Dynamics of peri urban area – An integrated approach for

Potential growth points

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by

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Under The Guidance of

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Abstract

Rapid urbanization has led to the expansion of peri-urban areas, which serve as transitional zones between urban and rural settlements. These areas experience significant changes in land use, population growth, and economic activities, often resulting in unplanned development, inadequate infrastructure, environmental degradation, and governance challenges. The absence of a comprehensive planning framework for peri-urban regions creates a gap between regional and local development strategies. This study, titled **"Dynamics of Peri-Urban Area: An Integrated Approach for Potential Growth Points,"** aims to identify and develop potential growth points that can support sustainable and balanced development in peri-urban areas.

The study focuses on the peri-urban region of Indore, Madhya Pradesh, covering approximately 36.4 sq. km. A combination of literature review, spatial analysis, and demographic assessment was used to understand the dynamics of the study area. Geographic Information System (GIS)-based Multi-Criteria Decision Analysis (MCDA) and the Analytical Hierarchy Process (AHP) were employed to evaluate land suitability for future development. Key parameters such as accessibility, transportation networks, existing settlements, environmental constraints, water bodies, and infrastructure availability were analyzed through weighted overlay techniques.

The results identified suitable locations for potential growth points that can function as service and economic hubs, strengthening urban-rural linkages and reducing development pressure on the core city. Based on the findings, an Integrated Development Plan was proposed to guide future land use, infrastructure provision, and environmental conservation. The study demonstrates the effectiveness of GIS-based planning in promoting sustainable peri-urban development.

सारांश

पेरि-अर्बन क्षेत्र वे तेज़ी से बदलने वाले स्थान हैं जो ग्रामीण क्षेत्रों और शहरी क्षेत्रों के बीच स्थित होते हैं। यह शोध-प्रबंध यह अध्ययन करता है कि ये क्षेत्र कैसे बदलते हैं, किन कारकों का इन पर प्रभाव पड़ता है और इन्हें बेहतर तरीके से कैसे योजनाबद्ध किया जा सकता है। अध्ययन के पहले चरण में यह समझाया गया है कि पेरि-अर्बन क्षेत्र सामान्य शहरी या ग्रामीण बस्तियों से कैसे अलग होते हैं और क्यों इन क्षेत्रों में भूमि-उपयोग, जनसंख्या और बुनियादी ढाँचे में तेज़ परिवर्तन देखने को मिलते हैं। यह शोध ग्रामीण और शहरी क्षेत्रों के बीच संबंधों की भी जाँच करता है ताकि यह समझा जा सके कि दोनों एक-दूसरे पर श्रम, सेवाओं, बाज़ार, संसाधनों और दैनिक आवागमन के लिए किस तरह निर्भर हैं।

वास्तविक स्थिति को समझने के लिए पिपला (नागपुर), दुर्गापुर, जमशेदपुर और रायपुर के चार केस स्टडीज़ का विश्लेषण किया गया है। इन उदाहरणों से यह पता चलता है कि किन पेरि-अर्बन स्थानों में विकास के शुरुआती संकेत दिखाई देते हैं। साहित्य और केस स्टडी निष्कर्षों के आधार पर पेरि-अर्बन क्षेत्रों में ग्रोथ पॉइंट की पहचान करने के लिए सरल और व्यवहारिक पैरामीटर विकसित किए गए हैं।

अध्ययन निष्कर्ष निकालता है कि पेरि-अर्बन क्षेत्र भविष्य में शहर के विस्तार के लिए बड़ी संभावनाएँ रखते हैं। एक स्पष्ट पैरामीटर-आधारित दृष्टिकोण योजनाकारों को ऐसे एकीकृत विकास योजनाएँ बनाने में मदद कर सकता है, जो इन संक्रमणकालीन क्षेत्रों में संतुलित और सुव्यवस्थित विकास को मार्गदर्शित करें।

CHAPTER-1 INTRODUCTION AND BACKGROUND

1.1Introduction

In India, peri-urban areas represent some of the most rapidly transforming spaces, located at the fringes of growing cities. These areas are often underdeveloped because their scale is vast and difficult to manage under existing planning frameworks. Unlike core urban zones, peri-urban regions do not always receive consistent attention from planning authorities, resulting in poor infrastructure, inadequate services, and fragmented land use. Land prices in these outer city areas are significantly lower, making them attractive for informal housing and unregulated construction. Due to weaker enforcement of development regulations, people build structures without proper approvals, which contributes to unplanned growth and deteriorating living conditions (Ministry of Urban Development [MoUD],(Mukherjee & Panda, 2024)(Tiwari, 2019)

This lack of planning consequently makes the growth of these areas haphazard in nature and precipitates various problems relating to transportation, sanitation, water supply, and environmental sustainability. In addition, these regions often face a socio-economic transition where traditional agriculture coexists in conflict with emerging industrial and residential land use, leading to shifts in identity and livelihoods for their local population. The absence of coordinated institutional mechanisms, along with overlapping jurisdictions between rural and urban governance bodies, further complicate their management. At the same time, their proximity to urban cores is critical to accommodating future growth pressures. Thus, the identification of potential growth points in such regions becomes an imperative necessity. Salem et al., 2025 An integrated approach can make these growth points function as planned hubs that steer expansion in a non-disjointed yet regulated manner, balancing urban requirements with rural transitions.

Strengthening regional planning policies, improving data-based land management, and promoting infrastructure investment can help address these challenges. Such an approach ensures that peri-urban areas are not left as neglected zones but instead emerge as strategic spaces for regional development (Kumar & Prasad, 2021; MoUD, 2014).(Goswami, 2018; Mukherjee & Panda, 2024; Tiwari, 2019)

1.2 Urban Areas-

India, the URDPFI Guidelines (2014) define an urban area to include any place governed by a statutory urban local body (municipal corporation, municipality, cantonment board, notified town area committee, etc.) or any other settlement meeting specific Census-based criteria. These criteria require a minimum population of 5,000, at least 75% of the male main working population engaged in non-agricultural activities, and a density of at least 400 persons per km². In practice, this yields the familiar categories of "Statutory Towns" (with urban local bodies) versus "Census Towns" (meeting the above thresholds) (URDPFI, 2014).

The URDPFI further classifies all urban settlements by size – from Small Towns (5,000–20,000 population) through Medium and Large Towns, up to Metropolitan Cities and Megapolises (over 10 million) – a hierarchy that guides local authority status and planning norms. Crucially, the URDPFI treats the *urban area* as a planning unit that typically extends beyond the city's core. It recommends that city development plans include adjacent peri-urban fringes (for example, extending 5–8 km beyond city limits for cities over about 300,000 population). These peri-urban zones – transitional rural–urban interfaces – are explicitly recognized as integral to urban growth patterns. At the top end of the scale, very large agglomerations (metropolitan areas above one million inhabitants) are often managed by special planning bodies (e.g. Metropolitan Planning Committees or Development Authorities) to coordinate development across the urban region (URDPFI, 2014)

1.3 Rural Areas-

In URDPFI (2014), a *rural area* is understood as any territory lying outside the statutory urban local bodies (municipalities, corporations, etc.) and is typically characterized by lower population density, smaller settlements, and a predominance of agriculture-based land use. These areas are generally administered by Panchayati Raj institutions rather than municipal governance. The guidelines highlight that rural areas have distinct demographic and functional profiles compared to urban settlements, and that urban planning must explicitly address their integration. For example, URDPFI notes the need to bridge the urban–rural divide by tackling "the problems arising out of the transition of rural areas into peri urban and urban areas". In essence, rural areas in the Indian context lack the high-density infrastructure and diversified non-agricultural economy of cities, and their

planning challenges (such as infrastructure deficits) are emphasized in URDPFI as part of a cohesive regional development strategy (URDPFI, 2014)

1.4 Peri Urban Areas -

A *peri-urban area*, according to URDPFI (2014), is a transitional zone on the outer fringe of a city or town where rural and urban characteristics mix. These zones lie between the formally defined urban boundary and the surrounding countryside, and they often absorb spillover growth from the city. URDPFI explicitly calls for managing peri-urban zones through integrated planning: it recommends the development of new norms, standards and zoning regulations tailored for these areas to guide their evolution. The guidelines advise that peri-urban areas should be administered in coordination with nearby local bodies, stating that "extra attention shall be paid on the development and administration of peri-urban areas through local self-governments" so that growth on the urban fringe remains consistent with the city's overall plan. In summary, the peri-urban area is seen as a buffer region under pressure from urban expansion, and URDPFI (2014) advocates a participatory, multi-level planning approach for such zones – including involving both municipal and rural authorities – to ensure that the peripheral growth of cities proceeds in an orderly, planned manner.

1.5Growth points-

growth point, are designed to serve about five service centres, will accommodate a population between 10,000 and 25,000. Similar to the idea of market towns, these growth points will be connected to main growth hubs through state highways and linked to service centres via district and local roads. With a focus on agro-industrial specialization, their economic base will revolve around the production, handling, and processing of agricultural and dairy products. By organizing these activities effectively, growth points can play a vital role in reducing rural unemployment and supporting balanced regional development. (Reginal planning in India by –Mahesh Chand)

R.P. Mishra viewed **growth points** as small settlements with potential to act as local hubs of development. These points, usually with a population of 10,000–25,000, provide essential services like education, healthcare, and markets to surrounding rural areas. They are primarily **agro-industrial** in nature, processing local agricultural produce and supporting small-scale industries. Mishra emphasized that growth points serve as the **first tier** in a hierarchical network connecting villages to larger towns and growth centres. When

properly planned and linked with transport and infrastructure, they generate **spread effects** that stimulate development in their hinterlands. Overall, growth points are crucial for reducing regional disparities and promoting balanced rural-urban development.

Table 1Difference btw growth point , pole and centre *Source – R.P Mishra*

Feature	**Growth Point**	**Growth Centre**	**Growth Pole**
Definition	Small settlement with potential to act as a local hub	Larger town/city stimulating regional development	Major metropolitan or industrial hub driving national/regional economy
Population	10000 – 25000	50000 – 500000	500000 – 2500000
Economic Base	Primarily agro-industrial, small-scale industries	Diverse industries, trade, and services	Highly diversified industries, advanced services, R&D, innovation
Function / Role	Provides basic services (education, healthcare, markets) to nearby villages	Acts as regional hub; attracts investment, services, infrastructure	Acts as apex node; drives growth for centres and points, generates major spillover effects
Linkages	Connected to service centres and villages via local roads	Connected to growth points and other centres via state/district highways	Connected nationally/internationally; influences multiple growth centres
Effect on Surrounding Areas	Generates local spread effects	Generates regional spread effects and	Generates strong regional/national spread effects but may also cause backwash to smaller areas

		moderate backwash effects	

1.6Need of the Study:

For any town, the growth of peri-urban areas largely depends on its regional location and connectivity. In many cases, portions of peri-urban areas fall within the planning boundary but remain outside the municipal limit .(Friedmann, 1996) This distinction means that the land use patterns are not strictly regulated, allowing growth to occur more rapidly. Real estate development often shifts towards these areas due to comparatively lower land values and the relative ease of obtaining permissions, as local panchayats typically regulate approvals instead of stricter municipal authorities.(Friedmann, 1996)

The study of the dynamics of peri-urban areas and the identification of potential growth points is necessary because these transitional zones between urban and rural environments face unique, rapidly evolving challenges and opportunities that demand an integrated planning approach.

Peri-urban areas are often marked by unregulated expansion, conflicting land uses, and substantial pressure on natural resources. As urban cores run out of space, growth spills over into these peripheries, leading to the conversion of agricultural land, environmental degradation, and infrastructure stress. Without intentional, integrated development planning, such areas experience:

- Chaotic land use patterns and haphazard development.(Rizvi & Mishra, 2023)(Goswami, 2018)
- Strains on infrastructure, utilities, and social services.(Goswami, 2018)(Rajendran et al., 2024)
- Environmental degradation due to unmanaged growth and resource exploitation.(Rizvi & Mishra, 2023)

1.7Title-

Dynamics of peri urban area – An integrated approach for

Potential growth points

Dynamics means the continuous changes, interactions, and forces that shape the growth, land use, economy, and social fabric of peri-urban areas—making them critical zones for identifying potential growth points.

1.8Aim-

1.8.1For Phase I-

Understanding the dynamics of peri urban areas its potential, its challenges and domino effect

1.8.2For Phase II-

What approaches can integrate the different aspect of dynamisms to develop as a potential growth point

1.9Objectives-

1.9.1For Phase I-

- ***Objective 1*** **-**To understand what does dynamism mean for peri urban areas

To achieve this objective, the study first focuses on developing a clear conceptual understanding of what peri-urban areas are and how they differ from conventional urban or rural settlements. This requires reviewing standard definitions provided by URDPFI (2014), national planning guidelines, and international literature to understand the unique scale, transitional character, and governance complexities of peri-urban regions. A comparative assessment is then undertaken to highlight the differences between peri-urban zones, dense urban cores, and rural hinterlands in terms of land-use patterns, livelihood structures, population characteristics, and levels of planning control. This helps establish why peri-urban areas experience higher instability and change. The study further examines the major challenges of peri-urban areas—such as unregulated land conversion, weak institutional coordination, fragmented infrastructure, and environmental pressures—which contribute significantly to their dynamic nature. To capture the full range of dynamism,

multiple dimensions are analysed, including land-use transitions, socio-economic shifts, infrastructure expansion, and evolving governance structures. Case studies of Pipla (Nagpur), Durgapur, Jamshedpur, and Raipur are used to observe how these forces operate in real settings and how different triggers—such as SEZs, industrial corridors, or transport networks—accelerate change in peri-urban belts. Insights from definitions, literature, and case studies are finally synthesised to build a comprehensive understanding of peri-urban dynamism as a complex, multi-layered process that distinguishes these areas from both rural and urban environments

- ***Objective 2***-To understand the relationship between urban and rural settlements

To address this objective, the study begins by reviewing theoretical perspectives that explain the interdependence between urban and rural settlements, including concepts such as the Rural–Urban Continuum, Growth Pole Theory, and the Peri-Urban Interface framework. This helps establish how cities and villages are connected through flows of goods, services, labour, capital, and infrastructure. A comparative functional analysis is then carried out to understand the complementary roles of urban areas—such as markets, employment centers, and service hubs—and rural areas, which supply agricultural products, labour, land, and ecological resources. The study also examines various movement and flow patterns, including daily commuting, migration streams, supply chains, and service dependencies, which demonstrate the intensity of interaction between rural hinterlands and urban cores. Special focus is given to the peri-urban region as an active transition zone where rural and urban characteristics blend, creating complex economic, social, and spatial exchanges. Case studies of Pipla (Nagpur), Durgapur, Jamshedpur, and Raipur are used to observe real-world examples of these relationships, showing how infrastructure expansion, land-use conversion, and economic activities reshape these linkages. Finally, insights from theory, comparison, and case studies are synthesized to develop a comprehensive understanding of how urban–rural relationships operate and how peri-urban spaces emerge as critical connectors that sustain regional development.

- ***Objective 3***-To understand the potential growth points in peri-urban areas

To achieve this objective, the study first reviews literature to understand what factors generally contribute to the emergence of growth points in peri-urban areas, such as good connectivity, availability of land, and the presence of economic activities. The next step involves mapping the city's outward expansion to identify the directions where major development is occurring and locating important roads, corridors, and facilities that influence this growth. Accessibility is then assessed to identify peri-urban settlements that are well connected to markets, services, and employment centers. Land-use change patterns are examined to understand where agricultural land is rapidly being converted into residential or commercial uses. Socio-economic changes such as population increase, migration inflow, and livelihood diversification are also considered to identify active and fast-growing nodes. Case studies of Nagpur, Durgapur, Jamshedpur, and Raipur help validate these observations and show real examples of how different locations become growth points. Finally, all findings are combined to prepare a preliminary list of peri-urban areas that have the potential to develop as future growth points.

