

Analysis of Population Growth and City Expansion using Census, Topographical and Remote Sensing Data: A Case Study of Nashik City of Maharashtra (India)

S. U. Deore

Dept. of Geography, Arts, Science and Commerce College, Manmad, Dist: Nashik, Maharashtra, India

Abstract

Population is the dynamic and biotic resource on the earth surface. It has very significant role in any nation's economy. The development of any regions or a small group depends on no. of peoples livings in this specific family. But, according to most of demographic experts, the quantity is not important, but the quality is important for the development and welfare of nations. The population situation of the world becomes large. The India is second leading country of the world after china. The population changes ultimately impacts upon the related environments. There for its proper identifications is the need of time. An attempt has been made here to analysis the population growth scenario from last few decades and its impact upon related study area. There are many factors, which influencing the growth of any city, but here only considered the population factor, because it is most dominating in all which primly changes the related cultural environment.

KEYWORDS: Population Growth, Census, Remote Sensing, Nasik City.

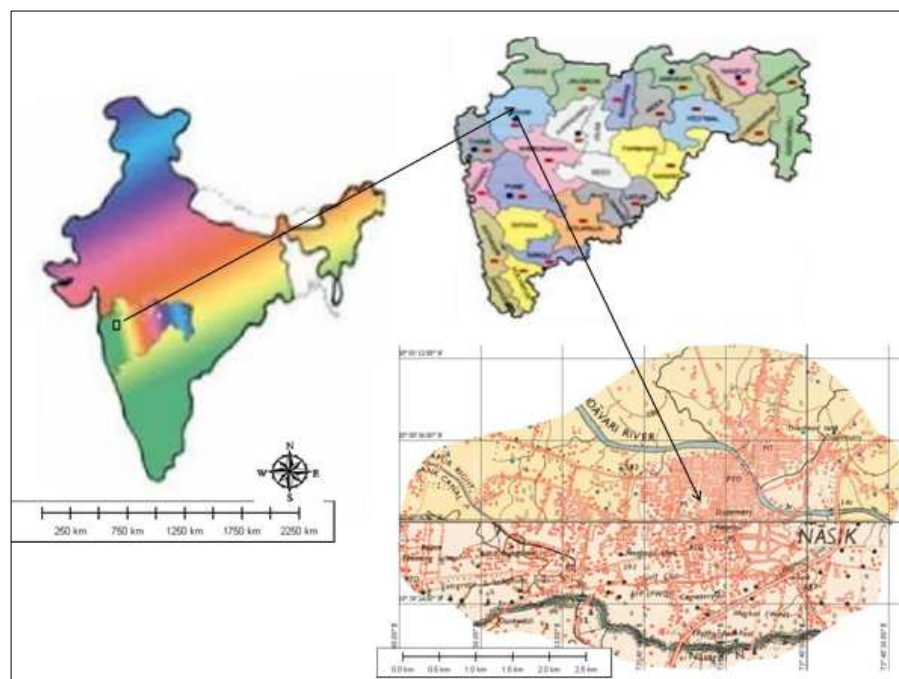
1. Introduction:

The surface expansions of many cities in the world are caused by population growth. For much kind of purposes peoples attracted toward the city, and result the horizontal and vertical expansion of concern city. Industrialization transportation and urbanization runs parallel to each other. Urbanization and rapid population growth in the city has created term endows problem, which is the root of the all environmental crisis. Due to increasing population the land under cultivation is reduced and city is becoming more crowded, water supply also affected, pollution is growing, drinking water become unsafe for drinking. There for raising the health problems within the city. Such types of problem can be minimized or solved through proper planning by studying each problem thoroughly and considering other affecting factors so the study of expanding cities has got more importance in the recent time. Present study belongs to identify the growth of population in Nashik city trough census data, as well as measurement of expansions using topographical maps and Landsat satellite image. The obtained results explain the city region's horizontal growth to various directions. This situation identification useful for sustainable beautification of the urban environment and making it more attractive for convenient living, it is requires proper urban planning.

