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Nearest Neighbour Analysis of Bassi Tehsil (Jaipur Rural)

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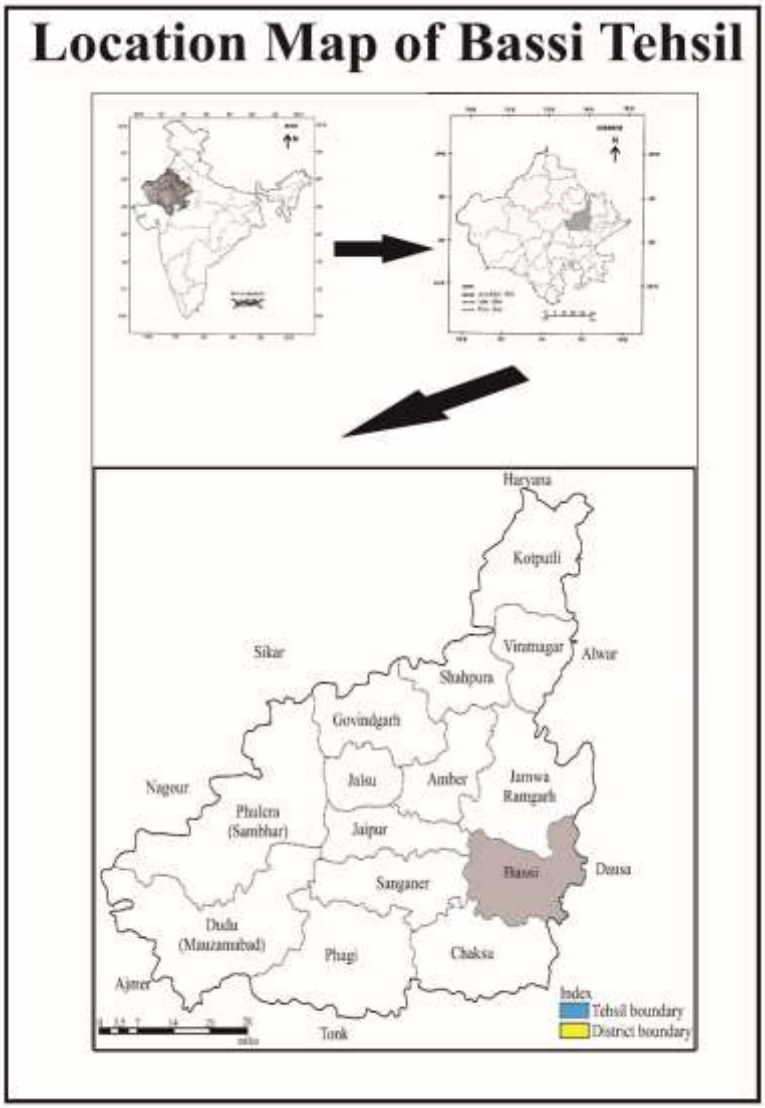
1. **Introduction:-** Among the seven stages of human evolution (Dryopithecus, Australopithecus, Ramapithecus, Homo habilis, Homo erectus, Homo neanderthalensis, and Homo sapiens sapiens) the Homo habilis humans (33 lakh to 14 lakh years ago) were first inhabitants, who made early permanent settlements like caves. The earliest geographical evidence of human settlement was *Jebel Irhoud*, where early modern human remains of eight individual date back to the Middle Paleolithic around 3,00,000 years ago. The city of Damascus (Syria) is considered to be one among the oldest continually inhabited cities in the world as early as 8,000 to 10,000 B.C. and the oldest metro city is London (U.K.). From this history to Tokyo (Japan; the largest populated city of the world); the study of settlements has an important role in Geography. The nearest neighbour analysis helps us to analyse the distribution of human settlements. It measures the spread or distribution of something over a geographical space. It provides a numerical value that describes the extent to which a set of points are clustered or uniformly spaced. We use it to determine whether the frequency with which something is observed spatially is comparable with other locations.
2. **Study Area:-** Bassi tehsil is situated in south-eastern part of Jaipur rural district among $26^0\ 40^l$ N to $26^0\ 58^l$ N and $75^0\ 54^l$ E to $76^0\ 13^l$ E in shape of irregular rhomboid and 0.28% of the state in area. It can be divided into two physical divisions like Aravali mountains and plains. Aravali hills are scattered in the middle of plain which are formed during Silurian and Devonian periods and its rocks were formed during precambrian period. Lalgarh, Nainath, Dhula, Nayla, Jhar, Hardi, Kuthada, Ghata, Bhojpura, Banskho and Benada are small hills of tehsil. The highest peak is 572m high, situated near Todabhata village in the middle of tehsil area. While plains are part of Tethys ocean. In Aravali region there are inseptisol soils while Alluvial soil is spreaded all over the plains. It is 300-430 m high above the sea level.

