CHAPTER: I

INTRODUCTION

1.1 Background

Widespread urbanization is a twentieth century phenomenon. Although cities such as Memphis, Babylon, Persepolis, Athens, Sparta, and Thebes, Mohen-ja-daro, Anuradhapura and others did exist in ancient times, there is little evidence of widespread urbanization in the early years of civilization. Rome was probably the first settlement to reach one million people in 5 BC; only in 1800 did London become the second. Over the last hundred years, depending on the region, the world has rapidly become an urban one, with the detrimental consequences and effects caused by changes in population distribution. The share of the expanding world population that lives in cities has increased from 5% in 1900 to nearly 50% today; the largest proportion of this urban population can be found in developing countries. Between 1990 and 2050, the total number of people living in urban areas is projected to double to more than 5 billion, which is a growth rate four times faster than that in rural areas. By the middle of the twenty-first century, almost two-thirds of the world's population will be living in towns and cities. An estimated 90% of this increase will occur in developing countries (Committee for International Cooperation in National Research in Demography 2003). With significant economic and livelihood opportunities in the urban areas, an expansion for accommodating the immigrants (or immigrating populations) is resulting in greater urbanization. Towns and cities are expanding in certain pockets with a change in the land-use in the immediate vicinity of the cities due to ad hoc approaches in regional planning, governance and decision-making. This dispersed development outside compact urban and rural centers is referred to as sprawl. Sprawl generally refers to some type of development with impacts such as losses of agricultural lands, open spaces, and ecologically sensitive habitats in and around the urban areas. Sprawl results in the engulfing of villages into peri-urban areas, peri-urban areas into towns and towns into cities. However, in such a phenomenon of

development to have basic infrastructure, regional planning requires an understanding of the sprawl dynamics. Nevertheless, in a majority of the cases there is meagerness to establish the nature of uncontrolled growth

Due to lack of earlier planning, coordinated decision-making and visualization of the outgrowths, the regions remain devoid of basic services like water, electricity, sanitation, etc. and result in inefficient and drastic changes in land-use, affecting the ecosystem and thus threatening the sustainable development of the region. In approaching urbanization coupled with economic development has transformed societies and cultures apart from the landscapes, and the natural environment. A key challenge faced by most nations today is to 'sustain' the economic growth rate development along with minimum impact on the environment. In the recent years, 'development' and 'urbanization' have almost become synonymous especially in developing countries. Further 'development' per se is mostly associated with economic development which most nation states promise to give to its citizens.

1.2 The Concept: Urban, urbanization and urban Sprawl

The term 'urban', has its origin from the Roman word 'Urbanus' which adopted the meaning 'city dweller' in Latin. The precise definition of an urban area can differ from country to country. Generally, the definition of an urban area is based upon the number of residents, population density, percent of people dependent upon non-agricultural income and provision of public utilities and services. Some countries define an urban area as any place with a population of 2,500 or more while some other countries set a minimum population of 20,000 as a criterion. There are no universal standards and therefore each country develops its own set of criteria for recognizing urban areas. In India, an area is designated as urban if the population is more than 5000 with a population density of more than 400 persons per sq. km and at least 75 percent of the population is involved in non-agricultural occupations (Shashidhar, H., 2001). Urbanization is a form of metropolitan growth that is a response to often less understood implications of technological, economic, social, and political forces and to the physical geography of an area.

Urbanization is the physical growth of urban areas and a product of demographic explosion and poverty induced rural urban migration. It is a dynamic process involving changes in huge expanse of land cover with the progressive concentration of human population. The process involves change from spread out pattern of human settlements to compact growth in urban centers and even towns or suburban concentration transforming into cities. Urbanization, as such, is not seen as a threat to the environment and development but it is the unplanned urbanization and dynamic urban growth, or the sprawl that affects the land-use of any region that becomes a matter of concern through its affectation in the loss of prime agricultural lands. It is thus essential to study and bring out the particulars and inference associated with the problem of unplanned urban growth ensuing into sprawl.

Rapidly urbanizing landscapes attains exceptionally large population size leading to gradual collapse in the urban services evident from the basic problems in housing, slum, lack of treated water supply, scarce infrastructure, higher pollution levels, poor quality of life, etc.

The process often leads to the dispersed haphazard development in the outskirts, which is often referred as sprawl. Thus urban sprawl is an outcome of social and economic development of a certain region under certain conditions. Modern usage of the term ’sprawl’ was coined by Earle Draper, one of the first city planners in the United States in 1937 (Black, 1996). In her report, Revisiting Sprawl: Lessons from the Past, Burgess (1998) defined sprawl as "...expanding physical development, at decreasing densities, in metropolitan regions, where the spatial growth exceeds population growth" Since then, the issue became popular and concerns continue to grow with different measures introduced to combat it in one way or another. This phenomenon is also defined as an uncontrolled, scattered suburban development that exhaust local resources due to large scale land use changes involving the conversion of open spaces (water bodies, parks, etc.) while increasing carbon footprint through the spurt in anthropogenic activities and congestion in the city (Peiser, 2001; Ramachandra and Kumar, 2009).