2. Study Area:

Nashik city is the capital of North Maharashtra and also has a head quarter of Nashik revenue division. Nashik city is a district head quarter located on the banks of Godavari River and is at 565 meters above mean sea level (MSL). Godavari River is "Dakshin Vahini", Ramkund is a unique place of religious importance at all the times,

especially in the “Kumbhamela”. The extend of town situated at Latitude $19^{\circ} 33'$ and $20^{\circ} 53'$ North Latitude and between $73^{\circ} 16'$ and $75^{\circ} 6'$ East longitude and at a distance of 185 Km from Mumbai (Bombay), 220 Kms from Pune, 165 Km. from Ahmednagar and 180 Kms from Aurangabad. The total area is 259.13 Sq. k.m. which is 2nd largest in Maharashtra after Mumbai. It has a population of 15, 00,000. There are two industrial estates namely Satpur having 1600 Acres and 750 numbers of units and Ambad having 1400 Acres area with 850 numbers of units. The city has become the center of attraction because of its beautiful surroundings and cool and pleasant climate. According to 2001 census, the population of Nashik city was 10, 77,236 persons. The study has 65 wards in 1991 but it increased in 2001 up to 87 wards. Since the city has old days basically the design of a religious place. However to it has been a flourishing industrial center as well as educational centers. The location of city and related many cultural, educational, mythological, industrial and political aspects impact upon the population growth and expansion of Nashik city.



Map. 1 Location Map of Nashik City

3. Aims and Objectives:

The present work belongs to the analysis of growth of population and urbanization of Nashik City and its impact over the socio-economic situation of related area. However the specific objectives of the present study area are as follows:

1. To study the populations growth from 1901 to 2011 using census data of Nashik city.
2. To discuss the spatio-temporal changes due to population growth and its effects.
3. To use the Topographical maps and Landsat satellite data for the expansion study.
4. After that, to suggest the further spatial planning and new policy for sustainable development of Nashik city.

4. Data Sources:

Data is the base for the any results findings. There for used the secondary data for the present study of population and horizontal growth of city.

The population data is collected by using census data of Govt. of India, and it is some time it is verified from another sources of information with the pilot survey method in the present study area at local residential, shopping points, and people's mob centers. The S.O.I Toposheets, i.e. 47/E/13 and 46/H/16 are used (1974) for identification of land cover of that period. Landsat satellite image of 2006 also used for notice the growth of Nashik city from 1974. The remaining data is collected by pilot survey, whereas it is need to verification.

5. Methodology:

The *Malhotra* was said in 2002, Research Design is the “framework” or “blueprint” for collecting the information needed for your project in the best possible way. It is one of the conceptual structures, which need to plan first during any research work.

In the present-study the information and data regarding the population aspects of urban geography up to 2011 has been considered. The primary data has been collected with help of field work. After collecting primary and secondary data, it has been tabulated and represented with the help of various diagram and graphs have been prepared to show the different types of information and distribution. SOI topsheets are scanned and georeferenced in GIS software. Landsat Satellite Image is downloaded from www.GLCF.org website (Global Land Cover facility). Both the images (Toposheets and Satellite Image) are digitized and superimposed

