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Original Article

GIS for Rural Infrastructure Mapping: Aurangpur Case Study

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Abstract *- The integration of geospatial technologies into rural planning is a transformative approach to achieving the Sustainable Development Goals. Uttar Pradesh in India devised a plan of urbanization in 29 villages of the Yamuna Expressway Industrial Development Authority (YEIDA) region. The plan was drafted in 2012. This was inspired by the PURA (Providing Urban Amenities in Rural Areas) of Dr.A.P.J. Abdul Kalam. This research investigates the Aurangpur of the YEIDA region and explores the efficacy of Geographical Information Systems (GIS) in conducting a micro-level mapping and analysis of socio-economic and infrastructural facilities in a rural context. A comprehensive household survey was conducted in 121 families, capturing data on demographics, caste, income, livestock, and housing, complemented by precise GPS coordinates. The collected data were integrated with the GIS environment for spatial analysis, employing thematic mapping and Kernel Density Estimation (KDE). The results revealed significant spatial clustering, with 28% of Below Poverty Line (BPL) families concentrated in the southern sector of the Aurangpur village. A strong and positive correlation was observed between livestock density hotspots and higher family income. The findings underscored the substantial role of geospatial technology in uncovering intra-village disparities, thereby facilitating targeted, data–driven interventions in infrastructure planning. This methodology provided a replicable model for equitable development in rapidly urbanizing regions. The investigation revealed recommendations to the policy makers and YEIDA authorities based on the Earth Observation (EO) data, geospatial data, and digital mapping developed.*

Keywords *- Geospatial Information System, Rural Infrastructure, Spatial Analysis, Kernel Density Function, Poverty Mapping, YEIDA.*

1. Introduction

India is predominantly a rural country with more than 65% of the population residing in rural villages, as reported from past research [1]. The migration of villagers towards urban regions for employability, sophisticated environment, infrastructural facilities, luxurious life, and ICT (Information, Communication, and Technology) facilities is a major problem in most developing countries. The Missile Man of India, Dr. A.P.J. Abdul Kalam, along with IIT (Indian Institute of Technology) Professors, drafted a scheme called PURA (Providing Urban Amenities in Rural Areas) for preventing the migration of villagers. The rural infrastructure is a cornerstone of poverty alleviation and sustainable growth in developing economies like India. However, the traditional planning methodologies rely on aggregated, aspatial data, which can obscure critical intra-village disparities, leading to insufficient resource allocation and ineffective policy implementation [2]. The emergence and democratization of geospatial technologies would offer a paradigm shift, providing precise, location–based analysis that may lead to a new level of transparency and accuracy in planning [3, 4]. The Yamuna Expressway Industrial Development Authority (YEIDA) region of Uttar Pradesh epitomizes a landscape undergoing rapid urbanization and industrial growth [5]. The research on PURA further revealed the risks of marginalizing existing rural settlements if the development is not integrated with a broader planning network. Hence, it is of paramount importance to understand the baseline infrastructural and socio-economic conditions of the 29 villages of the YEIDA region [6]. Geospatial technology was explored using GIS for utility in urban planning [7]. But a broader view has to be implemented in granular village-level planning, which remains unexplored [8]. The studies by the concerned authority revealed the fact that resource mapping [9] and environment management need to be further researched at the household level. Out of the 29 villages, the research was confined to six villages, namely Jaganpur, Afzalpur, Gunpura, Aurangpur, Dankaur, Dungarpur Rilkha, and Rabupura of the YEIDA region. This paper addresses the above-mentioned gaps by conducting a household survey and investigation in Aurangpur. The research addresses the following objectives: (1) To create a high-resolution geospatial database of household attributes, (2) to analyze the spatial distribution of key socio-economic indicators (caste, income) and infrastructural assets (housing, livestock), and (3) to identify spatial patterns and clusters that can inform equitable and effective civil engineering and infrastructure planning. The research further demonstrates a replicable evidence-based model for bridging the gap between macro-level regional policies and micro-level rural realities.

2. Literature Review

The research works from the past on the dynamics of urban growth are to shape and distribute the development to achieve sustainability [10] and reduce the social difference between urban and rural areas. The digital images [10] from satellite had been the major resource for land coverage. This was followed by reducing the [10] migration from rural regions to nearby cities. Wherever agricultural development is not feasible, urbanization is found to be crucial [10]. The city had been defined by the researchers as perceived [10] by social, economic, political, cultural, and urban components, which would develop a specific spatial space. The agricultural lands that exceed the needs of the farmers would be sought for urbanization. The randomness in the land usage [10] should be governed by schemes of the government for converting the excessive farmland to residential areas. However, the urban sprawl should be handled so that it does not affect the forest and green areas. The research should be focused on measuring [10] the urban sprawl by modern digital maps using GIS to track down the land cover. The GIS provides improved strategies for the information transparency and prediction of data related to Smart Village [10]. The clarity of information in planning the rural administration [11] needs geospatial analysis using GIS for the estimation of the probability of urban development. In the 1990s, the rural migration to urban regions resulted in overcrowding [11] in India.

This even led to informal settlements [11], leading to challenges in urban growth. The data on economic liberalization and outward expansion of the [11] cities were a major focus for the researchers. The land transformation contributed to the changes in the ecosystem [11] due to the expansion of human inhabitation by the spatial pattern of the locality. The data obtained [12] from the physical and virtual environments would create harmony between the two. The data to be collected would be framed as public, open, and private. The Earth Observation (EO) based satellite imagery data is reliable for the scientists and decision makers [12] to utilize them in risky areas related to the environment and urbanization. The researchers employ RS satellite [12] data and extract them from Google Maps and Google Earth. These data, predicted and analysed by the GIS tools/sensors, play a vital role in numerical model prediction. These studies are focused on interpreting [12], integrating, visualizing, and analyzing EO-based satellite data on spatial context. The sustainable development [13] needs a survey on local people and awareness of urbanization to draft development schemes. Good quality satellite data, laboratory facilities, trained manpower, optimized financial sources, and evaluation procedures must be fully addressed by the secondary data collected. These types of investigations [13] would be applicable at local, national, and international levels for sustainable development and safeguarding the eco-environment. The informal settlements at a fine-grained level [14] and demographic information are always needed for any government project on sustainability and rural development. The urban agglomeration due to migrants from rural regions and urban sustainable development is measured by the EO data and satellite imagery [14]. Any type of research work on urbanization worldwide requires measuring the building types, density, and organizations like slums and urban villages [14].

The consistency should be measured morphologically and environmentally. The socio-economic segregation, poor liveability, informal morphology, clubbed by overcrowded populations and high-density buildings with insufficient public services [14], is a major concern of urbanization. The most common way to assess the demographic information is door – to – door household surveys and censuses [14]. Apart from urbanization, Smart Growth (SG) has been found to be the relevant approach [15] for sustainable development and urban sprawl. The past investigations propose that about 70% of the world's population will live in cities by 2050 [15]. The American [15] Planning Association introduced Smart Growth (SG) in 2002. There were many research works concentrating on SG by agent-based modeling [15] for assessing the interaction of various communities. There were technical works by urban scholars to understand the households and environment [16] to create urban administrative systems. The smart dynamic ways depend on EO using satellite imagery along with surveys conducted at household levels [16].

This should be carried out [16] periodically to define homogeneous spatial units to tailor the "urban policies". There is a growing need for detailed, fine-grained, geographical, and temporal [16] data to create policies on urbanization. There should be spatial knowledge [17] on the local community and Participatory Resource Mapping (PRM) based on GIS for community-based projects. The traditional data fails to capture interrelationships of the communities and fragmented planning, leading to insufficient outcomes. The evidence-based decision-making on measuring urbanization requires spatial and non-spatial data. The Smart Village (SV) was the term coined to improve the quality of rural [18] people. The SV model includes governance, technology, resources, village service, living, and tourism as explored by N. Viswanadham et al., from India [18] in 2010. The collection of spatial data would help in planning and making decisions in urban planning [18]. The urban sprawl in Uttar Pradesh [18] demands more pressure on converting the villages to regions with enhanced living quality, adequate housing facilities, ICT, internet, road networks, water supply, sewerage system, education, sanitation, and providing all other urban amenities. The prediction on the urbanization [20] projects that about 843 million people will be living in urban areas by 2050 in India. To prevent the migration of villagers in and around NCR regions, the Smart Village (SV) was framed by the YEIDA region. The excess farming lands were acquired by the YEIDA authority to convert them to areas with urban amenities. The project needs a more technical assessment and research regarding the current status of the people in the villages under YEIDA. Hence, addressing this research gap, this investigation focused on the development of Earth Observation (EO) data using satellite imagery and a door-to-door survey. GIS was extensively used for this research on 6 villages.

