CHAPTER - IV

SPATIAL ANALYSIS OF RURAL SETTLEMENTS
GOA
DISTRIBUTION OF SETTLEMENTS
2001

INDEX

- Rural
- Urban

Scale: 1 cm = 6 kms

Fig. 2.3
Rural settlement is a complex entity and its study pertains to the description and analysis of the distributions of houses by which people attach themselves to the land. As an occupancy unit, it represents an organized colony of human beings, including buildings in which they live or work or store things or use them otherwise, and the streets over which their movements take place. The term rural settlement is generally used as a group of land holdings, with usually a central and in many cases scattered aggregate of residences, the people of which have certain relation and some kind of union or bond of common government.

One of the important considerations to study the spatial variations of rural settlements are the spatial aspects in which the size, spacing, density, nature of dispersion and patterns of the settlements can be analysed. The rural settlements have been studied by many social scientists, Anthropologists, Political Scientists, Economists and also Demographers. Their orientation to study the rural settlements definitely differ one among the others. As far as geographer are concerned the space is the most important aspect. Hence, attempt has been made here to study the rural settlements system in the study are mainly focusing on spatial perspective points of view.

The spatial distribution of rural settlements is the outcome of the relationship between the resources of a region and its people. The variation in
size and spacing of rural settlements from one region to another is due to the fact of the variations in ecological conditions. It is also a well known fact that the variation in size and spacing of rural settlements depends upon fundamental factors like fertility of land, productivity of agriculture, availability of water resources, history and stages of land occupancy etc. The size and spacing is also related to the socio-economic, politico-cultural and histo-religious conditions of the people in a particular region. On the other hand the types of rural settlement show the reciprocal relationship of human occupancy feature and environment. Aurousseau (1920) opined that the arrangement of rural settlements as a geographical entities to express the grouping of dwellings and their inter relationship. As rural settlement is basically an agricultural workshop, as such it cannot be separated from its land. It shape and arrangement are always with reference to the kind of work, the agricultural techniques and the way the soil is used.

The spatial distributions of rural settlements are governed by the historical, political and socio cultural factors in addition to the different ecological settings. Singh, R.B. (1979) made an attempt to study rural settlement types, their distribution and future trends in Varanasi district of Uttar Pradesh and observed that the distribution and types of settlement is in conformity with the natural landscape. Bhattacharya (1975) studied the settlement pattern of deltaic West Bengal in relation to physiography and agricultural land. The types, pattern and house types of rural settlement was analysed in Uttarakhand area in Uttar Pradesh and delineated a clear cut
distinction between hilly and plain area settlements. Negi (1972), Houston (1953) observed the relation of agricultural systems to settlement forms and types in Europe. Cluster and agglomerated settlement distribution are usually noticed in the plain area, where continuous, uniform and extensive explorations are found. Bricks (1976) described dispersed pattern of farmstead settlement in the North American Corn Belt, where Nearest Neighbour and quadrant method were used to examine the distributional pattern in relation to random and other types of point patterns. Mandal (1977) analysed the effect of completion of Kosi Project on rural settlements in the flood plains of Kosi. The nucleated pattern of settlements in Eastern Nigeria are on the periphery, while dispersed settlements are mainly distributed in the central part of the region is due to inheritance law and customs, kinship patterns, historical and political factors (Udo, 1975).

Singh, S.B. (1996) examined the spatial pattern of rural settlements by analyzing the physico-cultural, socio-economic and other characteristics of Suryapur plain of Uttar Pradesh and concluded that the perspective or evolving socio-economic conditions such as land and land tenure system, crop combination, means of transport and various communication, channels, political hold etc., have largely affected the people of the landscape, and their settlements.

Kailash Nath (1981) studied the spacing of settlements, nature of dispersion and types of settlements in Lower Ganga-Ghaghra Doab in Uttar Pradesh and observed that the spacing of settlements reveals a high degree of
spatial variation and is due to minor terrain differences. The types of settlement pattern is largely governed by the nature and fertility of the soils in the region. The statistical techniques were largely applied to study the spatial variation of rural settlements.

Ram Bali (1969) applied the statistical methods to evaluate the distributional pattern and sitting of rural settlements and concluded that the distribution of habitations over the space is guided by the physical, environmental factors as well as historical traditions and existing socio-economic conditions.

