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Geographical analysis of dispersal index of rural settlement in Chhatrapati Sambhajanagar (Aurangabad) district using GIS techniques

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Abstract

Finding the different kinds of rural communities and the elements that influence them in the study region is the primary goal of the current investigation. Bernard's (1931) method has been used to calculate the degree of concentration for the detailed investigation of rural settlements. The majority of the data used in this study is secondary, taken from the 2011 Aurangabad District Census Handbook. This estimated index demonstrates that favorable natural conditions like fertile soil and the presence of good irrigation infrastructure have led to a comparatively high concentration of settlements in the silled tehsils. The Godavari River occupies some of these areas. The western portion of the research region, which is mostly in the tehsils of Khuldabad and is distinguished by a steep terrain, has a low index of concentration. In the study area's tehsils of Aurangabad and Vaijapur, the index of concentration is moderate.

Keywords: Concentration index, compact, semi compact, and dispersed

Introduction

Because settlements are seen as a basic manifestation of the relationship between humans and the environment, settlement studies are important in the field of geography (Sharma, 2015) [6]. The settlements are seen as areas where people are concentrated. The term "human settlement" also describes the arrangement of people and homes. The place where individuals establish their permanent residence is called a settlement. Human settlements are divided into two primary categories based on factors such as population size, lifestyle, employment structure, and socioeconomic features. They are settlements, both rural and urban. Urban towns are home to people who work in non-agricultural pursuits, while rural communities are mostly inhabited by those involved in agriculture and related industries (R. L. Singh, 2002) [8]. Many other geographers have provided explanations of the different kinds of rural communities using a range of standards and statistical techniques. In contrast to its urban cousin, a rural community is a small, straightforward collection of houses situated in a convenient location (Singh & Kumar, 2018) [7].

The overall area under settlement, or built-up area, is shown by the concentration of settlement (Nandi and Mistri, 2018) [11]. Four primary categories of settlement are described by R. L. Singh (1955): Sprinkled or dispersed settlement, semi-compact (fragmented or hemleted communities), compact settlements, and semi-compact (Hamleted cluster). Depending on their immediate surroundings, every human community is unique. Therefore, human occupancy characteristics and environment exhibit a reciprocal link in rural communities. According to Dey and Bhaduri (2016) [1], there is variation in the settlement structure of India, ranging from dispersed to nucleated and from small hamlets to sizable villages. While dispersed settlements are typically found in regions with an extreme climate, hilly tracts, densely forested grasslands, poor land for agriculture, regions of extensive cultivation, and areas in which farmers must live on crops rather than in villages, compact settlements are primarily found in the highly effective alluvial plains (Majid Husain, 2018) [2]. In developing nations, there are a lot of rural villages with inadequate infrastructure (Ruchi, 2020) [5]. The physical and socioeconomic circumstances of the area have a direct impact on the kind and layout of rural villages. As a result, settlements are not seen in the

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same way everywhere on earth.

Objective

1. To study the identify the types of rural settlement and their affecting factors.
2. Calculate the concentration index using the Bernard method.

Study Area

The state's center, an elevated region, is home to the Aurangabad District. In the southern region, it is carved out by the Godavari River and its tributaries. The entire district is located in the Godavari Basin, except for a tiny area in the north and northwest that is part of the Tapi drainage. Aurangabad district lies between 19⁰17' North to 20⁰40' North latitude and 74⁰39' East to 76⁰40' East longitudes.

Jalgaon district borders it on the north, Jalna district borders it on the east, Ahmednagar district borders it on the south and southwest, and Nashik district borders it on the west. Additionally, it shares a few minor borders with the districts of Beed in the south and Buldhana in the northeast. The district occupies 10,100 square kilometers or 3.28% of Maharashtra. The urban area makes up 1.40% of the entire area, with the remaining 98.60% being rural. The population of the Aurangabad district is 36,95,928, or almost equal to that of Liberia, according to the 2011 census. As a result, it comes in at number 72 in India out of 640. Between 2001 and 2011, the population growth rate was 27.33%. (Figure 01)

