

SPATIAL DISTRIBUTION AND HIERARCHY OF SETTLEMENTS

Dr. Banwari Lal Jat*

ABSTRACT

Geography has been recognised as the discipline in distance. "Geography is only one of the disciplines concerned with the spatial distribution of phenomena". This phenomena is related to physical, social or economic distribution of natural resources, population and economic activities, etc. The locational arrangement of a region is significant as it contributes a lot in the typical characteristics of the region and its development patterns. The study of distance implies distribution and dispersion pattern and is very well realised in all geographical studies. It may be clarified that spacing is only the transformation of idea of distance and has wider scope as it includes the interlinkages of various phenomena and factors governing their spatial arrangement in a region.

Keywords: Spatial Distribution, Economic Distribution, Economic Activities, Dispersion Pattern.

Introduction

Recently a number of studies have been carried out regarding the distributional pattern of settlements. The study is mostly related to the network of locational arrangement of settlement and their interlinkage with each other. The evolution of settlement is governed by number of factors, physical, cultural, etc. and hence diverse spatial distributional patterns of settlement are found. The pioneering work in this direction was done by German geographer Christaller, who suggested that settlement patterns follows a definite principle and there exist a high degree of correlation between size and their spacing. Christallers scheme proposed a hexagonal arrangement of settlements, where centres of same level of specialisation would be equally spaced. The spatial pattern of settlements has been further studied by social scientists. The general consciousness of their studies suggest that the distribution of settlement rarely observes a definite geometrical pattern and depends on the local existing condition of various regions.

To analyse the spatial distribution of the settlements in the Shahpura tehsil three methods are applied. They are as following:

- Village density pattern
- Lorenz curve
- Nearest neighbour analysis

Village Density Pattern

In theoretical approach the spatial patterns of settlements are observed in terms of density. In Shahpura tehsil there are 73 villages spread over 535.83 sq.km. The average for village is 7.34 sq.km. Density patterns of settlements and their ranking are as given in following table:

Table 1: Density Patterns of Settlements and their Ranking

S. No.	Population Class	Area in sq.km.	No. of settlements	Average area Per Village	Ranking
1.	Below 200	8.58	9	0.95	1
2.	200-499	35.97	11	3.27	2
3.	500-999	52.60	14	3.75	3
4.	1000-1999	114.13	19	6.00	4
5.	2000-4999	240.89	18	13.38	5

* Associate Professor, Department of Geography, Government Girls College, Behror, Alwar, Rajasthan, India.

Above table shows that the area per village is the highest in the 2000-4999 population size. Rural settlements in this area are placed far apart. The area per village is the lowest in the below 200 population size. Hence the area is inversely related to the density of villages.

Spacing of Settlements

In order to maintain the spacing of the settlements the area per village is converted into the average size of a hexagon. Hexagon is the perfect form which covers covers the entire space of a region without leaving any intervening space.

The analysis of hypothetical spacing is based on Christaller's conceptual hexagonal arrangement of settlements, which in an area of uniform terrain. Population size-wise hypothetical spacing of settlements have been computed with the help of the Matter formula.

$$D = 1.0764$$

Where D = The distances between points in hexagonal arrangement

A = Total area

N = Total number of settlements.

1.0764 = Theoretical distance in hexagonal arrangement.

The above formula has been applied by many geographers in the study of rural settlements. In the present study calculation of D in various divisions of population in the Shahpura tehsil have been worked out.

Table 2: Spacing of Rural Settlements

S. No.	Class	Area in sq.km.	No. of settlements	d = N/A	D
1.	Below 200	8.58	9	1.040	1.050
2.	200-499	35.97	11	0.305	1.946
3.	500-999	52.60	14	0.266	2.086
4.	1000-1999	114.13	19	0.166	2.638
5.	2000-above	240.89	18	0.074	3.937
	Total	535.83	71	0.132	2.957

Above table explains two types of spacing of settlements.

- **Low Spacing Areas**

The value of spacing is less than 2 km in the below 500 population size class. It mostly consists of small size semi-compact settlements. The average population per village is less than 500 persons. Fertile land have favoured a more regular distribution pattern with closer spacing.

- **Moderate Spacing Area**

In all other settlements above 500 population size is only two. Here settlements are moderately spaced and they are developed on relatively developed grounds.

Lorenz Curve

The Lorenz Curve first expounded in 1905 has long been used for measuring the inequality in the income⁴. It is also used to depict distribution of wealth or the degree of population concentration and the concentration of settlements. It deals with the cumulative percentage distribution of the two attributes at different points. The cumulative percentage of one variable upto certain points is plotted on a graph against the cumulative percentage of the other variable upto the same point. The different points so obtained are then joined by a smooth free hand curve. For comparison a diagonal line is also drawn from the origin to the last point showing the line of equal distributions. The deviation of the curve shows the proportional the level of inequality in the dsitribution of one attribute in relation to the other.

