European Journal of Applied Sciences – Vol. 9, No. 6
Publication Date: December 25, 2021
DOI:10.14738/aivp.96.11176.
Binda, V., & Chharang, S. (2021). A Spatial Analysis of Settlement Pattern of Jakham River Basin in Pratapgarh District, Rajasthan. European Journal of Applied Sciences, 9(6). 102-111.

A Spatial Analysis of Settlement Pattern of Jakham River Basin in Pratapgarh District, Rajasthan

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ABSTRACT

In the recent era, in geographical studies, the spatial analysis of settlement has an essential place of research. The focus of the study, to relate settlements to their locational arrangement and their connection with each other. The evolution of settlement patterns in an area is governed by several factors, i.e. physical, cultural, etc. Hence, varied ways in the spatial distribution of settlement are found. In this research paper, the author uses the Nearest Neighbourhood Analysis technique for study. Generally, concentration is located in and around the city centre, and concentration continuously decreases as we go away from the city centre. But in this case of the above research of the Jakham river basin in Pratapgarh district, the situation is reverted. It noticed that uniformity is found in the concentration level and distribution pattern all over the district except in the North-western plain.

Key Words: Spatial Analysis, Habitat Pattern, Nearest Neighbour Analysis, Jakham River Basin.

INTRODUCTION

HABITAT is "the natural abode of a plant or animal". In the ecological process, each organism tries to adapt and habituate itself in the prevailing natural environment. The habitat has been defined as the "native environment of animal or plant, the kind of place that is natural for the life and growth of an animal or plant." It also means a physical environment that is conducive to the growth and multiplication of a particular living organism or species. Habitat is thus a locality where an organism lives, grows and activates. Therefore, the concept of habitat has a much broader perspective dealing with various aspects of the association between species and its environment. It does not merely concern with the dwelling place or house of an organism. It is also concerned with the environment around it. The entire process of postulating the natural environment for habitation in a region thus falls under the scope of habitat.

Man has been the most dominant and powerful creature of all the species and has been able to adjust himself to the environment better. There are three essential aspects of human habitation. (1) First is the natural environment like climate, physiography, soil vegetation, etc., which affect man's biological survival and adjust for necessities like food, shelter, and production or growth.

(2) The next is the socio-economic environment, like family, religion, caste, custom, employment, etc., which is needed to satisfy his personal needs.

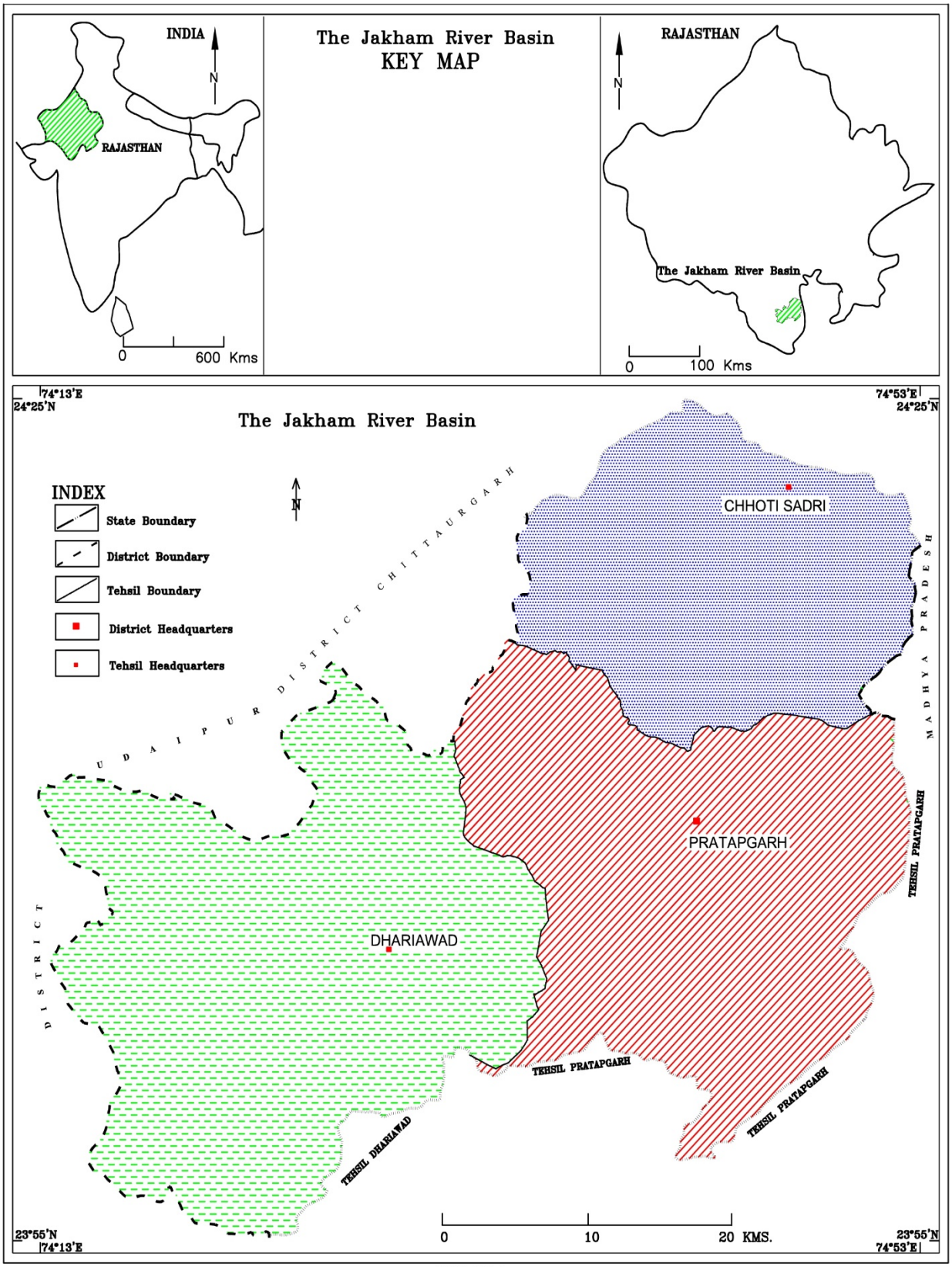
(3) The third one is materialistic or technological aspects, through which man draws benefits from the natural environment to satisfy his basic needs.

