EUROPEAN
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Mapping peri-urbanization in a non-primate city: A case study of Burdwan, India

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Abstract:

Peri urban areas are transition zone where the urban and the rural areas meet as well as interact. Empirically, peri urban areas are lying between urban and rural zone. Identification of peri-urban areas by using one or few indicator or by any simple method poses several difficulties; and there is no consensus among the scholars about the methods to delineate this juxtaposed area. The present paper is an attempt to delineate the peri-urban area of Burdwan city. Using 8 criteria belongs to three sets of indices or determinants namely demographic, Occupational Structure and Infrastructure have been selected for delimitation process. The study finds that the linear expansion mainly towards the north-east, south-east and north west directions of the Burdwan city, especially along the Grand Trunk road. Hence, the peri-urban area is extended up to 10 kilometres from the city centre.

Key words: Peri urban, Delineation, Indicator, Direction

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INTRODUCTION:

Urbanization is a process of villages to be developed into towns and further into cities and so on. It is evident that, an exorbitant growth of population as well as the growth of urban settlement are taking place simultaneously over the last few decades. Smaller villages becoming larger villages and status being transformed to another status of settlement. Smaller towns are acquiring all urban characters. It is more prominent in the third world urbanization. There is no universally accepted definition of urban settlement. In Census of India (1961) has defined urban centres as **"Places having a minimum population of 5000 with at least 75 percent of male workers being engaged in non-agricultural activities and the density of population should be 400 persons per square kilometres"**. An important development noted in last few decades with the exorbitant growth of population as well as rapid expansion of built up areas in periphery of Indian cities. So the cities have been expanding, in a haphazard manner, beyond their administrative boundaries into the surrounding rural areas. Recently it has been noted that a finger like built up growth in the periphery of the city has been taken place due to the good transport network and the development of public services like sanitation, water supply, electricity. It is likely to be prominent along the roads connecting to the city and its hinterland settlements. As a specific and non-neutral space, a peri-urban area refers to a transition or interaction zone, where urban and rural activities are juxtaposed and landscape features are subjected to rapid modifications, induced by human activities (Douglas, 1998). So the area, which is neither rural nor urban is called peri-urban area. As Di Gaetano and Klemanski (1999), stated that on one side, as indicated by that peri-urban areas have become the den of many economic activities and also brought multidimensional changes to the destination of the middle class for residence purposes. On the other side, these

areas suffer from the negative consequences of urban growth, land use changes, rapid social change, and degradation of natural resources. Like other Indian cities, Burdwan city also experienced high level growth in the periphery of the city limits. Burdwan city has situated to the Kolkata-Asansol corridor. So, this city has experienced remarkable growth in last few decades to horizontally and vertically. As the city expanding fast, moreover it is surrounded by a populous rural area with productive and rich agricultural hinterland. So, the peri-urban edge is the most active frontier of urban development in Burdwan. With the development of the city, it becomes difficult to delineate this complex area. Different heterogeneous factors are responsible for the formation of periphery zone and villages passes through various stages nearby a city (Ramachandran, 1974). Occupational Structure, Infrastructure, land use pattern, public amenities are tested variables on these basis villages were ranked. By analyzing all these factors the territorial extent of peri urban area of Burdwan city has been prepared.

OBJECTIVE:

The main objective is to delineate the peri-urban area of Burdwan city of West Bengal state.

DATA BASE & METHODOLOGY:

For the demarcation of peri urban area, several books, reports, articles were consulted to get the overview of the study. Critical literature review, survey research methodology and case study approach are followed in this study. The present study is carried out from the years 1991 to 2011. Data for this demarcation is taken from the census of India. Census data provided useful information at the village level specially population, infrastructure and occupation. Some additional

information on the villages was derived from district statistical handbooks. An analysis is carried out at two digit level for better comparison. To fulfil the objectives of present study a sound methodology has been considered to study the Demographic Determinants, Occupational Structure and infrastructure of the study area, census data used.

