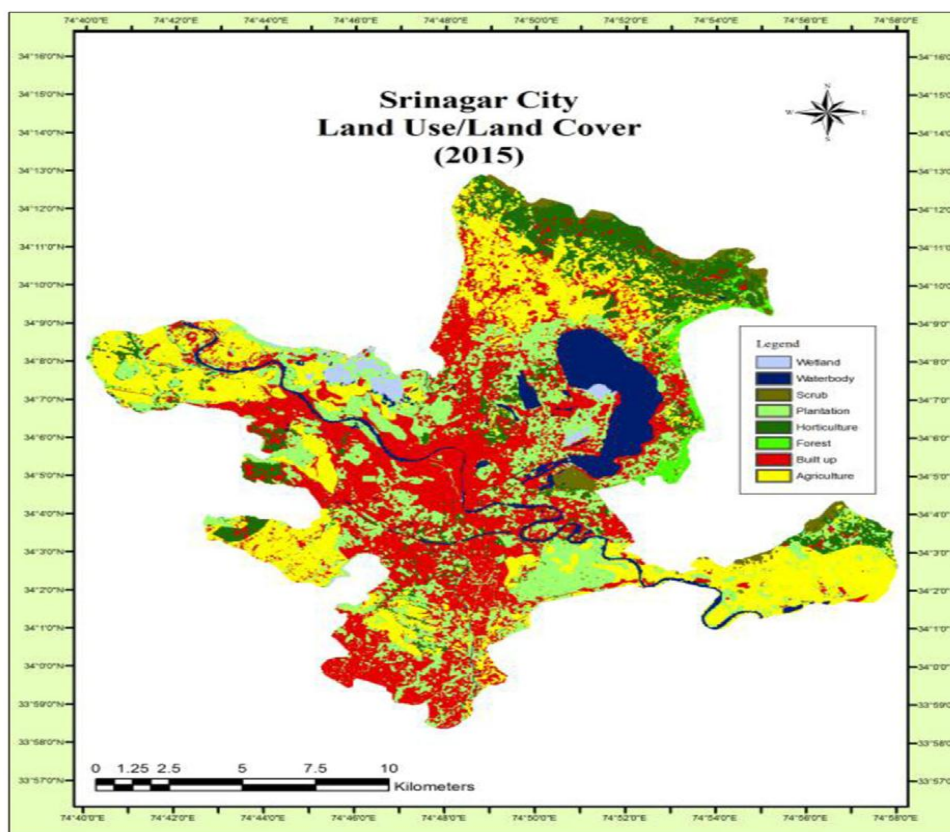


Figure 2.land use/land cover of Srinagar city 2015

FUTURE SCENARIO : The first furrow on land by the plough marked the beginning of human civilization. It is the land resource that replaced man’s savagery with what we now call “settlement”. The abuse of this land resource may probably cause settlers to become savages again. “Agri land conversion making 60% J&K population poorer by the day” a front-page report published in Greater Kashmir on 28-04-2019 is an eye opener for all. The report reflects a genuine concern regarding loss of cultivable land for non-farm purposes, which has resulted in a decline in farm income and its contribution towards the GSDP. The situation is alarming and needs to be tackled, earlier the better. Crop diversification for profitability and optimum use of the land resource is no doubt scientifically recommended and very useful, however, ruthless and unplanned conversion of farmland for non-farm purposes is a suicide and a great injustice for coming generations. We see a concrete jungle of buildings and commercial complexes coming-up in paddy fields, a 120 m wide and 100 km long four-lane highway running from Qazigund to Tangmarg and a railway track from Banihal to Baramulla with a major portion of all occupying a large chunk of paddy land. Moreover, a large number of farmers are converting their rice fields into orchards or commercial vegetable gardens. This scenario has gained concern and everyone is worried about the loss of paddy area to rampant constructions. But surprisingly (or not so surprisingly), the Digest of Statistics 2016-17 J&K State, depicts a regular increase in paddy area from 1955-2017. Only one of the two claims can be a fact. I fully agree with the suggestions given in the above-quoted report especially those to prevent the conversion of farmland for non-farm purposes and to curb the land mafia by framing a healthy and extensive housing policy. Let the authorities wake up from the slumber to save the agricultural land, and hence save the civilization and future generations

VI. FINDINGS & CONCLUSIONS

FINDINGS:

There is no clear mechanism put in place to lessen gap between available land and growing population.

Non economic development of rural areas is one of the factor to be analysed.

There is no policy on effect of urbanisation on climate change .

Urban zones of city have not been identified yet.

There is no guiding principle on population growth .

Due to lack crucial sustainable land management policies and practices to avoid the endangering of the environment and sustainable development

CONCLUSIONS:

1. The relative relevance of a city in a region can be understood from the following:

- Primate city model
- Zipf model-Rank size rule
- Losch model/christaller model

2. The residential and commercial pattern within the city can be understood from the following models:

- Burgese model
- Homer hyot model
- Edward Ullman model
- Leap frog model
- Lewis Munford theory of town planning

3. Srinagar master plan 2000-21 & draft master plan-2035 for Srinagar metropolitan region.

4. Decentralization of some higher order functions must take place as otherwise this leads to problems like traffic congestion, traffic jams, and pollution etc. in the core of the cities.

5. Sustainability should be a hallmark option.

6. With rapid technological advancements in the 21st century, a lot of old urban planning models have already become obsolete. This ensures that the focus should be on amalgamating latest technology goals and urban planning guidelines while recognizing the importance of sustainability. since a lot has changed over the decades, it should fundamentally reflect in urban planning strategies that focus on the future

7. New methodology

- Urban planning needs a new methodology. “A methodology involving people, process, technology and citizen participation, inviting experts to share knowledge, and facilitating enterprises,”
- Possible solution to tackle the issue of pollution. “Export ideas. Focus more on education and knowledge sharing, spreading awareness by encouraging people, organizing free workshops, and innovation and Inspiring startups”.
- “Encouraging the germination of new ideas, fast-tracking process, throwing new light on challenges is the way forward, training youth to understand financing solutions

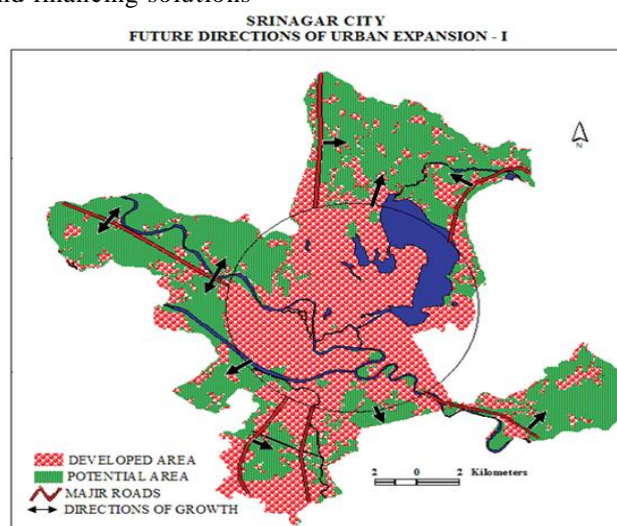


Figure 3. Future directions of urban expansion of Srinagar city (urban sprawl)

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