



SUSTAINABLE CHANGES AND CHALLENGES FOR LAND USE PATTERN & IMPACT OF PERI URBAN

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ABSTRACT

The rise of peri-urban areas is challenging traditional planning that relies on the urban-rural divide. The social and physical environment in peri-urban areas is altered by the interactions of dynamic processes. In the global south, peri-urban dynamics and the corresponding social and environmental change have created significant obstacles for the development of sustainable transportation. Rapid motorization in peri-urban areas, migration, low-density urban expansion, and economic growth all contribute to a change in travel habits that are less environmentally friendly. To achieve a sustainable transportation infrastructure, it is advised to implement an integrated land-use and transportation planning strategy. A deeper comprehension of peri-urban dynamics and how they relate to travel behavior is necessary for the successful execution of such a plan in peri-urban locations. However, comparatively little research has been done on the morphology of cities in peri-urban areas and the relevant changes in travel habits in the global south. Using Hyderabad, India as a case study, this study investigates how travel habits have changed in a peri-urban environment. The studied area has rapidly undergone peri-urban transition in recent years. Furthermore, migration and wealth growth have altered the region's demographic and socioeconomic makeup. In order to collect data regarding past and present travel habits, a questionnaire survey was conducted in this region. The findings demonstrate that the respondents' commute to work has considerably decreased. The percentage of walks and two-wheeler rides has gone up. The majority of responders, however, take shared autorickshaws.

Keywords: peri-urban, urban-rural, migration, urban morphology, socio-economic compositions.

INTRODUCTION

Hyderabad is the sixth largest city in India and is situated in the southern state of Telangana. It includes the Greater Hyderabad Municipal Corporation (GHMC) and twelve other municipalities. Hyderabad is situated inside the Krishna river basin's Musi sub-basin (11,000 km²). The city's population has increased due to its rapid development, particularly in the information technology (IT) industry, which has drawn both skilled and unskilled workers from other parts of India. In order to lessen the negative effects that Hyderabad's rapid development will have on its natural resources, city planning is therefore desperately needed. As a groundwater table recharge zone, a storm water runoff sink, and an enhancement of food security and aesthetic appeal, peri-urban agriculture makes a substantial contribution to ecosystem services. Since most families in Hyderabad's peri-urban districts support themselves by supplying the city with food and animal feed, these areas are crucial to the local economy. In addition to decreasing nearby agricultural regions, urbanization and population growth intensify competition for natural resources (such as land and water) and biodiversity. Hyderabad's service industry and urban developers face significant challenges as a result of these changes. In addition, the demand for water in cities has increased dramatically over the last 20 years, and the amount of water available in Hyderabad's city limits is currently insufficient to meet this need since freshwater lakes are being encroached

upon to construct homes and government buildings. Water must now be transported from neighboring rural settlements. Social and infrastructure services are being overburdened as a result of the continued decline in agricultural land inside the city limits caused by individuals moving from rural areas in quest of work and higher earnings.

LITERATURE REVIEW

Padmaja Ravula (2022) India, like many other developing nations, is seeing an increase in urban sprawl, which presents socioeconomic and environmental problems that have a concerning impact on urban sustainability. This study examined 622 urban and peri-urban residents of Hyderabad's perspectives of urban sprawl using a latent class clustering approach. According to the empirical findings, the respondents were divided into three groups according to how they perceived the effects of urban sprawl: "undecided respondents," "negative perceivers," and "opportunity perceivers." Most respondents were unsure and had no strong opinions about the effects of urban sprawl, which could make them more vulnerable and make it more difficult for them to effectively adapt to the negative social, economic, and environmental effects of urban sprawl. The effectiveness of government initiatives to raise public knowledge of urban development and its effects on the city is also called into question by this.

