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Trends of Population Growth in North Bihar Plain

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Abstract: *In this research paper we will examine the trend of population growth in North Bihar Plain, as against state of Bihar, and will also project growth of population in future up to 2051.This will also try to find out the reasons behind the phenomenal growth of population in the study area. North Bihar is a plain region which has been formed due to deposition of sediments brought down by different rivers originating from Himalayan region and peninsular India, and because of this it is very fertile land, prone to flood, almost every year, which causes huge loss of human lives, property, agriculture and other infrastructure. Agriculture is the main economic activity of the study area, especially of the food crops, in which paddy is the main crop. After Utter Pradesh and Maharashtra, Bihar is the third most populous state in the country, accounting for a total population of 104099452 with a density of 1106 persons per square kilometer. Growth of population is associated with a variety of demographic, socio-cultural factors, and, therefore, it reflects the prevailing dynamism of demographic characters in the study area. The density of population of North Bihar is not only greater than the density of Bihar, but it is much higher than the density of national average, which is going to be the greatest problem in near future.*

Keywords: *Bihar, North Bihar Plain, Population Density, Population Growth, Trend*

I. Introduction

Population growth refers to changes in the size of population over time, which may be either positive or negative. It depends upon balance between births and deaths. The population will grow at slower pace if there are more deaths, even it can decline. Apart from fertility and mortality migration may also play an important role in the growth of population, but the effect of migration is normally not as influential as the effect of fertility and mortality. However migration plays an important role in the growth of population of sub-areas of the national populations. It means population growth occurs when the birth rate is higher than the death rate or when immigration exceeds emigration. Population growth can be measured in both absolute and relative terms. Absolute growth is simply the difference between the number of population over a time, whereas relative growth refers to rate or a percentage growth. Population can grow at an exponential rate, like a compound interest in Bank account. Population growth is associated with a variety of demographic, socio-economic and cultural factor of the study area, and represents a dynamism in demographic characteristics. As the high population growth is a big problem, in less developed or developing countries, in the same way very low or zero population growth is also a big problem in developed countries . There occurs a significant changes in the demographic and socio-economic character of population, when there is rapid growth of population, caused by high fertility and large scale immigration. Such type of situation is prevalent in most of the northern most districts of North Bihar because it lies in the vicinity of Nepal in the northern side as well as West Bengal in the east.

Natural increase and migration are principal determinants of how a population can change and are at the very core of demographic studies. The movement by humans from one area to another area is known as migration. Migration may cause positive as well as negative change in the size of population. There is very little

immigration in North Bihar plain because it is dominated by agricultural economy, and apart from this it is a flood prone area. If there is any immigration, it is from Nepal and Bangladesh. Both of them are not able to create pull force. However, there are intra-regional migration, which does not account in the increase of the population of the area.

Bihar has got the highest fertility rate in India. It is still most common for woman to have kids in their 20s, the number of woman in their 30s having children, is growing. Bihar's child per woman ratio is 3.2 higher than the national average of 2.3 in 2018, Teenage birth is very significant in and out of 30 lakh births in state, 3.5 lakh are teenage births. Bihar can take pride in the fact that it registered the sharpest fall in infant mortality rate. Districts of North Bihar performed poorer in the efforts of the state government to reduce fertility. North Bihar districts like Saharsa, Sheohar, Araria, Kishanganj and Khagaria recorded highest crude birth rate in North Bihar.

North Bihar lies north of Ganga river, west of Mahananda river and east of Gandak river. In the north it is bordered by Nepal, east by West Bengal and Uttar Pradesh in the west. North Bihar is located between $25^{o}15'$ north to $27^{o}31'$ north latitude and $83^{o}50'$ East to $88^{o}70'$ East longitude covering an area of 53021 sq.km.