Urban sprawl increasingly has become a major concern for many metropolitan areas. Due to lack of visualization of sprawl, these regions are lack several infrastructure and basic amenities (like supply of treated water, electricity, sanitation facilities). Also these area are normally left out in all government surveys (even in national population census), as this cannot be grouped under either urban or rural area. Understanding this kind of growth is very crucial in order to provide basic amenities and more importantly the sustainable management of local natural resources through decentralized regional planning. Urban sprawl has been captured indirectly through socioeconomic indicators such as population growth, employment opportunity, number of commercial establishments, etc. (Bruckner, 2001; Lucy and Philips, 2001). However, these techniques cannot effectively identify the impacts of urban sprawl in a spatial context. In this context, availability of spatial data at regular interval through space-borne remote sensors are helpful in effectively detecting and monitoring rapid land use changes (e.g., Chen et al., 2000; Ji et al., 2001; Lo and Yang, 2002; Dietzel et al., 2005). Urban sprawl is characterized based on various indicators such as growth, social, aesthetic, decentralization ,accessibility, density, open space, dynamics, costs, benefits, etc. (Bhatta, 2009a,b, 2010). Further, Galster et al. (2001), has identified parameters such as density, continuity, concentration, clustering, centrality, nuclearity, proximity and mixed uses for quantifying sprawl. Urbanization and sprawl analysis would help the regional planners and decision makers to visualize growth patterns and plan to facilitate various infrastructure facilities. In the context of rapid urban growth, development should be planned and properly monitored to maintain internal equilibrium through sustainable management of natural resources. Internal equilibrium refers to the urban system and its dynamics evolving harmony and thus internally limiting impacts on the natural environment consequent to various economic activities with the enhanced growth of population ,infra-structure, services, pollution, waste, etc. (Barredo and Demicheli, 2003).

Urban growth patterns resulting in sprawl are ‘unsustainable’, with the present consumption flowing ahead of regions’ carrying capacity and leading to exhaustion of natural resources for

future generations. The need for managing urban sprawl also arises out of the global concerns of achieving sustainable urbanization.

Sustainable urbanization is a dynamic, multi-dimensional process covering environmental as well as social, economic and political institutional sustainability (United Nations, 2004). Besides this, the adoption of the Millennium Declaration and the Millennium Development Goals by all the member states of the United Nations to promote equitable and sustainable development across nations, in pursuit of shared future for all, poses significant challenges. This has also set a universal framework for development by targeting the achievement of eight significant goals. Specifically, the seventh goal on ensuring environmental sustainability addresses the concern of improving the lives of millions of slum dwellers living in rapidly expanding cities (United Nations, 2007).

1.3 Indian Context:

The process of urbanization in India through history because what distinguished India most, from many other countries of the world is its long tradition of urbanization dating back as far back as about five thousand years, when Indus Valley civilization saw the birth as the earliest urban settlement in human history. In India, the urban tradition continuous throughout these centuries and during the ancient period of our history there were many well planned, big and beautiful cities in different parts of the country.

The magnitude and nature of urban sprawl is quite different in the developed countries than to that of a rapidly developing and largely rural-agrarian populated country like India. The problem of sprawl is magnified in the developed countries after reaching saturation levels of urbanization. Conversely, most of the developing and under-developed countries are now urbanizing rapidly and already susceptible to the problem of sprawl at an even worse magnitude. A significant difference in the urbanization patterns of developed and developing countries is that of population densities. The developed countries embraced urbanization after industrialization

wherein the population growth rates and densities were lower, with a prosperous economy and technology to support. Conversely, developing countries are having high population growth rates and densities, in the midst of economic development, with lack of basic amenities and urbanization taking place at a rapid rate.

In India, already 28% of the population lives in urban areas and the cities are expanding with inadequate in facilities for transportation, water supply and sanitation, energy demands, etc. With a booming economic activity on the one side and large population in unorganized sectors of employment with inadequate housing on the other, rise of slums and squatters in urban areas seems inevitable.

The population has increased from 238.3 million in 1901 to 1027.1 million in 2001 and 1210.2 in 2011. By 2001, there were 35 urban agglomerations (cities having a population of more than one million), as compared to 25 urban agglomerations of 1991 and 48 urban agglomerations/cities having a population of more than one million in India in 2011. It has been observed that in spite of discontinuity in the growth of total population at some points during 1901 to 2011. The size of urban population was increased continuously from 25.85 million to 377.1 million. In 1901 about 1827 cities were accommodating all urban population and then in 2011 the number of cities increased to 7935. In 1901 out of1827 different cities size classes about 1614 belonging to city size of class IV, V and IV which contain 90% of total urban population this was the beginning stage

The urban population in India is growing at about 2.3% per annum with the global urban population increasing from 13% (220million in 1900) to 49% (3.2 billion, in 2005) and is projected to escalate to 60% (4.9 billion) by 2030 (Ramachandra and Kumar,2008; World Urbanization Prospects, 2005). The increase in urban population in response to the growth in urban areas is mainly due to migration.