Generally two extremes are found through this curve, first, if the curve follows the diagonal then a uniform distribution of settlements may be observed and secondly if the curve coincides with the X or Y-axis then the Y-axis then the settlements are concentrated at a particular point in the given region. In between these two extremes, the degree of uneven distribution of settlements is explained by the degree of departure of the curve from the diagonal.

In the present analysis, concentric circle at intervals of 5 km have been drawn with Shahpura town as the centre. Thus, four circular zones have been identified according to the above radial distances.

Two variables namely the number of settlements in the zone and the area of the zone have been taken for consideration

Explained with the help of a graph X-axis shows the cumulative percentage of number of settlements and Y-axis shows the cumulative percentage of areas. There is no concentration of settlements in Shahpura. It shows uniform distribution.

Percentage areas, falling within a radial distance of 15 km from Shahpura town have 61.65 per cent of the settlements, whereas in the rest 36 per cent of the area 38.35 per cent settlements are located.

A further analysis of the Lorenz curve has been done with the help of Gini's coefficient. Here respective X_i and Y_i values of the cumulative percentages are crossed multiplied and then added up. The Gini coefficient is calculated as following.

where X_i = is the cumulative percentage of number of settlements and

Y_i = is the cumulative percentage.

The value of G varies between 0 to 1. 1. Smaller is the value of G lesser is the concentration. In the case of complete concentration when all the settlements are located at one point the Lorenz curve will run along X-axis and value of G has been calculated as shown in the following table.

Table 3: Computation of GINI Coefficient

Distance from Town in Km.	Cumulative 1% of Settlements X_i	Cumulative % of area Y_i	$X_i \cdot Y_{i+1}$	$Y_i \cdot X_{i+1}$
Upto 5	12.33	13.75	408.61	565.26
5-10	41.11	33.14	2621.17	2043.08
10-15	61.65	63.67	6165.00	6367.00
Above 15	100.00	100.00	-	-
Total :			9194.78	8975.34

The value of G : .021 is very small and close to zero. Hence it can be concluded that the settlements in Shahpura tehsil have negligible concentration. In other words the distribution pattern of settlements is nearly uniform and equally distributed.

Nearest Neighbour Analysis

To measure the degree of dispersion of the settlements in different parts of Shahpura tehsil the nearest neighbour analysis has also been applied. This analysis was originally developed by plant ecologists, Clark & Evans (1954) for measuring spatial relationships of various plant species. According to them "Nearest Neighbour Analysis" indicates the degree to which any observed distribution of points deviates from what might be expected if the the points were distributed in a random manner within the same area. A random distribution of points is defined as a set of points on a given specified size has the same chance of receiving a point as any other sub-area of that size, and that the placement of each point has not been influenced by that of any other point.

This method is used for determining the distribution pattern of the settlements. This technique helps to measure the distance from an individual point to its nearest neighbour irrespective of direction. Generally the settlements are not always evenly spaced in a strictly random manner, because the interaction of various geographical factors mould the uniform pattern. Greater the diversity amongst different factors in different parts of of the region, higher is the variation in the distribution of settlements.

Hierarchy of Settlements

In the outgoing pages it has been emphasized that only a few settlements have some services to offer to the inhabitants. These settlements have been referred as service centres/central places and services performed by them are called as central functions. These central places generally develop in the natural process in response to economic and social needs of the people. It is quite obvious that all the services or functions cannot be located in all the clusters of settlements due to certain economic disadvantages. For example, there is no use of opening dispensary where there are are not sufficient number of patients for treatment. If such a dispensary is opened in a small settlement it will ultimately be closed. It will be feasible within a group of cluster which is most convenient, accessible from all the near by clusters. Thus two types of settlement hierarchy are identified first viz., the main service centre and the dependent settlements.

The main objective of all studies on central places is the identification of hierarchic order of service centres in any region for setting guidelines for regional development policies. studies have been carried out to consider degree of the functional activity affecting the real life of the people. Almost all the human settlements perform certain functions and render services to other settlements. All the settlements are interdependent and within this context, if there is any relationship which shows the mutual understanding and interdependence between settlements should prove helpful in preparing the policy of "Integrated Area Development".

The service centres have been studied widely. Their size vary from a very small settlement to a very big size metropolitan town. In a broader sense the cities can also be called as service centres but of higher degree. According to Dickinson cities are the focus of manifold human activities. Ullman calls them as the focal points in the occupation and utilisation of earth by man, both a product of and an influence on surrounding region, they develop in a definite pattern in response to economic and social needs. In the words of Christaller, a central place is the source of goods and services to an area larger than itself called as complementary region.

It is significant to identify the methodology, for hierarchy of settlements and to determine the levels of development. The level of development has been determined on the basis of composite score of social facilities enjoyed by each settlement.