North Bihar is a plain region which has been developed due to many rivers coming from Himalayan and peninsular region, specially due to the sediments brought by river Ganga, that's why North Bihar plain is characterized by monotony of alluvial deposits, it is the single geological formation spread over the entire region. Subtropical type of climate especially monsoonal type, is found in North Bihar plain. Most of the rainfall in North Bihar plain is concentrated in the three months of monsoon. Nearly 73.63% of the geographical area of North Bihar plain is considered to be flood prone, which causes huge loss of properly human lives, agriculture, livestock, and other infrastructure. North Bihar districts are vulnerable to floods due to five major flood causing rivers like Mahananda, Kosi, Bagmati, Burhi Gandak and Gandak rivers,which originates in Nepal, due to which nearly 76% population in North Bihar live under recurring threat of flood.Agriculture is the main economic activity of the study area, especially of the food crops, in which paddy is the principal crop.

II. Objective of the Study

The present research paper has been designed to understand the trend of population growth in North Bihar plain in relation of state of Bihar. This research paper will also find out the causes behind the phenomenal growth of population in the study area, and will also forecast the growth of population.

III. Database and Methodology

This research paper is based primarily on the secondary sources of data, which has been collected from different census reports of India, as well as data has been gathered from District Census handbook of different districts of North Bihar and Office of the Director, Census of Bihar. After collecting information from different secondary sources, the relevant data has been computed and tabulated and analysed with suitable statistical technique, and cartographic methods like line and bar graph, whereas some information are also presented in the form of qualitative statements.

Trends of population growth are always analysed in terms of time perspective. The present study includes census report right from 1901 to 2011, for the detail investigation of the population growth. In the present research paper population projection will be done by means of Incremental Increase Method. This method is an improvement over Arithmetical Increase Method and Geometrical Increase Method, which is actually a modification of Arithmetical Increase Method. This method is suitable for those areas where growth rate is found to increasing. The average increase in the population is determined by Arithmetical increase method and to this the average of the net incremental increase is added, once for each future decade. In other words the incremental increase is determined for each decade from the past population and the average value is added to the present population along with the average rate of increase. The Incremental Increase Method reads as follow

Population after n^{th} decade is $P_n = P+nX + \{n(n+1)/2\}Y$

Where, P_n = Population after n^{th} decade

X = Average increase

Y = Incremental Increase

IV. Trends of Population Growth

After Uttar Pradesh and Maharashtra Bihar is the third most populous state in the country accounting for total population of 104099452 with a density of 1106 persons/sq.km., which is the highest density in the country. If we see the total population of North Bihar plain in 2011, it is 65547527 with a density of 1236 persons/ Sq. Km, which is even higher than the density of Bihar. Bihar with a total area of 94163 sq.km., ranks twelfth with a national share of 2.86 percent, whereas the