For delimitation, first of all used break point distance formula for zone of influence from Burdwan city to another urban area.

$$BP = \frac{D_{ab}}{1 + \sqrt{\frac{Pop_b}{Pop_a}}} \quad \text{where } D_{ab} = \text{Distance between place a and place b}$$

From this formula, it is find out average distance is 30 km to Kalna, Katwa, Memari, Durgapur and Guskara. From there one third distance covered for buffer area from the centre of the city.

After that, composite score analysis above a cut off value used to analyse the indicators. In this method, weightage (i.e. 1 or 2) is given all the 72 villages of the 10 kilometre buffer zone in the Burdwan city. From that, only 57 villages are selected as the study area. These villages have weightage of 50 percent or above.
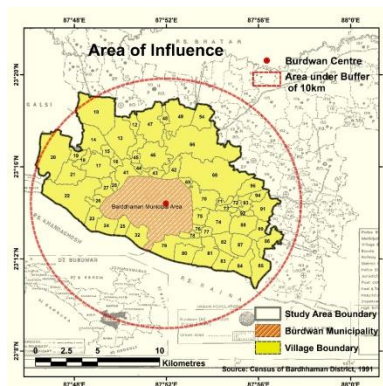

Figure 1: Buffer of 10 km from centre of city

STUDY AREA:

Barddhaman the alternative name of Burdwan has been a district capital since the time of Mughals. Later on it became a district headquarter of British India. From that, Burdwan city is capital of Barddhaman district. So, this place is of immense importance for a long era. Peri urban area of Burdwan city extends over **170** sq.km, accommodating about **158504** population. The area includes **57** villages in 7 gram panchayats of two community development blocks (C.D. Block) i.e. Burdwan I and Burdwan II. Within Burdwan I C.D. Block, there is 34 villages of 126 sq. km and 23 villages have 44 sq. km. in Burdwan II C.D. Block. It is extended between 23º 10´N to 23º 20´ N latitudes and between 87º 46´ E to 87º 58´ E longitudes. The major rivers are the Damodar and Banka. Whole area is well connected by roads (National Highway-2, Katwa road, Kalna road, Guskara road and Arambagh road) and railway network towards Howrah and Asansol division. This city is the centre of administration, transportation and education also.
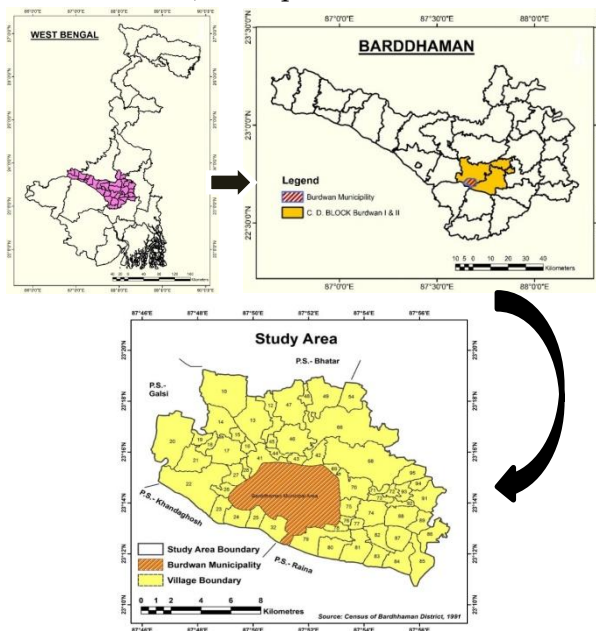

Figure 2: Boundary of the peri urban area in Burdwan city

DELIMITATION OF PERI URBAN AREA OF BURDWAN CITY:

The demarcation of peri urban area using the census data gives us appropriate results. The peri urban area consists of two types of administrative areas: (a) census towns and (b) gram panchayats or revenue villages. Close to the Burdwan city, the smaller census towns, in particular, tend to lose their geographical identity and to get to be part of Burdwan city. The study reveals that there are some common factors which may be taken as indicators of urban influence to nearby countryside. So this will rather wise step to decide the indicators of peri urban area delimitation. These basic factors to delimit the peri urban area are demographic features, socio-economic development and availability of public services and proportion of the non-agricultural population. To fix the territorial extent of peri urban of peri urban area, three determinants have been selected.

