

Spatio-Temporal Mapping of Population Density and their Characteristics of the Eastcentral Rajmahal Highlands, Jharkhand, India

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Abstract:

Population growth and population density are two important variables for population studies. The study of human resource reveals that population in the Eastcentral Rajmahal Highlands is gradually increasing. The decadal disparity of population growth of the study area shows a positive trend with distinct fluctuations rate of increase. The study area shows the change in population density from 206 persons per sq. km and 381 persons per sq. km in 1971 and 2011 respectively. The co-efficient of correlation between population growth and population density is highly positive relationship. Maximum populations are settled in the rural areas. Only 10.79 % (47,584) of the population are urban. It represents an unbalanced rural-urban population ratio and it also shows that rural economy particularly agriculture is dominating in the study area. The purpose of this paper is to analyse as well as spatial and temporal mapping of population density in the study area.

Keywords: Population, Eastcentral, Growth, Density, Spatial, Temporal variations

1. Introduction

The Eastcentral Rajmahal Highlands has a total population of 4,40,911 according to 2011 Census having an average density of 381 persons per sq. km and sex ratio is 975. Thus from 1971 to 2011, there has been net increase of 84.95 % in the study area. The decadal disparity of population density of the study area shows a positive trend with distinct fluctuations rate of increase. The study area, Eastcentral Rajmahal Highlands shows an overall increase in population density during a period of 50 years. If we analyse the village-wise data, we see that in every block, there has been both increase and decrease in population density. Only 6.38% of S.C. population, whereas 44.47% of S.T. population (2011 Census). The study area proves the change in sex ratio from 950 and 975 in 1971 and 2011 respectively. Agriculture related involvement of workers is dominant in the study area. Total agricultural workers of the study area are 18.07% according to 2011 Census having cultivators are 13.61% and agricultural labourers are 4.46 %. Since 1971 to 2011 there has been net decrease of 11.11% of agricultural workers and net increase of 17.18 % of non-agricultural workers in the study area. This decreasing trend of agricultural workers shows that the low intensity of agricultural activity of the study area.

2. Main Objectives

The main objectives are –

- To identify the block-wise temporal variation of population growth rate.
- To study the decadal disparity of population growth of the study area.
- To identify the block-wise spatial variation of population density.
- To identify the block-wise temporal variation of population density.
- To find out characteristics and distribution of population density in detailed.

3. Study Area

Extending from 23° 55'15"N to 24° 10'15" N latitudes and 86°56'00" E to 87° 30'00" E longitudes, the Eastcentral Rajmahal Highlands covering three blocks of Dumka district *viz*; Dumka, Ranishwar and Shikaripara in the State of Jharkhand, India is a portion of the Chotanagpur Highlands (Fig.1). Occupying an area of 1164.6 sq. kilometres, the study area comprises the entire portion of Dumka, Ranishwar and Shikaripara administrative blocks of Dumka district of Jharkhand and lies in the Eastcentral Rajmahal highlands. It includes 753 villages as well as one municipal area of Dumka Town. The study area is mainly characterised by undulating and rugged terrains dotted with residual hills and hillocks. Therefore, the area is one of the backward regions of the State of Jharkhand.

4. Material and Methods

Georeferencing and mosaicking all the three C.D. block maps (Dumka, Ranishwar and Shikaripara) have been done. For the analysis of population density and their socio-economic conditions, Census data from 1971 to 2011 have been tabulated, calculated and classified. A series of maps and diagrams (Fig. 1 to 6) on population density has been prepared for the analysis and visual expressions of the entire study area. Total study area has been digitized and map presentations through 21st Century GIS Professional 2012 software.

