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Spatio-Temporal Clustered Analysis of Population Dynamics: A Tahsil-Level Case Study of Deoria District, Uttar Pradesh

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Abstract:
The study of population dynamics is essential for the effective management and development of the human population. Population Dynamics is the study of how Population Size, Density, Distribution, Structure and Composition change over a period of time. This paper presents a comprehensive spatio-temporal analysis of Population Dynamics in Deoria District, Uttar Pradesh. Spatial analysis was performed at the Tahsil level utilizing temporal data from the 2001 and 2011 censuses from the ORGI and District Census Handbook-Deoria. By examine variations and employing Z-Score and Cluster Analysis, we explore dynamics in population growth, density, literacy, sex-ratio, urban-rural population SC/ST and Minority population patterns over time. This study provides a detailed understanding of demographic shifts in different Tahsils and their implications for regional development and planning.

Keywords: Population Dynamics, Population Structure, Population Composition.

1. Introduction

1.1 Background: Population dynamics, a cornerstone of demographic studies, offers profound insights into the growth, distribution, and structural changes within human populations, shaping social, economic, and environmental paradigms across the globe. Understanding these dynamics at varying spatial and temporal scales is imperative, as the patterns of population growth and movement are seldom uniform, often influenced by intricate socio-economic, cultural, and environmental factors. Globally, the world's population surged from 2.5 billion in 1950 to approximately 8 billion by 2023, with much of this growth concentrated in developing nations **(United Nations, 2022)**. India, poised to become the most populous country by 2023, contributes significantly to this narrative, housing over 1.4 billion individuals and accounting for nearly 17.7% of the global population **(World Bank, 2021)**. This demographic expansion, however, is not homogenous, with marked spatial variations observed across states, districts, and sub-districts.

Globally, spatio-temporal cluster analysis has emerged as a robust methodological framework for identifying and interpreting patterns of population change, enabling policymakers to design targeted interventions **(Getis & Ord, 1992; Anselin, 1995)**. This approach is particularly relevant in the Indian context, where the rapid pace of urbanization—with urban areas contributing nearly 60% of the GDP

despite hosting only 34.93% of the population—is juxtaposed with persistent rural demographic pressures **(World Economic Forum, 2020)**. Eastern Uttar Pradesh, including Deoria, faces significant rural-to-urban migration, fuelled by limited employment opportunities and agrarian distress, which underscores the need for granular analyses at the tahsil level **(Bhagat, 2018)**.

Uttar Pradesh, India's most populous state, exemplifies these variations, with a population exceeding 240 million as per the 2011 Census, and projections indicating further growth **(Census of India, 2011)**. The state accounts for nearly one-sixth of India's total population and exhibits stark contrasts in population density, literacy, fertility, and migration patterns among its districts and tahsils **(Registrar General of India, 2019)**. Deoria district, located in eastern Uttar Pradesh, represents a microcosm of these disparities, characterized by high population density (1,220 persons per square kilometre) and socio-economic challenges, including low per capita income and high dependence on agriculture **(Census of India, 2011)**. Such patterns make it an ideal case study for spatio-temporal analyses aimed at understanding localized population dynamics.

Characteristics	Deoria	Uttar Pradesh
Population	31,00,946	199,812,341
Male	15,37,436	104,480,510
Female	15,63,510	95,331,831
Decadal Growth Rate	14.2	20.2
Urban Person	10.2 % (3,16,803)	22.3 %
Rural Person	89.8 % (27,84,143)	87.7 %
Density	1,221	829
Sex-Ratio	1,017	912
Rural Sex-Ratio	1028	918
Urban Sex-Ratio	928	894
Child Sex-Ratio	925	902
Literacy	71.1 %	67.7 %
Male Literacy	83.3 %	77.3 %
Female Literacy	59.4 %	57.2 %

Table 1: Population Characteristics: Deoria and Uttar Pradesh, 2011

Moreover, the district's population growth is intertwined with socio-cultural practices, access to healthcare, and literacy levels, factors that are critical for achieving Sustainable Development Goals (SDGs) related to health, education, and inequality (United Nations, 2015). These localized dynamics necessitate a spatio-temporal analytical lens to unravel the patterns and drivers of population changes, enabling evidence-based planning and resource allocation.

This study's focus on the tahsil-level analysis of Deoria district is further motivated by its policy relevance. Small-area analyses provide a granular understanding that state- or district-level aggregations often mask, as noted in studies by **Alam and Jeffrey (2019)** and **Yadav et al. (2020)**. For instance, Deoria's high dependency ratio and limited industrialization underscore the importance of tailored developmental strategies. Furthermore, climate change and environmental stressors, including flooding and declining groundwater levels—phenomena that have intensified in Uttar Pradesh's Gangetic plains—add complexity to the region's demographic challenges **(World Resources Institute, 2021)**.

1.2 Literature Review: The study of Population Dynamics crucial for understanding the socio-economic development of any region. In India, demographic changes significantly impact resource allocation, infrastructure development and policy formulation. This paper focuses on Deoria District in Uttar Pradesh, examining the spatio-temporal patterns of population growth, Structure, Distribution and other demographic factors.

The study of population dynamics across time and space continues to evolve, offering valuable insights into the factors influencing regional disparities in population growth, density, and migration. Das and Mohanty **(2018)** studied fertility transitions in northern India, emphasizing the role of socio-cultural factors in regional fertility disparities. They advocated for targeted policies based on these differences. Similarly, Singh and Jha **(2020)** highlighted the persistent high fertility rates in rural Uttar Pradesh, urging the use of spatio-temporal approaches to address these issues effectively. Bhatia and Kumar **(2017)** focused on rural-to-urban migration, identifying agrarian distress and economic opportunities as major drivers. Their study showed the importance of localized data in understanding migration patterns. Alam and Jeffrey **(2019)** supported this view, suggesting that small-area demographic studies are crucial for capturing the full scope of migration trends. Kumar and Joshi **(2018)** also examined migration patterns, particularly the socio-economic consequences of rural-urban movement. Environmental factors, such as climate change and natural disasters, have also gained attention in population studies. The World Resources Institute **(2021)** connected environmental stressors like groundwater depletion and flooding to population movements. Tiwari and Mishra **(2019)** explored the effects of climate change on population distribution, urging for adaptive strategies to respond to these challenges. Verma et al. **(2018)** looked at the relationship between poverty and population density in eastern Uttar Pradesh, showing how poverty contributes to population clustering. Fotheringham et al. **(2002)** pioneered the integration of Geographic Information Systems (GIS) with spatial econometrics, providing an innovative way to visualize and analyse population changes. Chand and Puri **(2020)** extended this approach to examine urbanization trends, emphasizing the need for spatial analysis to understand regional inequalities in infrastructure development. Das and Sahu **(2017)** studied health disparities across states in India, connecting health outcomes to population density and socio-economic factors. Patel and Jain **(2016)** focused on demographic transitions in India, pointing out how fertility and mortality rates vary by region and advocating for policies informed by spatial data. Roy and Singh **(2021)** analysed how infrastructure development shapes rural-urban migration, particularly in areas with improved connectivity. Kundu and Basu **(2017)** explored the link between employment patterns and population growth, stressing the importance of spatio-temporal studies in addressing regional employment disparities. Ghosh and Mukherjee **(2019)** investigated gendered dimensions of population dynamics, showing how gender disparities in literacy and employment influence population trends. Bhaduri **(2015)** focused on the role of education in influencing fertility rates, emphasizing the link between literacy levels and population growth. Singh and Patel **(2019)** discussed how environmental factors like climate affect population dynamics, particularly in Uttar Pradesh, and called for region-specific policies. Sharma et al. **(2021)** applied machine learning techniques to model migration patterns in response to natural disasters, showing how technology can improve spatio-temporal predictions. Yadav and Sharma **(2020)** studied the impact of urban sprawl, demonstrating how rapid urbanization exacerbates population density and regional inequalities. They emphasized the need for integrated planning to manage these challenges. Prasad and Ghosh **(2018)** looked at the impact of education on fertility rates in rural and urban settings, advocating for policies that address the educational divide. Das Gupta and Singh **(2020)** explored how digital infrastructure can improve access to education

and healthcare, linking technological advances to better demographic outcomes. Ramachandran and Rajan **(2021)** focused on agricultural policies and their effects on rural population growth, arguing that sustainable farming practices are essential for maintaining stability. Saini and Kapoor **(2020)** examined the effects of urban poverty on population trends, particularly in slum areas, highlighting the need for inclusive urban planning. Patel et al. **(2017)** studied land-use changes and their impact on population dynamics, particularly how urban expansion affects population density. Gupta and Patel **(2019)** emphasized the role of technology in stabilizing rural populations, showing how agricultural and water management innovations can reduce migration pressures on cities. Kumar and Sharma **(2018)** examined how access to public services affects population growth, especially in underserved areas. Singh and Yadav **(2021)** looked at the effects of international migration on regional populations, particularly Indian labor migration to Gulf countries, and how it impacts local demographics. Jha and Mishra **(2020)** focused on the challenges posed by aging populations, particularly the elderly population in India, and how region-specific policies can help address these issues. Kumar and Reddy **(2021)** studied youth migration and its impact on urban population trends, highlighting how the movement of young people affects housing demand, labour markets, and social infrastructure. Adding to this body of knowledge, Gupta and Sharma **(2022)** examined the role of urbanization in shaping fertility patterns, particularly in peri-urban areas. They used GIS mapping and statistical models to track the growth of these areas and suggested that infrastructure development can help stabilize urban population growth. Singh et al. **(2022)** explored how the rise of digital platforms influences migration, particularly in terms of remote working trends, and argued that virtual migration is a growing phenomenon that requires attention in demographic studies. Mehta and Yadav **(2021)** focused on the relationship between transportation infrastructure and migration, showing that better connectivity increases movement from rural to urban areas. Their research stressed the need for policies that improve transportation in rural areas to reduce population imbalances. Patel and Kumar **(2022)** used satellite imagery and spatio-temporal analysis to study how environmental factors like droughts and floods influence migration in vulnerable regions. Their study showed how areas hit by frequent climate stressors experience higher out-migration, highlighting the importance of planning for climate resilience. Bhagat and Verma **(2021)** investigated the role of healthcare access in shaping population dynamics, showing that areas with better healthcare services tend to have slower population growth due to improved mortality rates. They advocated for expanding healthcare access to remote areas to manage population growth more effectively. Similarly, Sharma and Gupta **(2020)** studied the effects of public health crises, like the COVID-19 pandemic, on migration patterns. Their research found that migration decreased temporarily due to lockdowns but is expected to rebound, which underscores the need for long-term planning to manage population shifts caused by such crises. Khan and Singh **(2022)** examined how cultural factors influence migration, particularly in regions where traditional practices play a key role in shaping family size and mobility. They used ethnographic studies alongside demographic data to provide a more holistic understanding of migration patterns.