SIZE AND SPACING OF RURAL SETTLEMENTS

Geographers and other regional and social scientists are making an effort to analyse the pattern of irregularities either in spacing size shape etc and eversince trying to suggest means and ways to overcome their unpredictable nature. In this context several studies have appeared by now having geographical orientation. The analysis of hypothetical spacing is based on Christaller’s conceptual hexagonal arrangement of settlements which may be true only in an uniform terrain. Therefore the variation in spacing of settlements has due importance in a practical situation rather than hypothetical. There are several mathematical expressions and techniques by which several scholars have depicted the spacings of settlements in various regions.

This chapter aims to identify the size and spacing of rural settlements in the study area in order to evaluate the characteristics of determinants which
command the spatial characteristics of settlements in different talukas. The spatial patterns of rural settlements has been worked out on the basis of the average spacing of settlements and the average population size of the settlements (Table-2.1).

Table-2.1
Size of Rural Settlements

<table>
<thead>
<tr>
<th>Talukas</th>
<th>Rural Population</th>
<th>No. of Villages</th>
<th>Average Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canacona</td>
<td>27888</td>
<td>06</td>
<td>4648</td>
</tr>
<tr>
<td>Quepem</td>
<td>18199</td>
<td>06</td>
<td>3033.16</td>
</tr>
<tr>
<td>Sanguem</td>
<td>25797</td>
<td>08</td>
<td>3224.62</td>
</tr>
<tr>
<td>Salcete</td>
<td>93409</td>
<td>23</td>
<td>4061.26</td>
</tr>
<tr>
<td>Murmagao</td>
<td>15557</td>
<td>04</td>
<td>3889.25</td>
</tr>
<tr>
<td>Ponda</td>
<td>41651</td>
<td>10</td>
<td>4165.1</td>
</tr>
<tr>
<td>Sattari</td>
<td>80535</td>
<td>21</td>
<td>3835</td>
</tr>
<tr>
<td>Tiswadi</td>
<td>86960</td>
<td>16</td>
<td>5435</td>
</tr>
<tr>
<td>Bicholim</td>
<td>13654</td>
<td>04</td>
<td>3413.5</td>
</tr>
<tr>
<td>Bardez</td>
<td>41081</td>
<td>11</td>
<td>3734.63</td>
</tr>
<tr>
<td>Pernem</td>
<td>49367</td>
<td>11</td>
<td>4487.90</td>
</tr>
<tr>
<td>Total</td>
<td>494098</td>
<td>120</td>
<td></td>
</tr>
</tbody>
</table>


The formula for determining the spacing of rural settlements is based on their density in the rural area. Walenty Winid a Polish geographer derived a formula to determine the frequency of towns in any area. The same expression
was adopted by Kulakarni to evaluate the size and spacing of rural settlements in Belgaum district of Karnataka State and found quite applicable for rural studies. The formula is as follows

\[ D = \sqrt{\frac{A}{N}} \]

Where,
- \( D \) is the average distance between settlements.
- \( A \) is the total area of the taluka.
- \( N \) is the number of settlements within that area.

The method applied to compute the average size of rural settlement is

\[ S = \frac{P}{N} \]

Where,
- \( S \) is considered as the average size of population of the village.
- \( P \) is the rural population of the taluka.
- \( N \) is the number of villages in the taluka.

The same is applied and calculated for all the 11 talukas and grouped into three classes on the basis of quartile value. For the convenient of the analysis three categories have been formed in order to represent the spacing of the rural settlements as follows.

1. Areas of low spacing (<4.27 Kms)
2. Areas of moderate spacing (4.27 Kms - 7.65 Kms)
3. Areas of high spacing (7.65 -11.12 Kms)
AREAS OF LOW SPACING SETTLEMENTS

The areas of low spacing of rural settlements are clearly identified in the talukas of Salcete, Ponda and Bardez. The average distance of the settlements in the taluka of Bardez is 3.54 Kms and has a population size of 3835 persons. In Salcete taluka the average size of population is computed as 4061 persons and the average distance between the settlements is 3.56 Kms (Table-2.2). The last taluka in this category is Ponda which has the spacing as less as 4.27 Kms and the population of 5435 persons. There are 60 settlements in this category distributed in three talukas and amounts to 50% of total rural settlements selected for study. Hence, it can be easily concluded in the study that the 50% of the rural settlements have close spacing in the study region. The main reasons for such a close spacing of settlement is due to surface configuration, availability of water facilities and other natural resources (Fig. 3.1).

