

TRANSFORMATION OF URBAN AGGLOMERATION & SUSTAINABLE DEVELOPMENT: A CASE STUDY OF AHMEDABAD

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ABSTRACT

Urban agglomeration is the million plus city which deals with the industrialization, globalisation and heavy transportation services and many other urban activities. Land use changes and their influences put forth in urbanisation of Ahmedabad city. The main aim of this paper is to analyse the ground truth situation of Ahmedabad urban agglomeration and its fringe area expansion with sustainable use of resources. The city of Ahmedabad and the outer sprawl area are the pivot centre for assuming the variability of transformation in urban growth with sustainable use of resources. The current study of Ahmedabad analysed the urbanisation and sustainable use of resources with using census data from 2001 & 2011. The study divulge that the urban fringe transformation occurs with sustainable use of resources or not. However as per the data of census directorate of census, Ahmedabad total population was 6,361,084 in the year of 2011 and covers 464 sq. km whereas 1866 sq. km area of urban agglomeration in 2020, population increased by 7,868,633 and covers 1866 sq. km. its seems that the sustainable use of land are highly required. Ahmedabad human settlement are expanding towards its fringe area in which it includes Daskroi, Sanand, Kalol, Gandhinagar, kadi, dehgam, mehmedabad, kheda, bavla, dholka. These taluka's forming the suburb boundary of Ahmedabad city. Industrialization in Ahmedabad mainly takes place in naroda, narol area where the carbon emission is maximum due to which the problem of air pollution is increased.so as per the "SUSTAINABLE DEVELOPMENT GOALS" green industries should be promote in Ahmedabad in sustainable manner. Urban fringe transformation take place in rapid form for which the sustainable growth are required. Daskroi taluka is located 14 km towards south from Ahmedabad city where the urban expansion taking place. All though the urban planning and sustainable growth occurs in Ahmedabad but instead of these it stands for maintainable growth of city. Ahmedabad is located at [23.03°N 72.58°E](#) with the average elevation of 53 meter. It is a metropolitan city of India where all the urban activities are taking place which shows the inter relationship between human and nature.

Keywords: *Urban Agglomeration, Sustainable Growth, Urbanisation, Environmental Maintenance, Urban Fringe Expansion, Climate Change.*

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Introduction

Urban agglomeration deals with the expansion of fringe area which is considered as urbanisation. The built up area and land cover are transformed with increasing population. As the urban growth takes place it also necessary to evaluate the sustainable views of resources. Ahmedabad is the substantial city of Gujarat. The urban dimension or area in 2000 was 21, 292 hectares which increases at an average 1.9% since 2000 and in 2013 it was 27,409 hectares where's total population of Ahmedabad in 2000 was 4,718,391 which increases at average annual rate of 2.1 since 2000 and in 2013 it was 2,32,952. The large portion of Ahmedabad are now urbanised mainly due to expansion of human settlement towards outward area of the city, therefore city are confronted with the challenge of maintaining the natural resources. Although Ahmedabad city is clean and well-planned but on the other hand when we go to those regions where tribal and rural population are living, Than we comes to know

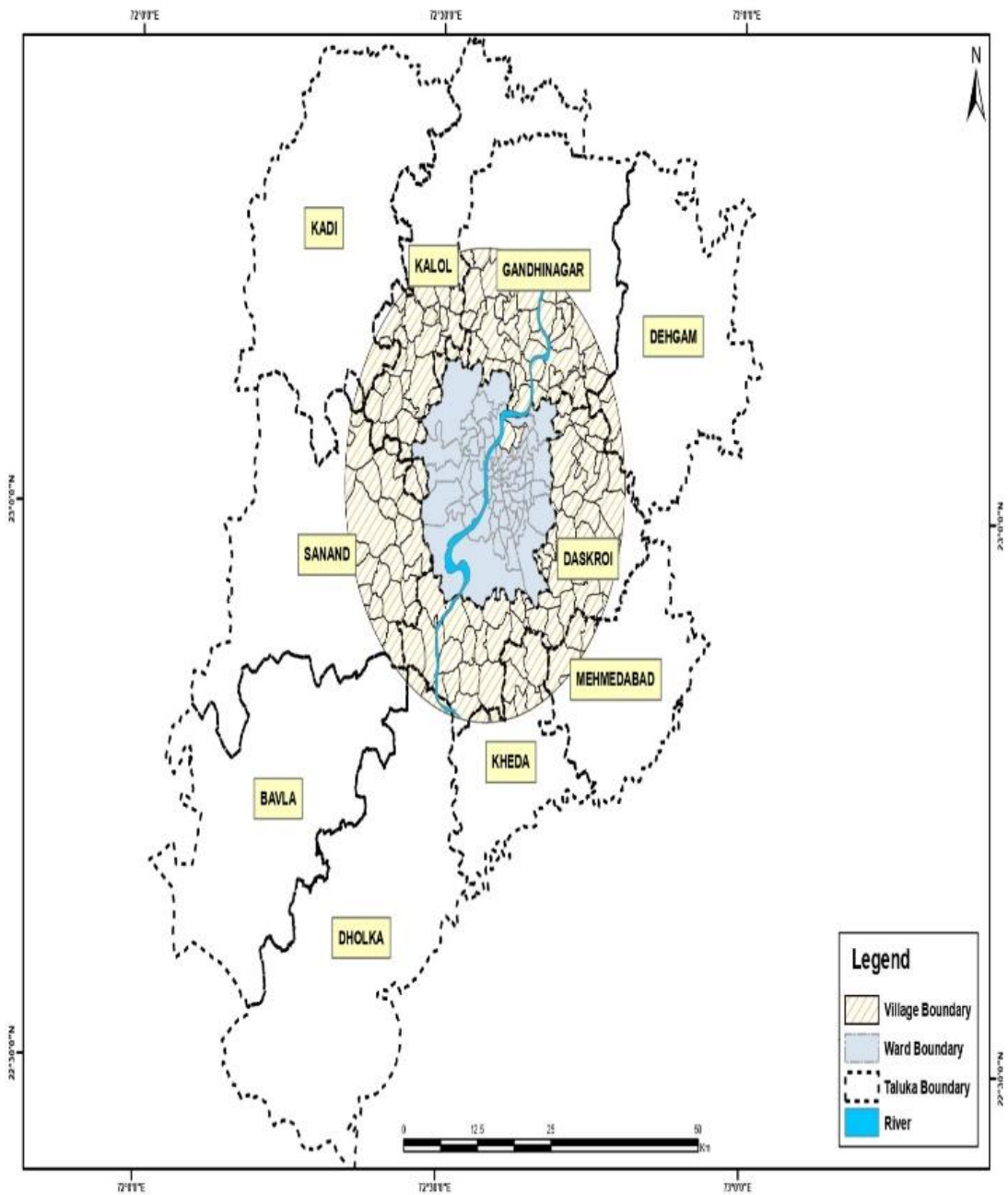
that their living standard is not maintained through which land degradation are taking place, urbanisation led with pollution mainly the air pollution and recently in june the world bank and its report said that "south Asia's hotspots-the impact of temperature and precipitation changes on living standard" there are 19th district are poised to become climate change hotspot by 2050 in the "moderate mild category".