- ***Objective 4-***To identify the parameters for growth points

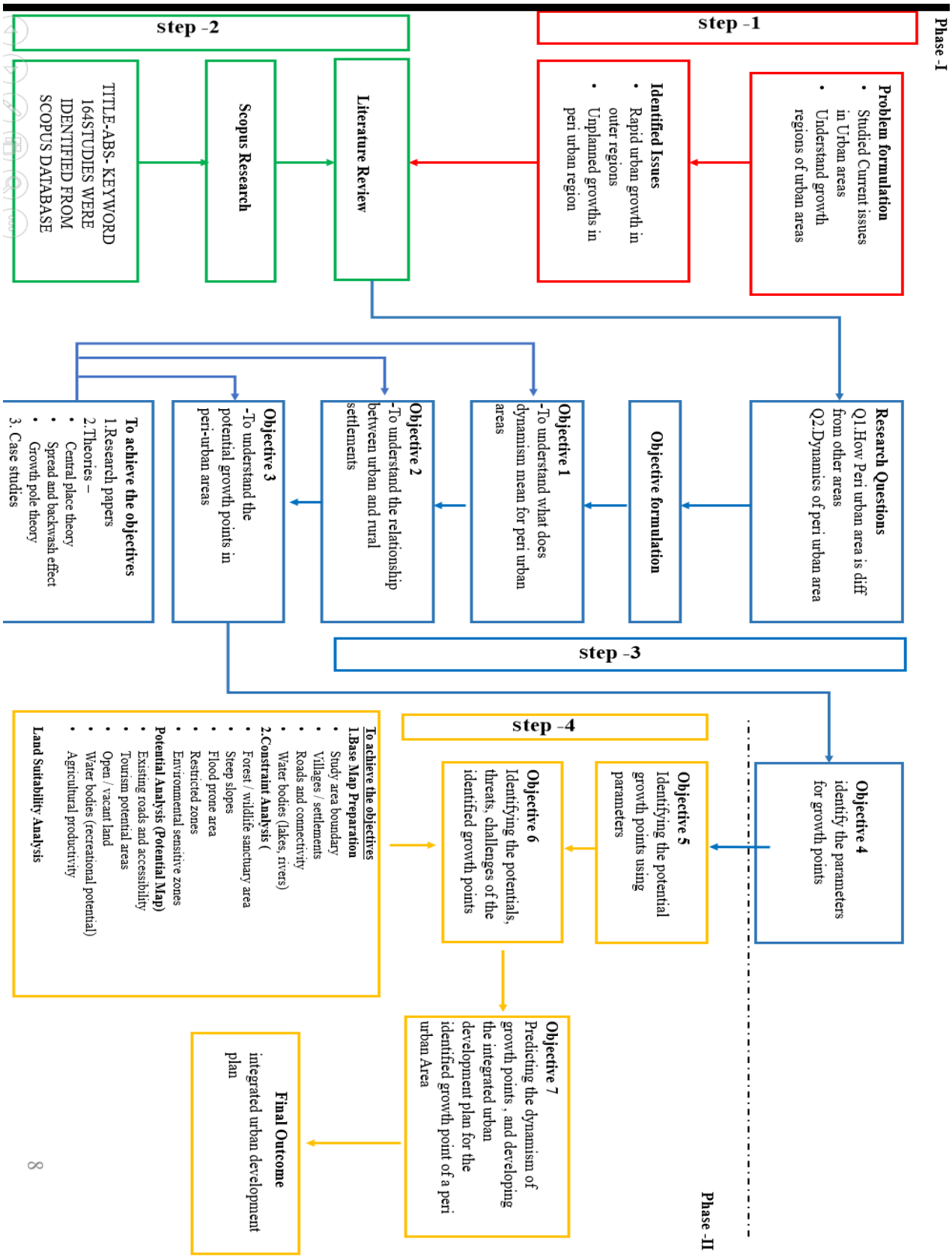
To accomplish this objective, the study first reviews national planning guidelines, particularly URDPFI (2014) and regional planning frameworks, to identify measurable indicators relevant to urban expansion and peri-urban development. Insights from the case studies of Pipla, Durgapur, Jamshedpur, and Raipur are then examined to determine which factors consistently influence the emergence of growth points. These observed indicators are converted into measurable parameters and systematically categorized into broader thematic groups such as location and connectivity, economic potential, land-use transformation, physical and social infrastructure, demographic characteristics, governance structure, and environmental suitability. Each thematic category is further refined by defining precise sub-parameters that can be objectively assessed using secondary data or field surveys. Finally, the parameter categories and sub-indicators are synthesized into a comprehensive evaluation matrix, which forms the basis for selecting potential peri-urban growth points in the subsequent planning phase.

1.9.2For Phase II-

- Identifying the potential growth points using parameters

- Identifying the potentials, threats, challenges of the identified peri urban area
- Predicting the dynamism of growth points , and developing the integrated urban development plan for the identified growth point of a peri urban region.

1.10Methodology –



CHAPTER-2 LITERATURE REVIEW

The concept of growth points (also called growth centers or growth nodes) originates in regional development theory. Growth pole theory posits that economic development is concentrated in specific hubs, which then have "trickle-down" effects on surrounding areas (Perroux 1955; Myrdal 1957; Hirschman 1958; Boudeville 1966). In this view, designated growth points - artificially selected towns or nodes - are provided with infrastructure and investment so that they become poles of local industrialization and services, stimulating wider regional growth. For example, Paul and Chatterjee (2014) define growth points as "centres of economic activity artificially created or stimulated with the intention that they will eventually become natural centres of economic growth." Declaring such promising, resource-endowed towns as growth points is meant to "kick-start" a cumulative growth process by attracting investment, population inflows, and favorable government treatment. (Haldar et al., 2024).Thus, growth point strategies are rooted in the hypothesis that concentrating resources at select nodes will induce broader economic development via enhanced linkages to smaller towns and rural hinterlands.

In India, planning history reflects these concepts but has been critiqued for urban bias. Early post-independence development strategies focused on industrial and urban growth concentrated at particular locations with disregard for large swaths of rural areas (Lipton, 1977; Sharma, 2012) libres.uncg.edu. Sharma (2012) comments that India's early planners assumed accelerated growth would occur at "certain urban growth points or 'growth poles,'" an approach which incorporated an "obvious urban bias" in policelibre. In turn, the approach that was later adopted put emphasis on the bottom-up approach: to strengthen rural towns and linkages with the urban to redistribute growth more evenly. For instance, Sharma (2012) illustrates that the planners suggested enhancing "urban–rural linkages" to surmount regional disparitieslibre. Similarly, R.P. Mishra's Growth Foci model (1972) proposed a multi-tier network of villages, small towns, and rural service centres feeding into district towns (growth points) and metropolitan service centers; this was a clear attempt to balance rural–urban development (cf. Mishra, 1972; Rajiv, 1984).

Empirical studies on growth points in India remain relatively few, but they illustrate these ideas in practice. Paul and Chatterjee (2014) examined the North 24 Parganas (West Bengal) and identified specific towns (like Krishna nagar, Habra) whose attributes make them potential growth points in that region. They argue that properly equipping such towns

can trigger industrial linkages and lift rural incomes.Similarly, a recent quantitative GIS study of the Durgapur peri-urban region (West Bengal) classified 57 peripheral localities into six categories: growth poles, growth centres, growth points, service centres, service points and rural centres. In that analysis, “growth points” were defined as towns with moderate development potential – less than the top-tier growth centres but still able to accelerate local development .(Toku et al., 2024) Notably, several towns (e.g. Chorra, Amlajora, Harishpur) were earmarked as growth points with the condition that strategic infrastructure improvements could help them spur broader growth . These studies emphasize common factors: growth points tend to lie along key transport corridors, have improving infrastructure, and act as hubs for surrounding hinterlands (often providing markets, schools, or clinics).(Mamun et al., 2024)(Afriyie et al., 2014)

Peri-urbanization is increasingly seen not merely as a transitional land use but as a complex socio-spatial phenomenon. Studies emphasize that peri-urban areas in the Global South, like in Chennai and Faridabad, India, represent arenas of rapid physical change and speculative land development.(Goel, 2011) These shifts profoundly affect social resilience and community identity. Researchers advocate adopting systems-thinking approaches and socio-spatial frameworks to better capture the unique characteristics of peri-urban growth, challenging Eurocentric models that may not be universally applicable.(Kumar et al., 2025) The lack of innovative methodologies and generalizations from limited case studies are noted research gaps.(Follmann et al., 2018)(Chettry, 2022)

Urbanization emerges as the dominant driver of land use transformation in peri-urban regions. Case studies from Faridabad highlight the chaotic and unregulated nature of urban sprawl, often at the expense of agricultural land and without adequate infrastructure.(Goel, 2011) These findings underscore the need for comprehensive urban planning, integrated development strategies, and stronger policy focus on peri-urban populations, which are frequently neglected in both urban research and governance.(Meshram, 2011)(Datta, 2004)

Several papers converge on the notion that rigid distinctions between rural and urban areas are becoming obsolete due to the intensifying interdependence brought about by technological and infrastructural advancements. (Allen et al., 2003)Urban centers increasingly depend on rural areas for resources, while rural populations rely on urban hubs for employment, services, and markets. Sustainable development demands a regional planning approach that recognizes and leverages these linkages. Yet, a persistent challenge

remains the absence of universally agreed definitions, which hinders sound research and policymaking.(Arif & Sengupta, 2023)

Recent works propose innovative frameworks that integrate spatial, temporal, and socio-economic data to assess landscape changes, including the use of GIS, remote sensing, and indicator-based models such as DPSIR. (Woiwode & Philip, 2024)These approaches address the complexities of peri-urban management and contribute to more holistic solutions for identifying and mitigating the adverse impacts of urban expansion.(Miljkovic, 2018)

2.1Increasing Interdependency of Urban and rural areas-

According to the Census of India 2011 as shown in Table-2 , nearly 68.84% of the population (833 million people) lived in rural areas, while 31.16% (377 million people) resided in urban settlements. A decade earlier, in 2001, the rural share stood at 72.2% (742 million) and the urban share at 27.8% (286 million) as showed in fig 1 . This steady increase of more than 91 million people in urban areas within ten years reflects India's rapid urbanization trend, while the majority of its population still resides in villages. This demographic shift underlines the growing importance of strengthening rural–urban linkages to ensure balanced development.

Table 2 Census Data *Source-Census2011,2001,1991*

Census Year	**Rural Population (%)**	**Rural Population (in millions)**	**Urban Population (%)**	**Urban Population (in millions)**
1991	74.3 %	628 million	25.7 %	217 million
2001	72.2 %	742 million	27.8 %	286 million
2011	68.84 %	833 million	31.16 %	377 million

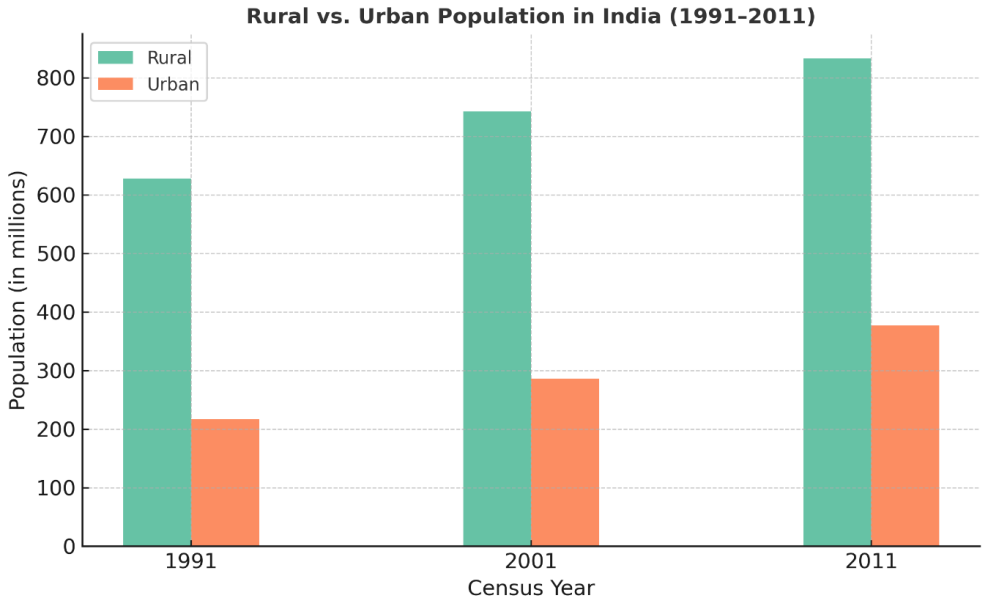


Figure 1 rural vs urban popl. *Source- Census data 2011*

As shown in fig.1 Rural and urban areas form a single interdependent system: neither can be understood in isolation. Researchers describe this link as a "joint or interactive relationship" in which each sphere gains mutual benefits.(Tandoh-offin, 2010) In practical terms, cities depend on their surrounding countryside for essential resources such as food, water, raw materials, and clean air, while rural regions draw on urban markets, services, and investment.(Sakketa, 2022) For example, one review notes that "almost all ecosystem services of urban areas are imported from rural areas", including food and timber. Conversely, urban development provides rural inhabitants with markets, infrastructure, and jobs. In short, strong rural–urban linkages improve living conditions and employment for both populations, underpinning regional growth and poverty reduction.(Gebre & Gebremedhin, 2019)(Mukhopadhyay, n.d.)

In India—where agriculture still engages a majority of people—these linkages shape everything from food security to labor migration.

There are many drivers to explain the interdependency and few major drivers are listed below.

2.2Drivers of Increasing Interdependency

- **Rapid urbanization and demographic shifts**: Cities and towns in India are growing quickly. According to UN projections, the global urban population will reach over

66% of the world total by 2050 .India's urban population is rising as millions migrate or commute to cities.(Tandoh-offin, 2010)

- **Economic restructuring:** The decline of a purely agrarian economy and the rise of industry and services (so-called "de-agrarianisation" and "tertiarisation") link rural and urban livelihoods .(Sakketa, 2022)(Arif et al., 2019)
- **Infrastructure and connectivity**: Improvements in transportation, logistics, and communication have bridged rural and urban areas.
- **Land-use change and peri-urban expansion:** As cities expand, farmland on the urban fringe is converted to residential or industrial uses.(Goran, 2017)
- **Migration and labor mobility:** Growing job opportunities in urban India attract rural migrants.(Ar. Manita Saxena & Ar. Suman Sharma, 2015)(Goel, 2011)

This interdependency is a challenge to balance the push pull factors of urban and rural, at the same time it is a potential for exploring the linkages at Regional scale for Balanced Regional Development

2.3Theories supporting Urban and Rural interdependency

Planning theories outline how development within a geographic region can be structured to promote balanced economic activity, social well-being, and environmental protection. These approaches together provide planners with strategies for fostering integrated and sustainable regional growth.(Kumar et al., 2025)

2.3.1Central Place Theory

The was introduced by *Walter Christaller* in his seminal work *Central Places in Southern Germany* (1933; trans. 1966), proposing a systematic explanation for the spatial distribution and hierarchy of settlements. Christaller argued that settlements, termed *central places*, function as centers that provide goods and services to surrounding hinterlands as

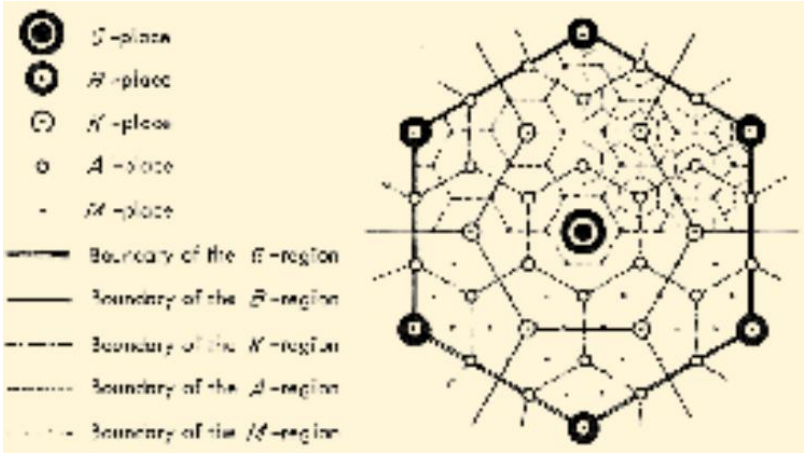


Figure 2Central Place Theory

Source- Christaller, W. (1966). Central places in Southern Germany. New Jersey: Prentice-Hall

showed in fig 2 . The theory assumes an isotropic plain, equal population distribution, and uniform transportation costs, leading to a hexagonal spatial pattern of settlements to ensure maximum accessibility and minimal overlap. According to Christaller, higher-order centers offer specialized services that lower-order centers cannot provide, creating a hierarchical network ranging from small villages to large regional capitals. This model aimed to reveal the logic behind urban hierarchy, market areas, and spatial organization of economic activities. Although later refined by scholars to reflect real-world complexities, Christaller's framework remains foundational in urban geography, regional planning, and settlement analysis for understanding the functional relationships among cities and towns. (Christaller, 1966)

2.3.2Growth Pole Theory (Perroux)

"Growth Poles and Growth Centers in Regional Planning: A Review" (1969), D. Darwent critically examined the conceptual foundations and practical implications of the growth pole theory within the context of regional development. Building upon the ideas of François Perroux, Darwent emphasized that economic growth does not occur uniformly across space but is concentrated around specific dynamic centers—termed *growth poles*—that stimulate development in surrounding areas through spillover effects.(Darwent, 1969) He highlighted the distinction between *growth poles* as economic phenomena and *growth centers* as their spatial manifestations in planning practice. Darwent also discussed the limitations of applying the theory directly to regional planning, noting that successful implementation requires supportive infrastructure, policy coordination, and consideration of socio-economic disparities. His work provided a bridge between abstract economic models and spatial planning applications, making it a cornerstone in the evolution of regional development strategies.(Darwent, 1969)

2.3.3Spread and Backwash Effect Theory

Gunnar Myrdal introduced the Spread and Backwash Effect Theory as a way to explain why regional development has been uneven. He asserted that economic growth often exerts both positive and negative external effects in contiguous regions. The spread effects are beneficial influences, including the diffused technology, capital, employment, and increased market linkages that stimulate growth in neighboring areas. (Myrdal, 1957) The backwash effects, on the other hand, are the negative implications, including the outflow

of capital, migration of skilled labor, and market domination by the core, which dampen peripheral development. Myrdal recognized that, in developing economies, backwash effects generally outweigh spread effects, giving rise to cumulative regional disparities. Through strong governmental and institutional interventions, Myrdal called for an appraisal to counter such disequilibrium to ensure fairer and more sustainable growth across regions. (Myrdal, 1957)

Theories are foundational base of knowledge generation. These regional theories will serve as a base for exploring the intricate relationship between urban and rural, thus indicating the regional influence.

