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Chapter I

INTRODUCTION

1.1 Introduction

Food, clothing and shelter are three basic necessities of human beings. Among them clothing is less important. Food and shelter, however, are almost of equal importance. With rapid increase in population during last 100 years, these two have emerged as two most important problems before the society. Security of housing accommodation has problem in both rural as well as urban areas. Due to rapid industrialization and consequent large scale rural-urban migration, housing accommodation has become an acute problem in areas. This is an attempt to understand precisely the nature of this problem. Efforts are being made to solve this problem at individual as well as at mass level.

The houses are constructed and settlements are proposed to protect themselves against the vagaries of weather and to enjoy social life. In fact, settlement is important step towards adopting physical environment. The problem of rural and urban settlements has been increasingly probed by anthropologists, sociologists, ethnographers, economists and geographers. They are however, examined this issues with different objectives and methodologies.

In ancient period urban settlements originated and then developed with considering changes in social, political, religious and historical conditions. Specific settlements get benefits from location, climate, relief, soil, and water supply etc. Some settlements have the central place or nodal place and some settlements are located along the road sides. These settlements naturally get the facilities like health, plenty water, suitable land for settlements and protectable relief from the surrounding area. The types of settlement develop physical personality of the region and functional multiplicity. Hence, the initial state smaller settlements slowly go through the various stages and evolved into town or city. Burgess in 1923 has studied the growth of the city. This study related to the model regarding landuse in city. The concentric zone model was inductive and based on the number of American cities in general. This model consists of six zones away from centre. The Burgess model is applicable only to older and larger cities of western or developed countries. Newer, smaller and rapidly growing cities do not follow such concentric zone pattern. This model excludes wide variety of factors which affect the urban landuse. Sector model
suggested that which is an extension of Burgess Model studied entitled “The structure and growth of residential neighborhoods in American cities (Homer Hoyt 1939). Theory and proposed a new model for the further modification, namely, the multiple nuclei model in 1945 both the concentric zone theory and sector theory were based upon the argument that the city develops around a single centre. ((c.f.), Patil S. 2010)

1.2 Urbanization

Urbanization is a process of villages to be developed into towns and further into cities and so on. There is no universally accepted definition of urban settlement. Different countries adopt different criteria for defining the urban settlement. Urban places are not even similar in character. This can be distinguished on the basis of defined demographic characteristic and available infrastructures. In India, criteria of urban centers are more or less similar to the ones suggested by the United Nations. In Census of India (1961) has defined urban centers as “Places having a minimum population of 5000 with at least 75 percent of male workers being engaged in non-agricultural activities and the density of population should be 400 persons per square Kilometers”. According to Trewartha, the level of urbanization is defined as the proportion of urban population to total population residing in urban places by shifting population from village to city and the process of transformation of villages into city is called urbanization. Urbanization is broadly defined as a growth of towns and increasing ratio of urban to rural population of a country. The growth of a country’s towns and cities is conditioned by the natural, economic and social progress. The concept of urbanization as a set is related to the socio-economic process which implies a shift in focus from the city as a cultural aspect to process that leads to the expansion of cities and generate and diffusing element of urban life and culture. Urbanization and modern civilization go together for in developing stage due to increasing economic specialization and advancing technology. The simplest and most common definition of urbanization is “Proportion of population living in urban settlement to total population”. Geographers have studied urbanization as a process of concentration of population in larger human settlement either through multiplication or concentrated. However, urbanization is not merely a demographic phenomenon. It has its economic and other concomitant at the same time. It is a special concomitant phenomenon involving the complex process of change involving population
concentration, structural transformation and socio-psychological change affecting both people and places by following dimensions:

I) A progressive concentration of people and activities in towns and cities, thereby increasing the general scale of settlement

II) A change in the economy of a country or region, whereby non-agricultural activities become dominant

III) A change in the “structural” characteristics of population (Lower birth rates, higher death rates, positive migration balances etc.).

