CHAPTER - 5

5.0.0.0 VARIATIONS IN SETTLEMENT CHARACTERISTICS

It has already been mentioned in the introductory chapter that settlements are the spatial expressions of the modes of resource utilisations by particular communities. The expressions vary in the spatial organisation of homesteads into hamlets and hamlets into villages and of villages into regional patterns. Central to all such different levels of spatial organisation is the ground plan of clustering of homesteads into a settlement unit consisting of a number of organically linked homesteads depicting on the surface of the earth, a shape or a form. All such forms should be identified first in order to find out the tendencies prevailing in a particular region. Within the identification process the dominant forms, their regionality and the probable relationships between forms and functions should be included.

5.1.0.0 IDENTIFICATION OF DOMINANT FORMS

The analysis of settlement form includes the study of the spatial arrangement of a particular cluster of houses, i.e. an individual settlement. This form denotes the geometric shape which essentially constitutes the resultant of mutual spatial arrangements between the homesteads, open space and roads of an individual settlement.

There are two extreme types of habitation, namely; (a) nucleated or clustered in which houses are placed closely together to form a compact habitation clearly demarcated from the surrounding space, and (b) the dispersed or scattered type where houses are built apart, either as single dwelling units or in small clusters of two or three. Between these two extreme types there are quite a number of variants. Clustering of houses generally produce distinct geometric shapes or settlement forms with some exceptions. Dispersion commonly produces shapeless villages. Although most regions
DOMINANT SETTLEMENT SHAPES OF SUNDERBAN

Legend
- Embankment
- Unmetalled Road
- Footpath
- River
- Settlement

Straight

Arquate

Meandering

Hook

Bridged

Bracket

Comb

Square

Rectangular

FIG. 3
have a predominant form, perhaps very few regions can claim to be entirely homogeneous. In Sunderban as a whole a very broad homogeneity is found in the geometric shape and form of settlements. At a micro-level, however, the form of villages varies sharply. Broadly speaking, Sunderban can be conveniently divided into two parts (a) the western, northern and central part where clustering or agglomeration predominates constitutes the larger segment, and (b) the adjoining areas of the reserve forests where dispersion is common. Most of the clustered settlements which forms our first category are found in Joynagar, the northern part of Mathurapur, Canning, northern part of Sagar, Kakdwip and Namkhana, most of Hasnabad, Minakhan and the northern part of Sandeshkhali and Hingalganj.

So far as identification of shape and form are concerned, emphasis has been placed on agglomerated settlements only as dispersed settlements are really amorphous. For this purpose all the topographical sheets (both 1" to 1 mile scale and R.F. 1:50,000) covering entire Sunderban, available areal photographs and 'land sat' imageries have been consulted carefully. The outer boundaries of each cluster have been joined by a line to get definite geometric shapes or form. Initially all the shapes even with slight departures from one another have been considered as discrete cases. Thus a series of settlement forms in Sunderban have been noted with distinct peculiarities (Fig. 3 ). According to the area, settlements are classified into (a) very large (b) large and (c) medium categories. A few villages of each category have been chosen as examples. While choosing the cases other different aspects of these villages were kept in mind so that various factors acting differently on the villages could be understood properly. Different types of settlement forms are as follow:
A. Straight Form

One of the most common forms of settlement in Sunderban is straight linear form. These elongated village form is identified by its simple arrangement of houses along a line. They are elongated in one direction and restricted in another due to certain physical or other economic and cultural factors. This form is produced because of cultural features, like embankments and cross-bunds which also serve as roads, both metalled and unmetalled, and have a great influence on the development of such forms. These linear villages are coterminous with strassendorf (street village) in Germany (Jones, 1969). This form has also emerged where the factors have no apparent physical expressions but have worked indirectly through other factors.

B. Arcuate Form

This is also a typical village form in Sunderban. Sometimes it so happens that several villages in the region have grown along the curvature of the rivers or roads or any other waterbodies. Their arcuate bends have led to the development of arcuate settlement forms. The sign of the original factor may gradually disappear from the topography. But the distinct form remains the same. In some cases a contiguous settlement has different names for its different parts. The implication is that separate settlements coalesced with one another with the progress of time.