REVIEW OF LITERATURE

During recent years focus of studies have been concentrated on the distributional pattern of settlements in a region. The pioneering work in this direction was done by German Geographer, Christaller (1933), who suggested that settlement patterns follow a definite principle. There is a high degree of correlation between the size of the service centers**.** Matui, a Japanese geographer, did good work on quantitative rural settlements geography in 1932. Some other geographers who also worked on this topic are Chambers, R. 2013, Michael, P. (Ed.),(2013), Mitchell, B.(1979), Sabins, F. (1978), Simons, I.G. (1981), Smith, R.W, Taeffe, E.J and King, L.J (1969), Webb, J.M. (1959). In India Despande, S.M. Ali, Ahmad, R.L. Singh, (1976), A.B. Mukerjee, (1970), Lahiri, (1971), Bhat, L.S. (1972), **N. Thakur,** Mandal, R.B. (1979), **R.N. Mishra (1981),** Kumar, A. (1986), Jain, P.C. (1989), **Prachi Shastri,** R.B. Mandal, (2001), Monika Roat, Roy, Dulal Chandra & Thomas, B. (2014) and Sharma P.K. (2015) published good research work on a rural area in India. According to Donglass, the size and spacing of settlements depend upon three principle items: a) The agricultural prosperity, b) Surface configuration, and c) Historical habits.

STUDY AREA

The maximum portion of the Jakham river basin is found in the Pratapgarh District of Rajasthan in India. The extension of this river basin is between 23° 55' to 24° 25' North latitude and 74° 13' to 74° 53' East longitude covering an area of 1812sq km and 382 villages in Pratapgarh District. (Map No. 1). The Jakham dam is also built on this river to fulfil the demand for irrigation. This dam is located in Pratapgarh Tehsil and is built on the Jakham river, which originates from a Jakhamia village. This river flows through the hilly region of Pratapgarh district in the southern-western direction and joins Som river near Remglei. It has two tributaries Karmai and Sukli rivers.


INDIA
N
RAJASTHAN
0
600 Kms
The Jakham River Basin
KEY MAP
RAJASTHAN
N
The Jakham River Basin
0
100 Kms
74°13'E
24°25'N
The Jakham River Basin
74°53'E
24°25'N
INDEX
State Boundary
District Boundary
Tehsil Boundary
District Headquarters
Tehsil Headquarters
N
CHHOTI SADRI
PRATAPGARH
DHARIAWAD
UDAIPUR DISTRICT CHITTAURGARH
MADHYA PRADESH
DISTRICT
TEHSIL PRATAPGARH
TEHSIL PRATAPGARH
TEHSIL PRATAPGARH
TEHSIL DHARIAWAD
0
10
20 KMS.
23°55'N
74°13'E
23°55'N
74°53'E

MAP NO.1

OBJECTIVES

- To study the spatial analysis of Settlements.
- To identify the various aspects of settlements pattern.