IV) A change in the social, psychological and behavioral patterns of the people overtime to adopt an ‘Urban Way’ of life i.e. Urbanism as a way of life and the spread of urbanism beyond the built up areas of towns and cities, thereby inducing rural dilution

V) The transmission or diffusion of change (Economic, social and technological) down the urban hierarchy and into rural areas, urbanization does not always take the same form, nor does its progress at the same rates everywhere

Urbanization is regarded as a complex process. It leads society towards the industrial and technological enrichment. The understanding of the growth dynamics of urban settlements at different levels becomes the primary requirement for any explanation of emerging pattern. The concept of urbanization as a process of change and transformation is yet in the stage of evolution through the verge and more in developing countries. Urbanization challenges for government and city authorities and struggling for various services for rapidly increasing city population. Urban population brings a critical need to look for new ways? Many strategies to reduce poverty tend to focus on rural poverty, ignoring the differing need of poor urban dwellers. The need of improve the lives of urban dwellers has been recognized in the United Nations. Millennium development goals, which pledge to achieve significant improvement in the lives at least 100 millions slum dwellers by 2020. In India, urbanization has occupied vital role in economic development of different regions. Urban development is a direct and immediate concern to 27 percent population who live in towns and cities ‘India lives in huts and cottages of olden days. But it also proved that India has a tradition of urban living and town planning which goes back to 3000 B.C. The cities of Indus valley civilization, Mohanjodaro and Harappa, which flourished in 3000 B. C., were large and well planned. The Indus valley people had
attained high standard of town planning and architectural signs. Hence, India’s urban tradition has continued through centuries and during the ancient period of our history when there were well planned and beautiful cities in different parts of country. Patliputra of Chandragupta Mourya, Ujjain of the Gupta’s Kannauj, Banaras and Mathura were some of the great cities found in northern India. In south India, the cities were established in medieval period by the Chalukya, the Rashtrakut, the Chola, the Hoysala and others. However, urban tradition of south has continued through Vijaynagar which flourished during the fifteenth and sixteenth centuries to modern Mysore and Bangalore. It is imperative in modern world the settlement may develop continuously by increasing growth of population and facility in urban areas. India is a developing country showing rapid urbanization. India has long history of urbanization in term of absolute number of towns and cities and size of urban population. India’s urban population in 2001 was 286 million living in towns and cities. The present urban hierarchy, both administrative and economics and interdependence among cities and towns have led to the formation of present urban system routed in British colonial era. The urban system has been found to be highly distorted being dominated by large metropolitan centers leading to hypertrophy like Mumbai in west, Kolkata in east, Delhi in north and Chennai in south. The urban system has developed around these four distinct metropolises in response to its politico-economic system, transport and communication and level of economic development.

The unprecedented growth of towns and cities in India has been a result of modernization process causing rapid growth of agriculture and industry. About 27 percent of India’s urban population was accounted in 2001 with 286 million people nearly as many as the entire population of the U.S.A. There are areas of high urban growth which are push created by out migration from poor rural regions. By contrasts, states like Punjab, Haryana, Rajasthan, Tamilnadu, Uttar Pradesh and Bihar. Urbanization is pool created by dynamic urban expansion. Until 1931 urbanization in India was slow and halting due to low rate of economic development. India’s level of urbanization in 1901 was roughly comparable to that of United States in 1830. Since 1931 the rate of urbanization has quickened and in 2001 Census it has increased to 286 million persons.

Today, industry is the most dominant factor of urbanization. It has accelerated the process of rural–urban migration and the creation of new and enlargement of existing urban centers. In a country like India, the level of urbanization is related to
the degree of industrialization. Maharashtra State is one of the urbanized states in India accounting one third of its population lives in towns. This stands in sharp contrast to 16.59 percent of its population living in towns; at the turn of the twenty-first century. In fact the population living in towns today is more than that of total population of Maharashtra State in 1911. During the period from 1911-2001, urban population of Maharashtra has increased thirteen-fold and last two decades are critical where urban population of the state became double. More than half of the total urban population of Maharashtra state lives in three large towns, viz. Mumbai, Pune and Nagpur accounts for over 40 percent of Maharashtra’s urban population. The earliest towns of Maharashtra State, namely, as Paithan, Junnar, Karad and Devgiri were governed as administrative and defence centers due to their strategic location. Solapur, Barshi lying in Bhima valley, Satara in Krishna valley and Nandurbar, Dhulia in Tapi valley as market centers. Nasik, Pandharpur and Trimbakeshwar are religious centers. The towns of Maratha were Sangli, Kurundwad, Kagal, Ichalkaranji, Miraj, Phaltan, Bhor, Aurangabad, Poona, and Mumbai too.

Urban geography is rapidly growing sub-discipline of human geography; it increases rapidly after Second World War. A systematic study of urbanization is a recent fact in developed countries. In India, urban study has attempted by conducting socio-economic surveys for selected cities. Town planners have conducted specific survey in several cities focusing on the development and trends of urbanization in India. The first review of urban geography was made by Aurousseau in 1924. He commented that urban geography embraces such a large section of human geography that it is hardly a specialization at all. Thus, studying consequence of the problems involved in identifying urban geography as a systematic study. Many Indian geographers have contributed in the field of urban geography.

