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## Determining the Type of Rural Settlements in some Selected Districts of West Bengal through Bernard's Method (1931)

**Dr. Rituparna Ghosh**

Assistant Professor of Geography, Raniganj Girls' College, rituparnargc@gmail.com

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### ABSTRACT

The present study is an attempt to identify the type of rural settlements in predominantly rural districts of West Bengal as per Census 2011. There were 19 districts of West Bengal in 2011. District of Kolkata is fully urbanized. The rest 18 districts have both rural and urban population. Four districts out of the 18 districts are predominantly rural in nature with 88 per cent and above rural population. The four districts selected for the present study in terms of descending order of percentage of rural population are Bankura, Koch Bihar, Purba Medinipur and Uttar Dinajpur respectively. The districts of Bankura, Koch Bihar, Purba Medinipur and Uttar Dinajpur are situated in the western, north-eastern, southern and northern parts of West Bengal. As per Census 2011, district of Bankura has 22 Community Development (C.D.) blocks, Koch Bihar has 12 C.D. blocks, Purba Medinipur has 25 C.D. blocks and Uttar Dinajpur has 9 C.D. blocks. The type of rural settlements relates to being compact, semi-compact, semi-sprinkled and dispersed. In order to identify the type of rural settlements in the selected districts Index of Concentration has been calculated using Bernard's Method (1931).

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### Introduction

In terms of rural population, the district of Bankura ranks first in the State of West Bengal with 91.7 per cent of rural population as per Census 2011. It is followed by the districts of Koch Bihar (89.7), Purba Medinipur (88.4) and Uttar Dinajpur (88.0). The districts with rural population of 80 per cent and above



are Murshidabad, Dakshin Dinajpur, Malda, Birbhum, Puruliya, Paschim Medinipur and Uttar Dinajpur respectively. The districts of South 24 Parganas, Jalpaiguri, Nadia, Darjiling, Hugli and Barddhaman have rural population between 60 and 80 per cent. The districts with less than 50 per cent of rural population are North 24 Parganas and Haora (Table No.1a and 1b).

The first four ranking districts in terms of rural population namely Bankura, Koch Bihar, Purba Medinipur and Uttar Dinajpur have been selected for the present study.

**Table No.1a.:** District-wise Rural Population of West Bengal, 2011

Name of the district	% of Rural Population (2011)
Bankura	91.7
Koch Bihar	89.7
Purba Medinipur	88.4
Uttar Dinajpur	88.0
Paschim Medinipur	87.8
Puruliya	87.3
Birbhum	87.2
Malda	86.4
Dakshin Dinajpur	85.9
Murshidabad	80.3
South 24 Parganas	74.4
Jalpaiguri	72.6
Nadia	72.2
Darjiling	67.7
Hugli	61.4
Barddhaman	60.1
North 24 Parganas	42.7
Haora	36.6
Kolkata	0.0

Source: Computed by the Author from different Census Reports.

**Table No.1b.:** Classification of Districts based on percentage of Rural Population (2011)

PERCENTAGE OF RURAL POPULATION	NAME OF THE DISTRICTS
<40	Haora
40 - 80	South 24 Parganas, Jalpaiguri, Nadia, Darjiling, Hugli, Barddhaman and North 24 Parganas
>80	Murshidabad, Dakshin Dinajpur, Malda, Birbhum, Puruliya, Paschim Medinipur, Uttar Dinajpur, Purba Medinipur, Koch Bihar and Bankura

Source: Computed by the Author.

### Previous Works

Bhore (2023) in his research paper on “Geographical analysis of dispersal index of rural settlement in Chhatrapati Sambhajinagar (Aurangabad) district using GIS techniques” has discussed about the rural settlement types in Aurangabad district. Aurangabad district has nine tehsils. The study is based on secondary data-Census 2011 and District Census Handbook. The type of rural settlements has been determined on the basis of Concentration Index using Bernard’s Method (1931). He has concluded that physical factors play a determining role for the type of rural settlements in the various tehsils.

Pagar (2021) in his research paper on “Geographical Analysis of Types of Rural Settlement in Nashik District, Maharashtra” has determined the type of rural settlements on the basis of Concentration Index. The Concentration Index has been calculated using Bernard’s Method (1931). There are fifteen tehsils under Nashik district. The study is based on Census 2011 data. He has also stated the importance of physical factors in determining rural settlement type.

The present study focusses on the determination of the types of rural settlements in four predominantly rural districts of West Bengal. The Concentration Index of Bernard 1931 has been applied for determination of the type of rural settlement in the selected districts.

