GEO-STATISTICAL ANALYSIS OF REGIONAL INEQUALITY

Geospatial mapping of Inequalities among SC and ST Population in Assam, 2011

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Abstract:
The spatial distribution of a particular attribute is a result of multi dimensional interactions of its determinants, such as, diversity in physiographical settings, locational advantages or disadvantages (strategic, no man's land, etc.), distribution unequal infrastructural facilities, political stability or instability, etc. As this process is dynamic and varies in space as well, concentration or dispersion in many spatial distributions is observed. All developmental theories, if it is not considered as space neutral, depend upon disparities and inequalities exist amongst the space bound determinants. Identification of such regional inequalities is a main task of regional planners. India is a land of diversity, as we all know, in terms of physiography, demography, economy, society and polity. These elements of diversity largely impact the developmental processes in the states of India. In this paper intra-regional distribution of Scheduled Caste and Scheduled Tribe population of Assam is taken into consideration to study its relative concentration and inequality to the total population. Findings shows that scheduled caste population is low inequality and high concentration than that of the scheduled tribe population in 2011 census data. Lorenz curve and Location Quotient are the two main methods used in the paper to discuss the regional inequalities.

Index Terms – Regional Inequalities, Lorenze Curve, Location Quotient.

INTRODUCTION

Regional imbalances or disparities means wide differences in per capita income, literacy rates, health and education services, levels of industrialization, etc. between different regions. Regions may be either States or regions within a State (Kumar, Dr. S. Vijay, 2016). Regional disparities especially in socio economic development are a ubiquitous phenomenon across India. India's North Eastern region (NER) comprising the states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura is a poorly developed and tribal population dominated region in India. In spite of ample natural and human resources, the north east region of India that consists of seven states is still lagging behind as compared to many states of India. People of these states are deprived in different socio-economic indicators. Multi-dimensional Poverty Index (MPI) value is highest in Assam but, inequality among the MPI Poor is high in Meghalaya. In 2011- 12, BPL population was highest in Manipur (46.7 %) followed by Assam (40.9 %) and Arunachal Pradesh (37.4 %) exceeding the all India level (29.5). It was observed that inequality is high in growth rate of population (%) (among demographic indicators), Sanitation Facilities (among the indicators of economic conditions), Rail Density (among indicators of infrastructure), Average Years of Education, Per Capita Monthly Expenditure (Rs) and Population Below Poverty Line[1].

Among the states of India, Assam is the area of this study. Assam is a state under the North Eastern Region of the country. The North Easter Region (NER) of India comprises of eight states. Majority of population of this region is tribal. Assam is the only state in the region having less percentage of tribal people compared to other

[1] *https://bhattadevuniversity.ac.in/docs/studyMaterial/Dr.BharatiGogoi_Geography/UG_6thSem_M_Disparity_in_socio-economic_development_in_NE_India_by_Dr._Bharati_Gogoi.pdf*

seven states of the region. Assam is considered as the gateway of this isolated region from the main land of the country. There are, at present, twenty seven district in Assam as per 2011 census and its total population is recorded at 3,12,05,576. The major livelihood of the people of the state is agriculture. Since independence of the nation, we have ample examples of various Government of India initiatives for development of the state but unfortunately, equal derivation of benefits by all section of the society is still lacking in the state. This incidence of uneven development in the state has paved the path of unemployment, poverty and insurgency. In fact, the existence of high magnitude of regional disparities at macro as well as micro levels, the state has encountered the problem of regionalism and natavistic tendency of the ethnic population at various levels. For example one of the reasons for demand for the formation of different states within the state of Assam is nothing but spatial disparities prevailing in the state. Therefore the problem of regional disparity is a serious issue of concern for the government which should be effectively dealt with[2].

Therefore, in this paper, inequality and concentration of SC and ST population in Assam -2011 has been examined.

METHODS AND DATABASE

The problem of regional inequalities in regional development has drawn attention of researches and regional planners. Different methods to measure regional inequalities are being used in Social and spatial sciences. Coefficient of Variation, Williamson Index, Theil Index, Atkinson Index, Hoover Coefficient, Coulter Coefficient, Gini's Index (Lorenze Curve), Location Quotient, etc. are commonly used methods and techniques of inequality studies. In this research paper, the Location Quotient and Lorenze Curve have been used to measure the concentration, dispersal and inequal distribution of Scheduled Tribe and Scheduled Caste population in Assam.