Table: 1.1 Urban & Rural Population Trends of India (1901-2011)

Years	% Urban Population to Total	% Rural Population to Total
1901	10.8	89.2
1911	10.3	89.7
1921	11.2	88.8
1931	12.06	87.94
1941	13.99	86.01
1951	17.3	82.7
1961	18	82
1971	19.9	80.1
1981	23.3	76.7
1991	25.7	74.3
2001	27.8	72.2
2011	31.16	68.84

Source: Census of India (2011).

Due to globalization process, the cities and towns in India are experiencing rapid urbanization consequently lacking appropriate infrastructure and basic amenities. Thus understanding the urban dynamics considering social and economic changes is a major challenge. The social and economic dynamics trigger the change processes in urban places of different sizes ranging from large metropolises, cities and small towns. In this context, the analysis of urban dynamics entails capturing and analyzing the process of changes spatially and temporally (Sudhira et al., 2004; Tian et al., 2005; Yu and Ng, 2007).Unplanned urbanization has serious impacts on the local ecology and on the sustenance of natural resources (Ramachandra et al., 2012). Unplanned growth would involve radical land use conversion of forests, surface water bodies, etc. with the irretrievable loss of ground prospects (Pathan et al., 1989, 1991, 1993, 2004).

Gujarat Population Census Data shows that it has Total Population of 6.03 Crore which is approximately 4.99% of total Indian Population. Literacy rate in Gujarat has seen upward trend and is 79.31% as per 2011 population census. Of that, male literacy stands at 87.23% while female literacy is at 70.73%. Urban Population of the State is 42.6%, which used to be at 37.4% in 2001. Gujarat is the fourth most urbanized state in the country. About 42.6% of Gujarat population (25.71 million) lives in urban areas as compared to India's 31.16% (Census 2011).

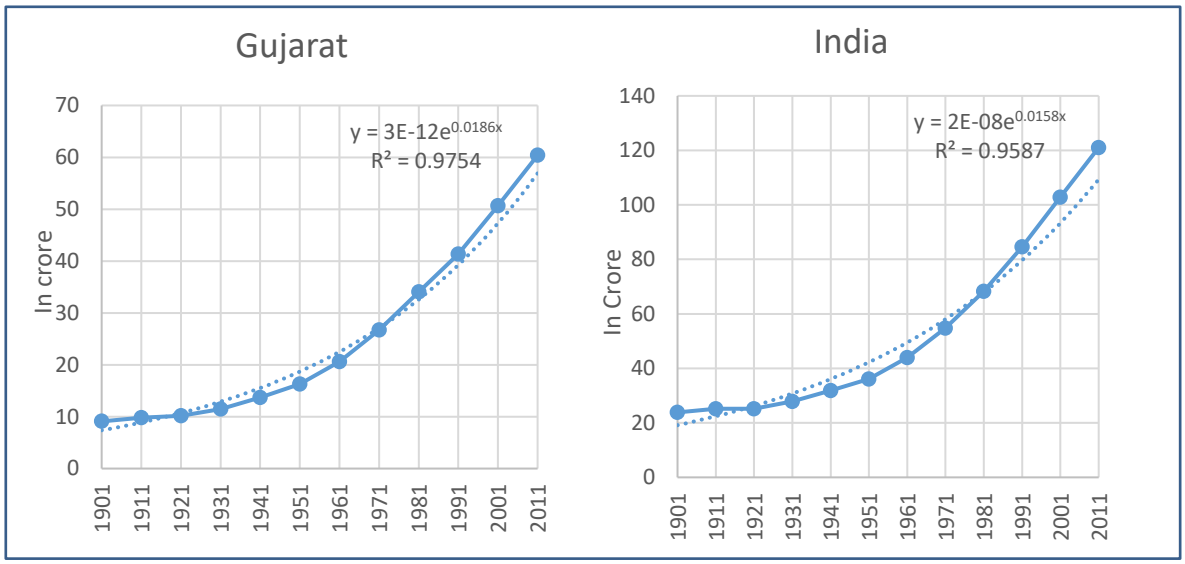


Figure.1: Total Population from 1901 to 2011 in Gujarat and India (Source: Census of India.)

It is projected that Gujarat will have 66% urbanization by the year 2030.Rural population in the state in 2011 fell to 57.4% from 62.6% in 2001. Gujarat's urban population of the state has been rising steadily since the formation of the independent state. The pace of urbanization, as measured by the decadal growth of urban population, was significantly higher than the national average during the decade 1991-2001, and is expected to remain high in the next two decades as well. In 2001, over 50% of the urban population in Gujarat resided in the seven cities that are classified as municipal corporations. This concentration of urban population increases to nearly 60% if urban agglomerations around these cities are taken into account. Nearly 40% of urban population of Gujarat resides in the three large cities of Ahmedabad, Surat and Vadodara only. The rising in urban population shows the Gujarat is one of the fastest growing urbanized states in the country.