### Objectives

- To identify the type of rural settlements in the four selected districts using Bernard’s Method (1931).
- To identify the reasons behind the spatial variation of the type of rural settlements.



## Materials and Methods

The present study is based on secondary data. Census 2011 data and District Census Handbook, 2011 of the different districts have been used. To identify the degree of concentration of population and to determine the type of rural settlements Bernard's method (1931) have been applied and is calculated by using the formula  $(S \times M)/N^2$ . The four selected districts are having 88 per cent and more of rural population and can be considered as predominantly rural in nature.

$$\text{Bernard's Concentration Index (K)} = \frac{S \times M}{N^2}$$

Where, S= Area of the C.D. Block in Square Kilometres

M= Total no. of rural households in the C.D. Block

N= Total no. of villages in the C.D. Block

## Study Area

Of the 19 districts in West Bengal (2011) Kolkata is completely urbanized. The remaining 18 districts have both rural and urban population. Out of the 18 districts, four districts have been selected for the present study considering their predominance in terms of rural population in the state. The districts selected for the present study in descending order of percentage of rural population are Bankura (91.7), Koch Bihar (89.7), Purba Medinipur (88.4) and Uttar Dinajpur (88.0) respectively. As per Census 2011 the district of Bankura has 22 Community Development (C.D.) blocks, Koch Bihar has 12 C.D. blocks, Purba Medinipur has 25 C.D. blocks and Uttar Dinajpur has 9 C.D. blocks. Bankura district (22°38'N to 23°38' N and 86°36'E to 87°46' E), Koch Bihar (25°57'56" N to 26°32'46" N and 88°47'40" E to 89°54'36" E), Purba Medinipur (21°38' N to 22°31' N and 87°27' E to 88°12' E) and Uttar Dinajpur (25°11' to 26°49' N and 87°49' E to 90°00' E) are located in the western, north eastern, southern and northern parts of the state respectively. Topographically the selected districts have plain lands excepting Bankura where there are some undulations.

## Results and Discussions

### Type of Rural Settlements in Bankura District

Table No.2 below show the degree of concentration of rural settlements of the District of Bankura which has been found out using Bernard's Concentration Index(K). Area of the villages in square kilometres have been denoted by S, number of rural households of the blocks have been denoted by M and number of villages in the blocks have been denoted by N. The calculated index value of all the villages is less than 1000 indicating the dispersed nature of rural settlements in the district. Settlements are dispersed in those areas where the climate is harsh, there are hilly regions, presence of extensive and thick forests, agriculturally unsuitable etc. (Hussain, 1999). Physio-graphically, Bankura district have all the characteristics and it is also drought-prone.

**Table No.2:** Calculation of Index of Concentration of the Rural Settlements of Bankura District, 2011.

C.D. Block	Area in Sq. Kms (S)	No. of Households (M)	Number of Villages (N)	S*M	N <sup>2</sup>	K
Saltora	312.62	28115	157	8789311.3	24649	356.58
Mejhia	162.87	17659	75	2876121.33	5625	511.31
Gangajalghati	366.47	37878	165	13881150.66	27225	509.87
Barjora	393.23	38664	198	15203844.72	39204	387.81
Sonamukhi	378.85	35022	186	13268084.7	34596	383.51
Patrasayer	322.62	40653	160	13115470.86	25600	512.32
Indus	254.99	37650	131	9600373.5	17161	559.43
Jaypur	263.82	34491	139	9099415.62	19321	470.96
Kotulpur	250.38	39146	169	9801375.48	28561	343.17
Vishnupur	365.73	33793	161	12359113.89	25921	476.80
Onda	502.46	53006	291	26633394.76	84681	314.51
Chhatna	447.47	38836	287	17377944.92	82369	210.98
Indpur	302.6	31668	222	9582736.8	49284	194.44
Hirbandh	190.97	17249	121	3294041.53	14641	224.99
Taldangra	349.74	31312	145	10951058.88	21025	520.86
Khatra	231.82	22505	153	5217109.1	23409	222.87
Simlapal	310.15	28324	202	8784688.6	40804	215.29
Sarenga	223.78	22020	166	4927635.6	27556	178.82
Raipur	369.92	35796	205	13241656.32	42025	315.09



Ranibandh	428.51	25953	186	11121120.03	34596	321.46
Bankura I	171.09	21917	150	3749779.53	22500	166.66
Bankura II	220.84	29502	154	6515221.68	23716	274.72

Source: Computed by the Author.

