



Quick Response Code:



Website: <https://wgges.us>



Creative Commons (CC BY-NC-SA 4.0):

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Manuscript ID:
IJWGAFES-2025-020801

DOI: 10.5281/zenodo.16962363

DOI Link:
<https://doi.org/10.5281/zenodo.16962363>

Volume: 2

Issue: 8

August

Year: 2025

E-ISSN: 3066-1552

Submitted: 08 July 2025

Revised: 10 July 2025

Accepted: 05 Aug 2025

Published: 31 Aug 2025

Assistant Professor, MVP
Samaj's S.V.K.T. Arts,
Science & Commerce
College, Lam Road, Deolali
Camp, Nashik
Email: pcgangurde88@gmail.com

Address for correspondence:
P. C. Gangurde
Assistant Professor, MVP Samaj's
S.V.K.T. Arts, Science & Commerce
College, Lam Road, Deolali Camp,
Nashik
Email: pcgangurde88@gmail.com

How to cite this article:
Gangurde, P. C. (2025). A Geo-Spatial
Study of Rural Settlement Spacing in
Nashik District. International Journal of
World Geology, Geography, Agriculture,
Forestry and Environment Sciences,
2(8), 1-4.
<https://doi.org/10.5281/zenodo.16962363>

A Geo-Spatial Study of Rural Settlement Spacing in Nashik District

P. C. Gangurde

Abstract

This study has attempted to examine rural settlements' spatial distribution, growth and socioeconomic landscape in relation to spatial variation in Nashik District, Maharashtra. The spatial distribution and spacing of rural settlements are significantly influenced by a combination of physical, environmental, socio-economic, and historical factors. This study examines the spacing of rural settlements in different tehsils of the study region, categorized into three types: low spacing (below 2.00 km), moderate spacing (2 to 3 km), and high spacing (above 3.00 km). The low-spacing area, represented by Peth tehsil, is characterized by hamletted settlements due to rugged terrain, dense forest cover, limited cultivable land, and poor infrastructure. Moderate spacing is observed in ten tehsils including Nashik, Dindori, and Niphad, where fertile agricultural land, irrigation facilities, and transportation connectivity support more evenly distributed settlements. High-spacing tehsils such as Malegaon and Sinnar show dispersed settlement patterns driven by non-perennial water sources, industrial influence, and topographical constraints. The database used SOI toposheets, district census handbooks, satellite images and DEM. GIS techniques like digitisation, vector overlay, raster and buffering analysis are applied to get the results. Field observations also carried out to identify and interpret the patterns and causes of rural settlement spacing, contributing to a better understanding of regional development and rural geography. Importance of geo-spatial study of rural settlements in the Nashik District is shown by this study. Considering spatial pattern of rural settlements varies across the region, primarily influenced by topography, water resources, agricultural suitability, infrastructure, and economic opportunities.

Keywords: Rural Settlement, Spacing Pattern, Western Ghats, Forest Cover, Agricultural Land, Irrigation Facilities, GIS Mapping, Settlement Distribution

Introduction

According to Mukerjee (1969), the spacing of rural settlements is influenced by various fundamental factors. Key among them are land fertility and the agricultural productivity of the area. The type and nature of crops grown also affect how settlements are spaced. Agronomic features and water availability play a critical role. The distribution of water sources influences settlement concentration. Rural population density is another major determinant of spacing. The size and type of rural settlements contribute to spatial arrangements. Cultural factors like mode of living also shape settlement patterns. Historical land occupancy and its stages impact rural layout. Tribal population strength can alter settlement distribution. Other socio-economic and environmental factors are also influential. Spacing reflects the relationship between people and land resources. It shows how rural populations adapt to geographic conditions. Hence, spacing is linked to the areal extent of settlements. It provides a base for understanding their spatial distribution.

Objectives of Study:

- To analyze the factors influencing the spacing and distribution of rural settlements.
- To evaluate the applicability of mathematical models, such as Winid's formula, in determining settlement frequency and density patterns in rural regions.

Data Collection:

The present study utilizes data from secondary sources. Information about rural settlements and rural population is primarily obtained from the Nashik District Census Handbook (2011). Additional spatial data was collected and analyzed using Google Earth and GIS software for enhanced analysis.