The three sets of indices for delineating the peri urban area of the Burdwan city are as follows:

1. Demographic Features:
i) Population density
ii) Decadal growth rate
iii) Literacy rate

2. Occupational Structures:
i) Female workers
ii) Non-agricultural workers

3. Infrastructure
i) Market availability
ii) Black topped road
iii) Bus services

1. Demographic Features: The following determinants are selected from the demographic structure to demarcate the peri urban area of Burdwan city.

Population density: The density of population is a good index of the measurement of the influence of the city. Both skilled and unskilled rural population is forced into Burdwan city for education, employment and other utility services but cannot afford to pay for high rent and reside in the periphery of the city at a commutable distance. The mean density of study area is 1271 persons per sq. km. (Census of India 2011). This average density has been taken as the lower mark for fixing the inner or outer limit of peri-urban area. It has seen that about six villages have the population density of 2000 persons per square kilometre.
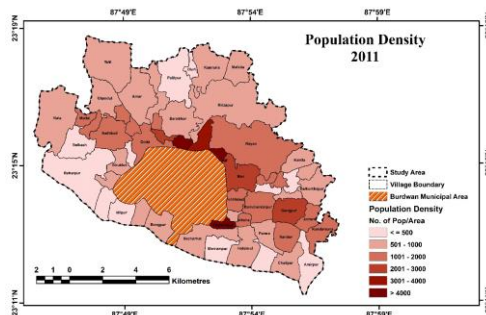

Figure 3: Density of population of the year 2011
Source: Census of India 2011

Decadal growth rate: Like density, decadal population growth is also an important factor for delimiting the peri-urban area. 29 percent growth during the year 2001-11 has been taken to fix inner or outer peri-urban area. The selection of the value based on the average growth of villages.10 out of 57 villages are above the 50 percent or more growth during this period. There is a greater tendency for increase of growth to nearby villages of Burdwan city.
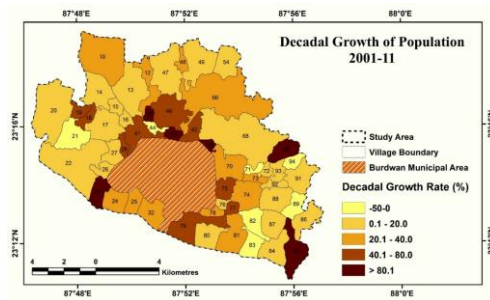
Figure 4: Decadal growth rate of population from 2001-2011
Source: Census of India 2001 and 2011

Literacy rate: It has observed that the area nearer the city will be more educated and literate than those further away. About 66 percent literacy is cut off between inner and outer peri-urban area of Burdwan city. The highly educated society of the city affecting and transforming the traditional and old living style of the villages. About 15 villages are above 70 percent literacy rate in peri urban area of Burdwan city. The intensity of literacy is more villages lying in the orbit of the city than distant villages.
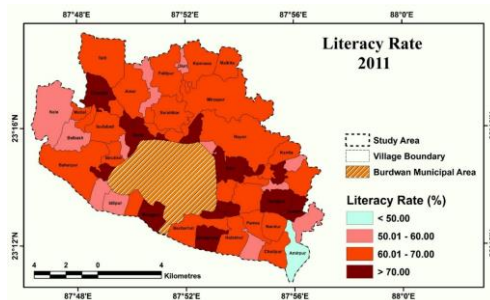

Figure 5: Literacy rate of the year 2011
Source: Census of India 2011

2. Occupational Structures:

Occupation is one of the important characteristics in peri urban area. People nearby to Burdwan city are engaged in non-agricultural activities. These habitats live in periphery areas of

the city which are classified as rural but they are not engaged in agricultural activities.