The paper "future climate change scenario in semi-arid climate of saurashtra Gujarat by IMD, Ahmedabad, they said that the average temperature will be increase as the maximum summer temperature will rise by 1.7 °C. Due to this rainfall will also increases by 11%. As per the Ahmedabad heat action plan 2017, by Ahmedabad Municipal Corporation. The urbanisation and climate change are inter related with each other due to which the average temperature and heat waves are increases. The city of Ahmedabad facing vital heat waves in May 2010 which also causes death in Ahmedabad thus AMC also working in order to reduce the health problems and threatening consequences of heat waves. The 2017 heat action plan is the early warning for heat waves in Ahmedabad. The city has been undeviating like towards growth and advancement and being a smart city and being only heritage city of India. Although the public transport of Ahmedabad is going to be discussed at the UN habitat meet hold on to Fukuoka, japan in July Aug. 2018. Fukuoka city going to organised its 12th Asian pacific city summit under theme of "sustainable cities and communities" in this Ahmedabad is one of the five cities which are selected for presenting their urban projects. Their 17th sustainable development goals (SDGs) which are introduce their for transportation accessibility of BRTS in Ahmedabad. Urban transformation takes place only through transportation community. In this summit mayor Ahmedabad Gautam Shah said as per estimate by 2050 around 70% world population will be staying in urban cities for the existing cities need better and sustainable infrastructure our BRTS is the best example.

Although Ahmedabad is one of the India's augmented cities but the pollution (air) rate is high as the Ahmedabad was stand at the 4th most polluted city in India in 2001. As per the air quality in Ahmedabad AQI and PM is 168 US AQI and PM 2.5 this can lead the temperature of the city. In present time period of December 2020 the day temperature is 33°C whereas it was only 5-20°C in December in 2019. So this data shows that how climate id variable but no one can serious about the current situation.

The study area is Ahmedabad and its fringe area which deals with the transformation of urban sprawl which area extend towards outside. According to UNGA (United Nations general assembly) 1987 provided the report that resources are misused by the urban population which make the loss of future generation need and demands.

Million plus city or urban agglomeration cities area the centre for making the example of climate change activities because those centres where the pollution rate area high they also make the contribution to the climate variability. Temperature increasing is the dominant consequence of the climate change.



Urban fringe transformation of urban agglomeration of million plus city like Ahmedabad which has experienced unsustainable growth because area is continuously expanding towards outside in the reference of human settlement. This figure shows the buffer zone of 10 km which represent the fringe area of Ahmedabad where there the population expansion is taking place. This buffer zone for showing sprawl area of Ahmedabad are include: daskroi, Sanand,

Kalol, gandhinagar, kadi, dehgam, mehmedabad, kheda, Bavla, Dholka. Which lies in the district of Ahmedabad, gandhinagar, mahesana and kheda.

The study of fringe is considered by the ward boundary of Ahmedabad and village boundary of Ahmedabad which also included the urban agglomeration boundary of Ahmedabad which can represent the fringe area of Ahmedabad.



Fig 1: Fringe area towards daskroi taluka: Google image November 2011.



Fig 2: Fringe area towards daskroi taluka: Google image January 2020



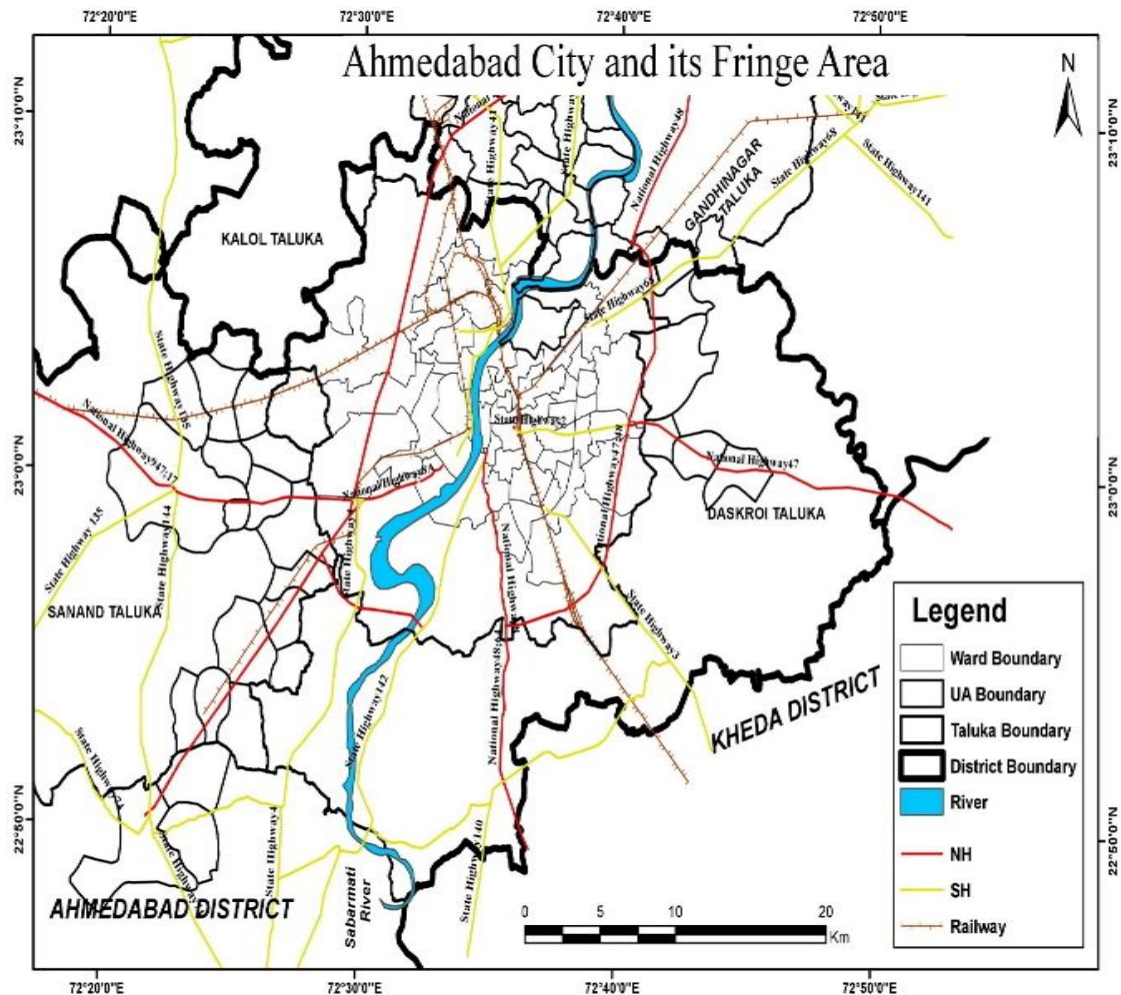
Fig 3: Ward boundary of Ahmedabad on Google earth December 2020