Table: 1.2 Urban and Rural Population Trends in Gujarat and India (1901-2011)

Years	% Urban Population to Total(Gujarat)	% Rural Population to Total(India)
1901	22.33	10.8
1911	19.25	10.3
1921	20.15	11.2
1931	20.5	12.06
1941	23.79	13.99

1951	27.23	17.3
1961	25.77	18
1971	28.08	19.9
1981	31.1	23.3
1991	34.49	25.7
2001	37.35	27.8
2011*	42.58	31.16

Source: Census of India (1901-2011).

Table: 1.3 Decadal Urbanization Level and Growth Trends in Gujarat and India (1951-2011)

Years	**Gujarat**			**India**		
	Urban Population (Millions)	Share of Urban Population (%)	Decadal Growth Rates (%)	Urban Population (Millions)	Share of Urban Population (%)	Decadal Growth Rates (%)
1951	4.43	27.23		62.4	17.29	
1961	5.31	25.74	19.64	78.9	18.00	26.44
1971	7.49	28.06	41.05	109.1	19.91	38.22
1981	10.6	31.1	41.52	159.5	23.70	46.23
1991	14.24	34.47	34.34	217.2	25.71	36.09
2001	18.93	37.36	32.94	285.4	27.78	21.35
2011	25.71	42.58	40.31	377.1	31.16	31.8

Source: Census of India 2011.

Vadodara is located in the most developed region of the state of Gujarat, popularly known as “Golden Corridor”. Vadodara Urban Area is located in Vadodara district of Gujarat, situated in the fertile alluvial plains of Mahi-Narmada interfluves belt, encompassing an area of 714km^2 and lies between 73°5' to 73°20' E and 22°10' to 22°28' N including the Vadodara Mahanagar Seva Sadan area and about 104 villages of Vadodara, Waghodia and PadraTaluka, of the district.

The name “Vadodara” has originated from the Gujarati word “Vad” which means Banyan tree. The city has many banyan trees growing along the road side thus revealing the name of the city. It is situated on the bank of Vishwamitri River and is also known as the “Cultural Capital” of Gujarat. Geographically the area is in between R. Mahi on the NW direction of Vadodara city and Vadsala village in the east and in north up to Jarod village and in south until Padra.