The spatial and non-spatial data were analyzed by household surveys resembling the past research done by Abhilash [21] et.al. The YEIDA region lacks information on EO data. This research work developed a spatially enabled geodatabase for the amenities provided. Also, the research came up with developing EO imageries on households, road networks, cattle, demographic data, annual income, caste system, and entrepreneurship of the people living in Aurangpur. The study examined the current status of implementation of PURA (Providing Urban Amenities in Rural Areas) and SV (Smart Village) in Aurangpur, YEIDA, by developing a geodatabase. The study is substantiated by the usage of Kernel Density Estimation (KDE) on spatial analysis by actionable intelligence. The KDE exposed the resource allocation for infrastructure development in SV and sustainability.

3. Past Research in YEIDA

The urbanization of YEIDA was proposed in 2012 by the Indian Government for providing enhanced amenities in village areas of YEIDA as per the Uttar Pradesh Industrial Development Act 1976. The past research exposed the facts of smart interventions, including smart roads, expressways, improved infrastructure, optimized transportation, and managing municipal solid waste management by the author. The urban fringe by the migrants from villages to Delhi NCR, nearby towns, and cities was measured and investigated. It was found that the migration was due to sophisticated life, employability, and having basic amenities. SV was initially proposed for regions having a population from 30,000 to 40,000. The policies like I-SPARSH YOJANA, Janeshwar Mishra Gram Yojana, and I-CHAUPAL introduced by the authority were investigated by Arvind Kumar et.al. It was observed that the village development had a positive direction as the villages had facilities within the village boundary. The research team further investigated the villages for the Rural Development Index by preparing Likert scale surveys in the notified region. An extensive SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis was carried out by the researchers, and Aurangpur had the highest index of 14.28 ‘[28], which was selected for further study.

The study projected that the unused land could be utilized for urbanization and providing employment in the construction sector for the villages. Observing the green growth and economic stability, the study proposed that further investigation is needed to assess the demographic data by door-to-door household surveys to measure the livelihoods, demography, agriculture, annual income, livestock, occupation, climatic impacts, and demands of the migrants and dwellers.

4. Research Gap

The traditional methodology of the research works in the YEIDA region depends on aspatial data, which is incomprehensible, leading to critical intra-village inequalities. There was no evidence-based research for the authority to inculcate resource allocation and implement or revise the existing policies. There is a need for the authority to have a plan at the micro level for socio-economic mapping in the peri–urban villages. The urgency in the need for developing the villages in YEIDA under PURA and urbanization demands a high-resolution mapping system and geospatial data at the household level.

The past research had an assessment based on measuring the indices of the development of YEIDA at a broader level. Hence, quoting the above research needs, this study has developed spatial analysis, like Kernel Density Estimation (KDE), and reveals the clustering of the caste system, the categorization of poverty, and livelihood assets. The investigation develops a granular geodatabase for referencing and generating insights for infrastructure planning using Earth Observation (EO) and surveys at the household level.

5. Research Methodology

The methodology is represented in Figure 1. A door-to-door survey was conducted in 121 households to collect socio-economic information along with infrastructure details. The collected raw data were categorized in the spreadsheets, and the poverty line demarcation was performed for households. This was followed by interpretation and processing by GIS software with GPS points.

The maps were then generated by importing spatial data. The clusters and dispersion patterns were identified based on spatial analysis. The KDE was applied to create density surfaces on the key variables. The spatial patterns were examined and correlated with infrastructure gaps. The infrastructure planning was recommended by socio-economic clusters. The details of the data collected and processed are given in Appendix 1.

6. Kernel Density Estimation Analysis

The purpose of Kernel Density Estimation (KDE) was to analyse the spatial clusters and density patterns of the socio-economic and infrastructural variables. The KDE revealed the areas of high concentrations (hot spots) and low concentrations (cold spots) across the study area of the Aurangpur village. This was highly suitable for rural analysis at the micro level when compared with other techniques like choropleth or point maps for planning the infrastructure of villages and interventions by framed policies. The KDE is expressed as

$$f^{\sim}(x) = \frac{1}{nh}\sum_{i=1}^{n} K\left(\frac{x-X_i}{h}\right) \quad (1)$$

$f^{\sim}(x)$ is the estimated density at location x.

where

n is the number of observed points.

h is the bandwidth

K is the Kernel function

Xi are the observed point locations.

The KDE represented by equation 1 was used to analyse the following variables: (i) livestock ownership, (ii) annual income category by using household GPS coordinates. The QGIS software used a Heatmap (KDE) for analysis. The parameters selected for Aurangpur's spatial characteristics are: the Epanechnikov Kernel was used for computational efficiency and smooth output. A radius of 500 metres was chosen as the bandwidth. The value of 10 metres was chosen as the output raster to produce a high-resolution density surface for micro-level analysis. The QGIS used bandwidths at 250m intervals from 250m to 1000m. The radius of 250m revealed noisy surfaces, whereas the range from 750 to 1000m oversmoothed the data. The walkable distance was associated with bandwidth relating to timings of 5 to 10 minutes. The number of livestock was used to scale for households, along with binary data for income category.

7. The Notified Area

The Aurangpur village lies in the jurisdictional belt of the Yamuna Expressway Industrial Development Authority (YEIDA) in Gautam Buddh Nagar district of Uttar Pradesh, India, as represented in the following Figure 2. Geographically, the village is located approximately between latitudes 28.344°N to 28.350°N and longitudes 77.508°E to 77.514°E. The selection of Aurangpur for the research is strategic. The village exists at the nexus of top-down development pressure and bottom-up needs [6]. Establishing a baseline understanding of its infrastructure is essential for fostering inclusive growth. The village exhibits a homogeneous social composition, with a population comprising solely of Backward Class (BC) and Scheduled Caste (SC). This provides a clear socio-spatial context for analysis, minimizing the complexities introduced by numerous social groups and allowing for a clearer examination of economic and infrastructural patterns.