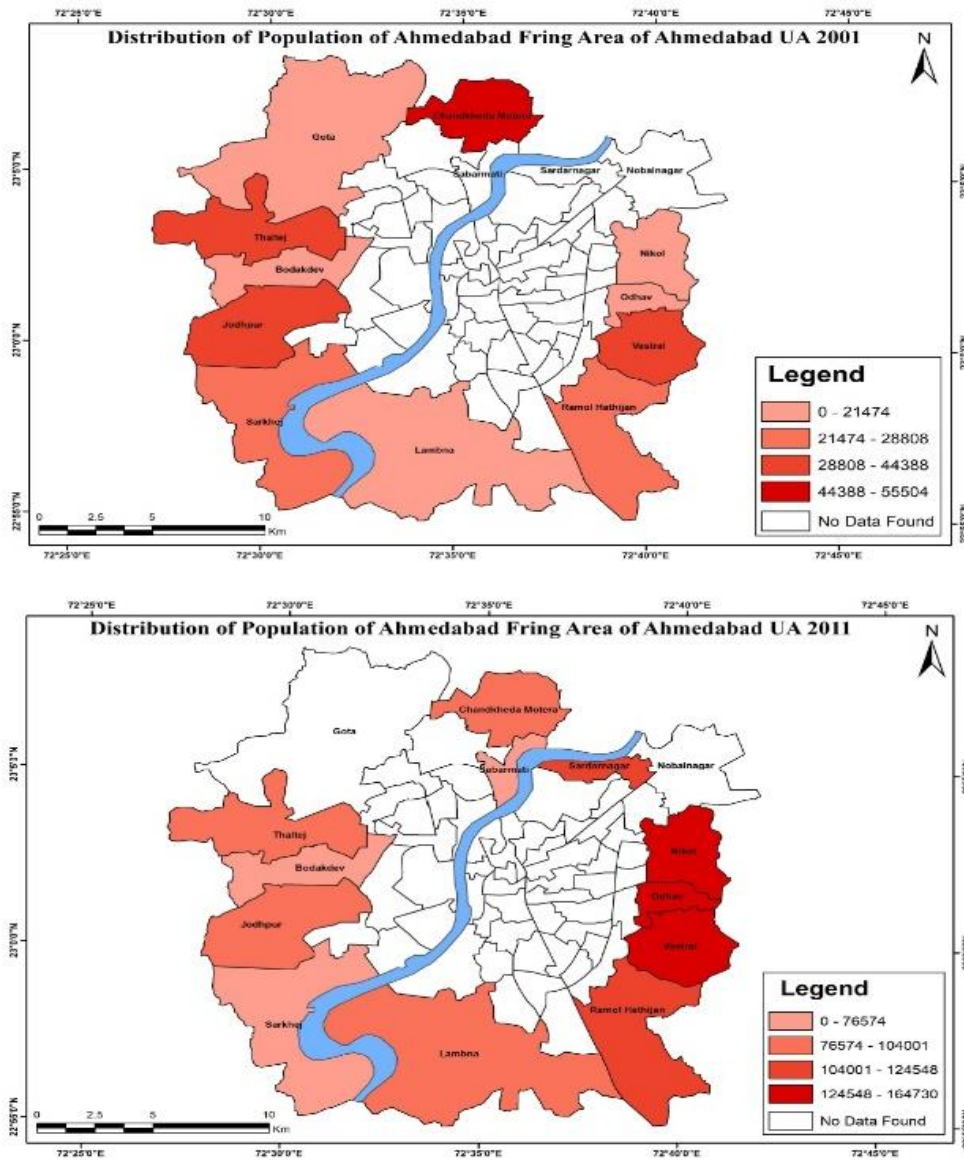
Population distribution of Ahmedabad is increases from 2001-2011 with the rapid rate. The population of fringe area increased by 55504 to 164730 as the population of nikol and odhav in 2001 was nearly 21474 people which is increased by 164730 people in 2011. With increase in population the household number and their distribution also increased but with this the sustainable use of resources are not taking place.

The fringe area of Ahmedabad are included the ward areas such as: Gota, Thaltej, bodakdev, Jodhpur, Sarkhej, ramol hathijan, vastral, odhav, noblenagar, and Sabarmati. These areas are extend toward outward area which is considered as sprawl area of Ahmedabad which include the taluka and district both nearby Ahmedabad.

The above map shows the ward boundary with district, taluka and urban agglomeration boundary which is approved by the AMC and AUDA. There are nine taluka and four district which create a boundary with Ahmedabad city or its ward boundary. The city became a commercial and industrial hub of the state thus it is expanding toward its fringe area and this fringe area can be shown with the help of these boundaries.

The main focus is on the village areas which are only considered as the village but their population is more than a town because of the industrial areas the problem occurs when the land degradation and the desertification are transpire on the land of villages which are lies in the taluka boundary and the UA boundary of the city.