CHAPTER-3 CASE STUDY

CASE STUDIES –

3.1CASE 1- Peri-urban Transition of Pipla (Nagpur)

Pipla was long a rural village just south of Nagpur city (population ~1,945 in 2011In the mid-2010s it began changing rapidly. The nearby MIHAN (Multi-modal Cargo Hub & Airport) project – announced in the 2000s – spurred "unprecedented growth" that enveloped **fringe villages** like Pipla *(Meshram, 2011)*. Plans and reports note that large tracts of farmland around MIHAN and other fringe areas were being sold for housing and industry, with "huge tracks of agricultural land being converted into non-agricultural usage," indicating large-scale residential and commercial activity. *(Chapter, n.d.)* In 2022 the state officially upgraded Pipla (with nearby Besa, Beltarodi, Ghogli, etc.) from villages to the **Besa-Pipla Nagar Panchayat**, calling the area a "rapidly urbanising" zone .(*No, 2009)* This formal change – and pending local elections – acknowledges a sharp rural–urban shift: as one local report notes, the new Nagar Panchayat's upgrade *"reflects the rapid urbanisation and population growth"* of these previously rural zones. In fig 3 and fig 4 show the drastic change in that area.

Key Drivers of Development: Several interlocking factors drove Pipla's peri-urban boom. The MIHAN SEZ and airport complex to the north and east brought industry, IT and logistics jobs, and a large influx of workers to the region(Chapter, n.d.). Improved connectivity further opened Pipla up: a new **Outer Ring Road** and widened Wardha Road now link Pipla directly to Nagpur city and highways, and an extended **Metro rail line** is planned to reach MIHAN. Local analysts emphasize Pipla's "convenient connectivity to Wardha Road, Outer Ring Road, and Amravati Road" and soon to the metro network. Educational/health campuses (e.g. new colleges and hospitals near MIHAN) and commercial amenities have also arisen. In sum, "MIHAN project and Nagpur Metro extension" – combined with new schools, hospitals and malls – are cited as key drivers in Nagpur's real estate boom. *(Properties in Besa-Pipla Road Nagpur | Top Investment in 2025, 2025)*

- **Proximity to MIHAN/SEZ:** The airport & SEZ triggered land sales and job growth. (Nagpur's sprawl studies explicitly link MIHAN to surges in housing and industry on the city's south side(Chapter, n.d.)

Road and Metro Links: New roads (NH-44/Wardha Rd.) and the Outer Ring Road improved access; Metro Phase II extensions to MIHAN are planned, making Pipla commutable to the city centre. . (Properties in Besa-Pipla Road Nagpur | Top Investment in 2025, 2025)

- **Education/Healthcare Growth:** International schools (e.g. Podar Int'l), new colleges (including IIM Nagpur in 2015), and hospitals in the Besa-Pipla area draw residents.

Real Estate Demand: Relative affordability has spurred investors. Local real estate reports note strong demand for apartments and plots here (prices ~₹2,800–4,200/sqft and 8–12% annual price rises in recent years. (Investors especially eye growth potential near transit and MIHAN.) . *(Properties in Besa-Pipla Road Nagpur | Top Investment in 2025, 2025)*

Types of Development: Pipla has seen a wave of housing and township projects. Multiple builders (including Jayanti Realtors) are laying out **residential colonies** with villas, apartments and plotted homes. For example, *"Jayanti Nagari 7"* – a gated township on Besa-Pipla road – is under construction. (Properties in Besa-Pipla Road Nagpur | Top Investment in 2025, 2025)

Other projects include affordable flats and luxury villas, often with community amenities. Commercial development is also growing: small shopping centers and offices are appearing along the new road corridors. Infrastructure works include a concrete **Besa–Pipla road** (under construction as of 2025 and expanded utilities (water, drainage, power lines). *(Kulkarni, 2025)*

- *Housing:* New layouts (villa and apartment complexes) have sprung up on former farm land. (One blog notes Pipla's quiet outskirts "transformed at lightning speed into a vibrant real estate hub" *(Kulkarni, 2025)*
- *Infrastructure:* The Maharashtra Jeevan Pradhikaran/NIT built a major water-supply network in the 2010s for 19 peri-urban villages (including Pipla) to meet rising demand. Street lights, drains and civic services are being extended as well. (Kulkarni, 2025)

- *Roads/Transit:* A planned new road, flyovers and the upcoming Metro will serve the corridor. *(Kulkarni, 2025)*

Government & Private Roles: Both sectors are active. State agencies (MADC/NIT/NMC/PWD) drove core projects: MIHAN development by Maharashtra Airport Dev. Co., a master water & sewer scheme by Maharashtra Jeevan Pradhikaran, and Nagpur Metro extensions under MahaMetro. Nagpur Improvement Trust's *Development Plan* explicitly includes Pipla and adjacent villages in its land-use plan around MIHAN. In 2022–23 the state notified the Besa-Pipla Nagar Panchayat (merging Pipla with Besa-Beltarodi-Ghogli) shifting governance and funding streams to an urban body. Private builders (both local and national firms) have launched projects: realty firms cite numerous new colonies and flats underway on Pipla/Besa road *(Properties in Besa-Pipla Road Nagpur | Top Investment in 2025, 2025)*

- **Population & Land Use:** Available data is limited, but the trend is clear. In 2011 Pipla's population was under 2,000 *(Census 2011)* Official estimates in 2014 placed the combined peri-urban area (9 villages) at ~165,000 (projected to double by 2029). Up to 2025, the new Besa-Pipla NagarPanchayat was reported to collect ₹3–4 crore/month in taxes, indicating substantial population and commerce. Agricultural fields have shrunk as they are rezoned for housing and industry; a government study notes "huge tracks of agricultural lands are being converted" and anticipates continued land-use change. Comprehensive census updates are pending, but city planners consider Pipla part of Nagpur's expanding metro fringe. *(Kulkarni, 2025) (Properties in Besa-Pipla Road Nagpur | Top Investment in 2025, 2025) No, 2009)*

- **Speed/Nature of Change:** The peri-urban shift in Pipla has been unusually rapid. Studies and local reports describe Nagpur's southern fringes "transforming at lightning speed" once MIHAN and road projects took off. Metro and NIT development plans project intense growth: Pipla now targets a mix of mid-density housing, commerce and services. (One analysis projects annual property gains of 7–12% driven by improved connectivity) In short, Pipla's character changed from quiet farmland to a commuter suburb in just a few years: new homes and utilities sprouted faster than they can be fully serviced. As Nagpur's 2022 government report notes, upgrading Pipla to a Nagar Panchayat "reflects the rapid urbanization and population

growth" of what were once rural villages . *Kulkarni, 2025) (Properties in Besa-Pipla Road Nagpur | Top Investment in 2025, 2025) No, 2009)*



Figure 4Pipla a peri urban area of Nagpur in 2012

Source-Google earth Pro



Figure 3Pipla a peri urban area of Nagpur showing drastic change over a period of 12 years

Source-Google earth Pro

The case of Pipla clearly shows how the arrival of major infrastructure as shows in fig.4 and fig.3 —such as the MIHAN project, Outer Ring Road, and proposed metro connectivity—acted as a catalyst for rapid peri-urban development. Once these projects were initiated, land conversion and real estate activity surged, transforming Pipla from a quiet rural village into a fast-growing suburban zone. However, this rapid growth has outpaced proper urban planning. Basic infrastructure like drainage, road quality, and water supply remain inconsistent, and unregulated construction is common. While connectivity and investment have unlocked development potential, the area suffers from a lack of coordinated planning and governance, risking unsustainable urban expansion in the future.

3.1.1INFERENCES –

The case of Pipla reveals how strategic infrastructure and economic initiatives can transform a rural settlement into a dynamic peri-urban growth point. The establishment of the MIHAN project and the development of the Outer Ring Road and Metro extension acted as major catalysts, attracting industries, real estate investments, and population influx. These interventions improved accessibility and economic opportunities, rapidly converting agricultural land into residential and commercial zones. However, the pace of growth has exceeded the capacity of local planning, leading to uneven infrastructure and governance challenges. Pipla now functions as a transitional growth node between Nagpur's urban core and its rural periphery, highlighting the importance of proactive

planning, infrastructure phasing, and environmental management to ensure sustainable peri-urban expansion.

3.2 CASE 2- Durgapur peri-urban region (West Bengal)

The study was undertaken in response to the rapid urban expansion of the Durgapur Municipal Corporation (DMC) region and its adjoining peri-urban areas. Like many fast-growing Indian cities, Durgapur's expansion has been driven by industrial growth, infrastructural development, and population migration from rural to urban zones. The peri-urban area represents a transition between the rural hinterlands and the urban core—a zone where land-use patterns, livelihoods, and socio-economic settings are in constant flux due to developmental pressure.(Haldar et al., 2023b) The expansion of the peri-urban region often leads to challenges in sustainable planning, resource management, and environmental conservation, necessitating a comprehensive investigation into how, where, and why these rapid spatial changes are occurring.

Key Factors Influencing Peri-Urban Dynamics

The study identified multiple interlinked drivers affecting peri-urban growth in Durgapur:

- **Proximity to City Center:** Areas closer to the urban core showed a higher probability of built-up expansion due to accessibility, economic activity, and infrastructural investments.(Haldar et al., 2023a)
- **Industrial and Mining Zones:** The presence of established industries and abundant mineral resources attracted both workers and related economic activity, leading to significant land-use conversion.(Haldar et al., 2023b)

- **Transportation Infrastructure:** Well-connected roadways (e.g., National Highways NH-2, NH-60) and railway stations were strong catalysts for urban sprawl, providing easy movement of people and goods.(Haldar et al., 2023b)
- **Population Pressure:** Rising population density in core areas triggered spillover into the peri-urban region.

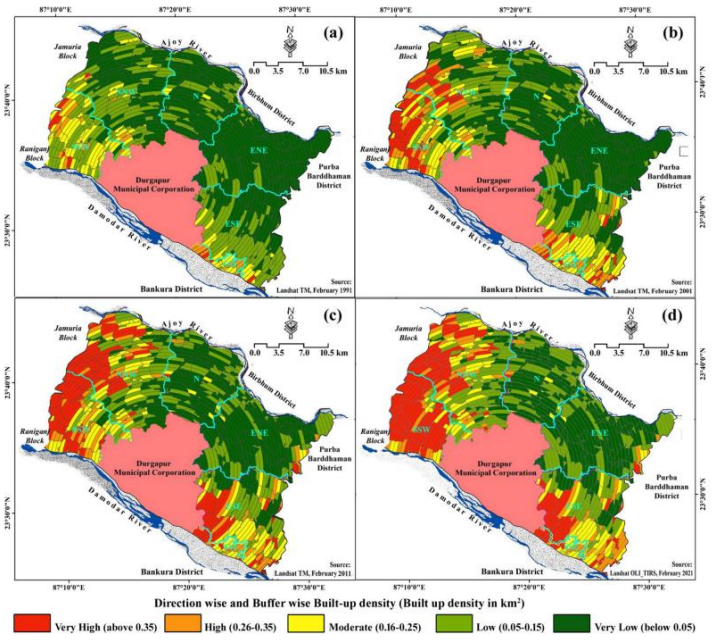


Figure 5Direction and grid wise built-up density for (a) 1991, (b) 2001, (c) 2011 and (d) 2021 in the peri-urban region of DMC Source- Haldar et al., 2023a

- **Agricultural and Environmental Constraints:** While some agricultural lands were converted to built-up areas, regulatory and environmental considerations—especially near rivers and fertile zones—sometimes suppressed expansion.
- **Socioeconomic Opportunities:** The promise of better employment, education, and services in peri-urban zones—a mix of urban convenience and semi-rural space—drove both migration and real estate development.
- The logistic regression model highlighted the relative importance of each variable, with proximity to city center, roads, and industrial corridors as dominant factor.

Tools and Techniques Employed

- **Multi-temporal Remote Sensing and Satellite Imagery**: Landsat TM data (1991, 2001, 2011) and OLI/TIRS data (2021) provided chronological land-use snapshots, processed and classified using ERDAS Imagine, supervised maximum likelihood algorithms, and ground-truth validation via Google Earth.(Haldar et al., 2023a)

- **Spatial Metrics and Zonal Analysis:** The study divided the peri-urban area into directional sectors and concentric buffers for detailed spatial examination. Techniques included:
    - Built-Up Density Index (BUDI)
    - Shannon's Entropy to quantify urban sprawl
    - Landscape Expansion Index (LEI), Area-Weighted Mean Expansion Index (AWMEI)
    - Annual Built-Up Expansion Rate (ABER), Built-Up Expansion Intensity Index (BEII), Built-Up Expansion Difference Index (BEDI)
    - Landscape metrics (Patch Density, Edge Density, Largest Patch Index, Landscape Shape Index, Open Space Ratio, Area Weighted Mean Patch Fractal)(Haldar et al., 2023b)
- **Statistical and Predictive Modelling:**
    - Logistic Regression Model (LRM) to correlate explanatory variables with expansion likelihood.
    - CA-Markov Chain Modelling and Multi-Layer Perceptron Neural Network (MLPNN) within TerrSet's Land Change Modeler for forecasting future built-up trends (projected up to 2031).(Haldar et al., 2023b)
- **Validation and Accuracy Assessment:** Use of Kappa coefficient and receiver operating characteristic (ROC) curves ensured robustness and accuracy of classifications and predictions(Haldar et al., 2023b)

The Durgapur peri-urban study illustrates a classic trajectory of urban expansion driven by industrialization, infrastructure, and migration. The built-up area saw a 15.2% increase over thirty years, with expansion concentrated along highways, industrial corridors, and urban fringes—particularly in western and southeastern sectors. The research emphasizes that distance to the city core, major transport arteries, and mining zones are key drivers of peri-urban growth, while environmental regulation and agricultural value modulate the pace and pattern elsewhere.

Critically, this work demonstrates the power of integrating remote sensing, advanced spatial analytics, and predictive modeling for urban studies. It calls for urban planners and policymakers to implement inclusive, sustainable strategies that anticipate both the opportunities and challenges of ongoing peri-urbanization—balancing growth with resource preservation and environmental stewardship

3.2.1 INFERENCES –

The Durgapur case demonstrates how industrial expansion, strong transportation networks, and population migration collectively shape peri-urban growth points. The city's peripheral areas evolved as economic and residential extensions of the urban core, particularly along highways and industrial corridors. Remote sensing and spatial modeling indicate that proximity to transport routes and industrial hubs remains the dominant driver of built-up expansion, while agricultural and environmental constraints limit unplanned growth in certain zones. These peri-urban nodes have become crucial interfaces between urban industry and rural livelihood systems. To guide this transformation effectively, planners must integrate spatial forecasting tools, regulate land-use conversion, and promote balanced infrastructure development to prevent resource depletion and unregulated sprawl.

3.3 CASE 3- Jamshedpur

Jamshedpur, one of India's earliest planned industrial cities, witnessed significant peri-urban expansion after 1951. Initially recognized as an industrial hub due to the establishment of Tata Steel, the city's influence led to the emergence of several census towns over time — 3 towns in 1951, 4 in 1961, 7 in 1971, 10 in 1981, and around 12 towns between 2001 and 2014. The peri-urban influence zone extends between 4 km and 15 km from the Jamshedpur Urban Agglomeration.

The major factor contributing to the city's growth is its strong industrial base, dominated by steel and manufacturing activities. Excellent connectivity through National Highway 33 (linking Ranchi and Kolkata), the Adityapur Highway, and an extensive railway network has further accelerated expansion. Natural boundaries such as the Subarnarekha and Kharkai rivers, along with the Dalma Hills, have shaped the direction of growth while offering geographical containment on one side.(Sahu et al., 2020)

Peri-urban areas like Adityapur have developed rapidly due to the concentration of industries, rising infrastructure demand, and migration from Kolkata and neighboring

districts. Land-use transformation from rural to urban has become prominent, accompanied by an increasing demand for housing and services. To manage this growth, the Jamshedpur Urban Agglomeration Plan 2027 has proposed expanding municipal boundaries and integrating 13 census towns into the planning framework to promote sustainable and organized development.

3.4 Case 4 -Raipur

Raipur, the capital of Chhattisgarh, has evolved from a single municipal corporation city into a dynamic metropolitan region with expanding peri-urban zones. Until 1991, Raipur had only one municipal corporation. However, census towns began emerging steadily — one in 2001, four in 2011, and two major growth points identified in 2021: Mana (12 km away) and Khairta (15 km away) from the city headquarters. The peri-urban belt primarily extends along major transportation corridors, facilitating linear growth.

The city's expansion has been driven by its role as a major economic and industrial hub in central India. Growth factors include trade, industrial activities, and the development of wholesale markets. Raipur is well-connected through NH-43 (Abhanpur–Atal Nagar), NH-200 (Bilaspur–Dhamtari), and an efficient rail network. The Swami Vivekananda Airport, located about 15 km from the city center, further enhances regional connectivity.

Significant transformation is evident in peri-urban zones such as Birgaon and along the Dhamtari Road corridor. Rapid industrialization in Abhanpur and Patan, coupled with migration from surrounding villages, has increased both population density and service demand. The Raipur Master Plan 2021 includes provisions for integrating Birgaon and nearby outer municipal limits for planned urban development. Furthermore, national urban schemes like AMRUT and JNNURM have been instrumental in improving infrastructure and promoting sustainable growth in Raipur's peri-urban areas(Sahu et al., 2020)

3.4.1 INFRENCES

The comparison of Jamshedpur and Raipur highlights that industrial growth, improved connectivity, and land availability are key factors driving the emergence of peri-urban growth points. Areas such as Adityapur and Mango near Jamshedpur, and Birgaon, Abhanpur, and Patan near Raipur, have developed as transitional zones linking rural and urban functions. Their proximity to highways, rail routes, and industrial corridors has encouraged land-use shifts from agriculture to residential and commercial purposes. These

nodes are expanding rapidly, often outpacing formal planning. Effective management, infrastructure provision, and sustainable land-use strategies are essential to channel this growth into organized and balanced urban development.