Location Quotient: When the proportion of any characteristic in an area is studied in relation to its proportion in the region, the ratio used is known as the Location Quotient (*Mahmood, Dr. Aslam, 2021*). *Say ,* $LQi = \frac{Pij/Pj}{Pj/P}$,

Where, Pij *= Number of person in jth (=1, 2,…..,m) category of the area i (=1,2,…..,n)*

$Pi = \sum_{j=1}^{n} Pij$ *, Total population in all the categories of area i*

$Pj = \sum_{j=1}^{m} Pij$ *, Sum of persons of category j in all the n areas i.e. population of region under category j*

P = $\sum_{i=1}^{n}$ $\sum_{i=1}^{n} Pij$, Sum of Pi in all the areas i.e., total population of the region in each category

Lorenze Curve: It is cumulative percentage distribution of two attributes at different point. Cumulative percentage variables of the two attributes are plotted on a graph. For comparison a diagonal line is also drawn showing the line of perfect equality.

Gini's Coefficient: The overall concentration found in Lorenze curve or in any such curve may also be measured numerically in terms of the area under the curve and the line of equal distribution to the area of the triangle formed.

$G = \frac{1}{100x100} [\sum_{i=1}^{n}(XiYi + 1)] - [\sum_{i=1}^{n}(Xi + 1Yi)]$, *Where, Xi = Cumulative distribution of total population; Yi = Cumulative distribution of sub population(SC or ST). The G-value ranges from 0 to 1.*

Geospatial mapping:

Quantum Geographical Information System (QGIS-open source), version-2.40 (Chugiak) is used to join the district wise Concentration of SC and ST population with the Vector layer (shape file) of Assam to produce a Choropleth map showing district wise spatial Concentration.

[2] *Hazarika, M. , Hazarika , Padmalochan,(2011)*

Microsoft Excel:
Required calculations are calculated in Microsoft Excel of Windows-7 ultimate. Required cartographic diagrams are also drawn with this M.S. office package.

Dataset: Data are collected from the Statistical Handbook of Assam-2011.

RESULTS:

Location Quotient:
Table 1 shows the Location Quotients of Scheduled Tribe population of districts of Assam.
Map-1 shows the spatial concentration of the Scheduled Tribe population of districts of Assam.
Table 2 shows the Location Quotients of Scheduled Caste population of districts of Assam.
Map-2 shows the spatial concentration of the Scheduled Caste population of districts of Assam.

Table : 1

Districts	Total population	Total ST population	% of ST population	LQ of ST population
Kokrajhar	887142	278665	31.4115	2.52349
Dhubri	1949258	6332	0.32484	0.0261
Goalpara	1008183	231570	22.969	1.84525
Barpeta	1693622	27344	1.61453	0.12971
Marigaon	957423	136777	14.286	1.14768
Nagaon	2823768	115153	4.07799	0.32761
Sonitpur	1924110	232207	12.0683	0.96952
Lakhimpur	1042137	249426	23.9341	1.92277
Dhemaji	686133	325560	47.4485	3.81184
Tinsukia	1327929	82066	6.18	0.49648
Dibrugarh	1326335	102871	7.75603	0.62309
Sibasagar	1151050	49039	4.26037	0.34226
Jorhat	1092256	139971	12.8149	1.0295
Golaghat	1066888	111765	10.4758	0.84159
Karbi anglong	956313	538738	56.3349	4.52573
Dima hasao	214102	151843	70.9209	5.69752
Cachar	1736617	17569	1.01168	0.08127
Karimganj	1228686	1940	0.15789	0.01268
Hailakandi	659296	691	0.10481	0.00842
Bongaigaon	738804	18835	2.54939	0.20481
Kamrup	1517542	182038	11.9956	0.96368
Kamrup_M	1253938	75121	5.99081	0.48128
Nalbari	771639	23364	3.02784	0.24325
Darrang	928500	8419	0.90673	0.07284
Total	**28941671**	**3107304**		

The values of the location quotient of the ST population show the higher concentration in Dima Hasao (5.69), Karbi Anglong (4.52), Dhemaji (3.81), Kokrajhar (2.52), Lakhimpur (1.92) , Goalpara (1.84) and Morigaon (1.14) as the values

Map 1 Geospatial mapping of Concentration of ST population

of L.Q. are greater than unity (L.Q. > 1). In Sonitpur and Kamrup (Rural) , it is quite balanced as the values of L.Q. are almost unity. In all other districts the population of Scheduled Tribe is much dispersed as the values of L.Q. are lesser than unity (L.Q. < 1). Map-1 shows the 6(six) classes of Concentration of S.T. population.