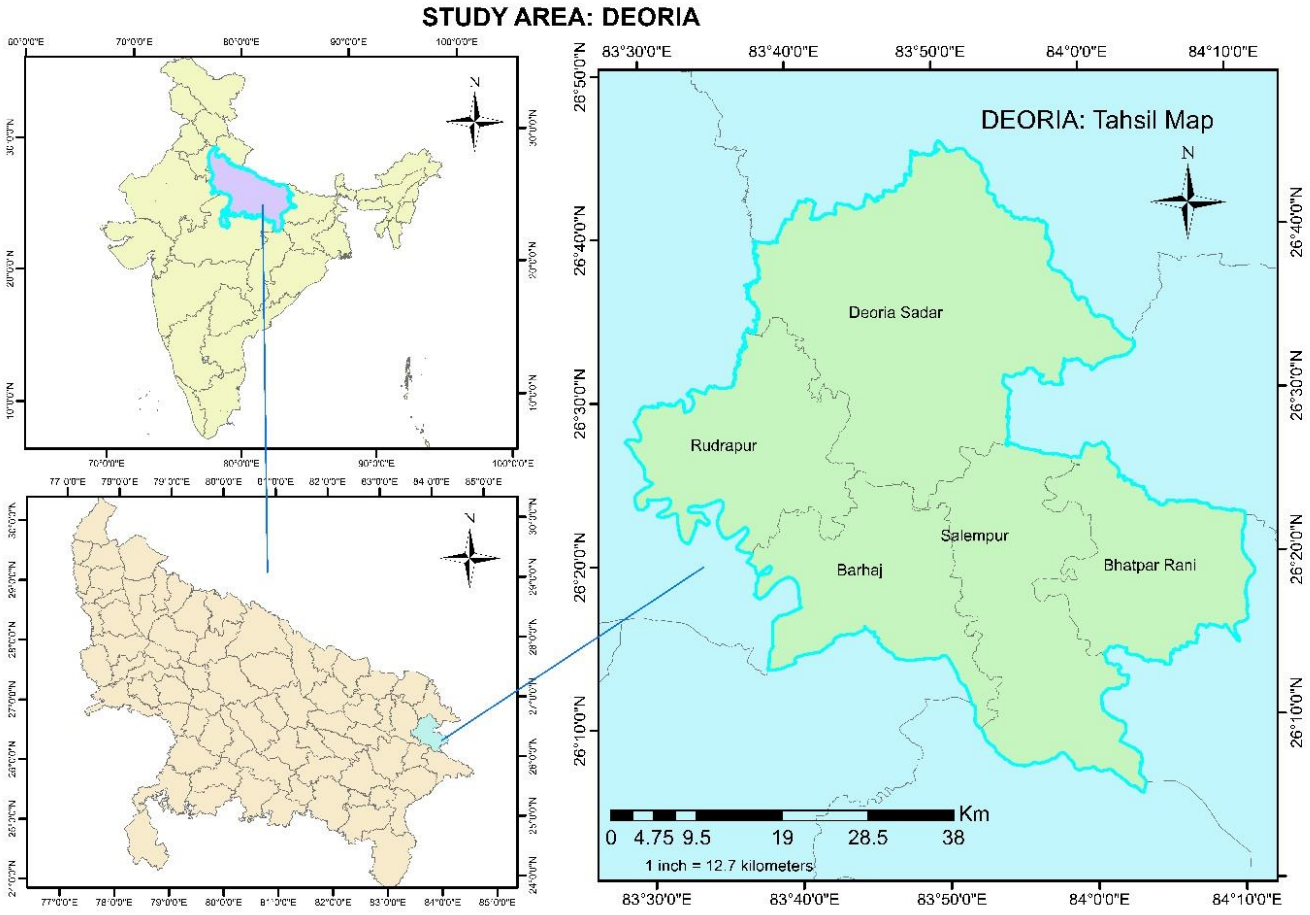
1.3 Statement of Problem: Deoria District in Uttar Pradesh has experienced significant demographic changes over recent decades including population growth, urbanization and shifts in socio-economic conditions. This aim of this research to fill this gap by conducting more comprehensive spatio-temporal assessment of Population Dynamics in Deoria District at Tahsil level. The ultimate goal is understanding of how population patterns and trend have evolved between 2001 to 2011.

1.4 Objectives: The main objectives of this study are follows -

1. To study the pattern and rates of Population Growth and Density in different Tahsils of Deoria District.

2. Examine the trends of population structure and composition in the district at Tahsil level.
3. To Investigate trajectories of population characteristics within various Tahsils of district.

1.5 Study Area: Deoria district's geographical coordinates are between 26 ° 6′ to 27° 8′ north latitude and 83° 29′ to 84° 26′ east longitude located in the eastern part of Uttar Pradesh, covering an area of approximately 2,533 square kilometres. It is bounded by Gorakhpur District to the west, Gopalganj and Siwan districts of Bihar to the east, Kushinagar to the north and Ballia and Mau to the south, respectively. Deoria District comprises five tehsils- Deoria Sadar, Barhaj, Rudrapur, Salempur and Bhatpar Rani.



Map 1: Location Map of Deoria district.

District Deoria ranks 32th in total population point of view in the state. The percentage share of urban population in the district is only 10.2% as against 22.3% of the population in urban areas of the state of Uttar Pradesh. Deoria district ranks 3th in sex ratio (1,017) which is higher than the state's average of 912 females per thousand males. Deoria district ranks 24th in literacy rate with 71.1 percent, which is higher than the state's average of 67.7 percent. There are a total 143 uninhabited villages out of total 2,162 villages in the district. Decadal Growth Rate of the district 14.2, is lower to the state's average of 20.2 percent. Deoria Sadar tahsil has the highest number of inhabited villages 686 and Barhaj tahsil has the lowest number of 265 inhabited villages. The district has 17 urban local body. There are 468,346 households in the district accounting for 1.4 percent of the total households in the Uttar Pradesh. The average size of households in the district is 6.6 persons per house.

Characteristics	2001	2011
Household	379,407	468,646
Persons	2,712,650	3,100,946
Proportion of U.P.	1.63 %	1.55 %
Male	1,355,023	1,537,436
Female	1,357,627	1,563,510
Decadal Growth Rate	24.2	14.3
Rural Person	24,44,345	2,784,143
Urban Person	2,68,305	3,16,803
Rural Male	12,15,257	13,73,111
Rural Female	12,29,088	14,11,032
Urban Male	1,39,766	1,64,325
Urban Female	1,28,539	1,52,478
SC Population	4,93,344	4,68,663
ST Population	533	1,09,894
Area	2,539 Km^2	2,539 Km^2
Density	1,069 Km^2	1,221 Km^2
Sex Ratio	1,002	1,017
Rural Sex Ratio	1,011	1,028
Urban Sex Ratio	920	928
Child Sex-Ratio (0-6y)	948	925
Child Proportion	19.01 %	14.98 %
Literacy	58.6 %	71.1 %
Male Literacy	75.0 %	83.3 %
Female Literacy	42.5 %	59.4 %

Table 2: Population Characteristics: Deoria (2001 & 2011)

2. Database and Methodology

2.1 Database: This study utilizes secondary data sources, particularly from the Office of Registrar general of India (ORGI) for analysis. Mostly data have been extracted from the District Census Handbook, 2001 and 2011.

2.2 Methodology: The analysis involves several steps:

2.2.1 Calculation of Variations: Basic demographic characteristics such as population growth rate, Density, sex ratio, literacy rate, SC/ST percentage Population and Urban-Rural Population shares are calculated using following formulas-

$$\boldsymbol{Variation = characteristics\ in\ 2011 - chacteristics\ in\ 2001}$$

2.2.2 Normalisation of variations: The normalisation of variations of different population characteristics done through calculating the Z-Score for standardisation. Z- score calculated with the help of following formula-

$$\boldsymbol{Z = \frac{X - \mu}{\sigma}}$$

Where,

Z = Z-score
X = Value of the data point
μ = Mean (average) of the dataset
σ = Standard deviation of the dataset
To Find Mean,

$$\mu = \frac{\sum Xi}{N}$$

To Find Standard Deviation,

$$\sigma = \sqrt{\frac{\sum(Xi - \mu)^2}{N}}$$

Where,
Xi = Each value in Dataset
N = Total number of values in Dataset

2.2.3 Spatial Clustering: K-mean's Cluster Analysis methods are applied to detect clustering patterns of Tahsils using SPSS Software on normalised Dataset.

3. Discussion and Findings

3.1 Population Size, Growth Rate and Density: Population size refers to the total number of individuals within a specific geographic area at a given time. Thomas Robert Malthus **(1798)** first theorized population growth, stating that unchecked growth would outpace food supply, leading to scarcity. Population growth rate measures the change in population size over a specific period, usually expressed as a percentage. According to Bongaarts **(2009)**, growth rate depends on birth rates, death rates, and migration patterns. Population density is the number of individuals per unit area. Clark **(1951)** examined density and its relationship to development.

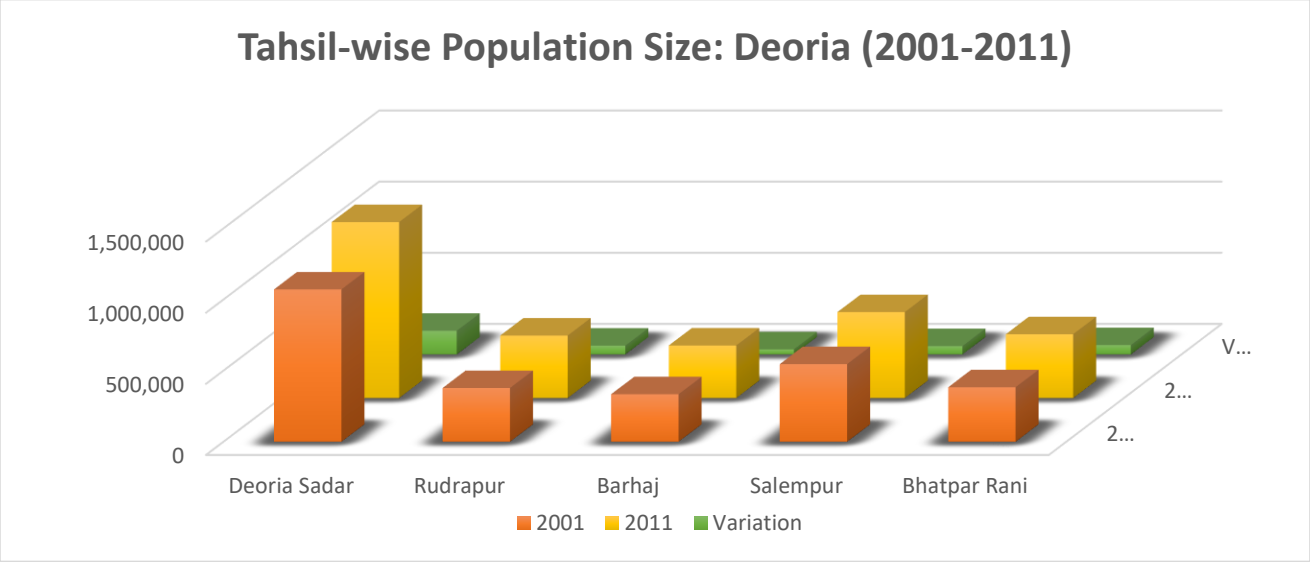
Table 3 presents the population size and decadal growth rates for five tahsils in Deoria district—Deoria Sadar, Rudrapur, Barhaj, Salempur, and Bhatpar Rani—for the years 2001 to 2011, along with the decadal variation and growth rates. The data reveals significant variations in population growth across the tahsils.

Tahsil Name	2001	2011	Decadal Variation	Decadal Growth Rate
Deoria Sadar	10,71,132	12,37,450	1,66,318	15.53
Rudrapur	3,77,893	4,39,763	61,870	16.34
Barhaj	3,34,194	3,69,994	35,800	10.71
Salempur	5,45,922	6,04,483	58,561	10.73
Bhatpar Rani	3,83,509	4,49,256	65,747	17.14
Total	27,12,650	31,00,946	3,88,296	14.31

Table 3: Tahsil-wise Population Size and Decadal Growth Rate.

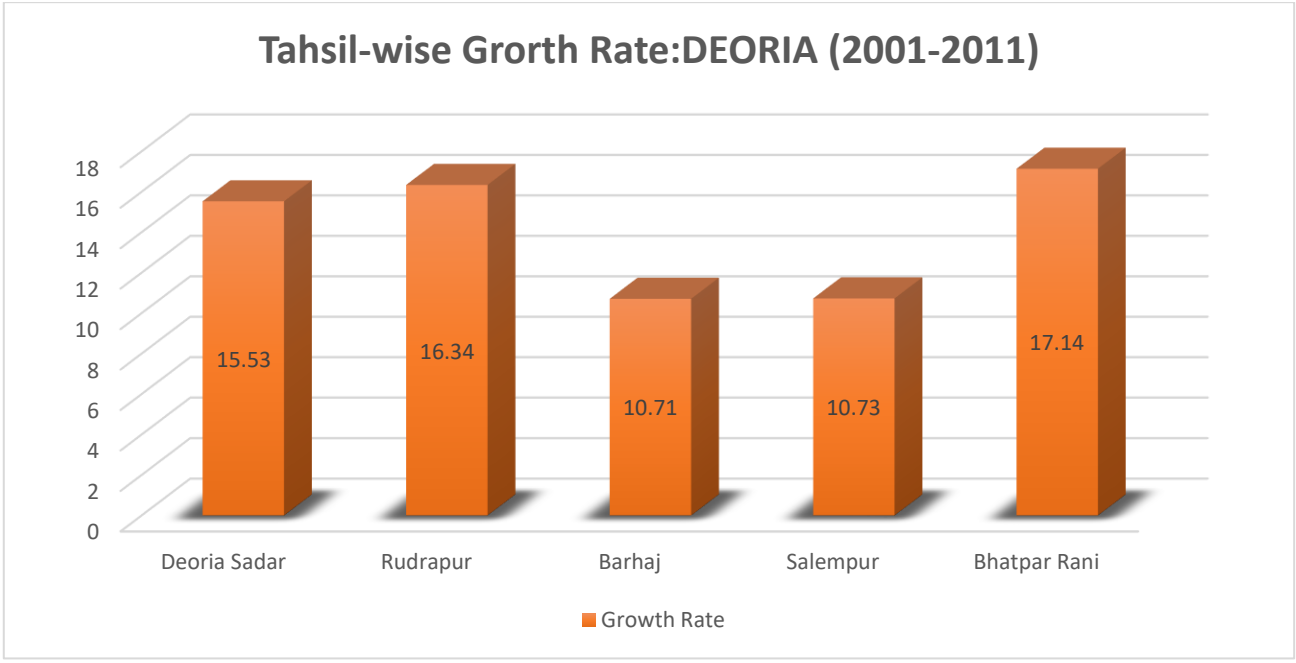
Deoria Sadar, the most populous tahsil, recorded a population of 10,71,132 in 2001, which increased to 12,37,450 in 2011, with a decadal growth rate of 15.53%. This growth rate is slightly higher than the district average of 14.31%, indicating relatively stable population dynamics in this tahsil. In contrast, Bhatpar Rani exhibited the highest decadal growth rate of 17.14%, with its population increasing from

3,83,509 in 2001 to 4,49,256 in 2011. This high growth rate may be attributed to factors such as higher fertility rates, limited access to family planning services, or in-migration due to economic opportunities **(Census of India, 2011)**.