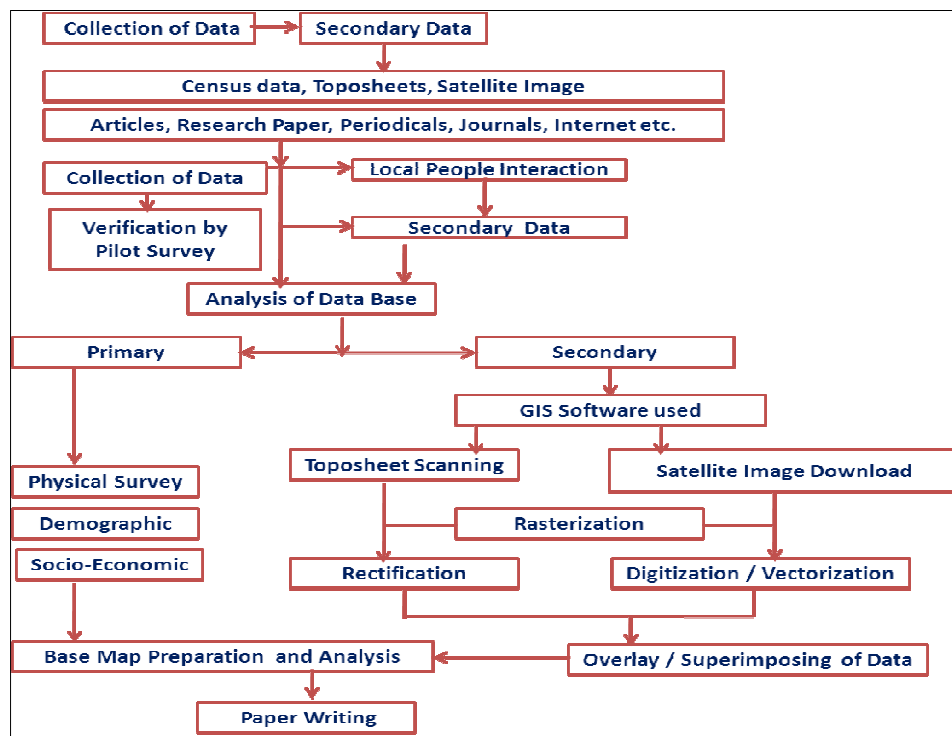


Chart. 1 Methodology Flow Chart

6. Findings and Results:

Here, a mainly population growth fact is identified, which is responsible for the major changes in internal morphology of Nashik city. The prime finding is the population is constantly growing, which is observed from census data (1901-2011). After that, we used the 1:50,000 scale, topographical maps (47/E/13 and 46/H/16) for

measurements of city area in 1974. The expansion of city is proved from Landsat satellite image (2006). The detail finding has been given bellow.

6.1 Population Growth:

In the 1901 census, population was only 21,490. Similarly, in the 1981 the population was 2, 62,428, at the same time total area of Nashik city was 5.6 sq. mi (14503932.8 sq. m.). According to 1991 census, the population of Nashik was 6, 56,925 persons, which has increase by 10, 77,236 persons in the year 2001. The decadal growth rate in the 1981-91 was 50.33 per cent, which has found increase in the decade 1991-2001, i.e. 63.98 per cent. The density of population was 2,535 persons per sq. km in 1991 which has found increase in the decade 1991-2001, i.e. 4,158 persons per sq. km. In the 2001 census, the total population of city was 10, 77,236 and the area expensed up to 41.38 sq. mi. (107173703.44 sq. m.). On the basis of 1901 to 2001 population growth next 2011 population is projected, which is 17,66,469 parsons.

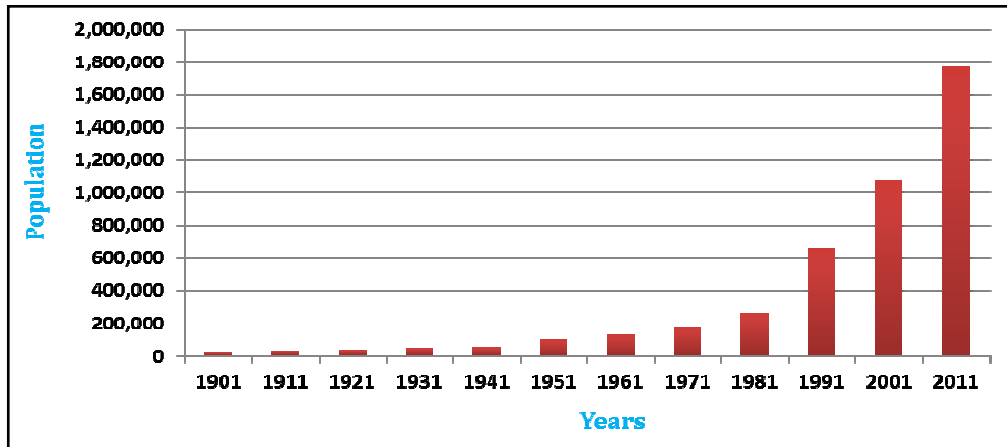
Such types of rapid growth in population of Nashik city is caused by further situation. Nashik city is fourth important city in Maharashtra. It is a part of Golden Triangle of Mumbai-Pune-Nashik. Nashik is an important city of Maharashtra, economically and socially one of the most advanced states in India. According 2001 census population of city was 10, 77,236 persons, where as in 1991 it was 6, 56,925 persons. In 1971 Nashik was classified as class one city by Census Authority of India. If it is compared with the 1901 census, the present population shows increase by 50 times. To understand the population growth in the study area is holds the key to understand of entire demographic structure of the area. The growth of the population of Nashik city is considered from the decade 1901 to 2001.