The climate of Bassi tehsil is subtropical semi-arid monsoony with a rainy season that runs from approximately from mid-June to September due to monsoon and a dry season from October to early June. In winters, from December to mid-March nights are cool and sometimes even cold, in January, 2011 the temperature dropped to 1.4^o C. In addition, from November to February, fog can be formed at night and in early morning, although more rarely than in Ganges plain. From mid-March to mid-June, before the monsoon, it is very hot, the temperature can reach or exceed 45^0 C. It reached 47^0 C in May, 2024. The highest temperature ever recorded was 49^0 C on May 23rd, 1994. Average precipitation amounts to 56.5 cm per year. It ranges from 3mm in the driest month (November) to 19 cm in the wettest one (August). It is located in '*cwg'* type climate zone according to Koppen, 'DA^lW' type climate zone according to Thornthwaite and '*caw'* type climate zone according to Triwartha. Wind speed ranges from 3 to 10.9 km per hour during the year but average wind speed is 7.6 kph. It is

situated in 'III-A Agro-climatic zone' (semi-arid eastern plain) among the 10 Agro-climatic zones of Rajasthan.



Dhund, Ratan ganga, Jatwada and Ban ganga are major rivers of drainage system. There are scattered deep ravines in some parts of the tehsil; mostly in north-eastern part. Kanota dam, Nayla pond, Borai pond, Bassi pond, Toonga pond are small water reservoirs situated here. Dolomite, Glass sand, Silicon, Sand stone, concrete gravel are major minerals found here. Average ground water table is 14m (46[l]) here. NH-21, SH-2 and SH-24 are major roadways in the tehsil.

According to administrative point of view this tehsil is further divided into 44 gram panchayats and 212 revenue villages in which 206 villages are inhabited and 6 are uninhabited. Kanota, Bassi, Jhar, Banskho, Jatwara are major railway stations. Occupational structure is like this- farmers are 51.59%, agricultural laborers are 6.59%, laborers engaged in domestic industries are 2.23%, laborers engaged in other occupations are 39.59% while total working population is 33.2%, non-working population is 59.4% and marginal workers are 7.4%. According to census of Bharat demographic structure of tehsil – literacy rate is 57.35% sex ratio is 924, S.C. population is 20.55%, S.T. population is 32.23%, density of population is 433 persons/km^2, population growth rate is 23.5%; religious structure – Sanatanies are 99.23%, Muslims are 0.46%, Christians are 0.02% and others are 0.27%.