Graph 1: Tahsil-wise Variation of Population Size

Rudrapur also experienced a significant population increase, with a growth rate of 16.34%, slightly above the district average. This could be linked to improved infrastructure, economic opportunities, or in-migration from neighbouring areas. On the other hand, Barhaj and Salempur recorded the lowest decadal growth rates of 10.71% and 10.73%, respectively. These lower rates may reflect better access to education, healthcare, and family planning services, which are known to contribute to reduced fertility rates **(Dreze & Murthi, 2001)**. Additionally, out-migration for employment or education could also explain the slower population growth in these tahsils.



Graph 2: Tahsil wise Variation of Decadal Growth Rate

The total population of Deoria district increased from 27,12,650 in 2001 to 31,00,946 in 2011, with a decadal growth rate of 14.31%. This growth rate is consistent with trends observed in other districts of eastern Uttar Pradesh, where high fertility rates and limited access to family planning services remain prevalent (National Family Health Survey **[NFHS-5], 2019–2021)**. The variations across tahsils highlight the diverse demographic and socio-economic conditions within the district, emphasizing the need for localized analysis to understand population dynamics fully.

Table 4 presents the population density for five tahsils in Deoria district—Deoria Sadar, Rudrapur, Barhaj, Salempur, and Bhatpar Rani—for the years 2001 and 2011, along with the decadal variation. The data reveals significant variations in population density across the tahsils, reflecting differences in geographical area, population growth, and socio-economic conditions.

Tahsil Name	Area (Km^2)	2001	2011	Decadal Variation
Deoria Sadar	884.71	1,211	1,399	188
Rudrapur	395.59	955	1,112	157
Barhaj	373.66	894	990	96
Salempur	493.34	1,107	1,225	188
Bhatpar Rani	342.11	1,121	1,313	192

Table 4: Tahsil-wise Population Density

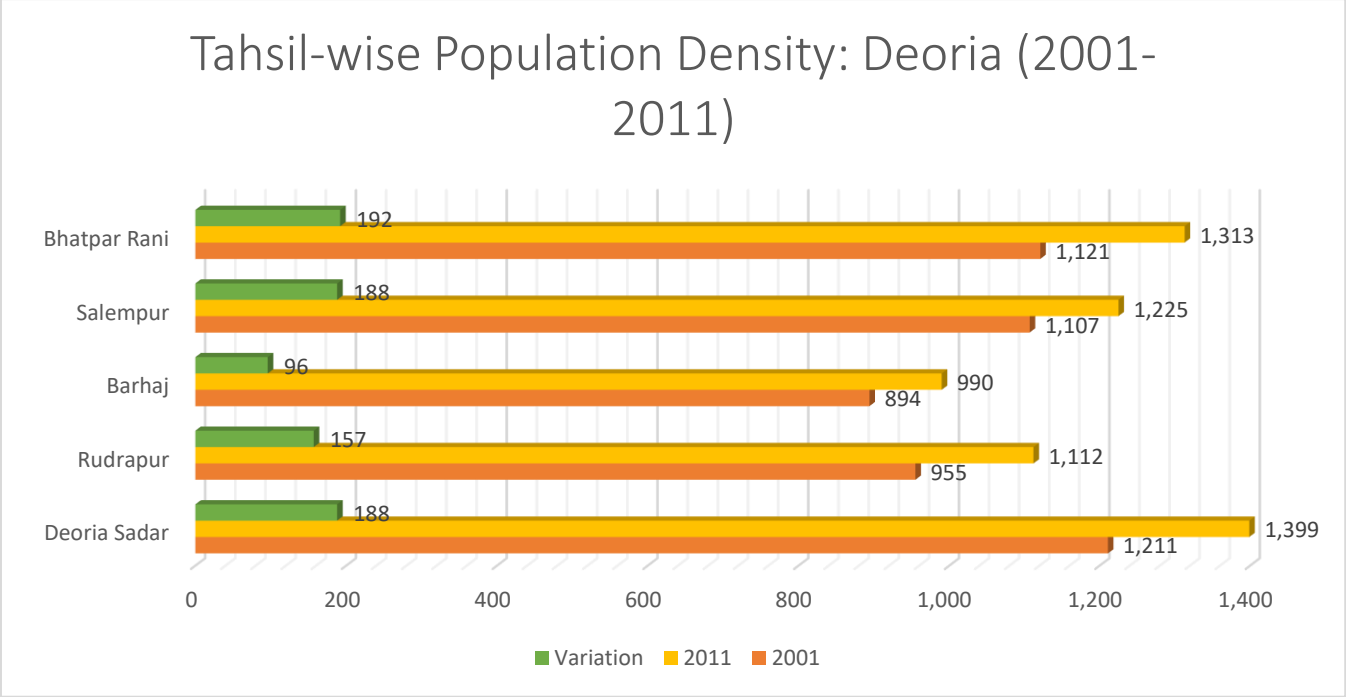
Deoria Sadar, with an area of 884.71 km², recorded a population density of 1,211 persons per km² in 2001, which increased to 1,399 persons per km² in 2011, with a decadal variation of 188. This tahsil has the largest geographical area among the five, yet it also experienced a substantial increase in population density, indicating significant population growth relative to its size. The high density may be attributed to urbanization, economic activities, and better infrastructure, which attract people to settle in this tahsil **(Census of India, 2011)**.

Rudrapur, with an area of 395.59 km², recorded a population density of 955 persons per km² in 2001, which increased to 1,112 persons per km² in 2011, with a decadal variation of 157. This tahsil, despite its smaller size, experienced a notable rise in population density, likely due to its economic opportunities and connectivity, which may have led to in-migration and higher population concentration.

Barhaj, with an area of 373.66 km², recorded the lowest population density among the tahsils, with 894 persons per km² in 2001, increasing to 990 persons per km² in 2011, with a decadal variation of 96. The relatively lower density and smaller decadal variation suggest slower population growth, possibly due to out-migration or limited economic opportunities compared to other tahsils.

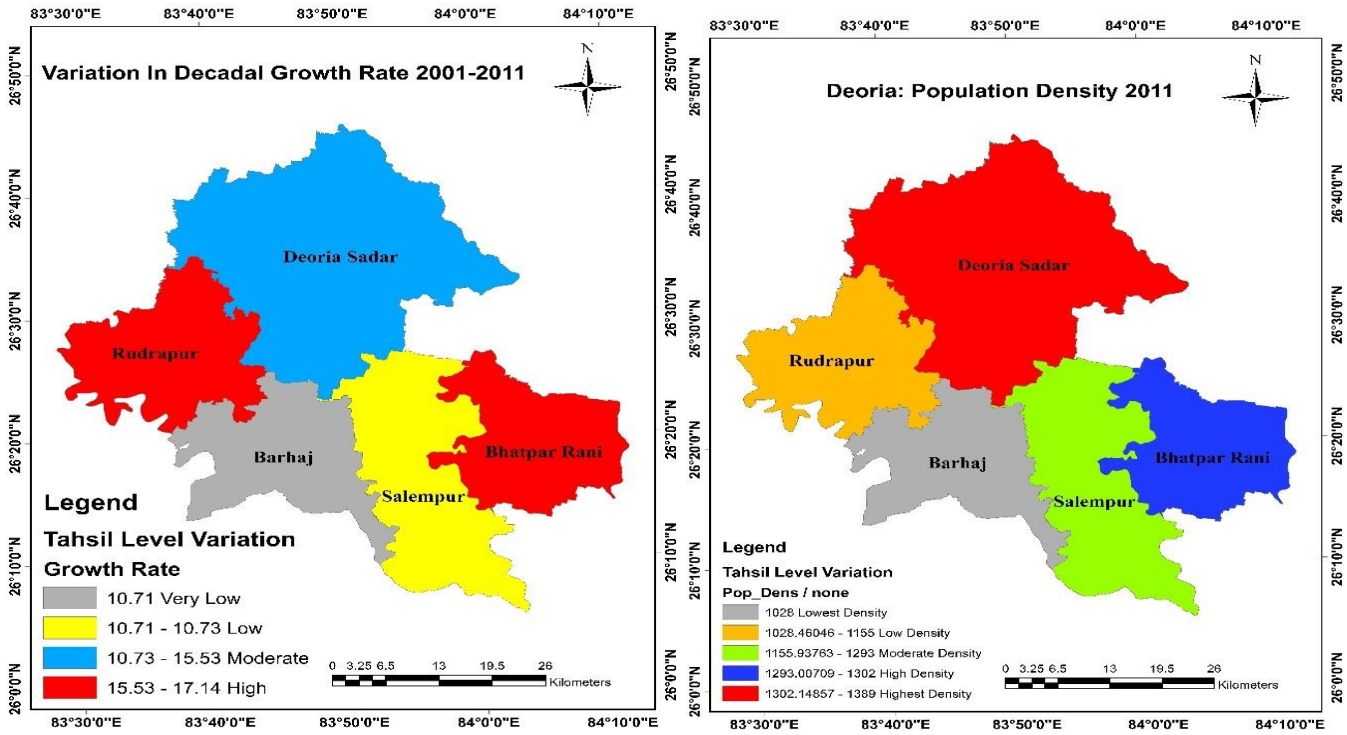
Salempur, with an area of 493.34 km², recorded a population density of 1,107 persons per km² in 2001, which increased to 1,225 persons per km² in 2011, with a decadal variation of 188. This tahsil experienced a significant rise in population density, similar to Deoria Sadar, indicating substantial population growth and possibly better access to resources and infrastructure.

Bhatpar Rani, with an area of 342.11 km², recorded a population density of 1,121 persons per km² in 2001, which increased to 1,313 persons per km² in 2011, with a decadal variation of 192. This tahsil exhibited the highest decadal variation in population density, reflecting rapid population growth, which may be linked to higher fertility rates, limited out-migration, or economic activities that attract settlers.



Graph 3: Tahsil-wise Variation of Population Density

The variations in population density across the tahsils highlight the diverse demographic and socio-economic conditions within Deoria district. While tahsils like Deoria Sadar and Bhatpar Rani experienced significant increases in population density, others like Barhaj showed slower growth. These differences underscore the influence of factors such as urbanization, economic opportunities, and migration patterns on population distribution and density.



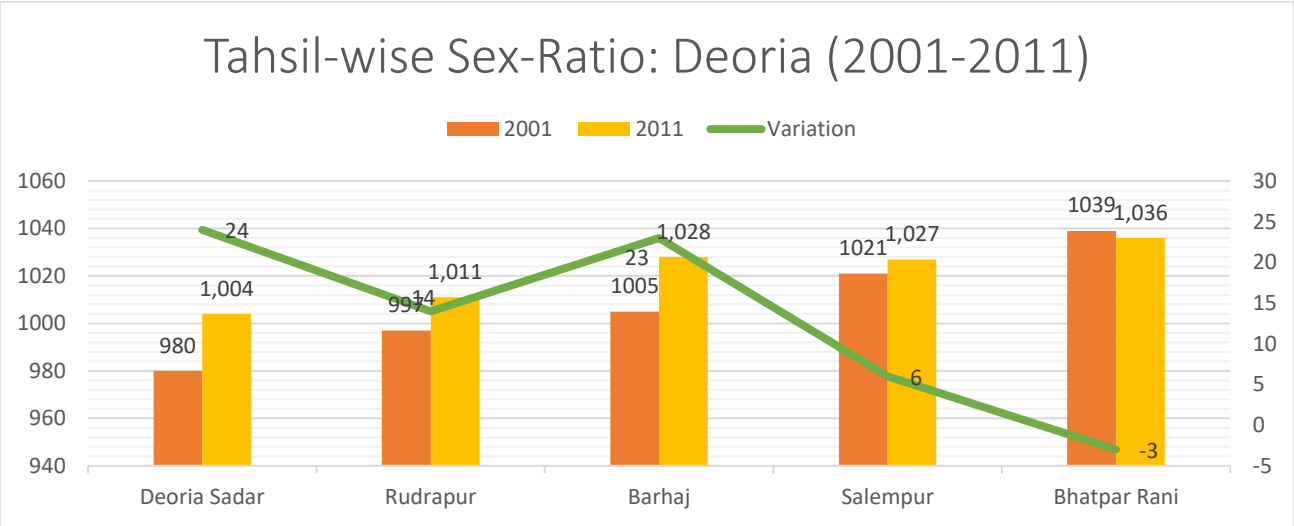
Map 2: Tahsil Level Variation in Growth Rate and Density.