Concept of Functional Hierarchy

The concept of functional hierarchy explains the spational organisation and certain activities of human interaction. There are certain similarities and regularities between the size of settlements and type of functions performed by them. The centrality is the by-product of central functions of any settlement. The central function settlements are a few in any region. Settlements around it enjoy the facility provided by the central function settlements. Function varies from one to another and also with the number of functions. There are many factors which affect the quality of central function. They are

- The number and types of functions performed and
- The level at which they perform.

All settlements do not perform all sorts of functions, only a few perform all functions at the same level. The hierarchy of settlements is undoubtedly related to the hierarchy of central functions. As mentioned earlier the quantity of central function can be determined after examining the individual function. However, a central function includes many sub-functions. This could enable one to identify different levels or degrees at which they are performed. On this basis the hierarchy of settlements can be determined which is also called as functional hierarchy.

First Hierarchic Level of Settlements

Shahpura, Manoharpur, kareeri and Amarsar are the constituents of first hierarchic order settlement. Population wise also these four villages are biggest among all the villages in the tehsil. Out of the above four, Manoharpur and Shahpura are located on the National Highway No. 8. The tehsil headquarters and centre of administration, it is functioning as the regional centre for the entire tehsil and perform some of the specialised functions like whole saling, banks, courts and tehsil level administrative offices.

Second Hierarchic Level of Settlements

In this category, there are five such settlements amongst all the villages belonging to population size 2000-4999. These villages receive irrigation by tube-wells. Location-wise these villages are away from the four settlements and first level are surrounded by small size settlements. All these settlements are linked by metalled roads and provide some of the services like regular markets, hats, primary health centres, higher secondary schools and post offices.

Third Hierarchic Level of Settlements

In this group, there are in all 4 settlements (5.47%) and each one of them have population size 2000-4999. These settlements are scattered and most of them have large areas. Two settlements of this category are western side of the tehsils, located along the while third settlement is located near the National Highway No. 8 and fourth settlement is located in the eastern part of the tehsil. The third service centres have a lower order of functions than first and second order of settlements.

Fourth Hierarchic Level of Settlements

The fourth order service centres mostly consist of the services of the lowest order like Ayurvedic Dispensary, family planning and child welfare centres, middle schools, village panchayat, co-operative societies etc. There are in all 7 settlements (9.58%) with population size of 2000-4999. These scattered settlements have relatively larger areal extension. All such settlements have irrigation facilities and are surrounded by small size settlements. Their major concentrations are found in the northern and middle part of the tehsil.

Fifth Hierarchic Level of Settlements

At the lowest hierarchy level of the settlements these are rural villages with a population of 1000 to 1999 persons. They have small services like primary schools, bus services etc. The primary schools have been established in hutments with least facilities. The total numbers of fifth hierarchic of settlements are 21.

According to size class, out of 21, two belongs to 500-999 population size class and 19 in 1000-1999 population size-class. Most of the settlements are located in the north-east part of the tehsil.

Sixth Hierarchic Level of Settlements

The total numbers of sixth order of settlements are 32. The sixth order service centres are also unevenly distributed in different parts of the tehsil. There are in all 32 settlements in this category having 43.83% of all the settlements. According to size- class one has got the population size below 200 while 11 settlements are of 200-499 and 12 settlements have the population size 500-999. Settlements belonging to this category are scattered all over the length and breadth of the study area.

Conclusion

In conclusion a close relationship between population size of the settlement and concentration of social amenities exists. A comparison of the two maps showing the distribution of settlements according to population size-class and distribution of villages forming different hierarchic levels of development reveals that the level of development and size of settlements are associated with each other. It is because every amenity requires a population threshold and only large sized villages can provide the required threshold for the localization of that particular amenity and hence the social amenities are attracted by large sized villages.

References

1. Wasson, J.W., "Geography a discipline in distance", Scottish Geog. Meg. Vol. II, pp. 1-13 (1955).
2. Berry, B.J.L. & Baker, A. "Spatial Analysis", pp. 97-100, Prentice Hall, 1968.
3. Mather, E.D. "A Linear distance Map of Farm Population in the U.S." Annals Asso. Am. Geography, 34 (1944), pp. 773-780.
4. M.O. Lornez, "Methods of measuring the concentration of wealth quarterly publication of publication of the American Statistical Association 9, pp. 209-219, June 1905.
5. Clark, Johns, I-Population Geography. II Edition (1972), pp.40-42.
6. Sen, Lalit, K.: Planning Rural Growth Centres for Integrated Area Development", NKD, Hyderabad, 1971, pp. 80-81.
7. Dickinson, R.E. "City Region in Western Europe", London 67 p.30.
8. Ullman, L.E. "Nature of Cities", Annals of Association of American Geography, Vol. 42, 1945, pp. 7-17.
9. Christaller, W. "Central places of southern Germany", (Translated by C. Baskin), Prentice Hall, 1966.
10. Wannali, Sadhir: "Regional Planning for Social Facilities", NICD, Hyderabad, 1970, pp. 19-21.
11. Bhat, L.S.: Micro Level Planning: A case study of Karnal area, Haryana, 1976, p. 60.