5. Population Growth

The Eastcentral Rajmahal Highlands has a total population of 4,40,911 according to 2011 Census having population growth rate is 18.90 %. The percentage of population growth and block-wise rate of change during 1971 to 2011 of the study area are given in Table 1 and Fig. 2. From 1971 to 1981 there was 2.48 % decrease of population under this category because of high mortality rate, most probably due to chronic diseases, food shortages, etc. whereas from 1981 to 1991, increasing trend has been identified with 20.25 % increase of population. From 1991 to 2001 there has been seen 32.42% increase of population and 2001 to 2011, there has been seen 18.90 % increase of population. Thus from 1971 to 2011, there has been net increase of 84.62 % (200467) in the study area (Table 1 and Fig. 2). The decadal disparity of population growth of the study area shows a positive trend with distinct fluctuations rate of increase. The increase of population in the study area is owing to the decline of death rate.

Block-wise temporal variation of population growth rate has been studied for a period of five decades (1971-2011). Block-wise decadal variation of population growth rate represents a positive trend. Ranishwar and Shikaripara blocks have shown steady increase of population growth rate since 1981 whereas from 1971 to 2011, fluctuating trend has been identified in Dumka block (Table 2 & Fig. 3).

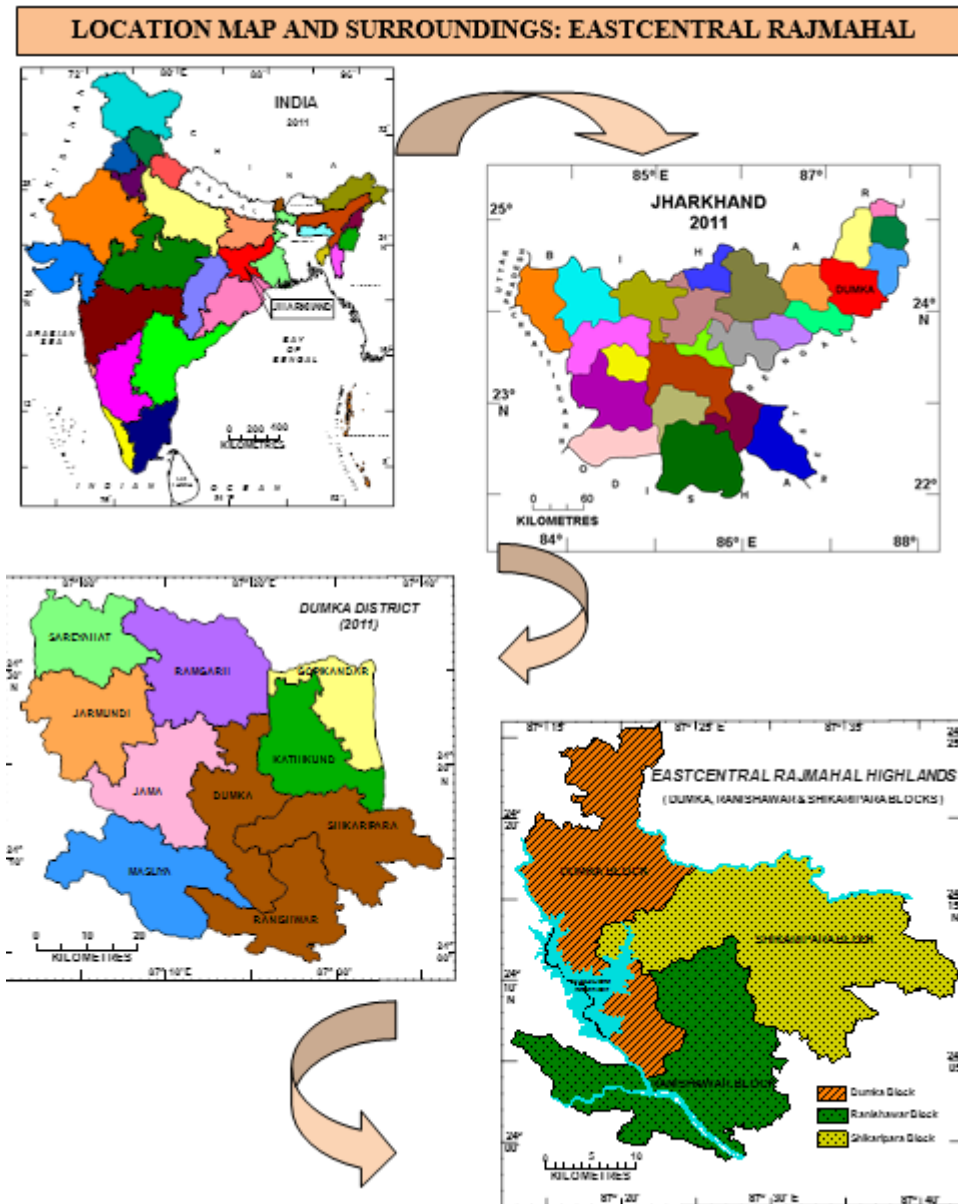


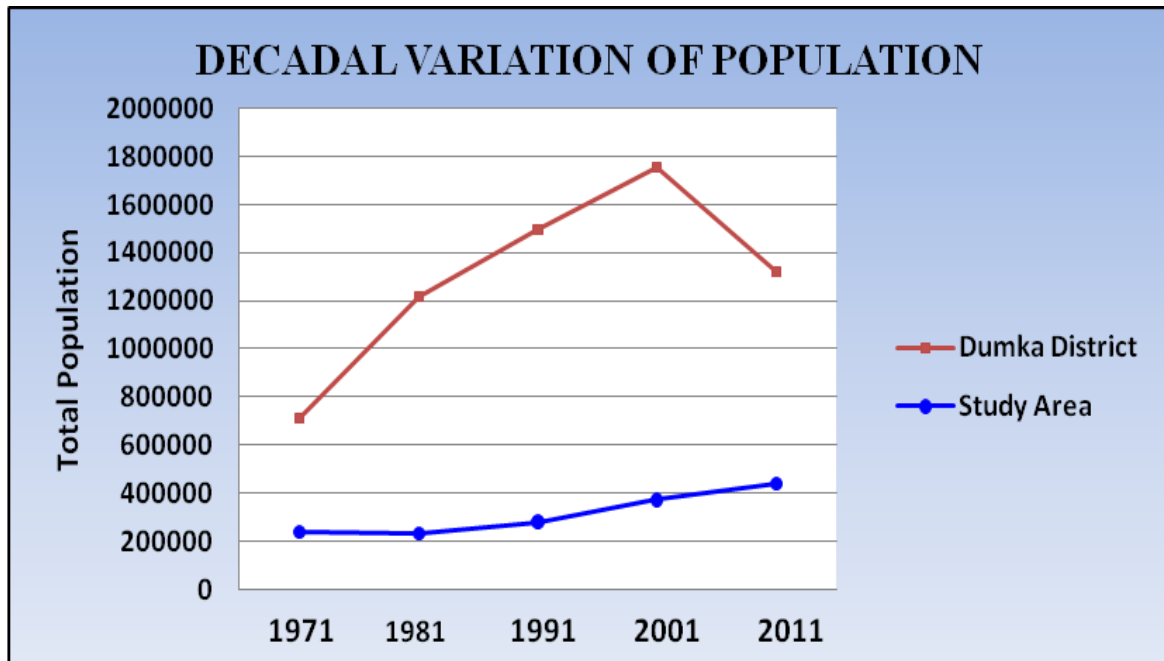
Fig. 1: Location map showing the Eastcentral Rajmahal Highlands in India

Table 1: Decadal Variation of Population (1971 – 2011)

Years	Total Population		% of Population to District Population	Population Growth Rate in %	
	Dumka District	Study Area		Dumka District	Study Area
1971	713444	240444	33.70	-	-
1981	1215452	234473	19.29	70.36	2.48
1991	1497266	281956	18.83	23.18	20.25

2001	1754571	373363	21.28	17.18	32.42
2011	1321442	443916	33.59	24.69	18.90
1971-2011	607998	203472	-	85.22	84.62

Source: Data obtained from Santal Parganas & Dumka District Census (1971 to 2011) and compiled by the researcher