3.2 Sex-Ratio and Literacy Rate: Sex ratio is defined as the proportion of males to females in a given population. According to Kingsley Davis **(1951)**, sex ratio refers to "the number of females per 1,000 males in a population. According to the **Census of India**, literacy rate is defined as the percentage of people aged 7 years and above who can read and write with understanding in any language.
The table 5 presents the sex ratio, number of females per 1,000 males, for five tahsils in 2001 and 2011, along with the decadal variation. The data reveals trends and variations in the sex ratio across these tahsils over the decade.

Tahsil Name	2001	2011	Decadal Variation
Deoria Sadar	980	1,004	24
Rudrapur	997	1,011	14
Barhaj	1005	1,028	23
Salempur	1021	1,027	06
Bhatpar Rani	1039	1,036	-03

Table 5: Tahsil-wise Sex Ratio

Deoria Sadar saw a marginal increase in its sex ratio, from 980 in 2001 to 1,004 in 2011, with a decadal variation of +24, indicating a slight improvement in gender balance. This improvement aligns with broader national trends, where increased awareness and policy interventions have contributed to a gradual rise in sex ratios in some regions **(Census of India, 2011)**. Rudrapur also experienced a modest rise, from 997 in 2001 to 1,011 in 2011, with a decadal variation of +14, reflecting gradual progress toward parity. Barhaj showed a more significant increase, from 1,005 in 2001 to 1,028 in 2011, with a decadal variation of +23, suggesting a positive trend in gender balance, possibly due to improved healthcare access and declining gender-based discrimination **(UNFPA, 2012)**. Salempur recorded a minimal increase, from 1,021 in 2001 to 1,027 in 2011, with a decadal variation of +6, indicating stagnation in improvements despite the ratio remaining above parity. In contrast, Bhatpar Rani experienced a slight decline, from 1,039 in 2001 to 1,036 in 2011, with a decadal variation of -3, making it the only tahsil with a negative trend. This decline could be attributed to factors such as male-selective migration or socio-cultural preferences for male children **(Drèze & Sen, 2013)**.



Graph 4: Tahsil-wise Variation of Sex-Ratio

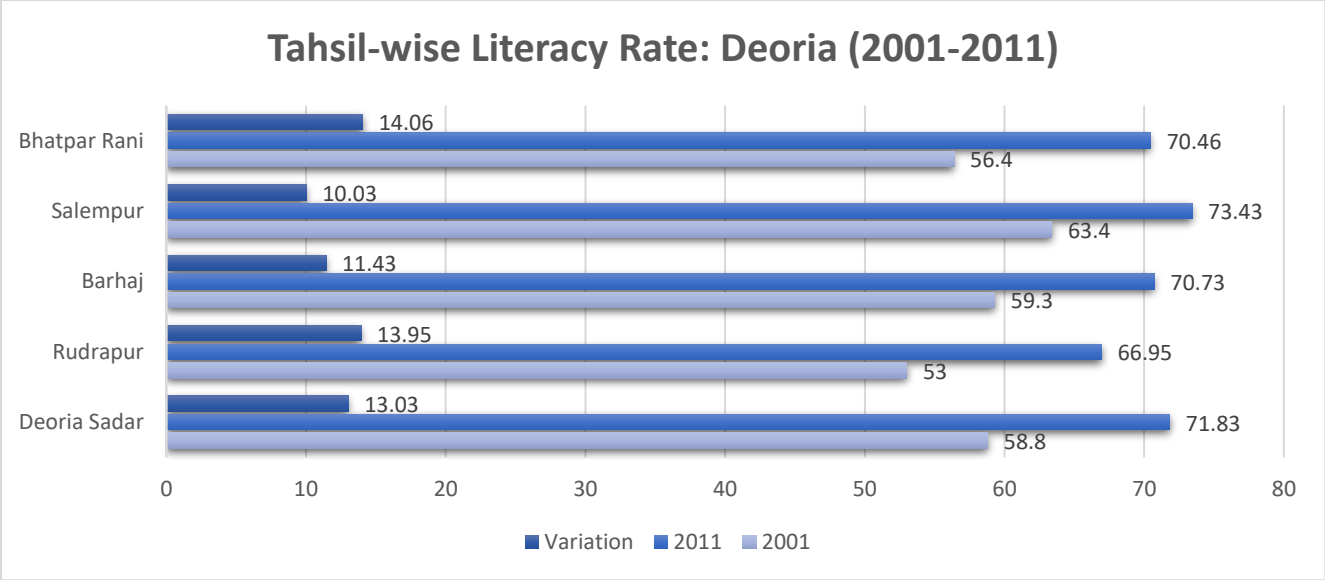
Overall, while most tahsils show improving or stable sex ratios, the data underscores the need for continued efforts to address gender imbalances, particularly in areas with slow progress or declining ratios. Targeted interventions, such as promoting female education and healthcare access, remain critical to achieving gender parity **(World Bank, 2015)**.

The table 6 presents the literacy rates for five tahsils in 2001 and 2011, along with the decadal variation. The data highlights significant improvements in literacy rates across all tahsils over the decade, reflecting the impact of educational initiatives and socio-economic development.

Tahsil Name	2001	2011	Decadal Variation
Deoria Sadar	58.8	71.83	13.03
Rudrapur	53.0	66.95	13.95
Barhaj	59.3	70.73	11.43
Salempur	63.4	73.43	10.03
Bhatpar Rani	56.4	70.46	14.06

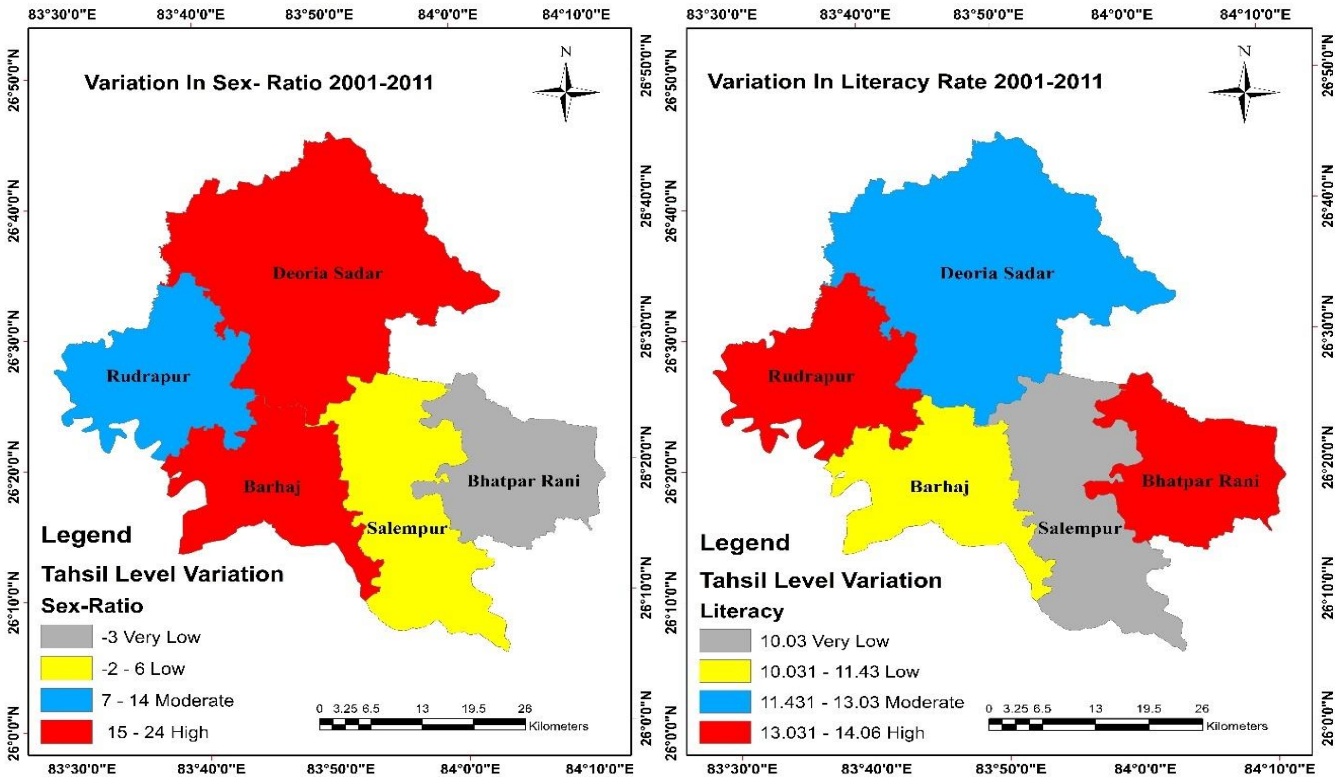
Table 6: Tahsil-wise Literacy Rate.

In Deoria Sadar literacy rate increased from 58.8% in 2001 to 71.83% in 2011, with a decadal variation of +13.03. This substantial improvement indicates successful efforts in promoting education and literacy in the region. Rudrapur also saw a notable rise in its literacy rate, from 53.0% in 2001 to 66.95% in 2011, with a decadal variation of +13.95. This is the highest decadal increase among the tahsils, suggesting effective implementation of educational programs. The literacy rate in Barhaj increased from 59.3% in 2001 to 70.73% in 2011, with a decadal variation of +11.43. This improvement reflects positive strides in educational access and enrollment. Salempur recorded an increase in its literacy rate, from 63.4% in 2001 to 73.43% in 2011, with a decadal variation of +10.03. Although the variation is relatively smaller compared to other tahsils, Salempur maintained the highest literacy rate in both years. Bhatpar Rani seen a significant rise in its literacy rate, from 56.4% in 2001 to 70.46% in 2011, with a decadal variation of +14.06. This is the highest decadal increase, indicating remarkable progress in educational development.



Graph 5: Tahsil-wise Variation of Literacy Rate.

All tahsils show a consistent increase in literacy rates, reflecting the success of national and state-level educational policies, such as the Sarva Shiksha Abhiyan and the Right to Education Act (Census of India, 2011). Rudrapur and Bhatpar Rani stand out with the highest decadal variations (+13.95 and +14.06, respectively), suggesting targeted efforts in these regions to improve educational access. Salempur, despite having the smallest decadal variation (+10.03), maintained the highest literacy rate in both 2001 and 2011, indicating a strong baseline and continued progress.



Map 3: Tahsil Level Variation in Sex-Ratio and Literacy Rate.

3.3 Urban-Rural Population Structure: The Census of India, stated that urban population consists of individuals living in areas designated as urban, which include cities and towns that have a municipal corporation, municipal board, or cantonment board, as well as settlements with specific criteria such as a population of 5,000 or more and a predominance of non-agricultural activities. The rural population includes those residing in areas that are not classified as urban. These areas are typically less developed, with the majority of people engaged in agricultural or primary sector activities.

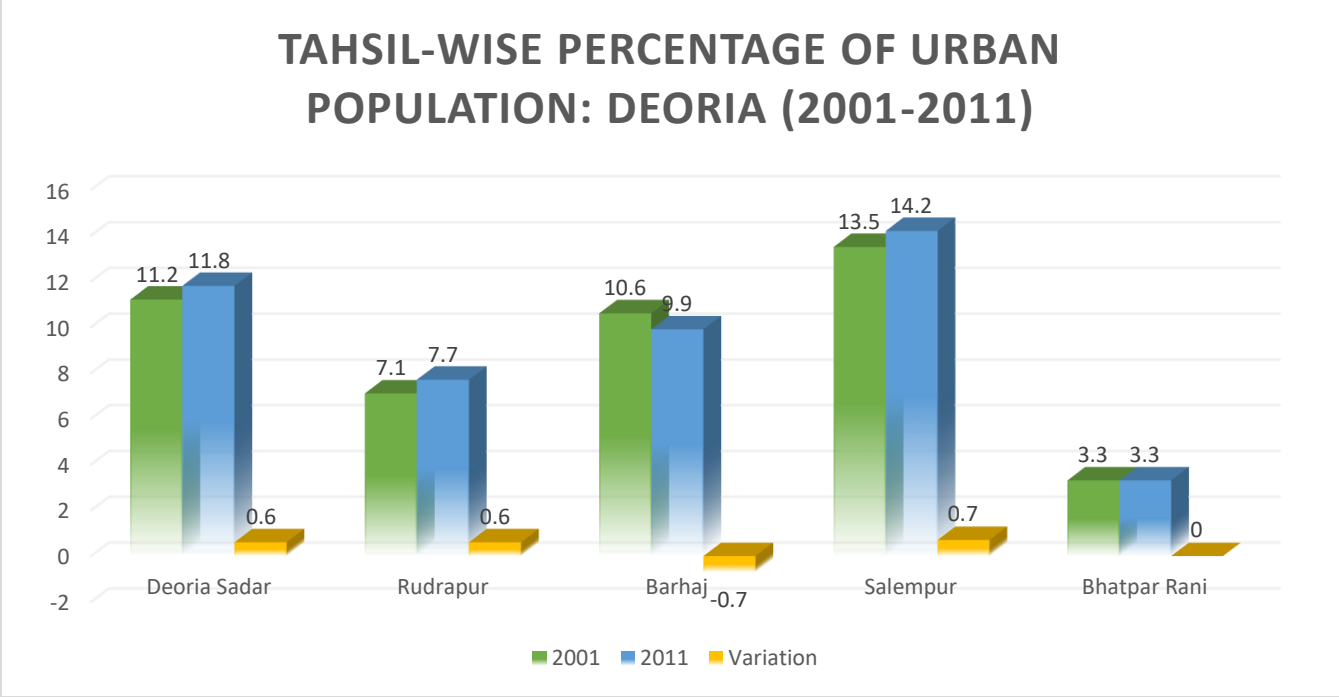
The table 7 presents the percentage of urban population for five tahsils in 2001 and 2011, along with the decadal variation. The data reveals trends in urbanization across these tahsils over the decade, highlighting both growth and stagnation in urban population shares.