C. Hook Shaped Form

An almost circular village form is also not very uncommon in Sunderban. This form looks like a hook. This hook shaped or in other words horse-shoe form of settlement develops on the sharp bend of meanders of rivers and roads. Hook shaped form is normally formed in the mature part of the delta and are often associated with the remnants of meanders of old
rivers and ox-bow lakes. Thus we find that large villages characterized by this form are present in the northern and north-western parts of Sunderban in Joynagar, Mathurapur, Canning and Haroa police stations.

D. Meandering Form

In meandering form, houses develop along a sinuous course. Sometimes villages maintain contiguity and create regular meanders along river meanders. Sometimes the contiguity breaks; dwellings spring up in a meandering form with gaps in between. This can be termed as irregular meandering forms. These are not very common but many instances are found in the northern marginal areas of Sunderban where communication with the outside world can be maintained directly from each individual segment due to better and more well developed transport links and also because collective security from hazards is less important due to their more inland location.

E. 'L' Form

The 'L' shaped villages are found at several sites where two linear forces meet at right angles to each other. This form is linked with the rectangular or square form. These linear forces may be two roads or footpaths meeting at right angles. There are also villages which grow along the sharp bends of the rivers and roads ultimately lead to the development of 'L' shape at a later stage. Big villages usually do not show this form because the gross pressure on habitable area in big villages becomes too high to leave any open space in the intervening area between the extremities of the two limbs.

F. Bracket Form

In this case three forces come together to form a string form
with two arms attached with either extremity. For convenience it may be termed as a (third) bracket. In different parts, this form varies in length and the closeness of clustering. Even in sparsely populated areas, the form is yet to concretise but the tendency can be easily observed from a close examination of maps and aerial photographs.

G. Zigzag Form

This form is found in some places mainly in the western part of Sunderban though not frequently. The villages grow along a zigzag direction. Unlike meandering, where a number of arcuate bends occur, zigzag settlements are produced by a combination of short string settlements along footpaths. These combinations are not due to coalescence of initially separate settlements. Their directions are mostly guided by the layout of plots.

H. 'T' and 'Y' Forms

This form predominates in police stations of Canning, Kultali and Mathurapur. In both the cases two linear forces meet to produce such forms but at different angles. There are various forms between a perfect 'T' and perfect 'Y'. Hence these two have been clubbed together. Yet there may be functional differences between the two forms as we shall show later.

I. Bridged Form

This is a rare case but very interesting in terms of its shape, size and density. Two long parallel string settlements are connected by another string settlement at their middle part and the form of 'H' in most cases.
J. Tooth-like or Comb-like

This is a form that occurs in the southern part of Sunderban in Sagar, Kakdhip, Namkhana, Patharpratima, Basanti and Gosaba. This settlement form consists of one main straight or string settlement. Several secondary string settlements joint the former at right angle. The principal line of settlement usually follows the high land or unchuzamin along the levee or the dyke. Inward parallel extensions take place later with the growth of population.

K. Radial Form

This distinct form is observed in Sagar and Namkhana. Quite a number of linear directions radiate from the refuge houses, located at the heart of the lots. The physical historical and cultural reasons for such forms will be discussed in the in-depth study on the island of Sagar in the following chapter.

L. Garland and Ring Forms

This form is marked by an unbuilt open space in the middle of the village. In this village the central space is occupied generally by a waterbody or land not suitable for house-building purpose.

M. Fan Form

This is not very common but found in a few occasions mostly in the northern part. These settlements are generally small with few exceptions like the large Kumarjol village in Minakhan.

N. Square Form

This form again is not common. Only a few small villages
like Dabu in Canning, are the cases in point. In Dabu, each caste group have created their own square blocks of settlements occupying the four quadrants produced by right angular crossings of two footpaths.

0. Triangular Form

This is found only in one or two villages in Canning and Minakhan. They are very small villages. They do not always appear as well-defined triangles. Their boundaries are mostly governed by natural features.