Table-2.2
Spacing of Rural Settlement

<table>
<thead>
<tr>
<th>Talukas</th>
<th>Total area of the taluka in Sq.Km</th>
<th>No. of Settlements</th>
<th>Average Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canacona</td>
<td>352.0</td>
<td>06</td>
<td>7.65</td>
</tr>
<tr>
<td>Quepem</td>
<td>318.3</td>
<td>06</td>
<td>7.28</td>
</tr>
<tr>
<td>Sanguem</td>
<td>873.8</td>
<td>08</td>
<td>10.45</td>
</tr>
<tr>
<td>Salcete</td>
<td>292.9</td>
<td>23</td>
<td>3.56</td>
</tr>
<tr>
<td>Murmagao</td>
<td>109.1</td>
<td>04</td>
<td>5.22</td>
</tr>
<tr>
<td>Ponda</td>
<td>213.5</td>
<td>10</td>
<td>4.62</td>
</tr>
<tr>
<td>Sattari</td>
<td>264.0</td>
<td>21</td>
<td>3.54</td>
</tr>
<tr>
<td>Tiswadi</td>
<td>292.8</td>
<td>16</td>
<td>4.27</td>
</tr>
<tr>
<td>Bicholim</td>
<td>495.1</td>
<td>04</td>
<td>11.12</td>
</tr>
<tr>
<td>Bardez</td>
<td>238.8</td>
<td>11</td>
<td>4.65</td>
</tr>
<tr>
<td>Pernem</td>
<td>251.7</td>
<td>11</td>
<td>4.78</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3702</strong></td>
<td><strong>120</strong></td>
<td></td>
</tr>
</tbody>
</table>

Source: Statistical Hand Book and Personal Computation.
The impact of fertility of land and the availability of water resources which led to close spacing of settlements can be easily noticed in the talukas of Bardez and Ponda. Both the talukas being located in midland region has large tracts of fertile land and numerous small rivers and rivulets which provide water for settlements and agricultural lands. The soils found in this region is relatively fertile which helps in close spacings of human settlements. The talukas of Bardez and Ponda have few industries functioning, which attract the people for employment and labours. As a result, such settlements have been emerged and closer to each other. Tivim is Bardez taluka and Cundaim in Ponda taluka being industrial areas quite but natural, that the settlements have been highly concentrated which reduce the spacing of the rural settlements.

It has been observed that the taluka of Salcete has maximum number of villages amounting 23, which are closely spaced due to locational advantages. As the taluka is located in the coastal region the surface configuration is relatively plain, which has attracted large number of people to establish their settlements. The settlements are developed in the coastal belt because of the overall development of the region which has all means of basic amenities like, water, electricity, transportation etc. There are good number or roads in the taluka as a result of which all along the transportation linkages the settlements have been emerged in close spacings. The tourism activity is a prime industry in the study region. as a result a large number of tourist visit the coastal areas to enjoy the aesthetic beauty of it. To extend the services by the localities to the tourists and to cater the need of such tourists, people use to stay or settle in
such areas ultimately, the settlements have increases resulting into decrease in spacing of settlements in the taluka of Salcete.