Tahsil Name	2001	2011	Decadal Variation
Deoria Sadar	11.2	11.8	0.6
Rudrapur	07.1	07.7	0.6
Barhaj	10.6	09.9	-0.7
Salempur	13.5	14.2	0.7

Bhatpar Rani	03.3	03.3	0.0

Table 7: Tahsil-wise Urban Population.

In Deoria Sadar urban population increased slightly from 11.2% in 2001 to 11.8% in 2011, with a decadal variation of +0.6. This marginal rise suggests slow but steady urbanization in the region. Rudrapur also saw a small increase in its urban population, from 7.1% in 2001 to 7.7% in 2011, with a decadal variation of +0.6. This indicates gradual urbanization, though the overall urban share remains low. In contrast, Barhaj experienced a decline in its urban population, from 10.6% in 2001 to 9.9% in 2011, with a decadal variation of -0.7. This is the only tahsil in the table showing a negative trend, which may reflect slower urban development or outmigration from urban areas. Salempur recorded an increase in its urban population, from 13.5% in 2001 to 14.2% in 2011, with a decadal variation of +0.7. This tahsil has the highest urban population share among the five, indicating relatively stronger urban growth. Bhatpar Rani showed no change in its urban population, remaining at 3.3% in both 2001 and 2011, with a decadal variation of 0.0. This stagnation suggests limited urban development or economic opportunities in the area.



Graph 6: Tahsil-wise Variation of Urban Population.

Most tahsils (Deoria Sadar, Rudrapur, and Salempur) show a slight increase in urban population, reflecting slow urbanization trends. This aligns with broader patterns in India, where urbanization has been gradual in many regions, particularly in rural-dominated states **(Census of India, 2011)**. Barhaj is the exception, with a decline in its urban population share. This could be due to factors such as limited urban infrastructure, lack of economic opportunities, or migration to larger urban centers **(Kundu, 2011).** Bhatpar Rani's stagnant urban population highlights the challenges of urban development in smaller or less economically dynamic areas, where urbanization often lags behind national trends **(World Bank, 2013)**. Salempur, with the highest urban population share and a positive decadal variation, stands out as a

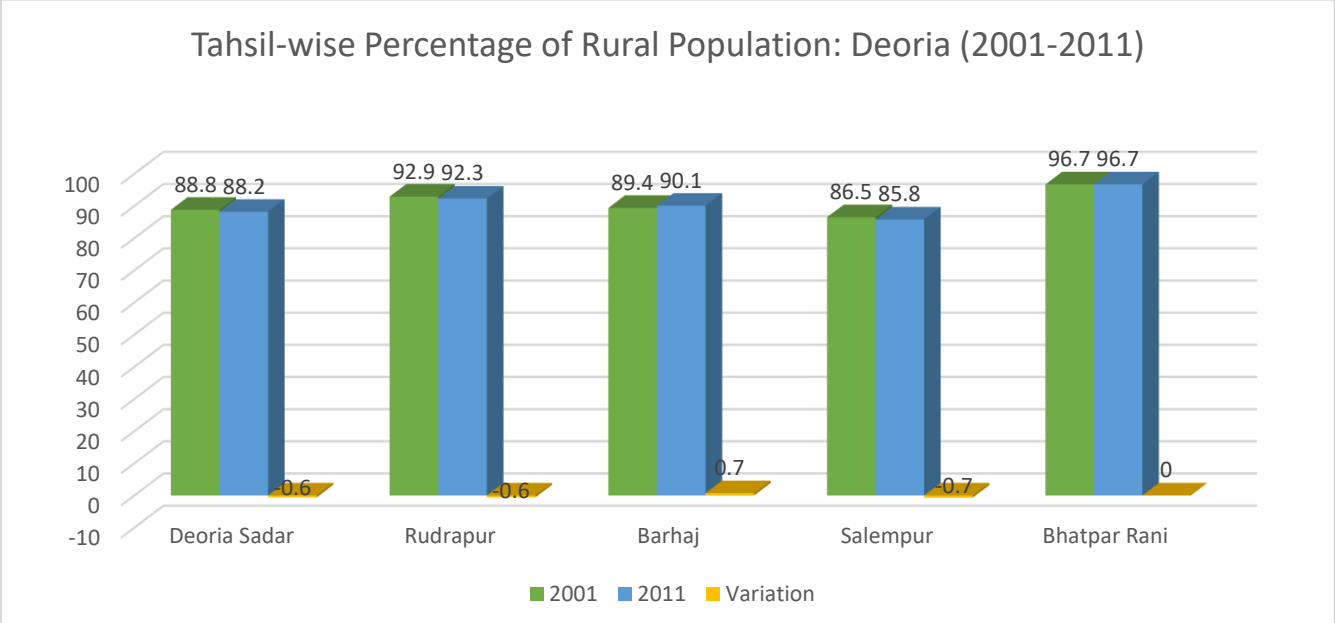
relatively more urbanized tahsil, possibly due to better infrastructure or economic activities driving urban growth.

The table 8 presents the percentage of rural population for five tahsils in 2001 and 2011, along with the decadal variation. The data reveals trends in rural population shares across these tahsils over the decade, highlighting shifts in urbanization and rural-urban dynamics.

Tahsil Name	2001	2011	Decadal Variation
Deoria Sadar	88.8	88.2	-0.6
Rudrapur	92.9	92.3	-0.6
Barhaj	89.4	90.1	0.7
Salempur	86.5	85.8	-0.7
Bhatpar Rani	96.7	96.7	0.0

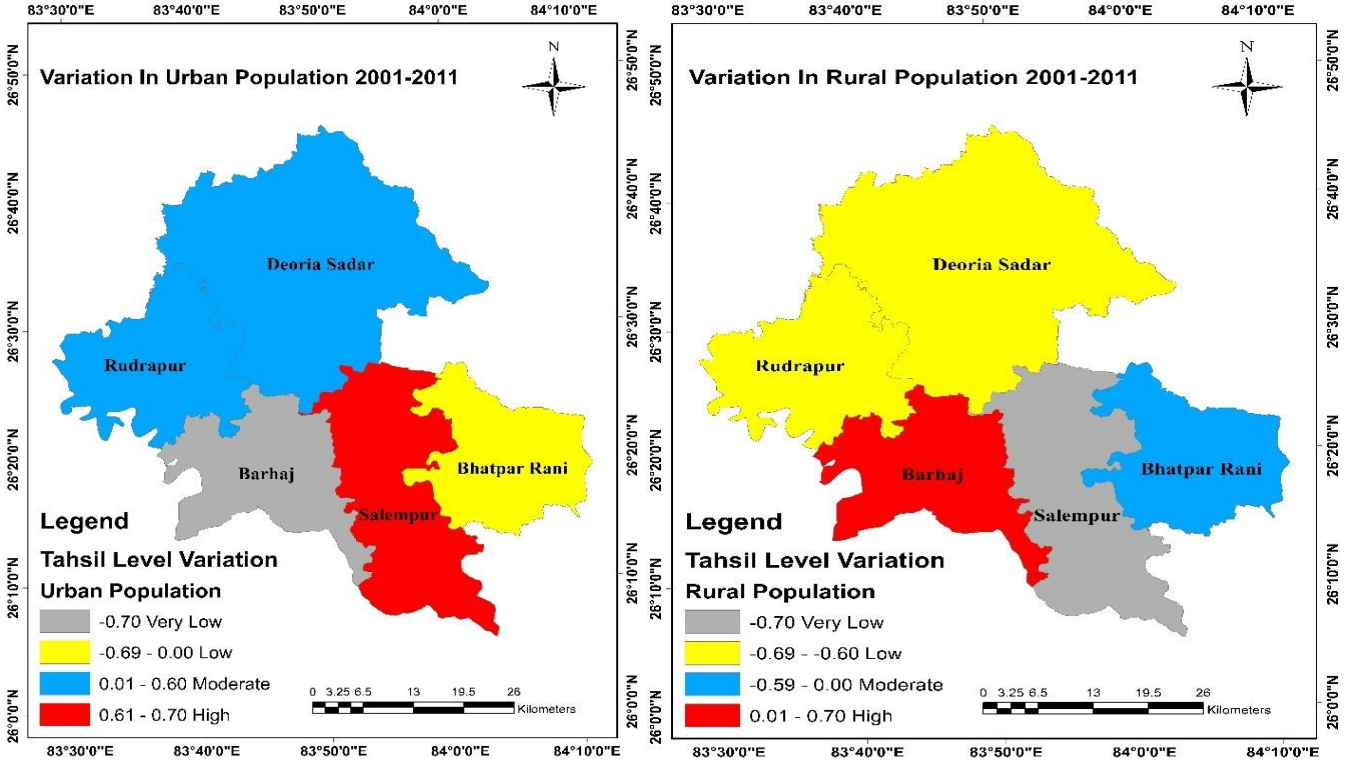
Table 8: Tahsil-wise Rural Population.

In Deoria Sadar, rural population decreased slightly from 88.8% in 2001 to 88.2% in 2011, with a decadal variation of -0.6. This marginal decline suggests a slow shift toward urbanization, though the region remains predominantly rural. Rudrapur also saw a small decrease in its rural population, from 92.9% in 2001 to 92.3% in 2011, with a decadal variation of -0.6. This indicates a gradual movement toward urbanization, though the rural population share remains high. In contrast, Barhaj experienced an increase in its rural population, from 89.4% in 2001 to 90.1% in 2011, with a decadal variation of +0.7. This is the only tahsil in the table showing a positive trend, which may reflect slower urban development or a preference for rural livelihoods. Salempur recorded a decline in its rural population, from 86.5% in 2001 to 85.8% in 2011, with a decadal variation of -0.7. Despite the decrease, Salempur has the lowest rural population share among the tahsils, indicating relatively higher urbanization. Bhatpar Rani showed no change in its rural population, remaining at 96.7% in both 2001 and 2011, with a decadal variation of 0.0. This stagnation highlights the tahsil's overwhelmingly rural character and limited urban development.



Graph 7: Tahsil-wise Variation of Rural Population.

Most tahsils (Deoria Sadar, Rudrapur, and Salempur) show a slight decrease in rural population shares, reflecting slow urbanization trends. This aligns with broader patterns in India, where rural-to-urban migration has been gradual but persistent **(Census of India, 2011)**. Barhaj is the exception, with an increase in its rural population share. This could be due to limited urban opportunities, stronger rural economies, or cultural preferences for rural living **(Kundu, 2011)**. Bhatpar Rani's stagnant rural population underscores its highly rural nature, with minimal urban development. This is consistent with trends in regions where economic activities remain predominantly agriculture-based **(World Bank, 2013)**. Salempur, with the lowest rural population share and a declining trend, stands out as the most urbanized tahsil, likely due to better infrastructure or economic opportunities driving urban growth.



Map 4: Tahsil Level Variation in Urban-Rural Population.