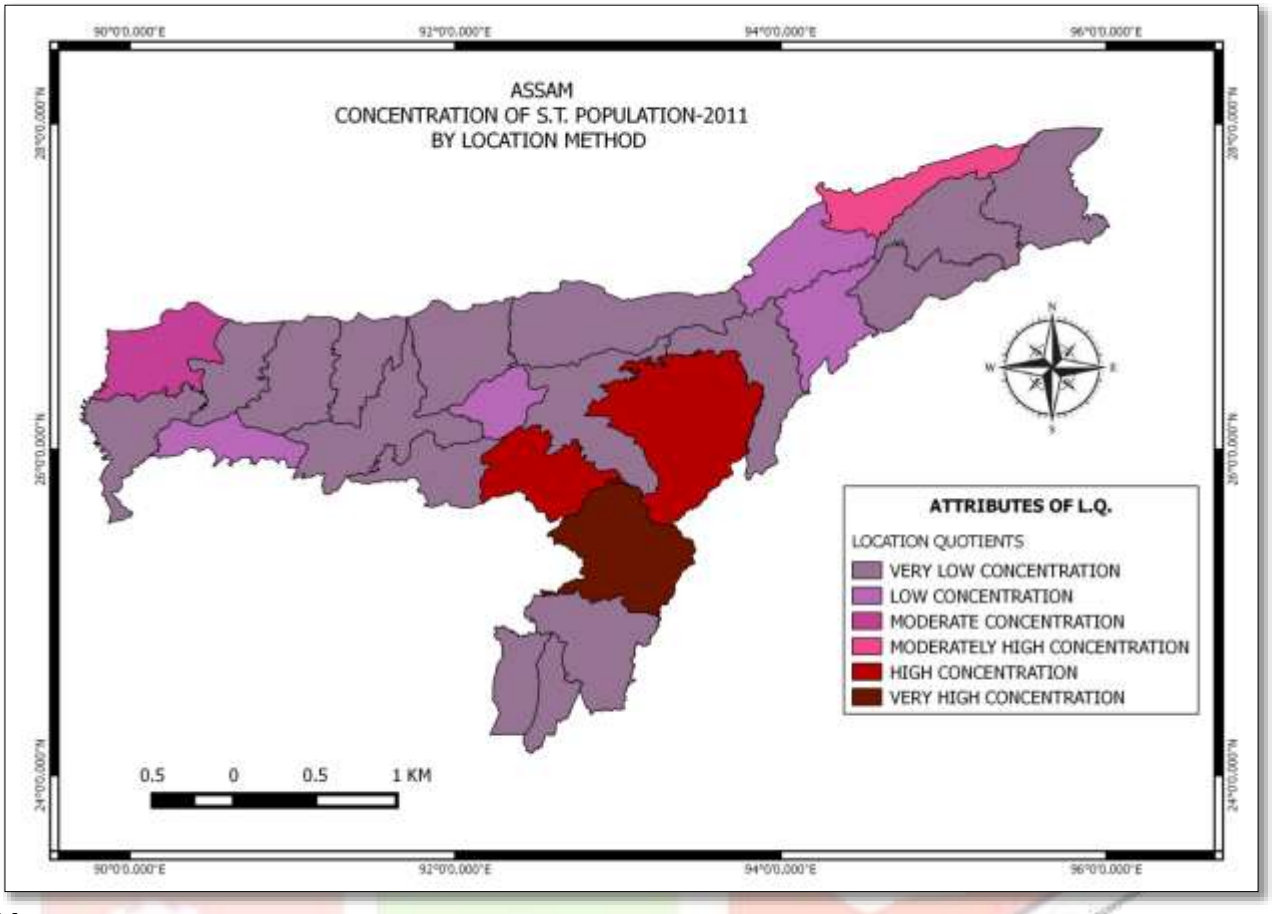