Apart from the abovementioned forms there are also a few others in Sunderban, but they are insignificant and so have not been included for discussion here.

No two villages can be identical in form. Different villages even under similar environmental circumstances have assumed different forms and the factors causing dissimilarities are always very specific in time and space.

One can say that the 'L' shape is nothing but an inverted 'T' with a truncated arm which has not developed at all due to some specific cause. It can also be said that if a second arm is attached with the open end of 'L' in the same direction it produces a 'bracket'. If several parallel arms grow at the central part of the 'bracket' then it is considered a 'comb'.

5.2.0.0 REGIONALITIES IN DOMINANT FORMS

We have already identified seventeen different settlement forms in Sunderban as a whole. But different police stations have different dominant forms and that way Sunderban can not be called entirely undifferentiated from the standpoint of settlement characteristics.
It appears that Kakdwip has the most number of forms including straight, arcuate, complex open ended and irregularly-shaped settlements along with a sizeable number totally dispersed units. Very close to Kakdwip come Namkhana, Mathurapur, Patharpratima, Canning, Kultali, Gosaba and Basanti although irregularly-shaped settlements are quite infrequent in Namkhana, Canning, Basanti, Gosaba and Kultali. While the incidence of straight linear settlements is very low in Patharpratima and complex open ended forms are not important in Kultali. Hingalganj, Hasnabad and Sagar have similar cultural landscapes from the point of view of settlements alone showing the dominance of straight linear, arcuate and complex open ended forms. Joynagar and Sandeshkhali have almost similar patterns with the prevalence of straight linear and arcuate forms. Similarly, Haroa and Minakhan have almost similar. Characters exhibiting the dominance of arcuate and complex open ended forms with parts of Haroa being occupied by settlements of irregular forms. A notional tabulation the facts stated above can be made to describe the regional differences (Table 28).

**TABLE 28**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Forms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Straight</td>
</tr>
<tr>
<td>Joynagar and Sandeshkhali</td>
<td>✓</td>
</tr>
<tr>
<td>Hasnabad</td>
<td></td>
</tr>
<tr>
<td>Hingalganj and Sagar</td>
<td>✓</td>
</tr>
<tr>
<td>Gosaba, Basanti Canning and Namkhana</td>
<td>✓</td>
</tr>
<tr>
<td>Haroa</td>
<td></td>
</tr>
<tr>
<td>Minakhan</td>
<td>✓</td>
</tr>
<tr>
<td>Kultali</td>
<td></td>
</tr>
<tr>
<td>Mathurapur</td>
<td></td>
</tr>
<tr>
<td>Patharpratima</td>
<td>✓</td>
</tr>
<tr>
<td>Kakdwip</td>
<td></td>
</tr>
</tbody>
</table>

Note: ✓ indicates the presence of a dominant form.
Apart from the regionalities it is evident that the history of colonisation has also an important role to play in the results of the grouping process; otherwise, Sagar, Hingalganj and Hasnabad would not have found their places in the same group.

Based on the findings related to the dominant shapes as observed in the fifteen police stations, some statements can be made.

The northern police stations like Hasnabad, Haroa, Minakhan, northern part of Canning, Joynagar, and northern Mathurapur generally contain large clusters compared to their southern counterparts. Either they have emerged as big blocks producing polygonal forms or even if the forms are linear they definitely show significant clustering. These settlements have produced distinct shapes or geometric forms. They are generally associated with complex combinations of different shapes. In few occasions big clusters are unable to retain their original forms. Some of them begin to loose. The initial shape had become irregular or amorphous (big settlements located to the south-west of Joynagar, Arjuntala-Khalisadi-Dhanpota-Mazumpur of Haroa, Kumarjol of Minakhan, Raidighi-Kankandighi of Mathurapur etc.). All these settlements are important centres of their respective neighbourhoods either offering various occupational opportunities or being administrative centres and enjoy a long settlement history. Too much pressure of population has distorted the mechanism that once controlled the evolution of the early forms. At the same time the presence of an optimum population has actually helped some settlements to attain distinct forms.