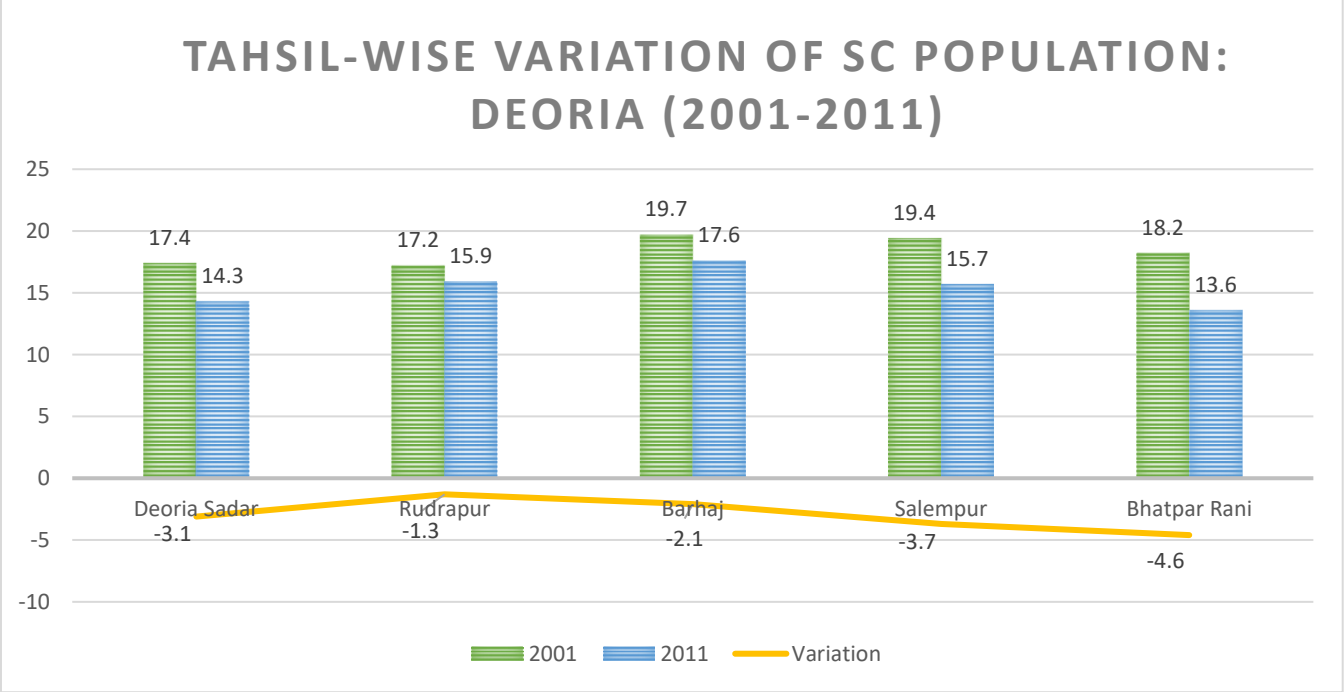
3.4 Caste and Minority Composition: The Scheduled Castes are groups of people who are historically marginalized and have been designated as such in the Constitution of India. They were formerly known as "Untouchables" and faced social discrimination and exclusion. The Constitution recognizes them as a disadvantaged group that requires affirmative action in areas such as education, employment, and political representation. The Scheduled Tribes are groups of people who are indigenous to certain regions and have distinct cultural practices, languages, and traditions. They are generally found in more isolated or rural areas and have often been historically disadvantaged in terms of access to education, healthcare, and other essential services.

The table 9 presents the Scheduled Caste (SC) population in a percentage of the total population for five tahsils in 2001 and 2011, along with the decadal variation. The data reveals trends in the demographic share of the SC population across these tahsils over the decade, highlighting changes in their representation.

Tahsil Name	2001	2011	Decadal Variation
Deoria Sadar	17.4	14.3	-3.1
Rudrapur	17.2	15.9	-1.3
Barhaj	19.7	17.6	-2.1
Salempur	19.4	15.7	-3.7
Bhatpar Rani	18.2	13.6	-4.6

Table 9: Tahsil-wise SC Population.

In Deoria Sadar the SC population percentage decreased from 17.4% in 2001 to 14.3% in 2011, with a decadal variation of -3.1. This decline suggests a relative reduction in the SC population share, possibly due to faster growth in other population groups or migration patterns. Rudrapur also saw a decrease in its SC population share, from 17.2% in 2001 to 15.9% in 2011, with a decadal variation of -1.3. This indicates a gradual decline in the SC population proportion, though the change is less pronounced compared to other tahsils. The SC population percentage in Barhaj declined from 19.7% in 2001 to 17.6% in 2011, with a decadal variation of -2.1. Despite the decrease, Barhaj has the highest SC population share among the tahsils in both years. Salempur recorded a significant decrease in its SC population share, from 19.4% in 2001 to 15.7% in 2011, with a decadal variation of -3.7. This is the largest decline among the tahsils, reflecting a notable shift in demographic composition. Bhatpar Rani experienced the most substantial decline in its SC population share, from 18.2% in 2001 to 13.6% in 2011, with a decadal variation of -4.6. This highlights a significant reduction in the SC population proportion over the decade.



Graph 8: Tahsil-wise Variation of SC Population.

All tahsils show a decline in the SC population share, indicating a relative decrease in their proportion compared to other population groups. This trend may be attributed to differential population growth rates, migration, or socio-economic mobility among SC communities **(Census of India, 2011)**. Barhaj, despite

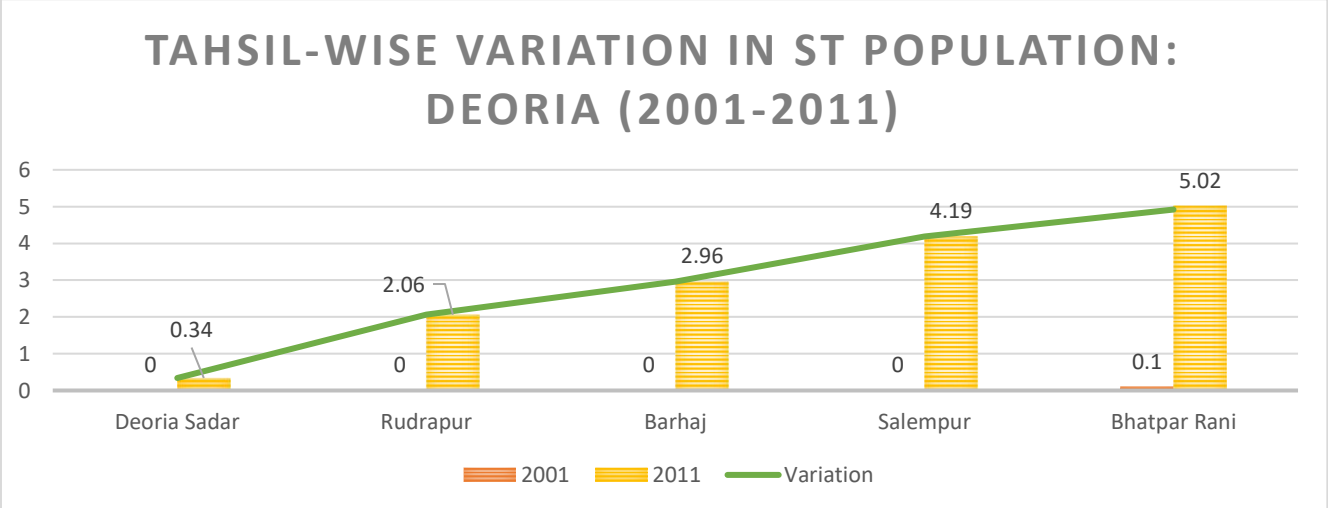
the decline, maintains the highest SC population share in both years, suggesting a relatively larger presence of SC communities in this tahsil. Bhatpar Rani and Salempur show the most significant declines, which could reflect outmigration of SC populations to urban areas or other regions in search of better opportunities **(Desai & Dubey, 2012)**.

The table 10 presents the Scheduled Tribe (ST) population as a percentage of the total population for five tahsils in 2001 and 2011, along with the decadal variation. The data reveals trends in the demographic share of the ST population across these tahsils over the decade, highlighting significant changes in their representation.

Tahsil Name	2001	2011	Decadal Variation
Deoria Sadar	0.0	(4,221) 0.34	0.34
Rudrapur	0.0	(9,071) 2.06	2.06
Barhaj	0.0	(10,946) 2.96	2.96
Salempur	0.0	(25,302) 4.19	4.19
Bhatpar Rani	0.10	(22,554) 5.02	4.92

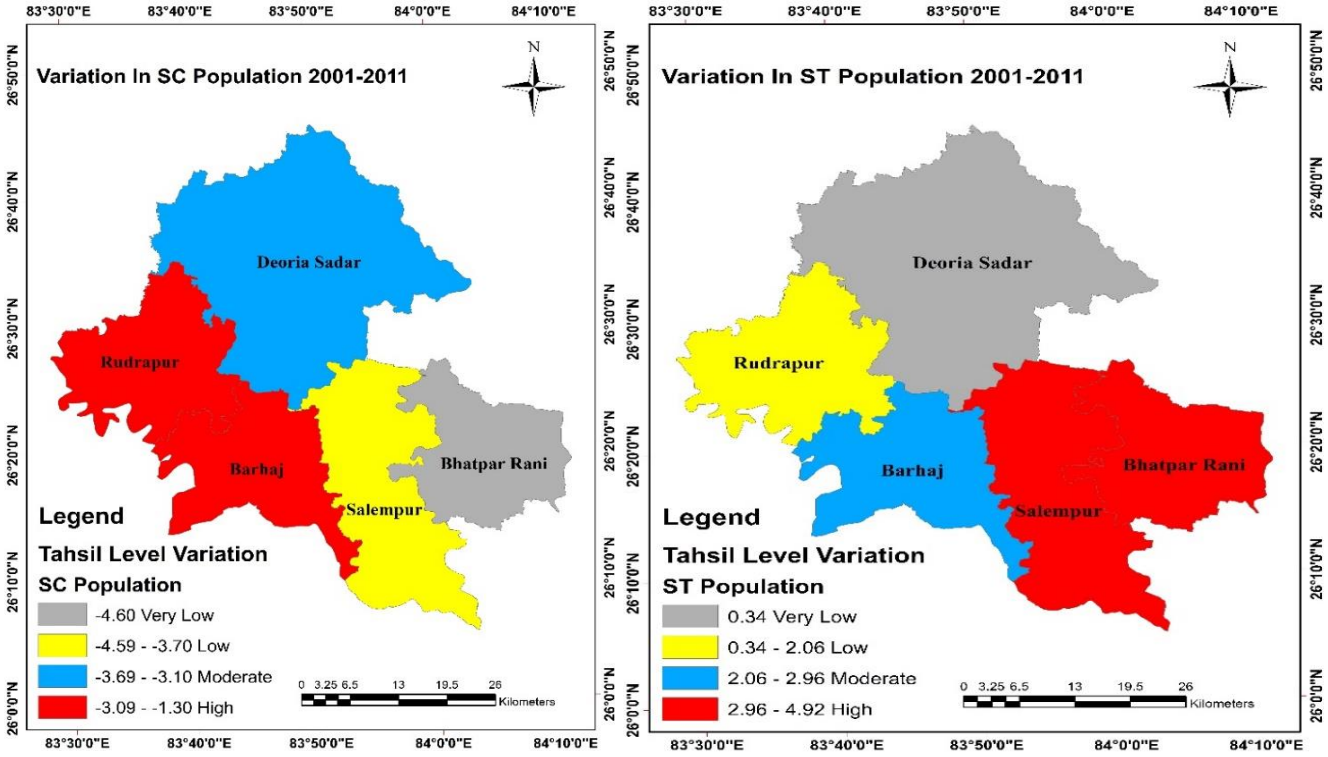
Table 10: Tahsil-wise ST Population.

In Deoria Sadar the ST population percentage increased from 0.0% in 2001 to 0.34% in 2011, with a decadal variation of +0.34. This indicates the emergence of a small ST population in the region, which was previously absent or negligible. Rudrapur also seen an increase in its ST population share, from 0.0% in 2001 to 2.06% in 2011, with a decadal variation of +2.06. This significant rise suggests a growing presence of ST communities in the tahsil. The ST population percentage in Barhaj increased from 0.0% in 2001 to 2.96% in 2011, with a decadal variation of +2.96. This is the second-highest increase among the tahsils, reflecting a notable growth in the ST population. Salempur recorded the highest increase in its ST population share, from 0.0% in 2001 to 4.19% in 2011, with a decadal variation of +4.19. This indicates a substantial rise in the ST population, making it the tahsil with the largest ST community. Bhatpar Rani experienced an increase in its ST population share, from 0.10% in 2001 to 5.02% in 2011, with a decadal variation of +4.92. This is the highest decadal variation, highlighting a dramatic rise in the ST population proportion.



Graph 9: Tahsil-wise Variation of ST Population.

ll tahsils show an increase in the ST population share, with some areas (Salempur and Bhatpar Rani) experiencing significant growth. This trend may be attributed to improved identification and enumeration of ST communities, migration, or natural population growth **(Census of India, 2011)**. Salempur and Bhatpar Rani stand out with the highest ST population shares and decadal variations, suggesting these tahsils have become focal points for ST communities, possibly due to economic opportunities or cultural factors **(Xaxa, 2014)**. The emergence of ST populations in tahsils like Deoria Sadar and Rudrapur, where they were previously absent, may reflect migration patterns or changes in administrative categorization of tribal communities **(Ministry of Tribal Affairs, 2013)**.



Map 5: Tahsil Level Variation in SC and ST Population.

Census of India, states that minority population refers to any group of people who are numerically smaller than the majority population in a given area, usually based on religious, linguistic, or cultural factors. For this study, the number of people belonging to religions like Muslim, Christianity, Sikhism, Buddhism, Jainism, Others and Not Stated etc., are considered minority in Deoria because they are not in the majority here.