Female workers: Female work participation is one of the key determinants to demarcate the peri-urban area of Burdwan city. Continuous migration of the population from the rural areas to the city and nearby villages in search of employment has engaged women in different works. 26 percent female work participation has been selected as an index to the extent of inner or outer peri-urban area. Villages located far from the city have more female work participation. Because these people came to city for different domestic working places. Some villages named like katrapota, amirpur, baharpur, kantia and diuri have high work participation. Higher the female work participation is higher the women empowerment.
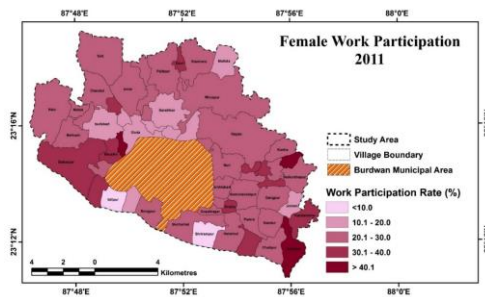
Figure 6: Female work participation rate of the year 2011
Source: Census of India 2011

Non-agricultural workers:

Non- agricultural workers are one of the important attribute of the occupational structures of peri urban area of Burdwan city. In fact, a significant percentage of non-agricultural workers in the working population of village areas is an inferential measure of urban influence.The mean percentage of workers engaged in non-agricultural workers of per-urban area is 33%. Villages having the greater share than the average indicates that inner peri-urban as they show a higher degree of urban influence. After plotting the data on map, the distribution of

non-agricultural population has expansion towards north west, north east and west direction. So far, 26 villages come under above 33 percent workforce in non-agricultural activities. So this determinant gives a satisfactory result to demarcate the peri urban area of Burdwan city.
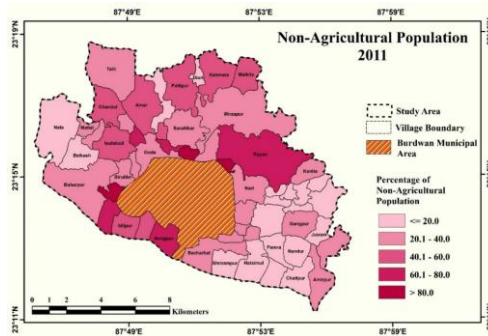
Figure 7: Non-agricultural population rate of the year 2011
Source: Census of India 2011

3. Infrastructure:

Infrastructural development is the major threshold area on which development depends upon in an area. The expansion of and optimization of infrastructure have been a matter of concern for administrators. These infrastructure development are not in proportion to phenomenal growth of population and the expansion of city. Here three type of infrastructure taken as consideration for the demarcation of peri urban area of Burdwan city.

Market availability:

Availability of market is one of the major index to demarcate of peri-urban area. Within 1 km distance from the village has more influence than the distant market area. About 15 villages have less than 1 km distance market availability. So within 1 km distance village market availability has considered as inner peri urban.
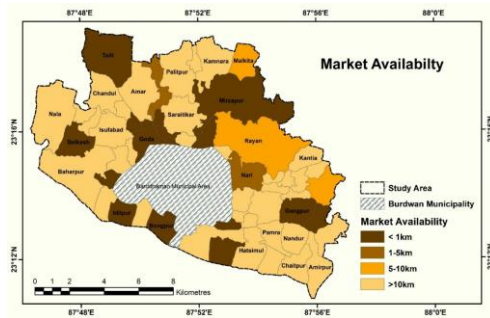
Figure 8: Market availability of the year 2011
Source: Census of India 2011

Black topped road: Roads are one of the significant factor for urban growth. Availability of black topped road has increased accessibility towards city. As road network grows and decay over time, they evolve into a variety of spatial patterns. Good road have link the villages with markets, administrative area and nearby city. Most of the villages have black topped road within 1 km radius. So that, road within the village has taken into consideration for inner peri-urban area.
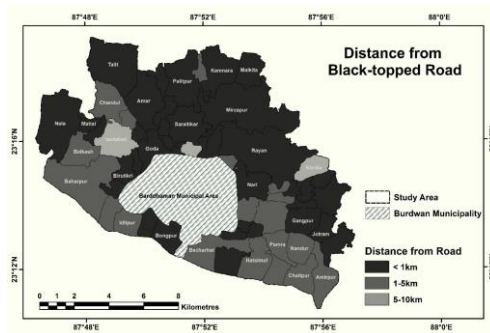
Figure 9: Distance of black topped road in villages of the year 2011
Source: Census of India 2011