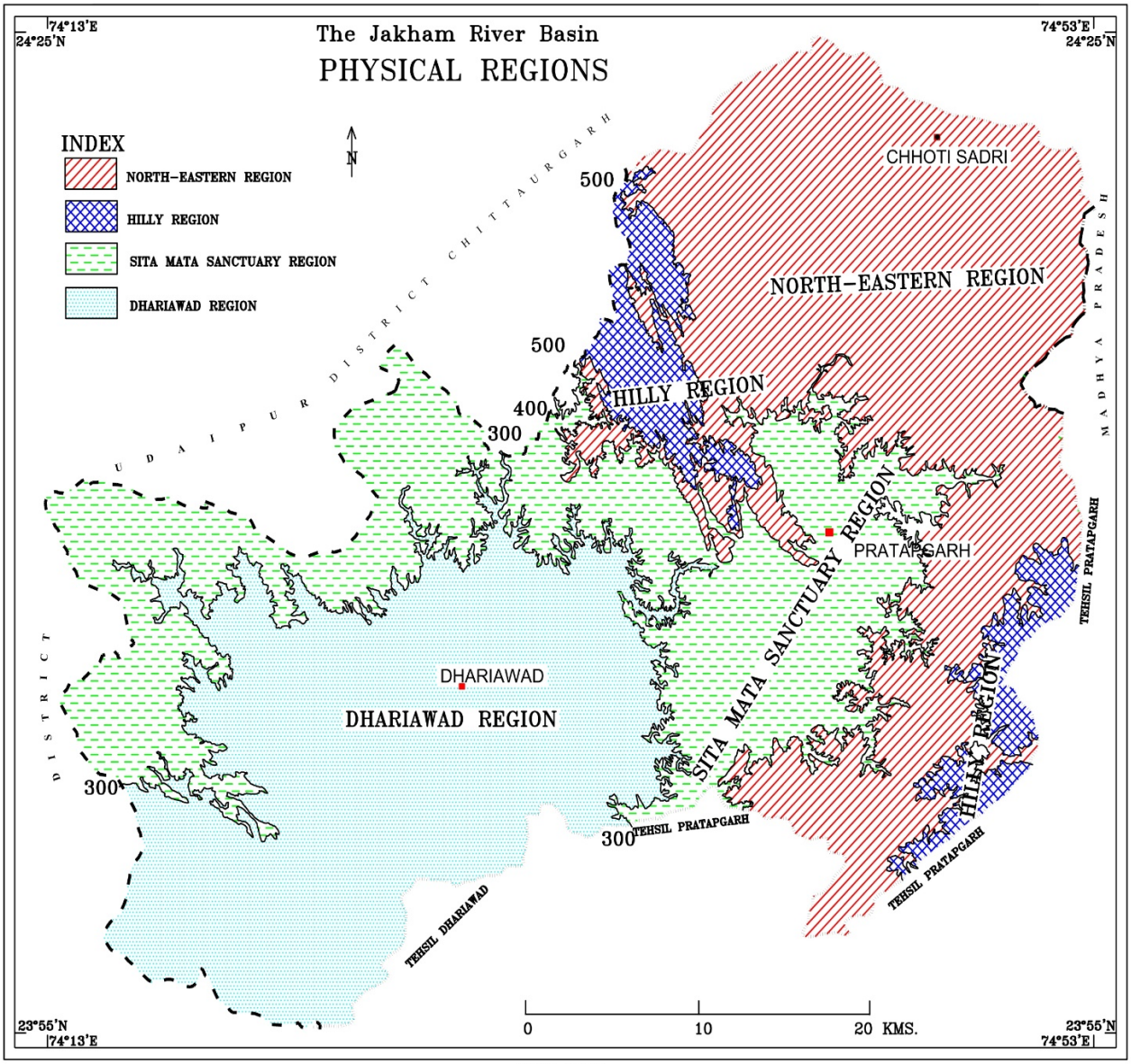
DATA SOURCES AND METHODOLOGY

In this research, scholar mainly use secondary data for the study. Among all the available sources of settlements in the Jakham river basin, the census of India and toposheets are the most vital secondary data sources. An attempt has been made here to find out the actual status of the settlements pattern. The nearest Neighborhood Analysis technique has been applied to spatial analysis of settlements in the Jakham river basin.