Population of Nashik recorded the highest growth rate between 1941 and 1951. Growth was the result of partition of India. Population growth rate started steadily after 1961 and Nashik recorded more than the average growth rate for India in two decades, between 1971-1982 the city limit was expanded and Nashik acquired the status of Municipal Corporation with a population of 4,32,000 persons. Growth rate of 63 per cent for the decade 1971-81 continued in the decade 1981-91. In 2001 Nashik has become a million plus city

Sr. No.	Year	Total Population
1	1901	21,490
2	1911	30,098
3	1921	38,230
4	1931	45,744
5	1941	52,386
6	1951	97,042
7	1961	1,31,103
8	1971	1,76,091
9	1981	2,62,428
10	1991	6,56,925
11	2001	10,77,236

12	2011#	17,66,469
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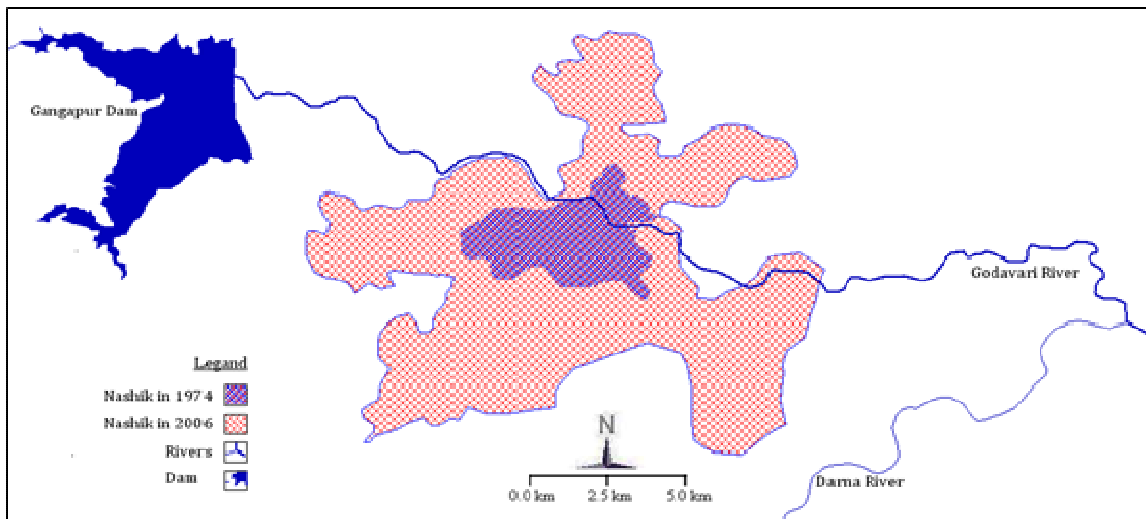
Table. 1: Population from 1901 to 2001, (# Projected Population)



Graph. 1: Bar Graph showing Population Growth (1901- 2001, (2011- Projected Population)

