1.1 Introduction

Urbanization is considered to be an important process of socio-economic development and cultural transformation. All over the world, urban centers, cities or small towns are expanding by migration and natural increase in population. One important aspect of urbanization in India is the tendency towards concentration of population in larger urban centers. This has serious implications. These cities are growing rapidly and services are not able to keep up with the pressure of population. These growing cities have literally expanded into the surrounding countryside leading to changes in land use pattern, social and economic and demographic lives of the rural folks living in the peripheral areas of the cities. These peripheral areas have grown around all Indian cities and have assumed a vital significance for the planning of cities in future. The villages of the fringe today are likely to become an integral part of the city tomorrow.

The growth of human settlement is a continuous phenomenon. The form, pattern and function of urban settlements are undergoing tremendous changes both vertically and laterally due to centripetal forces like higher order facilities and services, higher wage rates, more and better job opportunities etc. and centrifugal forces like overcrowding in core areas, availability of cheap land in peripheral areas of city and less or no strictness on the development control in the fringe area. An important feature in the development of human settlement during the last several decades, the rapid expansion of population and build-up area in the fringe and within the cities and towns which resulted in the leap frogging development. Consequently, indelible imprints of urbanism are also found
beyond the Municipal Corporation limits, these imprints easily identify that rural indices and are also seen with the urban fence. In view of rapid influx of activities beyond the municipal boundaries and the absence of developmental control, it is difficult to administer these areas successfully. As a result of which fringe area is full of incongruities of physical landscape, changing aspiration of original fringe habitants, coming up of nonconforming land uses, land speculation, indiscriminate erosion of rich agricultural land and inadequate services, all pertaining problems are to organize planned spatial growth and development.

It is very difficult to define the partly rural and partly urban areas occurring in between the rural and urban landscape. The nature of fringe, it neither purely resembles with the city characters nor with rural characters but corresponds to both. The physical characters at the urban periphery are associated with the transfer of land from rural to urban purpose. The development of fringe area has become an integral component of physical structure and growth of towns and cities. However the fringe area is considered as the problem area for urban administration.

Rural urban fringe signifies both urban and rural characteristics. The better way to identify the fringe area is in terms of land use as well as socio economic dynamics of the area. The fringe area acts as a bridge between the rural and urban community. All the characteristics of the urbanity and ruralism are medium in fringe area. These characteristics are urban habits, land value, public utility service, commuting, non-agricultural activities, land use characteristics, sex ratio, literacy rate, population density, agricultural activities etc. these characteristics are dynamic in nature form town to town depending upon the cultural and physical setting of the town. The occurrence of Rural
Urban Fringe is a rather recent phenomenon around the Indian cities, though its occurrence around western cities was observed long ago. Cities are the reflectors of socio-economic development of any nation. They are the centers of religious and socio-economic activities. The size, growth and development of any settlement depend on its interaction with the surrounding hinterland or city region.

In the modern age of urban expansion the term fringe has assumed an important significance. Urban areas are growing in size and expanding in aerial extent due to counter-urbanization and migration of people from rural areas. As a result urban areas start expanding towards surrounding rural areas. This process of urban expansion together with market forces of city/town creates distinctive socio-economic characteristics named as rural urban fringe. The rural urban fringe is the area where the built up urban area meets the open countryside. Usually at the edge of the city, it is semi-urban and semi-rural.

The expansion of the town depends up on the nature of the fringe as well as the nature of the town. City does not grow out wards in well-defined pattern, it sprawls haphazardly making rapid advances at one point, and hardly moving at all at another. This results into incoherent landscape which is the characteristics of the fringe. The rapid expansion of modern city outside its political boundaries and beyond its real physical cultural domains possesses several attendant problems (Sinha 1979). Rural urban fringe lies between the continuous build up area of a city and of urban shadow and it can be viewed as an area of invasion in which population density is increasing, land value is rising and land use is under the process of change from farm to non-farm uses.
The rural urban fringe, which is very near to municipal boundary of city or wherein municipal boundary is called urban fringe or inner fringe and that part of the fringe which is beyond urban fringe is called outer fringe or rural fringe. Urban fringe experiences more urban influence. The inner fringe is the area which is characterized by land in advanced stage of transition from rural to urban land use. Various attempts have been made to delineation of rural urban fringe both in Western as well as in Indian cities but the criteria or indicators of delimitation vary. In India mainly social, demographic and economic criteria were used for the delimitation of rural urban fringe.

