

Assessment of Additional Land Required For Future Population of Pithampur Plannign Area (M.P.) Using Geospatial Technology

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Abstract : Past is the key for development of future. Assessment of additional land requirement for future population can play a major role considering the availability and conservation of land resources. The study carried out using census of india data of 74 villages of Pithampur planning area. In the present study future population for the year 2021 to 2051 is calculated using census of India data and different methods of population projections. The present and past developed land is calculated by using visual interpretation of high resolution multideate satellite data. Multideate LISS IV satellite data of spatial resolution 5.8 m of year 2001 and 2012 is used to map the built-up land developed in 2001 and 2012 for population. Result shown that additional land required calculated is 5246.35 ha for year 2021 and 14549.15 ha for year 2051.

I. INTRODUCTION

Urbanization is taking place at a faster rate in India. According to 1901 census, population residing in urban areas in India was 11.4%. This count increased to 28.53% according to 2001 census, and crossing 31.16% as per 2011 census. Madhya Pradesh is the second largest state of the India. Total urban population of Madhya Pradesh was 10.48% in 1901 which increased to 26.46% in year 2001 and grows to 27.63% according to census 2011. Demography of an area is very much important as it shows the growth profile and various socio economic aspect of that region. Census of India published population report in every 10 years. Out of the total 74 villages, 37 villages fall in Dhar tehsil, 3 in Indore tehsil, 8 in Mhow tehsil and 26 villages are in Depalpur tehsil. Due to a large number of villages it is significant to compile the statistics according to portions of four tehsils. Geospatial technology with its tools can help up to an extent in this regard. Satellite data interpretation integrated with GIS software can reveal various parameter and statistics essential for the analysis. The spatial patterns of urban sprawl over different time periods, can be systematically mapped, monitored and accurately assessed from satellite data along with conventional ground data (Lata K.M. et al,2001). Identification and analyses of the patterns of sprawl in advance would help in effective infrastructure planning in urban area (Sudhira H. S., 2003).

II. STUDY AREA

The study area is positioned in Indore and Dhar districts of Madhya Pradesh and covers an area of 367 Sq km. It lies between 22° 34' 4" N to 22° 42' 32" N latitudes and from 75° 29' 34" E to 75° 49' 9" E longitudes. Pithampur planning area is declared by Town and country planning department under section 13 and subsection (1) of Town & Country Planning Act 1973, MP. Govt on 10.06.1985. Study area comprises of total 74 villages which are a part of four tehsils, one of Dhar district and 3 Tehsils belongs to Indore district. Location map of the study area is shown in figure no. 1 and spatial distribution of villages in planning area is shown in figure no 2.

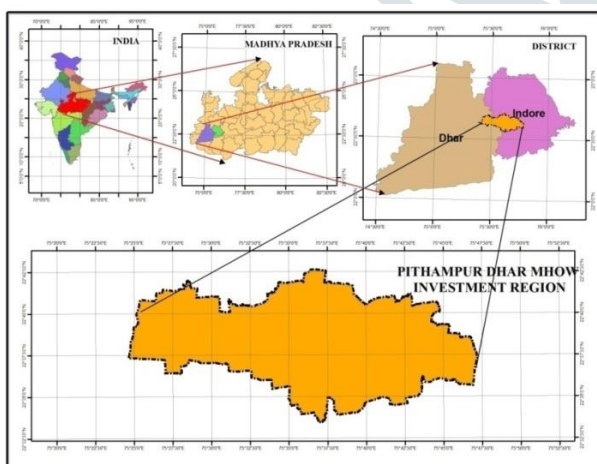


Figure 1 Spatial Distribution of Study Area

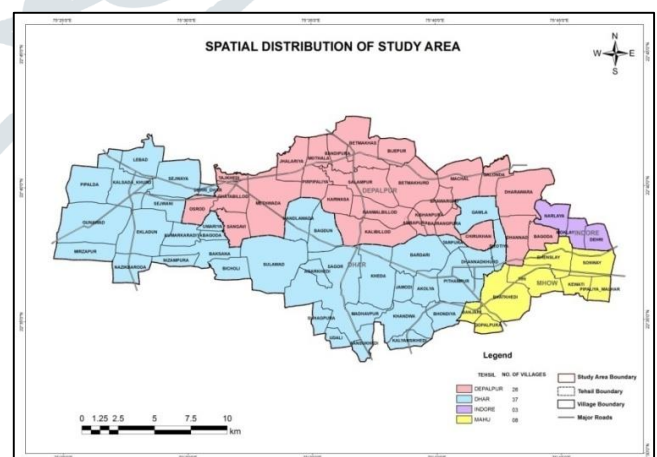


Figure 2: Location Map of The Study Area

III. MATERIAL AND METHODOLOGY

Census of India data of archival years is used for population projection of Pithampur planning area. LISS IV satellite data of year 2002 and 2012 is used for interpretation and mapping of built-up land of Pithampur planning area. Brief Methodology adopted is shown in figure no.3.