Location Map

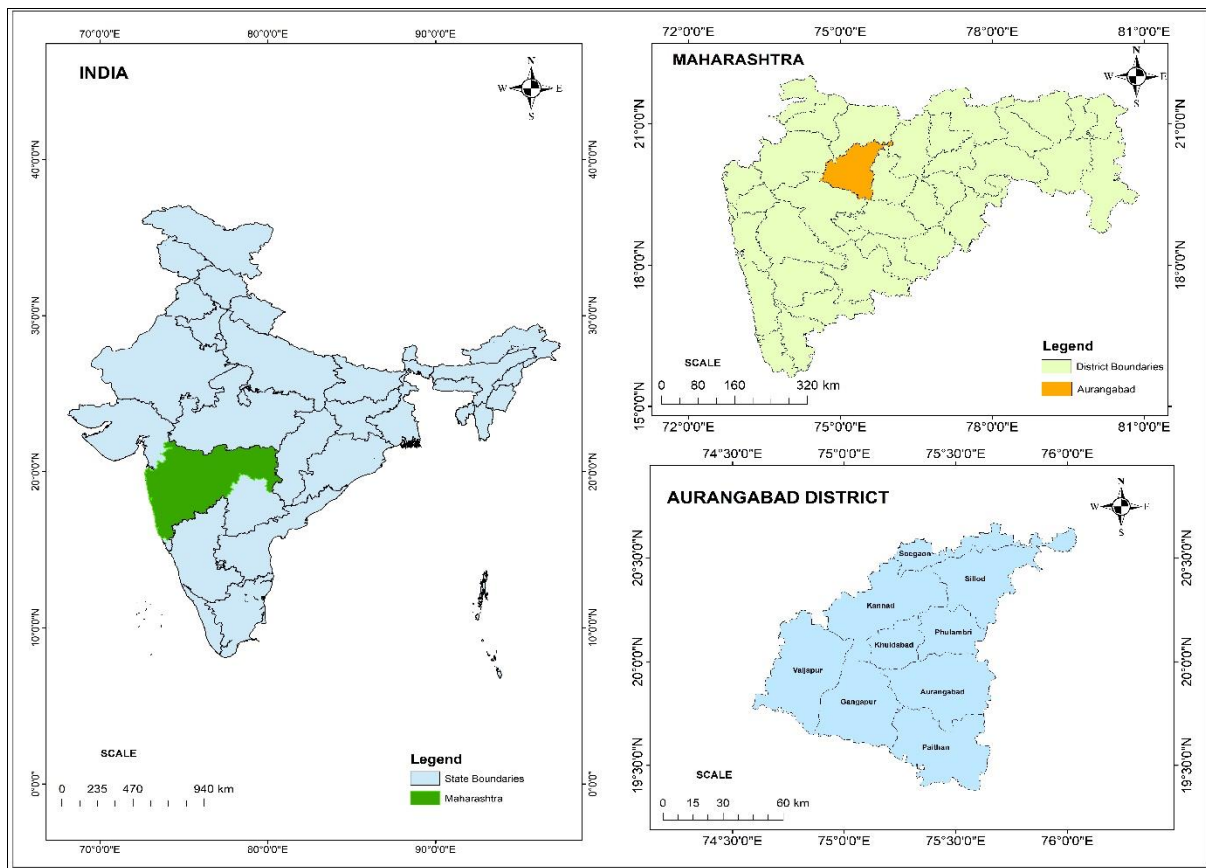


Fig 1: Show the population growth in Aurangabad district, Maharashtra

Methodology

The current study's objective is to determine the district's degree of concentration (Index) for the 2011 census. Aurangabad district which is shown in this area was thoughtfully selected for this investigation. This work's data came from secondary sources. The information required for analysis is acquired from the Aurangabad District Handbook. When describing the geographical variations of settlement dispersion refers to a technique for calculating Bernard's method and using the following formula, which he applied to get the degree of concentration index:

Degree Concentration Index

$$K = \frac{S \cdot M}{N^2}$$

Where

K = Degree of Concentration

S = Area of the Tehsil

M = Total number of houses in the tehsil

N² = Total number of settlements in the tehsil

Result and Discussion

Using the Bernard method, a straightforward formula was utilized to obtain the index of concentration. The Aurangabad district has four different kinds of rural settlements based on the index of concentration for each tahsil village. They are semi-sprinkled, compact, semi-dispersed, and semi-compacted settlements. The types of settlements and level of settlement concentration in the study region are depicted in Table No. 2 and Figure No. 2.