Rural urban fringe is often described as the garbage and sewage dump of the city. The classical examples of such land uses are garbage dumps, sewage disposal tanks and farms, burial and cremation grounds, airports, timber yards, brick kilns and so on. Residential and industrial development occurs in haphazard manner. Rural urban fringe is a transition zone of land use but also the zone of mixed socio-economic characteristics. It contains both rural as well as urban population. It is the zone of segregation and isolation. Selective migration is an important characteristic of the fringe. A rural urban fringe can only exist between the growing urban center and its rural hinterland, so it is no diminution of the concept to view it as the residual zone between two more readily defined poles. In 1968 Pryor has defined the rural urban fringe and differentiated the rural fringe and urban fringe, as follow:

The rural urban fringe is the zone of transition in land use, social and demographic characteristics, lying between (a) the continuously build-up urban and suburban areas of central city, and (b) the rural hinterland, characterized by the almost absence of non-farm dwellings, occupations and land use, and of urban and rural social
orientation; an incomplete range and penetration of urban utility services; uncoordinated zoning or planning regulations; areal extension beyond although contiguous with the political boundary of the central city; and an actual and potential increase in the population density, with the current density above that of the surrounding rural districts but lower than the central city. The characteristics may differ both zonally and sectorally, and will be modified through time.

Within the rural urban fringe it may be possible to identify:

1. The urban fringe, that sub zone of the rural urban fringe in contact and contiguous with central city, exhibiting a density of occupied dwellings higher than the medium density of the total rural urban fringe, a higher proportion of the residential, commercial, industrial and vacant as distinct from farm land, and a higher rate of increase in population density, land use conversion and commuting; and

2. The rural fringe, sub zone of the rural urban fringe contiguous with the urban fringe, exhibiting the density of occupied dwellings lower than the medium density of the total rural urban fringe, a higher proportion of farm as distinct from non-farm and vacant land, and a lower rate of increase of population density, land use conversion and commuting”.

1.2 Role of Geographical Information System and Remote Sensing

Rural urban fringe signifies both urban and rural characteristics. The nature of fringe, as it neither purely resembles with the town characters nor with rural characters and at the same time it corresponds to both. The better way to identify the dynamic nature of fringe area is in terms of social, cultural, demographic and land transformation at
different time periods. Therefore, to acquire current information of the changing scenario of rural urban fringe for effective management of social, cultural, demographic and land transformation GIS and remote sensing provides the platform for detecting the changes occurring in the rural urban fringe of city.

Land use land cover of a region is an outcome of natural and socio-economic factors and their utilization by man in space and time. For managing natural resources and monitoring environmental changes, land use and land cover change has gained a lot of importance. The change in the land use and land cover reflects the functional pattern of a region. High population growth has resulted in the high pressure on agriculture which ultimately makes it a scarce resource. Therefore it is essential to have the current information about the changing scenario of land use in order to make the optimal utilization of scarce resources in order to meet the increasing demand of human needs and welfare. (Saxena, A., Agarwal, R. 2008). Land use at rural urban fringe tends to change more frequently and quickly than elsewhere because of incessant urban sprawl. It is essential to acquire such land use information in timely and accurate fashion to avoid mistakes in planning. It is the area of dynamic in nature both in socio-economic and demographic profile and also in land use conversion. These changes in rural urban fringe are observed due to the expansion of urban area. Therefore both the regional planners and municipal planners require current information of the changing scenario of rural urban fringe for effective management of land development and plan for change. In general, in urban area particularly in fringe area this change is very rapid. As a result it is difficult to maintain up to date information on new residential, commercial, and other changes of land use. Off course these changes have occurred and will occur in future but due to the
lack of current information which in turn leads to miss management of resource utilization. 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)