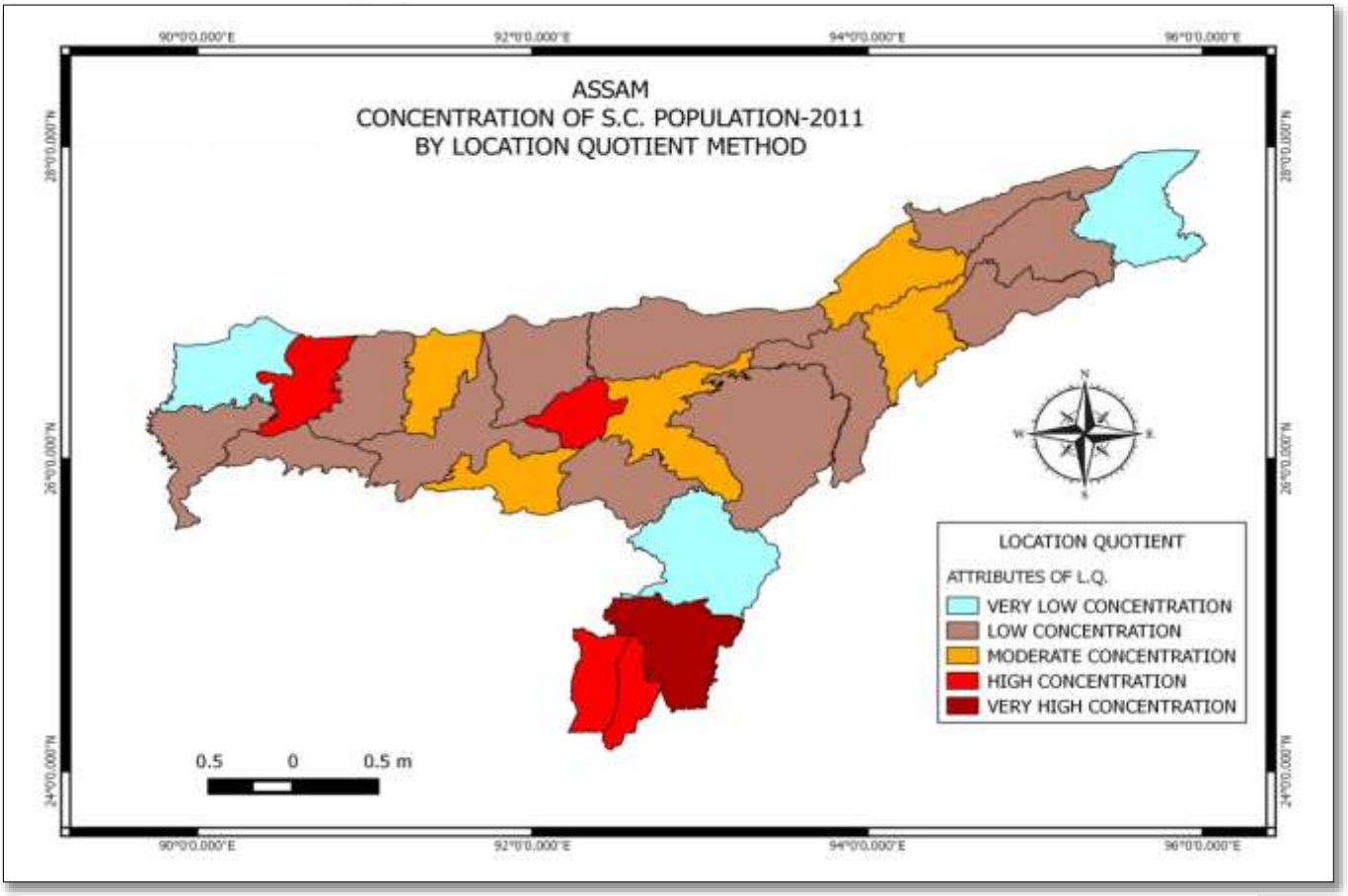