Table 1: Aurangabad District: Types of Settlement 2011

Sr. No.	Tehsil	Area (kmsq.)	No. of Villages	No. of Household	N ²	K	Types
1.	Kannad	1,637	211	59,680	44521	2193.85	SP
2.	Soegaon	652	85	23,566	7225	2126.65	SP
3.	Sillod	1,233	131	59,545	17161	4277.55	C
4.	Phulambri	695	92	31,550	8464	2590.46	SP
5.	Aurangabad	1,354	185	83,551	34225	3305.81	SC
6.	Khuldabad	494	76	20,166	5776	1725.07	D
7.	Vaijapur	1,586	166	56,173	27556	3232.05	SC
8.	Gangapur	1,435	221	70,656	48841	2076.38	SP
9.	Paithan	1,356	189	63,682	35721	2417.60	SP

Source: Computed by researcher

Table 2: Degree of Concentration Index

Sr. No.	Types of settlement	Index Range	Tehsil	Total No. of settlement	Total area (%)
1.	Compact	<4000	Sillod	131	11.81
2.	Semi Compact	3000-4000	Aurangabad, Vaijapur	351	28.16
3.	Semi Sprinkled	2000-3000	Kannad, Soegaon, Phulambri, Gangapur, Paithan	798	55.31
4.	Dispersed	0-2000	Khuldabad	76	4.73