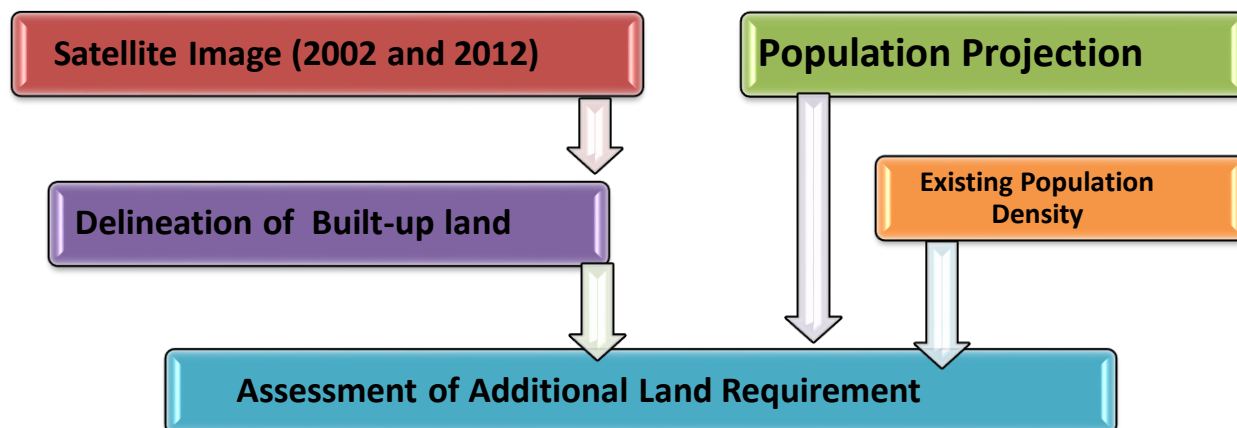


Figure 3: Brief Methodology of Assessment of Additional Land Requirement

The population variation of villages under Pithampur planning area is shown in table no.1.

Table No. 1: Population Statistics of Study Area since 1991-2011

Research Area	District	Part of Tehsil	No.of Villages	Population		
				1991	2001	2011
	Indore	Depalpur	26	30694	41500	47210
		Indore	03	730	931	1074
		Mhow	08	9998	17633	18377
		Dhar	Dhar	37	30938	94379
	Total		74	72360	154443	217534

Source: Census of India

As per census 2011 total population of study area is 217534, out of that 69.36% falls in Dhar tehsil of Dhar district, 21.70% in Depalpur tehsil, 0.49% in Indore tehsil and 8.45% in Mhow tehsil of Indore District. Pithampur and Betma towns, which accounts for the maximum share of the total population, have a population of 126099 and 16000. Average Annual Growth rate is calculated between year 1991-2001 and 2001-2011 by using formula.

$$AAGR = \frac{(P_{Present} - P_{past}) * 100}{P_{past} * N}$$

Where : AAGR- Average Annual GrowthRate
 P_{present} - Present Population.
 P_{past} - Past Population.
 N -Duration of Year

Table No. 2: Average Annual Growth Rate. (1991-2011)

Research Area	Part of Tehsil	Population			Average Annual Growth Rate (AAGR)	
		1991	2001	2011	1991-2001	2001-2011
	Depalpur	30694	41500	47210	3.5	1.37
Indore	730	931	1074	2.7	1.53	
Mhow	9998	17633	18377	706	0.42	
Dhar	30938	94379	150873	20.5	5.98	
	72360	154443	217534	11.3	4.08	

Table No. 3: Population Growth Rate (2001-2011)

Research Area	Part of Tehsil	Population		Growth Rate
		2001	2011	2001-2011
	Depalpur	41500	47210	13.76
	Indore	931	1074	15.36
	Mhow	17633	18377	4.21
	Dhar	94379	150873	59.86
		154443	217534	40.85

Population Density:

It is a quantitative relationship between number of people and number of unit of land area. Density of population is expressed in terms of total number of persons per Hactare of land. Study area observes an insignificant less population density because the study area is mainly composed of rural habitation and villages. Population density of villages is also very low. Density in 2001 was 4.21 persons per hectare which increase to 5.13 person per hectare. Highest population density is observed in Dehri sarai (74.01 pph), Banjari (24.31 pph), Betmakhas (19.65pph) and Pithampur (15.65pph).