Table : 2

Districts	Total population	Total SC population	% of SC population	LQ of SC population
Kokrajhar	887142	29570	3.3332	0.4662
Dhubri	1949258	70395	3.6114	0.5051
Goalpara	1008183	45094	4.4728	0.6255
Barpeta	1693622	95320	5.6282	0.7871
Marigaon	957423	117841	12.3081	1.7213
Nagaon	2823768	266350	9.4324	1.3191
Sonitpur	1924110	109130	5.6717	0.7932
Lakhimpur	1042137	81840	7.8531	1.0983
Dhemaji	686133	44225	6.4455	0.9014
Tinsukia	1327929	37688	2.8381	0.3969
Dibrugarh	1326335	58876	4.4390	0.6208
Sibasagar	1151050	42347	3.6790	0.5145
Districts	Total population	Total SC population	% of SC population	LQ of SC population
Jorhat	1092256	88665	8.1176	1.1353
Golaghat	1066888	62298	5.8392	0.8166
Karbi Anglong	956313	44961	4.7015	0.6575
Dima hasao	214102	4337	2.0257	0.2833

Cachar	1736617	264897	15.2536	2.1333
Karimganj	1228686	157890	12.8503	1.7971
Hailakandi	659296	70659	10.7173	1.4988
Bongaigaon	738804	82784	11.2051	1.5671
Kamrup	1517542	107827	7.1054	0.9937
Kamrup_M	1253938	101789	8.1175	1.1353
Nalbari	771639	60216	7.8036	1.0914
Darrang	928500	40260	4.3360	0.6064
Total	**28941671**	**2085259**		

The values of the location quotient (table-2) of the SC population show the higher concentration in Cachar (2.13), Karimganj (1.79),Morigaon (1.72), Bongaigaon(1.56), Hailakandi (1.49), Nagaon (1.31), Jorhat and Kamrup Metro (1.13) as the values of L.Q. are greater than unity (L.Q. > 1). In Lakhimpur (1.09), Dhemaji(0.90) and



Map 2 Geospatial mapping of Concentration of SC population

Kamrup Rural (0.99) and Kamrup (Rural) , it is quite balanced as the values of L.Q. are almost unity. In all other districts the population of Scheduled Caste is much dispersed as the values of L.Q. are lesser than unity (L.Q. < 1). Map-2 shows the 5(Five) classes of Concentration of S.C. population.

Lorenz Curve:

Table 3 and 4 shows the Lorenz Curve of Scheduled Tribe and Scheduled Caste population of districts of Assam as per 2011 population census.

Districts	Total population	Total ST population	% of ST population to total population	% distribution of total population	% distibution of ST population	Cumulative % distribution of total population (xi)	Cumulative % distribution of st population (yi)	XiYi+1	Xi+1Yi
Dima Hasao	214102.00	151843.00	70.92	0.69	3.91	0.69	3.91	12.20	14.66
Karbi Anglong	956313.00	538738.00	56.33	3.06	13.87	3.75	17.78	98.12	105.77
Dhemaji	686133.00	325560.00	47.45	2.20	8.38	5.95	26.16	183.00	196.05
Chirang	482162.00	178688.00	37.06	1.55	4.60	7.49	30.76	294.40	324.18
Baksa	950075.00	331007.00	34.84	3.04	8.52	10.54	39.28	486.53	518.68
Udalguri	831668.00	267372.00	32.15	2.67	6.88	13.20	46.16	704.30	740.81
Kokrajhar	887142.00	278665.00	31.41	2.84	7.17	16.05	53.34	958.98	1034.06
Lakhimpur	1042137.00	249426.00	23.93	3.34	6.42	19.39	59.76	1274.12	1351.62
Goalpara	1008183.00	231570.00	22.97	3.23	5.96	22.62	65.72	1566.10	1688.10
Marigaon	957423.00	136777.00	14.29	3.07	3.52	25.69	69.24	1871.10	2020.90
Jorhat	1092256.00	139971.00	12.81	3.50	3.60	29.19	72.85	2300.55	2575.24
Sonitpur	1924110.00	232207.00	12.07	6.17	5.98	35.35	78.82	2952.24	3169.90
Kamrup	1517542.00	182038.00	12.00	4.86	4.69	40.21	83.51	3474.07	3643.87
Golaghat	1066888.00	111765.00	10.48	3.42	2.88	43.63	86.39	3884.98	4136.60
Dibrugarh	1326335.00	102871.00	7.76	4.25	2.65	47.88	89.04	4364.57	4642.30
Tinsukia	1327929.00	82066.00	6.18	4.26	2.11	52.14	91.15	4853.29	5118.72
Kamrup M	1253938.0	75121.00	5.99	4.02	1.93	56.16	93.08	5298.22	5570.67
Sibasagar	1151050.00	49039.00	4.26	3.69	1.26	59.85	94.35	5823.64	6499.95
Nagaon	2823768.00	115153.00	4.08	9.05	2.96	**68.90**	**97.31**	6745.63	6944.81
Nalbari	771639.00	23364.00	3.03	2.47	0.60	71.37	97.91	7022.34	7219.55
Bongaigaon	738804.00	18835.00	2.55	2.37	0.48	73.74	98.40	7307.21	7789.33
Barpeta	1693622.00	27344.00	1.61	5.43	0.70	79.16	99.10	7880.86	8396.56