The area covering northern Sagar, Kakdwip some parts of Namkhana northern Patharpratima, northern Sandeshkhali and some parts of Hingalganj exhibit settlement forms with a lesser degree of clustering compared to northern Sunderban. Although definite shapes or forms are produced, they are yet
to achieve optimum distinctiveness along with the proper
degree of clustering. Either the forms are simple or even
with complex combinations of forms they are mostly very
thin and not at their climax of development. These
clusters are often intermingled with dispersed homesteads.

Further south, either the settlements are just developing
some shapes (straight, arcuate or meandering) or the region
is covered by absolute dispersion. No form can be identified
because they are still in their embryonic stage of develop­
ment.

Thus the most distinguishable fact is the prevalence of
different stages of settlements in different parts of
Sunderban. Apart from the influences rendered by other
aspects of demography, reclamation history and the impact
of physical setting on the evolution of these different
stages of settlement forms is directly related to the popu­
lation pressure on habitable land. The size and degree of
clustering along with the distinctiveness of forms increase
with increasing population excepting in those cases where
inherent specificities of physical space have subdued the
cultural influences or where planned interventions have
disregarded the role of physical controls. The radial form
in Sagar or straight criss-crossed linear forms in the
Mahishani island of Namkhana and Charkhali of Gosaba are
the result of planned intervention.

5.3.0.0 FACTORS CONTROLLING FORMS

Out of the multitudes of forms which can be identified in
various parts of Sunderban, a broad generalisation can be
made that the dominant tendency almost everywhere is towards
linearity. As will be seen from the case study of the river
settlements along the Bidyadhari, the history of colonisation,
jungle clearing and ground lay out of plots can explain to a
SCHEMATIC MODEL OF A
ZIGZAG SETTLEMENT FORM

FIG. 4
great extent the reasons behind the linear formations. Almost all departures from unilinearity are due to complexities added by demographic growth during the later part of the course of development of these settlements. In most cases these complexities arose when the new settlers tried to settle in more inland positions being compelled by any or both of two major factors. The first is the congestion along the embankment close to an embarking point; and the second is an increasing assurance that the inland locations will not be flooded so easily due to the reinforcement of the peripheral embankments. Thus, from a simple linear settlement branches were thrown off inwards in the form of 'L' to 'bracket' or 'T' or a 'comb' depending upon physical opportunities.

In a lesser number of cases other types of complexities arose particularly where the settlements are located in much more positions away from the rivers and peripheral embankments. The implications of shape like 'L', 'bracket', 'Z' etc. are different from those thrown by the peripheral settlements. In these cases the two major factors determining the shapes are the plot layout and absence of public roads. For example in a situation where a series of plots trending in a particular direction is truncated by another series of plots trending in another direction and where a foot-path has to be created for internal communication from within privately owned lands only by the shape of the settlement will be determined by the angle of which the truncation takes place. A repetition of the same situation in an area may produce a zigzag pattern. The turns may even become right angular in certain cases. A schematic plan of such settlements will explain it more conveniently(Fig 4).

In a still lesser number of cases settlement forms may be guided by bank erosion or erosion by creeks extending into the islands from the major rivers. This has happened in
cases where 'y' shaped settlements are found near the banks with the fork of the 'Y' pointing towards the main river enfolding an advancing creek within the fork. In other cases, such forms may appear at the confluence of two small inland creeks.

Much should not be read between straight linear and arcuate developments because the differences are mostly guided by the shape of the embankments or roads. However, arcuate forms are mostly peripheral whereas straight linear forms are mostly associated with cross-dykes.

Small agglomerations are frequently characterised by economically and socially deprived population like landless labourers and small low caste minorities and even small tribal communities. But such a relationship applies to the more southern areas of Sunderban where these small agglomerations are considered to be merely segregated hamlets within a larger village. In a completely different situation in the northern periphery of Sunderban, some clusters may appear along a given direction but their economic independence and nearness to communication lines have kept them as separate entities as already explained in connection with the meandering forms.