Availability of Bus services: This service has been very widely used in the delimitation of peri-urban area because there is a close interaction between the city and the flow of traffic on roads focused on it. It is evident from the traffic flow and traffic volume that Burdwan- Katwa, Burdwan-Kalna, Burdwan-Memari, Burdwan-Guskara, Burdwan-Durgapur etc.

are prominent routes showing high intensity of bus traffic flow. Most of the villages connected with good bus services. So villages with bus services has considered as inner per-urban.
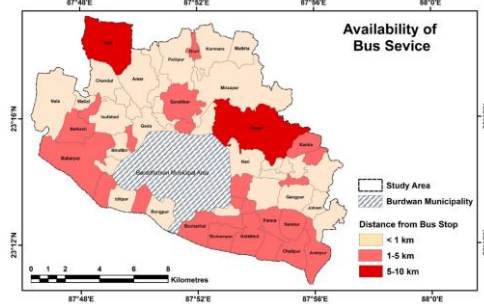
Figure 10: Availability of bus services in villages of the year 2011
Source: Census of India 2011

Correlation Analysis: As a measure of intensity of degree of relationship between two variables, Karl Pearson developed a formula called correlation coefficient.

In this study correlation analysis has been done to understand the relationship between the distance from city centre and different determinants viz. literacy rate, non-agricultural workers, decadal growth rate and female workers.

Sl No.	Variables	Correlation Values
1	Literacy rate	-0.2
2	Non-agricultural workers	-0.44
3	Decadal growth rate	-0.31
4	Female workers	+0.3

Table 1: Correlation of different indicators

Above table reveals that there exists negative correlation between the distance from the city and literacy i.e. **r = − 0.2**. It is quite convincing also that with the increasing distance the literacy level decreases.

Correlation between the distance and non-agricultural workers is equal to **r = - 0.44**. It is evident that decrease in

percentage of non-agricultural workers with the increasing distance from the city limits.

Correlation between distance from the city and decadal growth rate is **r = - 0.31**. It is clear from the table that with the increasing distance from the city the decadal growth rate goes on decreasing.

Another correlation between distance and female workers is to **r = 0.3.** These two variables are positively correlated with each other. It shows that there is almost corresponding increase in female workers with increasing distance from city centre

Extent of peri urban area of Burdwan city:

The villages beyond the limits of a rapidly growing Burdwan city undergoes a process of change in physical as well as socio-economic. This area has predominantly active in non-agricultural activities. All the above indicators are plotted on the map by analysing the composite score analysis. There is a zone where most of the variables subsist in the space where as some villages are co-existing of few indicators. All those villages which have fulfilled at least four indices from above analysis are included in peri urban area of Burdwan city. Among four indicators one from demographic, one from the occupational structure and two from infrastructure. Delimited on the basis of above characteristics discussed above, 57 villages with an area of 170 square kilometres consist of peri urban area of Burdwan city. This area extends from 3 km to 10 km from the centre of the city. The peri urban area of Burdwan city, which demarcated, subdivided into two categories (i) inner and (ii) outer peri urban area according to the indices.
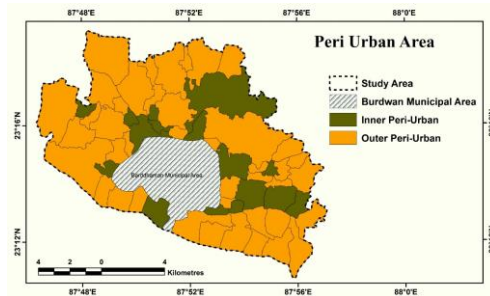
Figure 11: Inner and Outer peri urban area
Source: Census of India 2011

Villages having 75 percent and above weightage included in inner peri urban area where as below 75 percent included in outer peri urban area. Among the study area, 16 villages have considered inner peri-urban area. Remaining 41 villages are marked as outer peri-urban area. Actually, this inner peri urban area is intimately connected to the city and has the potential of high growth. This zone has rapid unplanned growth through the settlement area. On the hand, outer peri urban area has more agricultural land. Also less developed in comparison to inner peri urban area. At the same time, they are not only facing tremendous change in their population growth, economic structure but also endured unplanned growth of built up area which has created various in the orbit of the city.