AREAS OF MODERATE SPACING

The settlements of moderate spacings are mainly confined to the midland region of the study area. There are six talukas in this category namely, Tiswadi, Bicholim, Pernem, Murmagao, Quepem and Canacona. The average spacing of settlements in these talukas is ranging between 4.62 Kms to 7.65 Kms. The settlement spacing of 4.62 Kms is found in Tiswadi taluka where as the maximum spacing of settlements in this category is 7.65 Kms found in the taluka of Canacona. The talukas of Bicholim, Pernem and Canacona have moderate spacing largely because of the agricultural land and extension of irrigation facilities. The taluka of Canacona has large amount of forest cover and a wildlife sanctuary, which is also a part of western ghats. Hence, the settlements are not largely developed, which led to moderate spacing of habitations. The moderate spacing of rural units in Quepem taluka has quite different reasons than that of Tiswadi. The taluka has a average population of 3033 population and the distance between settlements is 7.28 Kms. The region which lies in midland region of the study area has vast tract of agriculture lands. But the settlements have developed only is the region where there are fertile lands and effective water bodies. All the well irrigated tracts of the region have a closer spacing of rural units with low population size. This justifies that the means of availability of water is the main consideration for moderate spacing of settlements.
The taluka of Tiswadi has average spacing because of the influence of the state capital city Panaji. There is large number of roads radiating from the state capital city, and many settlements have developed all along such roads spacing them moderately. The other reason observed is the flow of the river Mandovi in this taluka which has attracted rural settlements all along its banks leading to moderate spacing. The taluka of Murmagao has moderate spacing with the average distance between settlements as 5.22 Kms and population size of 3889 persons. There are only four settlements in this taluka and it is one of the smallest taluka in the study region. The moderate spacing of settlement in this taluka is due to the fact that of presence of port city Murmagao from which number of goods are transported towards interior regions. As there is a good network of roads to the city, all along the roads the settlements have developed with moderate spacing. There are large number of oil bunkers and other industrial godowns in the region which attract few people for settlement and employment in these sectors.

Altogether there are varied reasons for the moderate spacings of rural settlements which vary from region to region, however some of the most common reasons are availability of moderate fertile lands, impact of extended irrigation facilities, locations of settlements along the transportation nodes, development of tourism spots etc.

AREAS OF HIGH SPACING SETTLEMENTS

There are only two talukas in the study area namely, Sanguem and Sattari which show high spacing and are located towards eastern parts of the study region which generally forms the foothills of Western ghats.
The average distance between the settlements in Sanguem taluka is 10.45 Kms and has an average population of 3225 persons. There are quite a few reasons of high spacing in this taluka. The prominent reason is, it is the largest taluka and has more area compared to other talukas in the study region. The topographical condition does not permit the large settlements. The region is widely under the influence of forest cover and a wild life sanctuary called Bagwan Mahavir wild life sanctuary where human habitations are restricted. There are very few economic resources compared to other talukas of the study region which drive the people towards other talukas rather than settling in these areas.

The taluka of Sattari has a average spacing of 11.12 Kms which is the maximum distance between the settlements in the study area. This taluka has large deposits of mineral resources and mining activities are more dominant. Due to poor transportation, large amount of pollution and limited basic amenities, the rural habitation is limited to few areas. The settlements are widely spaced only at the areas of mining and agricultural tracts. As the mining activities are largely mechanized there is very less scope for human habitations hence the spacing of settlement is more compared to other regions in the study area. Around 50 percent of settlements in the study region are closely spaced and depict the developed areas, and 40 percent of rural settlement have moderate spacing which is relatively developing is nature and around 10 percent of settlements have large spacing due to varied reasons in the study area.
It is observed that the settlement with close spacing highly depend upon each other for various functions. Lesser the spacing more in the development of the region. As the spacing is less there is a concentration of functions in many talukas. On the other hand higher more the distance between settlements, lesser the inter dependence between them. It is also noted that the overall development is also less, as the various functions are concentrated only at few places in the form of isolated pockets. Thus, it is a need of the hour so as to give thrust for planning and development of such areas of higher spacing between rural settlements.

NATURE OF DISPERSION OF RURAL SETTLEMENTS

A major hurdle towards the attainment of balanced regional development in India is created by the nature of planning policies and programes which give more attention towards sectoral planning neglecting spatial and functional aspects. Before entering into the process of planning of any region, it is essential to know how the settlements are distributed, the basic facilities available, what type of relationship among these distributional pattern exist etc. For planning of overall development of the taluka or a region, the settlements or the growth centres cannot be at random. It is necessary that one centre should be linked with other settlement spatially and functionally. There are numerous distributional patterns ranging from perfect clustering to perfect uniformity emerged on the surface of the earth. To explain there distributional pattern effectively, number of scholars developed quantitative methods like Nearest Neighbour analysis, and has been applied to explain distributional pattern of settlements precisely.
Nearest Neighbour method originally was developed by two botanists Clark and Evans (1954) with an assumption that the distributional pattern of settlements will be at random because various physical, economical and social factors influence the pattern with different velocities in a region. The distributional patterns may be clustered or may be linear, along the transportation lines, and coastal areas etc. Such various patterns can be explained precisely by applying Nearest Neighbour methodology.