It is not only the science of obtaining information about an object under investigation but also has emerged as a powerful tool for planning of land use land cover dynamics. It also helps in monitoring the rapid changes in the land scape resulting for urban development (Alberti et al., 2004) and capable of detecting and measuring a variety of elements relating to the morphology of cities (Yeh and Liu, 2001). It can provide useful information about land use pattern in and around the cities and their changes. The surface of earth itself is in dynamic nature and changes over time remotely sensed data potentially offer a rich source of information about condition of its change. This is possible because of the availability of multi data remote sensing, data monitoring spatio-temporal changes which are occurring on the earth’s surface. Remote sensing in association with Geographic Information System is now providing a tool for advanced ecosystem management. The collection of remotely sensed data facilitates the synoptic analysis of the earth system, function, pattern and changes at global, regional and local scales over time. Remote sensing has been recognized as a useful mean of supplying up-to-date information of activities within the urban environment, including rural urban fringe (Ehlers et al. 1990; Forster 1985; Jensen and Tool 1982).

However it is felt that the interface of GIS technology with remote sensing will provide maximum information content and analysis capabilities and thus be of benefit to land use planners (Nellis et al. 1990). It has been recognized that there are many
advantages to combine remotely sensed data with existing spatial image and statistical data, thereby maximizing the information up on which responsible decisions for land use planning can be made. Geographical information system (GIS) provides the medium for the integration of spatial data and at the same time provides a powerful tool for quantitative analysis of land use change and map revision (Welch et al 1988). The integration of both Remote Sensing and Geographical Information system produces symbiotic relationship and ultimately deliver synergetic result and therefore in recent times they have emerged as powerful tools for decision making process. Thus GIS and remote sensing provides a system for regularly monitoring the changes occurring in the area with a view to better planning.

1.3 Statement of Problem

Urbanization policy cannot simply be treated as an isolated problem of cities and towns, but the regional impact of urbanization needs to be examined as well. In particular, the areas in the intermediate periphery of large cities deserve attention. The rural urban fringe has been ignored from both ends, rural as well as urban by policy and decision makers. It is necessary that in farming an urbanization policy in any state, due attention should be given to rural-urban fringe. The rural urban fringe area of cities expresses certain typical characteristics pertaining to economic base and social set up such as increase in commuting population and conversion from agricultural to non-agricultural land uses in general, but each city has peculiar characteristics of its own. The foremost concern of a geographer is to study the manner in which socio-economic and technological changes have capability of altering the direction of urban development. This depends on the needs and location requirements of individuals and families on the
one hand and that of economic set up of the region on the other. It is observed that the urban rural interaction is at its maximum immediately beyond the edges of the continuously built up areas. It is this undeveloped space into which a town or city expands by circumferential or radial growth. It is a zone of mixed land-use patterns and characteristics in which rural activities and modes of life are in a rapid retreat and into which not only residential, but also commercial, educational, recreational, public service and other largely extensive uses of land intrude. This spatial intrusion makes several demands on the surrounding countryside – commonly referred to as ‘urban sprawl’ leading to changes in land use pattern and social structure. Very often at a given singular moment of time, several transformations may occur simultaneously, which are rooted in the spatio temporal context and by forming connections between the past and the present it can help us in understanding them.

Landscape at rural urban fringe comprises of vast area that lie follow, waiting for future urban development. This is an important thing in the rural urban fringe area. The pattern of land use in the fringe area is dynamic in nature and changes from rural to urban use in short period of time. This changing scenario of land use has given rise to other problems like as unemployment of the farmers, loss of agricultural land etc. with the growth of population in the fringe area leads to housing problem as well as problem of transportation, shopping and education. These problems are ignored by the Town Planning Authorities as a region outside the Municipal Corporation and rural area also ignore these problems because the development of the fringe is beneficial for town dwellers only. Therefore separate authorities should be set up to solve the problem in the
fringe area. Thus, the fringe zone has been neglected because of its transitional as well as its conversational character.