Future Population Projection (FPP):

The future population projection is based on the past and present volume of population and its growth trend and pattern, which is collected from census reports. FPP are calculated from various methods mathematical, statistically & graphical methods. The arithmetic/ zero order / linear method and geometric or first order method has been used for population estimation of study area.

1. Arithmetic / Zero Order / Linear Method:

$$P = P_1 + K_a (t - t_1)$$

$$K_a = \frac{dP}{dt}$$

P = Population;

t = Time;

K_a = Arithmetic Growth Constant

dP = difference in population

dt = difference in time interval.

2. Geometric / First Order Method:

$$\ln P = \ln P_1 + K_g (t - t_1)$$

$$K_g = \frac{\ln P_2 - \ln P_1}{t_2 - t_1}$$

P = Population;

t = Time;

K_g = Geometric Growth Constant

P_2 = Present population.

P_1 = Past population.

As shown in growth rate table no.3 overall growth rate of 40.85 % is observed in study area between years of 2001 to 2011. It shows a very high growth rate in population increase, this is due to immigration of peoples from outside of the region in the search of job and services. Pithampur industrial area is the one of the largest industrial area in Madhya Pradesh hence it attracts the population to immigrate into the region. Future population is projected for year 2051 using two methods is shown in table no.4.

Table No.4: Population Projection of the Study Area

S.no.	Year	Population	
1	2001	154443	
2	2011	217534	
	Projected	Arithmetic/ZeroOrder/ Linear Method	Geometric/First Order Method
3	2021	280625	305590
4	2031	343716	429338
5	2041	406807	603197
6	2051	469898	847460

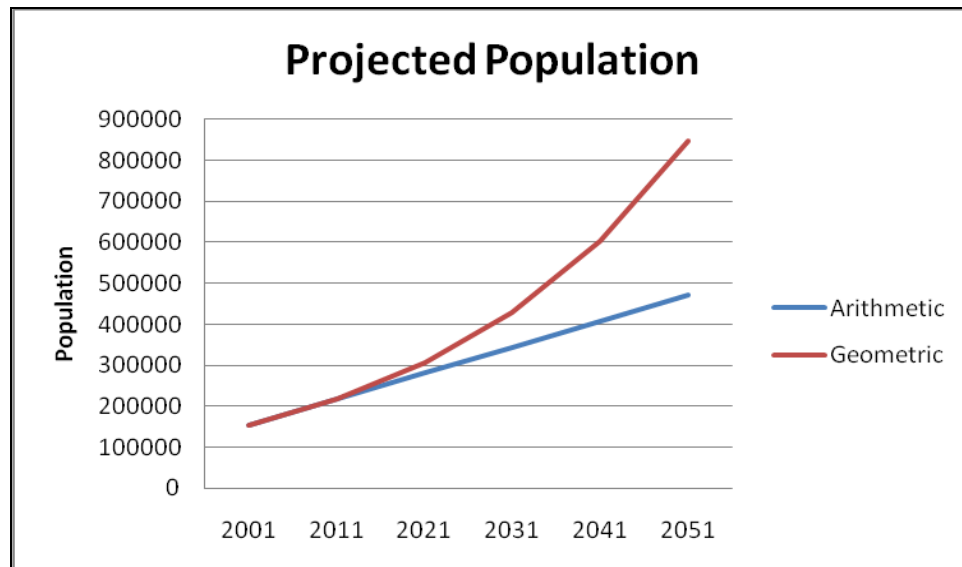


Figure 4: Projected Population of Study Area.

It is interesting to see in population projection table that according to arithmetic increase method a population of 469898 is to be increase in 2051 but according to geometric increase order it reach up to 847460 which is nearly double of the first method. As the study area is industrial area hence the increase or decrease in population will largely depends on the establishment of new industrial units. Geometric increase is the most accepted method for population projection hence further analysis is carried on the basis of population calculated using this method. On the basis of population of 2051, requirement of land for development is calculated by using previous correlation of population and developed land.