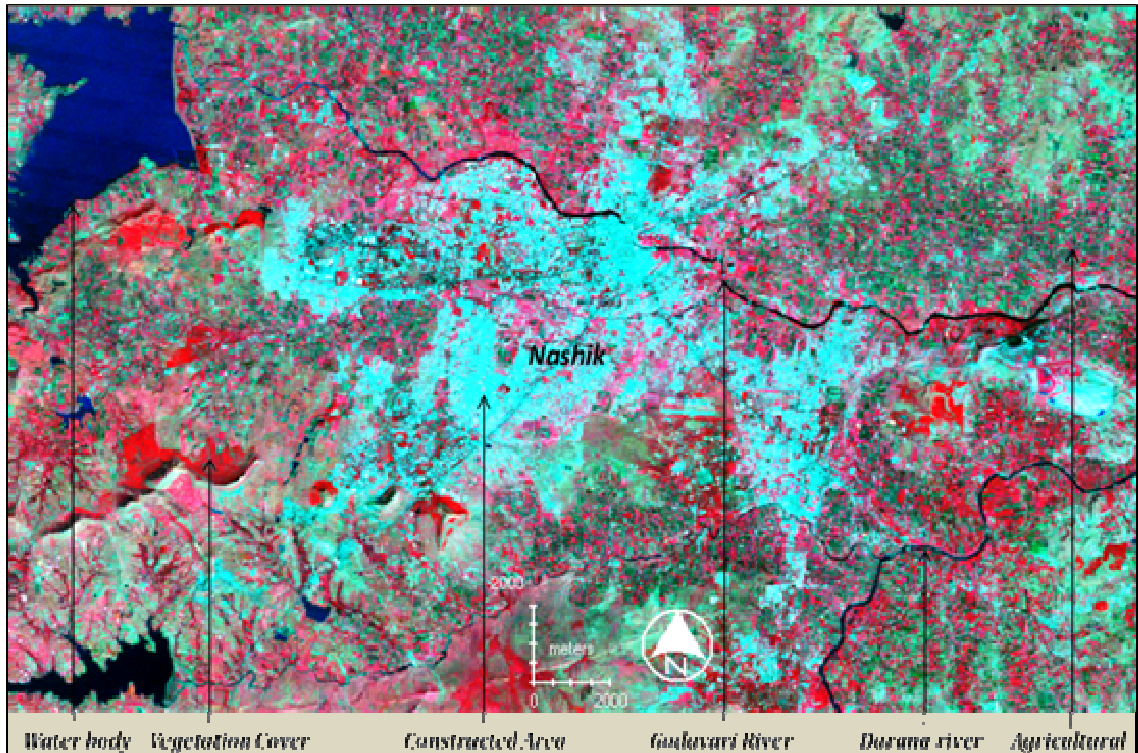
6.2. Horizontal Changes:

According to land use and land cover occurrence study, one can note that in Nashik city, there are growing settlements trends toward the agriculture region. Nearby, 41% of land use covers under the settlements. The surrounded region of Nashik region is mostly plain region which is suitable for agriculture activity. But, there is large encroachment of fertile soil for construction; this is noticed from field survey.



Map. 2: City Area in 1974 and 2006

The land use and land cover changes prepared in the GIS software by superimposing the Landsat satellite area over the toposheets area of Nasik city. The area measured from SOI toposheets, which is survey in 1974, was around 5.6 sq mi (14503932.8 sq. m.) and the area measured from Landsat satellite Image of 2006, which is 41.38 sq mi (107173703.44 sq. m.), means; there is high level of spatial changes. The expansion of city looking like star shape, it is because of natural aspects around the study area. These changes are delineated with the help of traditional and remote sensing data.



Map. 3: Landsat satellite (TM) image of Nashik and Surrounding region

The Landsat Program is a series of Earth-observing satellite missions jointly managed by NASA and the U.S. Geological Survey from the time 1972. Landsat satellites have collected information about Earth surface from the space. This science, known as remote sensing, has matured with the Landsat Program. Landsat satellites have taken specialized digital photographs of Earth's surface for over three decades, which is enabling people to study many aspects of our earth and to evaluate the dynamic changes caused by both natural processes and human practices. The present satellite image is taken in 2006, which shows the different types of cultural and natural land cover. The middle patches of white color indicate the construction zone. There is large surface features clearly define like as hilly region, rivers, water body, city, agricultural land, roads etc.

7. Conclusion:

The population growing since 1901 and impact upon the land use and land cover pattern within Nashik city. Due to increasing population the land under cultivation is reduced and city is becoming more crowded. This situation affecting the natural environment, such has Godavari River water become polluted after crossing city, therefore, drinking water become unsafe for drinking. There for raising the health problems within the city. At the same time, there is pressure on the administration for providing the basic facility. The land prices are raising rapidly and the agricultural land under facing threat, because of expansion of city. Agriculture is the prime resource for human kind, but the encroachments are seen in city at the time of field observation. Most of the fertile soil zones going under construction, which is not beneficial for human ecology. Hence, such type of situation identification is the essential task before any urban planning. Finally, we suggest there should be need for population planning, avoid the construction in cultivated land, environmental

protection and make the administrative policy for sustainable population and urban developments.

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