DISCUSSION

An attempt has been made to measure the degree of dispersion of the settlements in the Jakham river basin of Pratapgarh district by the Nearest Neighborhood Analysis. This analysis was initially developed by plant ecologists Clark and Evans (1954) to measure the spatial relationship of various plant species. According to them, "Nearest Neighborhood Analysis" indicates the degree to which any observed distribution of points deviates from what might be expected if the points were distributed randomly within the same area. A set of points on a given area is defined as a random distribution. Any point or any sub-area of specified size has had the same chance of receiving a point as any other sub-area of that size. It means any other point has not influenced the placement of each point. The entire area of the Jakham river basin is divided into four physiographic divisions on behalf of contour lines (Map No. 2). These are:

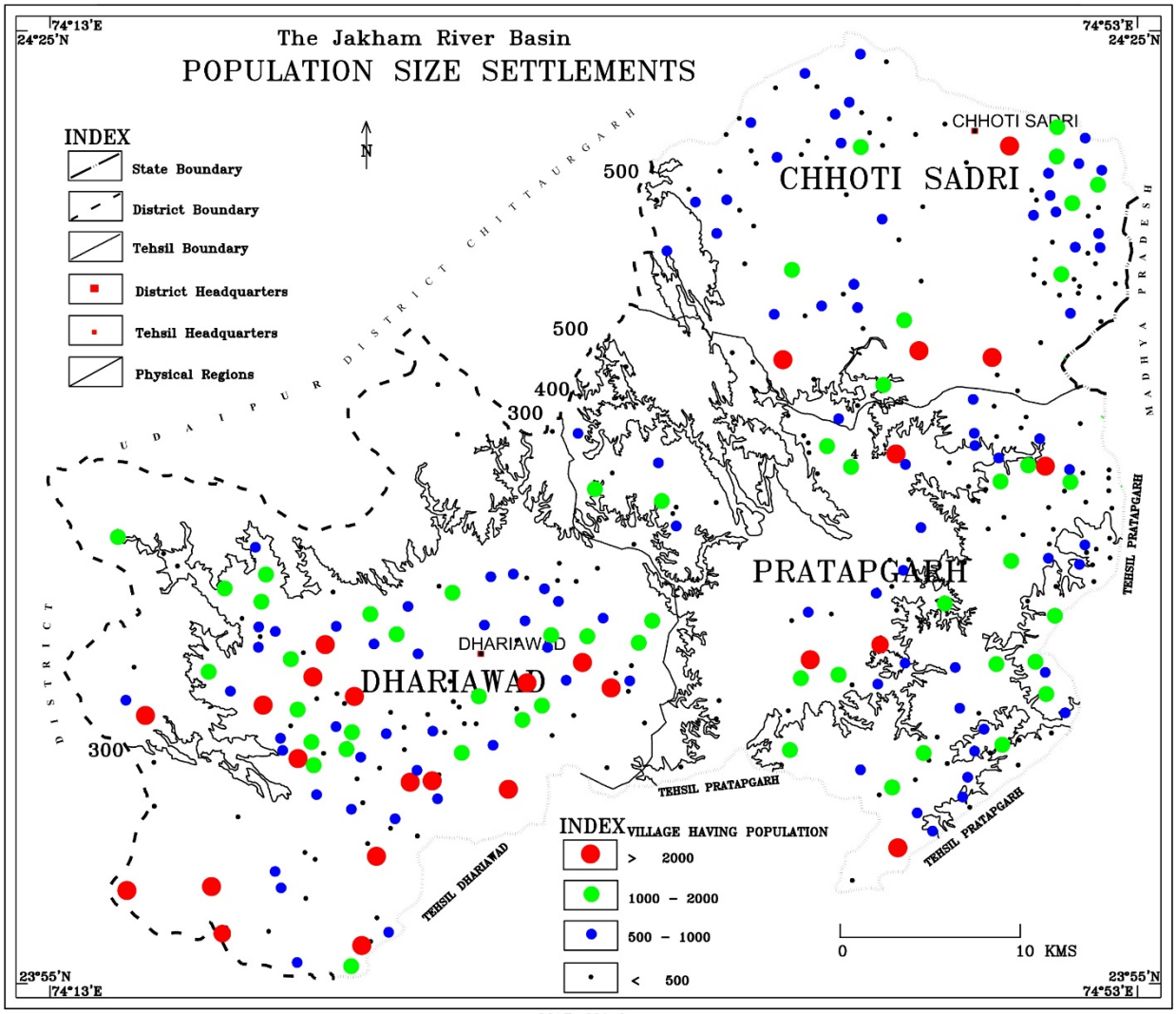
1. Dhariawad Region
2. Sita Mata Sanctuary Region
3. North-Eastern Region
4. Hilly Region