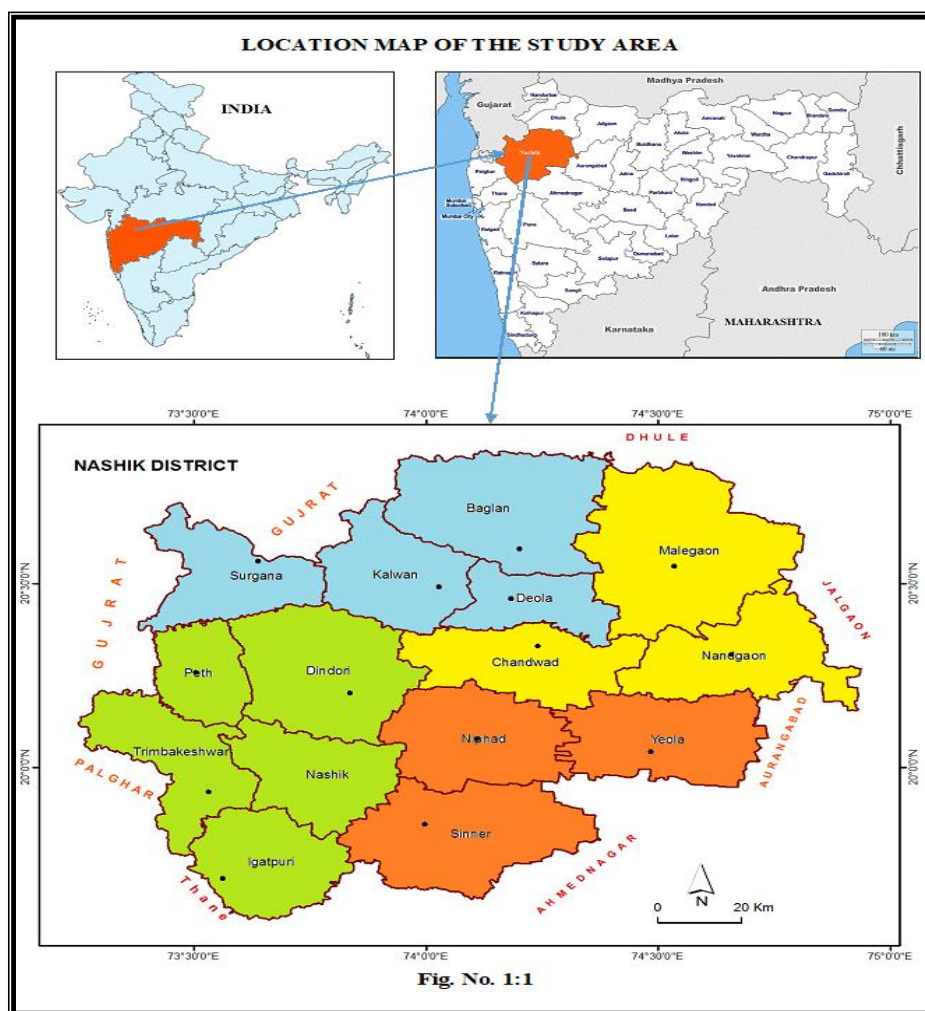
Study Area:

The Nashik district has been selected for this study due to its distinct geographical and socio-economic characteristics. Situated in the northwestern region of Maharashtra, Nashik is located within the basins of both the Godavari and Gurna rivers. Geographically, it extends from 19°33' to 20°53' north latitude and 73°15' to 75°16' east longitude (Nashik Gazetteer, 1983), and is mapped by the Survey of India on degree sheets 46H, 46L, 47E, and 47I.

Located on the leeward side of the Western Ghats, Nashik is one of Maharashtra's more developed and populous districts, excluding its tribal regions. Encompassing an area of 15,530 square kilometers, the district comprises a wide variety of landscapes, with elevations ranging from 300 meters to over 1,200 meters. It contains 1,922 rural settlements, reflecting its diverse topography and socio-economic framework. These characteristics render Nashik an ideal area for studying the spatial distribution and growth of rural settlements.

Methodology:

The data collected for the present study have been systematically organized and analyzed. The dataset encompasses information on rural settlements and population from 1991 to 2011. Geographic Information System (GIS) tools were used to map the rural settlements of Peth tehsil. Spatial analysis techniques, such as buffer analysis and nearest neighbor analysis, were applied to calculate inter-settlement distances. Socio-economic parameters such as availability of infrastructure, education, health services, employment opportunities, and migration trends were studied to understand their impact on settlement spacing. A thematic map was prepared showing the spacing of rural settlements in the study region.