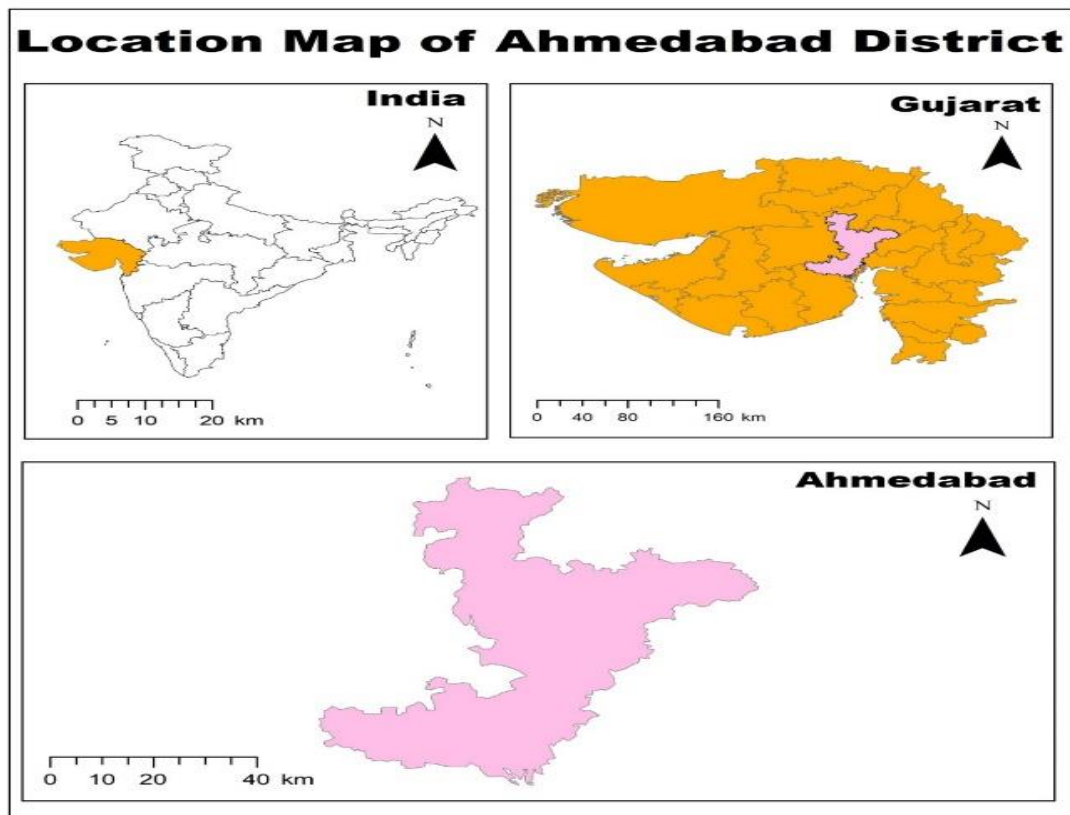
This figure shows the distribution of population of Ahmedabad fringe area of Ahmedabad urban agglomeration as per the census of India 2011 and 2001. The inter-governmental panel on climate change (IPCC) has an important report on climate change, desertification, land degradation, sustainable land management, food security and greenhouse gas flames in terrestrial ecosystem given by sustainable technology, Indian institute of science, Bangalore.

Although urbanisation led the development of the city but it also on to the land degradation and impulsive dump of urban waste. According to directorate of economics and statistics 2013, there is rapid growth rate in speedy urbanisation in because of industrialisation growth and the evolution of tertiary sector in Ahmedabad. Contemporary the urban population in Ahmedabad is 6361084 in which 3,350582 are males and 3010502 are females. Maximum villages of Ahmedabad are densely populated because of amalgamation of population. The study area of this paper is the sprawl area of vastral, odhav, nikol, Sarkhej, Lambha, Thaltej and Gota. Ahmedabad area the million plus city of Gujarat which is administrated by Ahmedabad Municipal Corporation (AMC) and it's also responsible for certain mandatory and voluntary services.

Study Area

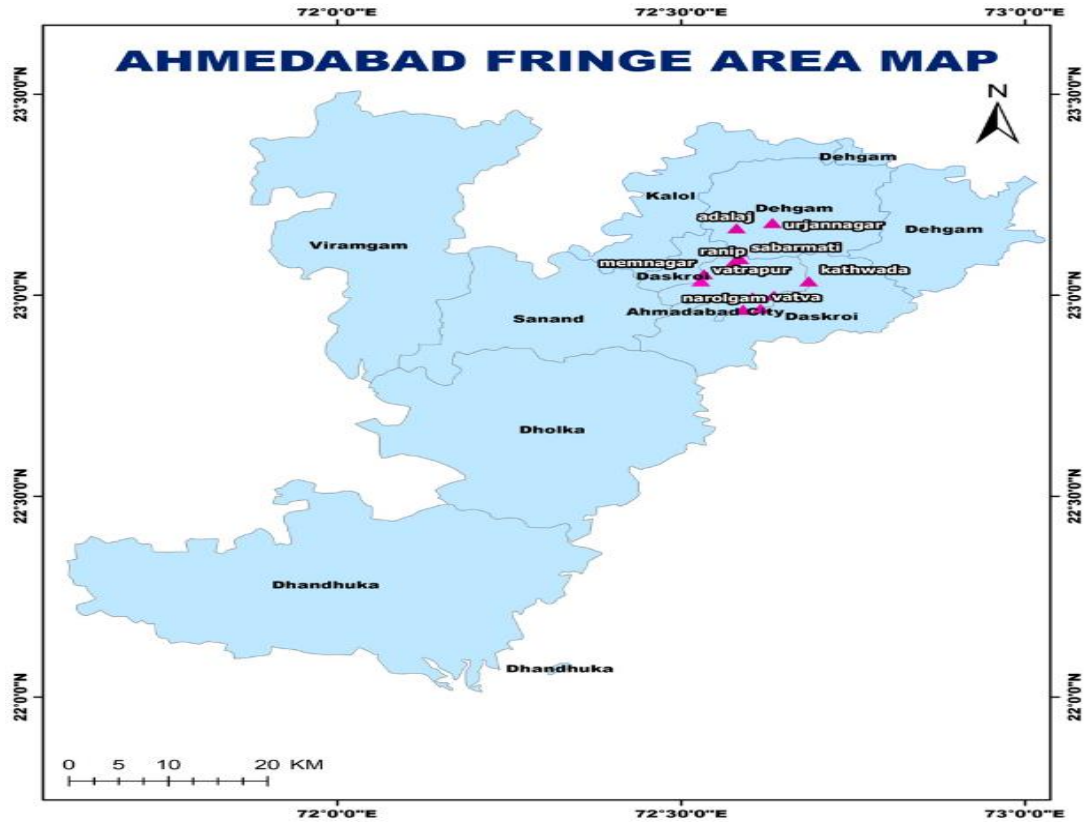
The study area of this paper is Ahmedabad fringe area of Ahmedabad urban agglomeration. It is located on the embankment of Sabarmati River in the mountain portion of Gujarat and the western portion of India. It is situated at 23.03°N 72.58°E extending over 205 km.