Though the technique suffers from number of short coming (Medvedkor, 1967), it serves as a better statistical tool for geographers to analyse the pattern of point distributed over an area (King, 1962). In defending the method, Ambrose (1972) observes that the technique is not simply a statistical “toy” to be played around with, but a genuine tool to improve the analysis that geographers make use of in the settlement distribution pattern and also considered as a planning tool.

The formula of nearest neighbour is as follows.

\[
\text{The Nearest Neighbour Index (Rn)} = \frac{\text{Observed Distance (OD)}}{\text{Expected Distance (ED)}}
\]

\[
\text{Observed Distance} = \sum \frac{\text{Distance between Settlements}}{\text{Number of Settlements in a Taluka}}
\]

\[
\text{Expected Distance} = 0.5 \sqrt{\frac{A}{N}}
\]

Where,

A is the total area of the taluka.
N is the number of settlements in the taluka.
The Rn Index generally ranges from 0.0 to 2.15, where 0.0 indicates more regular disposal of points and 2.15 indicates perfectly regular pattern. The range of Index value 0.0 to 2.15 can be grouped into seven categories on Rn scalogram to explain the distributional pattern precisely.

To know the nature of dispersion the above method was adopted and the talukas have been taken as the areal units for the measurement of dispersion of rural settlements.

On the basis of Rn-values calculated in the study region the nature of dispersion may be grouped into five categories.

CLUSTERING

In the category of clustering only one taluka namely Pernem having Rn value 0.0 occupies the position. This taluka lies towards the Northern part in the study area, having the total rural population of 62,381 persons. The taluka accounts for about 6.79% i.e., 251.7 Sq.Km of the total area and has 9.1% of rural settlements. The average area per village is recorded as 22.88 Sq.Km and the number of persons per village is calculated as 5671 persons. The most common reasons for cluster nature of settlements in this taluka is due to limited amount of agricultural land and also the land under irrigation is less. More than 85% of the land is having laterite type of soil which is very low in fertility as a result; the agricultural activities are limited to only few pockets. The areas with concentration of water bodies have attracted some settlements which make the region more clusters in settlements (Fig. 3.2) (Table-2.3).
GOA
NATURE OF DISPERSION OF RURAL SETTLEMENTS

INDEX

- Clustering
- Elongated or Approaching Clustering
- Leading Towards Clustering
- Random
- Approaching Uniformity

Fig. 3.2
### Table-2.3

Distribution Pattern of Settlements by Nearest Neighbour Analysis

<table>
<thead>
<tr>
<th>Talukas</th>
<th>Observed Distance</th>
<th>Expected Distance</th>
<th>Rn Value</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canacona</td>
<td>4.2</td>
<td>3.82</td>
<td>1.09</td>
<td>Random</td>
</tr>
<tr>
<td>Quepem</td>
<td>2.6</td>
<td>3.64</td>
<td>0.71</td>
<td>Leading towards clustering</td>
</tr>
<tr>
<td>Sanguem</td>
<td>4.94</td>
<td>5.58</td>
<td>0.88</td>
<td>Random</td>
</tr>
<tr>
<td>Salcete</td>
<td>1.48</td>
<td>1.82</td>
<td>0.81</td>
<td>Random</td>
</tr>
<tr>
<td>Murmagao</td>
<td>2.59</td>
<td>2.61</td>
<td>0.99</td>
<td>Random</td>
</tr>
<tr>
<td>Ponda</td>
<td>1.53</td>
<td>2.07</td>
<td>0.73</td>
<td>Leading towards clustering</td>
</tr>
<tr>
<td>Sattari</td>
<td>2.17</td>
<td>5.56</td>
<td>0.39</td>
<td>Elongated or approaching clustering</td>
</tr>
<tr>
<td>Tiswadi</td>
<td>1.83</td>
<td>2.43</td>
<td>0.75</td>
<td>Leading towards clustering</td>
</tr>
<tr>
<td>Bicholim</td>
<td>1.82</td>
<td>1.11</td>
<td>1.63</td>
<td>Approaching uniformity</td>
</tr>
<tr>
<td>Bardez</td>
<td>1.59</td>
<td>1.77</td>
<td>0.8</td>
<td>Leading towards clustering</td>
</tr>
<tr>
<td>Pernem</td>
<td>2.39</td>
<td>2.39</td>
<td>0</td>
<td>Clustering</td>
</tr>
</tbody>
</table>

Source: Personal Computation.