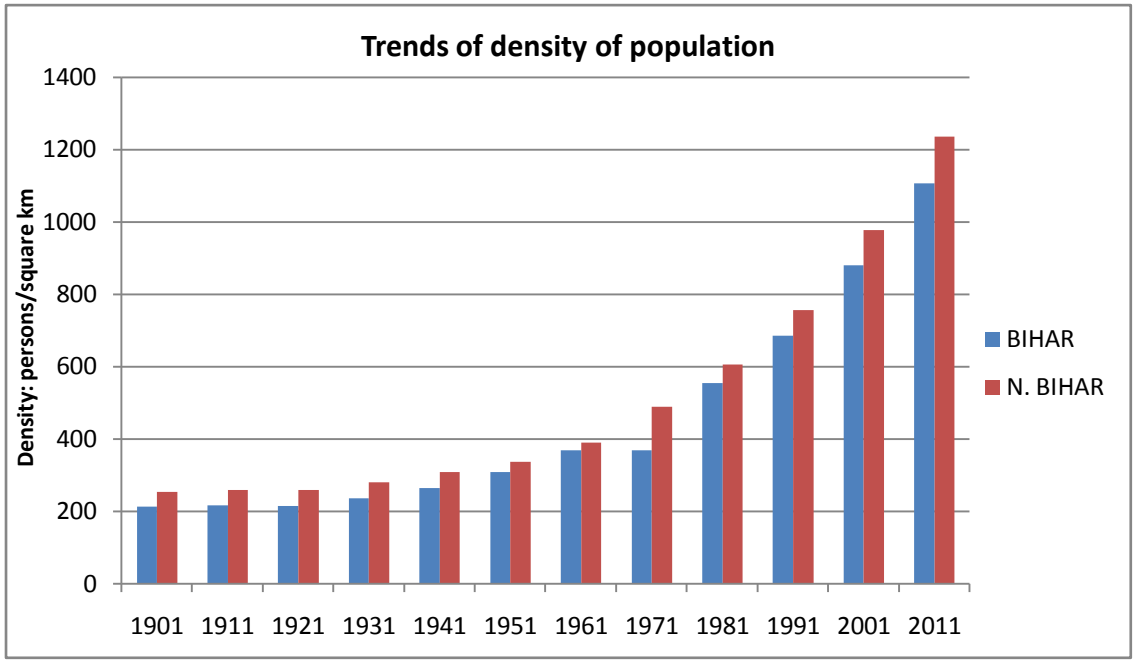
total area of North Bihar plain is 53021 sq.km., according to 2011 census. The total population of Bihar was 21243632 in 1901 which has been increased to 104099452 in the year 2011. In the same way total population of North Bihar was 13516792 in 1901, which has now become 65547527 in 2011. There was a highest increase of population in the state of Bihar during 1991-2001, with a percentage increase of 28.62%. Similarly North Bihar plain also witnessed the highest increase in population during 1991-2001 with a percentage increase of 29.12 percent. It is striking to enough to note that during the period of last hundred years (1911-2011) the state's percentage population growth has increased from 1.52 percent to 25.42 percent (Table 2).

Table 1: Trends of Population Density

	BIHAR		NORTH BIHAR	
Year	Persons	Density (Per Sq.Km)	Persons	Density (Per Sq.Km)
1901	21243632	214	13516792	254
1911	21567159	217	13803080	260
1921	21358905	215	13806712	260
1931	23438371	236	14923102	281
1941	26302771	265	16455449	310
1951	29085017	309	17903836	337
1961	34840968	370	20685996	390
1971	42126236	370	25977703	489
1981	52302665	555	32229589	607
1991	64530554	685	40131243	756
2001	82998509	881	51817268	977
2011	104099452	1102	65547527	1236

Source: Apart from the last few decades, density has been calculated by author on the basis data regarding population and area available in Census of India

Figure-1



Similarly, North Bihar plain also witnessed a somewhat lower percentage growth of population from 2.12 percent to 26.50 percent, which records an increase of 12.5 times as against 16.72 times in the case of state of Bihar which is greater than the increment in North Bihar plain.

It will be worth mentioning in this context that the pressure of population on land (person/km^2) in the North Bihar plain was already high in 1901 (254) as compared to corresponding state average 214, which has increased to 1236 in 2011, as against 1106 in 2011 in Bihar. When we look at the decennial growth pattern of population in the state as well as North Bihar plain, it is found to vary significantly throughout the past century. As per the census 2011 the population density of India has gone up to 382 persons per square km. from 325 person per square km. in 2001. On an average, 57 more people inhabit every square kilometer in the country as compared to a decade ago. In the state of Bihar the density of population is 1102 persons per square kilometer in census 2011 as compared to 881 persons per square kilometer in 2001, which is much higher than the country in both the decade, but when it is compared with the North Bihar plain, it is much higher than both the state and country, it is 1236 person/sq.km. in 2011 and 977 persons/sq.km in 2001. The population density of Bihar and North Bihar from 1901 to 2011 has been shown in table 1. At the beginning of the twentieth century i.e., in 1901, the density of Bihar was 214 persons per square kilometer which steadily increased in each decade and reached up to 1102 persons per square kilometer. In the same way in the beginning of twentieth century i.e., in 1901 the density of North Bihar was 254 persons per square kilometer, which steadily increased in each decade and reached 1236 persons per square kilometer, which is much higher than the national average.