Source: Diagram prepared by the researcher on the basis of tabulated data

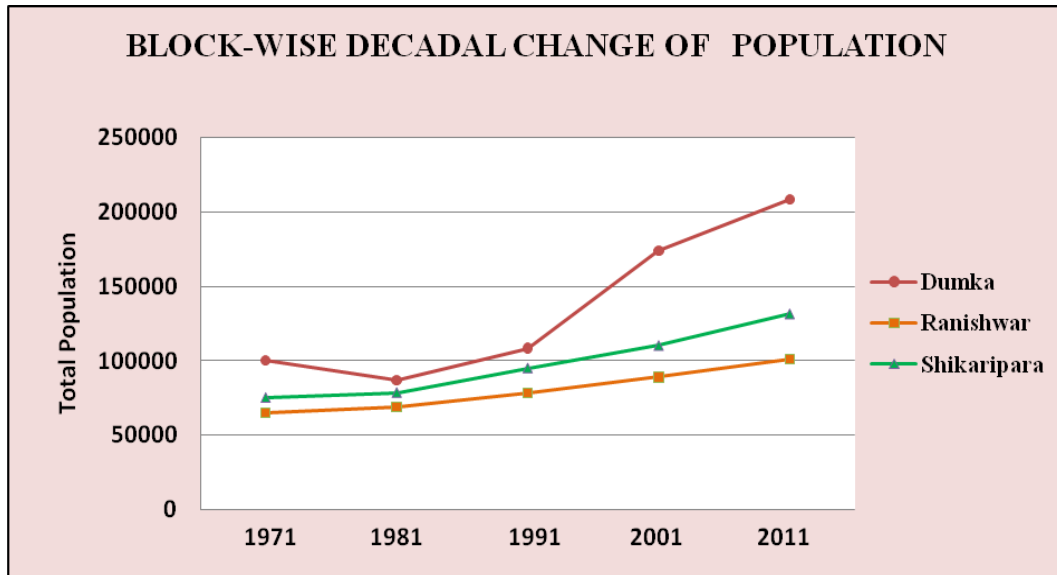
Fig. 2

Table 2: Block-Wise Variation of Population Growth Rate

Blocks	Year	Total Population	Decadal Variation		Population Density per sq. km.
			Absolute	Percentage (%)	
Dumka	1971	100256	-	-	265
	1981	87093	13163	13.13	230
	1991	108445	21352	24.52	286
	2001	174211	65766	60.64	460
	2011	210785	36574	20.99	556
Ranishwar	1971	65017	-	-	188
	1981	68810	3793	5.83	199
	1991	78526	9716	14.12	227
	2001	89020	10494	13.36	257
	2011	101667	12647	14.21	293
Shikaripara	1971	75171	-	-	171

1981	78570	3399	4.52	179
1991	94985	16415	20.89	216
2001	110132	15147	15.95	251
2011	131464	21332	19.37	299

Source: Data obtained from Santal Parganas & Dumka District Census (1971 to 2011) and compiled by the researcher



Source: Diagram prepared by the researcher on the basis of tabulated data

Fig. 3

6. Population Density

The study area shows the change in population density from 206 and 381 in 1971 and 2011 respectively. The density of population and block-wise rate of change during 1971 to 2011 of the study area are given in Table 3 and Fig. 4.