MAP NO.2

These physiographic divisions are further divided based on population (Map No. 3). The classification of settlements according to the population is beneficial to identify the actual concentration level. The range of the population is as follows:

1. Population > 2000
2. Population 1000 – 2000
3. Population 500 – 999
4. Population < 500



MAP NO.3

This method is now extensively used for determining the distribution pattern of the settlements in the river basin area. In this technique, we measure the distance from an individual point to its nearest neighbor irrespective of direction. Generally, the settlements are not always evenly spaced in a strictly random manner. Complete randomness is hardly found because several geographical factors disturb the uniform pattern. The greater the diversity amongst different characteristics in a different part of the region, the higher the variation in the distribution of settlements.

This method defines quantitatively a scale that measures the degree of departure of an observed from a theoretical random distribution. The scale used in this analysis is known as Nearest Neighbor Scale: known as Rn Scale.

Rn value can be calculated by the following formula:

$$\mathbf{Rn} = \frac{r\bar{o}}{r\bar{e}}$$

Where Rn = Nearest Neighbor Statistic for measuring the degree of randomness.

rō = Observed mean distance of existing pan.
rē = Expected mean distance if points were distributed at random.

Further rō = $\frac{\varepsilon d}{N}$

Where d = The distance of a settlement from its nearest neighbor.
N = The total number of settlements.

Further rē = $\frac{1}{2\sqrt{N/A}}$
N = The total number of settlements.
A = The total area under study.

As suggested by Clark and Evans the value of Rn values from zero to 2.15. Show the nature of the distribution of settlements in a given space. Observed distances have been measured from Map No. 2.

S.N.	Rn Index Value	Level of Concentration
1.	0.00 – 0.09	Absolute concentration
2.	0.10 – 0.50	High concentration
3.	0.51 – 0.99	Clustered pattern
4.	1.00 – 1.19	Random pattern
5.	1.20 – 1.49	Approaching uniform
6.	1.50 – 2.14	Dispersed pattern
7.	> – 2.14	Perfect hexagonal

Table No. 1: Nearest Neighbor Analysis score of Settlements having Population > 2000

Physical Regions	Rn Value	V Score	Di Score	Z Score
Dhariawad Region	1.13	2.28	17.62	1.02
Sita Mata Sanctuary Region	1.09	0.76	67.66	0.36
North-Eastern Region	1.40	7.61	77.60	1.94
Hilly Region	-	-	-	-

Source:- Computed by scholar

When we analyse the Rn values for those settlements which has a population of more than 2000 in these four physiographic regions, only the Dhariawad region and Sita Mata Sanctuary region have a random pattern. The Rn index values both are almost close to each other. That's why there is no significant change in the pattern. The North-Eastern region comes under clustered pattern, and the Hilly region has not any settlements having more than 2000 population. The result is the same when the Rn value is cross verified with the Di value, V value and Z Score.

Table No. 2:Nearest Neighbor Analysis score of Settlements having Population 1000 - 2000

Physical Regions	Rn Value	V Score	Di Score	Z Score
Dhariawad Region	1.01	1.67	11.52	0.26
Sita Mata Sanctuary Region	0.93	4.3	27.25	0.42
North-Eastern Region	1.06	2.85	20.84	0.48
Hilly Region	0.75	2.02	59.14	0.98

Source:- Computed by scholar

When we analyse the Rn values for those settlements with a population from 1000 - 2000 in these four physiographic regions, only two types of settlement patterns emerge. The Dhariawad Region and North-Eastern Region have Random patterns. The Sita Mata Sanctuary Region and Hilly Region comes under the clustered pattern. In this case, the result is again the same when the Rn value is cross verified with the Di value, V value and Z Score.