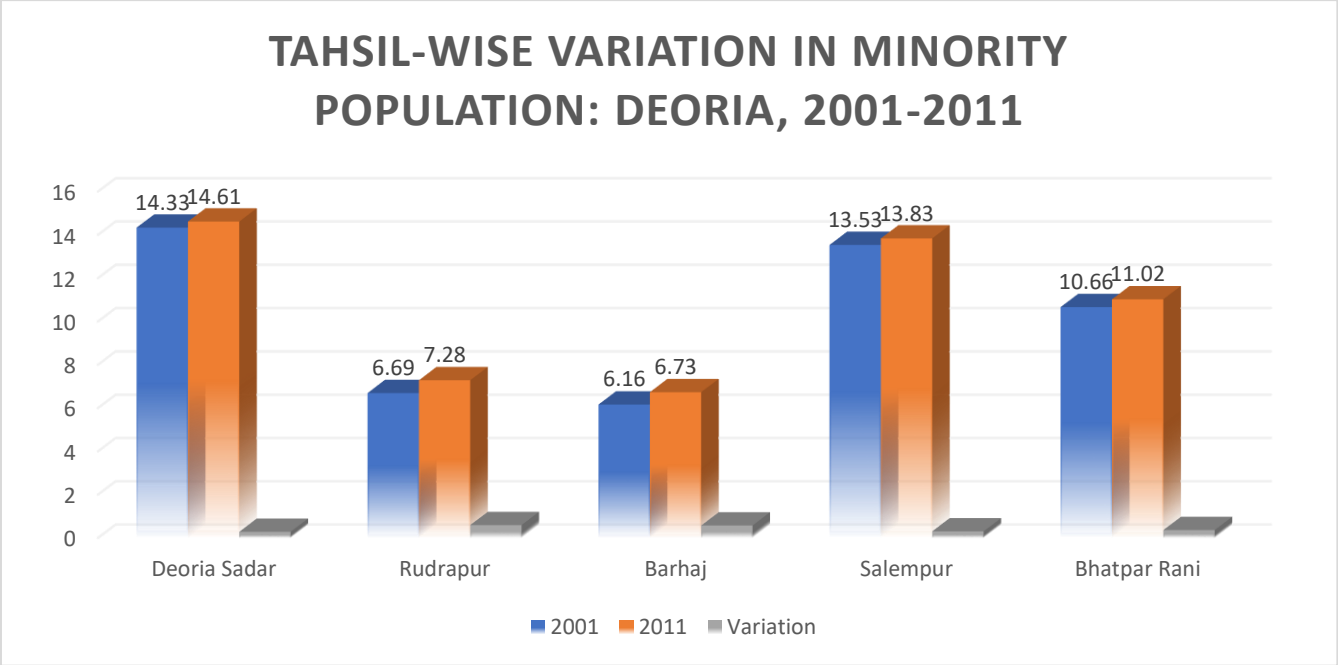
The table 11 presents the minority population as a percentage of the total population for five tahsils in 2001 and 2011, along with the decadal variation. The data reveals trends in the demographic share of minority populations across these tahsils over the decade, highlighting changes in their representation.

Tahsil Name	2001	2011	Decadal Variation
Deoria Sadar	14.33	14.61	0.28
Rudrapur	6.69	7.28	0.59
Barhaj	6.16	6.73	0.57
Salempur	13.53	13.83	0.30

Bhatpar Rani	10.66	11.02	0.36

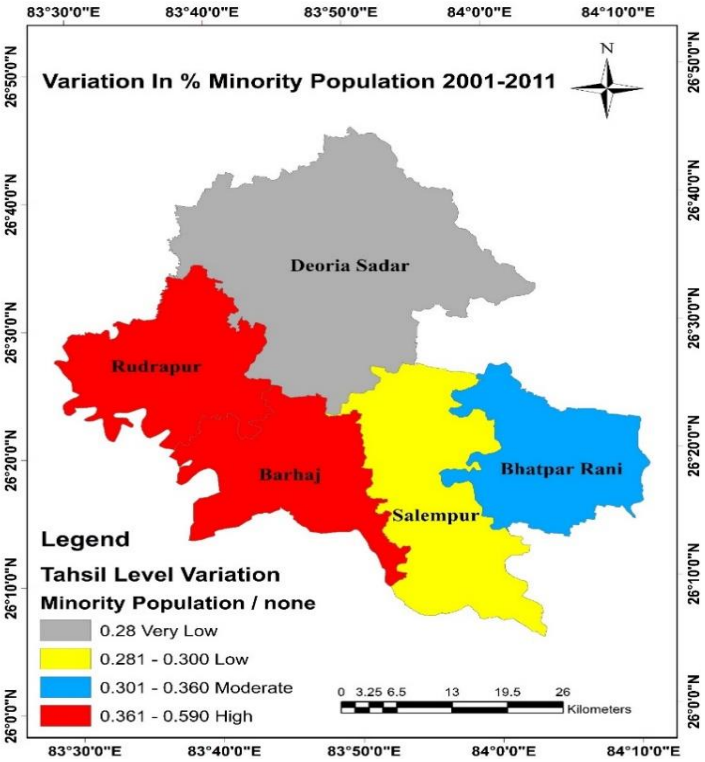
Table 11: Tahsil-wise Minority Population.

In Deoria Sadar, the minority population percentage increased slightly from 14.33% in 2001 to 14.61% in 2011, with a decadal variation of +0.28. This marginal rise suggests a stable presence of minority communities in the region. Rudrapur saw a modest increase in its minority population share, from 6.69% in 2001 to 7.28% in 2011, with a decadal variation of +0.59. This indicates gradual growth in the minority population, though the overall share remains relatively low. The minority population percentage in Barhaj increased from 6.16% in 2001 to 6.73% in 2011, with a decadal variation of +0.57. This reflects a steady but slow growth in the minority population. Salempur recorded a slight increase in its minority population share, from 13.53% in 2001 to 13.83% in 2011, with a decadal variation of +0.30. This tahsil has the second-highest minority population share among the tahsils, indicating a significant presence of minority communities. Bhatpar Rani experienced a small increase in its minority population share, from 10.66% in 2001 to 11.02% in 2011, with a decadal variation of +0.36. This suggests a gradual rise in the minority population proportion.



Graph 10: Tahsil-wise Variation of Minority Population.

All tahsils show a slight increase in the minority population share, reflecting a gradual growth in their presence. This trend aligns with broader national patterns, where minority populations have been growing steadily due to natural population growth and socio-economic factors **(Census of India, 2011)**. Deoria Sadar and Salempur have the highest minority population shares, indicating a significant presence of minority communities in these tahsils. This could be due to historical, cultural, or economic factors that have attracted and sustained minority populations Rudrapur and Barhaj, despite having lower minority population shares, show steady growth, which may reflect migration or improved enumeration of minority communities.



Map 6: Tahsil Level Variation in Minority Population.

3.5 Variations of characteristics across Tahsils in Deoria and Z-Score

Tahsil	Growth Rate	Density	Sex-Ratio	Literacy	Urban Population	Rural Population	SC Population	ST Population	Minority Population
Deoria Sadar	15.53	188	24	13.03	0.6	-0.6	-3.1	0.34	0.28
Rudrapur	16.34	157	14	13.95	0.6	-0.6	-1.3	2.06	0.59
Barhaj	10.71	96	23	11.43	-0.7	0.7	-2.1	2.96	0.57
Salempur	10.73	188	06	10.03	0.7	-0.7	-3.7	4.19	0.30
Bhatpar Rani	17.14	192	-03	14.06	0.0	0.0	-4.6	4.92	0.36
Mean	14.09	164.20	12.80	12.50	-0.24	-0.24	-2.96	2.894	0.28

Table 12: Tahsil-wise Dynamics of various characteristics in Deoria, 2001-2011.

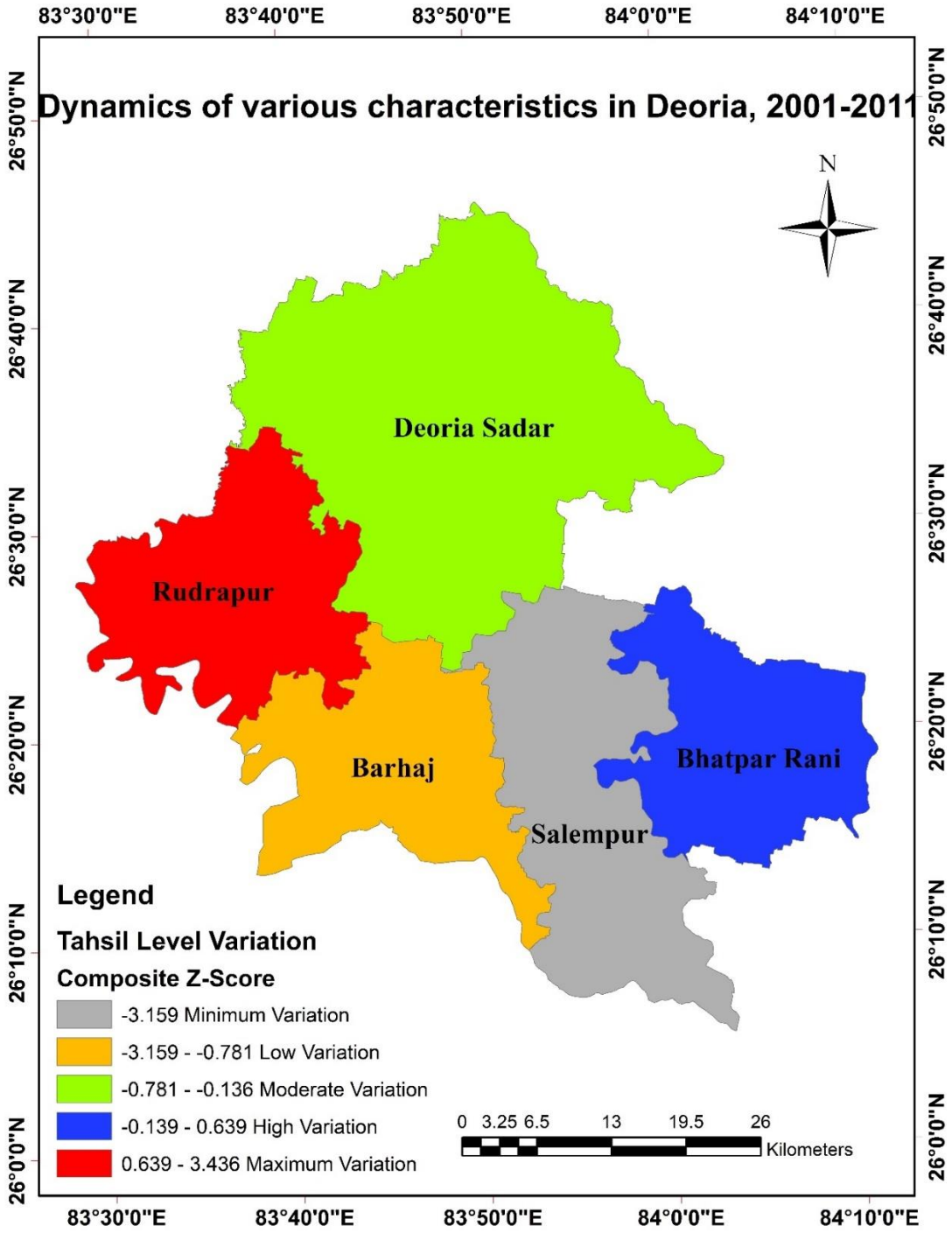
The table 13 presents the composite Z-scores for five tahsils in Deoria, calculated based on the standardized scores (Z-scores) of various demographic and socio-economic characteristics, including growth rate, population density, sex ratio, literacy rate, urban and rural population, SC population, ST population, and minority population. The composite Z-score provides a holistic view of the relative performance and dynamics of each tahsil across these indicators.

Tahsil	Zscore(Growth_Rate_Var)	Zscore(Density_Var)	Zscore(Sex_Ratio_Var)	Zscore(Literacy_Var)	Zscore(Urban_Population_Var)	Zscore(Rural_Population_Var)	Zscore(SC_Population_Var)	Zscore(ST_Population_Var))	Zscore(Minority_Population_Var)	Composite Z-Score
Deoria Sadar	0.46027	0.58553	0.97594	0.3052	0.60592	-0.60592	-0.10776	-1.41632	-0.93856	-0.1357
Rudrapur	0.71917	-0.17713	0.10457	0.83498	0.60592	-0.60592	1.27768	-0.46249	1.13968	3.43646
Barhaj	-1.08035	-1.67785	0.88881	-0.61615	-1.58212	1.58212	0.66193	0.0366	1.0056	-0.78141
Salempur	-1.07396	0.58553	-0.59254	-1.42234	0.77423	-0.77423	-0.56957	0.71869	-0.80448	-3.15867
Bhatpar Rani	0.97488	0.68393	-1.37678	0.89832	-0.40395	0.40395	-1.26229	1.12351	-0.40224	0.63933

Table 13: Composite Z-Score of Dynamics of various characteristics in Deoria, 2001-2011.

