

RESEARCH ARTICLE



Spatio-temporal growth and development of Bangalore metropolitan- using geo-spatial technologies

 OPEN ACCESS

Received: 07.03.2018

Accepted: 24.04.2018

Published: 10.06.2018

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Citation: Hanumantharaju R, Hanjagi AD. (2018). Spatio-temporal growth and development of Bangalore metropolitan- using geo-spatial technologies. *Geo-Eye*. 7(1): 6-11. <https://doi.org/10.53989/bu.ge.v7i1.2>

Funding: None**Competing Interests:** None

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Published By Bangalore University,
Bengaluru, Karnataka

ISSN

Print: 2347-4246

Electronic: XXXX-XXXX

Abstract

Change in any form and any society in any circumstance is unavoidable; it has become part of urban growth. An Urban City is a location characterized by a high dense human population and vast human-built features compared to the areas surrounding it. Bengaluru is the second-fastest-growing city in Asia. Today Bengaluru is facing many issues and challenges because of the fastest growth of Urbanization. Bengaluru has a vast number of opportunities in terms of employment, education, investment, and favorable climatic conditions attracting people from various places. This research paper aims to assess the Spatio-temporal growth and development of urban growth in Bengaluru City. The physical growth of Bangalore city examines from the origin of Bangalore from Nadaprabhu Kempegowda period. The data for the research has been obtained from spatial and non-spatial data sources. Secondary data have been used to write the research papers. QGIS software has used to prepare the maps to show the growth and development of the Bangalore city region. The growth identified many merits and demerits which affects the Bangalore city in the future.

Keywords: Urban; growth; development

Introduction

Change in any form and any society is inevitable; it has become part of urban growth. Urban areas may be cities, towns or conurbations, but the term is not commonly extended to rural areas such as villages and hamlets. Urbanization is one of the fastest-growing phenomena in the contemporary modern world. The process of transformation of settlements from rural to urban is called Urbanization. Today nearly half the human population lives in cities; because of the spread of the industrial revolution, more and more people started living in urban areas

(UNPFA, 2007). Urban space is a location characterized by high human population density and vast human-built features compared to the areas surrounding it. As per 2015 data 52% of the world lived in urban centres, 33 % in urban clusters and 15% in rural areas. This makes the total urban share is nearly 85% that is more than 6.1 billion or 610 crores. This was the first time that the majority of the world's population lived in a city. Bengaluru is one of the fastest-growing cities in India. Today Bengaluru has faced many issues and challenges because of the rapid growth population through the Urbanization.

The significant challenges that cities encounter are crimes, drinking water, traffic congestion, over-urbanization, slums, urban population, waste disposal and many more. Out of these acute problems faced by the city is over-urbanization.

Study Area

The Government of Karnataka re-organized the erstwhile district of Bangalore District on 15th August 1986 into a Bangalore Urban District and Bangalore Rural District. The re-organization exercise's objectives and modus operandi were dependent and indeed inspired by the Urban-Rural dichotomy both in revenue administration urban development. Bengaluru Urban District is located in the state of Karnataka in southern India. The district is the third most populated city in India. The district lies between latitudinal 12°39' N to 13°18' N and the longitudinal meridians of 77°22' E and 77°52' E on the other. The maximum distance from the western and eastern tip is about 50 km and the northern end to the southern end is about 58 km. Ramanagara District bounds Bangalore Urban district in the west, Bangalore Rural District in the east and north and Krishnagiri District of Tamil Nadu on the south. Bangalore Urban district consists of 4 taluks, namely Bangalore South, Bangalore North, Bangalore East and Anekal. Within these taluks study area covers 198 BBMP wards and the total geographical study area is 741 sq. km.