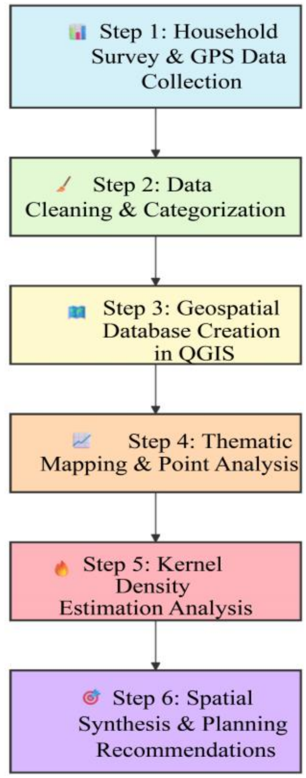

Fig. 1 Methodology

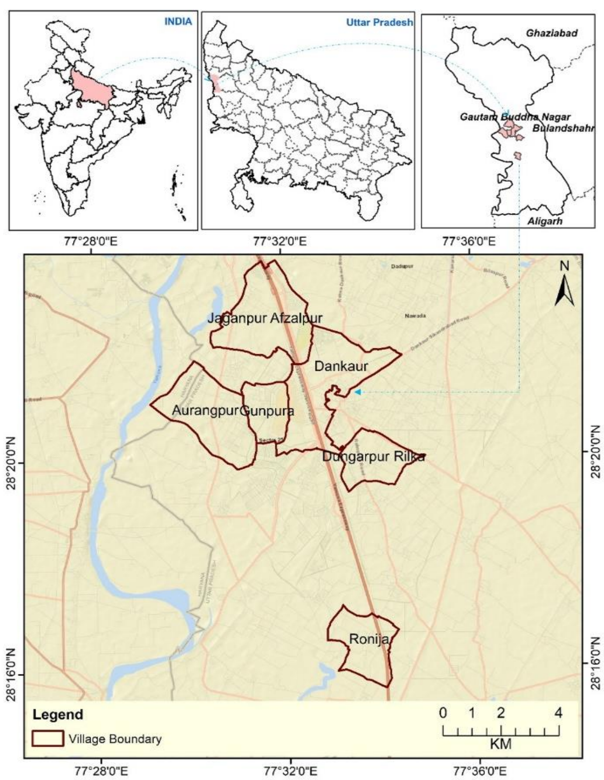

Fig. 2 Notified area

The research methodology was structured into four sequential phases, including data collection, data preparation, geospatial analysis, and synthesis. The data were collected through a door-to-door household survey covering all 121 households of Aurangpur. The socio–economic parameters include the number of household heads, caste, male population, female population, self-employed members, and annual income of the family. The infrastructural facilities covering the number of rooms and storeys, and the number of cattle were collected. The spatial data was recorded using a handheld Garmin GPS with an accuracy of ±5. The raw survey data were processed in a spreadsheet [22]. The annual income was delineated [23] as Below Poverty Line (BPL), Above Poverty Line (APL), based on the simplified threshold limits. Open-source [24] GIS software was used to add a delimited text layer. The geospatial techniques [25] covering thematic mapping [36] for household analysis, point pattern analysis (Clustered and dispersed) were utilized [27]. The Kernel Density Estimation [28] provided continuous raster surfaces representing attributes, including livestock ownership and annual income, to define hotspots (Areas of high density) and cold spots (areas of low density) using a search radius. The map shown in Figure 2 represents the residential area of Aurangpur village.

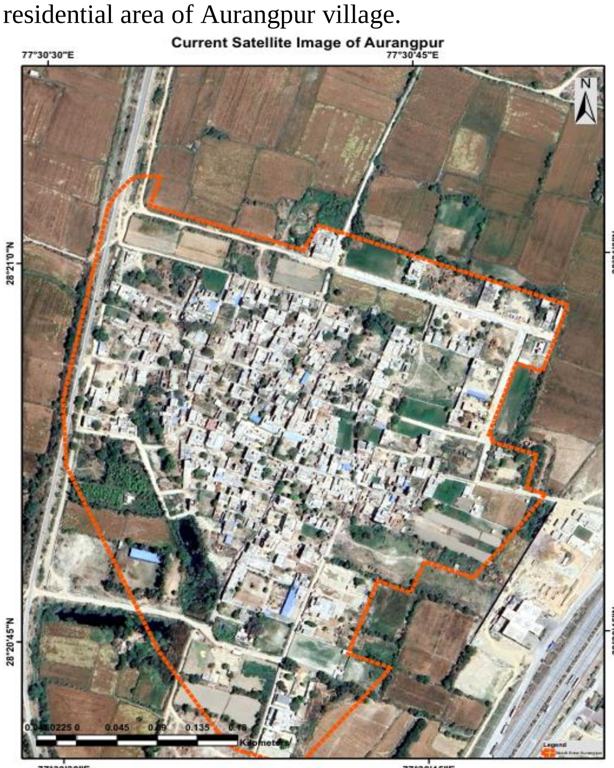

Fig. 3 Residential area of Aurangpur

From the map of Figure 3, it could be observed that the Aurangpur village does not bear any multistorey apartments and buildings, as observed in the other villages that come under the smart village scheme of PURA. The village comprises an area of 558.7 hectares. About 96.4% of Aurangpur is farmland, and the map shows the residential area. The region is under development, unlike other villages of the YEIDA region. The saffron boundary provides the village's organic edges, followed by curving gently enclosing the settlement, excluding the surrounding open lands, emphasizing Aurangpur's defined administrative footprint under YEIDA notification. On all sides, the village is encircled by uniform expanses of farmland. The lush green rectangular plots indicate the irrigated wheat and mustard fields during the November post-monsoon season, divided by dirt tracks. These are observed in the western and southern sides of the map. At the eastern and northern edges, browner, fallow, and harvested patches with subtle soil lines indicate tilling and preparation for dryland. The irrigation is usually done by tube wells. The fields extend to 1.5 Km beyond the boundary.

8. Demographic and Socio-Economic Profile

The survey data, summarized in the following Table 1, reveal the total population, the demographic data, the economic profile, livestock, caste, and annual income. The geospatial and non-geospatial databases were developed for the Aurangpur village to inform the YEIDA authority regarding the current status of the implemented PURA scheme. Over a decade had passed, and still there is a scope for developing the geospatial data to make the government and the rural area realize the current status of the planned and projected development. The household survey would be an awareness regarding the existing population, their dependency on the developed infrastructure, including road network, economy, drainage, sewer lines, manholes, self-employment, professionals, literates, and illiterates, their way of survival, urgency in using ICT (Information, Communication and Technology), internet facilities, and solid waste management.

Table 1. Demographic data

Category	Total Count	Percentage
Total Population	**773**	100%
Male	398	**51.5%**
Female	375	**48.5%**
Livestock	**194**	100%
Cows	56	**28.9%**
Buffaloes	138	**71.1%**
Economic Status	**No. of Families**	**Percentage**
Below Poverty Line (≤ ₹1.5 Lakhs)	37	**28.0%**
Above Poverty Line (>₹1.5 Lakhs & ≤₹8 Lakhs)	95	**72.0%**
Caste Distribution	**No. of Families**	**Percentage**
Backward Class (BC)	85	**64.4%**
Scheduled Caste (SC)	47	**35.6%**
Other Castes (OC/MBC/ST)	0	**0.0%**

The total population had been reported to be 773 individuals, with a slight male skew aligning with broader rural trends. The sex ratio had been reported to be 942 females per 1000 males. The average household is projected to be 5 to 6 members. The livestock serve as economic assets and cultural markers in an agrarian setting. The village harbours livestock with buffaloes forming the predominant species in this region. The cows represent 28.9% of the livestock. The local irrigation and fodder availability enhance and promote the livestock, leading to nutrition and supplemental income.

8.1. Male Population Distribution

In the village of Aurangpur, the male population accounts for 51.5% of the population, indicating a modest male surplus, with Indian national rural trends influenced by rural trends of labour migration and socio-cultural dynamics. Figure 4 displays the information on the male population in the household. The figure reveals a point-based distribution showing male hotspots in the central and northern regions with APL families (72% of the households) and livestock density correlate positively with higher incomes, exposing the fact that the males in these regions are engaged in self-employment and animal husbandry activities.

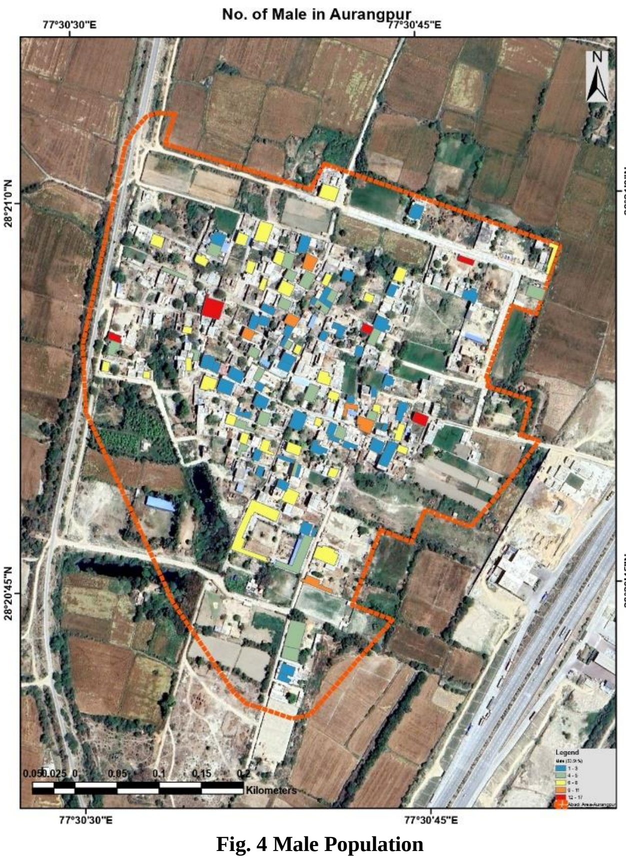

Fig. 4 Male Population

The spatial pattern enhanced by thematic mapping in QGIS reveals better-connected infrastructure, such as paved roads, in the northern sectors. This facilitates male-dominated economic pursuits, leading to revenue generation through market access in YEIDA. The southern BPL clusters face lower male density, indicating seasonal migration of the males for employment in urban areas. They leave the familial responsibilities. This also highlights the negativity of infrastructural gaps, including the absence of sewers, which would affect the permanent settlement of the villagers. The males from BC (64.4%) families are in prosperous zones, whereas the SC (35.6%) males cluster in underserved areas. The YEIDA has to balance the demographic pressures, ensuring the male population by providing enhanced infrastructure facilities for sustainable village development.