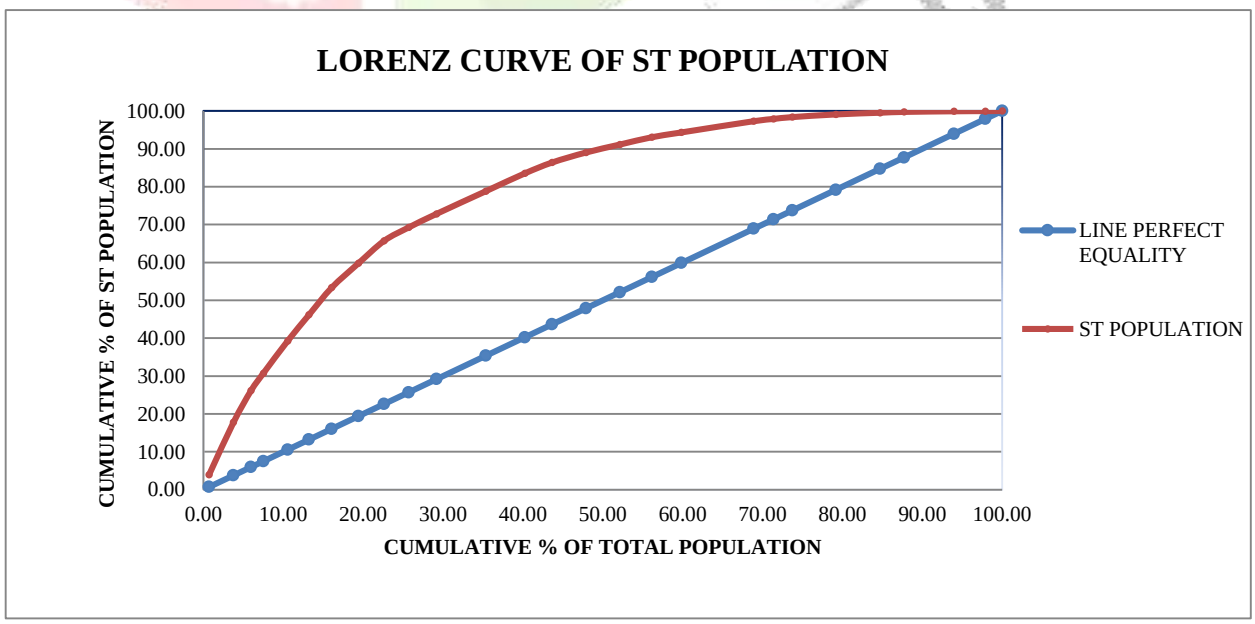
Cachar	1736617.00	17569.00	1.01	5.57	0.45	84.73	99.55	8453.24	8731.09
Darrang	928500.00	8419.00	0.91	2.98	0.22	87.70	99.77	8764.39	9373.31
Dhubri	1949258.00	6332.00	0.32	6.25	0.16	93.95	99.93	9393.31	9782.09
Karimganj	1228686.00	1940.00	0.16	3.94	0.05	97.89	99.98		
Hailakandi	659296.00	691.00	0.10	2.11	0.02	100.00	100.00	95967.38	101588.81
	3120557 6	**388437 1**	**12.44**						

