

Settlement Patterns In The Kathmandu Valley

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The traditional approach to the description of settlement patterns has been basically a simple dispersed-nucleated dichotomy. In this sort of study attention has been focused on the shape of individual settlements rather than their general pattern. The notion of the pattern of spatial arrangements of settlements was developed by Christaller in his central place theory.¹ It was further reemphasised by Losch in his subsequent development of the Christaller model.² According to these authors, settlements would be arranged in the form of regular triangular lattice on theoretical grounds. Though Losch has tried to incorporate even farm settlements in his model, the arrangement of the regular triangular lattice is mainly referred to in connection with central places. The general pattern of settlements can be described with reference to certain extreme types of distribution which can be distinguished as: (a) uniform or regular (b) random (c) clustered or aggregated.³ For the analysis of the observed pattern the nearest-neighbour index is now widely used by geographers.⁴ King and Morrill present very useful summaries of the nearest-neigh-

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1. W. Christaller, **Central Places in Southern Germany**, translated by C.W. Baskin (Englewood Cliffs: N.J. Prentice-Hall, 1966).
2. A. Losch, **The Economics of Location**, translated by W.F. Stolper (New York: Yale University Press, 1954).
3. M. Chisholm, **Human Geography** (Harmondsworth, England: Penguin, 1975), pp. 67-69.
4. R. Hammond and P.S. Mc Cullagh, **Quantitative Techniques in Geography** (London: Oxford University Press, 1974), pp. 237-243.

bour technique.⁵ Studies made by Dacey to analyse the distribution of hamlets, villages, and towns in the United States⁶ and by King to analyse the distribution pattern of urban places in a comparative analysis of twenty sample areas in the same country,⁷ are the pioneer works which show the usefulness of nearest - neighbour techniques in analysing the point pattern. The objective of the present paper is to analyse the pattern of spatial arrangement of settlements in the Kathmandu valley along such objective lines. It is also aimed to analyse the pattern of location of settlements in the relevant context.

Settlement Units

A large number of settlements have developed in very close proximity in the Kathmandu Valley. The physical continuity of these settlements is quite apparent from their appearance on large scale maps still more so when they are viewed from the air. This presents a great problem in defining individual settlements. Minimum distances of dwelling units are often used for delineating the limit of individual settlements. Zierl often defined the limit of a settlement within an area when the dwellings were separated from each other by distances of not more than 150 to 200 mtrs.⁸ In the United Kingdom a house situated a quarter of a mile from any other house is conveniently taken to be isolated. When similar distance values have been tried in the study area, a number of rural settlements have appeared to be larger than Kathmandu city in spatial extent. After undertaking several exercises it has been

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5. L.J. King, *Statistical Analysis in Geography* (Englewood Cliffs, N.J.: Prentice-Hall, 1969). R.L. Morrill 'On the Arrangement and Concentration of Points in the Plane' in H. McConnett and D.W. Xaseen (eds.), *Prospective in Geography, I, Models of Spatial Variation* (Illinois: Northern Illinois University Press, 1971), pp. 29-43.
 6. M.F. Dacey, *Analysis of Central Place and Point Patterns by nearest neighbour method* Land studies in geography Series 8, Human Geography, 24, 1962, pp. 55-75.
 7. L.J. King, "A Quantitative Expression of the Pattern of Urban Settlements in settled areas of the United States", *Tijdschrift Voor Economic che en Sociale Geographic*, 53, (1962), pp. 1-7.
 8. J.M. Houston, *A Social Geography of Europe*, (London: Gerald Duckworth, 1963), p. 83.

decided that the distance of 50 mtrs. is appropriate to the local situation. Straight-line measurements between two dwellings have been taken.⁹ And a building which lies within a distance of 50 m from the nearest dwelling has been taken as the part of the same settlement.¹⁰ However, if the dwelling units are intervened by physical barriers like river courses without the provision of bridges they are considered as dwelling units of separate settlements, though located within the distance of 50 mtrs. To avoid isolated units and very small settlements only those settlements which contain more than 19 buildings are included in the present study.¹¹

Structure of Settlements

There are altogether 346 settlements with more than 19 dwellings in the Kathmandu Valley. These settlements are divided into three strata: hamlets (with 20 to 99 building units), villages (100 to 999), and urban places (1000 and above). The estimated population size of these settlements ranges from 100 to 499 in hamlets, 500 to 4999 in villages, and 5000 and above in urban places. Hamlets constitutes 83 percent of the total settlements, villages 14 percent and urban centres 3 percent. These figures are not comparable with percentages noted by Dacey for the similar strata of settlements (hamlets 61 percent, villages 31 percent and towns 8 percent).¹² The ratio of different strata from higher to lower is about 1: 9: 45. So the local structural pattern of settlements converges fairly well with the conceptual structure of hierarchy of settlements. There are many small settlements, a lesser number of medium sized settlements and fewer large settlements.