Result and Discussion:

According to Mukerjee (1969), the spacing of rural settlements is influenced by several fundamental factors, including land fertility, agricultural productivity, crop types, agronomic conditions, water availability, population density, settlement size and type, lifestyle patterns, historical land occupancy, and the presence of tribal populations. The spacing of rural settlements is considered an extension of their areal size and reflects their relative locational arrangement. It serves as a crucial basis for analyzing the distribution patterns of rural settlements in any given region. Donglass emphasizes that rural settlement spacing primarily depends on three key factors: agricultural prosperity, surface relief, and historical background. The measurement of spacing is also closely related to the concept of settlement density. Walenty Winid, a Polish geographer, developed a formula to calculate the frequency of towns in a region, which was later applied by Kulkarni (1983) to study rural settlement size and spacing in Belgaum district, Karnataka. This method proved effective and relevant for understanding rural settlement patterns. This formula is as follow.

$$D = \sqrt{A/N}$$

Where,

D is average distance between rural settlements.

A is the total area of the tehsil.

N is the number of rural settlements in the tehsil.

By applying this formula, calculated all 15 tehsils of the study region and divided into three classes based on quartile value. For the convenient study, three groups have been formed to represent the spacing of rural settlements as follows.

1. Area of low spacing below 2.0 km
2. Area of moderate spacing 2 to 3 km
3. Area of high spacing above 3 km

1. Low Spacing of Rural Settlements (Below 2.00 Km.)

There is only one tehsil in the study region, which is Peth tehsil shows area of low spacing and is located towards the western part of the district which generally forms the foothills of the Western Ghats. The distance between the rural settlements in Peth tehsil is below 2 km. The topographical condition does not permit the large settlements. This tehsil is widely under the influence of forest cover where rural settlements are restricted. There are rare economic resources as compared to other tehsils of the study region which drive peoples towards other tehsils and district headquarters. Due to poor transportation, limited basic amenities, undulating nature of relief, less economic development and scarcity of continuous cultivable land, the rural settlements are hamletted types and closely spaced.

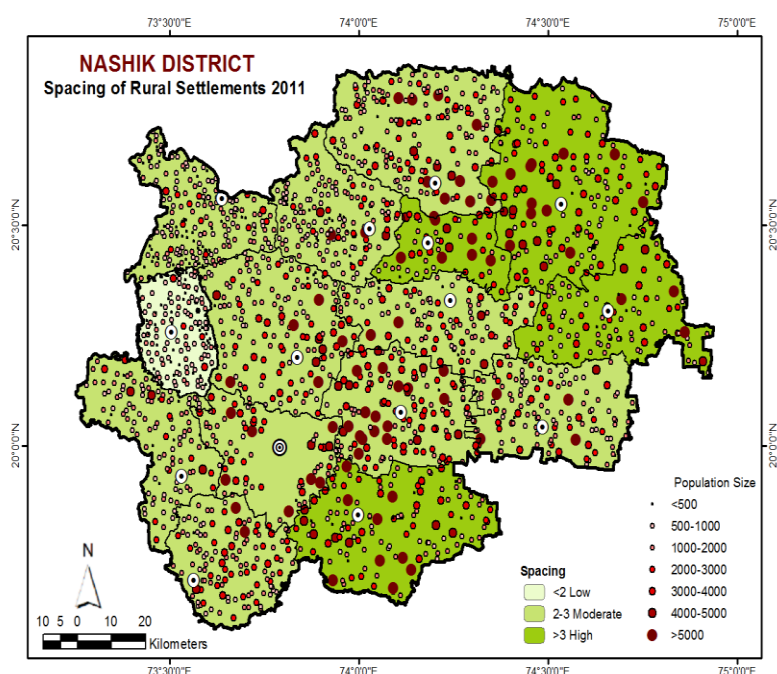


Fig. No. 1:2

2. Moderate Spacing of Rural Settlements (2 to 3 Km.)

The rural settlements of moderate spacing are mainly confined to the middle and west part of the study region. There are 10 tehsils in this category namely, Surgana, Kalwan, Baglan, Chandwad, Dindori, Tryambkeshwar, Nashik, Igatpuri, Niphad and Yeola. The spacing of rural settlements in these tehsils is ranging 2 to 3 km. These tehsils have moderate spacing mainly because of agricultural land and availability of irrigation facilities. Surgana, Kalwan, Dindori and Tryambkeshwar tehsils have some amount of forest cover which is also part of Western Ghats and hence rural settlements not largely developed and led to moderate spacing. The region which lies the middle part of the study region has a vast tract of agricultural land. But the settlements have developed only in the region where fertile land and effective water bodies are present. All well-irrigated part of the region has a closer spacing of rural settlements with the low population size. This indicates that the availability of water bodies and irrigation facilities are the main consideration for moderate spacing. Baglan, Chandwad, Nashik, Niphad and Yeola tehsils influence these factors.

The river Godavari, Girna, Darna, Kadwa, Aram and Banganga attracted rural settlements along its banks leading to moderate spacing. As there is a good network of transportation by roads and railways to the city, all along the roads the rural settlements have been developed with moderate spacing.