Mahesh Jampani (2020) Multipurpose land-use patterns that create a mosaic of agricultural and built-up areas define peri-urban zones. In areas where urban and rural areas coexist, they are transformative because they are essential for supplying food and other agricultural products, livelihood possibilities, and a variety of ecosystem services. The purpose of this study is to comprehend how changes in groundwater and wastewater consumption for irrigation relate to peri-urban agricultural and landscape changes. Variations in the watershed's built-up, paragrass, paddy rice and vegetable farming, groundwater, and wastewater-irrigated regions were among the temporal dynamics of the peri-urban system that were assessed. The observed changes show that agricultural landscapes are being transformed into built-up regions as a result of urban pressures, while at the same time, previously arid terrain is being turned into agricultural plots.

Suranga Wadduwage (2019) The common topics of land-use change research—urbanization and land-use change, peri-urbanization, and land-use sustainability at the outskirts of cities—are the subject of this integrated overview of the literature on land-use science. Additionally, it talks about the ideas that the land use research community has created to synthesize the phenomena of peri-urban land transformation in parallel with the current presence of urbanization. This qualitative review provides an overview of the land-change science developed pathways in the Land System Science approach, including but not limited to examining the drivers of land change, peri-urban land-use sustainability, critically analyzing the literature, identifying methodological issues at various geographies, and identifying knowledge gaps in the field.

N. Abhishek (2017) Over the past three decades, India has seen a fast increase in urbanization. This study looks at the variables influencing Indian cities' growth over the course of three consecutive censuses. For the analysis, a database on Indian cities is created. Eight factors are examined from the perspectives of economic geography and classical

economics to see how they affect population growth and size. The results of regression analysis have been constant over the course of three years and indicate that beginning population and capital city status have a strong positive impact on city growth; being close to other cities makes adjacent cities larger. Our study's key finding is that improved healthcare and infrastructure development strategies are becoming more and more necessary for Indian urban agglomerations to thrive sustainably.

Irshad Mohammad (2017) Due to exodus from rural to urban areas and industrialization, several Indian capitals are quickly growing into megacities. Within city limits, land use has constantly changed to accommodate development and replace conventional land-use patterns. This study examined the effects of land-use and land-cover changes in urban and peri-urban Hyderabad using data from Landsat-8 and IRS-P6. In the analysis, sophisticated approaches were used, such as spectral matching algorithms using ground information. Between 2005 and 2016, the city's limits expanded from 38,863 to 80,111 hectares, and the wastewater-irrigated land next to the Musi River grew from 15,553 to 20,573 hectares. The increasing demand for fresh vegetables and urban animal feed, as well as the ease of access to markets brought about by the city's growth, led to opportunistic changes in land use, particularly in relation to wastewater-irrigated agriculture. The accuracy of the land-use maps that were created was found to be between 80 and 85 percent.

Lack of adequate growth in cites other than Hyderabad

Every urban region needs to see some growth in order to continue becoming more urbanized. And growth should be multifaceted, including geographical and economic. When urban regions do not grow enough, people are drawn to them but not to the nearby urban centers. For Telangana's urbanization to be sustainable, there should be continuous, sufficient expansion in urban areas, both in terms of quantity and quality.

Absence of Demarcation between urban and rural areas

Many towns in Telangana are having trouble clearly defining the boundaries between urban and rural areas. Numerous urban centers continue to serve as rural centers. Telangana's metropolitan regions do not adequately adopt the modern ways of functioning. People who live in the continuation zone of urban people are becoming tense as a result. Demarcating the urban area should take into account the demands of people throughout the next century.

Urban sustainability

The preservation of urban sustainability is currently the most crucial concern. An urban center should be able to offer every service for which it was designed; it should also be able to meet the demands of people in the future. Existing areas are being ignored and encroached upon during the urbanization process. This will lessen the significance of the current one. This might be abandoned soon. It is important to preserve this urban sustainability.