Three different shapes of settlements are discernible. They are (1) com-

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9. This measurement is made on the 1: 10,000 scale maps published by the *Arbeitsgemeinschaft für Vergleichende Hochgebrigsforschung*. These maps are based on air photographs of 1971.
 10. In compactly built up areas the exact number of dwelling units remains unclear. In several cases settlements have been categorised on the basis of field information. And a great range in the number of buildings are taken for classifying settlement types to avoid probable mistakes that may occur in counting dwellings.
 11. The localities which do not contain houses but are completely associated with uses like military barracks, hospitals & institutional establishments are not considered as settlements.
 12. Dacey, Op. cit.

compact shape where houses are attached, (2) dispersed shape which has detached houses and (3) mixed shape. Compactness is generally characteristic of the large settlements. Most of the hamlets have dispersed shapes.

It is pointed out that the type of settlements may be related to ethnic and racial factors significantly.¹³ This sort of relation is well seen in the Kathmandu Valley in a distinct way. Here the shape and the form of settlements reflect well the traditions of different community groups. Traditionally Newars live in compact settlement and non-Newars in dispersed settlements. Accordingly, compactness is the characteristic shape of the Newar settlements, and the settlements occupied by non-Newar people are relatively dispersed in character. Even in the culturally mixed settlements the Newar-non-Newar dichotomy is well reflected on the nature of grouping of dwelling units. In such cases the localities inhabited by Newars are compactly built-up unlike the increasing tendency of detachment of houses in the adjoining locality occupied by non-Newar people. This association of the specific shape of settlements with two different community groups is attributed to several historical and social factors.¹⁴

Pattern of Distribution

The pattern of the distribution of settlements in the Kathmandu Valley is analysed by using the nearest-neighbour technique. The nearest-neighbour index ranges from zero when all settlements are clustered in one locality, through 1.00 which represents a random distribution, up to 2.15 for uniform triangular lattice.¹⁵ This technique is used to determine whether and to what extent a given distribution departs from randomness in the direction of either clustering or regular dispersion. The index value normally written as R, is derived from.¹⁶

$$R = \frac{\overline{D}_{obs}}{\overline{D}_{ran}}$$

\overline{D}_{obs} = the measurement of mean distance between nearest neighbouring points observed in the study area.

\overline{D}_{ran} = mean distance to be expected from a similar number of points randomly distributed in the same area.

13. Houston, *Op. cit.*, pp. 85-97.

14. Department of Housing & Physical Planning, **The Physical Development Plan for the Kathmandu Valley** (Kathmandu: DH-PP H. M. G., (1969) pp. 53-82.

15. Hammond and McCullagh, *op. cit.*

16. *Ibid.*

For computing mean distance a series of straight-line measurements have been taken between each settlements and its nearest neighbouring settlement. The calculated R value for all the settlements (regardless of size) is 1.028. R values for different groups of settlements show a small range from 0.893 in the case of villages, through 0.94 for hamlets, to 0.971 for urban centres. These values have been tested by.

$$C = \frac{\bar{D}_{\text{obs}} - \bar{D}_{\text{ran}}}{\frac{0.26136}{\sqrt{nm}}}$$

C values calculated for different cases vary from 1.02 (all settlements) 1.74 (hamlets), 1.50 (villages), to 0.132 (urban centres). Tests have shown that the pattern of the distribution of settlements is random in all cases. The randomness is significant at 95 percent level of confidence. Though C values show randomness in all strata of settlements, there are variations in the degree of randomness. The R value computed for all the settlement of the Valley is tending towards regularity. In the cases of the different strata of settlements the values are tending towards clustering. Even the hamlets show more vestiges of clustered arrangement unlike the regular arrangement of similar type of settlements as noted by Dacey.¹⁷ The absence of regularity in the distribution of settlements is attributable to negative effects of several factors. In many cases landforms appear to be responsible for the irregular distribution of settlements. Distortions in the regular arrangement of settlements have also been due to the extent of built-up of large towns over extensive tracts.