When we go through the decennial growth pattern of population in state of Bihar as well as North Bihar plain, it varies significantly throughout the century and in the both the cases, state as well as in North Bihar, decadal growth of population is higher during the post independence period (1951-2011) than the pre independence period (1901-1951). It is also significant to note that the decadal growth rates of population in both the state of Bihar and North Bihar, in both the periods were higher than the national

Trend of population growth may broadly be divided temporally in three phases

(1) First phase of marginal growth
(2) Second phase of moderate growth
(3) Third phase of rapid growth

(1) First phase of Marginal Growth (1901-1921)

This phase extends from 1901 to 1921. During this first phase of decadal population growth of Bihar state, the total population increased from 21243632 in 1901 to 21567159, which accounted for a decadal percentage growth of 1.52, whereas,in the year 1921 population went down to 21358905 which accounted for a decadal percentage growth rate of -0.96. In the North Bihar plain same thing happened,

population increased from 13516792 in 1901 to 13803080 in 1911, with a percentage growth of 2.12, but in 1921, population does not show any decrease and reaches up to

13806712, with a percentage growth of 0.02. No doubt it is nominal growth of population, but the whole country was going through the negative population growth

Table 2 : TRENDS OF POPULATION GROWTH

	BIHAR			NORTH BIHAR		
Year	Persons	Growth in percentage	Cumulative Percentage	Persons	Growth in percentage	Cumulative Percentage
1901	21243632	.....		13516792	.....	
1911	21567159	+1.52	+1.52	13803080	+2.12	+2.12
1921	21358905	- 0.96	+0.56	13806712	+0.02	+2.14
1931	23438371	+9.73	+10.29	14923102	+8.09	+10.23
1941	26302771	+12.22	+22.51	16455449	+10.27	+20.50
1951	29085017	+10.58	+33.09	17903836	+8.80	+29.30
1961	34840968	+19.80	+52.89	20685996	+15.54	+44.84
1971	42126236	+20.91	+73.80	25977703	+25.58	+70.42
1981	52302665	+24.16	+97.96	32229589	+24.07	+94.49
1991	64530554	+23.38	+121.34	40131243	+24.52	+119.01
2001	82998509	+28.62	+149.96	51817268	+29.12	+148.13
2011	104099452	+25.42	+175.38	65547527	+26.50	+174.63

Source: Census of India

The year 1921 is known as a great divide in the demographic history of India. When mortality started to decline, which led to the acceleration in the rate of population growth. The rate of population growth was generally low before 1921. In North Bihar plain percentage decadal growth of population was however very low in both the decades of 1911 and 1921, which was mainly attributed to high death rate caused by lack of medical facility and very low level of awareness towards fertility and mortality and especially due to frequent famines and epidemics, which took human lives. The natural calamities in the form of famine and epidemics occurred in the years of1911, 1918 and 1919, whereas the east of the North Bihar plain was affected by successive floods, still this area is prone to flood.

