SETTLEMENTS DISTRIBUTION AND THEIR CORRELATION WITH MORPHOMETRIC ATTRIBUTES IN SIMLA HILLS

S. C. Singh, Srinagar and S. B. Singh, Kotdwara

ABSTRACT : In the present paper an attempt has been made to study the distribution of settements and their correlation with morphometric attributes in Simla hills. The study reveal there are some stretches which are not suitable for the growth of settlements which correspond with the areas of steep slopes and high relief (480–840 metres).

INTRODUCTION

Study of settlement distribution and their correlation with morphometric attributes is one of the applied aspects of geographical studies. To advance the applied aspects of geography for the welfare of the human being it is now defined as the science which provides the base to understand the earth as a home of man (James 1972). Within this frame, a new trend in geomorphology have evolved, which correlates the geomorphological attributes to the human phenomena, as such it gives a relevancy for the physico-cultural planning. Such a physical and cultural unity concerning its processes, impact and evolving structure will certainly represent the real world situations which has been long advocated by Sauer (1965).

The analysis of geomorphological attributes further provide a fundamental base to analyse the process of settlement and its spatial pattern, thus it emphasises the role of physical environment. Such an approach concerned with the ' form, function and the genesis ' parallel to that of geomorphologists ' structure, process and stage ' (Baker, 1969). The present study is limited within the correlative study of the impact of geomorphological attributes upon the spatial characteristics of the settlements like absolute relief and relative relief and settlement density, correlation with the slope and dissection index have been left untouched, simply because these attributes tend to follow the above mentioned morphometric attributes.

The data used here for the analysis of settlement is based on one inch survey sheets of India.

DISTRIBUTION OF SETTLEMENTS

The spatial distribution of human settlements are mainly governed by climatic conditions, relief, slope, water frontage and socio-economic factors, but in the hilly tract, climatic and topographic conditions exert their influence on the distribution of settlements more than other factors. Moreover, three important factors--water frontage, religious places and transport are also responsible for the distribution of human settlements in the Simla hills. Due to the control of the mentioned factors to a different land of their intensity, the settlement distribution in the whole area is uneven (Fig. 1). Dispersed settlements consisting of a group of more or less isolated houses, are the basic characteristic of the rugged, steep and densely forested terrain whereas agglomerated settlements are mostly found on more or less flat ground either in the wide valleys or on the high grounds of ridges and their off-shoot spurs with moderate to moderately steep slopes.

The settlement distribution becomes quite obvious with Fig. 1 and 2. The map of settlement distribution and settlement density reveals that the Shali ridge, Nagtikar ridge Narayanpurdhar, Thalgordhar and a part, of Sutlaj valley east, Giri valley south and northern Harsingh–Deo–Dhar are either unsettled or sparsely settled. In these areas

highly dissected topography, steep to very steep slope, high altitude and densely forested terrain restrict the growth of human settlements. Most of the settlements are confined to the upper Nauti Khad, Upper Assan valley, Giri valley, sourth-western flank, upper and middle Nayasari Khad. Apart from the valleys the ranges and their off-shoot spurs are also highly settled. Along the Sutlej valley the example of compact settlements are traceable. In addition to this tract south-western flank near plains where the land is comparatively level and agricultural facilities are available the compact type of settlements are visible. In these areas most of the population accommodated them on agricultural production. Due to contact point sites most of the urban centres have developed near the joints of hills and their off-shoot spurs where they get some flat surfaces for the development and establishment along the roads. In general, the population of the valley depends on agriculture while the population of hill top depends on the business.

SETTLEMENT DENSITY

The settlement zones are quite clear from the Fig. 2 which has been prepared by counting the number of settlements per km². The whole area has been divided into 6 categories taking interval of 4, ranging from the areas of practically no settlement to areas with above 16 settlements per km². The map of settlement density has been divided into 6 zones as follows :

(1) Practically no settlement,
(2) Zone of least settlement,
(3) Zone of sparse settlement,
(4) Zone of moderate settlement,
(5) Zone of moderately desnse settlement,
(6) Zone of dense settlement.