RESEARCH METHODOLOGY

Prior research served as the impetus for the methodology of mapping urban, peri-urban, and rural areas for each scenario (2011 and 2016). The spatial pattern of urban expansion was predicted using a GIS-based Cellular Automata Model. A two-step procedure was used to identify the areas that transitioned from rural to peri-urban. Initially, the Hyderabad metropolitan core and its environs were mapped into urban, peri-urban, and rural areas for

two distinct time periods (2011 and 2016). The locations that were classified as rural in 2011 and as peri-urban in 2016 were then found using a GIS overlay analysis of two maps. The research region is separated into cells with a resolution of 90 meters, which has been shown to yield the best prediction accuracy and maintain the urban area's form. One modeling technique that has attracted a lot of attention is CA, which is said to be able to create complicated systems from a set of basic rules. Von Neumann utilized this method, which was first created in the 1940s, to examine the logical nature of self-reproducible systems, and it gained widespread recognition. An example of a model that needs basic principles but has the ability to produce extremely complicated behavior is the CA Model, which applies the same rule repeatedly at each iteration. As a result, a vector layer was created, with the indicators as properties in each tessellation cell. This layer was used to carry out ArcGIS' grouping analysis function. Analysis of grouping

RESULTS AND DISCUSSIONS

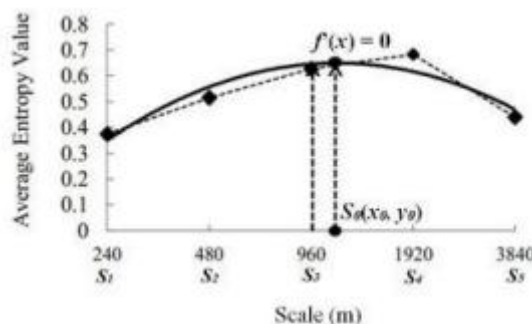
As previously mentioned, five tessellations of five distinct cell sizes were used to mimic the AoI. Additionally, two scenarios were filled in for each tessellation. As a result, ten maps were produced after ten tessellations in total were examined utilizing grouping analysis. For a given scenario and cell size, each map displays the scope of the AoI's urban, peri-urban, and rural areas.

Table 1: Share of urban, peri-urban and rural areas in AoI (in percentage)

| Cell Size | Urban | | Peri-Urban | | Rural | |
|---------------|-------|------|------------|-------|-------|-------|
| | 2011 | 2016 | 2011 | 2016 | 2011 | 2016 |
| 100m X 100m | 1.87 | 1.92 | 8.81 | 10.87 | 89.32 | 87.21 |
| 300m x 300m | 2.04 | 2.19 | 15.95 | 20.25 | 82.02 | 77.56 |
| 500m x 500m | 2.06 | 3.71 | 23.08 | 27.73 | 74.86 | 68.57 |
| 800m x 800m | 2.13 | 5.60 | 34.42 | 39.31 | 63.45 | 55.10 |
| 1000m x 1000m | 2.19 | 6.48 | 40.81 | 44.62 | 57.01 | 48.90 |

According to Table 1, the proportions of urban and peri-urban areas have grown for every cell size between 2011 and 2016. Conversely, the proportion of rural areas has declined for each cell size. A pattern of urban development and peri-urbanization in and around Hyderabad from 2011 to 2016 is indicated by the growth in urban and peri-urban regions.

The population, built-up, and road network layers are used in this research. According to earlier research, the city's population, built-up areas, and road network have all grown rapidly in recent decades. Urban and peri-urban areas may grow as a result of such population growth and built-up areas, as this study found.