Figure 2

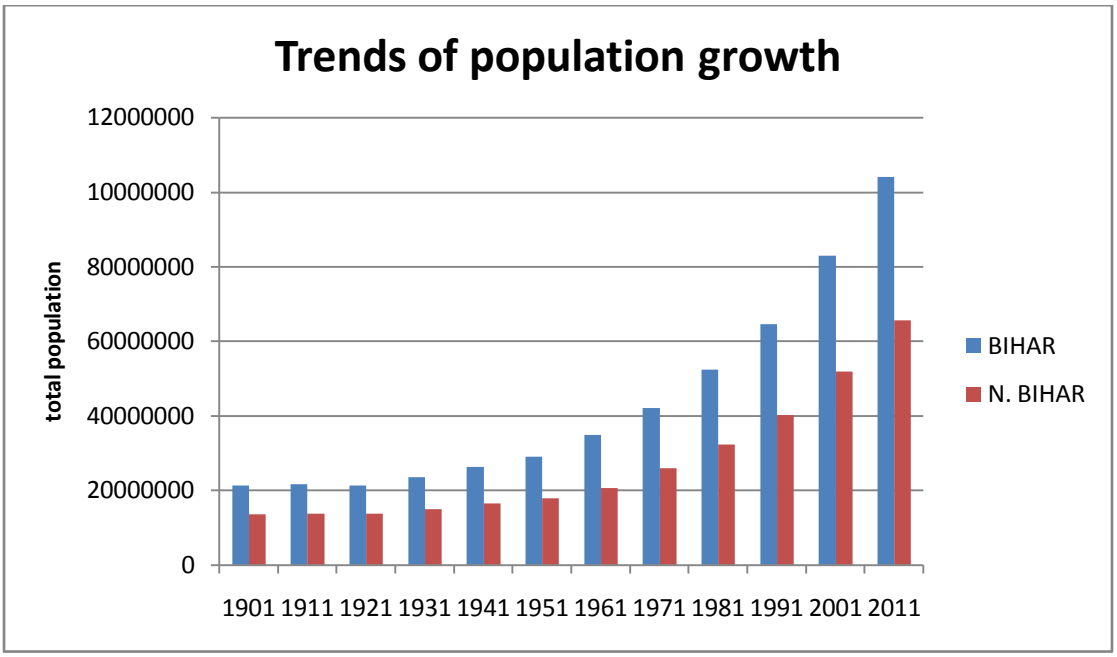
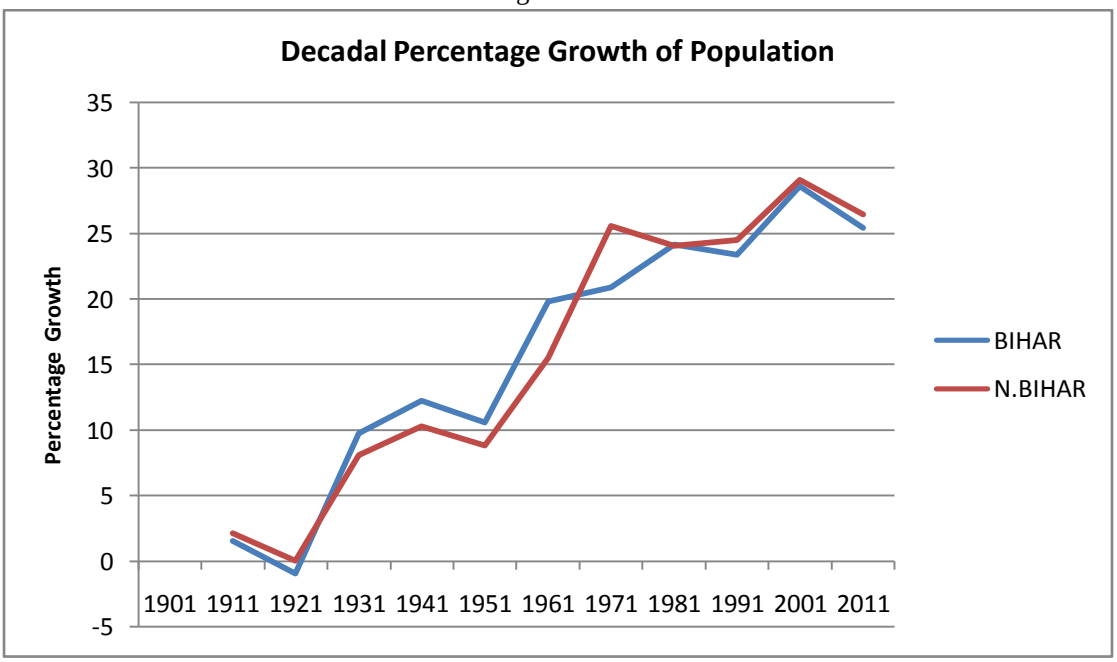


Figure 3



(2)Second phase of moderate growth (1921-1951)