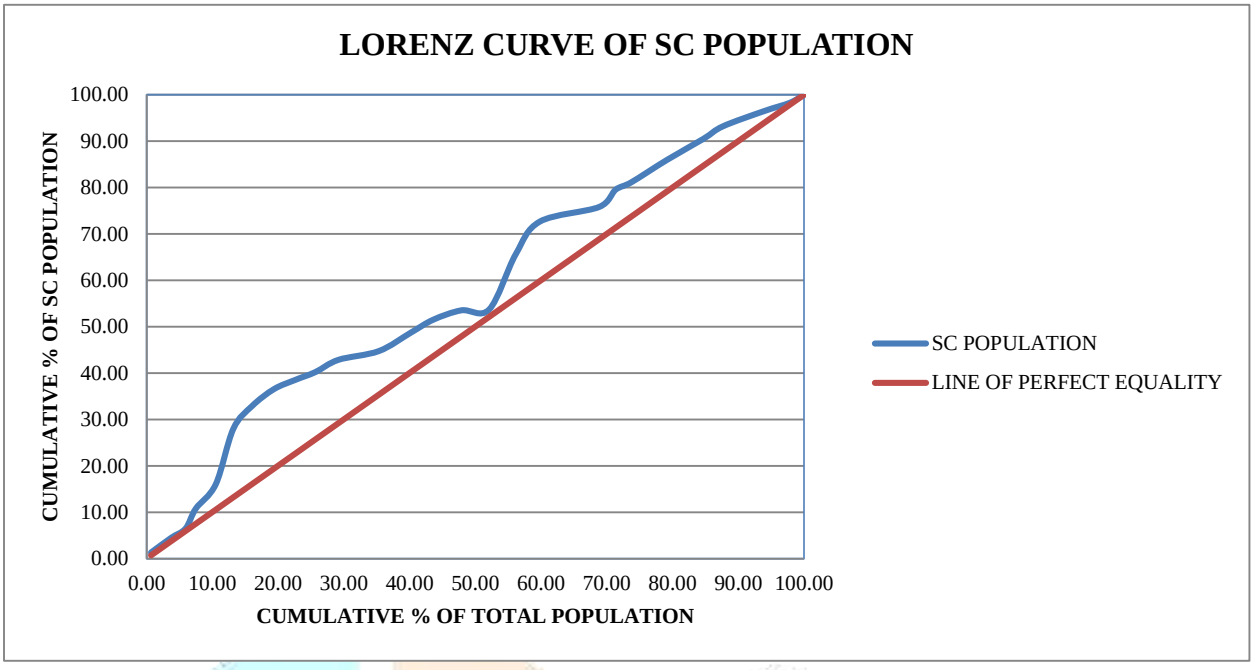
Districts	Total population	Total sc population	% of SC population to total population	% distribution of total population	% distibution of SC population	Cumulative % distribution of total population (xi)	Cumulative % distribution of sc population (yi)	Xiyi+1	Xi+1Yi
Dimahasao	214102.00	29570.00	13.81	0.69	1.33	0.69	1.33	3.07	4.97
Karbianglong	956313.00	70395.00	7.36	3.06	3.15	3.75	4.48	24.38	26.65
Dhemaji	686133.00	45094.00	6.57	2.20	2.02	5.95	6.50	64.09	48.72
Chirang	482162.00	95320.00	19.77	1.55	4.27	7.49	10.77	120.32	113.54
Baksa	950075.00	117841.00	12.40	3.04	5.28	10.54	16.05	295.00	211.98
Udalguri	831668.00	266350.00	32.03	2.67	11.94	13.20	27.99	434.18	449.18
Kokrajhar	887142.00	109130.00	12.30	2.84	4.89	16.05	32.88	586.52	637.47
Lakhimpur	1042137.00	81840.00	7.85	3.34	3.67	19.39	36.55	747.00	826.66
Goalpara	1008183.00	44225.00	4.39	3.23	1.98	22.62	38.53	909.69	989.71
Marigaon	957423.00	37688.00	3.94	3.07	1.69	25.69	40.22	1100.87	1173.87
Jorhat	1092256.00	58876.00	5.39	3.50	2.64	29.19	42.86	1306.27	1515.15
Sonitpur	1924110.00	42347.00	2.20	6.17	1.90	35.35	44.76	1722.72	1799.90
Kamrup	1517542.00	88665.00	5.84	4.86	3.97	40.21	48.73	2071.98	2126.30
Golaghat	1066888.00	62298.00	5.84	3.42	2.79	43.63	51.52	2336.05	2467.12
Dibrugarh	1326335.00	44961.00	3.39	4.25	2.01	47.88	53.54	2572.91	2791.43