3.5INFERENCES OF CASE STUDIES -

Table 3 Inferences of case studies Source – Author

Parameters	**Pipla (Nagpur, Maharashtra)**	**Durgapur (West Bengal)**	**Jamshedpur (Jharkhand)**	**Raipur (Chhattisgarh)**	**Inference on Peri-Urban Growth Points**
Location Context	Lies south of Nagpur near MIHAN SEZ and airport; newly formed Besa–Pipla Nagar Panchayat	Lies around Durgapur Municipal Corporation within the industrial belt	Situated along the industrial corridor between Jamshedpur and Adityapur	Expanding around Raipur Municipal Corporation and NH corridors	All represent transitional zones between rural and urban areas, absorbing spillover from growing industrial or administrative cores.
Major Growth Drivers	MIHAN SEZ, Outer Ring Road, and Metro expansion	Industrial and mining activities, transport corridors (NH-2, NH-60)	Tata Steel industrial base, transport connectivity, and employment opportunities	Industrial corridor development, new trade and service centers	Industrialization and infrastructure serve as key catalysts triggering land-use conversion and population influx.
Connectivity & Transport Infrastructure	Connected via Wardha Road (NH-44), Outer Ring Road, and proposed Metro link	NH-2 and NH-60 highways, strong rail connectivity	NH-33, rail networks, and Adityapur–Kandra corridor	NH-43, NH-200, rail and air connectivity (Swami Vivekananda Airport)	Enhanced connectivity acts as a major determinant for peri-urban expansion and investment attraction.

Industrial & Economic Influence	Influenced by MIHAN industrial hub, logistics and IT sectors	Driven by Durgapur Steel Plant and industrial-mining clusters	Influenced by Tata Steel and adjoining small-scale industries	Growth driven by industrial estates, trade, and logistics hubs	Industrial proximity generates employment, stimulating housing and service demand in peri-urban belts.
Land-Use Transformation	Rapid conversion of farmland into residential and commercial layouts	Gradual but steady conversion along industrial and highway corridors	Peripheral villages merging with city limits through industrial expansion	Agricultural land along transport routes converted into mixed land uses	Fast but unregulated land transformation is common, leading to spatial fragmentation.
Population Dynamics	Sharp population rise post-2015; officially urbanized in 2022	Steady growth due to migration and industrial employment	Continuous migration of industrial workers and informal laborers	Strong population inflow from rural Chhattisgarh; rise in census towns	High population growth intensifies demand for housing and infrastructure in peri-urban fringes.
Infrastructure Development	Partial civic infrastructure; major roads and water network developing	Better near industrial core, weaker in outer sectors	Limited infrastructure in outer villages; informal housing prevalent	AMRUT and JNNURM improved core services but peri-urban areas lag	Infrastructure provision lags behind growth, creating service disparities and unbalanced development.
Governance & Planning	Recently brought under Nagar Panchayat; planning	Managed by DMC with spatial monitoring and	Weak municipal control; overlapping jurisdictions between	Governed under Master Plan 2021 but lacks coordination in fringe zones	Governance delay and poor inter-agency coordination allow unplanned expansion.

	remains fragmented	predictive modeling	industrial boards		
Spatial Growth Pattern	Clustered residential colonies near major transport corridors	Linear expansion along highways and industrial belts	Dispersed settlement pattern following industrial zones	Ribbon development along NH corridors and outer ring roads	Growth form varies, but all reflect unplanned peri-urban sprawl following economic axes.

3.6Gaps-

Growth points in the peri-urban areas, like Pipla, Durgapur, Jamshedpur, and Raipur, demonstrate how common planning and governance gaps define India's transitional urban landscape. These growth points rapidly expand beyond the municipal boundaries, where institutional control is weak and regulatory mechanisms are absent. In effect, land conversion is without proper zoning, leading to a 'fragmented' landscape with chaotic intermingling of residential, commercial, and industrial uses. Growth usually outpaces the provision of infrastructure such as roads, water supply, drainage, sanitation, and waste management, being either inad-equate or delayed. Limited coordination among government agencies and an absence of long-term planning frameworks further worsen these challenges. Speculative land markets and private developers use this regulatory vacuum to their advantage, turning growth into imbalanced, excluding essential public services. In effect, lack of appropriate transport networks, public infrastructure, and civic amenities impacts on both quality of life and environmental balance within these emerging zones.

All this needs an understanding of the potentials and challenges of each of the peri-urban regions to effectively address the issues. Each growth point has unique opportunities such as strategic location, land availability, or proximity to industrial or transportation corridors that can serve as catalysts toward planned urban expansion. On the other hand, these potentials are frustrated by threats such as haphazard construction, informal land transactions, and ecological degradation. Assessing these parameters aids planners in developing an evidence-based approach to formulation that can match development

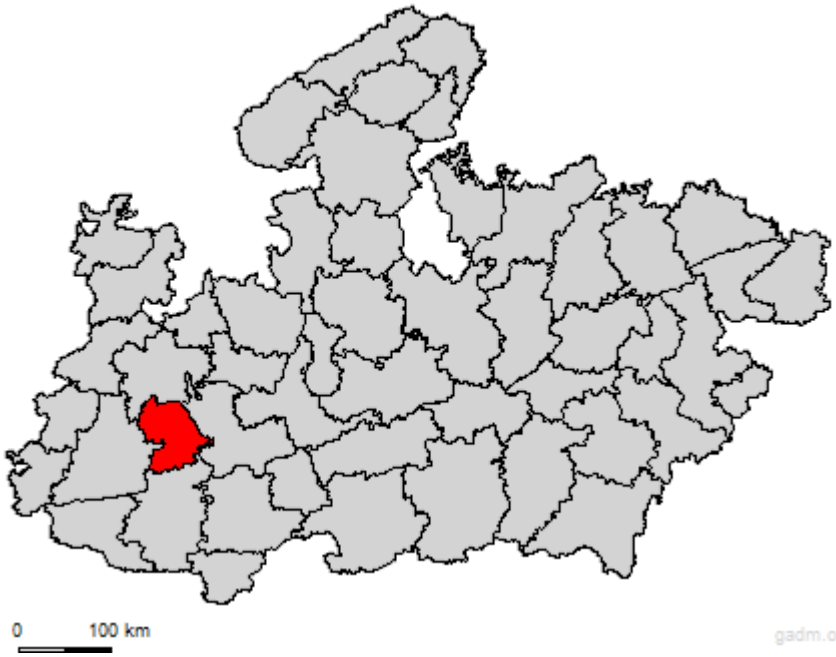
priorities with sustainable outcomes. Predicting the dynamism within growth points regarding population trends, altered land uses, and economic drivers can provide foresight during periods of rapid transition. This predictive insight supports the creation of an integrated urban development plan matched to the identified growth point of a peri-urban region.

A vision of this type should highlight inclusive governance, fair distribution of infrastructure, and environmental resilience. Integration of spatial planning tools such as GIS mapping, land suitability analysis, and participatory community planning into decision-making will help improve efficiency in decision-making and implementation. The expansion of municipal governance boundaries, implementation of zoning and land-use regulations, and preferential investment in infrastructure and social services are all key steps in managing these emergent zones. With a comprehensive and forward-looking approach, the peri-urban areas can be restructured from being unplanned sprawl into sustainable, inclusive, and well-connected corridors of urban growth that support regional growth and long-term urban resilience.

CHAPTER-4 CITY SELECTION

Madhya Pradesh (MP), located in central India, is the second-largest state by area and ranks eighth in terms of urbanization within India (MP Urban Development Company, 2014). The state exhibits a growing trend in urban population, driven by industrialization, improving infrastructure, and regional economic development (MPUDP, 2024). MP's urban bodies are governed by elected local authorities and supported by the Madhya Pradesh Urban Development Company (MPUDC), which facilitates planning, implementation, and capacity building for urban services (MPUDC, 2019).

The urban growth in MP has brought challenges including unplanned expansion, uneven service delivery, and infrastructure stress, yet it also offers opportunities to innovate with inclusive urban planning models. MP's priorities include sustainable growth, enhanced public space design, and improved mobility—key factors underpinning pedestrian and informal sector integration in urban spaces.



Source: - https://gadm.org/maps/IND/madhyapradesh/indore.html

Indore, as the largest city and commercial capital of Madhya Pradesh, exemplifies rapid urban transformation. With a population exceeding 2.5 million (2025 estimates) and an urban

agglomeration expanding into adjoining towns, Indore's growth offers both complexity and potential for axial urban development (Indore Smart City, 2022; Wikipedia, 2023).

Indore is recognized under the Smart Cities Mission for pioneering urban innovation through digital integration, infrastructure upgrades, and citizen-centric planning..Indore's growth is largely market-driven due to trade and industrial development, whereas Bhopal's growth is influenced by its administrative role as the state capital(Soma et al., 2015)

"Indore's peri-urban areas are undergoing rapid land-use transformation, with increasing built-up expansion and rural-urban land-use conflicts."(Sharma & Dehalwar, 2023)

The peri-urban area of Indore has been selected as the study area due to its rapid urban expansion and its strategic importance as one of the fastest growing urban centers in Madhya Pradesh. Indore, being the commercial and economic capital of the state, has experienced significant population growth, infrastructural development, and spatial expansion over the past two decades. This growth has resulted in the transformation of surrounding rural areas into peri-urban zones, where rural and urban land uses coexist and often compete. These areas are currently undergoing intense land-use change, infrastructure pressure, and environmental challenges, making them highly relevant for planning research. Compared to other cities in Madhya Pradesh, Indore presents a dynamic case where urban growth, economic development, and environmental constraints intersect, providing an ideal context to analyze development potentials, emerging threats, and planning challenges. Therefore, the peri-urban region of Indore offers a suitable and representative case for examining spatial growth patterns and formulating sustainable planning strategies.

District	2001 Population	2011 Population	Growth %
Indore	2,585,321	3,276,697	~26.7%
Bhopal	1,843,510	2,371,061	~28.6%
Jabalpur	2,168,912	2,463,289	~13.6%
Gwalior	1,629,881	2,032,036	~24.7%
Ujjain	1,710,751	1,986,864	~16%
Sagar	2,021,783	2,378,458	~17.6%
Rewa	1,973,306	2,363,744	~19.8%

Figure 6 District wise Population Source- Censuses

Economic vs Administrative Growth

Indore's growth is largely market-driven due to trade and industrial development, whereas Bhopal's growth is influenced by its administrative role as the state capital.

Soma, Mishra, Pandit, et al., 2015)

Peri-Urban Pressure & Land Use Change

Indore's peri-urban areas are undergoing rapid land-use transformation, with increasing built-up expansion and rural-urban land-use conflicts.

(Sharma & Dehalwar, 2023)

CHAPTER-5 DATA COLLECTION AND ANALYSIS

5.1Data collection-

First, we collected this data from the Panchayat Office in Bhopal regarding the Gram Panchayats likely to be included in the urban area in the near future. The data includes the areas that have the potential to become urban growth points in the next 10 years and 20 years. After collecting the data, we compiled and listed it .

The potential to become urban growth points in the next 10 years as shown in table-4.

Table 4 Potential Growth points in next 10 years *Source-Panchayat Raj Sanchalnalay Bhopal*

Sr No	Gram Panchayat Name	Population	Janpad Panchayat Name	Proposed Urban Area
1	Kelodhala	3248	Indore	Nagar Nigam Indore
2	Jhalariya	1940	Indore	Nagar Nigam Indore
3	Badiyakima	2340	Indore	Nagar Nigam Indore
4	Devguradiya	1998	Indore	Nagar Nigam Indore
5	Sanawadiya	3010	Indore	Nagar Nigam Indore
6	Ralamandal	2863	Indore	Nagar Nigam Indore
7	Mirzapur	1441	Indore	Nagar Nigam Indore
8	Asrawad Khurd	3984	Indore	Nagar Nigam Indore
9	Rangwasa	8633	Indore	Nagar Nigam Indore
10	Bank	18534	Indore	Nagar Nigam Indore
11	Sinhasa	5050	Indore	Nagar Nigam Indore
12	Menod	5538	Indore	Nagar Nigam Indore
13	Begamkhedi	1799	Indore	Nagar Nigam Indore
14	Limbodagari	3360	Indore	Nagar Nigam Indore
15	Budaniya	2956	Indore	Nagar Parishad Hatod

16	Phulkaradiya	1105	Indore	Nagar Parishad Hatod
17	Santer	8591	Dr Ambedkar Nagar Mhow	Cantonment Board Mhow
18	Gujarkheda	8457	Dr Ambedkar Nagar Mhow	Cantonment Board Mhow
19	Kodariya	18501	Dr Ambedkar Nagar Mhow	Cantonment Board Mhow
20	Gangaliyakhedi	3471	Dr Ambedkar Nagar Mhow	Cantonment Board Mhow
21	Dongargaon	4460	Dr Ambedkar Nagar Mhow	Cantonment Board Mhow
22	Haranyakhedi	4778	Dr Ambedkar Nagar Mhow	Cantonment Board Mhow
23	Medugariya	3314	Dr Ambedkar Nagar Mhow	Cantonment Board Mhow
24	Kankadiya	3677	Dr Ambedkar Nagar Mhow	Nagar Parishad Manpur
25	Rampuriyakhurd	2116	Dr Ambedkar Nagar Mhow	Nagar Parishad Manpur
26	Shipur	2619	Dr Ambedkar Nagar Mhow	Nagar Parishad Manpur
27	Awada	1237	Dr Ambedkar Nagar Mhow	Nagar Parishad Manpur
28	Naharkhedi	2576	Dr Ambedkar Nagar Mhow	Nagar Parishad Manpur
30	Bhatkhedi	9577	Dr Ambedkar Nagar Mhow	Nagar Parishad Mhowgaon
31	Kawati	3841	Dr Ambedkar Nagar Mhow	Nagar Parishad Mhowgaon
32	Banjari	10535	Dr Ambedkar Nagar Mhow	Nagar Parishad Mhowgaon
33	Panda	1777	Dr Ambedkar Nagar Mhow	Nagar Parishad Rau
34	Nawada	2874	Dr Ambedkar Nagar Mhow	Nagar Parishad Rau
35	Pigdambar	5214	Dr Ambedkar Nagar Mhow	Nagar Parishad Rau
36	Bhainslay	2660	Dr Ambedkar Nagar Mhow	Nagar Parishad Rau
37	Sonvay	4554	Dr Ambedkar Nagar Mhow	Nagar Parishad Rau
38	Khakrod	1795	Sanwer	Nagar Nigam Indore
39	Todi	1255	Sanwer	Nagar Nigam Indore
40	Dakachya	6364	Sanwer	Nagar Nigam Indore

41	Kadwali Buzurg	2102	Sanwer	Nagar Nigam Indore
42	Ringnodia	2987	Sanwer	Nagar Nigam Indore
43	Bajrang Paliya	1490	Sanwer	Nagar Nigam Indore
44	Gavla	2958	Sanwer	Nagar Parishad Sanwer
45	Simrol	2499	Sanwer	Nagar Parishad Sanwer
46	Barodiya Khan	3382	Sanwer	Nagar Parishad Sanwer
47	Kankariya Boria	2501	Sanwer	Nagar Parishad Hatod
48	Badrakha	1825	Sanwer	Nagar Parishad Hatod

The potential to become urban growth points in the next 20 years as shown in table-5

Table 5 Potential Growth points in next 20 years *Source-Panchayat Raj Sanchalnalay Bhopal*

Sr No	Gram Panchayat Name	Population	Janpad Panchayat Name	Proposed Urban Area
1	Panod	2714	Indore	Nagar Palika Nigam Indore
2	Bisankheda	1413	Indore	Nagar Palika Nigam Indore
3	Barankhedi	2259	Indore	Nagar Palika Nigam Indore
4	Garhipiplya	2682	Indore	Nagar Palika Nigam Indore
5	Asrawad Buzurg	5053	Indore	Nagar Palika Nigam Indore
6	Dudhiya	5384	Indore	Nagar Palika Nigam Indore
7	Umrikheda	1944	Indore	Nagar Palika Nigam Indore
8	Jamburkhurd	1204	Indore	Nagar Palika Nigam Indore
9	Tilawarkhurd	6464	Indore	Nagar Palika Nigam Indore
10	Morod	2571	Indore	Nagar Palika Nigam Indore
11	Machla	1439	Indore	Nagar Palika Nigam Indore
12	Umrikheda	1986	Indore	Nagar Palika Nigam Indore
13	Sidoda	1850	Indore	Nagar Palika Nigam Indore
14	Bisanawada	2347	Indore	Nagar Palika Nigam Indore
15	Rijlay	1815	Indore	Nagar Palika Nigam Indore
16	Jamburdi Hapsi	4320	Indore	Nagar Palika Nigam Indore
17	Rojdi	2343	Indore	Nagar Palika Nigam Indore
18	Santer	8591	Dr Ambedkar Nagar Mhow	Cantonment Board Mhow
19	Gujarkheda	8457	Dr Ambedkar Nagar Mhow	Cantonment Board Mhow
20	Kodariya	18501	Dr Ambedkar Nagar Mhow	Cantonment Board Mhow
21	Gangaliyakhedi	3471	Dr Ambedkar Nagar Mhow	Cantonment Board Mhow