Second phase of moderate growth of population extends from 1921 to 1951. The prevalence of somewhat high and fluctuating growth rates of population in Bihar and North Bihar plain has been largely associated with high birth rate and fluctuating death rate. The population growth potential in Bihar and North Bihar plain is high on two counts, first the base population is large and second a reduction of death rate without a corresponding decline in the birth rate. The growth of population in the state of Bihar in the year 1931 reported 9.73 percent, which is a huge jump from the previous decade of 1921. Similarly North Bihar plain also shows a growth of 8.09 percent which is far greater than the previous decade of 1921, which accounted for only 0.02 percent decadal growth. In 1941 population growth jumped from 9.73 percent in 1931 to 12.22 percent in the state of

Bihar. Similarly in North Bihar plain population registered a growth of 10.27 percent. This phase registered faster rate of population growth till 1941, in both state of Bihar as well as North Bihar plain due to some consciousness towards the medical care facilities, but there is a decline of population growth in the year 1951. It declined from 12.22 percent in 1941 to 10.58 in 1951 in the state of Bihar. Similarly in North Bihar it declined from 10.27 percent in 1941 to 8.80 in 1951. This decline of population from 1941 to 1951 in both the state of Bihar and North Bihar may be attributed to that the large number of muslims migrated to Bangladesh during partition. Apart from this some small scale migration occurred towards Chotanagpur, to work on mines. Above all North Bihar also witnessed drought, epidemics and other natural calamities during this period.

(3)Third phase of Rapid Growth (1951-2011)

This phase extends over six decades from 1951 to 2011. There is a huge jump of over 9% in 1961 from the previous decade of 1951 in the state, almost same trend has been observed in the decadal growth rate of population in North Bihar in 1961, where, the percentage growth is 15.54 percent as compared to the previous decade 1951 with a growth rate of 8.80 percent. The third phase shows a continuous trend of population growth, in fact population is growing at a faster rate. The decadal growth rate of population in this phase is significantly high from 20.91 in 1971 to 25.42 in 2011, in state of Bihar, almost same is true about the North Bihar plain, decadal growth rate is progressively increasing from 25.58 percent in 1971 to 26.50 percent in 2011, but there is a minor decline of growth rate in 1981, recording 24.07 percent, which is little lesser than the growth rate in 1971, which is 25.58 percent.

If we see the cumulative growth of population, we find that it has increased tremendously from 1.52 in 1911 to 175.38 in 2011 in the state of Bihar, almost same conditions prevail in North Bihar, it has increased from 2.12 in 1911 to 174.63 in 2011. The cumulative growth of population during third phase is more alarming in both state as well as North Bihar plain. It is 52.89 in 1961 which has increased to 175.38 in 2011, it means there is more than three times increase in the cumulative population growth in the third phase, whereas in North Bihar plain, this increase is almost four times greater from 44.84 percent in 1961 to 174.63 percent in 2011.

Therefore we cans say that demographic history in third phase (1951-2011) had been characterized by alarmingly high growth rate of population in the Bihar as a whole, as well as in North Bihar plain. This rapid increase in population in Bihar as a whole and North Bihar plain is a result of prevailing high birth rates and a large scale decline in the death.

V. Causes of high birth rate

- The practice of early marriage, which gives longer reproductive period.
- Poverty leads to more children more earning hands.
- Tropical climate of the study area, causes early puberty.
- Joint family system and polygamy.
- Lesser awareness towards family planning.
- Age and sex structure.

VI. Causes of decline in death rate

- Improved medical and health facilities
- Control on famines.
- Control on dreaded diseases.
- Improved hygiene.
- Improvement in socio-economic conditions.

VII. Projection of Population growth

Population projection or forecasting attempts to show how human population will change in future. Government policy makers and planners around the world use population project to find out, future demand for food, water, energy and other services, for the growing population. Population projection tries to estimate the rate of

population growth, but it is difficult to predict, because unforeseen events can alter the fertility mortality and migration on the resources. Birth rates may decline faster, which has been predicted due to several reasons like access to contraception, later age of marriage etc. In the same way death rate could also fall unexpectedly due to medical and health facilities. At the same time death rates can also increase unexpectedly due to disease, wars, flood and other catastrophes. Further, forecasters can be handicapped due to reasonable data, which are rarely attainable outside the developed countries. Population projections are simply mathematical formula which uses current population and rate of population growth to estimate future population. The population projection of North Bihar plain has been done by means of Incremental Increase Method which is a modification of arithmetical method, and is suitable where the growth rate is found to be in increasing order. The incremental increase is determined for each decade from the past population and the average value is added to the present population along with the average rate of increase, therefore, population after n^{th} decade is :