Conflict of Interest: Authors have no conflict of interest

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Appendix: WEIGHTAGE OF INDICATORS AND COMPOSITE SCORE ANALYSIS

		INDICATORS												
		Demography						Occupational Structure				Infrastructure			
JL No.	Village Name	Population Density (<1271:1 or >1271:2)		Decadal growth rate (<29%:1or>29%:2)		Literacy rate (<66%:1 or 66%>2)		Female Workers (>26%:1 or <26%:2)		Non-Agricultural Workers (>33%:1 or <33%:2)		Market availability (NO 1/ YES 2)	Black Topped Road (No1/Yes 2)	Bus Services (within 1 km.) (Available 2 or NA 1)	Composite Score
10	Talit	743.4	1	26.3	1	65.73	1	22.5	1	33.85	2	2	2	1	68.75
12	Nutangram	785.2	1	22.67	1	59.63	1	21.76	1	19.7	1	2	2	2	68.75
13	Amar	693.4	1	13.1	1	65.34	1	27.2	2	45.9	2	1	2	2	75
14	Chandul	672.6	1	16.9	1	73.34	1	25.1	1	50.7	2	1	1	2	62.5
15	Jhinguti	1073.5	1	11.6	1	67.48	2	39.5	2	35.7	2	1	1	2	75
16	Nababhat	1107	1	5.6	1	80.50	2	12	1	64.5	2	2	2	2	81.25
17	Isufabad	1201	1	13.8	1	69.59	2	18.5	1	46.9	2	1	1	2	68.75
18	Kashimpur	1167.7	1	74.9	2	61.38	1	24.94	1	35.98	2	1	1	1	62.5
19	Matial	1977.8	2	49	2	66.39	2	26.3	2	28.4	1	1	2	2	87.5
20	Nala	519.6	1	8.6	1	56.16	1	26.4	2	18.98	1	1	2	2	68.75
21	Belkash	303.3	1	-30.46	1	58.44	1	23	1	10.5	1	2	1	1	56.25
22	Baharpur	310.8	1	4.3	1	68.06	2	37.5	2	39	1	1	1	1	62.5
23	Khargeswar (P)	284.6	1	109.8	2	57.84	1	35.5	2	64	2	1	1	1	68.75
24	Idilpur (P)	138	1	39.7	2	54.90	1	4.4	1	52.9	2	2	1	2	75
25	Fakirpur	669	1	20.9	1	64.79	1	17	1	53.8	2	1	2	1	62.5
26	Kanchannarar (P)	775.5	1	14.4	1	79.01	2	21	1	80.7	2	2	2	2	81.25
27	Birutikri	617.7	1	13	1	65.17	1	31.1	1	38.2	2	1	2	2	68.75
28	Katrapota (P)	99	1	45.1	2	52.70	1	48.7	2	24.4	1	1	2	1	68.75
32	Bongpur (P)	894	1	24	1	71.82	2	20.4	1	71	2	2	2	2	87.5
41	Goda	1425	2	49.1	2	76.14	2	17.4	1	30.7	1	2	2	2	87.5
42	Bahir Sarbamangala	3937.4	2	43.7	2	70.18	2	17.4	1	30.8	1	2	2	1	81.25
43	Krishnapur	11072	2	83.5	2	62.99	1	16.8	1	82.9	2	1	2	1	75
44	Jotgoda	2119	2	0	1	68.36	2	16.9	1	68.9	2	2	2	2	87.5
45	Bidebhala	1405	2	109.8	2	61.27	1	29.04	2	53	2	2	2	2	93.75