Locational Association of Settlements

It seems that the concentration of settlements is related to several factors. Landforms, Soil types, and accessibility appear to be the most potent factors in conditioning the distribution of settlements. Sources of drinking water access to good farm lands, traditional highways and social integration may have varying degree of effects of the location of settlements. However, the degree of effects of all these variables can not be analysed at present owing to incomplete information and data. Only the variable, land farms & soil types, are selected here for the analysis. The selection of these variables is justifiable

17. Dacey, Op. cit.

in view of the fact that most of the settlements in the Kathmandu Valley are still agricultural and the intensity of agricultural activity is significantly conditioned by these factors.

Landforms of the Kathmandu Valley can be classified into three types: (1) hills with elevation of 1600 mtrs and above, (2) Tar and foot hills lying between 1320 mtrs and 1600 mtrs and (3) lowland (locally called dols) with less than 1320 mtrs. Fig. 1 and 2 clearly show that the settlements are highly concentrated in the tar and foot-hills. About 84 percent of the total settlements are located here. Negative effects of the hills on the distribution of settlements are quite apparent as only 14 out of the 346 settlements are located in the hills. The low land area contains only 12 percent of the total settlements. It is found that the zone of the Tar and foot-hills accommodates about 83 percent of the total hamlets and 96 percent of the villages. This area contains 4 out of 6 urban places. Not a single large settlements of village and urban centre level is found in the hills. Of the 60 higher order settlements (villages and urban places) 56 centres are concentrated in the Tar and foot-hills, and the other 4 are located in the low land area. (Table 1)

Table 1
Location of Settlements in different Landforms

	Settlement Hills above 1600 m.		Tar & foot hills 1320 to 1600 m.		Low land area Below 1320 m.	
	Number	Percent	Number	Percent	Number	Percent
Hamlets	14	4	235	83	37	13.3
Villages	×	×	52	96	2	4
Urban Centres	×	×	4	66.7	2	33.3

The distribution pattern of settlements in relation to topographical features partly reflects the negative effects of certain landforms. It is perhaps due to unfavourable terrain of slopes in the hills and flood danger in the lowland area that the Tar and foot-hills have remained the traditional settlement zone. It also indicates the rational basis of the traditional Land use in the Kathmandu

Valley. If the fertile lowland area is traditionally well preserved for agricultural purposes, it is perhaps felt that the hills should be preserved for forest. The increasing disturbance in the ideal land use pattern of the past has taken place only recently.

Table 2 shows the relation of the location of settlements to soil types. It is clear from this table that settlements are highly concentrated in the soil zones of loamy and clayed haplaquepts and dystrochrepts and loamy dystrochrepts. It is found that the number of settlements increases with increasing.

Table 2
Distribution of Settlements in different Soil Zones

Settlements	Loamy and Sandy Haplaquept imperfectly to poorly drained		Clayed Haplaquepts imperfect to poorly drained		Loamy and clayed Haplaquepts, in perfectly to well drained		Loamy Dystrochrepts well to moderately well drained	
	Num ber	Per cent	Num ber	Per cent	Num ber	Per cent	Num ber	Per cent
Namlet	37	13	58	20.3	87	30.4	104	36.3
Village	2	4	20	37	18	33	14	26
Urban Centres	2	33.3	4	66.7	×	×	×	×

Sources: United Nation Development Programme, Food and Agricultural Organization, General Soil Survey of the Bagmati and Narayani Zones, Rome, 1975.

dryness of soils in most cases. The areas with loamy and clayed haplaquepts and dystrochrepts and loamy dystrochrepts contain about 64 percent of the total settlements, and the soil zones of loamy and sandy haplaquepts and clayed haplaquepts accommodate 24 and 12 percent of the total settlements respectively. The similar pattern of relation is seen in the distribution of different strata of settlements as well. Urban centres stand as exceptions as all 6 urban

places are located in loamy & sandy haplaquepts and clayed haplaquepts soil zones.

Conclusion:--

Although the majority of settlements in the Kathmandu Valley have dispersed shapes, other shapes are also discernible. The variations in the shape of settlements are markedly associated with cultural traditions of different community groups. The preceding analysis shows that the settlement pattern in the Kathmandu Valley is significantly random. This pattern stands prominent in all groups of settlements. It is seen that settlements are highly concentrated in the Tar and foot-hill area and dry soil zones.