These zones are very well associated to the physiographic characteristics of the area.

Areas of practically no settlement are marked along the Shali range, Nagtikar peak, Jubbar awaidhar, Narayanpurdhar, Thalgordhar and Nag-Ka-Tibba in the eastern Sutlej valley. Another major part of this zone is marked on the top of Gintadhar, Kawalia-Ka-Tibba, Manoya peak and few small stretches in the south Giri valley. Third important part of this zone can be observed in the lower Nayasari Khad (including steep slope of Harsingh-Deo-Dhar) and north-western Naldera ridge. Besides, these important unsettled areas some small pockets of unsettled zone are also found throughout the study area where the topography and other factors restraint the growth of settlements.

The next zone of least settlements broadly follows the trend of the unsettled zone. Settlement density in this zone does not exceed more than 3 per km². The relief is comparatively low. The settlements are mostly found in small groups. They have occupied the sides either in the valleys or on water divides of steep slopes.

Most of the part of the Nauti Khad, south-eastern Naldera ridge, Fagu-Narkanda ridge, northern Giri valley. upper Assan valley, south-western flank and part of the Nayasari Khad present the zone of sparse settlement. The strips of this zone occupies the flat and moderately sloping valley walls and also the flat tops of the ranges where roads and the contact points of spurs have attracted the people to develop their dwellings. Small patches of this zone are also visible in the eastern Sutlej valley and southern Giri valley, a region of the most rugged and steep terrain in the study area.

The areas of moderately settled zone are confined in small patches where the physical environment is favourable for the settlement growth. The patches of this zone covers most of the part of upper Nauti Khad, upper Assan valley, Kandaghat, Subathu upland, Kunihar and Arki areas with some other stretches in south-western flank (Gambhar catchment), Neldera and Baldiha areas and north-western part of

Mashobra village. Some pockets of this zone are also marked in the eastern Sutlej valley and southern Giri valley. Agricultural and other living facilities have attracted people to settle in groups. Gentle to moderate slope, fertile soil, sufficient water and sun rays etc. have attracted for the growth of compact type of settlements.

There are few localities of moderately dense settlements, which are confined to small patches around urban centres, i.e., Simla, Solan, Subathu, Kunihar and Arki. The population of these localities are mainly engaged in agriculture and business both. Availability of soil, gentle to moderate slope and contacts points of roads etc. have influenced the people for concentrated development.

The above mentioned localities of moderately dense setlements make the peripheries of urban centres of densely settled areas. These localities are the urban centres in the study area which are observed on the ridge tops in the linear pattern along the roads running besides the ridges. Simla, Subathu, Kunihar and Arki are the urban centres which are marked in this zone. It is significant to note that the settlements are clustered in a small area. Urban amenities administrative facilities, tourists attraction etc. are the factors which attract the people to settle near the towns.

CORRELATION OF SETTLEMENT DISTRIBUTION WITH MORPHO- METRIC ATTRIBUTES

After the qualitative analysis of settlement distribution, the interpretation now switches on the quantitative analysis, of the settlement distribution in relation with the absolute relief and relative relief. In Himalayan area the settlement distribution is mostly affected by above mentioned two morphometric attributes. Drainage texture does not play any important role in the distribution of settlements specially in the Himalayan area. Hence, it has not been included for corre-

lation studies. In general, it can be inferred that the low to moderate altitudinal zones and moderate relative relief zones in the study shares much settlements whereas the high altitudinal)zones and high to very high relative relief zones do not enjoy much number of settlements.