The size hierarchy of individual forms may have something to do with the evolutionary history of settlements. Therefore, the forms along with size variations among the chosen examples of settlements in different police stations are given in the form of a chart in Appendix 5.4.0.0 STAGES IN THE LIFE CYCLE OF SETTLEMENTS

From what has been discussed already in the previous subsections of this chapter, it appears that each and every settlement has a life history of its own in response to
population pressure and the carrying capacity of the land.

One can possibly conceptualise that a settlement passes through the stages of initiation, youth, early maturity, late maturity and old age, each having certain complementarities of its own. These complementarities are discussed below.

Initial stage – When the resources are not fully explored and the population is lower than even the man power required to assess the resource (land) situations. Here, form is yet to develop and dispersion prevails.

Youth – The land has been surveyed and assessed but the population is less than the perceived potential of the land. Form is ribbon-like but disjointed at places.

Early maturity – Population and land resources are imbalanced with respect to one another. The form in this case is contiguous linearity.

Late maturity – Population has to increase the productivity in order to sustain itself. The resultant form is multiple linearity with parallel lines and lines projecting in different directions from the principal axis and the widening of the settlements maintaining a linear orientation.

Old age – The population is in excess of the carrying capacity of land at the given level of productivity. Non-agricultural activities start coming in. Options for selecting sites for settlements are closed. The tendency towards linear formation slackens and clusters become shapeless.
5.4.1.0 MEASUREMENT OF FORMS

The conceptual stages in the life cycle of a settlement may be identified by constructing some indices from measurements made on maps. One such index is the index of linearity which is given by the following expression:

\[ I = \frac{L}{W} \]

where

\( I \) = index of linearity,
\( L \) = sum of all maximum lengths and
\( W \) = sum of all modal widths.

The measurements were taken from toposheets surveyed during 1968-69 with reference to the rural areas of the police stations of Joynagar and Namkhana. For the purpose of ease of comparison these police stations have been sub-regionalised into a number of tracts according to the appearance of the settlement patterns on the maps. The boundaries of the tracts were adjusted to the mouza boundaries as far as practicable. In some cases a tract comprise of a single mouza, whereas in others includes a few. Thus some tracts are smaller in size compared to others and in cases awkward in shape.

The measurements were taken in the following manner.

At first the length of each settlement along its longest axis was determined and measured. All such lengths of individual settlements within a tract were summed up to derive the factor \( L \) in the equation. The width of each individual settlement was then measured along several cross sections and the modal width was found. All such widths within a tract were summed up to derive the factor \( W \) in the equation.
5.4.2.0 THE INDEX VALUES

The maps (11, 12) and the tables (29) showing the tractwise index values along with the corresponding population densities are presented below.