8.2. Female Population Distribution

The female population had been found to be a near-balanced gender ratio (48.5%) influenced by male preference in birth rates. The following Figure 5 depicts the female population in the village of Aurangpur. Correlating this with geospatial visualizations, a denser population of women and girls had been found in southern and south-western sectors where BPL households (28%) are predominant, projecting limited mobility and access to women in economically disadvantaged zones.

Fig. 5 Female Population

The Kernel Density Estimation (KDE) exposed how the deficiency in infrastructure, such as inadequate roads and drainage, may worsen gender specific vulnerabilities. Access to healthcare and education facilities for women faces longer travel times on unpaved paths. In SC-dominated subclusters (35.6%), experienced compounded marginalization emphasizes the need for developing women-centric community halls and improved sanitation for fostering empowerment. To promote the female population in the YEIDA region, which expects to accommodate 35 lakh people by 2031, gender sensitive planning, infrastructure development, proper sewer lines, and manholes have to be rendered.

8.3. Caste Based Spatial Patterns

The caste composition of Aurangpur village is represented by the following Figure 6. The village is predominantly comprised of 64.4% of the population who are BC (Backward Class), followed by 35.6% of SC (Scheduled Caste) people. The satellite imagery depicts a generally mixed settlement pattern with minor SC subclusters in the southern peripheries aligning with BPL concentrations.

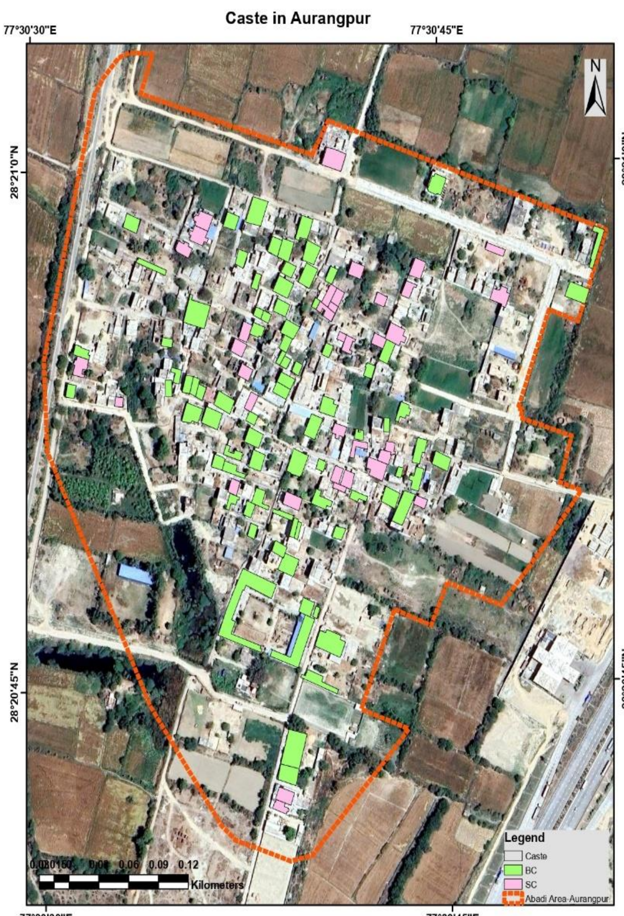

Fig. 6 Caste System

The corresponding livestock and asset ownership are lower. This status projects SC people occupying marginal lands with poor drainage and road access, which is a historical structure. In contrast to this, the BC people are dominant in central and northern regions, correlating with higher income densities as per KDE maps.

This type of caste spatial linkage advocates equitable resource allocation, such as uniform sewer line extensions and manhole installations across clusters, to prevent caste-based inequities in sanitation. This caste-based GIS data ensures that infrastructure planning would foster social cohesion, mitigate risks of marginalization in a region poised for demographic growth and solid waste management challenges.

8.4. Annual Income

The annual income is categorized with 37 BPL families (28%) and 95 APL (72%) families, reflecting a middle-lower economic profile reliant on agriculture and livestock, as mapped in the following Figure 7.

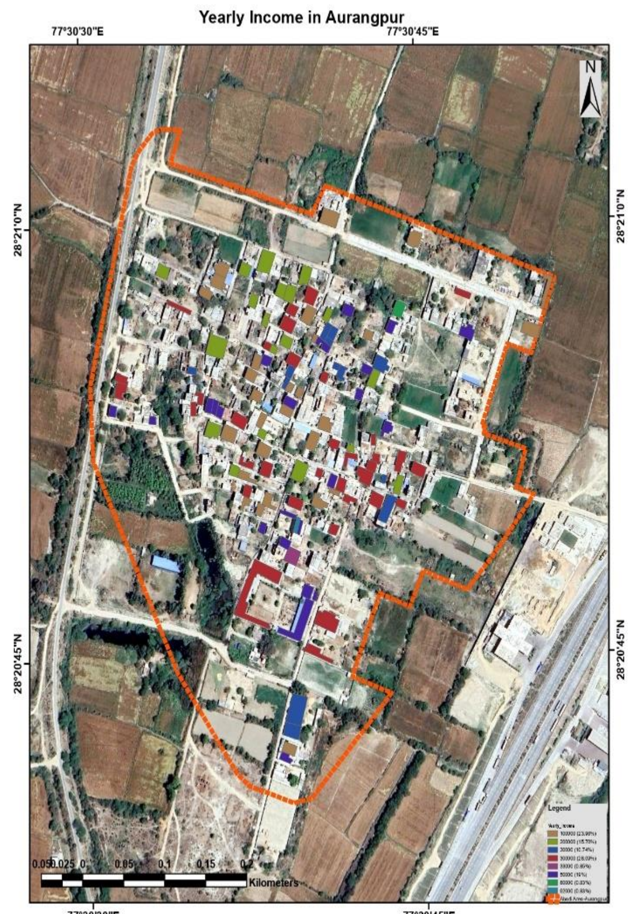

Fig. 7 Annual income of Aurangpur

The satellite correlation predicts that the northern hotspots have higher income, aligning with livestock clusters where the BC people are dominating, suggesting economic linkages from the animal husbandry. The southern part of the village has BPL concentrations with denser female and SC populations, indicating inequality due to poor infrastructure access. This also highlights the fact of limiting income diversification. Hence, KDE-derived analysis suggests that civil engineering focuses, such as irrigation enhancements in low-income zones, can boost productivity, aligning with YEIDA's population projection of 35 lakhs by 2031.

8.5. Entrepreneurship and Self-Employment

The self-employed businessmen of the Aurangpur village are shown in the following map, depicted in Figure 8. The business people are concentrated in the APL northern sectors, where income and livestock densities correlate. With 72% families, these entrepreneurs benefit from proximate roads and YEIDA's industrial hubs, facilitating dairy ventures among 398 males. However, in southern BPL areas, limited infrastructure, such as drainage, hinders the scalability of SC groups (35.6%). This calls for cooperative facilities. Hence, YEIDA should adopt the Smart Village (SV) model to promote entrepreneurship to enhance economic resilience.