How far and how much settlement distribution in the study area is affected with the morphometric attributes will be discussed here with the help of correlation values computed on the basis of Karl Pearson's method. Dakeyne (1962), Tewari (1966), Singh (1968), Asthana (1968), and Kharkwal (1969) have studied in their study areas the influence of physical factors on the distributional pattern and types of settlements on different landforms. The study of Rich (1917) is pioneer in this field which analyses the landform–cultural features relationship and formulated some concepts.* Through his study Rich has tried to know how far the cultural features are controlled by terrain of that area and to what extent they can be correlated with the stages in the former physical cycle. In the same way Zakrazewaska (1967) concludes various relationships between physical landforms and cultural landforms, by reviewing the ideas of American Geographer, on the gemomorphic landform analysis and its relation to other landform studies. Besides these above studies the studies of Mutton and Adams (1939) and that of Swainson (1944) are also of good importance which show the relationship of physical phenomenon to cultural phenomenon, e.g., settlements.

ABSOLUTE RELIEF VS SETTLEMENT DISTRIBUTION

Inverse relationship has been marked in between the settlement distribution and absolute relief. The whole study area has

---

*The analysis treats four cultural features (forest clearings, road s, houses and towns) and seven types of topography (youth, Leteyouth, early maturity, maturity, old age and extreme old age).

been divided into 17 absolute relief categories ranging from below 750 m to above 3000 m with an interval of 150 m except the last category. The highest percentage of settlements lies in the height group of 1,550–1,800 m which accounts 14.24% of the total settlements. The second and the third maxima of 12.54% and 12.0% occupies the height groups of 1950–2100 m and 1350–1500 m respectively. The tables shows that 9.23% of the total settlements lies in height groups of 1,050–2,400 m. This high percentage of settlements is scattered in the flat valley bottom, on the river terraces and on the flat tops of the ridges and their moderately sloping spurs. Settlements percentage is low below 1,050 m but density is high here and above 2,400 m density of settlement is also low here. Lower and upper height groups having low percentage of settlements provide different basis of explanation because of difference in density. So far as the lower altitude is concerned, here the area is less, hence, the density is high. But as far as higher altitude is concerned it is poorly settled, because, this is the zone of steep slope, scarps, cliffs, highly dissected and densely forested terrain. All these factors can be held responsible for the repelling of human settlements.

The data of settlement frequency (converted into percentage) is of little importance as it does not consider the related aspects. However, density does appear as a better media to consider the related aspects. The settlement density in the area varies from 6.1 per km² for the height group 900–1,050 m to 0.2 for the 2,850–3,000 m height group. Settlement density is fluctuating around 5 per km² from the lowest height group to the height group of 2,250 to 2,400 m. It reveals more or less the even nature of distribution of settlements upto the height of 2,400 m. Higher concentration of settlement can be observed in the height groups of 900–1,050 m, 1,650–1,800 m, 1,950–2,100 m and 2,250–2,400 m with settlement density of 6.1, 5.8, 5.7 and 5.6 per km²

TABLE 1

Height groups and settlements

Absolute relief groups (m)	Density 1 km²	Percentage of the total number of settlements
600– 750	5.0	0.06
750– 900	5.0	0.19
900–1, 050	6.1	3 20
1, 050–1, 200	5.1	7.17
1, 200–1. 350	5.0	8.16
1, 350–1, 500	5.2	12.00
1, 500–1, 650	5.0	9.18
1, 650–1, 800	5.8	14.24
1, 800–1, 950	4.7	9.52
1, 950–2, 100	5.7	12.54
2, 100–2, 250	5.4	10.75
2, 250–2, 400	5.6	7.67
2, 400–2, 550	3.9	3 30
2, 550–2, 700	2.4	1.45
2, 700–2, 850	2.1	
2, 850–3, 000	0.2	0.52
3, 000–3, 150	0.0	

respectively. But there is sharp decrease after the height groups of 2,250–2,400 (Fig. 2). However, in the higher elevation zones the density of settlements diminishes regularly, which, no doubt, denotes the scarps facing peaks of Shali and Thalgordhar. The density is nil in the highest height group of above 3,000 m.

Further, for more precise result the quantitative relationship has been expressed by the correlation coefficient of the above mentioned two variables, which show negative inter-dependance with correlation coefficient minus value of 0.059. The negative value is the result of young topography and different upheavals which provide steep

Slope and scarps in the area and practically such terrains cannot be utilized for human dwellings. The existence of platforms at higher elevations do provide facilities for habitation. Hence, the correlation coefficient does not approach minus 1. But in the present study area the inverse relationship between altitude and settlements holds very high position.