In the study of municipal geography one mainly studies urban places and the problems associated with urban areas. These problems are of different types and arise due to rapid urbanization. Our cities are increasing at phenomenal rate in other haphazard manner, particularly during recent decades.

The second urban phenomena was associated with the ‘Industrial Revolution’ in the closing half of the nineteenth century, with new and vigorous dimensions of the development of urban centers. Towards the end of nineteenth century, the world witnessed an unprecedented swelling in proportion of the urban population to the total population. The economically and industrially advanced western countries faced rapid
growth of urban centers. Today 80% of their population lives in urban places and in some western countries and particularly in the U. S., there is also counter urbanization.

On the other hand, the less developed countries have on an average only 34% urban population; but they face rapid growth of urban centers, mainly metropolitan cities, due to economic development and industrialization. It is believed that such countries will have more than 50% of their population living in cities at the end of 20th century.

Rapid Urbanization in the world is quite alarming in the developed countries, as compare to developing countries e.g. Asian countries. Urbanization is the process through which the forests, fertile agricultural lands, surface water bodies are being irretrievably lost, (Pathan, 1991). In India the percentage of people living in cities and urban area almost doubled to 27.78% in year 2001, which was low when compared to developed countries. However, the 28.53 crore urban population living in 27 metros, 396 cities and 4738 towns is more than the total population of developing and developed countries. This kind of uncontrolled, haphazard, low density settlements leads to Urban sprawl.

Urban sprawl defined as the spreading of new development on isolated tracts, separated from other areas by vacant land ((cf), Shekhar, 2005). The result is increase in the built up area and related changes in the urban landuse patterns, causing loss of fruitful agricultural lands, forest cover, other forms of greenery, loss in surface water bodies, reduction in ground water aquifers and increasing levels of air and water pollution; causing ecological problems. The process of urbanization is contributed by population expansion and migration. Infrastructure initiatives result in the growth of villages into towns, towns into cities and cities into metros involving large scale migration from rural to urban area. Sprawl is considered to be an unplanned outgrowth of urban centers along the fringe of cities, along highways, along the road linking a city (Sudhira, et.al, 2003).

The current rapid high level of urbanization at world level is relatively a recent phenomenon. One among six people on this world live in India: After China, India is the second largest populated country and is projected to cross China’s population with 1.5 billion people by 2040. India has more population than all of Africa and also more than South America and North America put together.
In year 1901, per person out of 10 used to live in urban areas in India, but by 2001, one out of 4 is living in towns and cities. The urban population in India increased from 62.4 million in the year 1951 to 285.4 million in 2001.

The Maharashtra state is a highly urbanized with 42.40 % of the population in urban areas as against 27.78 % at all India level (Census, 2001).

As per census 2001 an urban area should have
1. A minimum population of 5000.
2. At least 75% of male working population engaged in non agricultural practices.
3. A density of population should be at least is 400 persons /sq km

The PCMC (Pimpri - Chinchawad Municipal Corporation) 94.4 % was recorded highest development of population according to 2001, census in Maharashtra, which is the part of Pune Metropolitan area. This is mainly due to the rapid increase in the Information Technology divisional section. Between 1991 and 2001, the growth has doubled to 62.17 % in contrast; Pune district has a growth rate of 38.58 %, while the state is experiencing the growth rate of 22.5 %. Therefore it is necessary to add the precedent and nearby growth trends of these rapidly growing cities, for effective urban management (S. Shekhar, 2005).

Providing the basic services of civic life, services such as water supply and sanitation, roads and drains, street-lights, collection and disposal of solid waste, maintenance of public places, burial grounds and crematoria, cattle pounds, registration of births and deaths, maintenance of markets have long been seen as the function of municipal bodies. In addition, they performed certain regulatory functions relating construction of buildings, public Health areas such as eating places, slaughter houses and tanneries, etc.

For healthy and happy living provision of sufficient community facilities and public utility services are essential as they enhance efficiency and economic utilization of time. As a matter of fact, there is wide gap between the resource availability and resource need which is reportedly due to the permanent arrival of rural population to urban centres. As a result, the accessible infrastructure gets burdened. One of the major reasons leading to immigration to these big cities is the lack of services in small and medium towns. In order to control such migration, Government has undertaken the Integrated Development of Small and Medium
Towns (IDSMT) project. Under the project community facilities and public utility services have been considered as the most necessary component of urban life. In order to prepare development plan of a city, there is a need of good and reliable information regarding location of existing facilities, their accessibility, adequacy and development trends in relation to socio-economic structure of the city. The process of planning for urban areas involves use of both spatial and non-spatial data. Planners need updated accurate maps and other critical information to prepare useful development plan. In this context, Geographic Information System (GIS) has emerged as the central component in the world's environmental information structure and it will continue to play a fundamental (primary) role in the ensuing decades.

