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Proposal for Delineation of Nashik Metropolitan Region

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Abstract: Recent studies by Section of Social and Economic events, United Nations evaluate, today 55% world's citizenry lives in metropolitan region and percentage is that assume to rise 68% by 2050. When a city grows, peripheral region also develops in haphazard mode. The unmanaged density and land use become crucial issues for civic authorities for provision of infrastructure and planners to plan. If the area already included in urban planning well before to accommodate future growth, the management of land issues can be resolved. The first step of the study is to acquire multi temporal data to detect the changes over the time. For this purpose, Landsat – 5&8 TM (1991-2018) (Source: USGS Earth Explorer), satellite images have been acquired. For this, delineation is done with the help of GIS software, to propose Nashik Regional Development Authority. With this process of delineation regional level development, it can be controlled and covered under a unified regulatory framework with a well-planned land use zoning to accommodate further expansion. Major parameters of this study are to analyze population density and growth pattern and to identify the future expansion factors which are accountable for growth of Nashik city. As a result of urbanization and expansion of municipal corporation limit, the city has undergone a drastic change in land use character. The study has analyzed the relationship between urban expansion using remote sensing and GIS.

Keywords: Remote sensing and GIS, Satellite Towns, Peri-Urban area, Urbanization.

I. INTRODUCTION

Now day's population emission became a major problem. Most of the people are moving toward the cities because it gives the number of job opportunities, educational facilities, etc. to survive in good living condition. As a result of this, the limit of the city gets increased day by day. Therefore, when the city grows the peripheral area also develop in the haphazard manner. The planning of peri-urban areas is one of the most challenging works in the coming decades. The peri-urban is a region of clumsy urbanization which is leading to sprawl. The satellite city or towns were created somewhat near to but are usually independent of large metropolitan areas. The rapid growth of population and migration from rural to urban area, become major issue for municipal authorities for provision of infrastructure and planner to plan and land use. The delineation of proposed Nashik Metropolitan Region has been demarcated with the help of GIS platform and it is suggested with a unified regulatory framework with a properly controlled and it is covered under planned land use zoning to accommodate future growth. Last few decades it has been observed that in most developing countries of the world urbanization is destined when requirement on land is high, agriculture incomes are low and population increases dramatically. Urbanization has been both one of the principal manifestations as well as a sign of development. The 21st century is the century of urban transition for human society. In a way, human development is decided by urbanization. However, messy urbanization has been responsible for several problems, from waste management to water management and the transportation as our cities facing today, resulting in low standard of living, crucial problems of drinking water, groundwater exploration, water quality assessments, noise and air pollution, critical issues of vehicular parking and the traffic volume etc. To overcome earlier discussed environmental deteriorations in and around cities, if the fruits of urban development are meant to be deprived ones then it must be accounted that these acute problems have to address to the latest the technological development in related fields. Nowadays the process of collecting physical data is simplified with the solution of cutting edge technology of Remote Sensing in which satellite-based and aerial photography is introduced with the drone surveying to overcome the problems of spatial and temporal resolutions of data and together in-hand with the science of Geographic Information System (GIS) it is easy to interpret, analyze and visualize the collected data thereby the whole planning process can be done at the optimum level. These information systems also offer a critical interpretation of physical data with other societal socio-economic data, which is the key factor for enhancing the whole planning process effectively for the citizens as is the motto of smart cities. Therefore, it is need of the hour to the urban and regional planners to know thoroughly about the available remote sensing data products and its characteristics and capabilities (Praveen Kumar Ra i, 2011).

II. BACKGROUND

A. Image Classification

Image processing is a technique that uses a computer to collect information for digital image manipulation. Image classification typically involves four steps. First, it is a pre-rendered image that finds group correlation, diminishes the beams and atmospheric correction, and secondly, the training sample is the process to describe specific criteria for example. Thirdly, it aims to select the appropriate technique to compare the target image by example and, finally, estimating the image class accuracy.