22	Dongargaon	4460	Dr Ambedkar Nagar Mhow	Cantonment Board Mhow
23	Haranyakhedi	4778	Dr Ambedkar Nagar Mhow	Cantonment Board Mhow
24	Medugariya	3314	Dr Ambedkar Nagar Mhow	Cantonment Board Mhow
25	Kankariya	3677	Dr Ambedkar Nagar Mhow	Nagar Parishad Manpur
26	Rampuriyakhurd	2116	Dr Ambedkar Nagar Mhow	Nagar Parishad Manpur
27	Sherpur	2619	Dr Ambedkar Nagar Mhow	Nagar Parishad Manpur
28	Awada	1237	Dr Ambedkar Nagar Mhow	Nagar Parishad Manpur
29	Naharkhedi	2576	Dr Ambedkar Nagar Mhow	Nagar Parishad Manpur
30	Bhatkhedi	9577	Dr Ambedkar Nagar Mhow	Nagar Parishad Mhowgaon
31	Kawati	3841	Dr Ambedkar Nagar Mhow	Nagar Parishad Mhowgaon
32	Banjari	10535	Dr Ambedkar Nagar Mhow	Nagar Parishad Mhowgaon
33	Panda	1777	Dr Ambedkar Nagar Mhow	Nagar Parishad Rau
34	Nawada	2874	Dr Ambedkar Nagar Mhow	Nagar Parishad Rau
35	Pigdambar	5214	Dr Ambedkar Nagar Mhow	Nagar Parishad Rau
36	Bhainslay	2660	Dr Ambedkar Nagar Mhow	Nagar Parishad Rau
37	Sonvay	4554	Dr Ambedkar Nagar Mhow	Nagar Parishad Rau
38	Mangliya	12337	Sanwer	Nagar Nigam Indore
39	Dawli	8107	Sanwer	Nagar Nigam Indore
40	Sulkhedi	2771	Sanwer	Nagar Nigam Indore
41	Ram Pipliya	5176	Sanwer	Nagar Nigam Indore
42	Lasudiya Parmar	3464	Sanwer	Nagar Nigam Indore
43	Baroli	2512	Sanwer	Nagar Nigam Indore
44	Alwasa	3239	Sanwer	Nagar Nigam Indore
45	Magarkheda	4437	Sanwer	Nagar Nigam Indore
46	Bhangya	4128	Sanwer	Nagar Nigam Indore
47	Panchderiya	2278	Sanwer	Nagar Nigam Indore
48	Kudana	4312	Sanwer	Nagar Parishad Sanwer
49	Kajlana	4264	Sanwer	Nagar Parishad Sanwer
50	Karyakhedi	1671	Sanwer	Nagar Parishad Sanwer
51	Panchola	3508	Sanwer	Nagar Parishad Sanwer
52	Bawalyakhedi	1797	Sanwer	Nagar Parishad Sanwer
53	Khujariya	2003	Sanwer	Nagar Parishad Hatod

5.2Data Analysis

For the analysis of potential urban growth nodes, a number of locations were initially identified for both the 10-year and 15-year growth scenarios. However, only around 10–12 locations from each category were selected for further consideration as shown in table -6 and fig.7. The main reason for this selection is that these identified locations fall within the Municipal Area or within the defined Planning Limit.

The remaining potential locations lie outside the Planning Limit. Since areas outside the planning boundary are not part of the current development jurisdiction, including them in the analysis would not be practical for the proposed planning framework. Therefore, only those growth nodes that fall within the Municipal Area and the Planning Limit have been considered for the study.

Table 6 Potential Growth points *Source-Panchayat Raj Sanchalnalay Bhopal*

S.no.	Villages	Population			Annual Growth Rate
	Name	1991	2001	2011	
1	Jhalariya	733	859	1940	4.99%
2	Kalod Hala	1190	2992	3248	5.15%
3	Deoguradia	841	1041	1998	4.42%
4	Begam Khedi	606	877	1799	5.59%
5	Sanawadia	1603	2479		3.20%
6	Ralamandal	231	466	2863	13.20%
7	Mirjapur	204	733	1441	10.27%
8	Asrawad Khurd	1195	3259	3984	6.21%
9	Rangwasa	1637	2248	8632	8.67%
10	Sinhasa	4569	0	5050	0
11	Bank	0		18534	0
12	Nainod	2538	3837	5538	3.98%
13	Bisanawada	1379	2074	2347	2.69%
14	Sindoda	332	1373	1850	8.97%
15	Machla	955	1155	1439	2.07%
16	Morod	1380	1728	2218	2.40%
17	Kalod kartal	766	1431	1986	4.88%

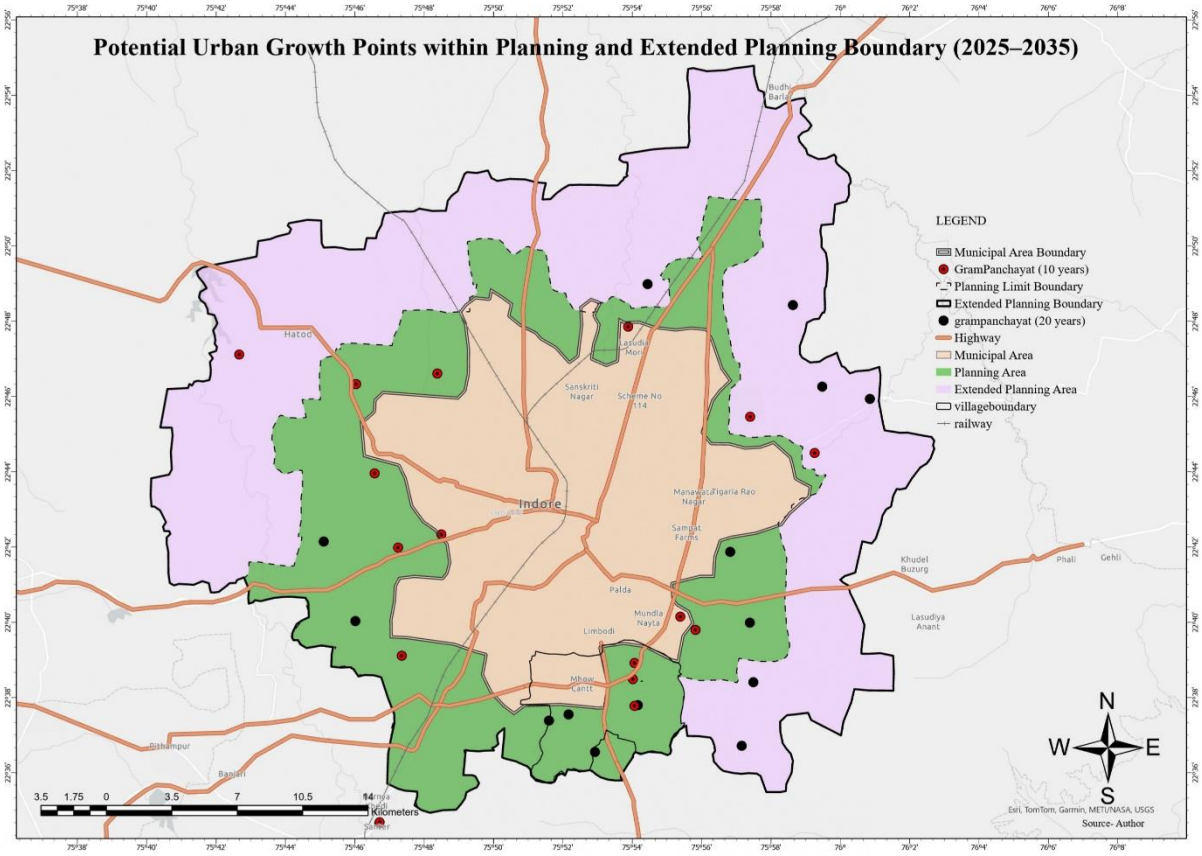


Figure 7-Potential growth points within planning and extended planning boundary *Source- TNCP Indore , Author*

5.3Area Selection-

The villages Ralamandal, Mirzapur, and Asrawad Khurd were initially identified as the primary study area based on the detailed analysis carried out during the study as shown in fig. 8. These villages exhibited comparatively higher population growth potential among all the villages analyzed and satisfied most of the key parameters identified during the analysis stage. One of the major factors influencing their selection was their close proximity to the main highway, which significantly enhances accessibility and increases the likelihood of future urban expansion along the corridor.

However, to ensure spatial continuity and a more realistic representation of development patterns, two additional villages, Kalod Kartal and Morod, were also incorporated into the study area. Urban growth along major transportation corridors typically occurs on both sides of the highway rather than being confined to a single side. Therefore, including these villages, which are located on the opposite side of the highway, was necessary to maintain balanced and comprehensive spatial development within the corridor.

Consequently, the final study area comprises five villages—Ralamandal, Mirzapur, Asrawad Khurd, Kalod Kartal, and Morod which together represent a strategically significant zone with strong potential for future growth and development.

The final study area comprises five villages with varying spatial extents. Asrawad Khurd covers an area of 8.3 sq. km, while Mirzapur occupies 3.8 sq. km. The village Ralamandal has an area of 5.5 sq. km. In addition, Kalkota Katal covers approximately 9.6 sq. km, and Morod extends over 9.2 sq. km.

Collectively, these five villages form the complete study area with a total spatial extent of approximately 36.4 square kilometers, which has been considered for further spatial analysis and planning interventions.

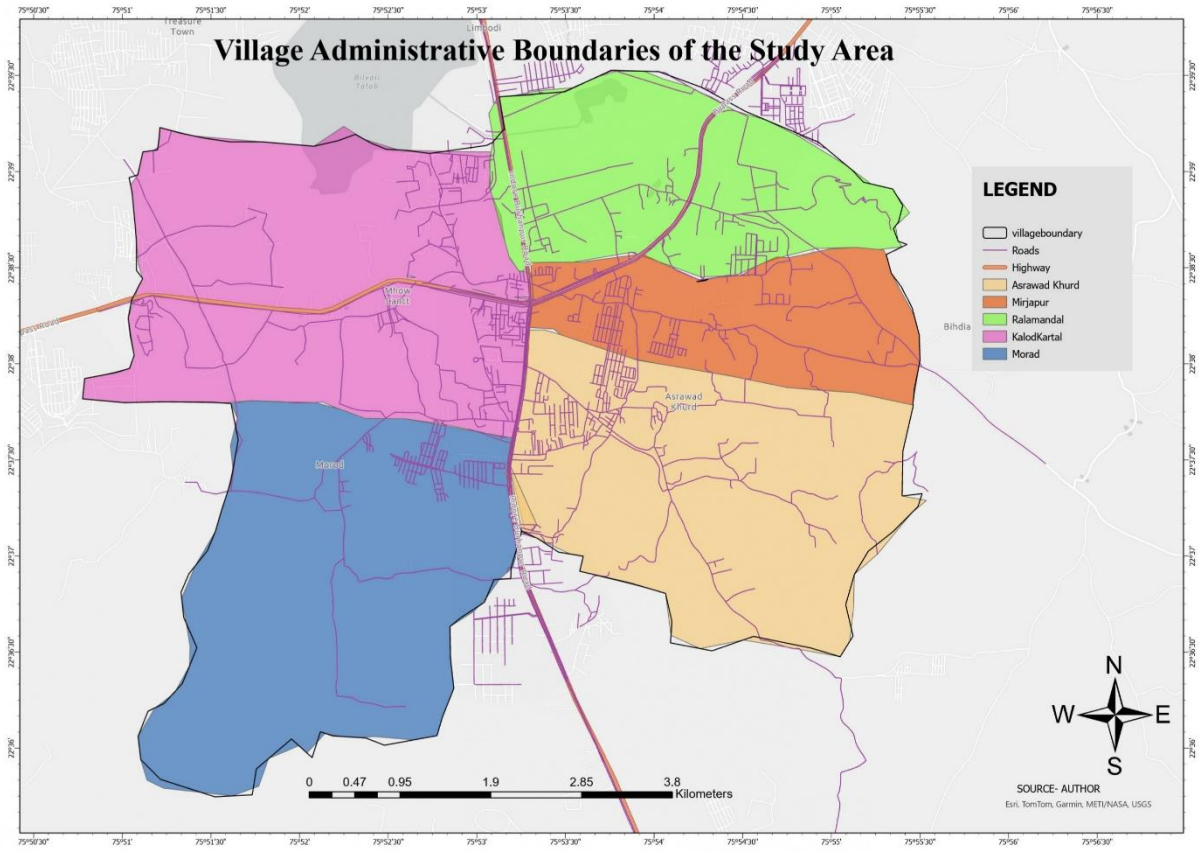


Figure 8 Village administrative Boundaries of the study area *Source-Author*

5.4Area Analysis-

During the data analysis stage, it was observed that the study area is influenced by the Indore–Khandwa National Highway passing nearby. Based on the study of satellite images from different years, it was identified that before 2023, the highway existed as a two-lane road.

However, by the end of 2025, the construction and upgradation work was completed, and the highway has now been developed into a proper four-lane highway as shown in fig.9.

The upgraded highway has an approximate right-of-way (ROW) of 50 meters, and it includes service lanes on both sides, which significantly improves accessibility and enhances the potential for future development along the corridor.

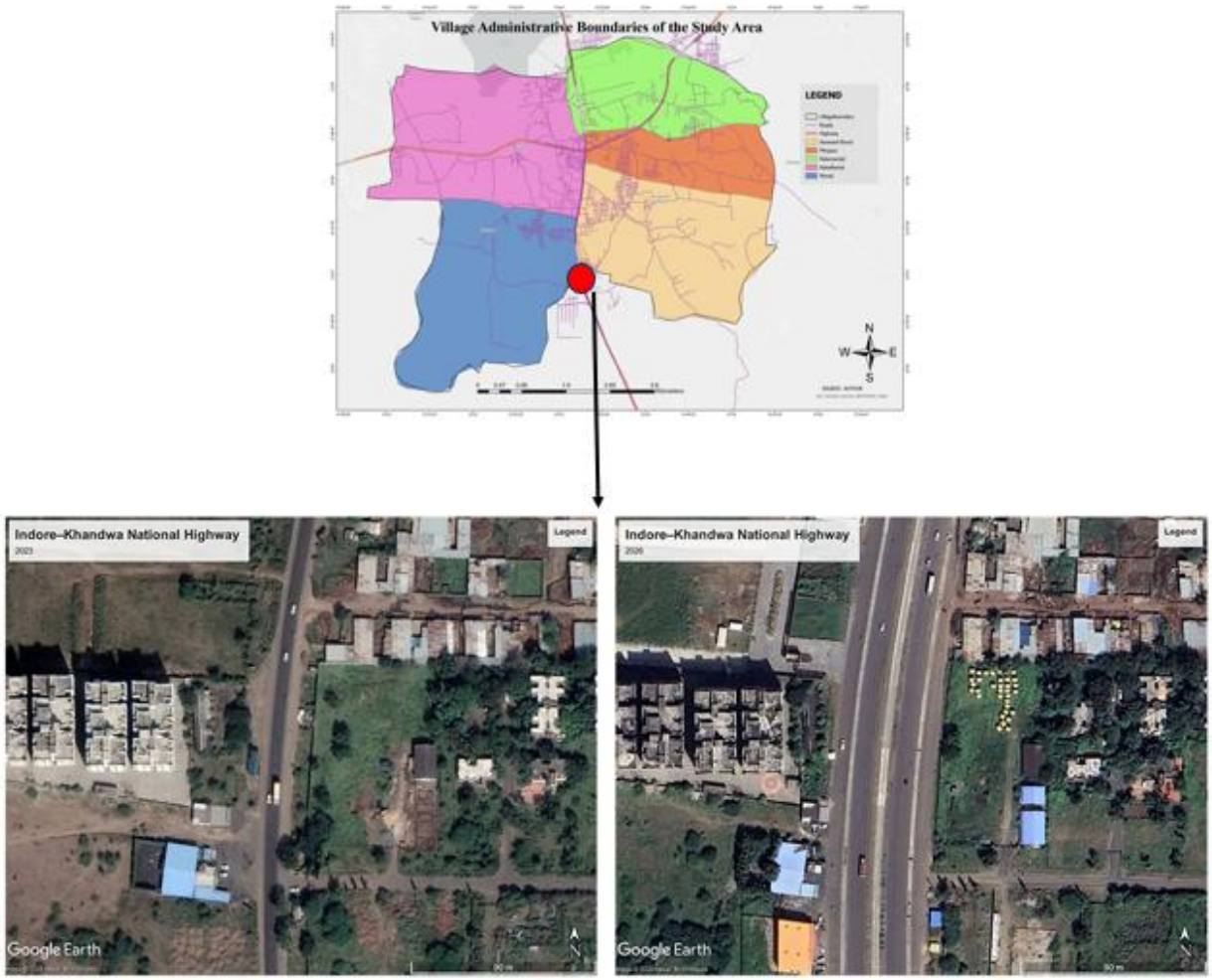


Figure 9 Indore–Khandwa National Highway comparison 2023 to 2025 *Source Google earth pro*

5.4.1Topographic Features within the Study Area

During the analysis of the study area using Google Earth and satellite imagery, it was observed that the region contains significant natural features that influence the spatial structure and environmental character of the area. One of the most important natural assets within the study

area is the **Ralamandal Wildlife Sanctuary**, which lies in close proximity to the selected villages as shown in fig. 10..

The Ralamandal Wildlife Sanctuary is one of the oldest protected natural areas near Indore and was officially established in 1989 for the conservation of local flora and fauna. The sanctuary covers an area of approximately 5 square kilometers and is located on the outskirts of Indore in Madhya Pradesh. It was historically used as a hunting ground by the Holkar royal family, and later it was declared a protected wildlife sanctuary to preserve biodiversity in the region.

The sanctuary consists of hilly terrain and dry deciduous forest vegetation, including tree species such as teak, bamboo, babul, eucalyptus, and sandalwood, which support a diverse ecological environment. A variety of wildlife species can be found here, including leopard, blackbuck, sambar deer, chital (spotted deer), nilgai (blue bull), barking deer, jackal, fox, porcupine, wild boar, and rabbits. In addition, the sanctuary also supports a large number of bird species, making it an important habitat for both resident and migratory birds.