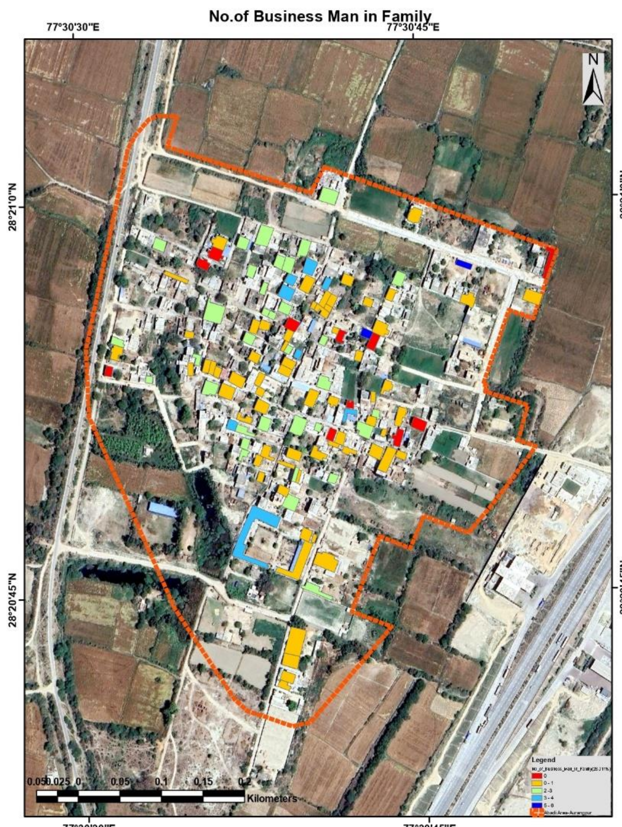

Fig. 8 Entrepreneurship patterns

8.6. Sewerage System

The sewer lines shown in the following map (Figure 9) are rudimentary, with linear features in the satellite image indicating coverage in northern livestock-rich areas, aligning with BC and APL families for effluent management. Southern deficiencies exacerbate disparities for SC and lower-income groups, advocating for extensions to prevent environmental hazards, integrated into YEIDA's plans. The manholes in Aurangpur, part of nascent sewerage systems, are sparsely distributed, primarily in central areas correlating with APL zones where higher incomes afford better sanitation. The Southern BPL clusters show gaps, risking contamination in dense female populations, emphasizing the need for modular manhole installations to support equitable health outcomes in urbanization.

8.7. Village Road Network

The road infrastructure is a semi-structured network with primary paved roads along central axes connecting the Yamuna Expressway, followed by secondary unpaved lanes dominating peripheral lanes, as inferred from Figure 10. The northern APL zones (72% of the families) benefit from better road quality, facilitating access for 398 males involved in business and livestock transport. But the southern BPL sectors (28%) are disrupted with eroded paths isolating 375 females and the SC community. This disparity, visible in geospatial overlays, informs how inadequate roads correlate to lower annual income, limiting market linkages and emergency services.

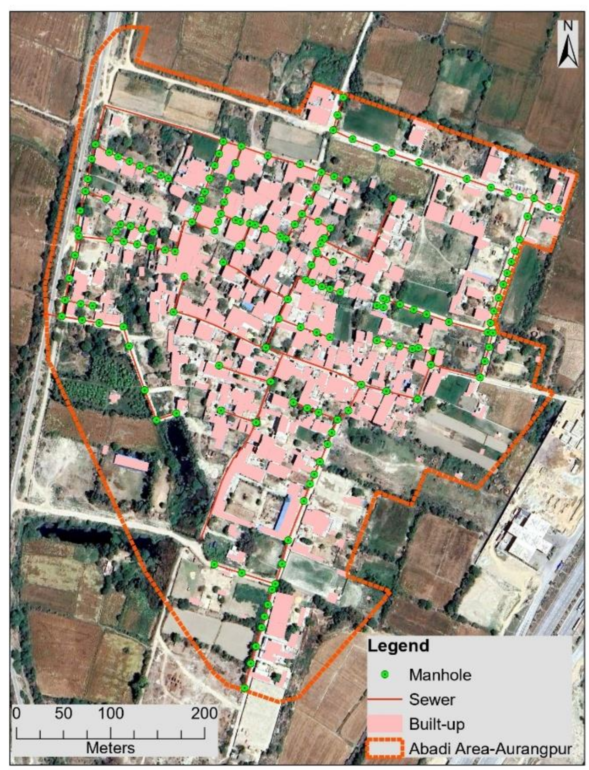

Fig. 9 Sewer systems

Such interventions from GPS-mapped household data would bridge the infrastructure gap, promoting sustainable mobility in a region integrating 226 villages by 2041.

9. Novelty of the Research

The research came up with highly granular and micro-level data using geospatial technology of an unexplored and understudied village from the YEIDA region. Using GIS and Remote Sensing (RS), the investigation explored the rapid urbanization prevailing in the village of Aurangpur. By conducting household surveys in the peri-urban location, the research drafted a result analysis for the regional planning of the village. So far, no publicly available data and details are available for the concerned village.

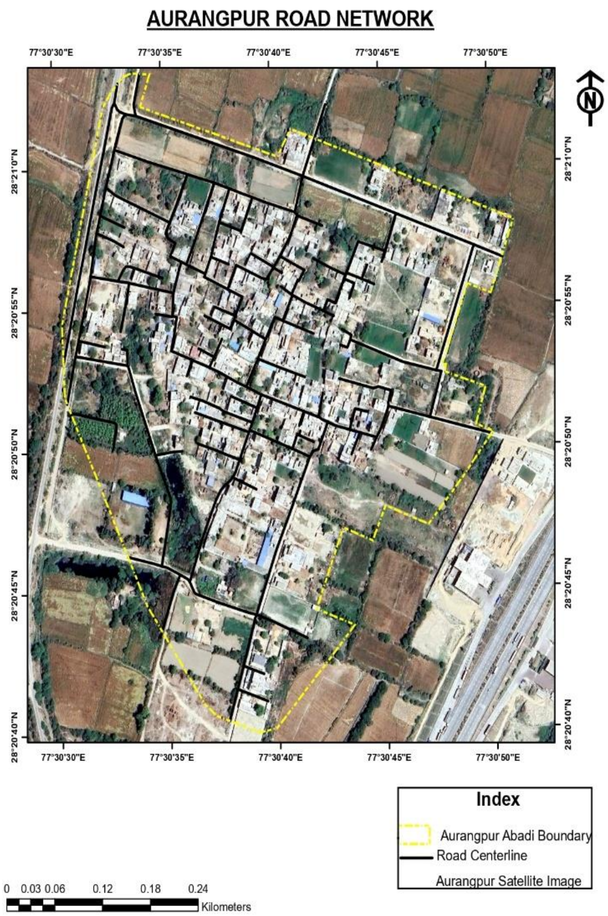

Fig. 10 Road Network

The QGIS and KDE were employed to project the socio-economic and demographic data of the selected locality. The spatial clusters delivered the implications of the correlation between livestock and the livelihoods of the migrants and the high-income group of the village in northern and central regions. The KDE poverty mapping revealed the status of the underdeveloped village people and their lives, which are associated with self-employment and migration to more sophisticated regions. The study could be related to macro-level regional planning for the future of the villages in YEIDA. Using geospatial intelligence, GIS, and KDE, the study had projected and developed high-resolution household data for further focus on developing SDGs 1, 10, and 11.

10. Conclusion and Recommendation

This research investigation is a part of "Parametric Studies on Smart Village Scheme of YEIDA region," confined to six villages: Jaganpur Afzalpur, Gunpura, Aurangpur, Dankaur, Dungarpur Rilkha, and Rabupura, limiting generalizability within YEIDA's 29-village framework. Inspired by the PURA (Providing Urban Amenities in Rural Areas) framed by Dr.A.P.J. Kalam, this research explored the current status of the village Aurangpur. The investigation addresses the gaps in the micro-level rural planning by obtaining household-level socio-economic data with advanced Geographical Information Systems (GIS). A high-resolution geospatial database was developed by conducting a household survey on demography, caste, population, cattle, infrastructure, road network, drainage, and sewer systems. The Kernel Density Estimation (KDE) revealed nuanced intra-village disparities that traditional aggregated data often overlook, thereby fulfilling the study's objective of database creation, spatial distribution analysis, and pattern identification.