III. STUDY AREA AND DATA SETS

A. Study Area

Figure 1 shows the study area chosen for the study. The territory includes seven talukas in Nashik, Sinnar, Niphad, Dindori, Peint, Trimbakeshwar, Igatpuri. The Nashik City Corporation is located between the 55th and the 20th of the 1950s, between the North latitude and $73^{\circ} 41'$ and the $73^{\circ} 54'$ eastern longitude. The maximum temperature in summer is 42.5°C , the minimum temperature in winter is less than 5.0°C . Relative humidity ranges from 43% to 62%. The normal annual temperature in the region fluctuates from about 500 mm to about 3400 mm. It is at least in the north-eastern part.

These areas have been selected to cover land use and land classification classes. The teleconference methods will be used to classify land use and land classification. Selection of the study area can help to select the satellite image correctly. To the south-east of Nashik is busy with the railroad station. It is a rapidly developing space and has a huge potential for development, taking into account its profitable situation in the Golden Triangle of Mumbai-Pune-Nashik.

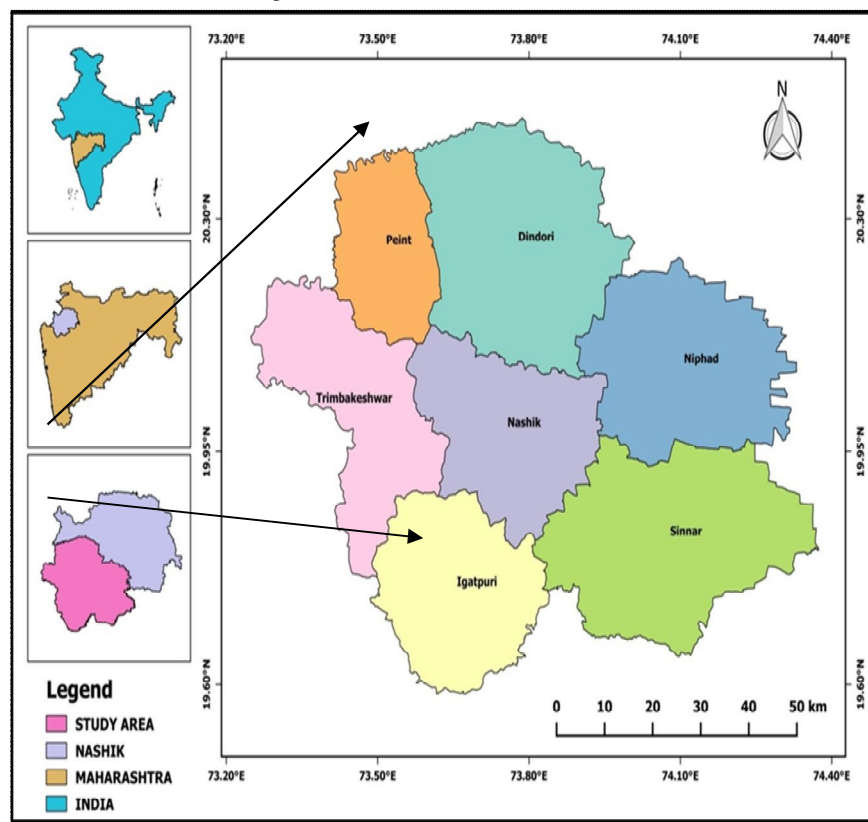


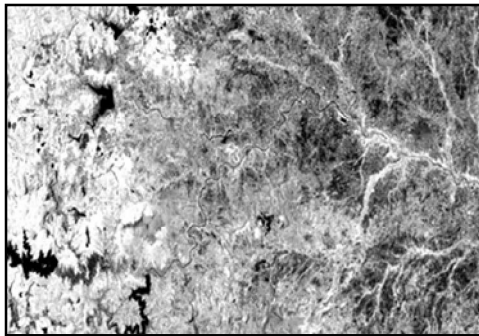
Fig. 1. Study area

B. Satellite Imagery

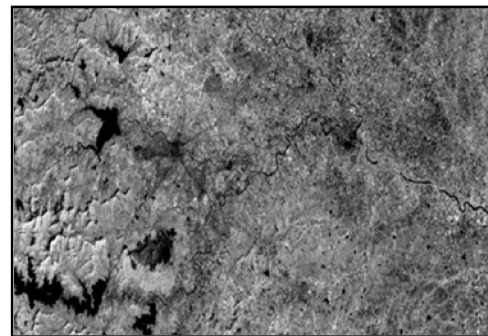
In this study, Landsat 8 and 5 satellite sensors will be used to analyze land use and land coverage. The Landsat 8 decision is about 30.00 meters. The 30 meter resolution can show land surface and soil mapping, land use changes and land coverage. The ability to measure changes in surface surfaces has been assembled with spectral information. Table I shows the details of satellite imagery acquired by USGS earth explorer.