6.1. Temporal Variation of Population Density

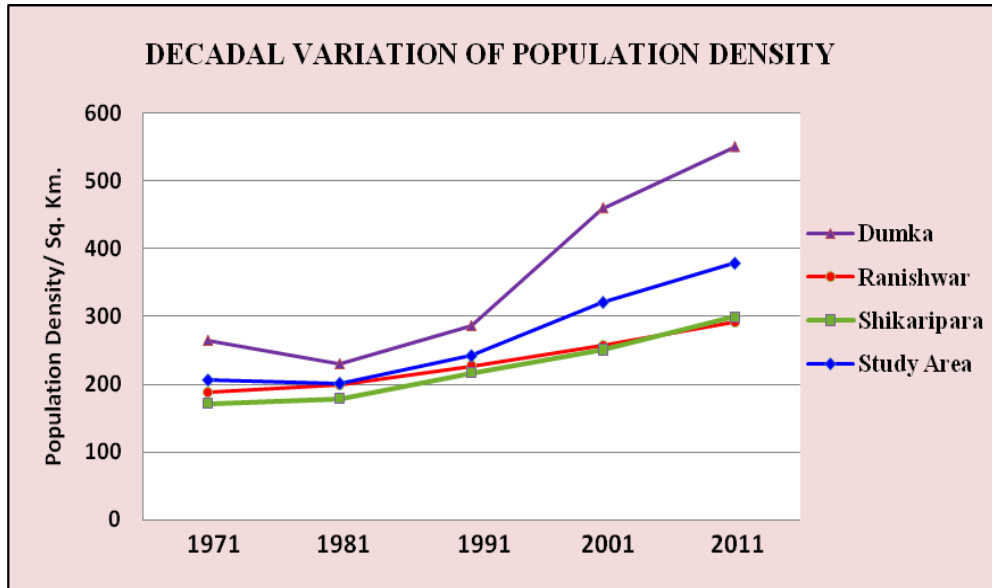
From 1971 to 1981 there was 2.43 % decrease of population density, whereas from 1981 to 1991, increasing trend has been identified with 20.40 % increase of population density. From 1991 to 2001 there has been seen 32.64% increase and 2001 to 2011 there has been seen 18.69% increase of population density. Thus from 1971 to 2011, there has been net increase of 84.95 % in the study area (Table 3 and Fig. 4). The decadal disparity of population density of the study area shows a positive trend with distinct fluctuations rate of increase. The co-efficient of correlation between population growth and population density is highly positive relationship and it was found to be 1.00 (Table 4).

Table 3: Decadal Variation of Population Density (1971 – 2011)

Years	Population Density per sq. km.			STUDY AREA	% of Change
	Dumka	Ranishwar	Shikaripara		
1971	265	188	171	206	-
1981	230	199	179	201	2.43
1991	286	227	216	242	20.40

2001	460	257	251	321	32.64
2011	556	293	299	381	18.69
1971-2011	-	-	-	175	84.95

Source: Data obtained from Santal Parganas & Dumka District Census (1971 to 2011) and compiled by the researcher



Source: Diagram prepared by the researcher on the basis of tabulated data

Fig. 4

Table 4: Correlation between Population Growth and Population Density

Years	Population Growth (X)	Population Density (Y)	Relation between Population Growth and Population Density
1981	2.48	2.43	$\sum X = 73.24$, Mean (X) = 18.31, SD(X) = 12.29 $\sum Y = 73.54$, Mean (Y) = 18.39, SD(Y) = 12.41 r = 1.00
1991	20.25	20.40	
2001	32.42	32.64	
2011	18.09	18.07	

Table 5: Population Density, 1971

Persons/Sq. Km.	No. of Villages Within Each Blocks			Total No. of Villages	Percentage to Total
	DUMKA	RANISHWAR	SHIKARIPARA		
100 & Below	37	35	54	126	17.28
101 - 200	98	73	102	273	37.45
201 - 300	68	42	65	175	24.00
301 - 400	22	19	10	51	7.00
401 - 500	10	5	4	19	2.61
Above 500	16	13	5	34	4.66
Uninhabited Villages	10	21	20	51	7.00
TOTAL	261	208	260	729	100

Table 6: Population Density, 2011

Persons/Sq. Km.	No. of Villages Within Each Blocks			Total No. of Villages	Percentage to Total
	DUMKA	RANISHWAR	SHIKARIPARA		
100 & Below	14	13	18	45	6.17
101 - 200	44	39	55	138	18.93
201 - 300	68	49	70	187	25.65
301 - 400	38	40	47	125	17.15
401 - 500	32	17	18	67	9.19
Above 500	58	28	31	117	16.05
Uninhabited Villages	7	22	21	50	6.86
TOTAL	261	208	260	729	100