RELATIVE RELIEF VS SETTLEMENT DISTRIBUTION

As far as the relative relief is concerned there appears to be a marked inverse relationship between the settlement distribution and relative relief. In general, most of the settlements are located in the areas of moderate to high relative relief zones of 60–600 m. Settlement density per km^2 is higher (7.9) in the lowest relative relief group of 60-120 m and more or less settlement densiry is decreasing as the relative relief value is increasing and it is as low as 1.5 settlements in the highest relative relief group of 780–840 m. Settlement density in the moderate and moderately high relative relief areas is high only because of facilities available which are essential for the growth of human dwellings in these areas which have been discussed in the previous pages of this paper. Settlement density is high upto the relative relief of 360 m and moderately high upto 480 m and moderate upto 600 m and moderately low upto 780 m and low in the relative relief group of 780–840 m (Table 2).

The settlement frequency have also been analysed in relation to relative relief group with their areal coverage. Settlement frequencies are less (1.20%) in the lowest relative relief group of 60–120 m with the highest settlement density of 7.9 denotes the less areal coverage (about 13 km$_2$) along with the valleys (mainly in the Gambhar catchment and along the Sutlej river) and plain like terrain. The settlement frequency is high (19.20%) in the relative relief group of 360–420 m with the moderately high

settlement density of 5.7 denotes highest areal coverage, i.e., 278 km$_2$ scattered throughout the Sutlej area. Lowest frequency percentage 0.60% of the total number lies in the very high relative relief group of 720–840 m with lowest areal coverage of 11 km^2 mostly near the peaks and scarp steep slopes of valley walls.

A numerical measure is yet to be carried out. The two variables, settlements and relative relief are correlated and similar inferences are afforded by the statistical correlation of the above two variables. The Karl Pearson's coefficient of correlation between the two variables, i.e., relative relief and settlement, in the area under study, is negative 0.0152 which gives a positive support to the above discussion by way of quantitative analysis that the settlements decreases as the relative relief increases. Moreover, the value of correlation coefficient does not

TABLE 2

Relative relief groups and Settlements

Relative relief group (m)	Density 1 km^2	Percentage of the total number of settlement
60–120	7.9	1.20
120–180	5.9	4.59
180–240	6.3	9.87
240–300	6.9	14.48
300–360	6.5	18.60
360–420	5.7	19.09
420–480	5.1	15.45
480–540	4.6	7.30
540–600	4.5	6.32
600–660	2.7	1.30
660–720	2.7	1.13
720–780	3.0 ⎫	
780–840	0.81 ⎭	0.60

approach minus one. Theoretically, the high to very high relative relief zones should not go under human habitation. But, the local level platforms (mostly on the ridges and their offshoot spurs) even at the high relative relief zones have been inhabited by the people since long. Yet, it can be said strongly that the inverse relationship between these two attributes holds very high position

NEGATIVE AREAS FOR THE GROWTH OF SETTLEMENTS

In the study area, there are some stretches which are not suitable for the growth of settlements as the physical factors do not allow them. The areas which are not suitable for the growth of settlements correspond with the areas of steep to very steep slope, high to very high relative relief and high altitude   About 50% of such localities are marked in the north eastern

part of the study area near Shali Peak, Nagtikar peak, Narayanpurdhar and Thalgordhar peak. In general, the northern slopes having most precipitous and densely forested topography throughout this zone of study area are rather least suitable for the growth of settlements. Apart from these high crest zone some other pockets are also in the area which are not suitable for the settlement growth. These zones also correspond with rugged terrain, steep to very steep slope and high to very high relative relief. Such patches of not suitable for the growth of settlement are mostly lying in the Giri catchment lower Nayasari khad and Gintadhar range. The areas of not suitable, least suitable and less suitable are well marked in the Fig 3. Pachmunda hill and Krol hill both do not provide any suitable condition for the growth of settlements.