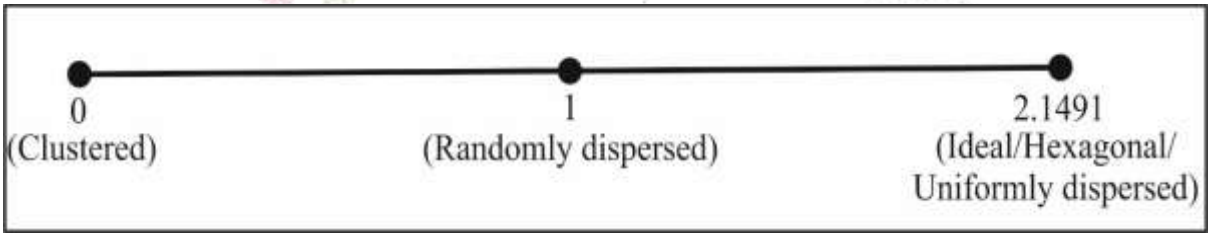
2118 hectare land is covered by natural vegetation. Land under forest is 3.48%, land available for agriculture is 12.98%, land under scattered hills is 1.82%, barren land is 4.35%, land under non-agricultural use is 6.22%, pasture land is 7.23%, cultivable barren land is 4%, current fallow land is 6.32%, old fallow land is 6.01%, agriculture land is 59.56% and cropping intensity is 153.83%. Wheat, Barley, Bressica, Mustard, Gram, Radish, Carrot, Beetroot, Spinach, Coriander are major crops of Rabi season; Pearl millet, Sorghum, Moong, Cowpea, Okra, Bitter gourd, Bottle gourd, Pumpkin are major

crops of Kharif season; cucumber, watermelon, Muskmelon are major Jayad crops cultivated in Bassi Tehsil. Buffalo, cow, goat, sheep, camel, Poultry and pigs are raised here.

3. **Methodology:-** A history of NNA in academic geography begins with the mid- 1950s article by Clark and Evans (1954), published in the journal Ecology, specifying an innovative method for quantifying the spatial distribution of a given community of plants (or possibly animals) within a given area. As they argued, it is helpful for researchers to be able to measure to quantify whether such a distribution displays either clustering, wherein individual members appear to clump together into one or more clusters, or regularity, wherein individuals appear to be regularly or evenly spaced apart from one another. Putting another way, the objective is to decide the extent to which a distribution departs from randomness or no discernable pattern in the direction of either clustering or regularity, since such departures suggest the operation of "underlying forces active in the formation of particular patterns" (Clark and Evans 1954, p. 446). Randomness was here defined as occurring when every individual or "point" in a distribution "has … the same chance of occurring on any sub- area as any other point," every sub- area (however exactly defined) within the overall area possesses an equal chance of "receiving a point," and when "the placement of each point has not been influenced by that of any other point" (Clark and Evans 1954, p. 446). In situations where "equal chances" are not the case and where points are influencing the position of each other, then "underlying forces" will likely be at work inflecting the distribution toward either clustering or regularity. The formula of NNA was further developed and modified by Warren and Robinson; and M.F. Dessy used it in academic geography. The formula of NNA is-

$$\left[R_N = \frac{\gamma^{0-}}{0 \cdot 5\sqrt{\frac{A}{N}}} \right]$$

Where, R_N= nearest neighbour value,
r^{o-} = mean observed nearest neighbour distance,
0.5= constant,
A = area,
N = total number of settlements.