The spatial clustering patterns depicted the interplay between socio-economic factors and infrastructure accessibility in Aurangpur. The southern sector was concentrated by 28% of BPL families, which was correlated with higher densities of Scheduled Caste (SC) populations (35.6% of households), and females (48.5% of the population), alongside deficiencies in road networks, drainage, and sewerage systems. In contrast, the northern and central hotspots exhibited positive correlations between the livestock density (predominantly buffaloes at 71.1%) and higher income among the Backward Class (BC) households (64.4%), supported by a better road network and proximity to industrial hubs of the YEIDA region. The SC community was found to occupy the marginal lands with poor connectivity. The investigation from geospatial analysis revealed the KDE-derived hotspots and cold spots, providing evidence-based insights for irrigation enhancements, sewer line extensions, modular manhole installations, and women-centric facilities in underserved areas of the YEIDA region.

The geospatial intelligence bridged the macro-level regional policies with micro-level realities and offered a replicable, evidence-based model for equitable development, mitigating risks of marginalization under schemes like PURA and SV (Smart Village). The study would promote transparency in planning and resource utilization, and support sustainable development goals to alleviate poverty (SDG 1), reduce inequality (SDG 10), and build sustainable cities and communities (SDG 11). Furthermore, the study's emphasis on household-level mapping addresses unexplored granular aspects of village planning, such as the economic resilience boosted by animal husbandry and the vulnerabilities exacerbated by infrastructural gaps, thereby fostering inclusive growth in agrarian settings. The research using QGIS and KDE reaffirms the pivotal role of geospatial technologies in uncovering the hidden disparities and enabled precision-targeted infrastructure planning in rural India. This investigation has developed a blueprint for replicable, scalable applications and discourses on sustainable urbanization, which would urge policymakers, civil engineers, and researchers to leverage tools for holistic, equitable development. Ultimately, realizing the PURA vision requires not just urban amenities in rural areas but a data-centric paradigm that ensures no community is left behind in the march toward progress. The southern region of the village occupied by SC clusters reveals high-density poverty with women-headed households. The KDE hotspots must be utilized to upgrade the unpaved roads to all–weather roads, thereby providing improved access to the southern region of Auranpur. The sewerage system should be extended by the authority with provision for manholes to prevent contamination. There should be a micro drainage system implemented in the flood-prone zones of the village. The investigation revealed that the annual income is influenced by livestock cattle.

This study emphasizes that the dairy cooperatives, along with veterinary units, should be provided for the villagers. Further, there must be women–centric centres to ensure good and developed social connectivity and sanitation of the women population. More skill development programs for upskilling women should be conducted by the YEIDA authority. The landless SC population of the southern region must be provided with housing facilities in the upcoming urbanization scheme of the YEIDA authority. There should be more focus on building and enhancing groundwater recharge and rainwater harvesting systems in the village. To nurture location-specific amenities development, the YEIDA should design a participatory GIS workshop. All the recommendations must be performed by responsible agencies like YEIDA Engineering Wing (District Rural Agency), YEIDA Planning Cell (State IT/Geo Informatics Department), YEIDA Urban Development Directorate, and NITI Aayog. The household surveys carried out for the research are available at the following link:

https://drive.google.com/file/d/1V_pmOKfFnIL1V9rdJXTwf8SGps3H8zjt/view?usp=sharing

Abbreviations

YEIDA: Yamuna Expressway Industrial Development Authority, SV: Smart Village PURA: Providing Urban Amenities in Rural Areas, APL: Above Poverty Line, BPL: Below Poverty Line; KDE: Kernel Density Estimation; SDG Sustainability Development Goals, BC: Backward Class, SC: Scheduled Caste, ICT: Information, Communication and Technology, IIT: Indian Institute of Technology, QGIS: Quantum Geographic Information System, GPS (Global Positioning System), EO (Earth Observation)

Author Contributions

The undersigned authors declare that the manuscript titled " GIS for Rural Infrastructure Mapping: Aurangpur Case Study" is our original work, and all listed authors have made substantial contributions to the research, data analysis, and manuscript preparation. The contributions are as follows: Mr.K. Arvind (Retd., Senior Manager, YEIDA & PhD Scholar) - Conceptualization, methodology, and data collection. Dr. Ramesh Babu C: Supervision, critical review, and validation of research methodology, manuscript drafting, and findings.

References

[1] Rural Population (% of Total Population) - India, The World Bank Group, 2019. [Online]. Available: https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS?locations=IN

[2] Paul A. Longley et al., *Geographic Information Science & Systems*, 4th ed., John Wiley & Sons, 2015. [Google Scholar] [Publisher Link]

[3] Michael Zeiler, *Modeling Our World: The ESRI Guide to Geodatabase Concepts*, ESRI Press, 2010. [Google Scholar] [Publisher Link]

[4] Master Plan 2031 (Phase – I), Yamuna Expressway Industrial Development Authority (YEIDA), 2025. [Online]. Available: https://www.yamunaexpresswayauthority.com/master-plan-2031

[5] Amitabh Kundu, "Trends and Processes of Urbanisation in India," *International Institute for Environment and Development (IIED)*, no. 6, pp. 1-64, 2011. [Google Scholar] [Publisher Link]

[6] Michael Batty, *The New Science of Cities*, MIT Press, 2017. [Google Scholar] [Publisher Link]

[7] S. Fotheringham, and Peter Rogerson, *Spatial Analysis and GIS*, CRC Press, 2013. [CrossRef] [Google Scholar] [Publisher Link]

[8] M. Dinesh Kumar, *Groundwater Management in India: Physical, Institutional and Policy Alternatives*, Sage Publications, 2007. [Google Scholar]

[9] Chander Kumar Singh, *Geospatial Applications for Natural Resources Management*, 1st ed., CRC Press, 2019. [CrossRef] [Google Scholar] [Publisher Link]

[10] Abdulaziz Alzahrani, Naief Aldossary, and Jamal Alghamdi, "Observing the Dynamics of Urban Growth of Al-Baha City using GIS (2006-2021)," *Alexandria Engineering Journal*, vol. 95, pp. 114-131, 2024. [CrossRef] [Google Scholar] [Publisher Link]

[11] Reshmi Shaw, and Arijit Das, "Identifying Peri-Urban Growth in Small and Medium Towns using GIS and Remote Sensing Technique: A Case Study of English Bazar Urban Agglomeration, West Bengal, India," *The Egyptian Journal of Remote Sensing and Space Sciences*, vol. 21, no. 2, pp. 159-172, 2018. [CrossRef] [Google Scholar] [Publisher Link]