REFERENCES

P. E. James (1972) :   All Possible World. New York, Odyssey Press, p. 2.

C. O. Sauer (1965) :   Land and Life. Ed. J. Leighly. Berkeley Univ. of California, pp. 325.

A. R. H. Baker (1969) :   Trends in Geography. Ed. R. V. Cooke and J. H. Johnson, London, Pergaman Press, pp. 127.

R. B. Dakeyne (1962) :   Australian Geographer, Vol. 8 : pp. 180–90.

A. K. Tewari (1966) :   Australian Geographer, Vol. 10 : pp. 35–46.

K. N. Singh (1968) :   Southern uplands of Eastern U. P., A Study in Landform and Settlement Distribution. Unpublished Ph.D. Thesis, B.H.U., Varanasi.

V. K. Asthana (1968) :   Landforms and Settlements in Almora and its Environs. Unpublished Ph.D. Thesis. B.H.U., Varanasi.

S. C. Kharkwal (1969) :   Landforms and Settlements in Nainital and its Environs. Unpublished Ph.D. Thesis. B.H.U., Varanasi.

J. L. Rich (1917) :   Geographical Review, Vol. 4 : pp. 297–308.

B. Zakrzewska (1967) :   Ann. Assoc. of Amer. Geogr., Vol. 57 : pp. 128–165.

A. F. A. Mutton and A. E. Adams (1939) :   Economic Geography, Vol. 15, pp. 169–78.

M. B. Swainson (1944) :   Geography, Vol. 29 : pp. 1–8.

Address of the Authors

Dr. S. C. Singh,

Department of Geography, Garhwal University, Srinagar (U.P.).