Bangalore Urban District is the smallest among the districts of Karnataka State, with an area of about 2191 sq.km. With population-wise, it stands first 96, 21, 551 as per the Census of 2011. At the core of this district is the Bruhat Bengaluru Mahanagara Palike (BBMP), with a total area of 741 sq.km, with a population of 84,43,675. Bangalore District has four taluks, namely Anekal, Bangalore North, Bangalore South and Bangalore East. The area of BBMP being divided between the Bengaluru North, Bengaluru South and Bengaluru East taluks. Being the state's headquarters, it is the chief administrative center for many state and divisional government departments and offices associated with the state legislative, executive, and judicial branches of administration. The city is the headquarter of both the districts. Bengaluru is the administrative, industrial, commercial, transportational and educational centre of Karnataka State and it is situated at the heart of good agricultural hinterland. It is also the main networking centre of the highway, railway, and airway in the state. A gifted chieftain, Kempegowda, had a vision of the city's future, and he is said to have erected pillars to indicate his vision of the extent to which it would grow. But those limits have long been surpassed.

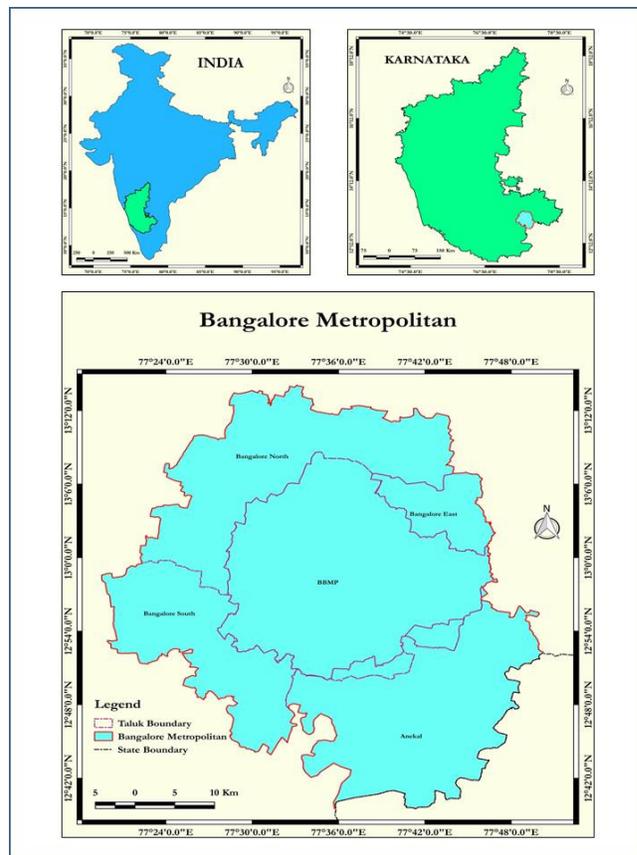


Fig. 1. Location map of the study area

Objectives

The major objective of the research paper is to show the Spatial and Temporal Growth of Bengaluru City since the formation of Bangalore area means 15th century to till date.

Data Collection

Collection of data for the research, primary and secondary data obtained from different sources like Topomap, BBMP, BDA, Government District Gazetteers of Bengaluru Urban District, leading News Papers, and sampled field surveys have been done to get Primary data.

Methodology

To get a meaningful result, geospatial Techniques have been applied. Collected data is processed and presented in forms tabular and graphical. The research takes a close look at the growth and development of Bengaluru city in Spatial and Temporal.

Discussion

There are numerous versions related to the city naming as 'Bangalore' in conformity with the general practice. As per the information available in the Karnataka State Gazetteer, this district is named after it is headquartered town, which incidentally happens to be the State's premier city and its headquarter. The initial reference to the name is seen in Ganga's hero stone inscription from Begur as 'Bengaluru', mentioning a battle that was fought at the place in the ninth-century. According to popular belief, the name 'Bangalore' is the anglicized form of 'Bengaluru', derived from Bengalu, a corrupt form of the word 'bendakalu' means cooked beans. However, other historical evidence tells that the Kempe Gowda, known as the founder of Bangalore, played a significant role in shaping the city. A feudal lord himself used to serve under the Vijayanagara Kings. A hunting enthusiast once he saw his dog being chased by a hare. Amused and impressed by this incident, he started calling Bangalore as 'Gandu Bhoomi' means a heroic place. With the help of Vijayanagara Emperor Achutaraya, he built a mud fort in Bangalore and inside it founded the towns. Kempe Gowda built Bangalore in 1537.