1.3 Conceptual Framework: Urban Sprawl

The urban sprawl means the urban settlements spread towards the rural fringe, i.e., growth of built-up area outside the city limits. In India major metropolitan cities are already saturated due to large scale migration of population. Many big urban centers are facing problems of congestion of city core and in some cases decay also due to saturation within the proper city or the urban limits. This results in pressure on the cities. Fringe areas and nearby villages were start merging and become part of the city due to the process of suburbanization. The rapid growth of population and congestion of the core areas strength of middle class people to settle along the fringe areas and urban sprawl starts, i.e., the outward spread of cities. Slowly the surrounding villages are absorbed and the sprawl further extends outward into a new fringe area, which is a continuous process of expansion of cities. The suburbanization in many Indian cities started with newly added industrial and commercial functions. The cities have developed haphazardly without proper planning, because planning was introduced only after the conditions started failing.

**Urban sprawl** is defined as the physical pattern of low density development of large urban areas under market conditions into the surrounding agricultural areas. Sprawl life in advance of the principal lines of urban growth and implies little planning control of land subdivision. Development is patchy, scattered and strung out, with a tendency to discontinuity because it leap-frogs over some areas, leaving agricultural enclaves. Its three major forms are low density, continuous development, ribbon development and leap frog sprawl.
Causes of Urban Sprawl - the process of urbanisation is moderately contributed by population growth, migration and transportation initiatives resulting in the growth of villages into towns, towns into cities and cities into metros. However, in such a fact for economically feasible development, planning requires a kind of the growth dynamics. Nevertheless, in most cases there are lot of inadequacies to ascertain the nature of uncontrolled progression of urban sprawls. Sprawl is considered to be an unplanned outgrowth of urban centres along the periphery of the cities, along highways, along the road connecting a city, etc. Due to lack of prior planning these outgrowths are devoid of basic amenities like water, electricity, sanitation, etc. condition of certain transportation facilities like new roads and highways; fuel such sprawls that ultimately result in inefficient and extreme change in land use affecting the ecosystem. With respect to the role of technology in urbanisation, has illustrated a new linkage between transport infrastructure development cycles and spurts in urbanisation. Urban infrastructure development is doubtful to keep pace with urban population development.

Human Causes of Land-Use Change - Land use is obviously constrained by environmental factors such as soil characteristics, climate, topography, and vegetation. But it also reflects the importance of land as a key and finite resource for most human activities including agriculture, industry, forestry, energy production, settlement, recreation, and water catchments and storage. Land is a fundamental factor of production, and through much of the course of human history, it has been tightly coupled to economic growth (Richards 1990). As a result, control over land and its use is often an object of intense human interactions.

Human activities that make use of, and hence change or maintain, attributes of land cover are considered to be the proximate sources of change. They range from the initial conversion of natural forest into cropland to on-going grassland management (e.g., determining the intensity of grazing and fire frequency) (Schimel et al. 1991; Hobbs et al. 1991; Turner 1989).

Such actions arise as a consequence of a very wide range of social objectives, including the need for food, fiber, living space, and recreation; they therefore cannot be understood independent of the underlying driving forces that motivate and constrain production and consumption. Some of these, such as property rights and the structures of power from the local to the international level, influence access to or control over land resources. Others, such as population density and the level of
economic and social development, affect the demands that will be placed on the land, while technology influences the intensity of exploitation that is possible. Still others, such as agricultural pricing policies, shape land-use decisions by creating the incentives that motivate individual decision makers.

Interpretations of how these factors interact to produce different uses of the land in different environmental, historical, and social contexts are controversial in both policymaking and scholarly settings. Furthermore, there are many theories regarding which factors are the most important determinants. Particular controversy arises in assessing the relative importance of the different forces underlying land-use decisions in specific cases. For example, apparent dry land degradation could be the result of overgrazing by increasingly numerous groups of nomadic cattle herders; an unintended consequence of a "development" intervention such as the drilling of bore holes which increases stress on land close to the wells; or the political clout of groups that, through governmental connections, are able to over-exploit land belonging to the state or local communities (Pearce 1992; NERC 1992). Identifying a particular cause may have implications for the rights of competing user groups or the formulation of policy responses.