- Delineation of study Region and urban Fringe Areas
 - Ahmedabad is consider as the metro urban city which now naming the fringe area mainly in the Eastern Belt.
 - The Spatial Expansion of the city which include sprawl area and urban fringe and the objective of sustainable development
 - Focusing will be on the Suburb area of the new Residential area of Ahmedabad with land use and land cover data for the analysis of sustainable use of land.
 - The expansion of central business district towards the boundary area of the city and pollution.
 - Study area includes the boundary region of the Ahmedabad which is undertaken by the AUDA (Ahmedabad urban development authority).
 - Urban fringe means the expansion of urban outskirts which include social, economic and political boundaries. Whereas sustainable development means the maintainable use of resources from their future generation can also able to use the resources.
 - Urban fringe is also known as urban conurbation or urban hinterland and when the fringe area became the part of urban authority thus it is known as "Urban Agglomeration"

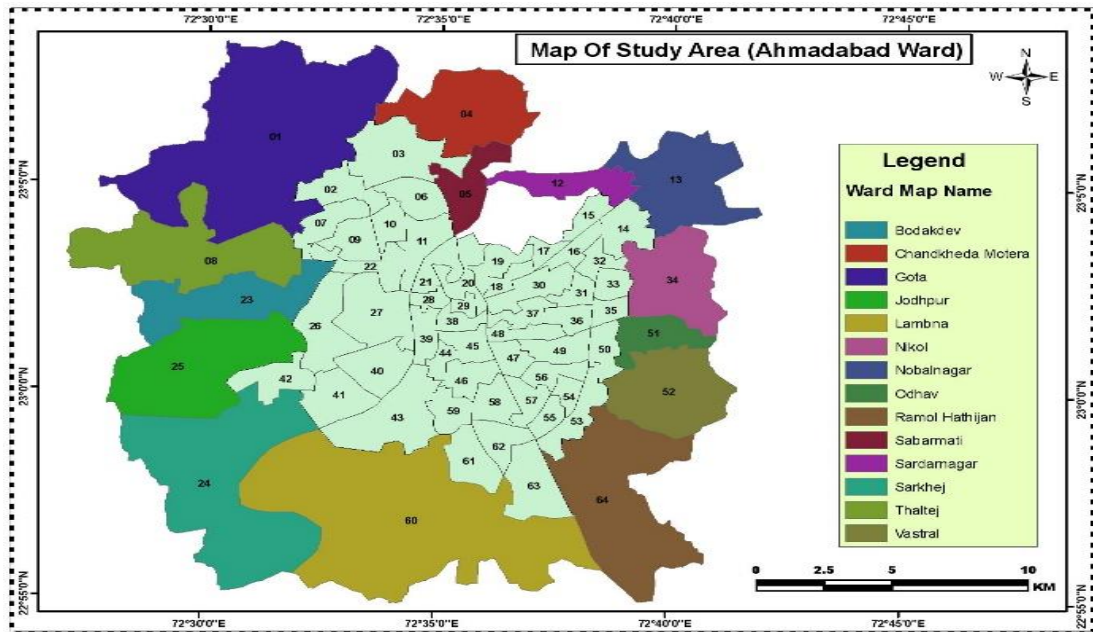


- Demarcation of Fringe Zone & Study Area: -The Fringe area of the Ahmedabad will be Demarcate by the primary Data Collection with the help of QGIS and other tools through which these areas will be demarcate.

Sustainable development of Ahmedabad is considered by the data of pollution which represent that the quality of resources are reduces with inclination in population graph.



The ward boundary of Ahmedabad is the study area whereas the main aim of the paper is to point the real situation of the fringe area of the Ahmedabad urban agglomeration with increase in population and also in pollution. These outward area of Ahmedabad ward area are to be considered as sprawl area where land degradation and air pollution is the main problem.