Physical Expansion till 2001

Bangalore's history starts from 1537 when Kempe Gowda I Nada Prabhu of Yelahanka created Bangalore's place after seeing its importance and clearing the jungle. Now Bangalore is one of the top urban areas in India and as well as in the world. The founder constructed a mud fort and pillar in all the four directions, north pillar constructed in Mekhri Circle area, South pillar constructed in the Lal Bagh Botanical Garden area, east and west pillars constructed respectively in Ulsoor and Kempambudhi Tank area. The center of this pillar or forts commercial area has been established known as "Petes". Today this area is known as the Market area and its surrounding regions, which is familiar with the commerce activities.

This Urban area consisted of many Temples, Tanks and Agraharams (areas). The primary tanks built by the other rulers are as follows, Kempambudhi Tank, Dharmambudhi Tank, Karanjee Tank, Sampangi Tank, Kempapura Agrahara Tank, etc. Gavi Gangadeshwara Temple, Bull Temple, Someshwara Temple were some of the temples built all around the area. In the 16th century to 18th century, many attempts were made by the rulers to control this region because of its dynamic and strategic importance until the Mysore Kingdoms brought it. It passed in and out of local princely hands for a few years before joining the Kingdom of Mysore in 1689. When Mysore is ruled by the Hyder Ali and his son Tippu Sultan, Bangalore seen many changes. The Mysorean Army repulsed several attempts by the British to capture Bangalore. Tippu successfully stalled the British in the

first, second and third Anglo-Mysore wars, held in the last three decades of the 18th century. The symbolic Bangalore fort was finally captured by the British armies under Charles Cornwallis, 1st Marquess Cornwallis, on 21st March 1791 during the Third Anglo-Mysore War and formed a center for British resistance against Tippu Sultan. The Bangalore joined the British Indian Empire after Tippu Sultan was defeated and killed in the Fourth Anglo-Mysore War in 1799.

Bangalore holds importance as a commercial center because it is well-connected to the other surrounding regions, to sell and buy peoples used to travel towards Bangalore. Agricultural products were available in large quality and that can create a good market also. Bangalore is known as Garden city because of huge gardens and various species were known by that time. In 1799, when Tippu Sultan died, new developments took place in the Bangalore and became a vast military camp, intensely active, with a mass of fighting forces. The British returned the kingdom back to Krishna Raja Wodeyar III. However, the British again took over the kingdom in 1831, citing misrule by Krishna Raja Wodeyar III as the reason. Under British rule, Bangalore started developing into a modern city, with all the contemporary facilities like railways, telegraphs, posts and telegraphs, etc. The city was again given back to the Wodeyar in 1881. However, since the British Commissioners were based in Bangalore, its development into a contemporary city continued unabated.