**ELONGATED OR APPROACHING CLUSTERING**

The Rn value for the taluka of Sattari was calculated as 0.39 and is the only taluka which has the distribution as Elongated or approaching clustering. The taluka forms the part of highland region and topographically the region is very rugged and uneven. It has about 3.3% of rural settlements and the taluka constitutes about 13.37% of total study region. The average area per village is calculated as 123.77 Sq. Kms and the total number of inhabitants per village is around 3413 persons. The area is highly dominant with pockets of mining
activities and hence settlements have developed only in such areas leading to approaching clustering. The settlements are concentrated only in the area where there is sufficient amount of water and other resources. The agricultural activities are also confined to these small areas of settlements.

LEADING TOWARDS CLUSTERING

The settlements pattern in the talukas of Quepem, Ponda, Tiswadi and Bardez shows the characteristic of leading towards clustering. There are altogether 53 settlements which constitute about 44.16% of rural settlements in the study region. The total area covered under these taluka is around 1088.6 Sq.Km which forms 29.40% in the study area. The average area per village is around 20.53 Sq.Kms and the average inhabitants per village is 4270 persons. Some of the major reasons for such type of clustering are, the distribution of agricultural land, its fertility and to some extent the irrigation of the region. It is noticed that the agricultural lowlands have attracted large number of settlements compared to relatively higher attitudes. In the talukas of Tiswadi and Bardez this type of cluster is due to the coastland where overall development is more with other economic resources like fisheries and agriculture.

RANDOM

The rural settlements in the talukas of Canacona, Sanguem, Murmagao and Salcete have random distributions. The talukas of Murmagao and Salcete are the most developed talukas in respect to social and economic activities. It
has good network of roads, communication and other economic resources, as a result of which the settlement distribution in randomly developed. On the other hand, the Canacona and Sanguem taluka has large tracts of agricultural lands, with good fertility of land. Both the talukas have large area and agricultural activities are more dominant leading to random distribution of rural settlements. There are 44 rural settlements contributing about 36.6% of settlements in the study area. The total area over which the settlements are randomly distributed constitute about 1628.8 Sq.Km which is about 43.97% of the total study region. The average area per village is recorded as 36.99 Sq.Km and the average number of people per village is around 3697 persons.

APPROACHING UNIFORMITY

The Bicholim taluka has found the settlement distribution as approaching uniformly uniform. The taluka has a population of about 41081 with only 11 rural settlements. About 9.1% of rural settlements are found in this taluka and has an area of 238.8 Sq.Km which is about 6.4% of the total study region. The average area per village is calculated as 21.70 Sq.Km and the average number persons per village is 3735. The main reason for such a uniform distribution is the dominance of mining activities almost all over the taluka.

TYPES OF RURAL SETTLEMENTS

Doxiadis (1968) explains the term ‘Type’ as the relationship between settlements within space. The explanation holds true at any spatial level i.e., local, regional and national.
The first report of the commission on Types of Rural Settlements published by the International Geographical Union in 1928 recognised only two types of settlements, compact and dispersed. This classification has been accepted universally. Two methods of classifications i.e, personal observation and statistical method are predominantly used in determining the types of rural settlement. Out of there the most successful method is the personal observation and the detailed knowledge of their variation. The settlement types can also be analysed on the basis of nature of agglomeration of dwellings in a village territory and arrangement of dwellings in individual agglomeration (Singh, 1981). Several scholars have used different methods for the determination of types of rural settlements in different regions of the world. Some researchers have classified settlements on the basis of their sizes as large, medium and small, while others have classified them on the basis of their locational attributes like valley area, river side, road side village etc.