46	Saraitikar	815	1	45.7	2	69.52	2	19.1	1	23.9	1	1	2	1	68.75
47	Palitpur	423	1	19.6	1	61.99	1	21.04	1	44.4	2	1	2	2	68.75
48	Diuri	416.5	1	27.1	2	56.74	1	38.1	2	15.6	1	1	1	1	62.5
49	Kamnara	515	1	11.3	1	69.31	2	21.5	1	43.9	2	1	2	2	75
54	Malkita	985	1	17	1	69.69	2	17.2	1	41.7	2	1	2	2	75
66	Mirzapur	665.4	1	30.8	2	66.21	2	25.35	1	24.5	1	2	2	2	81.25
68	Rayan	1746	2	12.5	1	68.64	2	20.4	1	60.1	2	1	2	1	75
69	Sadhanpur (P)	4197	2	112.9	2	57.82	1	22.8	1	92.5	2	1	1	1	68.75
70	Nari	2708	2	28.1	2	79.59	2	21.9	1	33.9	2	1	2	2	87.5
71	Kalyanpur	1151	1	-17.4	1	75.25	2	37.1	2	14.8	1	1	1	2	68.75
72	Nandara	1599	2	12.7	1	69.32	2	33.3	2	15.6	1	1	2	2	81.25
73	Dangachha	493	1	27.9	2	61.19	1	30	2	15.9	1	1	1	2	68.75
74	Bamchandaipur	1434.8	2	32.7	2	67.96	2	29.2	2	18.4	1	1	1	2	81.25
75	Ichhlabad (P)	1484	2	74	2	65.41	1	25.45	1	39.4	2	1	1	1	68.75
76	Kanainatshal (P)	798.2	1	18	1	73.45	2	25.4	1	34.8	2	1	2	1	68.75
77	Alisha	1318	2	64.3	2	79.53	2	33.3	2	35.1	2	1	2	1	87.5
78	Gopalnagar (P)	4404	2	38.9	2	77.52	2	21.65	1	35.6	2	2	2	2	93.75
79	Becharhat (P)	559.8	1	52.2	2	61.90	1	20.6	1	25.6	1	1	1	1	56.25
80	Shrirampur	151.2	1	8.94	1	80.35	2	9.16	1	17.9	1	2	2	1	68.75
81	Hatsimul	504.5	1	25.8	1	60.19	1	28	2	13.3	1	1	1	1	56.25
82	Pamra	911.4	1	-17.8	1	64.96	1	27.6	2	15.6	1	1	1	1	56.25
83	Kanthalgachhi	268	1	-18.1	1	57.96	1	35.04	2	6.4	1	1	1	1	56.25
84	Chaitpur	618	1	7.04	1	66.72	2	23.4	1	5.4	1	1	1	1	56.25
85	Amirpur	199	1	126.6	2	41.34	1	44.7	2	24	1	1	2	1	62.5
86	Kandarsona	1272	2	9.6	1	59.99	1	35.8	2	20.4	1	1	2	2	75
87	Nandur	1086	1	6.9	1	62.62	1	29.5	2	12.9	1	1	1	1	56.25
88	Gangpur	2258	2	8.34	1	75.31	2	22.2	1	27.8	1	2	2	2	81.25
89	Jotram	1312	2	-13.52	1	72.70	2	18.6	1	19.9	1	2	2	2	81.25
91	Baikunthapur	941.3	1	9.02	1	64.73	1	27.3	2	13.1	1	1	2	2	68.75
92	Aswatthagaria	909.6	1	16.7	1	55.07	1	38.6	2	12.2	1	1	1	1	56.25
93	Naopara	476	1	10.85	1	72.92	2	25.64	1	13.7	1	1	2	2	68.75
94	Syamsundarpur	892	1	-10.85	1	56.41	1	41.4	2	7.6	1	1	1	1	62.5
95	Kantia	969	1	122.7	2	63.47	1	29.8	2	31.4	1	1	1	1	62.5