### Type of Rural Settlements in Koch Bihar District

The calculated index of concentration of the rural settlements of the C.D. blocks of Koch Bihar can be seen from Table No. 3. Two C.D. blocks have K value greater than 3600, four C.D. blocks have K value ranging between 1200 to 2400 and the rest six blocks have K value below 1200. It can be said that two blocks have compact rural settlements, four have semi-sprinkled settlements and the remaining six blocks have dispersed settlements. The district of Koch Bihar situated in the eastern Himalayan foothills is very much flood-prone, as a result most of the rural settlements are dispersed in nature.

**Table No.3:** Calculation of Index of Concentration of the Rural Settlements of Koch Bihar District, 2011.

C.D. Block	Area in Sq. Kms (S)	No. of Households (M)	Number of Villages (N)	S*M	N <sup>2</sup>	K
Haldibari	152.38	24238	62	3693386.44	3844	960.82
Mekliganj	302.07	36007	186	10876634.49	34596	314.39
Mathabhanga I	319.39	49786	102	15901150.54	10404	1528.37
Mathabhanga II	309.99	50902	93	15779110.98	8649	1824.39
Cooch Behar I	361.17	68419	143	24710890.23	20449	1208.42
Cooch Behar II	385.38	67496	111	26011608.48	12321	2111.16
Tufanganj I	317	59091	72	18731847	5184	3613.40
Tufanganj II	265.69	43430	53	11538916.7	2809	4107.84
Dinhata I	279.67	66528	130	18605885.76	16900	1100.94
Dinhata II	246.98	60896	119	15040094.08	14161	1062.08
Sitai	160.82	26647	53	4285370.54	2809	1525.59
Sitalkuchi	262.51	42587	70	11179513.37	4900	2281.53

Source: Computed by the Author.

### Type of Rural Settlements in Purba Medinipur District

On the basis of the calculated K values (Table No.4) of the different blocks of Purba Medinipur the rural settlements can be categorized into semi-compact, semi-sprinkled and dispersed. There is one C.D. block having semi-compact rural settlements, two C.D. blocks having semi-sprinkled rural settlements and the remaining twenty-two C.D. blocks are having dispersed settlements. The district of Purba Medinipur suffers from monsoonal as well as coastal flooding resulting in dispersed rural settlements in a large number of C.D. blocks.

**Table No.4:** Calculation of Index of Concentration of the Rural Settlements of Purba Medinipur District, 2011

<b>C.D. Block</b>	<b>Area in Sq. Kms (S)</b>	<b>No. of Households (M)</b>	<b>Number of Villages (N)</b>	<b>S*M</b>	<b>N<sup>2</sup></b>	<b>K</b>
Panskura	227.15	62854	229	14277286.1	52441	272.25
Kolaghat	147.91	51403	109	7603017.73	11881	639.93
Tamluk	123.5	46265	99	5713727.5	9801	582.97
Sahid Matangini	97.82	41579	86	4067257.78	7396	549.93
Nanda Kumar	165.7	59240	101	9816068	10201	962.27
Mahisadal	146.48	43433	75	6362065.84	5625	1131.03
Moyna	154.51	51938	85	8024940.38	7225	1110.72
Potashpur I	172.26	39095	139	6734504.7	19321	348.56
Potashpur II	191.74	40105	151	7689732.7	22801	337.25
Bhagawanpur I	174.24	52066	165	9071979.84	27225	333.22
Bhagawanpur II	180.2	45285	168	8160357	28224	289.13
Chandipur	137.58	37832	112	5204926.56	12544	414.93
Sutahata	79.54	25805	80	2052529.7	6400	320.71
Haldia	65.44	22385	24	1464874.4	576	2543.19
Nandigram I	181.84	41064	98	7467077.76	9604	777.50
Nandigram II	105.74	25759	40	2723756.66	1600	1702.35
Khejuri I	130.51	27554	42	3596072.54	1764	2038.59
Khejuri II	137.46	27260	99	3747159.6	9801	382.32



Contai I	155.27	37073	225	5756324.71	50625	113.71
Contai III	160.52	34342	166	5512577.84	27556	200.05
Deshopran	170.3	37078	168	6314383.4	28224	223.72
Egra I	197.9	35273	133	6980526.7	17689	394.63
Egra II	184.71	39034	117	7209970.14	13689	526.70
Ramnagar I	139.43	33450	149	4663933.5	22201	210.08
Ramnagar II	163.27	31612	137	5161291.24	18769	274.99

Source: Computed by the Author.