Tinsukia	1327929.00	4337.00	0.33	4.26	0.19	52.14	53.73	3420.55	3017.47
Kamrup M	1253938.00	264897.00	21.13	4.02	11.87	56.16	65.60	4081.54	3926.15
Sibasagar	1151050.00	157890.00	13.72	3.69	7.08	59.85	72.68	4539.14	5007.31
Nagaon	2823768.00	70659.00	2.50	9.05	3.17	68.90	75.85	5481.08	5413.03
Nalbari	771639.00	82784.00	10.73	2.47	3.71	71.37	79.56	5790.19	5866.16
Bongaigaon	738804.00	35135.00	4.76	2.37	1.57	73.74	81.13	6338.59	6422.59
Barpeta	1693622.00	107827.00	6.37	5.43	4.83	79.16	85.96	7166.27	7283.54
Cachar	1736617.00	101789.00	5.86	5.57	4.56	84.73	90.53	7898.70	7939.40
Darrang	928500.00	60216.00	6.49	2.98	2.70	87.70	93.22	8463.34	8758.41
Dhubri	1949258.00	73083.00	3.75	6.25	3.28	93.95	96.50	9235.64	9446.09
Karimganj	1228686.00	40260.00	3.28	3.94	1.80	97.89	98.30		
Hailakandi	659296.00	37844.00	5.74	2.11	1.70	**100.00**	**100.00**	**76710.10**	**78262.80**
	31205576	**2231321**	**7.15**						

Plotting of Lorenz Curves :

Lorenz curve of ST and SC population has been plotted hereunder for comprehensive understanding of the inequality in its distribution with reference to the total population.





An examination of the two curves reveals that the distribution of ST population is relatively more concentrated than that SC population. When a curve of certain population group orients near the line of perfect equality, it indicates equal distribution of that group in the total population and vice-versa. A careful inspection of the above stated table-3 of ST population also reveal that almost 97 % ST population lives with the 68.9% of total population and the rest of the ST population (approximately 3%) is living with the 31.1 % of total population of Assam. On the other hand, the curve for SC (see table -4) population doesnot show such a high degree of concentration.

Gini's Coefficient (G):

G-value for ST population is found to be 0.562142788 and SC population is 0.1553 which is calculated from columns of Xiyi+1 and Xi+1Yi of table 3 and 4. The G value ranges from 0 to 1. The value approaching to 1 from 0.5 shows greater concentration and from 0.5 to 0 shows less or no concentration. In this case, ST population shows greater concentration whereas the SC population shows no concentration in the total population.

CONCLUSION

Inequality study is one of the significant segments of regional planning. Marginal group(s) of people very often faces exclusion when they concentrate with the mainstream population groups. Therefore, spatial distribution and concentration of those marginal communities need to be identified in order to formulate welfare schemes. In the other hand, concentration of marginal communities helps competent authorities to confer empowering mechanism, such as geographical autonomy or satellite autonomy. The problem stated here can be dealt with more updated methodology and analyzing tools.

NO CONFLICT OF INTEREST: There is no conflict of interest in terms of funding and collected data.

REFERENCE

Borana,S.L. and Yadav,S. K. , 2013. Study of Spatial Variation for Provision of Public Utilities Services in the Jodhpur Municipal Area using Remote Sensing and GIS Technology

Jackson, Andrew Lloyd and Davies, Carolyn A. 2010, Do differences in the administrative structure of populations confound comparisons of geographic health inequalities?

Kumar, Dr. S. Vijay, 2016.
https://www.researchgate.net/publication/308507103_Regional_Imbalances_in_India_An_Overview

Mahmood, Dr. Aslam (2006), Statistical Methods in Geography, Rajesh Publications, New Delhi

Sarma , K (2001) : Forest (ed), Geography of Assam, Rajesh Publication, New Delhi

Zheng Tian,2013.Measuring Agglomeration Using the Standardized Location Quotient with a Bootstrap Method