Altogether there is a varied region for the moderate spacing of rural settlements which vary from region to region. The most common reasons are the availability of moderate fertile land, developed irrigation facilities, location of settlements along with the transportation nodes and development tourism centres.

3. High Spacing of Rural Settlements (Above 3 Km.)

The high spacing area of rural settlements recorded in the tehsils of Deola, Malegaon, Nandgaon and Sinnar. The main reason for the high spacing is surface configuration, availability of water and other resources. These tehsils have fertile land, several small rivers which provide water for settlements and agricultural lands, but these rivers are not perennial. The presence of the hilly region is also another reason for the high spacing of rural settlements. The soils found in this region are relatively fertile which led to the high spacing of rural settlements. The Nandgaon, Malegaon and Sinnar have few industries functioning, which attracts the people for employment and labour purpose. There a large number of oil bunkers and industrial

godowns in the study region. As a result of the industrial area, the settlements have been highly concentrated there which increases high spacing of the rural settlements. There is a good number of roads in the tehsils as a result of which the transportation linkages the rural settlements.

Conclusion:

The spacing of rural settlements in the study region reflects a strong interrelationship between physical geography, availability of natural resources, agricultural potential, and infrastructural development. Areas like Peth tehsil, with dense forest cover, rugged terrain, poor infrastructure, and limited cultivable land, exhibit low spacing (below 2 km), resulting in hamletted and scattered settlements. In contrast, moderate spacing (2–3 km) is observed in tehsils where agriculture is viable due to fertile soils and irrigation availability, such as Niphad, Nashik, Dindori, and Tryambkeshwar, especially along rivers and transportation corridors. High spacing (above 3 km) is seen in Deola, Malegaon, Nandgaon, and Sinnar, where surface configuration, industrial development, and seasonal water availability shape larger inter-settlement distances. Thus, the spatial pattern of rural settlements varies across the region, primarily influenced by topography, water resources, agricultural suitability, infrastructure, and economic opportunities.

Acknowledgement

I P. C. Gangurde would like to express my sincere gratitude to my supervisor, D. S. Kumbhar, Z. B. Patil College, Dhule, for their valuable guidance, continuous support, and insightful feedback throughout the course of this research. Their expertise greatly enriched the quality of this work.

I am also thankful to the faculty of Department of Geography, S.V.K.T. Arts, Science and Commerce College, Deolali Camp, Nashik, for providing the necessary resources and a conducive environment for my research.

Special thanks to my colleagues and friends for their assistance and encouragement during the study of this research.

Financial support and sponsorship

Nil.

Conflicts of interest:

The authors declare that there are no conflicts of interest regarding the publication of this paper.

References:

Books, Articles, and Chapters

1. Auroseau, M. (1920). The arrangement of the rural population: A geographical review. *Geographical Review*, 10, [page range if known].
2. Blache, V. de la. (1962). *Principles of human geography* (p. 316). New York: [Publisher not identified].
3. Demangeon, A. (1962). The origins and causes of settlement types. In P. L. Wagner & M. Mikesell (Eds.), *Readings in cultural geography* (pp. 89–101). Chicago: University of Chicago Press.
4. Finch, V. C., & Trewartha, G. T. (1946). *Elements of geography: Physical and cultural* (p. 553). New York: [Publisher not identified].
5. Hudson, F. S. (1970). *A geography of settlements*. London: Macdonald and Evans.
6. Kulkarni, A. R. (1983). *A geographical analysis of rural settlement in Belgaum District* (Unpublished doctoral dissertation). Karnataka University, Dharwad.
7. Mandal, R. B. (1978). *Introduction to rural settlements*. New Delhi: Concept Publishing Company.
8. Mukerjee, A. B. (1969). Spacing of rural settlements in Andhra Pradesh. *Geographical Outlooks*, 6, [page range if known].
9. Murthy, K. L. N. (1999). *Geographical research* (pp. 86–109). New Delhi: Concept Publishing Company.
10. Perpillon, A. U. (1966). *Human geography*. Edinburgh: Longmans.
11. Singh, R. Y. (1998). *Geography of settlements* (pp. 73–79). New Delhi: Rawat Publications.
12. Sinha, V. N. P. (1976). *Chota Nagpur Plateau: A study in settlement geography* (p. 79). New Delhi: [Publisher not identified].

Government Publications

1. Census of India. (1991–2011). *Nashik district census handbook*. Government of India.
2. Government of Maharashtra. (2011–2018). *Nashik district socio-economic abstract*. Directorate of Economics and Statistics, Mumbai.