Due to its ecological significance and proximity to the study area, the Ralamandal Wildlife Sanctuary plays an important role in maintaining the environmental balance of the region. The presence of this protected forest area also acts as a natural green buffer and influences the pattern of future development and land-use planning around the surrounding villages.

In addition to the wildlife sanctuary, the study area also contains three major lakes, namely **Bilawali Lake, Asrawad Khurd Lake, and Limbodi Lake** as shown in fig. 10, which contribute to the hydrological and ecological system of the region. These water bodies play a significant role in groundwater recharge, local climate regulation, and supporting biodiversity within the study area.

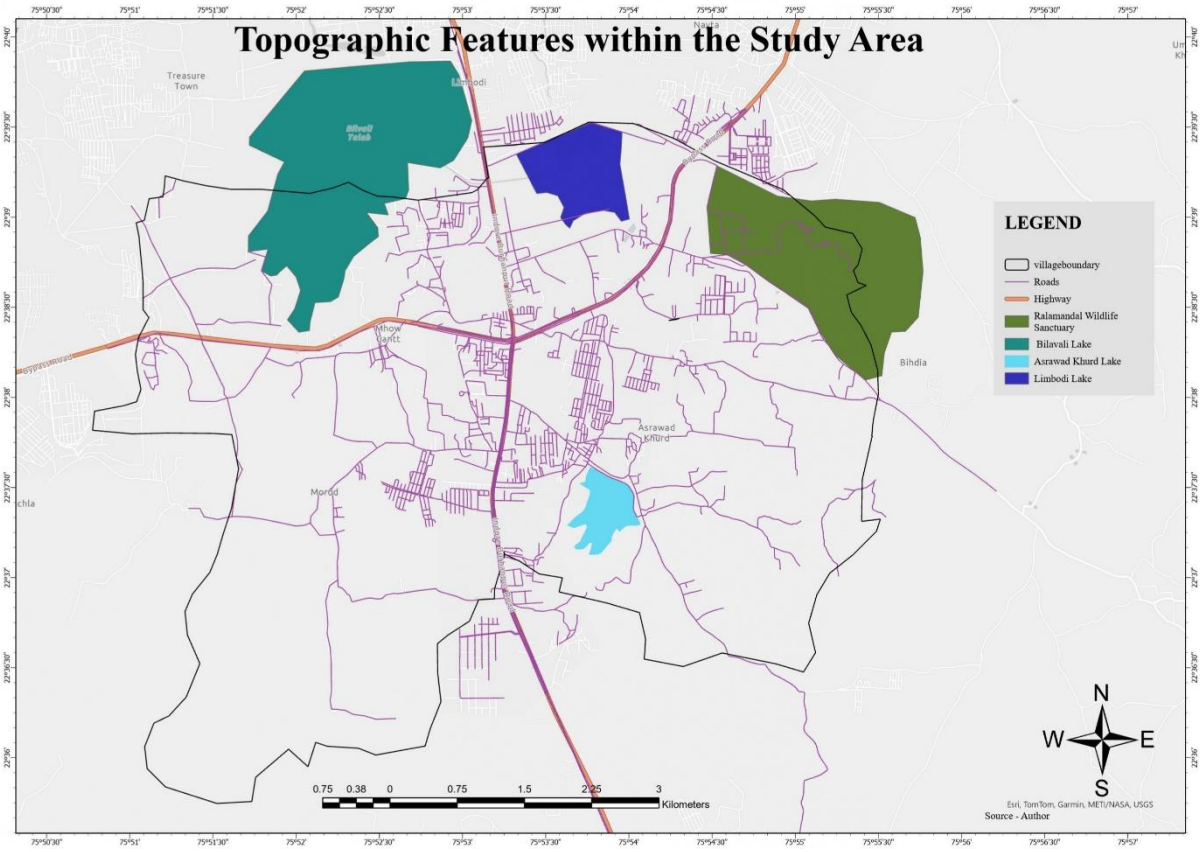


Figure 10 Topographic Features Within the Study area *Source- Author*

5.4.2Buffer Area of Topographic features within study area

The study area comprises several significant topographical and environmental features, including lakes and a wildlife sanctuary, which require careful consideration in the planning process. As per environmental planning norms and regulatory guidelines, buffer zones have been delineated around these sensitive features to restrict or control development activities. In this study, all lakes with an area greater than 10 hectares have been assigned a buffer of 100 meters to protect their ecological integrity and prevent encroachment.(For & Stakeholders, 2021) Additionally, a buffer zone of 1 kilometer has been marked around the wildlife sanctuary to minimize human interference and conserve biodiversity as shown in fig.11.

(As per the directions issued by the Supreme Court of India in *T.N. Godavarman Thirumulpad vs Union of India & Others* (Order dated 3 June 2022), a minimum Eco-Sensitive Zone (ESZ) of 1 km has been mandated around all national parks and wildlife sanctuaries to regulate development and protect ecological integrity.) These buffer zones have been mapped as restricted or no-construction areas, as illustrated in the map provided below, and have been incorporated into the spatial analysis to guide sustainable development planning.

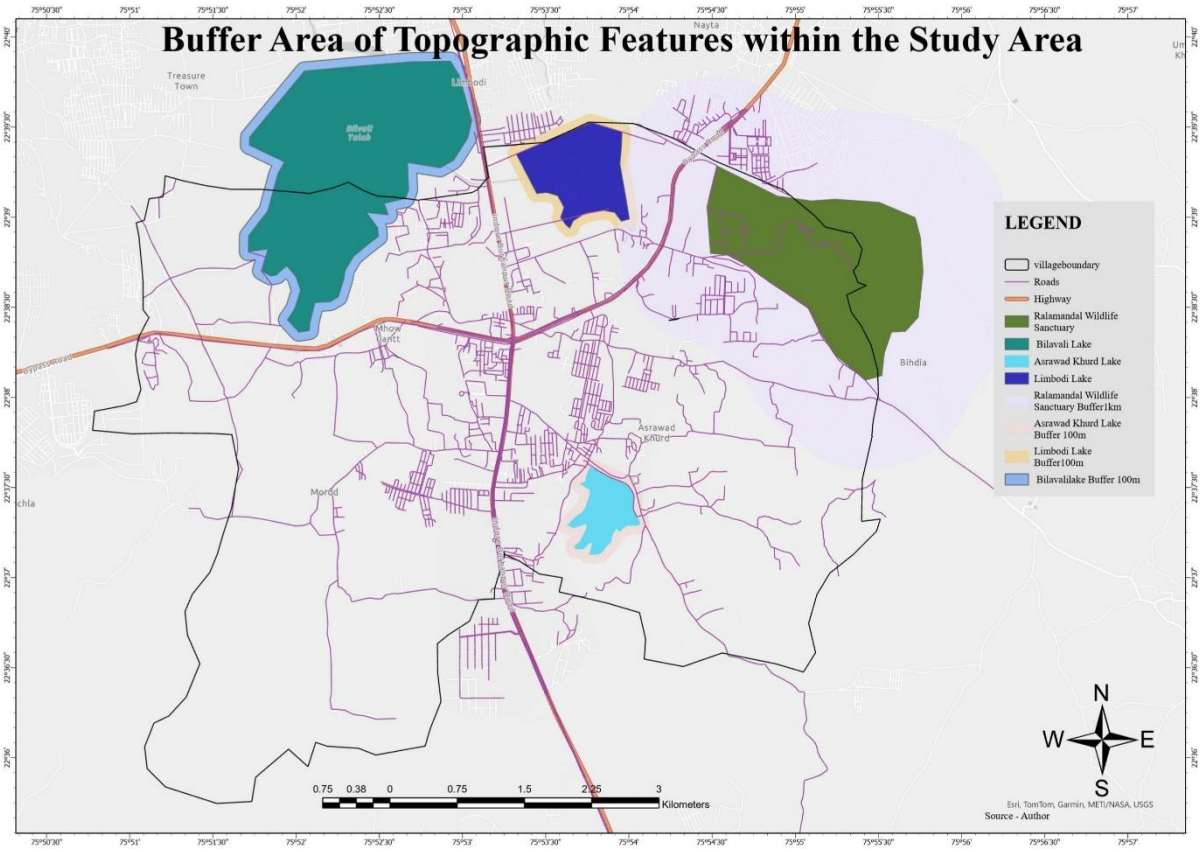


Figure 11Buffer Area of Topographic Features *Source- Author*

5.4.3Analysis of Buffer Area-

Upon analyzing the delineated buffer zones, it was observed that the 1 km buffer area around the wildlife sanctuary has already experienced significant development pressure as shown in fig.12 . A considerable amount of construction has taken place within this buffer, and ongoing development activities indicate that further construction is likely to occur in the near future. This is particularly concerning as the buffer zone is intended to function as a restricted or regulated area to protect the ecological integrity of the sanctuary. The presence of residential developments and new housing within this zone highlights issues of regulatory enforcement and poses potential threats to the surrounding ecosystem.

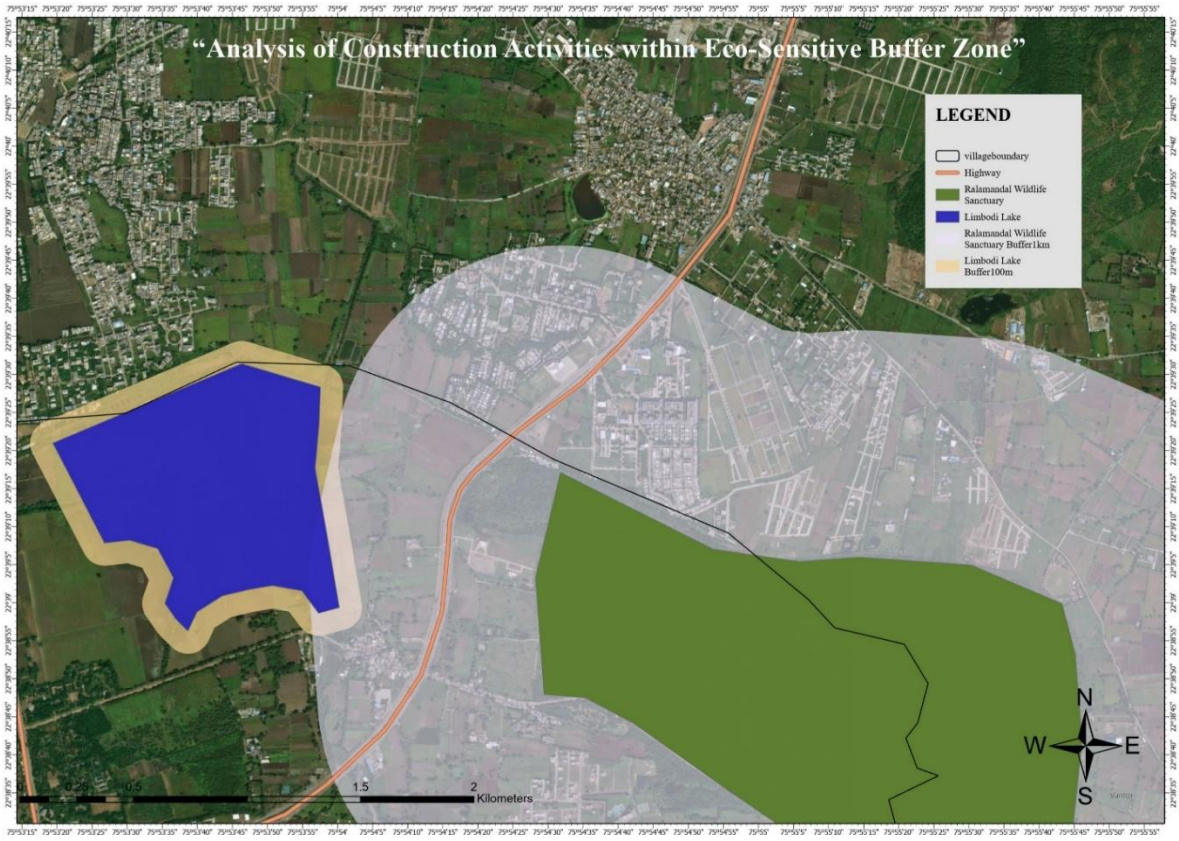


Figure 12 Analysis of Buffer area *Source – Athor*

5.4.4Analysis of Growth Points

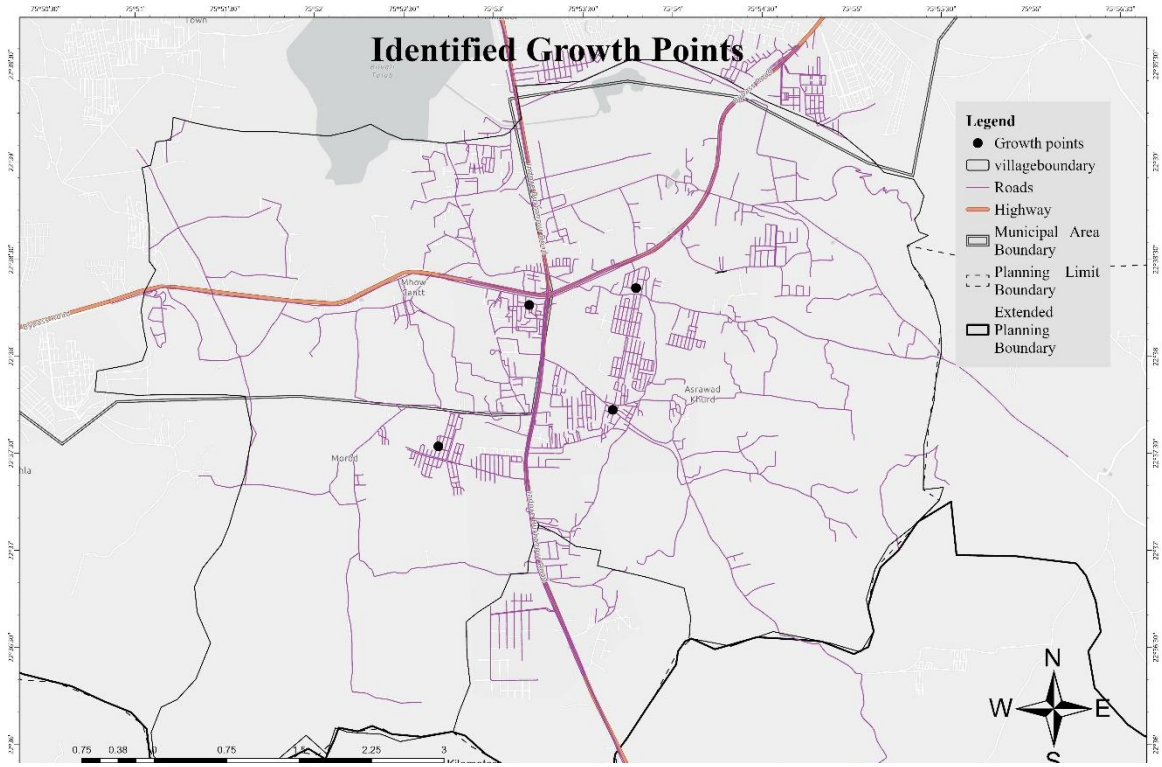


Figure 13 Identified Growth Points *Source- Author*

The study identifies four growth points within the study area as shown in fig 13. After analyzing the satellite imagery (2015–2026) of the selected locations, it is observed that these identified growth points have experienced significant spatial and built-up transformation over the last decade. Areas that were previously dominated by agricultural land and low-density settlements have now transitioned into more compact and developed urban forms.