Land use is the way in which, and the purposes for which, human beings employ the land and its resources: for example, farming, mining, or lumbering. Land cover describes the physical state of the land surface: as in cropland, mountains, or forests. The term land cover originally referred to the kind and state of vegetation (such as forest or grass cover), but it has broadened in subsequent usage to include human structures such as buildings or pavement and other aspects of the natural environment, such as soil type, biodiversity, and surface and groundwater.

Land cover is affected by natural events, including climate variation, flooding, vegetation succession, and fire, all of which can sometimes be affected in character and magnitude by human activities. Both globally and in India, though, land cover today is altered principally by human use: by agriculture and livestock raising, forest harvesting and management, and construction. There are also incidental impacts from other human activities such as forests damaged by acid rain, from fossil fuel combustion and crops near cities damaged by tropospheric ozone resulting from automobile exhaust.

Information on the spatial spread and monitoring the dynamics of the land use/land cover is the basic prerequisite for planning and implementing various
developmental activities. Apart from this, nation wide land use information becomes important room the point of view of addressing changing pattern in land use/land cover and also an overall reporting on the nation’s land use/land cover scenario.

**Urban Land Use Suitability** - Identification of suitable land for urban development is one of the critical issues of planning. The suitability of land for urban development is based on a set of physical parameters and economic factors. The cumulative effect of this factor determines the degree of suitability and also helps in further categorizing of the land into different orders of development. The assessment of the physical parameters of the land is possible by analyzing the land use, soil, slope, geology, flood hazard, physiography, distance from the road network and railway stations etc. and which very much amenable to GIS analysis. However the assessment of physical parameters gives an identification of the limitations of land for urban development. The concepts of limitation are derived from quality of land for e.g., if the slope is high the limitation it offers is more than for a land, which has gentle slopes or a flat terrain. Practically this would mean that the development of high slope land would require considerable inputs (finance, man power, materials, time etc.) and thus may be less suitable as against the flat land where the inputs required are considerably less. This concept is true for all the land parameters that are assessed. In this particular study 10 such physical parameters have been considered for analysis, which are mostly accepted by urban planners. The parameters are soil depth, soil texture, slope, land use, flood hazard, erosion hazard

**1.4 Need of the Study**

In industrialised countries the future growth of urban populations will be moderately humble since their population growth rates are low and over 75% of their population already live in urban areas. Conversely, developing countries are in the middle of the transition process, when growth rates are highest. The exceptional growth of many urban agglomerations in many developing countries is the result of a threefold structural change process: the transition away from agricultural employment, high overall population growth, and increasing urbanisation rates. Sprawl is seen as one of the potential threats for such development.

Normally, when rural pockets are linked to a city by a road, in the initial stages, development in the form of service centres such as shops, restaurant, etc. is seen on the roadside, which eventually become the core of trade and industry
activities leading to sprawl. In time a major amount of increase could be observed along these roads. This type of upsurge caused by a road system between urban / semi-urban / rural centres is very much established and constant at most places in India. These regions are devoid of any infrastructure, since planners are unable to visualise this type of growth patterns. This growth is normally left out in all government surveys (even in national population census), as this cannot be grouped under either urban or rural centre. The investigation pattern of this kind of growth is very crucial from regional planning point of view to provide basic amenities in these regions.

The study of this kind reveals the type, extent and nature of sprawl taking place in a region and the drivers responsible for the growth. This would help developers and town planners to project growth patterns and facilitate various infrastructure facilities. In this direction, an attempt is made to identify the sprawl pattern, quantify sprawl across roads in terms of Shannon's entropy, and estimate the rate of change in built-up area over a period with the help of spatial and statistical data of nearly three decades using GIS and remote sensing.

1.5 Significance of the Study

Advancement of information technology has provided wide arrays of new digital tools that can support the generic activity of geographical analysis and urban modal. In spatial decision-making and designing, in particular, these tools support different stages of the process which involve rapid and effective storage and retrieval of information, various kinds of visualization to inform survey and analysis, and different strategies for communicating information and plans to the affected community (cf. S. Shekhar, Delaney, 2000).

Ever since our culture came to form urban agglomerations, there has been a stable expression of interest in the study of urbanization. Yet in geographic studies, urban geography has been regarded as less topical in comparison to the other more recognized fields (cf. S. Shekhar, Carter, 1995).