[12] Meysam Majidi Nezhad et al., "A GIS-Portal Platform from the Data Perspective to Energy Hub Digitalization Solutions-A Review and a Case Study," *Renewable and Sustainable Energy Reviews*, vol. 223, pp. 1-32, 2025. [CrossRef] [Google Scholar] [Publisher Link]
[13] Mukesh Singh Boori et al., "Using RS/GIS for Spatiotemporal Ecological Vulnerability Analysis based on DPSIR Framework in the Republic of Tatarstan, Russia," *Ecological Informatics*, vol. 67, 2022. [CrossRef] [Google Scholar] [Publisher Link]
[14] Wei Tu et al., "Towards SDG 11: Large-Scale Geographic and Demographic Characterisation of Informal Settlements Fusing Remote Sensing, POI, and Open Geo-Data," *ISPRS Journal of Photogrammetry and Remote Sensing*, vol. 217, pp. 199-215, 2024. [CrossRef] [Google Scholar] [Publisher Link]
[15] Laila M. Khodeir, Aya Elsisy, and Muhammad Nagy, "Pre-assessment of Metropolitan Areas' Smart Growth through Agent based Modelling," *Procedia Environmental Sciences*, vol. 34, pp. 245-257, 2016. [CrossRef] [Google Scholar] [Publisher Link]
[16] Alon Sagi et al., "Uncovering the Shape of Neighborhoods: Harnessing Data Analytics for a Smart Governance of Urban Areas," *Journal of Urban Management*, vol. 11, no. 2, pp. 178-187, 2022. [CrossRef] [Google Scholar] [Publisher Link]
[17] Chamara J. Hettiarachchi et al., "Participatory GIS-Based Approach for the Demarcation of Village Boundaries and Their Utility: A Case Study of the Eastern Boundary of Wilpattu National Park, Sri Lanka," *ISPRS International Journal of Geo-Information*, vol. 11, no. 1, pp. 1-18, 2022. [CrossRef] [Google Scholar] [Publisher Link]
[18] A.A. Azzita, and T.D. Susanto, "The Smart Village Model for Rural Area (Case Study: Banyuwangi Regency)," *IOP Conference Series: Materials Science and Engineering, 3rd International Conference on Engineering Technology for Sustainable Development (ICET4SD)*, Yogyakarta, Indonesia, vol. 722, pp. 1-17, 2020. [CrossRef] [Google Scholar] [Publisher Link]
[19] Bushra Zalloom, "Smart Cities: Using GIS Technology in Urban Infrastructure Development at Migration Areas," *The Eurasia Proceedings of Science, Technology, Engineering & Mathematics*, vol. 18, pp. 64-71, 2022. [CrossRef] [Google Scholar] [Publisher Link]
[20] R. Shivpuje Prakash, Parmeshwar V. Poul, and K. Deshmukh Nilesh, "Application of Geoinformatics for Smart Village Creation," *International Journal of Computational Intelligence Research (IJCIR)*, vol. 13, no. 5, pp. 1073-1081, 2017. [Google Scholar] [Publisher Link]
[21] Abhilash Maryada, and Vijaya Lakshmi Thatiparthi, "Geospatial Technology for Mapping and Analysis of Social and Infrastructural Facilities at Village Level: A Case Study of Chinnapendyala Village," *Modeling Earth Systems and Environment*, vol. 6, no. 3, pp. 1763-1781, 2020. [CrossRef] [Google Scholar] [Publisher Link]
[22] Hadley Wickham, "Tidy Data," *Journal of Statistical Software*, vol. 59, no. 10, pp. 1-23, 2014. [CrossRef] [Google Scholar] [Publisher Link]
[23] Planning Commission, "*Report of the Expert Group to Review the Methodology for Measurement of Poverty*," Government of India Planning Commission, 2009. [Google Scholar] [Publisher Link]
[24] Spatial without Compromise, QGIS Web Site, 2026. [Online]. Available: https://qgis.org
[25] David O'Sullivan, and David J. Unwin, *Geographic Information Analysis*, John Wiley & Sons, 2010. [CrossRef] [Google Scholar] [Publisher Link]
[26] Terry A. Slocum et al., *Thematic Cartography and Geovisualization*, 4th ed., CRC Press, 2022. [CrossRef] [Google Scholar] [Publisher Link]
[27] Janine Illian et al., *Statistical Analysis and Modelling of Spatial Point Patterns*, John Wiley & Sons, 2008. [CrossRef] [Google Scholar] [Publisher Link]
[28] Bernard. W. Silverman, *Density Estimation for Statistics and Data Analysis*, Routledge, 1st ed., New York, 2018. [CrossRef] [Google Scholar] [Publisher Link]

Appendix 1

	VILLAGE -- AURANG PUR										
S_No	**Owner**	**Caste**	**Number of Males**	**Females**	**Rooms and Storeys**	**Self Employed**	**Annual Income**	**Cows**	**Buffaloes**	**Latitude**	**Longitude**
1	Naresh Nagar	BC	9	11	5 II	<Null>	300000	4	8	28.3487	77.51094
2	Rajpal Nagar	BC	3	5	4 II	2	300000	2	3	28.34883	77.51062
3	Jaychand Nagar	BC	5	7	4	2	200000	<Null>	<Null>	28.34887	77.51086
4	Sundar Nagar	BC	3	2	5 II	2	200000	2	<Null>	28.3488	77.5107
5	Balram Tanwar	BC	5	3	3	3	300000	1	2	28.34917	77.51094
6	Jaynarayan	BC	8	7	5 II	3	300000	2	3	28.34904	77.51088
7	Pramat	BC	1	3	2	1	100000	1	2	28.3489	77.51121

8	Virendra Tanwar	BC	4	2	4 II	1	100000	<Null>	4	28.34912	77.51114
9	Anil	BC	7	8	4	3	200000			28.34912	77.51138
10	Jogendar Tanwar	BC	9	7	9 II	4	300000	3	5	28.34931	77.51117
11	Mohanpal Nagar	BC	3	3	6 II	2	200000	<Null>	2	28.3495	77.51111
12	Bramhapal Nagar	BC	5	5	4	2	200000	<Null>	3	28.34933	77.51091
13	Hari Nagar	BC	7	5	8 II	2	200000	<Null>	5	28.34936	77.5108
14	Jaypal Nagar	BC	6	6	10 II	2	200000	<Null>	1	28.34964	77.51062
15	Rampal Nagar	BC	6	7	6 II	2	200000	<Null>	1	28.34957	77.51036
16	Kapil Nagar	BC	6	6	8 II	2	200000	<Null>	1	28.34927	77.51046
17	Dharamveer Nagar	BC	8	10	7 II	2	200000	<Null>	2	28.34908	77.5106
18	Sunil Nagar	BC	13	4	5	2	200000	<Null>	3	28.34885	77.50999
19	Jayprakash Nagar	BC	8	11	5	2	200000	<Null>	2	28.34957	77.50934
20	Inder Nagar	BC	5	4	4 II	1	300000	<Null>	<Null>	28.34922	77.50953
21	Vinod Nagar	BC	7	4	1	1	30000	<Null>	<Null>	28.34861	77.50968
22	Ranjeet Nagar	BC	14	1	4 II	2	300000	<Null>	<Null>	28.34855	77.5088
23	Shyam Nagar	BC	5	6	4 II	2	300000	<Null>	<Null>	28.34835	77.50977
24	Vikas Nagar	BC	6	6	5 II	1	300000	<Null>	<Null>	28.34824	77.50969
25	Inder Nagar	BC	3	1	2	1	50000	<Null>	<Null>	28.34826	77.50995
26	Jayveer Nagar	BC	2	2	5 II	1	300000	<Null>	<Null>	28.34812	77.51025
27	Karmveer Nagar	BC	2	3	2	1	50000	<Null>	<Null>	28.34821	77.51002
28	Yogesh Nagar	BC	2	2	2	1	50000	<Null>	<Null>	28.34827	77.50988
29	Charan Nagar	BC	6	6	5	2	200000	<Null>	<Null>	28.34804	77.50992
30	Sanky Nagar	BC	4	4	4 II	1	100000	<Null>	<Null>	28.34791	77.51116
31	Prakash Nagar	BC	3	2	3	1	200000	<Null>	<Null>	28.34799	77.51053
32	Gajraj Nagar	BC	3	3	6 II	2	200000	<Null>	<Null>	28.34762	77.51099
33	Santraj Nagar	BC	3	3	7 II	1	100000	<Null>	<Null>	28.34783	77.51055
34	Praveen Nagar	BC	3	3	6 II	1	100000	<Null>	<Null>	28.348	77.51012
35	Dipanshu Nagar	BC	2	4	6 II	1	50000	<Null>	<Null>	28.34694	77.51079
36	Leela Nagar	BC	4	4	8 II	2	300000	<Null>	<Null>	28.34765	77.51058
37	Lala Nagar	BC	2	2	4 II	1	300000	<Null>	<Null>	28.34771	77.51034
38	Dinesh Nagar	BC	3	1	6 II	1	300000	<Null>	<Null>	28.34791	77.51192
39	Dhanesh Nagar	BC	2	3	4	1	300000	<Null>	<Null>	28.3477	77.51225
40	Subhash Nagar	BC	3	2	2	1	50000	<Null>	<Null>	28.34835	77.51175
41	Rohit Nagar	BC	2	6	4 II	2	300000	<Null>	<Null>	28.34852	77.51132
422	kausal Nagar	BC	5	5	4 II	2	100000	<Null>	2	28.34758	77.51033
43	Kawar Nagar	BC	2	2	3 II	1	50000	<Null>	2	28.34801	77.51209
44	Harishchand Nagar	BC	7	10	2	3	200000	2	2	28.34764	77.51018
45	Kapil Nagar	BC	4	5	5 II	2	100000	1	<Null>	28.34733	77.51032
46	Gaurav Nagar	BC	2	5	4 II	1	100000	<Null>	1	28.34726	77.51049
47	Sumit Nagar	BC	2	3	4 II	1	50000	2	<Null>	28.34709	77.51052
48	Rajendra Madh Singh	BC	5	4	3 II	2	92000	1	3	28.3471	77.51095
49	Birendar Nagar	BC	2	2	3 II	1	50000	1	3	28.34708	77.51098
50	Ravindar Nagar	BC	2	3	3 II	1	50000	1	2	28.34721	77.51084