TABLE I
DETAILS OF SATELLITE IMAGERIES ACQUIRED FROM USGS EARTH EXPLORER

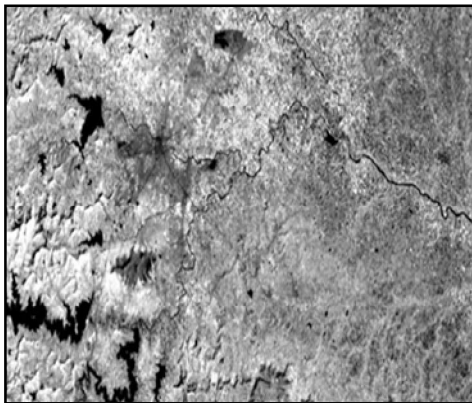
Spacecraft_ID	Dataset	Date of Imagery Acquisition	Spatial Resolution	ID	WRS_PATH	WRS_ROW
"Landsat_5"	TM	17 Feb 1989	30m	"LT51470461991048ISP00"	147	046
"Landsat_5"	TM	12 Feb 1999	30m	"LT51470462001043SGI00"	147	046
"Landsat_5"	TM	08 Feb 2009	30m	"LT51470462011039KHC00" "	147	046
"Landsat_8"	"OLI_TIRS"	05 April 2019	30m	"LC81470462014095LGN01" "	147	046



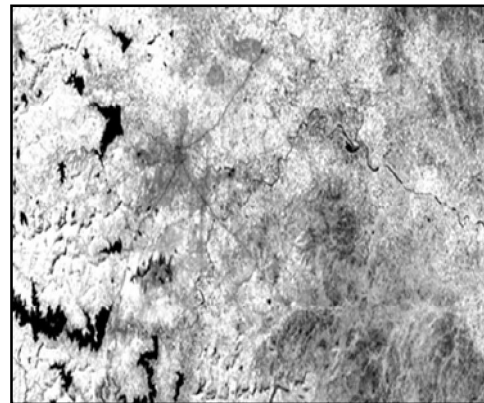
1989



1999



2014



2019

Fig. 2. Satellite Imageries Acquired from USGS Earth Explore

IV.METHODS

Figure 3 shows the methodology used in this study, it is divided into seven stages. In the first step, change the Google Earth exploration area. Second, acquisition of satellite images for 1989, 1999, 2014, 2019. The third stage is part of the analysis, analysed data from the exact truth data and then gets the exact score for each classifier.

Although the fourth phase is being developed for satellite imagery, including the initial processing and image classification. The fifth gives the land and the map of the land as the final result of the classification of images. The sixth stage of the barrier mapping gives certain types of land use that is most appropriate for development, and the last seventh stage has set the region's proposal for 2040