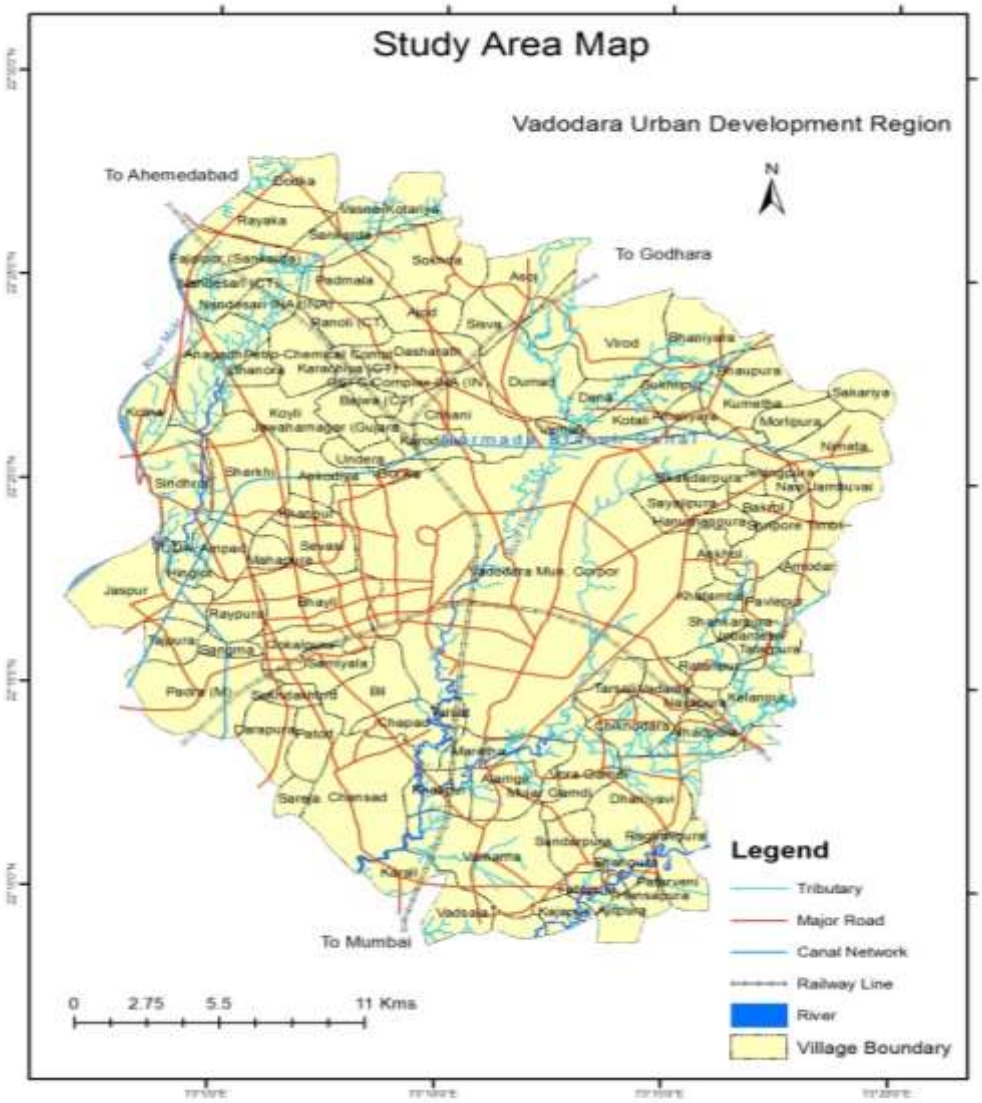


Figure: 1.1 Study Area Map

1.4 Objective

Thus, aim is to understand the spread of built-up areas and quantify the sprawl in order to determine the trend, the extent, and avert the associated complications. The study addresses the issue of urban sprawl, through the perspective of simulation modeling based on Cellular Automata. The precise objectives of the study are as follows:

- To develop and implement a Cellular Automata (CA) algorithm to simulate urban growth process.
- To evaluate a number of urban sprawl parameters, including the size and shape of neighborhood.
- Testing different types of constraints on urban growth simulation.
- To suggest different options and their impacts on the future development plans.

1.5 Data Set and Methodology:

1.5.1 Remote Sensing Data:

i) Land cover and Land use change are identified by using Remote Sensing Data and analysis using GIS. This will involve use of multi date satellite data. The decadal change is analyzed for past 30 years. Land use maps are generated by visual interpretation and digital processing. The land use maps thus prepared are integrated in GIS environment.

Collateral data used are from Survey of India Toposheets, Cadastral Maps, and Census of India Reports. Ground Truth Check is done to locate the changes.

ii) Thematic maps are prepared using various Remote Sensing and GIS tools, with the help of satellite images.

iii) Visual and Digital Image classification method will be used for preparing land use maps. The pattern of land use is analyzed using several mathematical and statistical operations and based on these, Cellular Automata (CA) model is generated predicting the future growth and development of environmentally compatible plan.

1.6 Data sources

Remote Sensing data: LANDSAT Images 30m resolution, world view images from Google earth platform.

GPS is used for Ground Truth Check with accuracy under 5 m. This was done for GCP extraction and ground validation of the image classified.

Secondary sources: Census data for the year 1981-2011, documents, local land records, official maps of the infrastructure and developmental plans, report publications, and the media.

Software used are ERDAS 9.0 Version for satellite data processing ARC GIS version10.1, QGIS, and IRDISI (Demo Version)for mapping and modelling, GPS Trimble for ground truth, FRAGSTAT for landscape ecology analysis..

1.7 Approach of study

The methodology dealt with following aspects

1.7.1 Phase I:

This phase deals with the collection of the data from various sources, its geometric correction and field verification for the accuracy and validation. Literature survey from libraries of The Maharaja Sayajirao University, online journals and articles are accessed. Secondary data from several sources like Census of India, Survey of India, Planning Atlas, Geology and Soil Survey maps, Statistical and Economic Abstract of Gujarat, Agriculture Census, discussion with planners and decision makers and Personal observation.