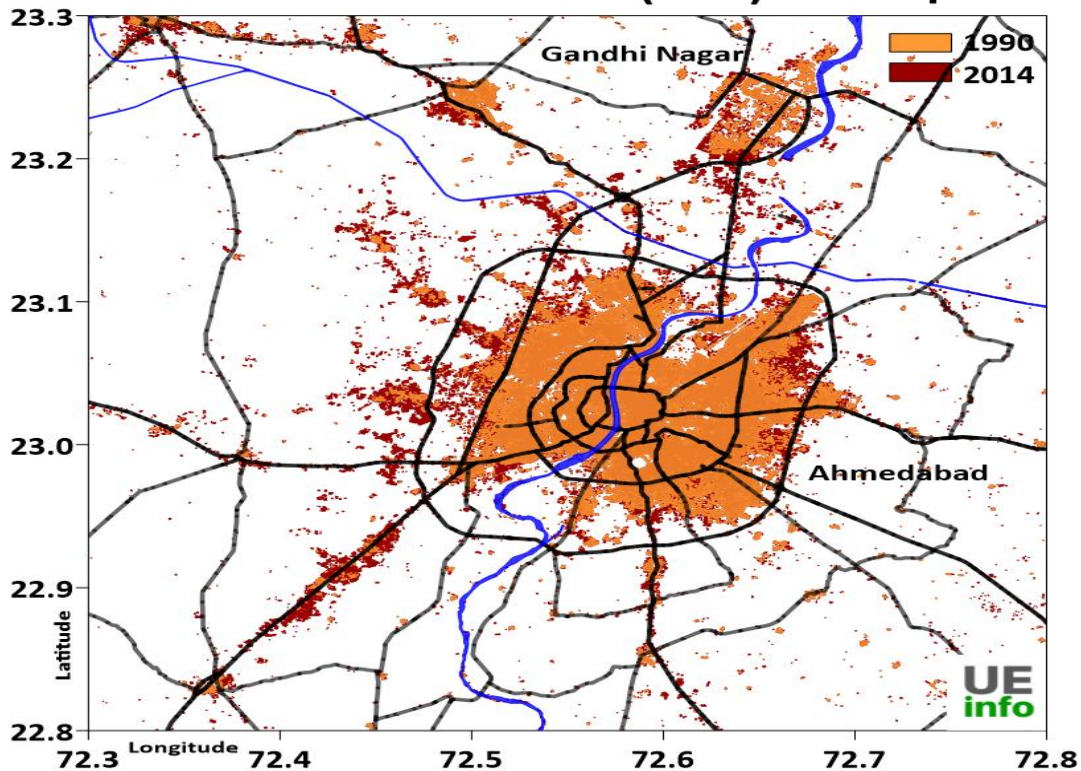


Air Quality Index of Ahmedabad and Fringe Area

City	Air quality index($\mu\text{g}/\text{m}^3$)
Ahmedabad	159
Sarkhej	163
Adalaj	163
Sanand	163
Gandhinagar	101
Mahemdabad	114
Dahegam	114

Above table shows the air quality index of Ahmedabad and its fringe area which reflect that Ahmedabad having very poor quality of air because of heavy traffic of vehicle and population pressure. Transformation of urban fringe area of Ahmedabad urban agglomeration led with the low quality of air and unsustainable use of resources.

Global Human Settlements (GHS) Built-up Area



Source: - urban emission .info

From the source of urban emission the data obtain of Ahmedabad which manifest that urban sprawl having maximum change in respect of human settlement from 1990 to 2014. Population expansion towards fringe area contains the problem of land degradation and dissipate resources. Ahmedabad is the largest city of Gujarat and also a million plus city and also considered as urban agglomeration (UA) and having 8 million population with 465 sq.

Km. Ahmedabad is also known as commercial city of the state whereas Gandhinagar is known as the administrative capital of Gujarat and they both they create the urban cluster with the million plus population.

Ahmedabad is declared the India's first UNESCO world heritage city on the basis of old eastern Ahmedabad and on the other hand the western Ahmedabad is the hub of urbanisation and urban agglomeration because it consist heavy infrastructure and transportation facility with the facility of housing and institutions.

Case Study Reviews

Jennifer Hrabchak Molinsky (2006) In general, most authors use “fringe” to refer to the dynamic area between built-up suburb and open countryside where metropolitan growth is occurring or is expected to occur in the near future. A basic attribute of the fringe is its changing nature: urban influences and land uses push out from the metropolitan core through the fringe in what has been described as a wave-like pattern (Blumenfeld, 1954; Hart, 1991), and the fringe itself pushes deeper into the countryside.

Bhargav Adhvaryu(2011) Archaeological evidence suggests that the area around Ahmedabad has been inhabited since the 11th century, when it was known as Ashaval or Ashapalli. The city got its current name when Sultan Ahmed Shah established rule in 1411. The population of Ahmedabad Municipal Corporation (AMC) area (191 km²) in 2001 was 3.5 million and the population of the Ahmedabad urban agglomeration (600 km²) was about 4.5 million (Census of India, 2001) Ahmedabad is located on the banks of Sabarmati River in the state of Gujarat in western India (see Figure 1). The city is divided by the river into two physically distinct eastern and western regions. Eastern Ahmedabad has the old (traditional) predominantly characterized by row houses (also known as terraced houses) along the streets. Outer areas of eastern Ahmedabad have industries and residences of lower income households. More recently developed, western Ahmedabad is generally characterized by modern buildings and more affluent people.

Jamalunlaili Abdullah(2012) The four main strategies employed then were resource and new land development strategies, in situ rural development, industrial dispersal strategy, and rural urbanization and growth centre strategy (Ghani Salleh, 2000). The first strategy entails the mobilization of large numbers of people into cleared virgin land which was transformed into agriculturally productive Ares. The RDAs developed high level of urban services and other infrastructure to serve the resource based industries in the newly opened areas. The in situ development, on the other hand, modernized existing rural areas through the provision of infrastructural facilities.

Darshini Mahadevia, Renu Desai, Suchita Vyas (2014) In spite of low rate of urbanisation in India¹ in the last two decades, cities have not been able to provide the growing urban population with viable housing, potable water, adequate sanitation, employment at reasonable wages, access to education and healthcare, accessibility to work and other opportunities and social security. As a result, a large proportion of the urban population is constrained to live in slums or informal settlements, depend on the informal sector for their livelihood, access water supply, education and healthcare in the private informal sector and use informal transport options. Parallel to this, over the past decade or two, governments and elites have been pushing for urban development that would transform Indian cities according to their images of a world-class or global city.

Annapurna Shaw(2015) Where the city ends and the rural area begins has become more and more blurred as the phenomenon of mixed land use with rural and urban features coexist in areas surrounding cities. Such areas are particularly vulnerable to environmental damage because of their proximity to the city which could be degrading their land and water resources, for instance, through the dumping of solid and liquid wastes or where population growth has spilled over from the city and the increased population has strained the carrying capacity of surrounding areas. While our urban areas as a whole, that is, the built-up area and areas within city limits as well as outlying areas and outgrowths, have an unsatisfactory level of environmental infrastructure services, such as water supply, sanitation, drainage, solid waste management, transport and air pollution control, many of these problems are much worse in the outlying areas or the periurban areas.

Diwakar, Ashok Qureshi M H (2015) Rapid urbanisation has been an important feature in the world during the 20th century. "Cities today are experiencing rapid change. They are growing in area and population, and at the same time they are acquiring a new character· as their people perform new tasks in the physical environment, that increasingly reflects the use of Western technology_"

The centrifugal forces impel functions to migrate from the core of the city towards its edge. It is becoming difficult to draw the boundary where the turban' ends and rural' begins. Thus, a rural urban continuum tends to emerge, but more in the post-industrial countries. Actually, no competent sociologist, for at least a generation, has maintained that the distinction between urban and rural is sharp one.