51	Veer Singh	BC	7	8	7 II	2	33000	<Null>	1	28.34681	77.51088
52	Ratan Singh	BC	3	3	2	1	50000	<Null>	<Null>	28.34642	77.51116
53	Jile Singh Pradhan	BC	3	4	2	1	50000	<Null>	<Null>	28.34647	77.51106
54	Aangand Nagar	BC	5	2	2	1	50000	<Null>	<Null>	28.34618	77.51093
55	Anil Nagar	BC	7	11	4	3	300000	<Null>	<Null>	28.34647	77.51044
56	Shyam Nagar	BC	4	1	1	1	30000	<Null>	<Null>	28.34513	77.51084
57	Bije Nagar	BC	4	2	1	1	30000	<Null>	<Null>	28.34533	77.5109
58	Ved Prakash	SC	3	3	3	1	100000	<Null>	<Null>	28.34496	77.5108
59	Shyami Singh	SC	3	4	2	1	50000	<Null>	<Null>	28.34487	77.51076
60	Mohanlal	BC	7	6	6 II	1	300000	<Null>	<Null>	28.34617	77.5113
61	Surendar Nagar	BC	11	9	4 II	2	300000	<Null>	<Null>	28.34587	77.51117
62	Ghanshayam	SC	4	3	4 II	1	300000	<Null>	<Null>	28.34843	77.50879
63	Rajiv Nagar	BC	7	7	4 II	2	300000	<Null>	<Null>	28.34705	77.5114
64	Daya Chand	SC	2	2	3	1	100000	<Null>	<Null>	28.34742	77.51142
65	Daya Chand	SC	2	2	3	1	100000	<Null>	<Null>	28.34742	77.51142
66	Karan Singh	BC	3	3	4 II	1	300000	<Null>	<Null>	28.34735	77.51161
67	Rajendar Nagar	BC	3	2	3	1	100000	<Null>	<Null>	28.34732	77.51123
68	Rajpal Singh	BC	6	8	3	1	100000	<Null>	<Null>	28.34734	77.5106
69	Rakidar Bhagmal	SC	6	5	7 II	1	300000	<Null>	<Null>	28.34787	77.51143
70	Mahesh Munshi	SC	6	4	4 II	1	300000	<Null>	<Null>	28.34732	77.51093
71	Mahipal	SC	7	5	6 II	2	300000	<Null>	<Null>	28.34744	77.51034
72	Dharmi	BC	6	6	4 II	2	300000	<Null>	<Null>	28.3476	77.51124
73	Rotash S/o Magmal	SC	7	4	5 II	1	300000	<Null>	<Null>	28.34729	77.51225
74	Giriraj Subedar	SC	11	5	8 II	2	300000	<Null>	<Null>	28.34756	77.51181
75	Biran	SC	11	11	8 II	4	300000	<Null>	<Null>	28.34773	77.51162
76	Shyamraj	SC	7	5	5 II	2	300000	<Null>	<Null>	28.34773	77.51195
77	Satveer Nagar	SC	4	2	5 II	1	300000	<Null>	<Null>	28.34748	77.5115
78	Rakesh Nagar	BC	1	1	1	1	30000	<Null>	<Null>	28.34724	77.51207
79	Leele Nagar	BC	2	1	6	1	300000	<Null>	<Null>	28.34733	77.51194
80	Satte Nagar	BC	3	2	1	1	30000	<Null>	<Null>	28.34753	77.51204
81	Pappu Nagar	BC	1	1	1	<Null>	200000	1	2	28.34784	77.51163
82	Rajje	SC	2	1	1	<Null>	50000	<Null>	<Null>	28.34752	77.5114
83	Sauraj	SC	5	2	5 II	1	300000	<Null>	<Null>	28.34765	77.51189
84	Mahaveer Nagar	BC	8	3	8 II	<Null>	200000	<Null>	2	28.34747	77.51221
85	Pratap Nagar	BC	4	2	8 II	<Null>	200000	2		28.3485	77.51193
86	Rati Nagar	BC	17	3	10 II	<Null>	300000	5	12	28.34761	77.51247
87	Narendra Nagar	BC	7	3	6	<Null>	100000	2	4	28.3493	77.5141
88	Ravindra Nagar	BC	6	3	8 II	<Null>	50000	1	4	28.34824	77.50868
89	Yogesh	SC	5	2	4 II	<Null>	100000	1	1	28.34946	77.51002
90	Jagveer	SC	6	2	6 II	<Null>	100000	1	2	28.34936	77.50987
91	Rajesh Kumar	BC	2	2	4 II	1	100000	1	2	28.34821	77.51084
92	Santram Nagar	BC	6	5	5 II	2	100000	2	1	28.34807	77.51132
93	Shyamveer	BC	8	9	5 II	3	100000	2	2	28.34838	77.51101

94	Medhraj	BC	5	5	4 II	1	100000	<Null>	2	28.34894	77.51389
95	Jaggi	SC	8	4	6	2	100000	<Null>	4	28.35005	77.51142
96	Prabhu Nagar	BC	3	8	8 II	1	50000	<Null>	2	28.34828	77.51089
97	Ranveer	SC	4	5	6 II	1	100000	<Null>	4	28.34836	77.51047
98	Gajraj Nagar	BC	5	8	4	2	100000	2	<Null>	28.34843	77.51089
99	Sukhpal Nagar	BC	3	4	6 II	1	100000	2	1	28.34983	77.51247
100	Shyami	SC	4	3	1	1	50000	<Null>	<Null>	28.34883	77.51131
101	Sachin	SC	2	2	1	1	30000	<Null>	<Null>	28.34886	77.51139
102	Krishna	SC	5	4	1	1	30000	<Null>	<Null>	28.34894	77.51144
103	Dharmverr	SC	2	1	1	1	30000	<Null>	<Null>	28.34862	77.51147
104	Tanuj	SC	1	1	1	<Null>	30000	<Null>	<Null>	28.34856	77.51154
105	Balendar	SC	8	10	2	2	80000	<Null>	<Null>	28.34916	77.51226
106	Rajindar	SC	3	2	2	1	50000	<Null>	<Null>	28.34899	77.51216
107	Suresh S/o Santi	SC	7	7	3	1	100000	<Null>	<Null>	28.34892	77.51188
108	Rajesh	SC	3	2	1	1	30000	<Null>	<Null>	28.34864	77.51203
109	Manohar	SC	3	5	1	1	30000	<Null>	<Null>	28.34896	77.51135
110	Tillu Sharma	BC	3	6	5	1	30000	2	<Null>	28.34858	77.51089
111	Shiv Sharma	BC	2	1	1	1	30000	<Null>	<Null>	28.34847	77.51084
112	Prahlad	SC	9	6	5 II	2	100000	1	4	28.34856	77.51041
113	Ajab Singh	BC	3	3	3 II	1	50000	1	2	28.34869	77.51061
114	Bhawar Singh	SC	3	2	3	1	100000	2	<Null>	28.34868	77.51048
115	Niranjan	SC	5	3	4 II	1	100000	<Null>	<Null>	28.34812	77.51053
116	Badale	SC	17	7	10 II	5	300000	4	12	28.3493	77.51306
117	Mahipal	SC	3	3	3	1	50000	<Null>	2	28.34892	77.5131
118	Gajraj S/o Chuttan	SC	8	8	8 II	2	50000	1	4	28.34814	77.50917
119	Jagmohan	SC	3	6	5 II	1	50000	<Null>	2	28.34916	77.51163
120	Sanjay	SC	3	2	5 II	1	100000	<Null>	<Null>	28.34958	77.51007
121	Rishipal	SC	14	15	7	6	50000	1	1	28.34859	77.51185