This can be explained partly by the nature of urbanization that comprises a number of fundamentals from landscape modal to transportation networks to various socio-economic exchanges. In addition, as each element plays its own role in the formation of urban structure, every city possesses a unique structure with its own momentum, presenting entities that are occasionally regarded as too diverse for a
single topical study. Nevertheless, “geography is not about the precise analysis of particular service areas... it is more concerned with the ways in which these relationships are reflected in the functional and physical structure of the town” (Dickinson, 1959).

This facility will aid management of public utilities like Hospital utility information, water supply, drainage, sewage system, roads, drains, streetlights etc. These facilities can be applied to town planning schemes, urban and estate management and property tax- related matters. The more important components of the new maps will be the precise pinpointing of the water supply pipes; sewage drains that cover the city. It will also help in better transport management of the city. The urban resource information system is a step towards it useful during emergency services like since all information is brought around the hot spots with the click of a button. The most beneficial amongst all departments are the roads and building and town planning.

### 1.6 Scope of the Study

GIS is an effective and efficient tool to display, store, analyze and retrieve (at will) spatial and non-spatial data. GIS supports up gradation, modification and extension of information as and when necessary. Pune Information System is such an outcome that can be utilized effectively by any person to gather information about different types of facilities and/or services in any neighborhood/ward within PMC limit. It would support one’s decision-making ability through accessing geographical location and its attribute data. Common man can make a decision fixing a wide range of queries such as

- Where are suitable locations for buying a new house considering municipal water supply?
- What are timings and ticket rates for a movie show in different theaters?
- What are the sites he can visit in a day in a certain neighborhood?
- What is the shortest path from a fire station to reach to a place of fire incidence?

This study is an example of the information system and can be applied to other metropolitan cities in India. This can be an efficient database in a GIS platform for administrators and town planners to assess the adequacy of and identify potential
areas for allocation of the given facility like school or hospital. However project deals with only selected facilities in the study area. Due to time constraint data acquired is not complete in all respects, only certain important attributes were taken into consideration. Further the coverage of database is limited to PMC and PCMC area only. This project can be expanded depending on area and administrative jurisdiction. Information in the existing modules i.e. Post office/Police Station/Fire Brigades & Hospitals can be upgraded and additional facilities can be included accordingly. Resident of any large urban area always needs information and timely availability of emergency services like police, hospital, fire brigade & support services like post and communication. The present study develops an information system within PMC and PCMC area for utility services. The information of availability is essential in case of civic emergencies. A user can identify and select these services depending upon his needs for personal security and medical support.

The generated datasets has been integrated into an Urban Resource Information System, which will provide an effective management tool for utilization of the urban resources. Such type of study has following types of utilities.

a) Monitoring horizontal sprawl over different periods of time.

b) Generation of utility database for emergency planning

c) Urban planning, including town planning

d) Study of landuse/landcover

e) Application of advanced GIS and Remote Sensing technique to monitor the sprawl using temporal remote sensing data

1.7 Satellite Data Based Urban Land Use Inventory

Multi-temporal and repetitive satellite data offer unique opportunities for mapping and monitoring as well as assessing some of the elements of urban core, its dynamics and the resultant urban structure. The complexities and elements of urban dynamics as well as the required satellite data characteristics are controlling factors in urban inventory and analysis. With careful analysis and assessment of satellite data capability, and also with the experience gained through earlier studies with IRS satellite data, this study is limited only to the delineation of major classes in urban core as well as urban sprawling trends.

Satellite data based mapping and monitoring has its own limitations in terms of monitoring the elements of urban dynamics. At very coarse or preliminary level of
mapping using the satellite data would be delimitation of built-up space, vacant/open spaces, recreational zones, industrial sites and other emerging suburban zones. The nature and interpretability of satellite land data decides the accuracy levels as well as the possible constraints in identification of urban features. Very fine resolution in the order of 5 meters will enable us to map urban land uses in level III or more (Welch, 1985). This attempt of delimiting the sprawling suburbs is to identify the zones of growth as well as the emerging suburban land uses such as developing in industrial/residential cluster and dynamism in rural urban fringe agricultural areas. These thus help in identification of typical and use zones and its territorial association to its urban core of the region shall enable to derive the emerging spatial urban structure. This process of evolution with reference to time and space forms essential component of the current dynamic phenomena of urban structure.

1.8 Selection of the Study Area

Pune city and Pimpri Chinchwad in India are growing at a very fast rate, acquired a complex urban structure over the years. The central part or the core has gone through unusual changes in terms of social and physical transformations. For a comprehensive study it is imperative to select all kinds of civic facilities and emergency services, required for urban areas considering Road network. However, due to time constraint, it was not feasible; hence in the present study emergency services such as hospitals, Solid Waste Management, Sewage, fire brigade services, police stations and postal service have been selected.