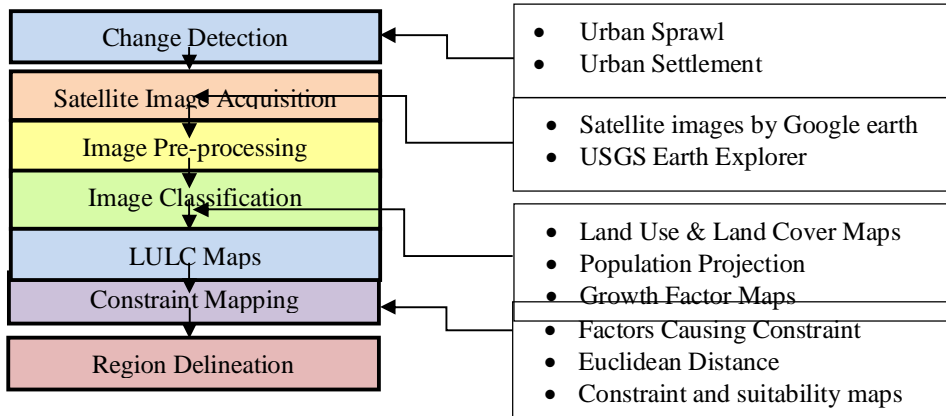


Fig. 3. Structure of research methodology

A. Population Growth Rate

Population is the direct measure of the growth. Hence population data from village level to taluka level were collected from census and growth rate of each taluka was calculated. Population and Population Density maps for the region were prepared for years 2001 and 2011 at village level using QGIS. The maps shows that the villages the no of villages showing increase in population. Villages near by Nashik City i.e. in Sinnar, Niphad, Dindori, Igatpuri etc. have shown significant population growth.

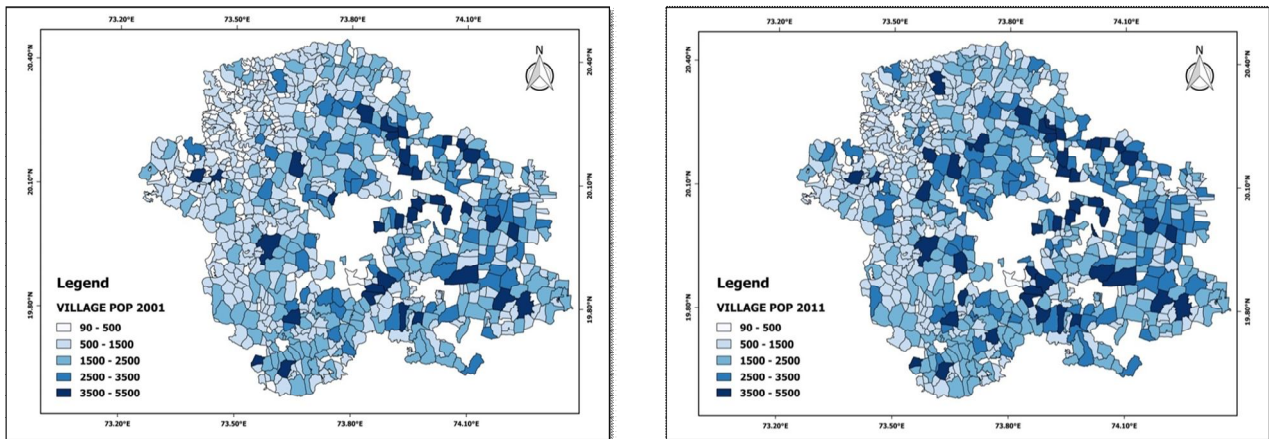


Fig. 4. Population Growth of year 2001-2011

B. Population Projection

Population prediction method is considered to be the most appropriate method for predicting populations for large cities and old cities with a significant increase. Population prediction method is a variety of population prediction methods such as arithmetic growth method, geometric growth method, incremental growth method, but here the arithmetic growth method. If this method is used for small and medium towns, it will be lower than the population estimate rather than the actual value.

This method gives the average population growth of the city by decadal population, which is calculated from the previous census data. This added value is added to the population of the next population to determine the population for the next decade.

TABLE III
POPULATION PROJECTION FOR YEAR 2011, 2021, 2031, 2041

Sr. No.	Methods of population projection	Projected Population			
		2011	2021	2031	2041
1	Arithmetic Increase Method	13,44,821	16,21,711	17,57,369	18,93,029
2	Geometrical Increase Method	16,97,795	20,06,171	27,08,331	36,56,247