Table 7: Changes in Population Density 1971 to 2011

Population Density	No. of Villages Within Each Blocks			Total No. of Villages	Percentage to Total
	DUMKA	RANISHWAR	SHIKARIPARA		
INCREASE (+)	244	172	235	651	89.30
DECREASE (-)	10	15	5	30	4.12
NO CHANGE	7	21	20	48	6.58
Total No. of Villages	261	208	260	729	100

Source: Data obtained from Santal Parganas & Dumka District Census (1971 & 2011) and compiled by the researcher

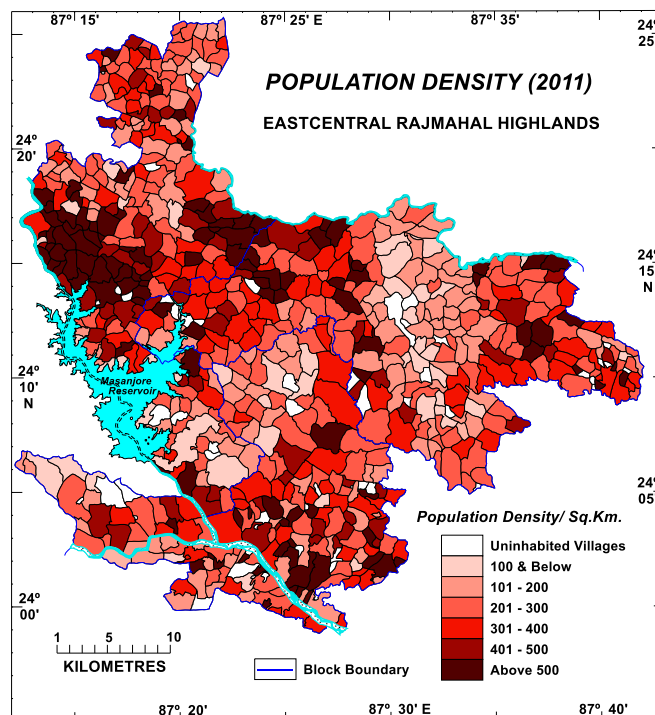


Fig. 5

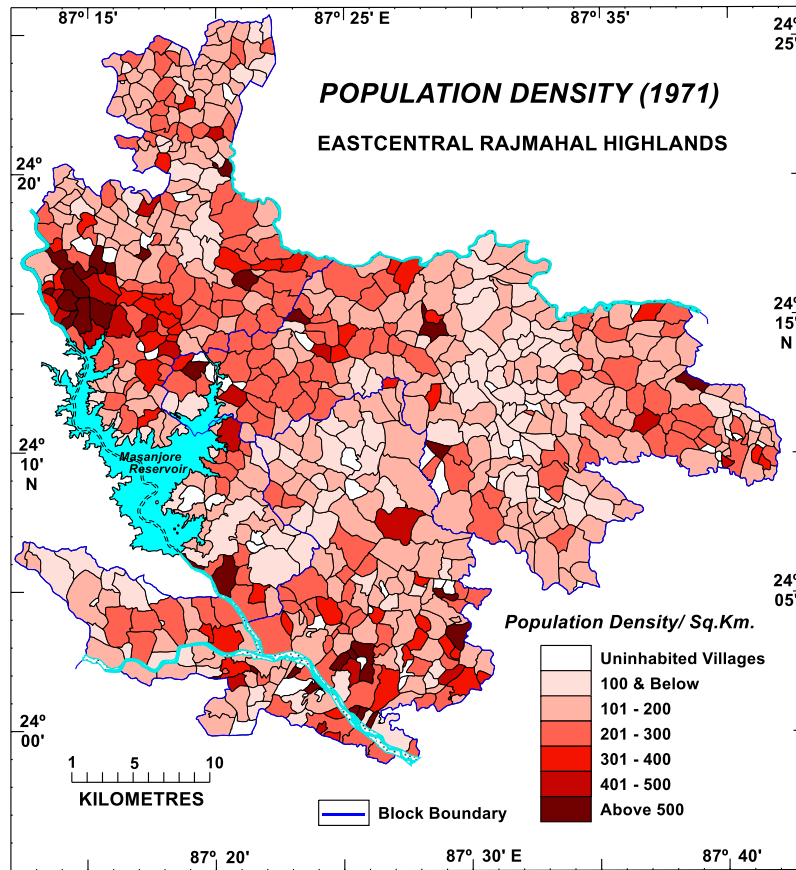


Fig. 6

Source: Data obtained from Santal Parganas & Dumka District Census (1971 & 2011) and maps prepared by the researcher

6.2. Spatial Variation of Population Density

During 1971, population density was 206. The regional distribution has been analysed (Table 5). Table 3 and Figs. 4, 5 show that in respect of total block, population density is highest in Dumka block (265) followed by Ranishwar block (188) and Shikaripara block (171). Out of 729 villages, only 126 villages (17.28%) fall under very low (100 and below) and 273 villages (37.45%) have low (101 - 200) density of population. These villages are mainly scattered in the northern, central, east-central and western part of the study area. Only 34 villages (4.66 %) experience above 500 population density, are concentrated in the north-western, southern and some eastern part of the study area.

During 2011, in all the villages, there were some proportions of population density. The population density of the study area increased from 206 to 381 persons per sq. km. in the year 2011. Table 6 and Figs. 4, 6 show that in respect of total block, population density is highest in Dumka block (556) followed by Shikaripara block (299) and Ranishwar block (293). Out of 729 villages, only 45 villages (6.17 %) fall under very low (100 and below) and 138 villages (18.93 %) have low (101 - 200) density of population. These villages are mainly scattered in the western, northern, east-central and central part of the study area. Only 117 villages (16.05 %) experience above 500 population density, are concentrated in the north-western, north-eastern, southern and some eastern part of the study area. The village-wise spatio-temporal variation of population density has also been analysed.