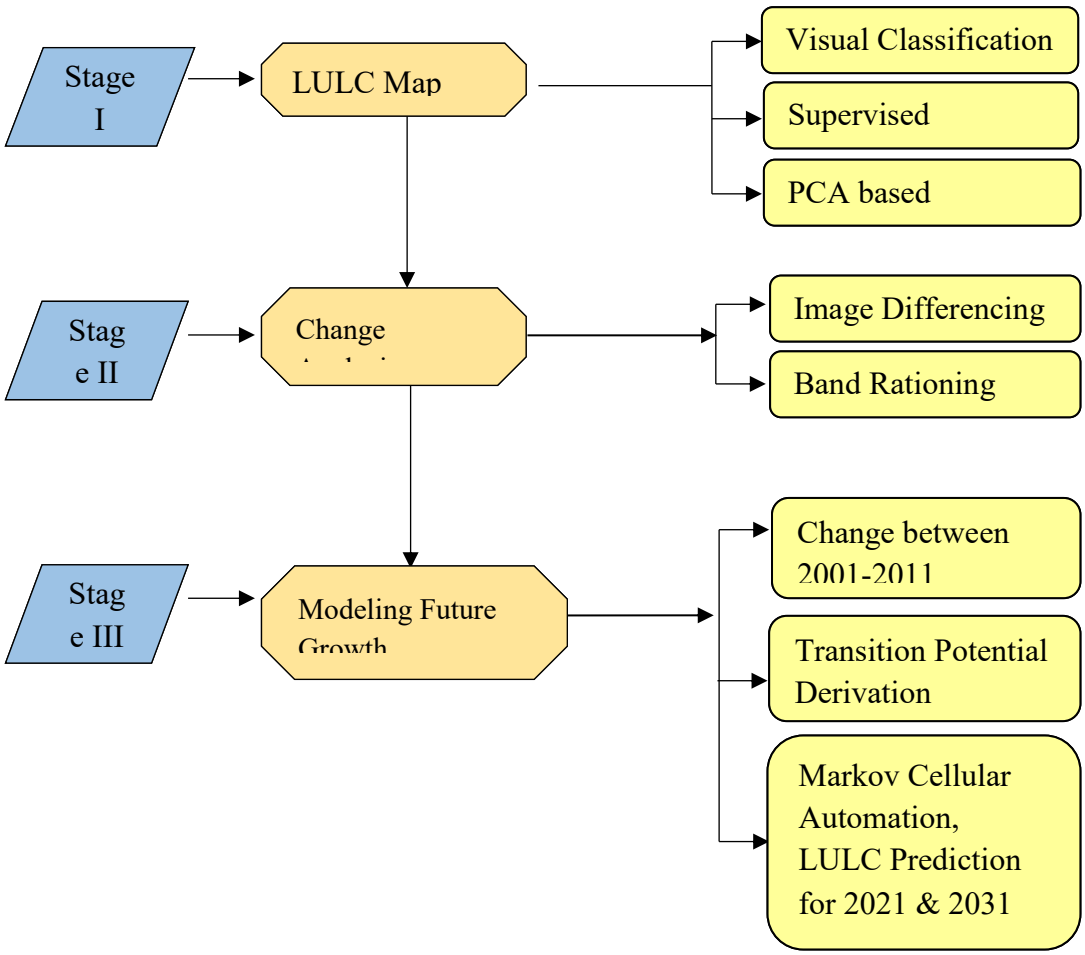
1.7.2 Phase II:

Deals with the delineation of land use and land-cover. It consists of creation of thematic layers of different classes viz. Water bodies, built up areas, vegetation and green cover, roads, etc. along with base map details based on the visual interpretation of satellite data in conjunction with field data and existing secondary data are also generated.

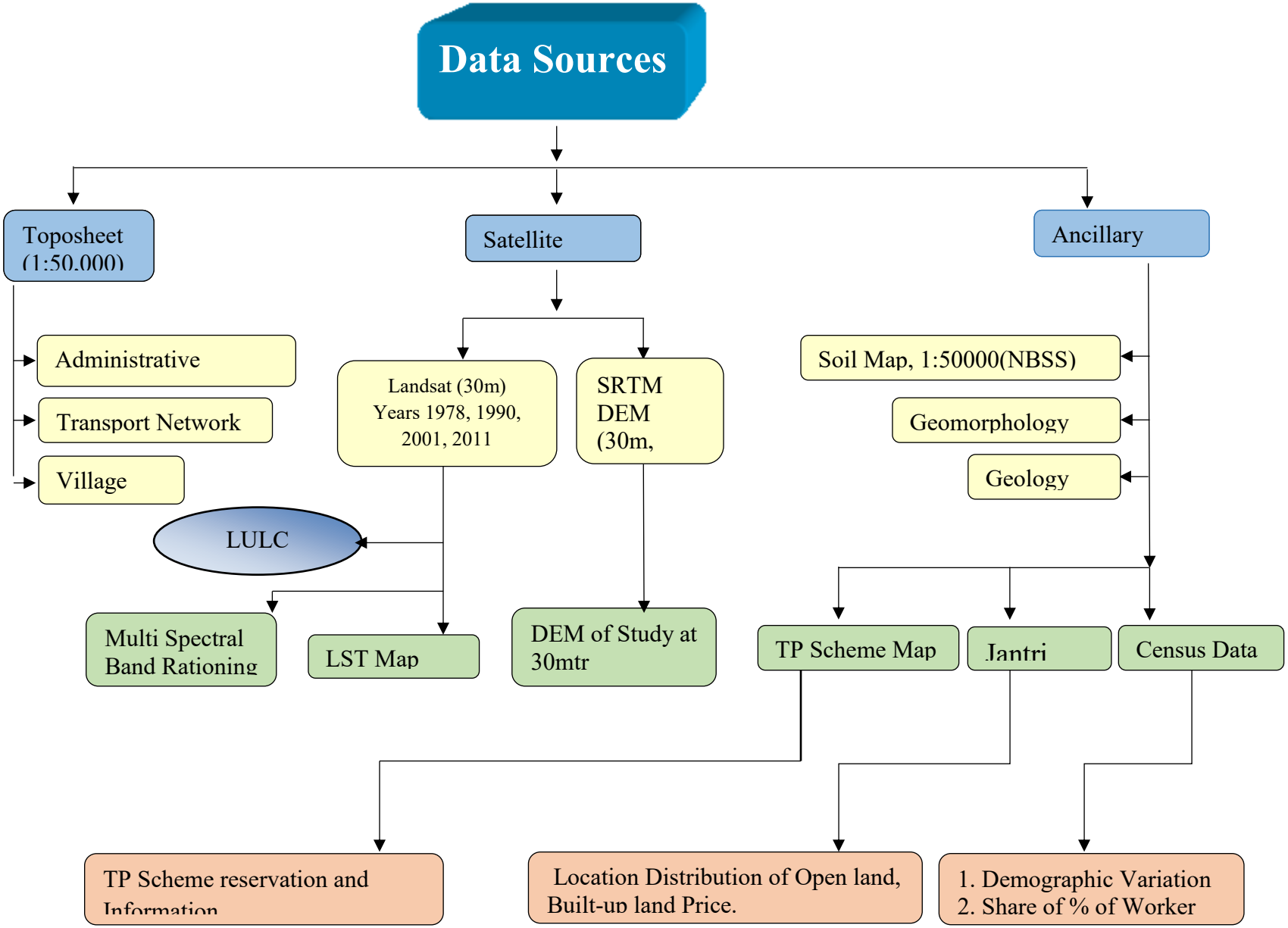
1.7.3 Phase III:

Deals with spatial data, analysis and modelling. It consists of Land-use land cover mapping, and quantifying the sprawl in order to determine the trend, the extent and the associated problems. Several techniques of visual, digital processing, spatial matrices and indices are calculated to attain quantification and understanding urban sprawl.

Study Process of Data Analysis:



Input Data source and Products



1.8 Outcome

The strength of this study comes from the ability of urban modeler to implement the growth simulation model, evaluating the results and presenting the output simulation results in visual interpretable environment, giving various scenarios. Artificial city simulation model provides an excellent environment to test a number of simulation parameters such as neighborhood influence on growth and constraints in driving the urban growth. Cellular Automata prove to be very efficient in simulating the urban growth simulation over time in understanding the complex and dynamic relationship of causative factors. Such prediction will help municipalities identify the future growth trend and design the sustainable infrastructure plans to contain, direct, limit accommodate such trend.It is expected to provide the basic scenario of the urban growth and its influencing factors. On simulation model several zones suitable for specific type of land use can be identified. Thus, gives a direction to urban growth that can check the sprawl and conserve the physical resources for sustainable development.

1.9 Outline of Chapters

The study has been organized into six chapters. All chapters highlight relevant literature.

1.9.1 Chapter 1: Introduction

The first chapter is an overview of the research work undertaken. It deals with the introduction to the subject, rationale and relevance of research topic in present context and study area, research database and methodology.

1.9.2 Chapter 2: Profile of Study Area

In the Second Chapter the brief characteristics of physical and socio-economic setup of the study area is outlined

The study area lies in Baroda district forming a part of the great Gujarat plain. Located between Mahi and Narmada, the chief rivers of the district, the study area is well-known for black soil which is suitable for the production of cotton.

This midland between the Mahi and Narmada covers the Baroda plain which is drained by tributaries of the Mahi, Narmada and Dhadhar. The river Vishwamitri is a dividing line between black soil sand red loams. Besides these rivers, the Jambuva and the Surya flow through the district and meet the Arabian Sea in the Gulf of Cambay.

Vadodara city has a general slope from east to west and north to south and an elevation of 39 metres (123 feet).

Vadodara features a tropical Savannah climate under Koppen's Climate classification. There are three main seasons: Summer, Monsoon and winter. Aside from the monsoon season, the climate is dry. The weather is hot through the months of March to July. From November to February, the climate is extremely dry. Cold northerly winds are responsible for a mild chill in January. The southwest monsoon brings a humid climate from mid-June to mid-September. Average rainfall in the study area is about

Demographic and Socio Economic Details:

This deals with the demographical dynamics of the region. The demography is one of the important aspects in characterization of the urban impact and the extent of urbanization with many indices, justifying the certain characteristics of the urban form. It is observed that population increased by 69% from 1991-2011.

1.9.3 Chapter 3: Land use/cover (LULC) Change Dynamics

This part of thesis deals about the time series land use and land cover statistic generation for Vadodara urban development authority limit region. The 3 time period extending from 1978 to 2011, i.e. for the year 1978 to1990 to 2001to 2011. Different techniques are used to generate of the LULC maps to get the comparison between the methodology and the out-put. In total 4 methods are applied and compared for the accuracy and efficiency to discuss for its application in the modelling of the urban sprawl. The LULC maps are generated using image analysis methods.