3	Incremental Increase Method	14,76,149	16,79,166	19,29.735	22,37.759
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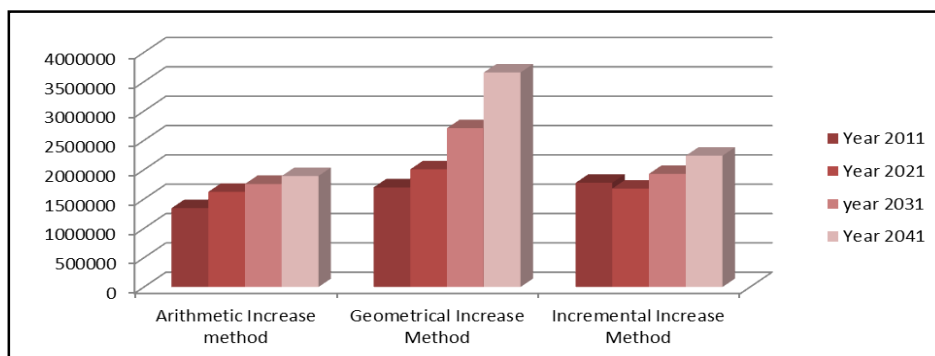
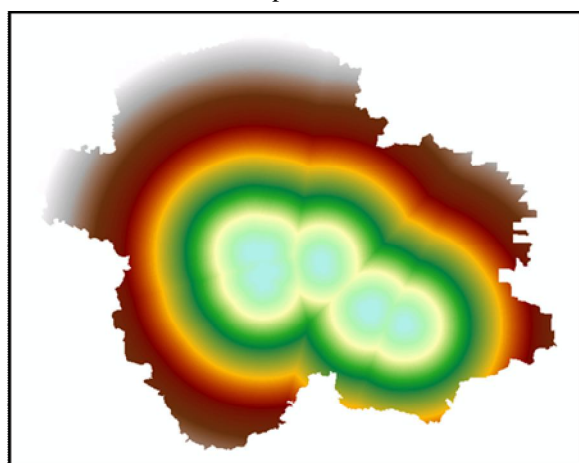


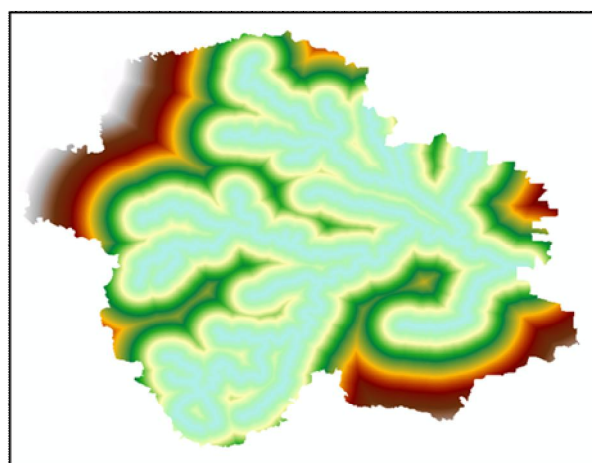
Fig. 5. Population Projection of year 2011-2041

C. Constraint Mapping

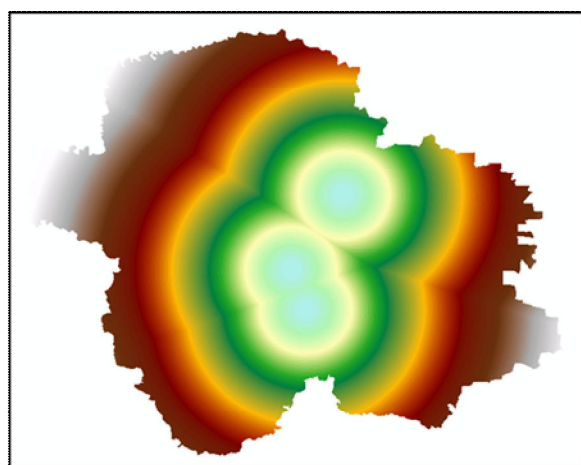
The proposed land use is derived finally by developing the constraint maps where development of particular type or any development cannot be possible or should not be promoted and same way by the suitability analysis where the land use of particular type is most suitable for the development.