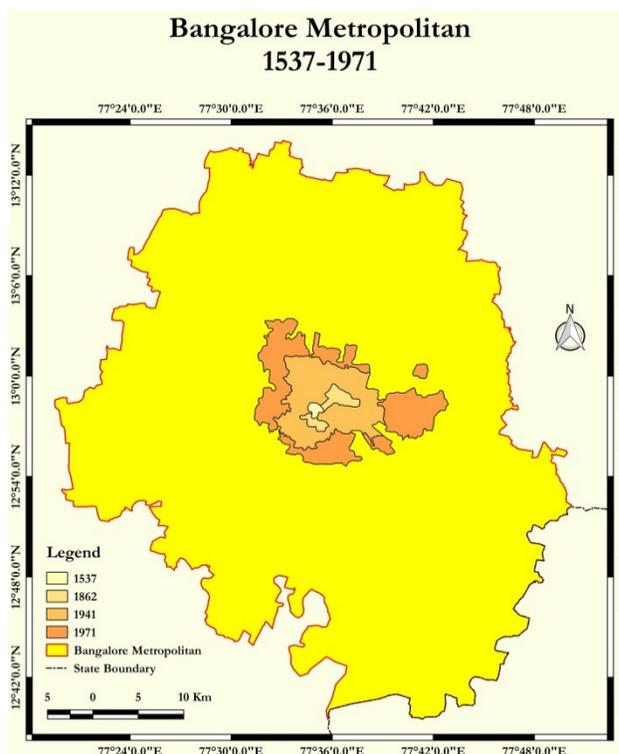


Fig. 2. Growth of the Bangalore metropolitan from 1537-1971

When Bangalore is centralized as a Military and Administrative District, peoples start to migrate towards Bangalore seeking jobs and other services. That starts the physical expansion of the city. Civil and Military station areas developed into a heterogeneous area with migrant populations belonging to different ethnic and religious communities on the one hand and the British population. In British rule, some of the essential places have been created to live the British population until today; we can observe the Anglo-India population. Many educational institutions, government offices, courts and other departments have been created to benefit British peoples, in the later stages, the Indians used it. The Bangalore Town reorganized and expanded during the Commissioner's period. Parade Ground, Cubbon Park, Sankey Tank, Hesaraghatta Reservoir are some of the important places that were created. By the end of the Commissioner's period, Bangalore is recognised as a full-fledged town with religious centers, educational institutions, shops, bars, taverns, public houses, parks, and many.

The urban expansion was very much dynamic in terms of population and area growth. The British created an autonomous territory within the broader political regime of Princely Mysore. British created the Municipal Board in 1862 to look for the activities take in the town. The population of Bangalore town was 132000 in 1871 out of a state population of 5050000. The physical expansion and population growth of the cities lead towards creating new residential areas. In the initial stage, some major areas took establishment in-between 1880's to 1940's.

These extensions or layouts were not uniform in size. Some areas were too small in a geographical area and some areas were large in a geographical area; the scale of the extensions like 14 to 1262 acres. Whereas Jayanagara stands as a large geographical area same time, Sunkenahalli had a small geographical area. Before Independence Bangalore had the existence of large-scale industries like Cotton, Woollen, Silk Mills, Maharaja Mills, and Tobacco factory. HAL started in the year 1940, Mysore established the Radio and Electrical Manufacturing Company in 1945. In the time of two world wars, many companies and industries were started and created new jobs in the Bangalore town. Because of industrialization, city space become congested and overcrowded. This leads to the expansion of the city in all directions. After Independence, the Bangalore city corporation population was 778977 and the total area was 69 square kilometers in 1951. In the year 1961 administrative area named Bangalore Metropolitan Area Town Group (BMATG) it added some more areas into the main part of the administrative zone; the areas are Devarajeevanahalli, Jalahalli, Jodi Kempapura, Kadugondanahalli, Kethamaranahalli, Yelahanka, Yeshwantapura and others. In 1971 the spatial expansion of the city became double and the population was nearly 14 lakhs. Bangalore city was receiving the population because of over migration for the betterment

of life.