The computation of village-wise population data (729 villages) is reflected and summarised in Tables 3, 5, 6 and 7. The study area, Eastcentral Rajmahal Highlands shows an overall increase (84.95 %) in

population density during a period of 50 years. If we analyse the village-wise data, we see that in every block, there has been both increase and decrease in population density. The difference is that in Dumka Block, more villages (244) have shown an increase while only 10 villages have shown a decrease. By comparing various columns of Table 7, the pattern of changes from 1971 to 2011 can be easily understood. The population density increased in 651 villages (Dumka 244, Ranishwar 172 and Shikaripara 235 villages) whereas the decrease was noticed in 30 villages (Dumka 10, Ranishwar 15 and Shikaripara 5 villages) and out of 729 villages only 48 villages represent no change of population density.

7. Conclusion:

In conclusion, the study of human resource reveals that population in the Eastcentral Rajmahal Highlands is gradually increasing. Total population of the study area is 4,40,911 according to 2011 Census. During the last five decades (1971-2011) population growth rate has increased 18.90 %. Population growth rate is low compared to the District's (24.69%) population growth rate. The decadal disparity of population growth of the study area shows a positive trend with distinct fluctuations rate of increase. The increase of population in the study area is owing to the decline of death rate. The study area shows the change in population density from 206 persons per sq. km and 381 persons per sq. km in 1971 and 2011 respectively. The co-efficient of correlation between population growth and population density is highly positive relationship and it was found to be 1.00. Maximum populations are settled in the rural areas. Only 10.79 % (47,584) of the population are urban. It represents an unbalanced rural-urban population ratio.

8. Acknowledgments

I would like to express my gratitude and sincere thanks to my supervisors Dr. Nageshwar Prasad and Dr. Kamala Bhattacharya, Formerly Professors, Department of Geography, the University of Burdwan, Burdwan, West Bengal for their guidance, kind advice, suggestions and efforts towards preparation of this paper.

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