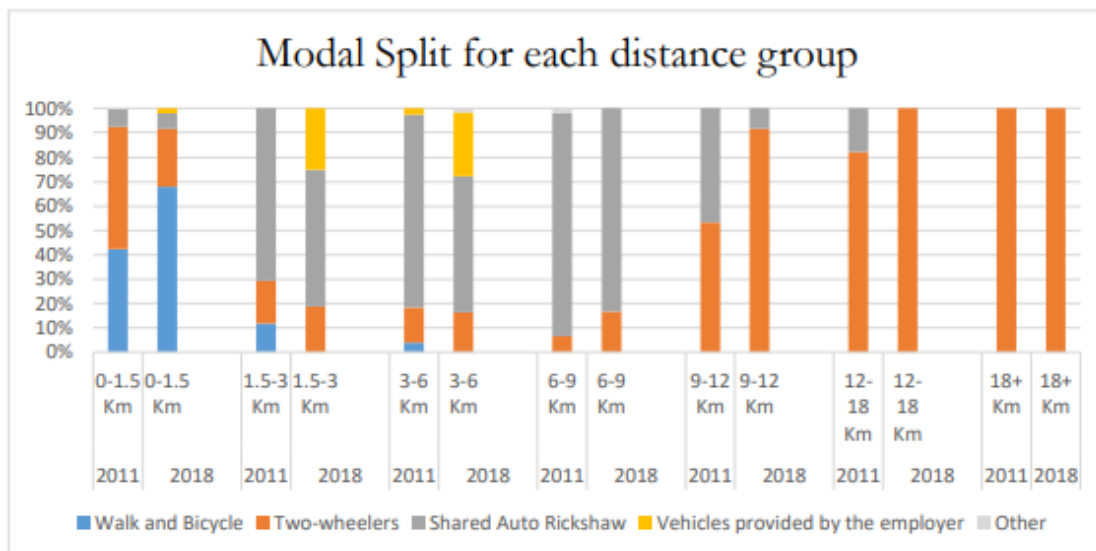
Graph 1: Determination of optimum scale using average entropy value.

Table 2 shows the shares of each method in 2011 and 2018. Most of the respondents who were formerly residents of the study used to take shared autorickshaws for HBW journeys in 2011. In 2011, two-wheelers and walkers rank second and third, respectively. 2018 saw a minor shift in the modes' order of use. The shared autorickshaw has the largest share. The second, third, and fourth most popular modes are walking, employer-provided vehicles, and two-wheelers.

Table 2: Modal split in 2011 and 2018

| Mode | 2011(%) | 2018(%) |
|-----------------------------------|---------|---------|
| Walk | 5.3 | 12.60 |
| Bicycle | 0.50 | - |
| Two-wheelers | 26.80 | 27.17 |
| Personal Car | - | 0.40 |
| Shared Auto Rickshaw | 65.80 | 44.09 |
| Bus from office | 0.50 | 0.40 |
| Vehicles provided by the employer | 1.10 | 15.35 |