The study of the rural urban fringe is necessarily for better planning and better livelihood for the fringe dwellers. Though footprints of the sprawl city are observed in fringe but in reality it is not the part of the city therefore the town planner does not moves beyond the city limits on the other hand village administrator is not found so sound that will tackle these problems. Another problem of fringe area is from the developmental perspective because of its transitional nature between rural and urban community, the town planners does not take it into consideration while making plan for city as it is beyond the municipal limits and but for village administrative it is the part of city.

The study of rural urban fringe has immense significance for those areas in which the trend of urbanization is very high. Hence the study of rural urban fringe aims at analyzing the growth of the Srinagar city and its influence on the surrounding areas in socio-economic, demographic, and land use aspect. The study of the fringe area is necessary for knowing the magnitude of urban influence on the surrounding areas of the city.

In most general terms, the problem of the fringe arises from two sources. The first is isolation and second is a tension which is created by the impact of city expansion upon the open countryside. The later one is very acute in small regions where the space is limited. So far as the region of Kashmir is concerned, it is in an axial form surrounded by mountains from all sides with the primate city of the state where the trend of urbanization is very fast. The growth of the Srinagar city has influenced the whole region but most importantly the area nearby it. The aerial growth of the Srinagar city has increased from
12.80 square kilometer in 1901 to 416.1 square kilometer in 2011. It suggests that the Srinagar city has encroached the surrounding area to a great extent.

Delimitation of rural urban fringe is of great significance for the planning of city and rural-urban fringe as the city is not an isolated entity but has continuous interaction with the fringe area. Srinagar has grown haphazardly in various directions. There are various villages and sub-urbs around the city and in future they will become part of the city. So delimitation of rural-urban fringe has great significance in long term prospective planning of Srinagar city.

Srinagar being the state capital and the most dynamic among all urban centers of the region constitutes 66.30 percent of total urban population of Kashmir region and 38.77 percent of total urban population of Jammu And Kashmir State in (2001 census). The city has shown unique trends in its population growth, as during the decades of 1971-1981 and 1981-2001, the population has exploded more than double. The population of Srinagar city has increased from 606002 persons in 1981, to 1192792 persons in 2011, with its annual growth rate of 24.20 percent. Population growth has not only resulted in unwieldy expansion of Srinagar but has also threatened its ecological balance. Secondly, unplanned inefficient and uneconomic ribbon extension along main roads sprawling out of a highly concentrated core and sporadic growth on the fringe with vast tracks of vacant land have resulted in the disjointed urban form which is highly uneconomic to serve and extremely difficult to manage for an average sized municipality.

Though the Town Planning Organization (TPO), Srinagar Development Authority (SDA) and Srinagar Municipal Corporation (SMC) have prepared the comprehensive Master Plan for the Srinagar city as early as in 1971, revised in 1984-85 and again in
2001, but it was limited to physical planning aspects, in which the rural urban fringe was altogether ignored. In view of the fact that the rural urban fringe provides scope for future urban sprawl. Therefore, urban planning should pay greater attention with overall urban development goals.

Keeping in view the above mentioned facts it is imperative that the rural urban fringe must be saved from the haphazard and unplanned development. Therefore the study of fringe is necessary so that the proper care may be taken in the expansion of the Srinagar city in future. If the fringe is properly developed, the pressure of population will be transferred to the fringe and the congestion in the city will be avoided. This will help the planners in providing better civic amenities to the city.