Table 1. Decadal extension

Decade	Name of the Extensions / Layouts
1880's	Benson Town, Cleveland Town, Richmond Town, Binny Mills
1890's	Chamarajapet, Seshadripuram, Basavanagudi, Malleswaram
1900's	Fraser Town, Sankarapura
1910's	Indian Institute of Science, Gavipuram, Srirampuram, Visveswarapuram, Minerva Mills
1920's	Austin Town, Cox Town, Tasker Town, Guttahalli, Kalasipalayam, Cooke Town, Richard Town
1930's	Gandhinagar, Government Electric Factory, Kumara Park, Narashima Raja Colony
1940's	HAL Sanitary Board, HAL Township, Wilson Garden Extension, Jayanagar, Sunkenahalli Extension, ITI Industrial area, Rajaji Nagar

In 1976 January 6th, BDA was created, superseding the earlier civic authority known as the City Improvement Trust Board. BDA started administration with the Geographical area of 112 square kilometre. By the time 1990's geographical area increased to 225 square kilometers. Sadhashivanagar came to existence after 1980's earlier; this is known as "Palace Orchards". The area is now home to many celebrities and politicians. The actual growth starts after the rapid growth of industrialization in the city, MICO (motor industries company) set up its plant in the city. The geographical area extended from the Peenya Industrial area in the west to Indiranagar and Whitefield in the east, from Yelahanka town in the north to J P Nagar in the south. The significant economic reforms took place in the 1990's; many IT industries were started in the city. That leads the extensional growth outside the city. This is the initial stage to be called Bangalore as Silicon Valley of India. The city administration council changed first to Bangalore City Corporation (BCC) and then to Bangalore Mahanagara Palike (BMP). By the end of the year 2000 Bangalore has a 226 square kilometers physical expansion.

Physical expansion from 2001 - 2011

The drastic expansion of Bangalore City happened in-between 2001 to 2011; geographical area wise Bangalore city increase like anything, before 2000 the area of Bangalore city was 226 square kilometre, but after the effect of industrialization and Information Technologies by the end of 2011, the geographical area was increased to 741 square kilometers. In the same way, population was increased to nearly 84 lakhs. After the government economic reforms, many foreign nations made their investment in Bangalore; the government provided the land and infrastructure outside the city district, leading the developments of industries all over Bangalore. The