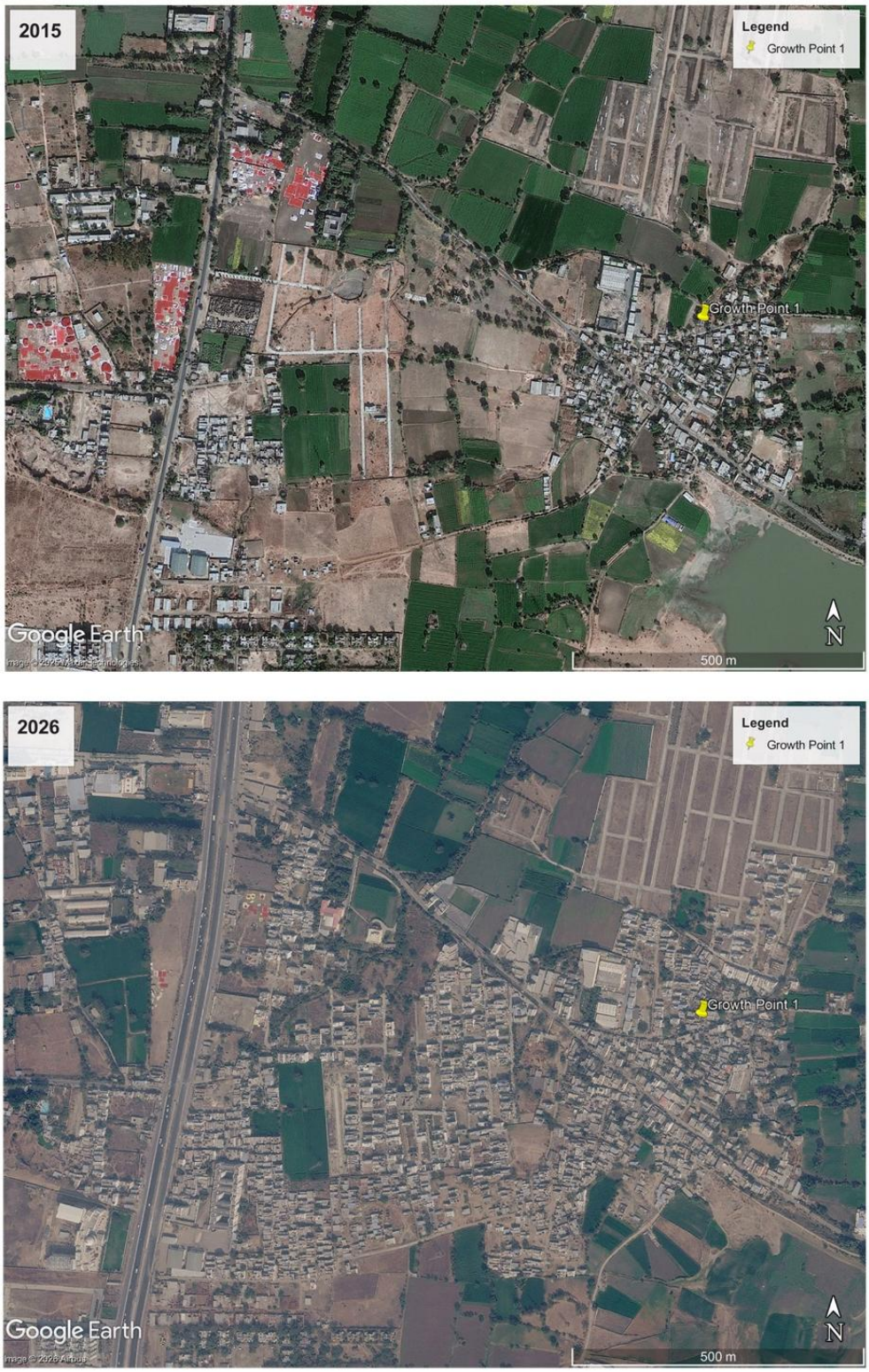


Figure 14 Location 1 comparison 2015 to 2026 Source Google earth pro

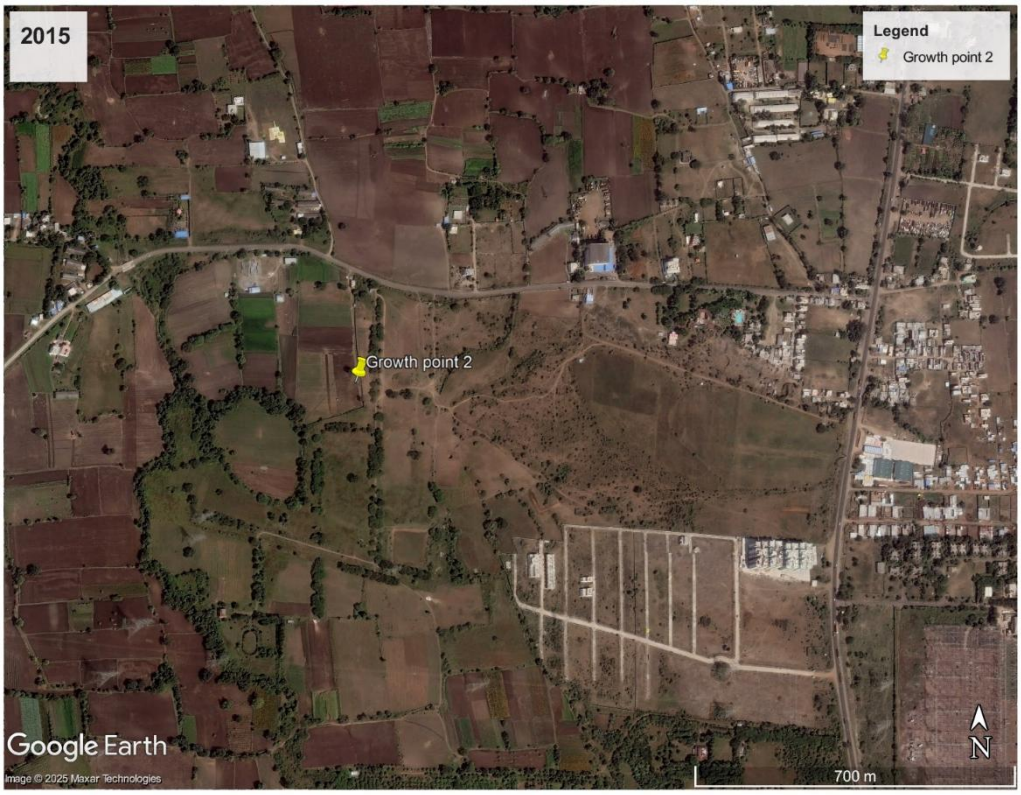




Figure 15 Location 2 comparison 2015 to 2026 earth pro *Source Google*



Figure 16 Location 3 comparison 2015 to 2026 *Source Google earth pro*



Figure 17 Location 4 comparison 2015 to 2026 Source Google earth pro

As shown in fig,14,15,16,17 .The comparison clearly shows that growth has occurred rapidly, especially around road networks and existing settlement clusters, indicating a strong relationship between accessibility and development patterns. These growth points are emerging as key urban expansion nodes within the study area.

This analysis highlights the following key observations:

- Rapid conversion of agricultural land into built-up areas
- Increase in residential density and settlement consolidation
- Development concentrated along major roads and connectivity corridors
- Emergence of unplanned and fragmented urban growth patterns
- A clear directional growth pattern in relation to the highway:
    - If a growth point is located away from the highway, development is expanding towards the highway, indicating its role as a major attraction corridor
    - If a growth point is located along the highway, development is expanding inward (away from the highway) into the surrounding areas

Considering these trends, it can be inferred that:

- These areas will continue to experience high development pressure in the coming years
- There is a strong possibility of unregulated and haphazard growth if no planning intervention is applied

5.5Land Suitability Analysis

Considering all relevant factors, including topographical features and their associated buffer zones where development is restricted, along with the parameters identified in the previous analysis such as increased land value and higher activity along highway corridors, a comprehensive land suitability analysis has been carried out using GIS-based methodology. The analysis incorporates multiple spatial layers, including environmental constraints, accessibility, and infrastructure proximity. A Multi-Criteria Decision Analysis (MCDA) approach was adopted, wherein weights were assigned to each parameter using the Analytical Hierarchy Process (AHP) based on their relative importance in influencing development potential. Subsequently, a Weighted Overlay Analysis was performed in a GIS environment to integrate all thematic layers and generate a composite suitability index. Environmentally sensitive areas and restricted buffer zones were assigned lower weights, whereas areas with high accessibility and development potential were assigned higher weights. The resulting land suitability map as shown in fig.18. illustrates the spatial variation in suitability levels, identifying zones that are highly suitable, moderately suitable, and least suitable for future development.

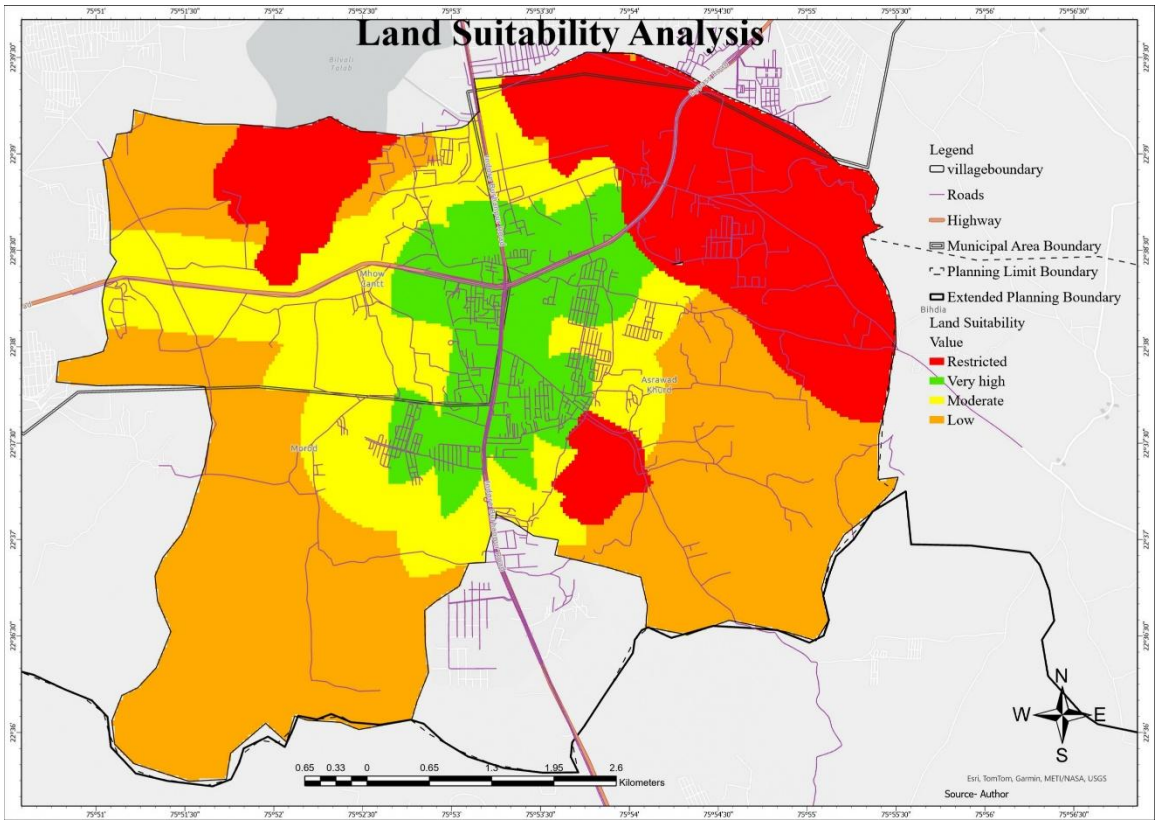


Figure 18 Land Suitability Analysis *Source - Author*

CHAPTER-6 RESULT AND DISCUSSION

The analysis carried out for the selected peri-urban villages clearly indicates that the study area is undergoing rapid and continuous urban transformation. The villages of Ralamandal, Mirzapur, Asrawad Khurd, Kalod Kartal, and Morod have emerged as major urban growth zones due to their strategic location along the Indore–Khandwa Highway corridor, increasing accessibility, and proximity to the expanding urban limits of Indore city. The findings reveal that the area has already started experiencing intense development pressure, and if this growth continues without proper planning intervention, it may result in severe environmental, infrastructural, and land-use related problems in the future.

The study identified that most of the selected villages recorded significant population growth over the past decades. Villages such as Ralamandal, Mirzapur, Rangwasa, Asrawad Khurd, and Sindoda showed comparatively high annual growth rates, indicating strong urbanization tendencies within the corridor. The rapid increase in population and built-up activities confirms that these areas are gradually transitioning from rural settlements into peri-urban urbanizing zones. Such transformation is mainly influenced by improved transportation infrastructure, availability of developable land, and increasing real estate activities.

One of the most important observations of the study is the strong influence of transportation infrastructure on development patterns. The upgradation of the Indore–Khandwa Highway from a two-lane road into a four-lane highway with service roads has significantly enhanced accessibility within the region. The satellite image comparison between 2015 and 2026 clearly demonstrates that development activities are rapidly concentrating along major road corridors and around highway intersections. This confirms that transportation corridors are acting as major catalysts for urban expansion and land transformation within the study area.

The comparative analysis of satellite imagery further highlights that agricultural lands and open areas are continuously being converted into residential and built-up uses. Growth points identified within the study area have witnessed significant spatial transformation over the last decade. Previously scattered settlements are now evolving into dense and compact urban forms. However, most of this development appears fragmented and uncoordinated in nature, indicating the absence of a comprehensive planning mechanism.

The study clearly shows that urban growth is occurring in a haphazard manner, particularly around highway corridors and newly developing residential pockets.

Another major finding of the study is the increasing development pressure within environmentally sensitive areas. The presence of the Ralamandal Wildlife Sanctuary and major lakes such as Bilawali Lake, Asrawad Khurd Lake, and Limbodi Lake plays a crucial role in maintaining the ecological balance of the region. To protect these environmentally sensitive features, buffer zones were delineated around the lakes and wildlife sanctuary based on planning and environmental regulations. However, the analysis revealed that considerable construction and residential development have already started taking place within the eco-sensitive buffer zones surrounding the wildlife sanctuary. This trend reflects weak development control mechanisms and poses a serious threat to the ecological sustainability of the area.

The results also demonstrate that the existing pattern of growth is largely unregulated and lacks integration with environmental considerations and future infrastructure planning. If such uncontrolled development continues, the area may face multiple urban problems in the coming years, including traffic congestion, environmental degradation, loss of agricultural land, pressure on infrastructure and services, water management issues, and inefficient land utilization. Furthermore, unplanned expansion near ecological buffers may negatively impact biodiversity, groundwater recharge systems, and the overall environmental quality of the region.

The land suitability analysis conducted using GIS-based Multi-Criteria Decision Analysis (MCDA) and Analytical Hierarchy Process (AHP) methods helped identify the most suitable zones for future development. The analysis integrated multiple parameters such as accessibility, environmental constraints, topography, infrastructure proximity, and restricted buffer zones. The resulting suitability map clearly indicates that while certain areas possess high development potential, other environmentally sensitive and restricted zones must be protected from further urban encroachment. This analysis demonstrates the importance of scientific and data-driven planning approaches in guiding future urban growth.

Based on the findings of the study, it can be concluded that the study area requires immediate planning intervention in order to control future haphazard growth and ensure

sustainable urban development. A detailed and properly structured land use plan is essential for managing future urbanization within the corridor. Such a land use plan should consider all critical factors, including environmental buffers, transportation networks, highway influence zones, proposed metro connectivity, existing development plan proposals, and future infrastructure requirements.

The study also highlights the importance of integrating proposed transportation projects, such as metro corridors and highway expansion, into the future land use planning framework. Development proposals must align with the criteria and zoning regulations defined in the existing development plan so that future growth can occur in a planned and organized manner. By considering all these factors collectively, it becomes possible to create an integrated development framework for the study area.

Therefore, the overall outcome of the study emphasizes that peri-urban areas surrounding rapidly expanding cities like Indore cannot be allowed to grow without planning control. Instead, there is a need for a comprehensive and integrated land use planning approach that balances urban growth with environmental sustainability, infrastructure efficiency, and long-term regional development goals. The preparation of a proper land use map and development proposal based on detailed spatial analysis will help guide future development in a sustainable and organized direction while minimizing the risks associated with uncontrolled urban expansion.

CHAPTER-7 PROPOSAL AND OUTCOME

7.1Population Projection

The study aims to estimate the future population of the proposed growth centre formed by combining five villages. The available census data is for the years 1991, 2001, and 2011. Based on this, population projection has been carried out for the years **2026** and **2036**.

Table 7 Combine population Data of selected area *source-census 1991,2001,2011*

Year	**Population**
1991	3,776
2001	7,617
2011	12,492

For projection, the following four standard methods have been used:

7.1.1Arithmetic Increase Method

Assumes constant increase in population.

$$P_n = P_0 + n \times I$$

7.1.2 Geometric Increase Method

Assumes growth at a constant percentage rate.

$$P_n = P_0(1 + r)^n$$

7.1.3 Incremental Increase Method

Considers increase and change in increase.

$$P_n = P_0 + nI + \frac{n(n+1)}{2}C$$

7.1.4 Exponential Growth Method

Represents continuous growth.

$$P_n = P_0 e^{rn}$$

Population Projection for 2026

Table 8 Population projection for 2026 *Source-Author*

Method	Projected Population
Arithmetic	19,029
Geometric	30,900
Incremental	20,968
Exponential	29,800

Using these methods, the population for the year 2026 has been estimated. The Arithmetic and Incremental methods result in comparatively moderate population values, whereas the Geometric and Exponential methods indicate a significantly higher growth trend as shown in table 8. This variation reflects the uncertainty and dynamic nature of population growth in the study area. Therefore, instead of relying on a single method, the average (mean) of all four methods has been considered to derive a balanced and realistic population estimate. Based on this approach, the projected population for the year **2026** is approximately **25,200.**

Population Projection for 2036

Table 9 Population projection for 2036 *Source-Author*

Method	Projected Population
Arithmetic	29,532
Geometric	46,000
Incremental	30,566
Exponential	44,500

Further, this projected population for 2026 has been used as the base to estimate the population for the year 2036. A similar methodology has been followed, where all four methods have been applied again. The results show a continued variation among the methods, with some indicating moderate growth and others suggesting rapid increase as shown in table 9. To ensure a reliable projection for planning purposes, the mean of all four methods has been taken. Accordingly, the projected population for the year **2036** is estimated to be approximately **37,650**.

This approach of using multiple methods and deriving an average value ensures that the projection remains balanced and suitable for planning a growth centre, as it avoids overestimation or underestimation that may arise from relying on a single method. The projected population figures will be further used for infrastructure planning, land use allocation, and service provision in the proposed development area.

7.2Population Density Analysis

7.2.1Density

Population density refers to the number of people living within a unit area of land. It is an important indicator used to understand the distribution of population and the intensity of land use within a region. In urban and regional planning, density helps assess land carrying capacity, infrastructure requirements, service provision, and future development potential.

Formula:

Population Density = Total Population / Total Area

7.2.2Gross Density

Gross density is calculated by dividing the total population by the total planning area. It includes all land uses within the study area, such as residential areas, commercial areas, roads, open spaces, water bodies, forests, and other non-developable lands. Gross density provides an overall measure of population concentration across the entire planning area.