Digital Change Detection Techniques are applied with the aim to investigate and quantify changes in land cover patterns also digital classification is concerned with spectral signatures, it is more accurate. Supervised Classification techniques are employed. The multispectral images were further processed through principal component analysis to derive unambiguous image. 4 principal component layers were derived and used to stack and this PCA derived images were subjected to supervised classification. In all the above application the land use land cover map were validated by using the kappa accuracy.

This index helps to discriminate the different land cover on the basis of the threshold values assigned. Combining indices could improve the classification accuracy and, thus, achieve better result. The image rationing technique developed used in derivation of several separate phenomenon's based on pixel's DN the digital number is calibrated on the basis of the sensor characteristics and emissivity of the object. Basically 5 indices are discussed viz NDVI, NDWI, BSI, NDBI, LST.

The Normalized Difference Vegetation Index is calculated as the ratio of the difference between near infrared (ρNIR) and red (ρred) reflectance divided by their sum. Valuesrange from -1 to +1.

The Normalized Difference Water Index (NDWI) helps to delineate open water features and enhance their presence in remotely-sensed digital imagery. It is also provide researchers with turbidity estimations of water bodies using remotely-sensed digital data.

BUI takes the form of high values in the urban areas and low values in the non-urban areas. The method classifies urban and non-urban areas according to a critical value determined using a sample whose characteristics are well known.

LST is derived to understand change in surface temperature reflecting the changes in land use and land cover on temperature in study area.

1.9.4 Chapter 4: Urban landscape Analysis Using Spatial Matrices

Landscapes, patches and image objects are used to systematically assess dynamic ranges of ecologic process and changes. A wide range of indicators have been developed to characterize the landscape, some of which describes the proportion of landscape with a particular LC class, the size, number, and perimeter of each LC patch, and the complexity of the shape of the patch (Rashed, 2008). Since most of the metrics are based on geometric properties of landscape elements, that can provide simple quantitative measurements of a complex pattern, they are frequently adopted in landscape research.

This chapter analysis attempts to identify the landscape ecology of the VUDA region in which the time series LULC maps are subjected to analyze for the linkage and interdependency in the performance of the ecological services of the urban city. These objectives are attained by using the FRAGSTAT, the ecological study tool. The result discusses about the fragmentation and decreases in the core area of important ecological service provider owing to the urban land transformation. Principally two ecological service providers are considered in the study i.e green space which includes all the open space which is devoid of the concrete material and hydro-scapes.

1.9.5 Chapter 5: Urban Modelling Cellular Automata

CA model can be used to simulate different urban forms and developments in the planning of sustainable cities. Alter- native development patterns can be formulated by incorporating different `sustainable' elements in the CA model.

On the basis of the time series LULC maps the land use change analysis is done and is predicted for the future course of growth. The 1990 LULC map is kept as the base for the transition and validation of the model. Using which 2011 image is validated with the transition potential, this potentiality information is used to generate the algorithm for the future growth and development potentiality. The probability map of urban growth of VUDA by 2020 and 2030 are generated. In the application of the CA model constrains are also allocated in terms of the plot

reservation planned in various Town planning scheme implemented and are proposed in VUDA and VMC limit, the land value, and road infrastructure proposed .

1.9.6 Chapter 6: Conclusion and Recommendations

The results of the study point out that Vadodara Urban Area has experienced rapid changes in LULC, particularly in terms of urban/built-up area. Over the past 30 years, urban/built-up areas have increased by the urban area in 1978, resulting in a substantial reduction in the area of farmland and green land. Urbanization has accelerated at an unprecedented scale and rate. Water bodies reveal seasonal fluctuation. Built up area changes also represents vertical expansions. Such changes also affects over all environmental condition of urban cities.

Many water bodies of the city have shown decrease in area. Many wetlands are disappearing over a period of time due to the rapid urbanization. Study also revealed that some of the water bodies of the city are facing the problem of eutrophication.

Estimation of Urban Sprawl Index (U.S.I), Land Consumption Rate (L.C.R.) and Land absorption Coefficient (L.A.C.) reveals that increased population rate is responsible for rapid sprawl of the city. The analysis of spatial structures and patterns are central to geographic research. Spatial primitives such as location, distance, direction, orientation, linkage, and pattern have been analyzed. This suggests new growth in peripheral areas.

A future pattern of urban growth when the prevailing urban process continues, the model can be used to generate different types of urban forms and developments according to different planning objectives. Monitoring land-use and land-cover change help to develop an understanding of past trends, while simulation based modelling can provide insights into potential future developments. Both complementary approaches are necessary strategies for implementing appropriate actions including formulating better land use policies, providing infrastructure, identifying future development pressure.

Summary

This chapter deals with the idea of urban sprawl, where the aspects of urban growth and urbanization were differentiate. In view of the origin of towns and cities, the chapter appraises literature with reference to urban studies in general and sprawl in particular carried out in developed countries and in India as well. Thus there is need for characterizing sprawl through patterns, capture the dynamics to recognize processes and source, and the need for an integrated spatial planning support system to assess the consequences.