1.9 Aims and Objectives of the study

Aim: The precise aim to this present study is to find out urban sprawl in Pune city and Pimpri-Chinchwad in India, suggest planning to provide utility services.

Objectives

1) To study existing land use/land cover using various satellite imageries
2) To identify various utility services
3) To implement the utility and planning for future urban sprawl in terms of services
1.10 Role of Remote Sensing and Geographic Information System

The 19th century witnessed a trickle of urbanization and the emergence of metropolises. Control the world’s urban development as crucial for future of humankind. This rapid and haphazard growth of urban sprawl and increasing population pressure is resulting in loss of productive agricultural land and loss of surface water bodies, green open spaces, besides causing air pollution, health hazards and contamination of water.

Geographic Information System (GIS) is a powerful set of tool for collecting, storing, retrieving, transforming and displaying spatial data from the real world. It has an ability to assimilate divergent sources of data both spatial and non spatial. GIS allows the user to integrate database generated from various sources on signal platform and analyze them in a spatiotemporal domain. GIS provides support in resource management and decision making (Burrough, 1986).

The term GIS comprises Three integrated parts.

- **Geographic** - Geographic of the world, the spatial reality, the geography
- **Information** - Data and information, their meaning and use
- **System** - The computer technology and support infrastructure

Although GIS has three parts, information is its heart. Without "I" information "G" and "S" are unrelated. Different people defined GIS, according to its capability and purpose for which it is applied A very brief description of GIS is that it is a computerized system (tool) that deals with spatial and non-spatial data in terms of collection, storage, management, and retrieval at will, conversion, analysis, and modeling and display. GIS accepts data from multiple sources which can be in a variety of formats. In other words GIS is very flexible in the types and structure of data. GIS is used by various disciplines as a tool for spatial data handling. Depending on the interest of a particular application, a GIS can be considered to be a data store, a tool, a technology, and information source or science. In India major development has occurred in the last decade with significant contribution from Department of Space, which emphasized the GIS application for National Resources Management. Recently commercial organizations have realized importance of GIS for diverse applications and many GIS based projects are in operation according to the requirements of user organizations.
The modern technology of remote sensing which includes both aerial as well as satellite based systems, allow us to collect lot of physical data rather easily, with speed and on repetitive basis, and together with GIS helps us to analyze the data spatially, offering possibilities of generating various options (modeling), thereby optimizing the whole planning process. These information systems also offer interpretation of physical (spatial) data with other socio-economic data, and thereby providing an important linkage in the total planning process and making it more effective and meaningful.

The satellite remote sensing and its ability to provide the accurate and reliable information to making map measure and monitor the various facts of urban development. When Geographical Information System, Remote Sensing and Global Positioning system coupled then it becomes a very powerful tool for planning and making the maps.

1.11 Literature Review

C. D. Deshpande (1975) has observed this process in India in the following forms, i) The rural fringe or the periphery along which the city starts sprawling, ii) The ribbon development along the main roads, railway lines and beaches, iii) The centers of the planned rail-linked suburbs and their expansion, iv) The working class migrations to industrial centers, v) The shanty towns and strip slums. A city region develops in stages 1) Rural-Urban fringe 2) Urban Sprawl 3) Suburbanization. Suburbanization is a result of over congestion in the core of city and high land values in the central localities (cf. Latkar S. R. 1993).

Sokhi & Rashid (1999) studied the landuse and landcover mapping in urban areas using areal photographs and satellite imageries of Jaipur (1983 & 1989), Coimbatore (1984), Ujjain (1985), Delhi (1987), Dehradun (1989), Bangalore (1994) and Jammu (1995), on the basis of urban sprawl analysis of these cities they concluded that human settlements are tend to expand in all directions of favorable conditions. In another case Raju (1999) used landsat MSS, SPOT and LISS II satellite data for mapping urban landuse and urban sprawl of Hyderabad and Vishakhapatnam cities in Andhra Pradesh. Prasad et.al (2001) worked on urban sprawl for Hyderabad city and its environs. They applied Shannon’s entropy approach to measure the degree of spatial concentration of geographical variables they demonstrated the utility of
entropy approach to identify, measure and monitor spatio temporal patterns of urban sprawl.

Ramchandra and Jagdish (2003) studied urban sprawl pattern and modeling using GIS on Udupi and Manglore highway according to them pattern of urban sprawl and analysis of spatial and temporal changes could be done cost effectively and efficiently using GIS and Remote Sensing data, they quantified the urban sprawl in terms of change in Built-up area.