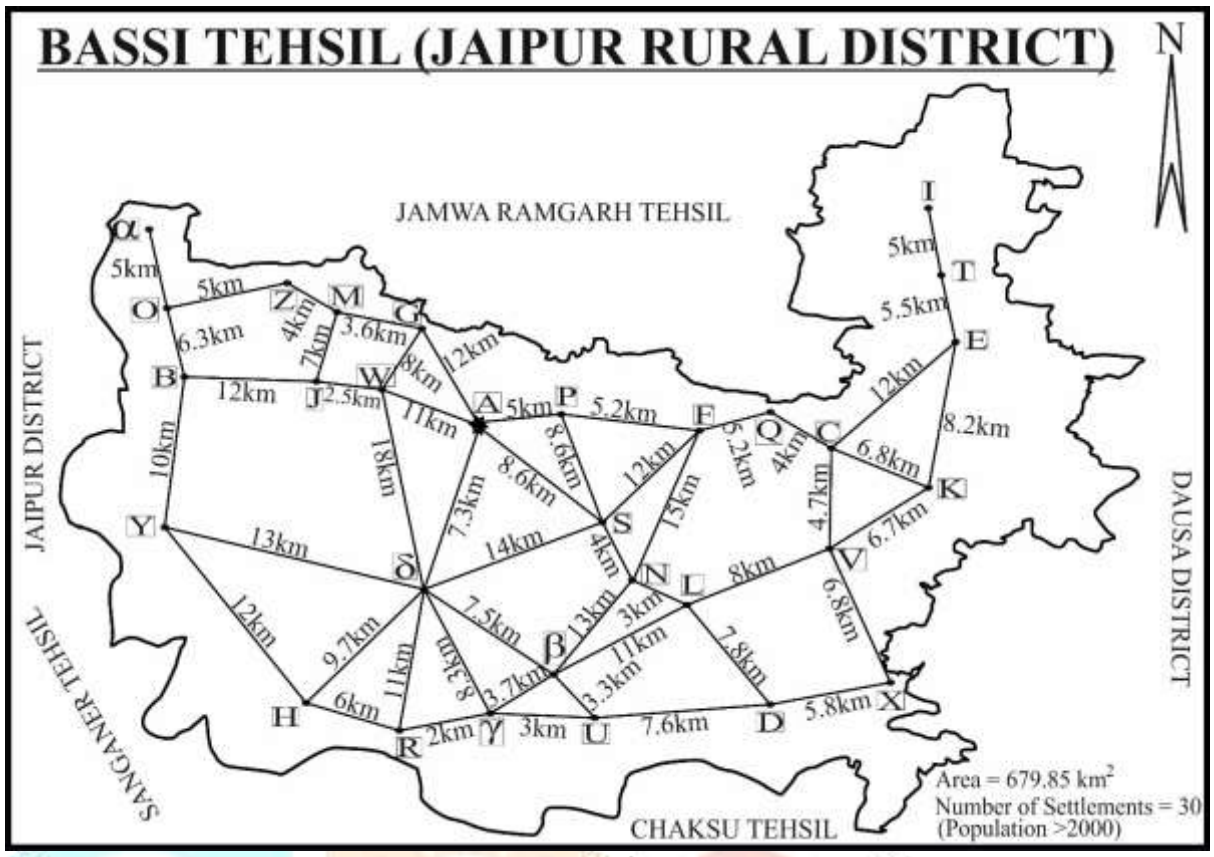
R_N Value	Pattern
0.00-0.09	fully congested
0.10-0.50	high concentration
0.51-0.99	clustered
1.00-1.19	Random
1.20-1.49	approaching uniform
1.50-2.1491	dispersed
2.1491-2.15	hexagonal

4. **Nearest Neighbour Analysis of Bassi Tehsil:-** Bassi tehsil lies under urban sprawl of Jaipur city. A lot of colonies are being developed by real state groups and there are many farmhouses; that is why settlement scenario is very scattered. So those settlements are selected which have population more than 2000 according to census of Bharat, 2011; as below :-

Settlements of Bassi Tehsil having population >2000

S. No.	Code	Settlements (Population >2000)	Population	S. No.	Code	Settlements (Population >2000)	Population
1	A	Bassi	26029	16	P	Mohanpura	2859
2	B	Kanota	11250	17	Q	Khori	2418
3	C	Baskhoh	11150	18	R	Moondli	2394
4	D	Toonga	6886	19	S	Todabhata	2361
5	E	Jatwara	6196	20	T	Tahatara	2358
6	F	Jhar	4683	21	U	Danau Kalan	2319
7	G	Bainara	4210	22	V	Rajpura Patalwas	2300
8	H	Sambhariya	4167	23	W	Mangarh Khokhawala	2223
9	I	Barwa	3747	24	X	Madhogarh	2198
10	J	Mansar Kheri	3662	25	Y	Sindoli	2189
11	K	Patan	3365	26	Z	Kuthara Khurd	2180
12	L	Garh	3332	27	α	Dyodha Chor	2162
13	M	Ghata	3087	28	β	Khatepura	2061
14	N	Lalgarh	3002	29	γ	Deogaon	2054
15	O	Vijai Mukundpura @ Hirawala	2953	30	δ	Shyampura Kacholiya	2047