Source: Computed by researcher

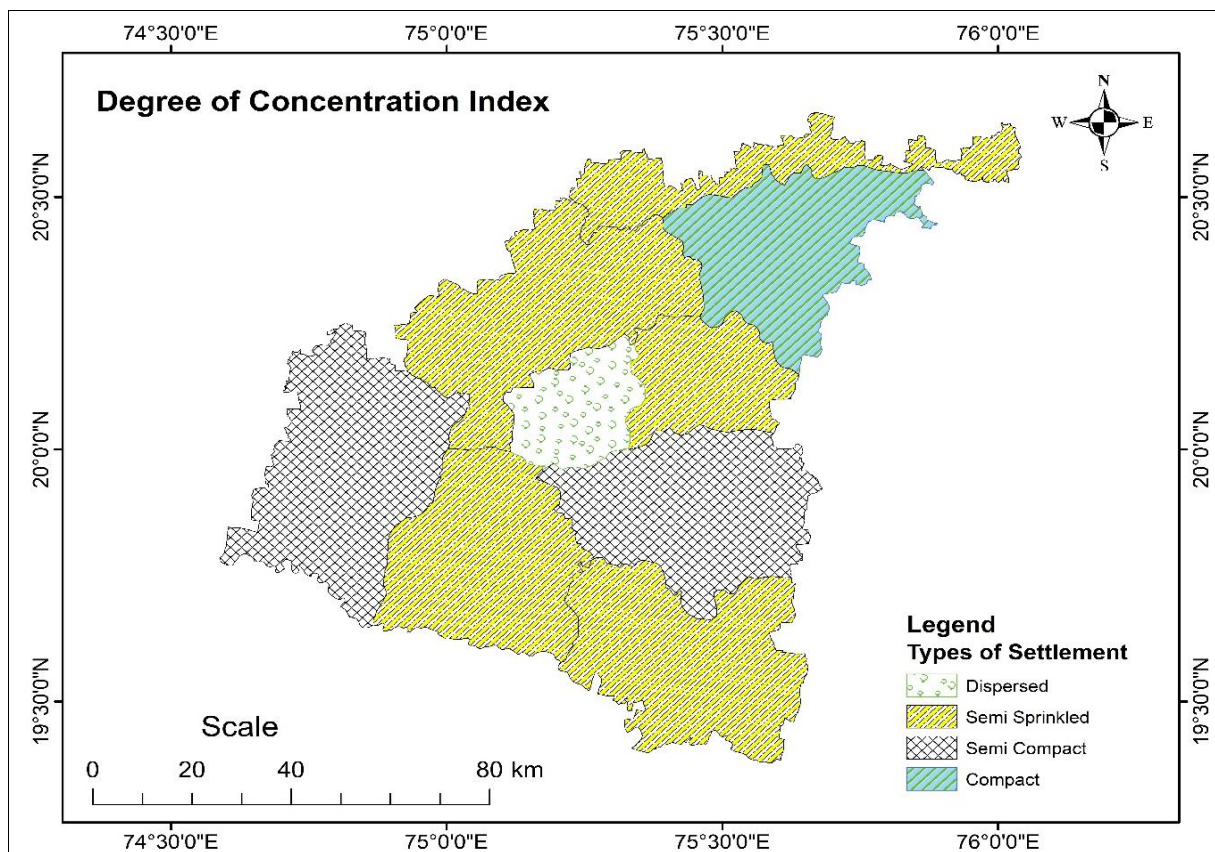


Fig 2: Degree of concentration index

Dispersed Settlement

Isolated settlements, sometimes referred to as dispersed settlements, are typified by small-scale units, which can range from a single house to a small cluster of buildings. The majority of these communities can be found in Khuldabad's tehsil. This group range's concentration index is less than 2000. Such settlements are the result of a combination of poor soil quality, steep slopes, rough terrain, and low groundwater levels. These tiny communities are dispersed over forested and hilly regions. The inclines in the terrain have reduced connectivity for these settlements. These kinds of settlements have been concentrated in the

eastern Khuldabad tehsil. In this area, hamlets and villages are small, and residences are situated distant from one another. Since a portion of the population is tribal, the main economic pursuits in these villages are agriculture and animal husbandry.

Semi Sprinkled Settlement

These little communities are situated close to land that can be farmed. There is a 2000–3000 concentration value range. This kind of settlement is primarily distributed throughout the research area's tehsils of Kannad, Soegaon, Phulambri, Gangapur, and Paithan. These kinds of towns are mainly

found close to arable land in Kannad tehsil. These towns' main features include their tiny size, dispersed individual habitations, low road quality, and limited road connectivity throughout the entire region. These kinds of settlements are primarily found in the middle regions of the tehsils of Phulambri and Gangapur.

Semi Compact Settlement

Semi-compact Settlement Falling somewhere between compact and hamleted settlements, semi-compact settlements are an in-between kind. These settlements consist of clusters of unconnected homes gathered in a single location (Mondal and Roy, 2020) ^[10]. These communities are distinguished by a compact, tiny nuclear center that is surrounded by a scattering of hamlets. This kind of settlement is primarily found in the research areas's Aurangabad and Vaijapur tehsils. In the case of the tehsils of Nashik, the primary factor supporting the growth of semi-compact settlements close to the central city is industrial development. The majority of industrial workers reside in these communities. In the case of Vaijapur, the onset of agricultural development and the provision of transportation and communication infrastructure facilitated the expansion of these villages. There is a 3000-4000 concentration value range.

Compact Settlement

The study area's Sillod tehsil is home to the majority of the compact settlement. The majority of the communities in this tehsil are characterized by small housing spacing and dense populations. This settlement has concentration values that are higher than 4000. Nucleated or clustered settlements are other names for these settlements. In nucleated settlements, buildings are typically built extremely near to one another, and the roads are quite small. Permanent agriculture, profitable land, and a climate that is conducive to settlement are the ingredients that produce compact rural settlements (Patil, 2019) ^[3]. Sillod tehsil's rich black soil and excellent irrigation infrastructure contribute to the area's agricultural development. This tehsil's well-developed transportation infrastructure and agricultural industries also aided in the development of the compact town there. Sillod tehsils' fast-expanding population is the primary factor for the development of these kinds of towns. These kinds of villages are mainly found near Sillod City.

Conclusion

The research work's overall analysis shows that the physiographical impact is evident in the development of the study area's settlements. In the studied region, four different kinds of villages are visible. It comprises compact settlement, semi-compact settlement, semi-sprinkled settlement, and dispersed settlement. Because Sillod tehsils have good irrigation facilities and fertile black soil, there is a comparatively large concentration of settlers there, according to the Degree of Concentration (Bernard, 1931) calculation for each tehsil. The hilly tehsils in the western section of the country, like Khuldabad, have a low index of concentration because of unfavorable physical characteristics like the region's rough topography and hills. In the Tehsils of Aurangabad and Vaijapur, the index of concentration is moderate.

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