1.4 Objectives

Keeping in view the domain of research, following objectives have been set up for the present study:

- To study the influence of urbanization on the land use change in Srinagar city.
- To delineate rural urban fringe of Srinagar city on the basis of selected variables.
- To analyze the socio-economic and demographic profile of rural urban fringe.
- To examine the change in land use pattern among the different zones of rural urban fringe.
1.5 Study Area

The rural urban fringe of Srinagar city 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 33°52′15″ to 34°15′33″ North latitude and 74°34′49″ to 75°01′24″ East Longitude. The city as well as its fringe area is encircled by natural walls of mountains (the sub mountain branch of Pir Panjal range) whose height varies from 1800 to 4300 meters above the sea level. However the surrounding area of the Srinagar city is very rich despite these physical diversities. The rural urban fringe of the city covers a vast area of Jhelum valley floor characterized by gentle undulating topography, while the south-west and southern peripheries have presence of elevated lands known as kerawas. The base map has been prepared for the area extending from city center up to the 20 kilometers. The rural urban fringe of the city covers an area of 890.36 square kilometers. With the population of 525514 persons (Census 2001) reflecting the population density of 590.23 persons per square kilometer. The study area comprises 418 inhabited villages and spreads over the districts of Srinagar and parts of Ganderbal, Baramulla, Bandipora, Budgam and Pulwama.
Methodology involves comprehensive studies using a historical perspective and the application of geographical framework for better representation and understanding both in time and space. The usefulness of any research depends up on the sound methodology and data base so that the objectives will be achieved. As the study aims to identify the dynamics of rural urban fringe in terms of its socio-economic and demographic profile and land use change, therefore the data relating to socio-economic and demographic variables have been collected from Census of India, Jammu and Kashmir Government Gazette. In addition 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).
A good number of researches have been carried out to delineate the rural urban fringe by employing different methods to represent the area of city’s influence. The delineation of rural urban fringe has become very complex because of rapid growth of urbanization which has resulted into overflow of population in adjacent areas. This causes frequent changes not only in land use pattern but also demographic, social, cultural and economic profile of the fringe area. Different methods have been applied by different scholars to delineate the rural urban fringe of a city like as mean, correlation, regression, coefficient of determination etc.

For the delineation of rural urban fringe the selected area has been delimited into inner city fringe, urban fringe and rural fringe by taking the rural and urban averages at National, State and District level have been taken into consideration and then the additions of the averages at the three levels (National, State and District) for both rural urban areas has been set as the demarcation limit as stated in the following formula:

\[
U_d = U_{an} + U_{as} + U_{ad} + \frac{1}{n} = \text{Urban Limit}
\]

\[
R_d = R_{an} + R_{as} + R_{ad} + \frac{1}{n} = \text{Rural Limit}
\]

Where:

\( U_d \) stands for urban limit  \( R_d \) stands for rural limit
\( U_{an} \) for National urban average  \( R_{an} \) for National rural average
\( U_{as} \) for State urban average  \( R_{as} \) for State rural average
\( U_{ad} \) for District urban average and \( R_{ad} \) for District rural average and
\( n \) the number of variables  \( n \) the number of variables

The mean obtained from the urban and rural averages, sets as the urban and rural limits respectively. Those villages which cross the urban limit with respect to population
growth, population density, sex ratio, literacy rate, settlement density, land value, ratio of non-agricultural workers ratio as high ranking villages set the ‘Inner City Fringe’. The villages falling within the two limits i.e., less than urban limit but greater than rural limit are medium ranking (except uninhabited villages) and thus called the ‘Urban Fringe’. The remaining villages which have value lower than rural average are lower ranking and form the ‘Rural Fringe’. At the second step, the villages thus divided into three categories as high, medium and low with respect to earlier mentioned variables, are rated as the values of 6, 4 and 2, respectively. An aggregate score (from the addition of the ratings) for those 6 variables in 1981 (i.e., at a maximum of $6 \times 6 = 36$ or a minimum of $6 \times 2 = 12$) have been added to the ratings for distance to determine the level of urbanization. While as the aggregate score (from the addition of the ratings) for those 8 variables in 2001 (i.e., at a maximum of $6 \times 8 = 48$ or a minimum of $8 \times 2 = 16$). Only those villages which have an aggregate value greater than 80 percent of the aggregate score has been designated as the ‘Inner City Fringe’, more than 60 per cent and less than 80 per cent as the ‘Urban Fringe’, more than 40 per cent and less than 60 per cent scores as the ‘Rural Fringe’ and less than 40 percent of score are purely rural villages.