Source : Census of India (2011)



Sum of Distances of Different Settlements From Nearest Neighbour			
S. No.	**Settlements (Population >2000)**	**Code of settlements according to map**	**Distance (in km)**
1	Bassi	distance of 'A' from nearest neighbour is	5.0
2	Kanota	distance of 'B' from nearest neighbour is	6.3
3	Baskhoh	distance of 'C' from nearest neighbour is	4.0
4	Toonga	distance of 'D' from nearest neighbour is	5.8
5	Jatwara	distance of 'E' from nearest neighbour is	5.5
6	Jhar	distance of 'F' from nearest neighbour is	5.2
7	Bainara	distance of 'G' from nearest neighbour is	3.6
8	Sambhariya	distance of 'H' from nearest neighbour is	6.0
9	Barwa	distance of 'I' from nearest neighbour is	5.0
10	Mansar Kheri	distance of 'J' from nearest neighbour is	2.5
11	Patan	distance of 'K' from nearest neighbour is	6.7
12	Garh	distance of 'L' from nearest neighbour is	3.0
13	Ghata	distance of 'M' from nearest neighbour is	3.6
14	Lalgarh	distance of 'N' from nearest neighbour is	3.0
15	Vijai Mukundpura @ Hirawala	distance of 'O' from nearest neighbour is	5.0
16	Mohanpura	distance of 'P' from nearest neighbour is	5.0
17	Khori	distance of 'Q' from nearest neighbour is	4.0
18	Moondli	distance of 'R' from nearest neighbour is	2.0
19	Todabhata	distance of 'S' from nearest neighbour is	4.0
20	Tahatara	distance of 'T' from nearest neighbour is	5.0
21	Danau Kalan	distance of 'U' from nearest neighbour is	3.0
22	Rajpura Patalwas	distance of 'V' from nearest neighbour is	4.7
23	Mangarh Khokhawala	distance of 'W' from nearest neighbour is	2.5
24	Madhogarh	distance of 'X' from nearest neighbour is	5.8

25	Sindoli	distance of 'Y' from nearest neighbour is	10.0
26	Kuthara Khurd	distance of 'Z' from nearest neighbour is	4.0
27	Dyodha Chor	distance of 'α' from nearest neighbour is	5.0
28	Khatepura	distance of 'β' from nearest neighbour is	3.3
29	Deogaon	distance of 'γ' from nearest neighbour is	2.0
30	Shyampura Kacholiya	distance of 'δ' from nearest neighbour is	7.3
		Sum of distances of settlements from their nearest neighbour is	137.8

Calculation of NNA:-

$$\left[R_N = \frac{\gamma^{0-}}{0 \cdot 5\sqrt{\frac{A}{N}}}\right]$$

$$R_N = \frac{\frac{137 \cdot 8}{30}}{0.5\sqrt{\frac{679 \cdot 85}{30}}}$$

$$R_N = \frac{4 \cdot 5933}{0 \cdot 5\sqrt{22 \cdot 66}}$$

$$R_N = \frac{4 \cdot 599}{0 \cdot 5 \times 476}$$

$$R_N = \frac{4599}{2 \cdot 38}$$

$$R_N = 1 \cdot 9299$$

5. **Conclusion:-** The R_N value of nearest neighbour is 1.9299 that means the thirty settlements which have population above 2000, according to census of India 2011 are distributed in dispersed pattern which is near to ideal hexagonal pattern. This result represents the uniform dispersion of settlements.