Jeffrey Raven (New York), 2018 Urban planning: A field of practice that helps city leaders to transform a sustainable development vision into reality using space as a key resource for development and engaging a wide variety stakeholders in the process. It generally takes place at the scale of the city

or metropolitan region whose overall spatial pattern it sets. Good urban planning formulates medium- and long-term objectives that reconcile a collective vision with the rational organization of the resources needed to achieve it. It makes the most of municipal budgets by informing infrastructure and services investments and balancing demands for growth with the need to protect the environment.

Dr. manzoor hussain, 2019 The urbanization as a concept, its dimensions and factors have always attracted the interest of many researchers across the globe. The present study aims to study the history of urbanization, urbanization concepts, its dimensions and factors like urban places, urban hierarchy, urban primacy, over-urbanization, urban sprawl, urbanism as a way of life, and factors of urbanization. After the comprehensive literature survey, results of various studies were correlated in a systematic manner for further analyses to reveal the findings and draw conclusions Cities are products of the process of urbanization. In other words urbanization is the social process that leads to the creation of cities.

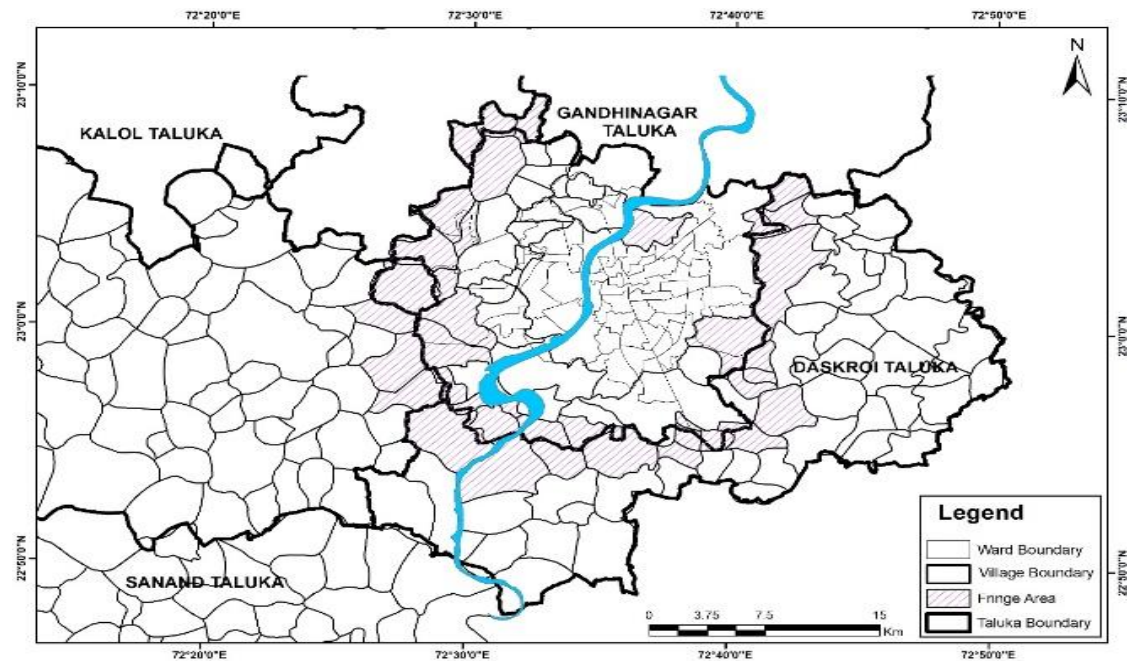
Study Area & Objectives

The Ahmedabad city is located on the bank of Sabarmati River in the northern portion of Gujarat and western portion of India. It is situated at 23.03°N 72.58°E extending over 205 km. the Ahmedabad city is divided into two parts one walled city which is considered as an old city and another one is known as new Ahmedabad city. The Ahmedabad urban agglomeration is the city of million plus city UA/City, it is also administrated by Ahmedabad municipal corporation.

Description	
Urban agglomeration	Ahmedabad
Government	Urban agglomeration
UA Type	Million Plus UA/City
State	Gujarat

Source: - Census of India 2011

The total population Ahmedabad agglomeration or Ahmedabad metropolitan region had a population 63.57 laces and cover the area of 464 sq. km.



Objectives

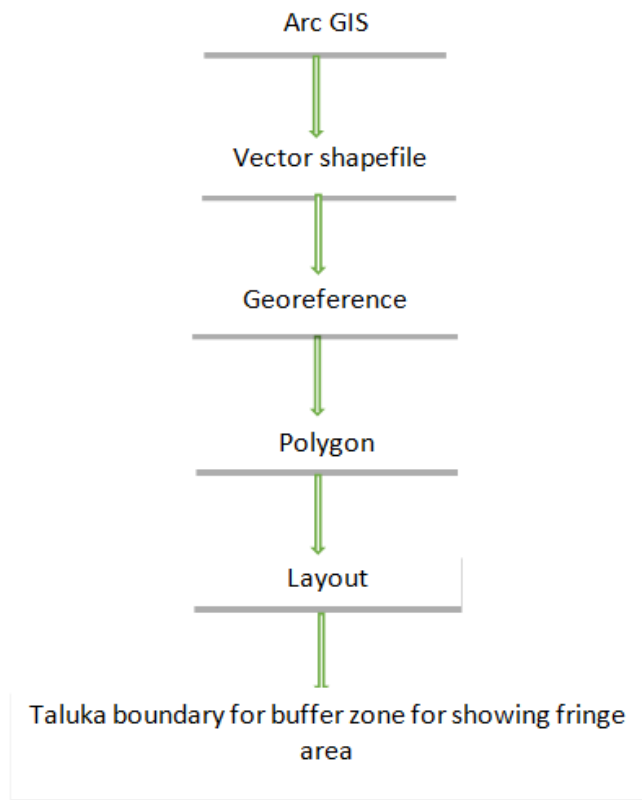
The objective of the study is to give the information about sustainable growth and urban fringe transformation. The above maps represent expansion of city towards the sprawl area of the region Ahmedabad is one the largest city which is having million plus population. The city is administered by Ahmedabad municipal corporation (AMC) with 466.35 sq. km. the total population of Nikol in 2011 was 137840 whereas it was only 17036 in 2001 similarly the total population of odhav is 137543 in 2011 and

the same was 21474 in 2001. Thus it shows that as the population increases the maintainable use of resources are decreases. In 2001 nikol lies in unhealthy group of air quality index (AQI) whereas in 2011 nikol lies in very unhealthy group of AQI.