Deoria Sadar's Composite Z-Score: -0.1357 shows a mixed performance across indicators. It has positive Z-scores for growth rate (0.46027), population density (0.58553), sex ratio (0.97594), and urban population (0.60592), indicating above-average performance in these areas. However, it has negative Z-scores for rural population (-0.60592), ST population (-1.41632), and minority population (-0.93856), reflecting below-average performance in these aspects. The overall composite score is slightly negative, suggesting moderate performance relative to other tahsils. **Rudrapur**'s Composite Z-Score is 3.43646 stands out with the highest composite Z-score, indicating strong overall performance. It has positive Z-scores for growth rate (0.71917), literacy rate (0.83498), urban population (0.60592), SC population (1.27768), and minority population (1.13968). Despite a negative Z-score for rural population (-0.60592), its overall performance is significantly above average, making it the best-performing tahsil. **Barhaj**'s Composite Z-Score is -0.78141, a negative composite Z-score, reflecting below-average performance. It shows positive Z-scores for sex ratio (0.88881), SC population (0.66193), and minority population (1.0056), but negative Z-scores for growth rate (-1.08035), population density (-1.67785), literacy rate (-0.61615), and urban population (-1.58212). The overall score suggests challenges in key areas such as growth and urbanization. **Salempur**'s Composite Z-Score is -3.15867, the lowest composite Z-score, indicating the weakest performance among the tahsils. It has negative Z-scores for growth rate (-1.07396), sex ratio (-0.59254), literacy rate (-1.42234), SC population (-0.56957), and minority population (-0.80448). While it has positive Z-scores for population density (0.58553) and ST population (0.71869), these are insufficient to offset the overall poor performance. **Bhatpar Rani**'s Composite Z-Score is 0.63933, shows a positive composite Z-score, reflecting above-average performance. It has positive Z-

scores for growth rate (0.97488), population density (0.68393), literacy rate (0.89832), and ST population (1.12351). However, it has negative Z-scores for sex ratio (-1.37678), SC population (-1.26229), and minority population (-0.40224). Despite these, its overall performance is relatively strong.



Map 7: Tahsil Level Dynamics of Population Characteristics based on Composite Z-Score.

Rudrapur is the top-performing tahsil, excelling in growth, literacy, and minority population dynamics. This suggests effective development policies and socio-economic progress in the region. **Salempur** is the weakest performer, with challenges in growth, literacy, and minority population indicators. This highlights the need for targeted interventions to address these gaps. **Deoria Sadar** and **Barhaj** show mixed results,

with strengths in some areas but significant weaknesses in others, such as rural population dynamics and ST population representation. **Bhatpar Rani** performs well overall but faces challenges in sex ratio and SC population dynamics, indicating areas for improvement.

3.6 Cluster Analysis: Using the K-Means algorithm to group the tahsils into clusters. For simplicity, we will assume **k = 3 clusters** (this is adjusted based on the elbow method or domain knowledge).

Quick Cluster

Notes		
Output Created		28-JAN-2025 15:57:53
Comments		
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Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on cases with no missing values for any clustering variable used.
Syntax		QUICK CLUSTER ZGrowth_Rate_Var ZDensity_Var ZSex_Ratio_Var ZLiteracy_Var ZUrban_Population_Var ZRural_Population_Var ZSC_Population_Var ZST_Population_Var ZMinority_Population_Var /MISSING=LISTWISE /CRITERIA=CLUSTER(3) MXITER(10) CONVERGE(0) /METHOD=KMEANS(NOUPDATE) /PRINT INITIAL.
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	Elapsed Time	00:00:00.02
	Workspace Required	1728 bytes

Initial Cluster Centers			
	Cluster		
	1	2	3
Zscore(Growth_Rate_Var)	-1.07396	.71917	-1.08035

Zscore(Density_Var)	.58553	-.17713	-1.67785
Zscore(Sex_Ratio_Var)	-.59254	.10457	.88881
Zscore(Literacy_Var)	-1.42234	.83498	-.61615
Zscore(Urban_Population_Var)	.77423	.60592	-1.58212
Zscore(Rural_Population_Var)	-.77423	-.60592	1.58212
Zscore(SC_Population_Var)	-.56957	1.27768	.66193
Zscore(ST_Population_Var)	.71869	-.46249	.03660
Zscore(Minority_Population_Var)	-.80448	1.13968	1.00560

Iteration History[a]

Iteration	Change in Cluster Centers		
	1	2	3
1	1.857	1.486	.000
2	.000	.000	.000

a. Convergence achieved due to no or small change in cluster centers. The maximum absolute coordinate change for any center is .000. The current iteration is 2. The minimum distance between initial centers is 4.245.

Final Cluster Centers

	Cluster		
	1	2	3
Zscore(Growth_Rate_Var)	-.04954	.58972	-1.08035
Zscore(Density_Var)	.63473	.20420	-1.67785
Zscore(Sex_Ratio_Var)	-.98466	.54026	.88881
Zscore(Literacy_Var)	-.26201	.57009	-.61615
Zscore(Urban_Population_Var)	.18514	.60592	-1.58212
Zscore(Rural_Population_Var)	-.18514	-.60592	1.58212
Zscore(SC_Population_Var)	-.91593	.58496	.66193
Zscore(ST_Population_Var)	.92110	-.93940	.03660
Zscore(Minority_Population_Var)	-.60336	.10056	1.00560

Number of Cases in each Cluster

Cluster	1	2.000
	2	2.000
	3	1.000
Valid		5.000
Missing		1.000

Clustering Results

Based on the Z-scores, the tahsils are grouped into the following clusters:

Cluster 1: High Performers Tahsils: (Rudrapur and Bhatpar Rani) with following properties:

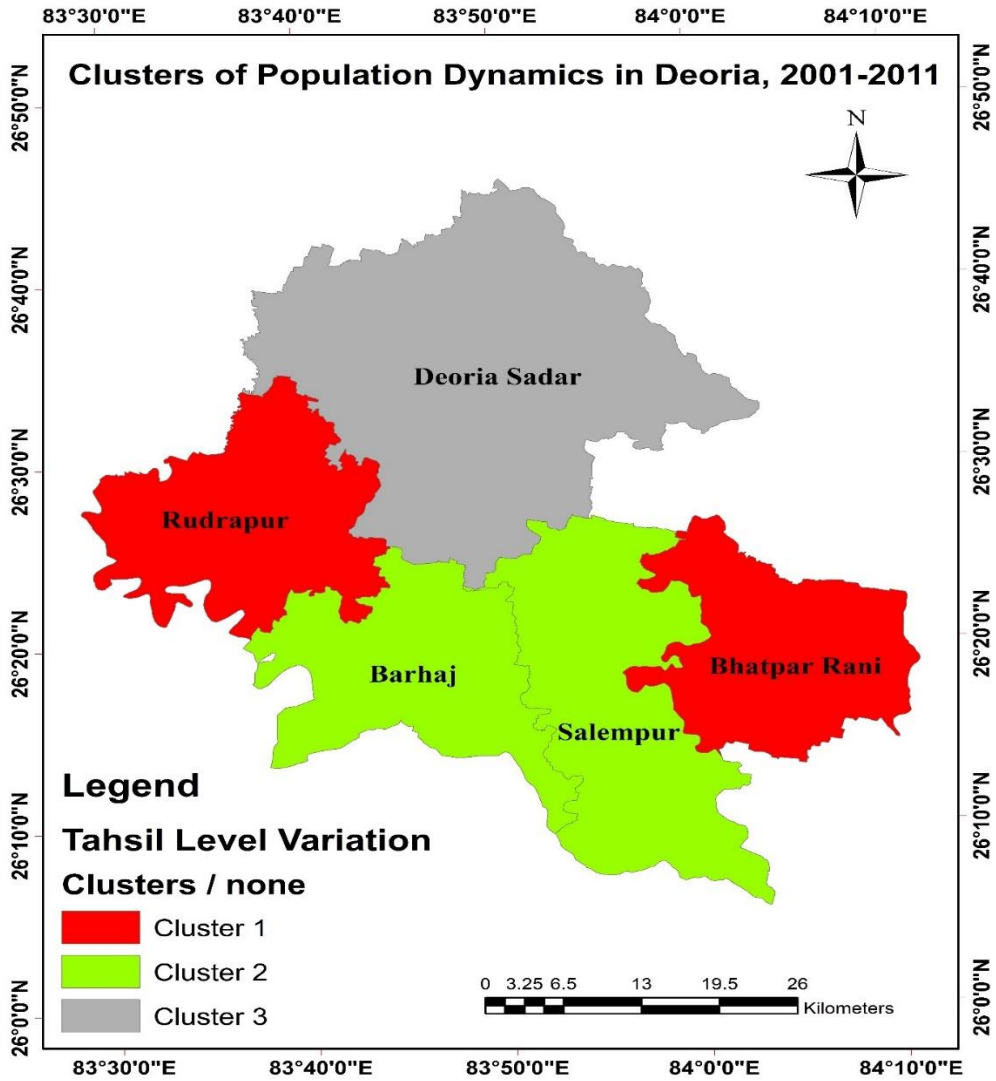
- High composite Z-scores (Rudrapur: 3.43646, Bhatpar Rani: 0.63933).
- Strong performance in growth rate, literacy rate, and urban population dynamics.
- Positive Z-scores for SC population (Rudrapur) and ST population (Bhatpar Rani).
- Above-average performance in minority population dynamics (Rudrapur).

Cluster 2: Low Performers Tahsils: (Barhaj and Salempur) with following properties:

- Low composite Z-scores (Barhaj: -0.78141, Salempur: -3.15867).
- Negative Z-scores for growth rate, literacy rate, and urban population.
- Challenges in rural population dynamics (Barhaj) and minority population (Salempur).
- Weak performance across multiple indicators.

Cluster 3: Moderate Performers Tahsil: (Deoria Sadar) with following properties:

- Moderate composite Z-score (-0.1357).
- Positive Z-scores for growth rate, population density, sex ratio, and urban population.
- Negative Z-scores for ST population and minority population.
- Balanced performance with some areas of improvement.



Map 8: Clusters of Population Dynamics in Deoria 2001-2011.

4. Conclusions:

The analysis of the composite Z-scores and the subsequent K-Means clustering of tahsils in Deoria district reveals distinct patterns in their population dynamics during the period 2001-2011. The clustering of tahsils into high performers, moderate performers, and low performers provides valuable insights into their relative strengths and weaknesses, enabling targeted policy interventions.

4.1 High Performers (Rudrapur, Bhatpar Rani):

These tahsils exhibit strong performance across key indicators such as growth rate, literacy rate, and urban population dynamics. Their positive Z-scores for SC and ST populations also reflect inclusive development. Rudrapur, with the highest composite Z-score (3.43646), stands out as a model tahsil, demonstrating effective implementation of development policies. These tahsils can serve as benchmarks for other regions, and their best practices should be replicated to promote balanced development.

4.2 Low Performers (Barhaj, Salempur):

These tahsils face significant challenges, as reflected in their low composite Z-scores (Barhaj: -0.78141, Salempur: -3.15867). They struggle with low growth rates, poor literacy rates, and weak urban population dynamics. Salempur, in particular, has the lowest composite Z-score, highlighting the urgent need for comprehensive development programs to address its socio-economic gaps. Focused efforts in education, healthcare, and rural infrastructure are essential to uplift these tahsils and ensure equitable development.

4.3 Moderate Performers (Deoria Sadar):

Deoria Sadar shows a mixed performance, with strengths in growth rate, population density, and urban population dynamics. However, it lags in ST and minority population representation. The tahsil's moderate composite Z-score (-0.1357) indicates the need for targeted interventions to address specific weaknesses, particularly in minority welfare and rural development.

5 Suggestions:

5.1 The successful policies and practices of high-performing tahsils like Rudrapur and Bhatpar Rani, especially in literacy, urban development, and inclusive growth, should be studied and implemented in other tahsils to promote balanced development.

5.2 Special welfare programs should be introduced to address gaps in minority and ST population representation, particularly in moderate and low-performing tahsils like Deoria Sadar, Barhaj, and Salempur, ensuring inclusivity in growth.

5.3 Focused efforts on education and literacy are needed in low-performing tahsils such as Salempur and Barhaj, as improving human capital will help address socio-economic challenges in these areas.

5.4 Investments in basic infrastructure, including roads, healthcare, sanitation, and clean water, should be prioritized for Barhaj and Salempur to improve living conditions and support overall development.

5.5 Regular monitoring and evaluation of the demographic indicators of all tahsils should be carried out. Custom interventions should be planned based on these assessments, such as improving rural development programs in Deoria Sadar or addressing weak growth dynamics in Salempur.

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