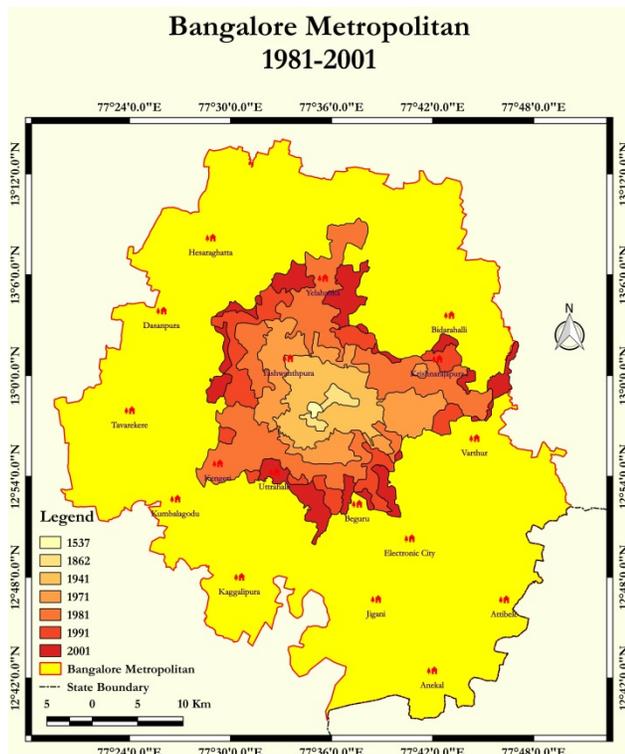


Fig. 3. Growth of the Bangalore Metropolitan from 1981-2001

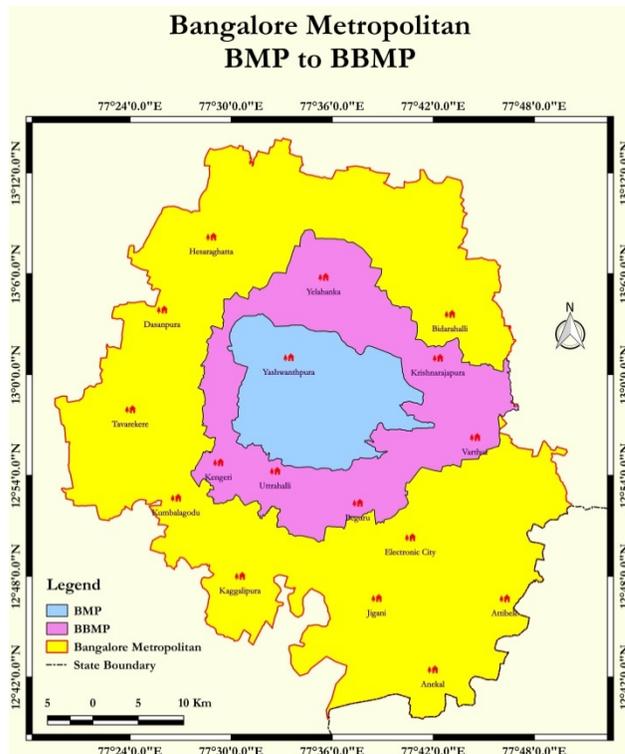


Fig. 4. BMP to BBMP

government created the ring road to give good infrastructure to the IT sectors. International Technological Park Limited, Manyata Technological Park, Bagmane Tech Park, Wipro Campus, Infosys, Special Economic Zones are the major IT Campus started surrounding Bangalore. BMP had 100 wards, but in November 2006, the BMP was dissolved by the government. They formed the new constitute committee by name BBMP (Bruhat/Greater Bengaluru Mahanagara Palike) in the year 2007 merging the earlier BMP, 7 City Municipal Councils (CMC's), 1 Town Municipal Councils (TMC's) and 111 villages.

The 7 CMC's are Rajarajeshwari City Municipal Council, Dasarahalli City Municipal Council, Bommanahalli City Municipal Council, Krishnarajapuram City Municipal Council, Mahadevapura City Municipal Council, Byatarayanapura City Municipal Council, Yelahanka City Municipal Council, Kengeri Town Municipal Council (TMC's) and the below table show the list of villages merged to form the BBMP.

In the year 2007 government formed BBMP merging all the above-mentioned areas, and created 147 wards in 741 square kilometre. But after some days again bifurcation took place and instead of 147 wards, they have classified 198 wards in BBMP Regions. In this decade the physical growth of the city increased more than 200 percent.

Table 3. Area and population growth of Bengaluru

Year	Ares in Sq.km	Population
1537	---	---
1862	---	144479
1941	69	410967
1971	177	1664208
1981	365	2921751
1991	445	4130288
2001	530	4397711
2011	741	8443675

Factors influencing Bengaluru's growth

Location of IT/BT Industries (South and East Bengaluru), Bengaluru International Airport (North Bengaluru), Cross-Cutting Bengaluru Metro Rail (Metro Phases), Bengaluru-Mysore infrastructure Corridor (South-West Bengaluru), Location of large-scale manufacturing industries (East and North Bengaluru), Development of Integrated Township, Peripheral ring road, Global Investment, Government Policies, Migration, Vertical Development.