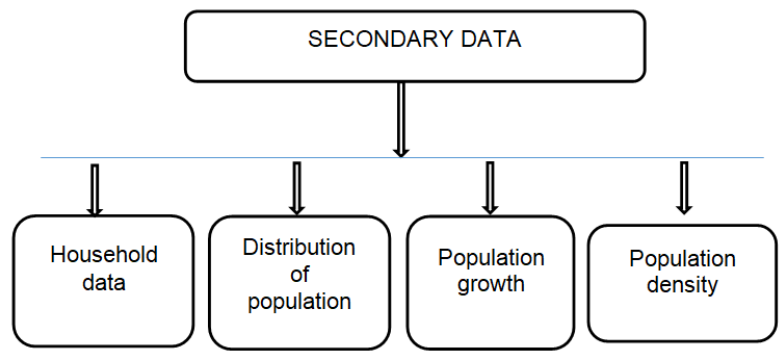
Methods & Methodology/Materials

Data for this study were obtained from primary and secondary sources both. But due to covid pandemic the primary collection of data in which field survey and personal interview are the main source. But through from census data from Directorate of Census Department gandhinagar, it seems that population are Increases rapidly. It is cleared that pollution also increases with increase in population by Gujarat Pollution board Gandhinagar.

The methodology are shown in following way:

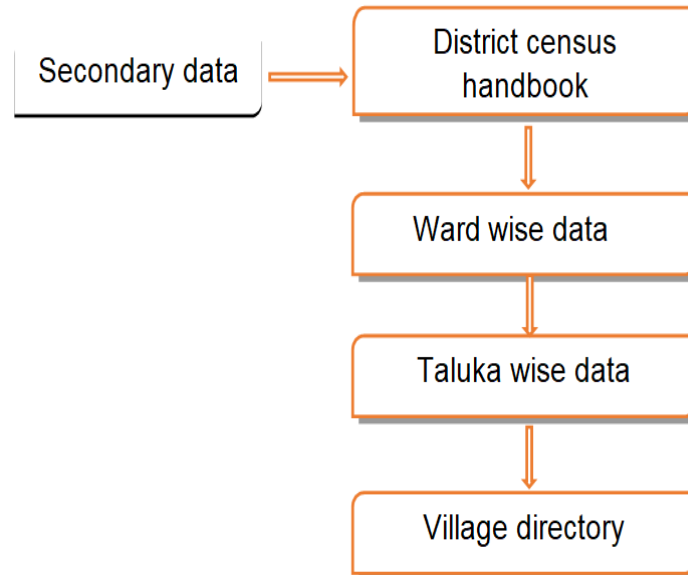


Secondary data are used in the form of census data which is obtained from the directorate of census department gandhinagar. The census data handbook having the data of fringe area of Ahmedabad and the uses of resources such as land and water.



Data and Sources

Data of the urban agglomeration and transformation of fringe area of Ahmedabad area collected from census department gandhinagar. Whereas urban expansion was analysed by using Arc GIS and temporal remote sensing data of the 2001 and 2011 period of time. City map and ward boundaries were digitised from directorate of census department map etc.



The method involves: - ward boundary shape file with Georeferencing. Data analysis and interpretation. Urban agglomeration boundary are digitised from JPEG file from census department. Digitised taluka boundary and the JPEG file of taluka is taken from the website of revenue department. Fringe area expansion are marked through Arc GIS software. Data of climate change has been collected from environment degradation. Statistical analysis and accuracy are done with the help of data analysis. Water bodies and air quality of Ahmedabad is unhealthy which is analysed with the help of AQ Index.

Review of literature are done through from different sources which shows that the fringe area is expanding due to increase in population distribution. As per the report of (SAC) space application centre 2016, there is land degradation and desertification occurs in Gujarat. According to air quality index Ahmedabad having “unhealthy” air quality in which pollution level is high and the main pollutant are PM 2.5 means $124.9(\mu\text{g}/\text{m}^3)$.

Selection of Study Area

While looking for the issues of Ahmedabad related to the human settlement and the environmental condition this topic is the relevant for the above issue. Air quality index also represent that it is “unhealthy” and “poor” similarly the land degradation problem also occurs in the Ahmedabad and its fringe area where there human settlement takes place with rapid rate.

Climate change is the main issue in the million plus city of India. Ahmedabad is the Manchester of India because there is a large number of industries area in Ahmedabad which include cotton textile, chemical industries, metal industries, etc. Thus the pollutants in the air and water are more as compare to their purity. Temperature of Ahmedabad is continuously increases with increase in number of people and their distribution. Thus this topic is important for the sustainable use of resources with increase in number of population.

Significant Achievement and Current Status

Ahmedabad is the commercial capital of the Gujarat and having million plus population and became urban agglomeration. According to the current situation of the city the climate change situation are appears in the city as according to the INDIAN METEOROLOGICAL DEPARTMENT, MINISTRY OF EARTH SCIENCES GOVERNMENT OF INDIA in 2015 the city records 35.6 degrees which is highest. The average temperature of the city is increased by 2.9 degree to 3.8 degree respectively.

- Climate change and the sustainable development is the master plan of the Ahmadabad municipal corporation.
- Ahmedabad fringe area is expanding with the rapid rate but on the other hand the maintainable use of resources are not implemented.
- The present status of the Ahmedabad city and its fringe is the degradation of the land and the increase in temperature.
- Although climate of the Ahmedabad is humid because it is located at 55m altitude from sea level. Summer is very harsh and extreme which is also the result of heavy industrial pollution and the urban fringe transformation which increases the rate of pollution.

Conclusion

Urban fringe transformation is the process of urbanisation in the urban agglomerated cities like Ahmedabad. Climate change is the global problem which cannot be denied in the regional level, Ahmedabad is the million plus city where the population is urbanised. It is divided into two parts in which the urbanisation takes place in the western portion of the Ahmedabad.

Increasing the average temperature of the city with decreasing the quality of the air is the major issue of the city. The city is expanding toward its sprawl area which reduces the green belt of the city due to which the renewable power of the natural resources is decline frequently.

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