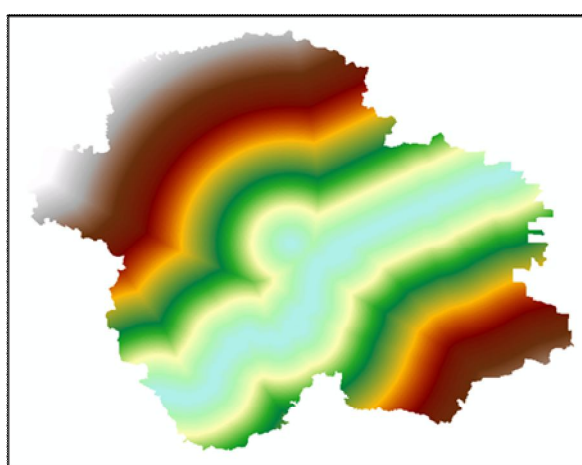
(a) Constraint Due to Existing Industries



(b) Water body Constraint



(c) Airport Constraint



(d) Railway Constraint

Fig. 6. Constraint Maps

According to URDPFI guidelines minimum 500 m green buffer should be applied from existing industries. Figure (a) shows such 500 m buffers from industries where development should be restricted. Water bodies are the major constraints for any development. 100 m from existing water bodies must be kept according to URDPFI guidelines. Figure (b) shows such areas with constraints. Presence of airport restricts various land uses and height limits for buildings which are shown in Figure (c) The area near the existing airport should be restricted from such development. Additional 1 km radius is also considered to accommodate future extension due to growth scenario of Nashik. Accessibility to railway network is crucial for industrial and commercial development, the areas with more than 5 km away from railway lines must be restricted for such development as they will require additional infrastructure and which may lead to sprawl in other than intended direction. Figure (d) shows the restricted land use.

D. Final Mapping

The proposal of the land use, constraint maps and suitability maps were created and based on that, Final mapping of Proposed Delineated Metropolitan Region has been carried out with the help of GIS software. The Total Delineated Metropolitan Area is about 2815.82 Sq. km. Following map shows the final boundary of Nashik Metropolitan Region for 2040.

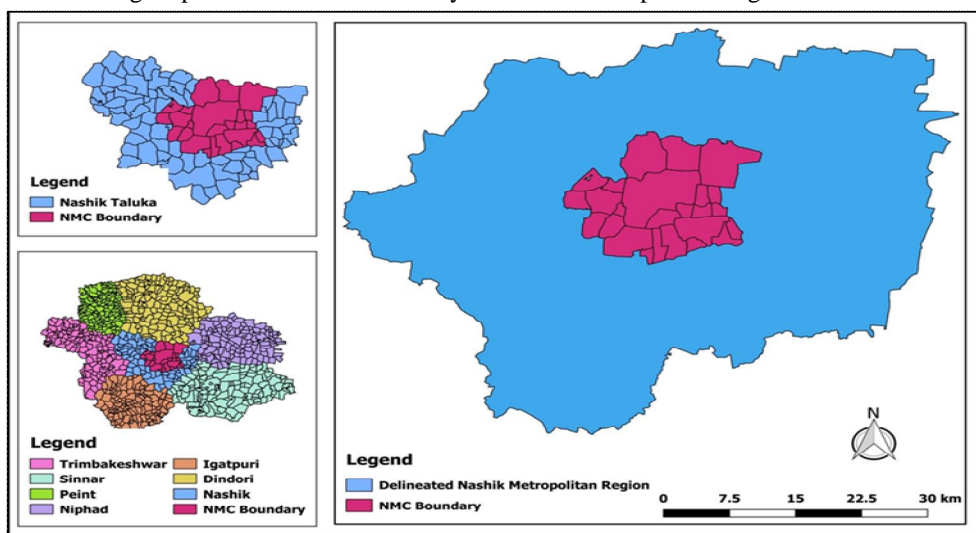


Fig. 7. Final Delineated Nashik Metropolitan Region

V. CONCLUSIONS

The projected population growth of the study area for the year 2041 is 18, 93,029 which is increased by 5, 48,208 as compared to year 2011. In this study significant increase in population density of 2011 has been observed and it has been concluded that rural population is migrating to the nearest to be urban nodes. The transportation connectivity in the study area is being well developed over the years and new proposed roads are in progress which is the major cause of urban nodes development. The constraint map has been prepared for the land use zone planning suitability. From the above conclusions it has been predicted that most residential zoning would be in the north and east side of the study area and the total area of new delineated boundary is about 2815.82 sq km

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