The data for the analysis of urban influence has been collected from both primary and secondary source. The study area has been taken up to the distance of 20 kilometers from the city center by taking into consideration the possibilities of future expansion of city. For determining the socio-economic and demographic profile or urban influence of Srinagar city on the fringe area, the study area with the help of buffer analysis has been divided into three Zones with respect to distance as Zone 1 (0-10 km), Zone 2 (10-15 km) and Zone 3 (15-20 km) from city center.
Field survey of the study area has been conducted to get the first hand information regarding socio-economic and demographic profile of rural urban fringe of Srinagar city. The sample villages have been selected from all three zones. Stratified random sampling method has been used for the selection of sample villages while the simple random method has been used for the selection of households. Out of 412 villages, 22 villages at 5 percent have been selected as sample villages. Out of total sample villages, 2 villages have been selected from Zone 1, 7 from Zone 2 and 13 from Zone 3. The sample villages constitutes 1910 household out of which 193 household have been selected for sampling at 10 percent. Out of 193 households, 29 households have been selected from Zone 1, 38 from Zone 2 and 126 from Zone 3. The data relating to Occupation, Literates, Illiterates, Education Facilities, Medical Facilities, Frequency of Transportation, Different kinds of Linkage, Responses of residents relating to urban encroachment and Newspaper circulation has been collected. The analysis of these variables has been done in relation to distance from the city towards the surrounding area. For the analysis of data, the descriptive and comparative statistical methods are used with the help of statistical techniques using SPSS 20 like Analysis of Variance (ANOVA), Correlation, Mean and percentages have been used. Data are also presented in the form of tables and figures.

The growing pressure of population along with increasing variety of demands on land resource, have brought extra pressure on available land resource all over the country. Hence in order to use the land optimally, it is necessary to monitor the dynamics of land use resulting out of changing demand of increasing population.
For land use/land cover change detection 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 and fringe area have 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. In order to examine the degree the urban influence on land use with respect to distance, the satellite images of fringe area have been further divided into three Zones as Zone 1 (0 - 10 km), Zone 2 (10 – 15 km) and Zone 3 (15 - 20 km). The data relating to these zones of two dates were compared to determine the rate at which the change in land use pattern has taken place with distance. The generated data were presented in the form of maps and tables and figures.

1.7 Organization of Thesis

The study has been organized into following chapters.

Chapter – 1: Introduction.

The first chapter is the introductory chapter providing an introduction to the topic, role of GIS and Remote Sensing, statement of problem, Objectives, Study Area, Methodology and Organization of the thesis.
Chapter – 2: Review of literature

This chapter deals with the review of literature. The review is on different aspects of rural urban fringe such as identification of fringe, its linkage, characteristics, and regarding the future planning of the fringe. The review of literature through GIS and remote sensing has also been carried out.

Chapter – 3: Srinagar City and Its Environment: A Geographical Background.

This chapter presents the scenario of the growth of the city. It includes the areal growth, Demographic and Socio-economic changes in the city from 1901 to 2001. The land use and land cover changes has also been detected from 1979 to 2010.

Chapter – 4: Demarcation of the Rural – Urban Fringe

It presents the profile of various variables on the basis of which the rural – urban fringe has been demarcated.

Chapter – 5: Socio-economic and Demographic Profile of Rural urban Fringe

It presents the profile of the urban influence of the city on the Socio-economic and Demographic Profile of Rural urban Fringe. This chapter also includes the analysis perception of the respondents based on the data collected from field survey.

Chapter – 6: Land Use land Cover Change

This chapter analysis urban influence on the land use change of rural urban fringe of Srinagar city in the concentric circle wise from 1979 to 2010
Chapter – 7: Summary and Conclusion.

It is a concluding chapter, which provides a summary of the thesis besides presenting major findings of from the study and suggestions for the further studies on fringe development.