TABLE 29
TRACTWISE INDEX VALUES OF LINEARITY AND POPULATION DENSITY : 1961

<table>
<thead>
<tr>
<th>Tracts</th>
<th>Index of linearity</th>
<th>Density of population/sq km</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - Joynagar</td>
<td>4.97</td>
<td></td>
</tr>
<tr>
<td>2 -</td>
<td>3.19</td>
<td></td>
</tr>
<tr>
<td>3 -</td>
<td>5.91</td>
<td></td>
</tr>
<tr>
<td>4 -</td>
<td>3.14</td>
<td></td>
</tr>
<tr>
<td>5 -</td>
<td>4.26</td>
<td></td>
</tr>
<tr>
<td>6 -</td>
<td>6.51</td>
<td></td>
</tr>
<tr>
<td>7 -</td>
<td>4.14</td>
<td></td>
</tr>
<tr>
<td>8 -</td>
<td>4.33</td>
<td></td>
</tr>
<tr>
<td>Joynagar</td>
<td>4.55</td>
<td></td>
</tr>
<tr>
<td>1 - Namkhana</td>
<td>4.78</td>
<td></td>
</tr>
<tr>
<td>2 -</td>
<td>4.67</td>
<td></td>
</tr>
<tr>
<td>3 -</td>
<td>4.74</td>
<td></td>
</tr>
<tr>
<td>4 -</td>
<td>7.78</td>
<td></td>
</tr>
<tr>
<td>5 -</td>
<td>5.91</td>
<td></td>
</tr>
<tr>
<td>6 -</td>
<td>5.40</td>
<td></td>
</tr>
<tr>
<td>7 -</td>
<td>5.98</td>
<td></td>
</tr>
<tr>
<td>8 -</td>
<td>5.08</td>
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<tr>
<td>9 -</td>
<td>8.78</td>
<td></td>
</tr>
<tr>
<td>10 -</td>
<td>5.43</td>
<td></td>
</tr>
<tr>
<td>11 -</td>
<td>5.44</td>
<td></td>
</tr>
<tr>
<td>12 -</td>
<td>5.52</td>
<td></td>
</tr>
<tr>
<td>13 -</td>
<td>6.50</td>
<td></td>
</tr>
<tr>
<td>14 -</td>
<td>3.00</td>
<td></td>
</tr>
<tr>
<td>15 -</td>
<td>3.63</td>
<td></td>
</tr>
<tr>
<td>16 -</td>
<td>7.73</td>
<td></td>
</tr>
<tr>
<td>17 -</td>
<td>7.13</td>
<td></td>
</tr>
<tr>
<td>Namkhana</td>
<td>5.49</td>
<td></td>
</tr>
</tbody>
</table>

Population densities of 1961 have been considered for purposes of comparison because the surveys of 1968-69 actually started around the beginning of the decade.

The inter-police station comparisons can be drawn from the respective index values. The general pattern in Namkhana is more linear than that in Joynagar. We also know at the same time that the settlements of Namkhana are more recent in origin than those in Joynagar and that the densities are far more higher in Joynagar than in Namkhana.
5.4.3.0 FOUR IMPORTANT CASES

Within the rural parts of the police station of Joynagar a comparison should be drawn between tract number 4 and tract number 6 having index values of 3.14 and 6.151 respectively. In the police station of Namkhana, a similar comparison can be drawn between tract number 9 and tract number 14 having index values of 8.78 and 3.00 respectively. These four tracts demand separate treatment to examine whether the assumptions stated in the previous section are tenable or not.

5.4.3.1 JOYNAGAR - TRACT NO.4

This tract has a comparatively old history of settlement, shows a low index of linearity along with a high population density, is located in the urban fringe of the town of Joynagar and is therefore, characterised by considerable diversity in the occupational structure. It can undoubtedly be taken as an example of a late mature stage of development of settlement form associated with ill-defined compact clusters shorn of distinct linearity.

5.4.3.2 JOYNAGAR - TRACT NO.6

This tract has a comparatively recent settlement history, shows a high index of linearity coupled with a high population density and is characterised by a physical environment which offered considerable productive opportunities for sustaining a high population in agriculture until very recently when some of the river channels started choking up. It may be taken as a case of early maturity in the setting of a highly productive habitat in which the settlements have already developed contiguous linear forms.
5.4.3.3 NAMKHANA - TRACT NO. 9

This tract has a comparatively recent settlement history, shows a high linearity index along with low population density which has remained below the police station average during the three census decades, between 1951 and 1981. With surplus land this tract still has a capacity to retain a higher population and thus can be taken as an example of an youthful stage of development.

5.4.4.4 NAMKHANA - TRACT NO.14

With a comparatively old history of settlement this tract has a low linearity index with a low population density. Being dissected by cross-bunds, this tract is divided into a number of plots, the available land both for agriculture and habitation thus setting considerably reduced. The slackening of the growth rate of population in the post 1951 phase obviously suggests that the carrying capacity of land was exhausted even with a low population base 1951. Characterised by disjointed clusters of settlements, this could be cited as an example of the early mature stage of development.

Out of this exercise it appears very strongly that the distinctiveness of settlement forms is related to certain stages of evolution in the life history of the settlement which again is a function of relative and effective pressure of population on land and not so much with the time of origin of the settlements.