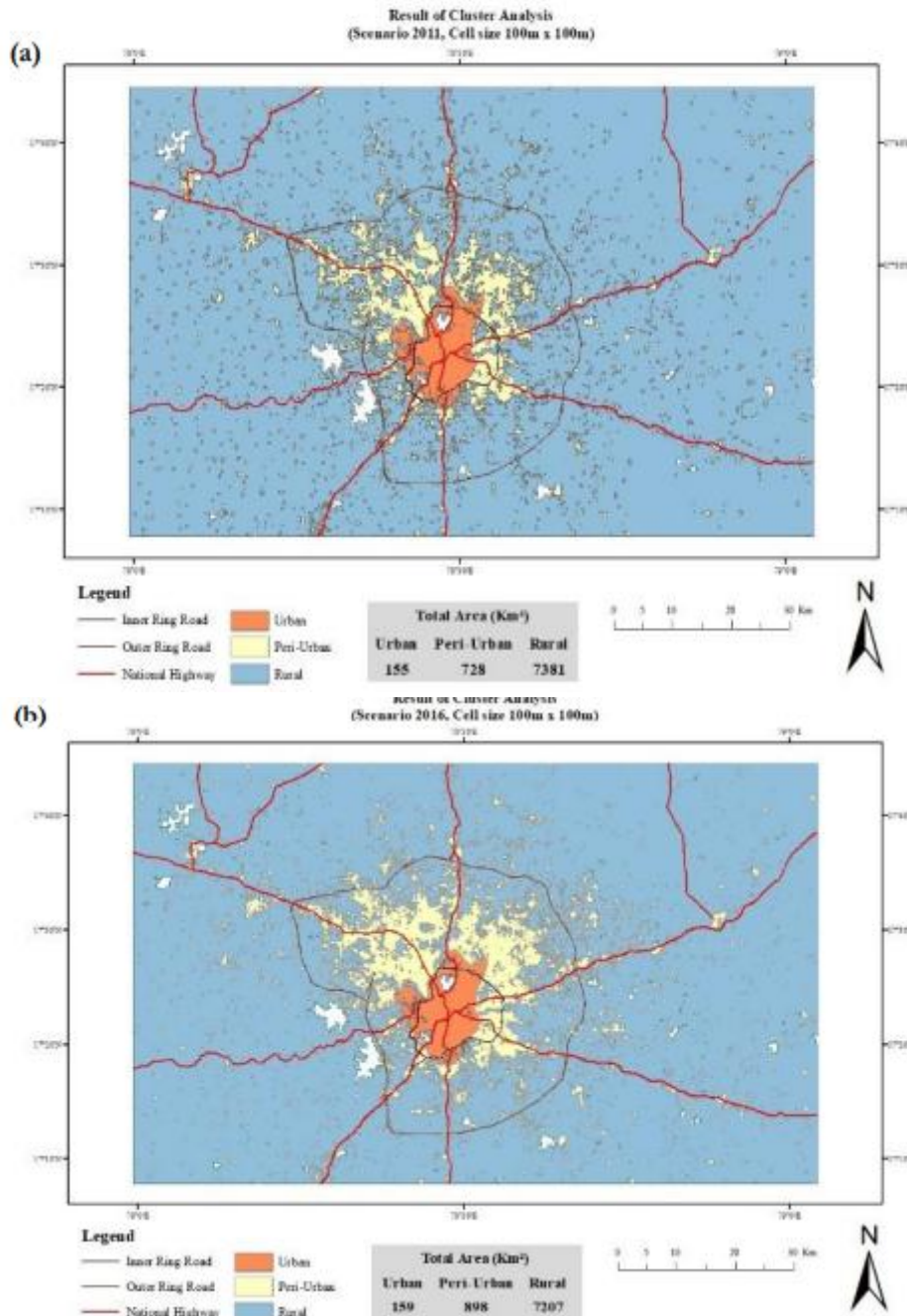
The modal splits (% of trips by a mode) of two scenarios for various distance groups are shown in Graph 2. It is noted that in 2011, two-wheelers (50%) and non-motorized alternatives (walk and bicycle, 42%) account for the bulk of shorter trips (less than 1.5 km). However, the majority of these brief excursions are conducted on foot in 2018. In 2018, the percentage of two-wheelers in the 0-1.5 km distance category fell. It shows that more people are walking for HBW-related purposes in 2018.



Graph 2: Share of modes for each distance group

According to the above debate, between 2011 and 2018, more people used non-motorized transportation options, such as walking and bicycling. All of the foot treks, however, are within a 1.5 km radius. In both the 2011 and 2016 scenarios, the shared autorickshaw is the most prevalent mode in the sample. Nonetheless, the general usage of shared autorickshaws

is declining, and this decline is seen across all distance categories. Conversely, two-wheelers are being used more frequently overall. Only shorter trips saw a decline in the two-wheeler usage percentage.



Graph 3: Result of cluster analysis using cell size 100m x 100m, (a) scenario 2011, (b) scenario 2016

CONCLUSION

The study shows how to map the distribution, rate, and future spatial pattern of urban expansion using geographic information systems (GIS). While this research only shows how to forecast urban spatial pattern with one planning scenario (compact growth), this approach can be used to predict urban spatial pattern with a scenario involving urban sprawl.

Numerous tactics have been developed to manage and focus urban growth in particular areas. First, an effort was undertaken to pinpoint the regions in and around Hyderabad, India, that have seen peri-urban transition since 2011. The central government launched urban development programs like HRIDAY, AMRUTH, and others, and the state government of Telangana is also implementing urbanization initiatives. As part of this process, the government should preserve sustainability, build numerous growth poles, and work to lessen Telangana's primary nature. In order to predict the future spatial pattern of urban growth utilizing various policy approaches, the methods employed in this study were straightforward and simple to execute. A list of markers that have been used to map peri-urban areas in earlier research was created. Using census tracts as the spatial unit of data organization and aggregation, it was discovered that the majority of these indicators are measured by census data. The use of census data in this study is restricted by two significant issues. Nevertheless, despite plan reviews, precious agricultural land continues to be encroached upon by urban expansion.

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