Rosero and Bixby (2004) used traditional measurements of access based on the distance to the closest facility and proposed a more comprehensive index of accessibility that results from the aggregation of all facilities weighted by their size, proximity and characteristics of both the population and the facility.

Sulochana Shekhar 2005, studied Changing space of Pune – A GIS perspective with urban sprawl pattern and modeling using GIS on Pune city according to her pattern of urban sprawl and analysis of spatial and temporal changes could be done cost effectively and efficiently using GIS and Remote Sensing data, they quantified the urban sprawl in terms of change in Built-up area. Abundant references, research papers can be ahead on urban sprawl. In this study tried to analysis civic amenities in the different wards of the pune city.


Paul Langlois (2006). A GIS approach for evaluating municipal planning capability: residential built form in Markham and Vaughan Ontario. This research describes a methodology for measuring built form patterns using spatial data and GIS that is amenable to the study of large geographical areas. This methodology was used to investigate the capability of municipal planning to influence residential development. In the early 1990s, the Town of Markham, Ontario, Canada adopted a residential development philosophy inspired by New Urbanism. An adjacent municipality, the City of Vaughan, has employed a conventional development approach. By calculating several built form measures derived from the design prescriptions associated with New Urbanism, this study seeks to discern if Markham’s adoption of an unconventional development philosophy has resulted in a residential built form distinct from that in Vaughan.
Rudraiah developed (2006) `Systematic Land Information System’ (SLIM) for Kanpur town as a management tool for strategic urban planning as well as real estate management highlighting the need of physical planners for various types of topographical maps. Objectives of the SLIM as reported were to conduct the modern ground surveys using latest tools and technology and prepare topographical maps with cadastral information on 1:1000 scales.

Suman Rao (2007), emphasized the significance of remote sensing as a source of information and GPS and GIS as powerful technologies for analyzing spatial and non-spatial data in urban facility analysis. She prepared location maps for selected urban facilities and services available in Dehra Dun to identify service areas of different facilities. This would form inputs for preparation of comprehensive development plan of the city. This would guide the service providers to identify areas for future expansion and location of those facilities and services. The study also included calculation of indices for ward wise levels of facilities available to the population of Dehra Dun city.

The cities are growing in all directions resulting in large-scale urban sprawl and changes in urban land use. The spatial pattern of such changes is clearly noticed on the urban fringes or city marginal rural areas, than in the city centre. Unconsciously this is resulting in increase in the built up area and related changes in the spatial urban land use patterns causing loss of fruitful agricultural lands, forest cover, other forms of greenery, loss in surface water bodies, diminution in ground water aquifers and rising levels of air and water pollution. Further, it is widely agreed that disintegration of land use is also harmful to biological conservation. There is a demand to regularly observe such changes and distinguish the processes for taking helpful and corrective actions towards a planned and healthy development of urban areas. In the recent times, Remote sensing data is being widely used for mapping and monitoring of urban sprawl of cities. The spatial patterns of urban sprawl over different time periods, can be scientifically mapped, monitored and accurately assess from satellite data in company with conventional ground data. In the present study ‘Entropy Approach’ for studying the urban sprawl patterns of Pune Municipal Corporation (PMC) and Pimpri-Chinchwad Municipal Corporation (PCMC) over different time scales has been attempted in the present study. Further, the use the GIS for quantifying the urban sprawl trends at various land use sites, viz., commercial, industrial, residential sensitive and mixed zones is also attempted.
Abundant references, research papers can be ahead on urban sprawl. But it was the author’s observation that very few scholars has worked out on services and facilities, the city is providing. Few scholars analyzed neighborhoods analysis of some regular services such as shopping plazas, vegetable market places or the shortest path leading to have some important goods and commodities.

In this present work author has emphasized on urban sprawl and utility planning for the cities grown up/ peripheral area which is lacking in various utility services.

1.12 Conclusion

This chapter deals with the introduction to the topic, basic concepts of urban area, urbanization, urban Sprawl, and its definitions, and relation with utility services. This chapter deals with recent trends at global, national, and state level. Occurrence of Sprawl in general and occurrence of sprawl in Pune and Pimpri-Chinchwad have been also discussed briefly. A major component of this chapter is devoted to the introduction of the study area, criterions for the selection of the study area, aims and objectives and the literature Survey. Literature survey and part of this chapter deals with the Urbanization, urban planning, Urban Transport and Utility Services. Review of modern techniques and methodology adopted for the study is also discussed in detail.