The locational advantage or disadvantage and homogeneity has been crept into heterogeneity, as a result the present investigation tend to deviate the standard classification which has been mentioned above. The present investigation of rural settlements is based on purely personal observation of the study area and the personal enquiry about the variations in the study region.

A cursory glance at the rural landscape of the study region reveals that there are wide variations in the settlement types. The researcher has observed various types of settlements which can be broadly grouped into three categories.

1) Compact settlements, 2) Semi compact and 3) Hamleted settlements.
COMPACT SETTLEMENTS

Compact settlement is the result of centripetal forces operating in the villages or between the villages which lead to settlement concentration. These types of compact settlements are more extensively found all along the coastal belt in the study region. It is noted that the role of tourism functioning in the coastal regions attract large number of settlements. The settlements along the coasts namely Agonda, Cavelossim, Colva, Majorda, Betalbatim, Nuvem, Cansaulim, Dabolim, Anjuna and Arambol are highly clustered and hence found in compact nature. Due to high influx of local and global tourist every year in these villages the infrastructural development is at a very high rate. To enjoy such infrastructure the settlements have developed very close to these areas resulting them in compact nature. The compact nature of settlements are not only confined to coastal region but also traced around large towns and cities. The impact of cities and the influence of urban amenities have attracted many settlements around large towns. The human tendency to locate the house if not in the city, atleast very close to the city, so as to enjoy urban amenities has resulted number of settlements near cities leading to compact in nature. The rural settlements which are developed under the influence of large cities and resulted in compact nature in the study region are Poinguinim, Xeldem, Assolna, Raia, Loutoulim, Shiroda, Usgao, Onda, Curca, Assanora, Corgao and Siridao. Besides the main reason the various other reasons for the compact nature of settlements are monotony of relief, uniform fertility of soil, availability of water resources etc.
SEMI-COMPACT SETTLEMENTS

Semi-compact settlements are the product of the interactions of both centripetal and centrifugal forces representing the intermediary type between clustering and dispersed settlements. It is characterized by the presence of a main large village along with one or more hamlets which are younger in age than the main village. The attached hamlets represent an outgrowth from the central nuclears due to increasing population pressure or the dwellings of later immigrants, who came to earn their livelihood by working as agricultural labourers or mining labourers. Large numbers of settlements which are found in the midland region of the study region are of semi-compact type. The rural settlements like Dargalim, Revora, Piligao, Amona, Orgao, Querim, Candepar, Priol, Borim, Macazana, Bali and Loliem has the main village where the main market attached and is known as the core of the village. Surrounding to this main village a group of hamlets have come up which are commonly called as 'wado' which make the settlement semi compact in appearance. All such wado's extensively depend on main village for marketing activities. The gap between the wado and the main village is commonly fixed with agricultural land, river divides or mines. It is observed that the people with high economic standards and the business classes have made their settlements in the main village, whereas the outward hamlets are the outcome of the people working for low wages in various sectors like agriculture and mining activities.
HAMLETED SETTLEMENTS

In this type of settlement the average village consists of a main site and several hamlets. Some of the village possess as many as 35 to 40 detached sites, and are spread over a large area and are treated as a single unit for the purpose of revenue and administration. Abundance of surface water, high water table, the religious factor, a large proportion of agricultural labourers and some times the security has led to there hamleted settlements. Hamleted types of settlements are very limited in the study region. Such settlements are highly dispersed all over the study area. The reasons for such a type of settlement differ from region to region. The settlements like Calem, Codli, Uguem, Gaondongrem, Cotigao, Morlem, Sarvona have such a type of feature. This hamleted nature is developed largely due to agricultural activities, where people have constructed their houses in the fields and later developed into hamlets. Such types of hamleted settlements are also noticed in coastal region which are developed due to fishing activities. Large number of hamlets has come up along the coasts but all hamlets together are considered for revenue and administration purpose. Such hamleted settlements which are the outcome of fishing activities are Agonda and Cansaulim.

The spatial analyses of rural dwellings show that, villages are largely governed by the topography and the socio-economic condition of the region. The spatial entities like size and spacing, nature of dispersion and types of settlements are critically examined both qualitatively and quantitatively in its prevailing conditions.