Change in Builtup land and Land Requirement:

Past is the key for of future. The present and past developed land is calculated by using visual interpretation of high resolution multidade satellite data. Multidade LISS IV satellite data of spatial resolution 5.8 m of year 2001 and 2012 is used to map the builtup land developed in 2001 and 2012 for population.

Table No.5: Built-up land assessment in previous years.

S.No.	Year	Builtup land (ha)	Other land (ha)
1	2001	2651.47	34013.1
2	2012	3788.98	32875.6

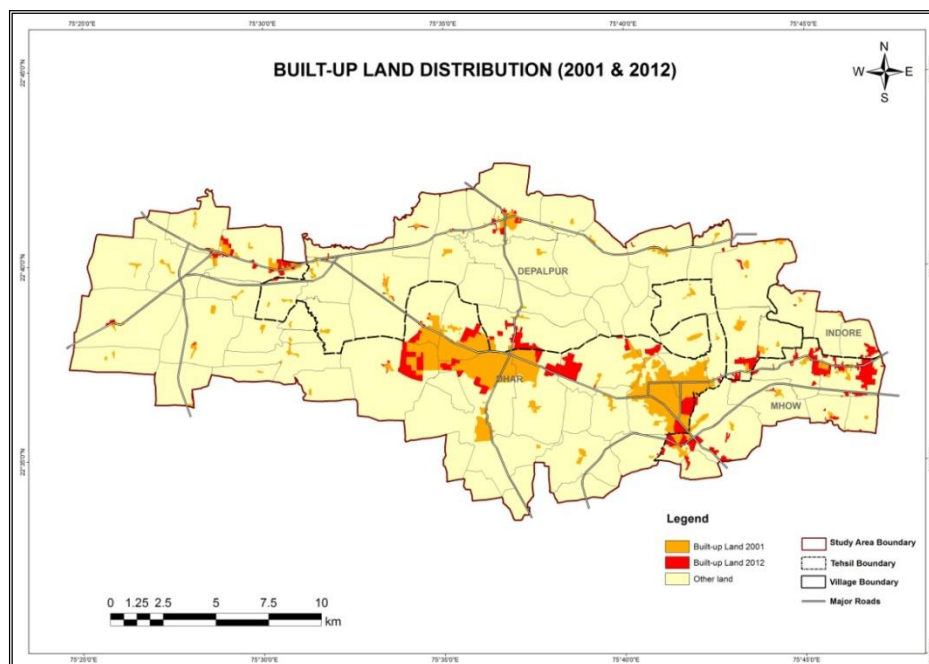


Figure 5: Builtup distribution 2001 & 2012

In last few decades Pithampur is developed as one of the most emerging industrial area of M.P. which gives it an identity at global level. It is observed that builtup land developed with respect to population shows a nearly constant behavior as it is 58 people per hectare in 2001 and 57 people per hectare in 2012. Because of growth in industrial area, the land required or developed is assumed on the basis of geometric population growth. Required land is calculated for a period up to 2051 using formula:

$$Area_t = \frac{Population_t}{Density_{present}}$$

$$Density_{present} = \frac{P_{present}}{Builtup_{present}}$$

IV. RESULT & DISCUSSION

Table No.6: Additional Land requirement for Future development

	S. No.	Year	Population (Geometric increase)	Builtup land (ha)
Present	1	2001	154443	2651.47
	2	2011	217534	3788.98
Projected	3	2021	305590	5246.35
	4	2031	429338	7370.85
	5	2041	603197	10355.66
	6	2051	847460	14549.15

By observing table no.6, it is clear that population of the area in year 2001 was 154443 people and built-up land developed was 2651.47 ha whereas population increased in 2011 was 217534 people and built-up land developed was 3788.98 ha. If population increases geometrically, it will go up to 305090 in year 2021, 429338 in 2031, 603197 in 2041 and 847460 in the year 2051. To fulfill the need of housing, commercial activities, amenity and facility infrastructure for increasing population, it is prime necessity to assume the land requirement and availability of land in the study area. Analysis resulted that land required in year 2051 is calculated is 14549.15 ha.

V. CONCLUSION

The research concluding at finding additional land required for future population of Pithampur planning area to sustain their life which plays a major role in planning process. Remote sensing and GIS tools can help in identification and delineation of existing built-up land using high resolution satellite data. Additional land can be used during urban development in the form of residential, commercial, industrial and recreational activities. Geospatial technology is useful in interpretation of surface features like urban sprawl and other surface features. It is also observed that integration of spatial data and non-spatial data can be used for future planning.

VI. REFERENCES

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