Table No. 3: Nearest Neighbor Analysis score of Settlements having Population 500-999

Physical Regions	Rn Value	V Score	Di Score	Z Score
Dhariawad Region	1.19	1.03	8.4	2.51
Sita Mata Sanctuary Region	1.08	2.6	19.47	0.65
North-Eastern Region	0.91	0.01	7.72	1.05
Hilly Region	0.90	0.83	5.61	0.53

Source:- Computed by scholar

When we analyse the Rn values for those settlements with a population from 500 - 999 in these four physiographic regions, the Dhariawad region and Sita Mata Sanctuary Region come under the Random pattern. The North-Eastern Region and Hilly Region comes under the clustered pattern. Therefore, From the table as mentioned above, it is clear that all settlements with a population from 500 to 999 in the Jakham river basin have the same pattern with minor Rn value differences. In this case, the result is again the same when the Rn value is cross verified with the Di value, V value and Z Score. Table No.4 Nearest Neighbor Analysis score of Settlements having Population < 500.

Table No. 4: Nearest Neighbor Analysis score of Settlements having Population 500-999

Physical Regions	Rn Value	V Score	Di Score	Z Score
Dhariawad Region	1.02	0.19	1.79	0.06
Sita Mata Sanctuary Region	1.02	1.06	7.5	0.28
North-Eastern Region	1.00	0.52	3.56	0.12
Hilly Region	1.11	0.50	1.92	0.94

Source:- Computed by scholar

The above table reveals that uniformity of Rn value is found in all physical regions of the Jakham river basin with a population of less than 500 and comes under a random pattern. To verify above mentioned value of Rn is also supported by the Di value, V value and Z score value.

To examine the validity of the above result, the Rn values in different regions have been further testified by using a standard curve and testing the hypothesis. In a regular random distribution pattern, the difference between the observed and expected mean values is significant. Still, if the difference is significant, the value deviates from random, and the distribution pattern is subject to chance factor. Clark and Evans also used this test of significance for measuring the departure of **r**ō and **r**ē from the normal curve.

The statistic Z can be given in the formula: $Z = \frac{\mathbf{r\bar{o}} - \mathbf{r\bar{e}}}{\boldsymbol{\sigma}\mathbf{r\bar{e}}}$

Where $\boldsymbol{\sigma}\mathbf{r}\bar{e}$ is the standard error and can be calculated by the following formula
$\boldsymbol{\sigma}r\bar{e} = \frac{\mathbf{0.26136}}{\mathbf{N/A}}$

Where N = denotes the number of total villages in the region.
A = the total area of the study region.

The value of Z obtained from the analysis has been shown in Table 7. It is noticed that except the North-western plain, in all other regions, the value of 2 is significant at a 1 percent level of significance. Otherwise, there is uniformity in the distribution pattern all over the district except in the Arnod tehsil.

The methods mentioned above explain the distribution of villages which means the total area of the abadi and the farms, i.e. the revenue villages. But when we talk about the distribution of settlements, it means the locations of Abadies. Within the village's total area, the Abadi may be located either in the center of the village or in any part of the village. This very idea is not taken into consideration in any of the methods mentioned above. The Nearest Neighbor Technique involves comparing the two mean magnitudes of the observed and the expected distances.

CONCLUSION

From the discussion mentioned above, it is clear that the Rn value for different physiographic regions is quite similar, which indicates that the concentration level is almost even. For the Dhariawad physiographic region, the Rn value for the population ranges >2000 is 1.13, 1000 - 2000 is 1.01, 500 - 999 is 1.19 and <500 is 1.02. All these values represent the random pattern. For the Sita Mata Sanctuary region, the Rn value for the population ranges >2000 is 1.09, 1000 - 2000 is 0.93, 500 - 999 is 1.08 and <500 is 1.02. Apart from the 1000 - 2000 range, all three values represent the random pattern.

For the North-Eastern region, the Rn value for the population ranges >2000 is 1.40, 1000 - 2000 is 1.06, 500 - 999 is 0.91 and <500 is 1.00. The two ranges (1000 - 2000 & < 500) represent the random pattern, apart from the > 2000 range and the 500 - 999. These two ranges represent approaching uniform and Clustered pattern, which is also close to a random pattern. It means in this region; the concentration is almost random. For the Hilly region, the Rn value for the population ranges >2000 is 0.00, 1000 - 2000 is 0.75, 500 - 999 is 0.90 and <500 is 1.00. The two ranges (1000 - 2000 & 500 - 999) represent the clustered pattern, apart from the > 2000 range and the < 500. These two ranges represent absolute concentration and random patterns. It means in this region, the concentration has clustered pattern.

After the findings, it is crystal clear that all other physiographic regions have a maximum random pattern in concentration apart from the hilly region. We can say that areas having a low value of contour lines are close to a random pattern. The Nearest Neighborhood Analysis is an essential tool to identify the level of concentration.

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