Dr. S. B. Singh,
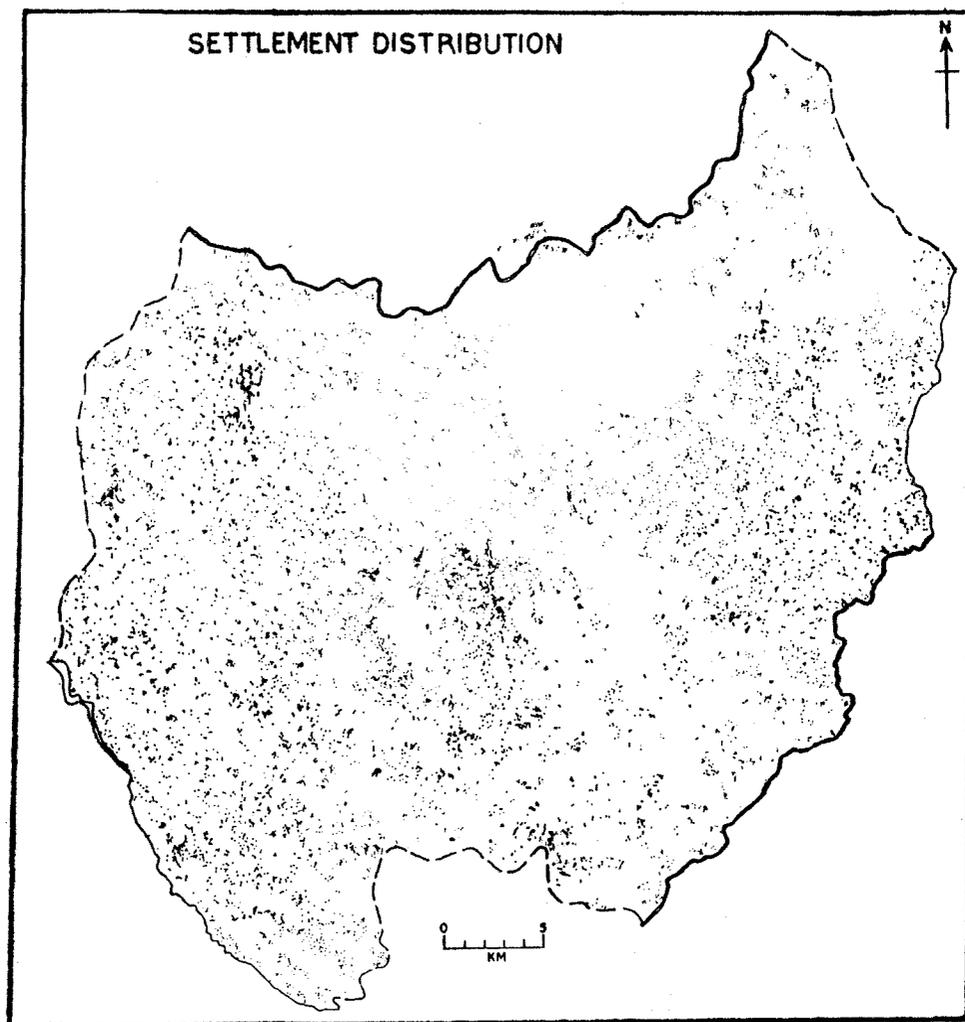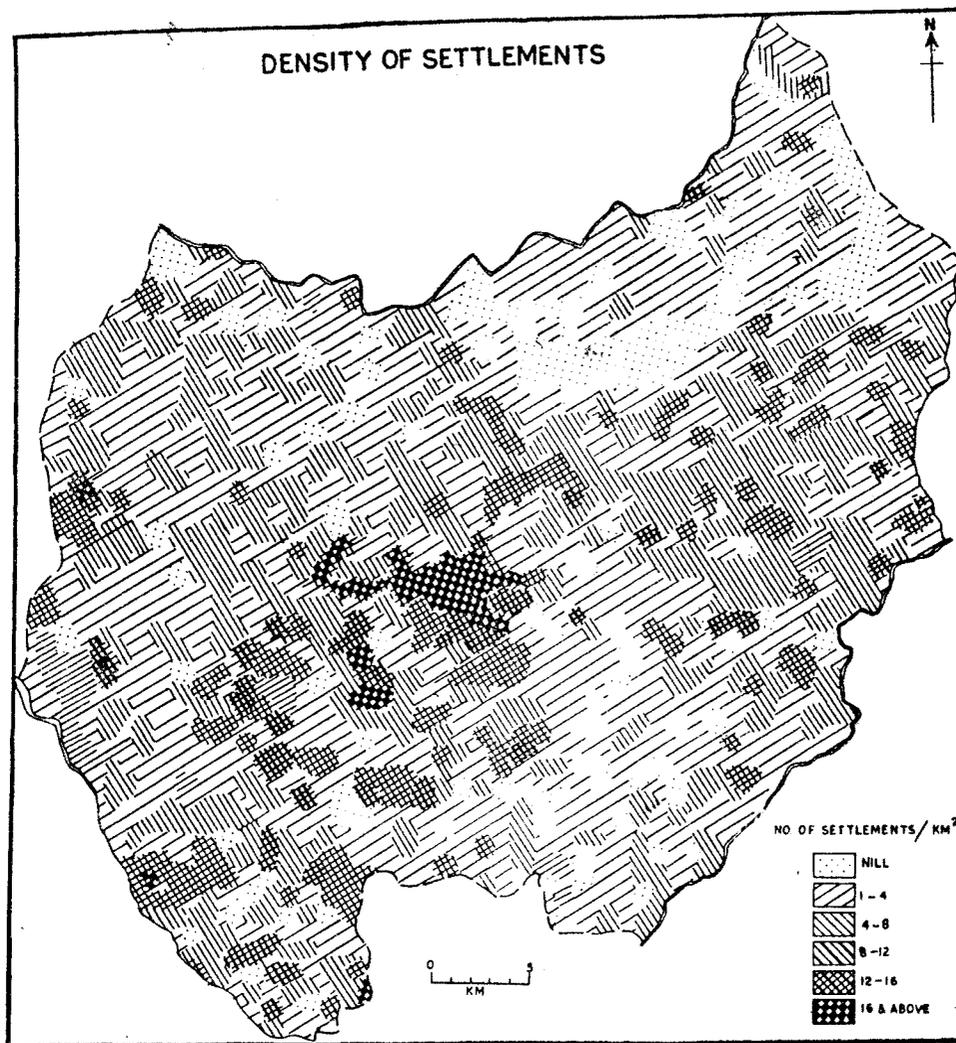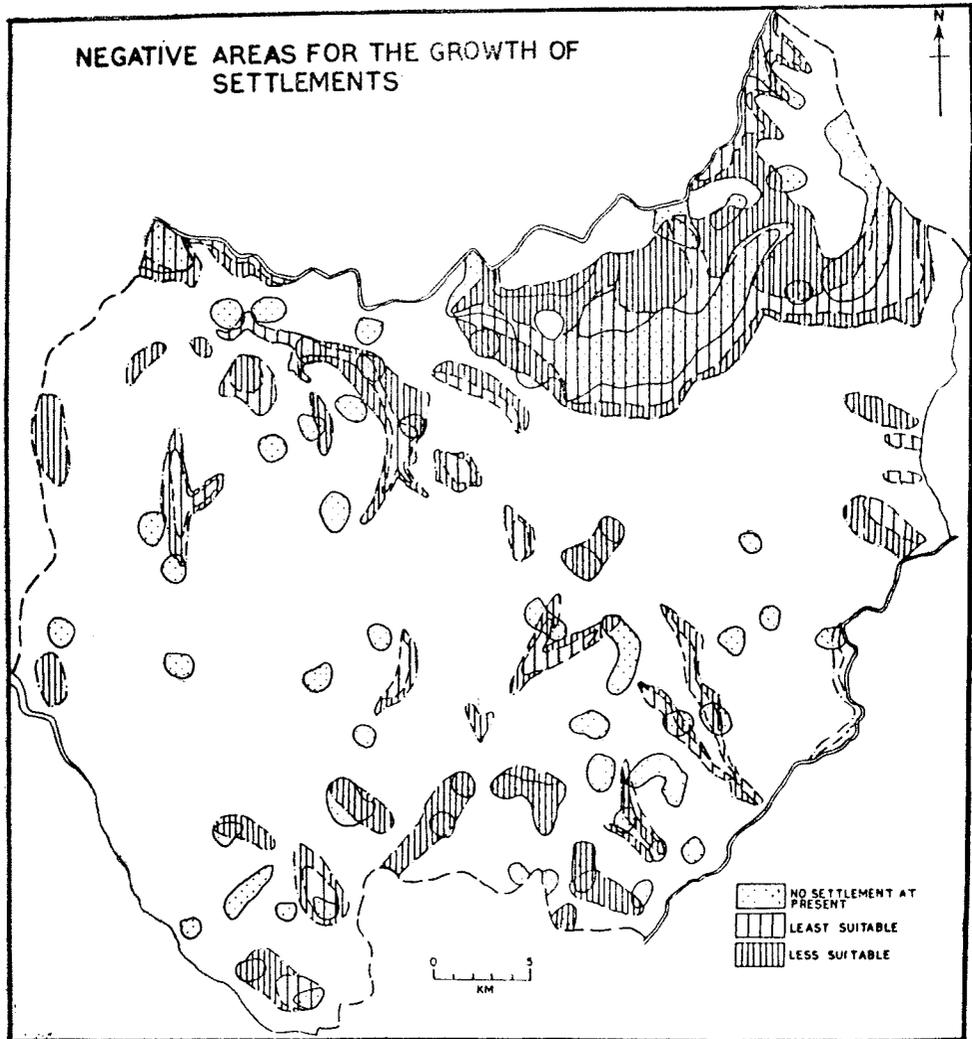
Govt. P. C. College, Kotdwara (U.P.).

SETTLEMENT DISTRIBUTION

FIG. I

FIG.2

NEGATIVE AREAS FOR THE GROWTH OF
         SETTLEMENTS

NO SETTLEMENT AT PRESENT
LEAST SUITABLE
LESS SUITABLE

FIG,3