### Type of Rural Settlements in Uttar Dinajpur District

The calculated K values (Table No.5) of the C.D. blocks of Uttar Dinajpur have classified the rural settlements into semi-sprinkled and dispersed type. There are two C.D. blocks having semi-sprinkled and seven C.D. blocks having dispersed rural settlements. The district of Uttar Dinajpur suffers from flooding which is evident from the presence of semi-sprinkled and dispersed rural settlements.

**Table No.5:** Calculation of Index of Concentration of the Rural Settlements of Uttar Dinajpur District, 2011

C.D. Block	Area in Sq. Kms (S)	No. of Households (M)	Number of Villages (N)	S*M	N <sup>2</sup>	K
Chopra	380.82	53227	118	20269906.14	13924	1455.75
Islampur	329.44	58580	101	19298595.2	10201	1891.83
Goalpokhar I	355.11	60192	152	21374781.12	23104	925.16
Goalpokhar II	298.69	55535	170	16587749.15	28900	573.97
Karandighi	374.77	69894	203	26194174.38	41209	635.64
Raiganj	472.13	88456	222	41762731.28	49284	847.39
Hemtabad	191.82	32147	116	6166437.54	13456	458.27
Kaliaganj	301.9	49745	192	15018015.5	36864	407.39
Itahar	362.4	64607	220	23413576.8	48400	483.75

Source: Computed by the Author.

### Main Findings

On the basis of the calculated K values of the districts selected for the present study the index range have been chosen as less than 1200, 1200 to 2400, 2400 to 3600 and more than 3600 (Table No.6). K value less than 1200 indicate dispersed, 1200 to 2400 indicate semi-sprinkled, 2400 to 3600 indicate semi-compact and greater than 3600 indicate compact rural settlements. In Bankura district 100 per cent of the C.D. blocks have dispersed rural settlements, 50 per cent of the C.D. blocks in Koch Bihar district have dispersed rural settlements, in Purba Medinipur district 88 per cent of the C.D. blocks have dispersed rural settlements and in Uttar Dinajpur district 77.8 per cent of the C.D. blocks have dispersed rural settlements.

**Table No.6:** Classification of Settlements of the Selected Districts as per Bernard’s Method (1931)

Type of Settlement	Index Range	District Bankura (No. of C.D. Blocks)	District Koch Bihar (No. of C.D. Blocks)	District Purba Medinipur (No. of C.D. Blocks)	District Uttar Dinajpur (No. of C.D. Blocks)	Name of C.D. Block in Bankura with no. of villages	Name of C.D. Block in Koch Bihar with no. of villages	Name of C.D. Block in Purba Medinipur with no. of villages	Name of C.D. Block in Uttar Dinajpur with no. of villages
Compact	$\geq 3600$	-	2	-	-	-	Tufanganj I (72) & Tufanganj II (53)	-	-
Semi-Compact	2400-3600	-	-	1	-	-		Haldia (24)	-
Semi-Sprinkled	1200-2400	-	4	2	2	-	Mathabha nga I (102) & II (93), Coochbehar I (143) & II (111),	Khejuri I (42), Nandigram II (40)	Chopra (118) & Islampur (101)



							Sitai (53) & Sitalkuchi (70)		
Dispersed	<1200	22	6	22	7	All	Rest C.D. Blocks	Rest C.D. Blocks	Rest C.D. Blocks
<b>Total</b>		<b>22</b>	<b>12</b>	<b>25</b>	<b>09</b>				

Source: Computed by the Author.

### Conclusion

The rural settlements in all the C.D. blocks of Bankura are dispersed in nature with calculated index (K) below 1200. About 50 per cent of the C.D. blocks of Koch Bihar have dispersed rural settlements, about 33.3 per cent of the C.D. blocks of Koch Bihar have semi-sprinkled rural settlements and 16.7 per cent of the C.D. blocks of Koch Bihar have compact rural settlements. In Purba Medinipur district 88 per cent of the C.D. blocks have dispersed rural settlements, 8 per cent of the C.D. blocks have semi-sprinkled settlements and 4 per cent of the C.D. blocks have semi-compact rural settlements. In Uttar Dinajpur district 77.8 per cent of the C.D. blocks have dispersed rural settlements and 22.2 per cent of the C.D. blocks have semi-sprinkled rural settlements. Thus, dispersed nature of rural settlements is pronounced in all the selected districts under the present study. Among the selected districts Bankura is drought prone and the other three districts of Koch Bihar, Purba Medinipur and Uttar Dinajpur are flood prone. The geographical location combined with hazard proneness have resulted in the occurrence of dispersed rural settlements in the selected districts.

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