$P_n = P + nX + \{n (n+1)/2\} Y$

Where, P_n = population after nth decade

X = Average increase

Y = Incremental increase

Table 3

POPULATION PROJECTION BY INCREMENTAL INCREASE METHOD

	NORTH BIHAR			BIHAR		
Year	Population	Increase(X)	Incremental Increase (Y)	Population	Increase(X)	Incremental Increase (Y)
1901	13516792			21243632		
1911	13803080	286288		21567159	323527	
1921	13806712	3632	-282656	21358905	-208254	115273
1931	14923102	1116390	1112758	23438371	2079466	1871212
1941	16455449	1532347	415957	26302771	2864400	784934
1951	17903836	1448387	-83960	29085017	2782246	-82154
1961	20685996	2782160	1333773	34840968	5755951	2973705
1971	25977703	5291707	2509547	42126236	7285268	1529317
1981	32229589	6251886	960179	52302665	10176429	2891161
1991	40131243	7901654	1649768	64530554	12227889	2051460
2001	51817268	11686025	3784371	82998509	18467955	6240066
2011	65547527	13730259	2044234	104099452	21100943	2632988
	Total	52030735	13443971	Total	82855820	21007962
	Average	4730066	1344397	Average	7532347	1909815

Calculated by author

7.1Projected population for North Bihar from 2021 to 2051

$\mathbf{P_{2021}}$ = 65547527 + (1 x 4730066) + {(1+1)/2} x 1344397
= 70277593 + 1344397
= 71621990

$\mathbf{P_{2031}}$ = 65547527 + (2x4730066) + {2(2+1)/2} x 1344397
= 75007659 + 4033191
= 79040850

$\mathbf{P_{2041}}$ = 65547527 + (3x4730066) + {3(3+1)/2} x 1344397

= 79737725 + 8066382
= 87804107

$\mathbf{P_{2051}}$ = 65547527 + (4x4730066) + {4(4+1)/2} x 1344397
= 84467791 + 13443970
= 97911761

7.2 Projected population for Bihar from 2021 to 2051

$\mathbf{P_{2021}}$ = 104099452 + (1x7532347) + {1(1+1)/2} x 1909815
= 111631799 + 1909815
= 113541614

$\mathbf{P_{2031}}$ = 104099452 + (2x7532347) + {2(2+1)/2} x 1909815
= 119164146 + 5729445
= 124893591

$\mathbf{P_{2041}}$ = 104099452 + (3x7532347) + {3(3+1)/2} x 1909815
= 126696493 + 11458890
= 138155383

$\mathbf{P_{2051}}$ = 104099452 + (4x7532347) + {4(4+1)/2} x 1909815
= 134228840 + 19098150
= 153326990