Table 2. List of villages merged to form the BBMP

Taluk	Villages
Anekal	Kudlu
Bangalore East	Varanasi, Ambalipura, Bellandur, Dellanduramanikere, DevaraBeesanahalli, Haralur, KariyammanaA- grahara, Chansandra, Kaudgodi Plantation, KubenaAgrahara, Dasarahalli, Rachenahalli, Bilishivale, Byrathi, Doddakanalli, Junnasandra, Kaikondarhalli, Kasavanahalli, Gunjur, Hagadur, Nagondahalli, K Channasandra, Kalkere, AmaniByrathikhane, Chalakere, HoramavuAgara, Geddalhalli, Koth- nurNarayanapura, Kottanuru, Kyalasanahalli, Chikkabellandur, Balagere, Panatur, Siddapura, Varthur, Kadabeesanahalli, Thanisandra, Horamavu, Bhoganhalli, Ramagondanahalli, Thubarahalli, Belathur, Sorahunise, NagareshwaraNagenahalli, Khanekandaya.
Bangalore South	Pillganahalli, Kammanahalli, Begur, Alahalli, Doddakallasandra, Basapura, Chikkathoguru, Dod- dathoguru, Gottigere, Gubbalalu, Vasanthapura, Uttrahalli, Anjanpura, Gollahalli, Kembathahalli, Thippasandra, Basavanapura, KalenaAgrahara, Yelenahalli, Lingadheeranahalli, BeratenaAgrahara, Naganathapura, ParappanaAgrahara, Subramanyapura, Sonnenahalli, Hosahalli, Raghuvanahalli, Uttarahalli, Vajarahalli, Talghattapura, Arehalli, Thurahalli, Chandrashekarapura, Hemmigepura, Soma- pura, Varahasandra, Vaddarapalya.
Bangalore North	Herohalli, Ullalu, Abbigere, Chikksandra, Shettihalli, ChikkaBettahalli, Kariobanahalli, Gidadakone- nahalli, Handrahalli, Myadarahalli, DoddaBettahalli, DoddaBidarakallu, Harohalli, Vasudevapura, Lin- gadeeranahalli, Bellahalli, Kattigenahalli, Srinivaspura, Thirumenahalli, Hosahalli, Gollarapalya, Anan- thapura, Govindapura, Kenchenahalli, Manchenahalli, Chokkanahalli.

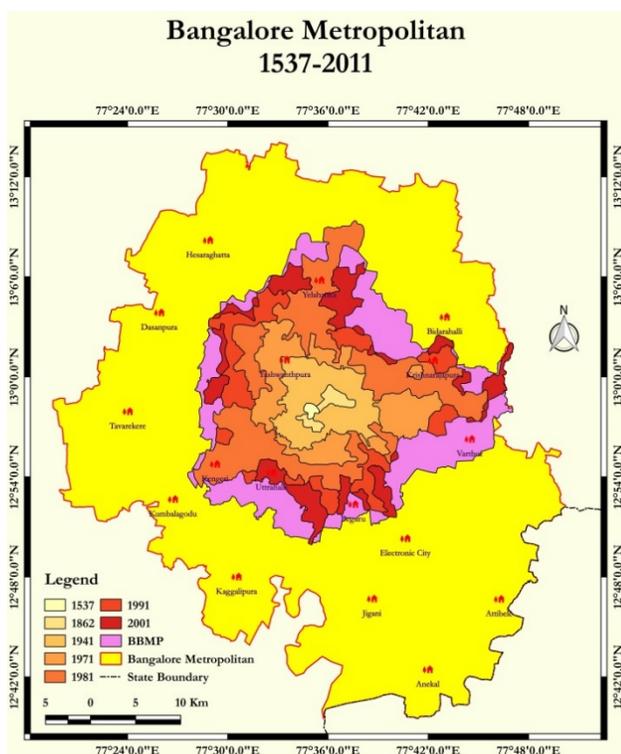


Fig. 5. Growth of Bengaluru from 1537-2011

because of the Information Technological Hub, Industrialization, Urbanization and Privatization. Government Policies are also helps the Spatial Growth of Bengaluru city. Migrations for different reasons will be the important causes for the spatial growth of Bengaluru city and within the span 20 years Bengaluru shown the growth in world level. From last few years Bengaluru is noticing horizontal and vertical development in it. Due all these developments it is facing many issues and challenges like crimes, drinking water, traffic congestion, over-urbanization, slums, urban population, waste disposal and many more. Out of these acute problem faced by the city is over-urbanization.

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Conclusion

The growth and development of Bengaluru in terms of Spatial and temporally is tremendous. Bengaluru rapidly growing