Table 4

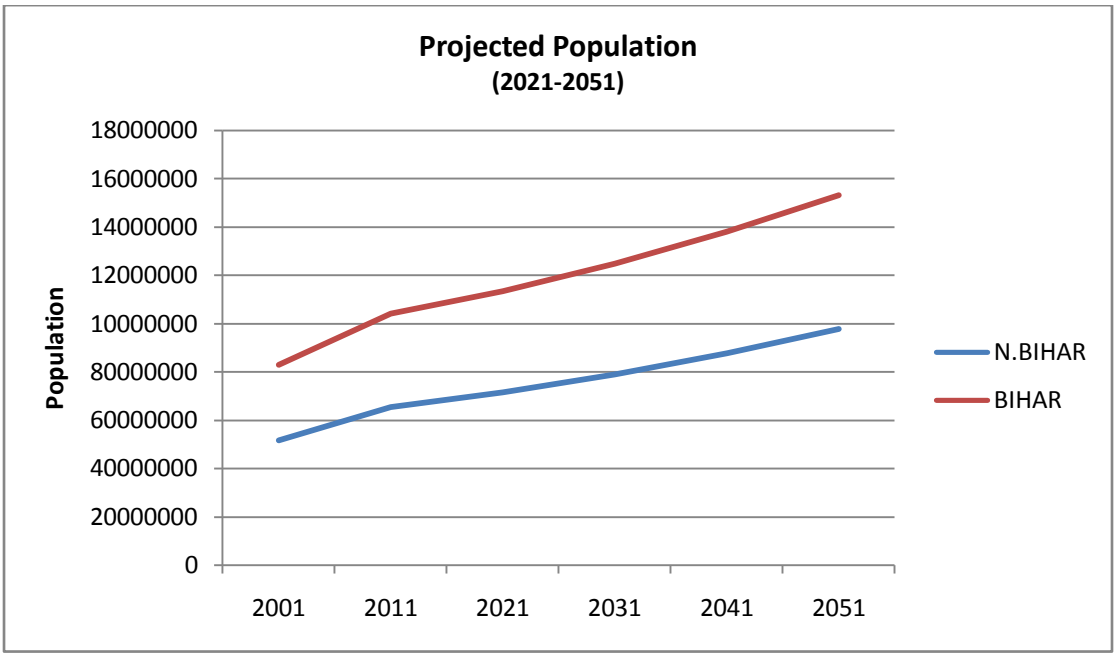
PROJECTED POPULATION

Year	Actual Population	Estimated Population (Incremental Increase Method)	Growth in percentage	Actual Population	Estimated Population (Incremental Increase Method)	Growth in percentage
2001	51817268			82998509		
2011	65547527		26.49	104099452		25.42
2021		71621990	9.27		113541614	9.07
2031		79040850	10.36		124893591	9.99
2041		87804107	11.09		138155383	10.62
2051		97911761	11.51		153326990	10.98

Calculated by author

If we go through the projected population growth in Bihar, we find a sharp decline from actual growth rate (26.49) in 2011 to 9.27 in projected year of 2021, but there is a little increase in 2031 with a growth rate of 10.36 percent and goes up to 11.51 percent in 2051. Almost same conditions prevail in North Bihar plain, there is a

Figure 4



sharp decline from the actual growth rate (25.42) in 2011 to 9.07 percent in the projected growth of population, later on there is a slow growth in the percentage growth of projected population and goes up to 10.98 percent in 2051. Table regarding projected population suggests that the total population will increase, but the growth rate will register a significant decline. This decline may be attributed to the decline in fertility rate, and will remain continue over next few decades, and this decline in fertility rate may be due to increasing alleviation of poverty, rising education levels, especially among woman, and growing urbanization.

VIII. Conclusion

North Bihar covers an area of 53021 square kilometer, out of 99200 square kilometer of Bihar. Geographically this fertile alluvial plain area is a flood prone area, flood is a regular and annual phenomena. In spite of this, Bihar plain is characterized by large size of population, with a high percentage of population growth, which is higher than the national average, which is a cause of concern, and will put insurmountable pressure on infrastructure resources and land, in particular, that can't be stretched to accommodate the growing number of people.

The 25.42 percent decadal population growth in Bihar and 26.50 percent in North Bihar plain in the year 2011 is a serious matter of concern, therefore, planners should keep an eye on it.

A lack of educational structure, coupled with high birth rate results in high growth rate. Poverty seems to be one of the leading cause of growth of population. Apart from poverty and high birth rate, poor contraceptive use, child labour, and reduced mortality rate play an important role in the growth of population. Improvement in medical and health facilities have led to lower mortality rates for many dreaded diseases, particularly dangerous diseases for children like polio, smallpox and measles have been eradicate.

Increase in population will cause many problems for our future generation, therefore, we have to be concerned about it. It is very important to educate men and boys about the gravity of the problem. The way men look at woman should be changed. The responsibility to address this problem should not be on woman alone. Therefore, it is necessary to empower women, give them employment opportunities, work at home facilities, and child and healthcare facilities, wherever they live.

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