Formula:

Gross Density = Total Population / Total Study Area

For the present study:

- Total Study Area = 36.40 sq.km

- Net Developable Area =26. 37sq.Km
- Projected Population (2036) = 37,650 persons

Therefore,

Gross Density = 37,650 / 26.37

= **1,428 persons/sq.km**

= **14.28 persons/hectare**

7.2.3Net Density

Net density represents the number of people accommodated within the actual developable or residential area. Unlike gross density, it excludes non-developable land and focuses on the area where population is expected to reside. Net density is considered a more accurate indicator for residential planning and infrastructure provision.

Formula:

Net Density = Total Population / Residential Area

For the proposed development:

- Net Developable Area = 26.37 sq.km
- Residential Area = 10.28 sq.km
- Projected Population (2036) = 37,650 persons

Therefore,

Net Density = 37,650 / 10.28

= **3,662 persons/sq.km**

= **36.62 persons/hectare**

Interpretation

The projected population of 37,650 persons is proposed to be accommodated within a residential area of 10.28 sq.km. Based on the calculations, the gross density of the study area is **1,428 persons per sq.km (14.28 persons per hectare)**, while the net residential density is **3,662 persons per sq.km (36.62 persons per hectare)**. The proposed density is

relatively low compared to the density standards generally adopted for urban residential development, indicating sufficient land availability for future growth and expansion. Therefore, the proposed land use plan is capable of accommodating the projected population while ensuring a sustainable and well-planned development pattern.

7.3 Proposed Land Use

As urban areas expand and populations increase, it becomes necessary to allocate sufficient land and infrastructure to meet future demands. Cities require additional spaces for housing, employment, commercial activities, education, recreation, healthcare, public utilities, and other community facilities. At the same time, urban growth must be planned carefully to ensure a balanced development pattern that supports a high quality of life, economic vitality, and environmental sustainability.

7.3.1Basis for Proposed Land use map

The proposed land use plan has been prepared through an integrated assessment of land suitability, existing statutory planning provisions, environmental constraints, and future transportation infrastructure. The Land Suitability Analysis was carried out using physical, environmental, accessibility, and infrastructure-related parameters to identify the most appropriate locations for different land uses. The Indore Development Plan–2021 was reviewed to understand the planned land use structure and development pattern within the study area. In addition, the proposed Indore Metro Route was considered to incorporate future transit-oriented development opportunities and improve regional connectivity. Environmentally sensitive areas, including the Ralamandal Wildlife Sanctuary buffer and waterbody buffer zones, have been designated as Protected and Undevelopable Zones to ensure ecological conservation and sustainable development. Areas with high accessibility and strategic location advantages, particularly near major transportation corridors and the proposed metro influence zone, have been allocated for commercial and mixed-use activities to support future economic growth. The final proposed land use structure aims to achieve a balanced, sustainable, and future-ready development pattern by integrating environmental protection, efficient land utilization, transportation connectivity, and potential growth opportunities within the peri-urban area.

7.3.2Zoning and Development

Zoning plays a significant role in urban planning by guiding city growth, controlling development intensity, and arranging land uses in an organized manner. It helps in separating incompatible activities, improving living conditions, and establishing a planned character for different parts of the city. Along with development regulations, zoning influences the availability of land and built-up spaces within different zones. Before preparing proposals for future development and land use distribution, it is essential to assess the development needs and understand the factors that influence land use patterns and population densities.

Approach towards Zoning

The primary objective of zoning is to guide urban growth and permit development in areas where it is most suitable and required. An effective zoning system should also provide flexibility to accommodate changing development needs and market conditions. Such flexibility helps reduce unnecessary restrictions on growth and allows urban development to respond more efficiently to the evolving economic and spatial trends within the city.

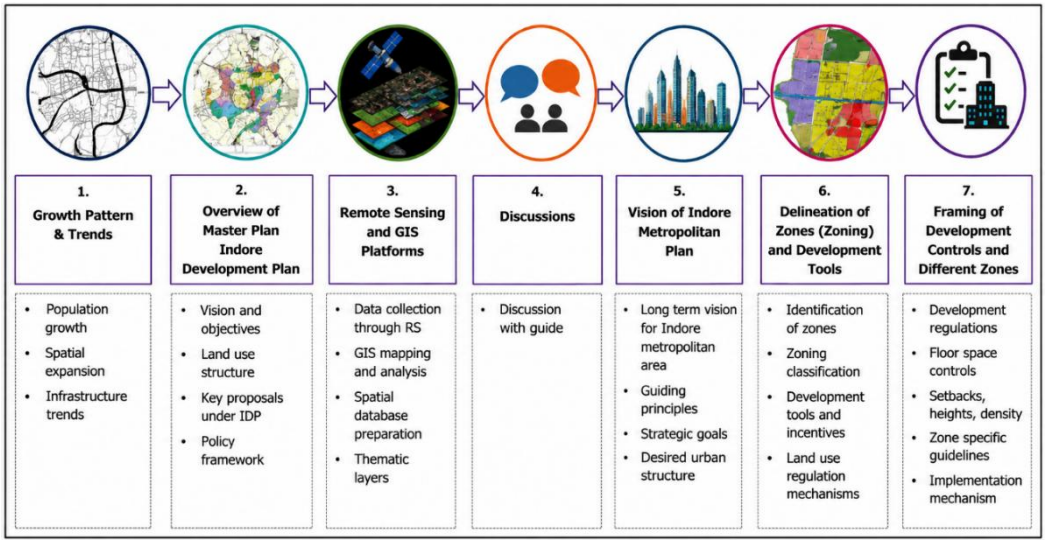


Figure 19 Planning process adopted *Source- Author*

Table 10 Land use Structure for Developable Area in Urban Centres *Source-URDPFI*

S.No.	Land Use Category	Small Cities (%)	Medium Cities (%)	Large Cities (%)	Metropolitan Cities & Megapolis (%)
1	Residential	45–50	43–48	36–39	36–38
2	Commercial	2–3	4–6	5–6	5–6

3	Industrial	8–10	7–9	7–8	7–8
4	Public & Semi Public	6–8	6–8	10–12	10–12
5	Recreational	12–14	12–14	14–16	14–16
6	Transport & Communication	10–12	10–12	12–14	12–14
7	Agriculture, Water Bodies & Special Areas	Balance	Balance	Balance	Balance
8	**Total Developed Area**	**100**	**100**	**100**	**100**

According to the UDPFI Guidelines, urban centres are categorized into Small, Medium, Large Cities, and Metropolitan Cities & Megapolis based on their population and level of urban development. Since Indore falls under the category of a Large City, the proposed land use distribution for the study area has been planned in accordance with the prescribed standards for Large Cities. The allocation of land for residential, commercial, industrial, public and semi-public, recreational, and transport-related uses has been carried out by considering the percentage distribution recommended under this category. This approach ensures that the proposed development remains balanced, functional, and suitable for the future growth requirements of the study area while maintaining proper urban planning standards.

Table 11 Land use Structure for Study area *Source-URDPFI*

Land Use Category	**Percentage (%)**	**Area (sq.km)**
Residential	36 – 39%	**10.28**
Commercial	5 – 6%	**2.27**
Industrial	7 – 8%	**2.59**
Public & Semi Public	10 – 12%	**3.16**
Recreational	14 – 16%	**3.98**

Transport & Communication	12 – 14%	**3.69**
Agriculture / Water Bodies / Special Areas	Balance	**Remaining Area**
Total Developable Area	**100%**	**26.37 sq.km**

The total study area is 36.4 sq.km, out of which 10.03 sq.km falls under restricted areas. Therefore, the net developable area is calculated as 26.37 sq.km. Based on URDPFI Guidelines for Large Cities, the land use distribution has been proposed for residential, commercial, industrial, recreational, public-semi public and transportation uses.

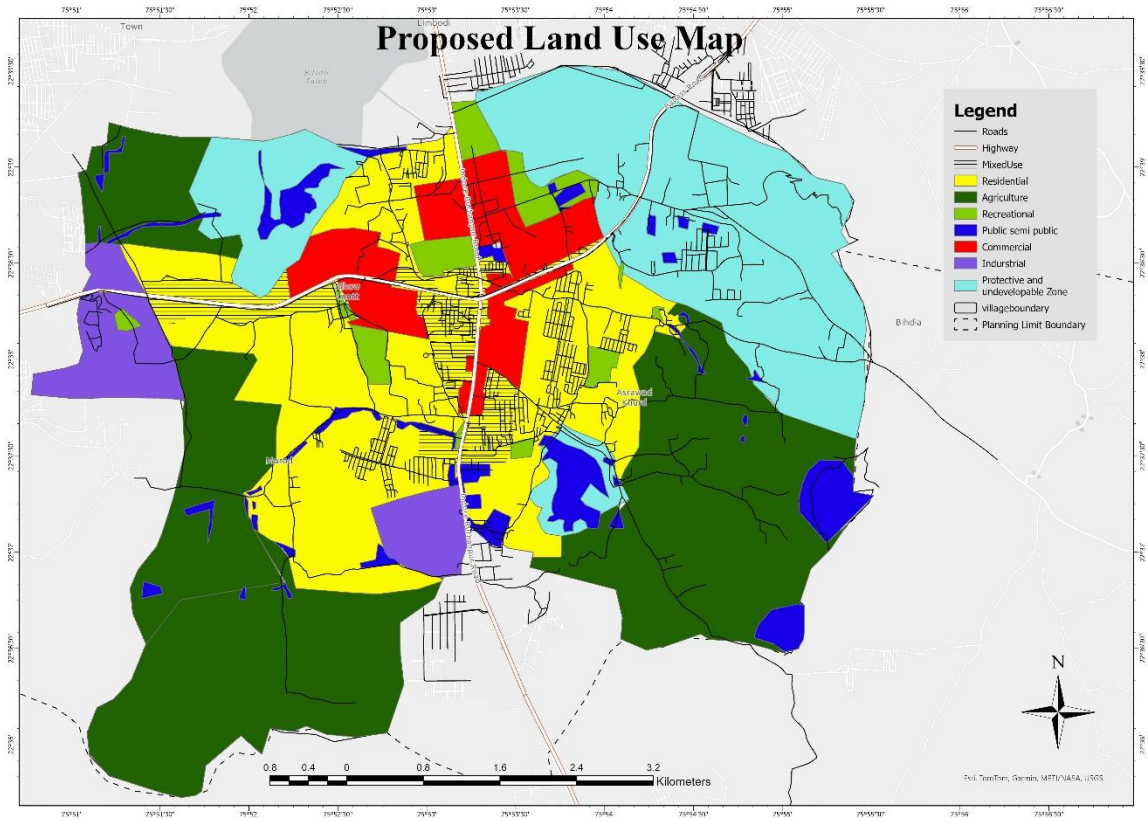


Figure 20 Proposed Land use map *Source-Author*

The proposed land use map for the study area has been prepared on the basis of the previously conducted Land Suitability Analysis. Different physical, environmental, accessibility, infrastructure, and development-related parameters were considered during the suitability assessment to identify the most appropriate locations for various land use

activities. The zoning pattern has been proposed in such a way that it ensures balanced urban growth, functional efficiency, environmental sustainability, and future development potential within the study area.

Based on the suitability analysis, areas having high suitability values and better accessibility were considered appropriate for commercial and mixed-use development. Special attention was given to the major highway intersection within the study area, where two important highways intersect and a proposed metro corridor is expected to pass in the future. Considering the future growth potential and transit-oriented development opportunities around this junction, the commercial area has been increased by approximately 1 sq.km beyond the standard distribution. The intention behind this proposal is to develop the area as a future commercial and activity hub, supported by high accessibility, increasing land values, and anticipated economic growth. Therefore, the surrounding areas of the proposed metro corridor and highway intersection have been allocated predominantly for commercial and mixed-use activities to ensure compact, efficient, and economically vibrant urban development.

The restricted and environmentally sensitive areas identified during the suitability analysis have been designated as Protected and Undevelopable Zones in order to conserve natural features and restrict unsuitable development activities. These areas are preserved to maintain ecological balance, environmental quality, and long-term sustainability within the planning area.

Areas with moderate suitability values were primarily proposed for residential development. These locations provide comparatively better living conditions, accessibility to infrastructure, and compatibility with surrounding land uses. The residential zones have been distributed in a manner that ensures proper connectivity with commercial, recreational, and public facilities while maintaining balanced urban growth.

Industrial zones have been carefully located away from protected and environmentally sensitive areas to minimize negative environmental impacts. At the same time, industries have been proposed along major highway corridors to ensure efficient transportation, logistics movement, and regional connectivity. This approach helps in reducing traffic conflicts within residential areas while supporting economic and industrial growth.

The areas having low suitability values for urban development were largely retained under agricultural use. Preserving these agricultural lands helps in maintaining the existing rural character, open spaces, and ecological stability of the region. It also prevents unnecessary urban sprawl into less suitable areas.

Overall, the proposed land use structure has been prepared through a scientific and suitability-based planning approach. The proposal aims to achieve sustainable urban development by integrating transportation infrastructure, environmental conservation, future growth potential, and efficient land utilization within the study area.

7.4 Infrastructure Requirement for 2036

These infrastructure facilities have been proposed for the study area to meet the requirements of the projected population by the year 2036.
The provisions are based on standard planning norms to ensure adequate and balanced development of services. All the facilities have been derived in accordance with URDPFI Guidelines (Volume II).

7.4.1Health Facilities

Table 12 Required Health Facilities *Source-URDPFI VOL. II*

Facility	Norm (Population)	Required Units	Area per Unit	Total Area
Dispensary	15,000	3	0.08–0.12 Ha	~0.30 Ha
Nursing Home	45,000	Not required (near threshold)	—	—
Polyclinic	1 lakh	Not required	—	—
Family Welfare Centre	50,000	1 (future provision)	500–800 sqm	~0.06 Ha

7.4.2 Socio-Cultural Facilities

Table 13 Required Socio-Cultural Facilities *Source-URDPFI VOL.II*

Facility	Norm	Required	Area	Total Area
Anganwadi	5,000	8	200–300 sqm	~0.20 Ha
Community Room	5,000	8	750 sqm	~0.60 Ha
Community Hall	15,000	3	2000 sqm	~0.60 Ha
Recreational Club	1 lakh	Not required	—	—

7.4.3 Recreational / Green Spaces

Table 14 Required Recreational / Green Spaces *Source-URDPFI VOL.II*

Facility	Norm	Required	Area	Total Area
Housing Area Park	5,000	8	0.50 Ha	4.0 Ha
Neighbourhood Park	15,000	3	1.0 Ha	3.0 Ha
Community Park	1 lakh	Not required	—	—

7.4.4 Safety & Security

Table 15 Required Safety & Security *Source-URDPFI VOL.II*

Facility	Norm	Required	Area	Total Area
Police Post	40,000–50,000	1	0.16 Ha	0.16 Ha
Fire Station	2 lakh / 5–7 km radius	1	1.0 Ha	1.0 Ha

7.4.5 Commercial Facilities

Table 16 Required Commercial Facilities *Source-URDPFI VOL.II*

Facility	Norm	Required	Area	Total Area
Convenience Shopping	5,000	8	1,500 sqm	~1.20 Ha
Local Shopping Centre	15,000	3	4,600 sqm	~1.38 Ha
Community Centre	1 lakh	Not required	—	—

7.5 Physical Infrastructure

7.5.1 Water Supply

The main aim of a public water supply system is to provide safe and potable water in sufficient quantity, in a convenient and cost-effective manner. However, increasing urbanisation has led to a significant rise in water demand, placing considerable pressure on existing resources. Therefore, while planning a water supply system, it is important to incorporate water conservation measures. This can be achieved through efficient utilisation of available water sources, minimising losses and wastage, and adopting appropriate demand management strategies.

Table 17 Water Supply Standards *Source: CPHEEO Manual, 1999.*

S. No.	Classification of Towns/Cities	Recommended Maximum Water Supply (LPCD)
1	Towns with piped water supply but without a sewerage system	70
2	Cities with piped water supply where a sewerage system exists or is proposed	135
3	Metropolitan and mega cities with piped water supply where a sewerage system exists or is proposed	150

7.5.1 Water demand

The estimation of water demand for the study area has been carried out based on the projected population for the years 2026 and 2036. Standard norms recommended by the CPHEEO Manual as shown in table 15 have been adopted for calculating domestic, institutional, and other associated demands.

1. Water Demand for the Year 2026

Projected Population (2026): 25,200

i. Domestic Demand (135 LPCD):
25,200 × 135 = 3.40 MLD

ii. Institutional & Commercial Demand (15% of domestic):
0.51 MLD

iii. Subtotal:
3.40 + 0.51 = 3.91 MLD

iv. Losses and Wastage (15%):
0.59 MLD

v. **Total Average Daily Water Demand**:
3.91 + 0.59 = **4.50 MLD**

2. Water Demand for the Year 2036

Projected Population (2036): 37,650

i. Domestic Demand (135 LPCD):
37,650 × 135 = 5.08 MLD

ii. Institutional & Commercial Demand (15% of domestic):
0.76 MLD

iii. Subtotal:
5.08 + 0.76 = 5.84 MLD

iv. Losses and Wastage (15%):
0.88 MLD

v. **Total Average Daily Water Demand**:
5.84 + 0.88 = **6.72 MLD**

Fire Fighting Water Demand

Fire demand has been estimated using the CPHEEO empirical formula:

$Q = 100 \sqrt{P}$

Where Q is the fire demand in litres per minute and P is the population.

- **For 2026:**
  Q = 15,870 L/min
- **For 2036:**
  Q = 19,400 L/min

It is important to note that fire demand is not a continuous daily requirement. It is considered separately for emergency situations and is primarily used for designing the distribution system, storage capacity, and fire-fighting infrastructure.

The total average daily water demand is estimated to be **4.50 MLD for 2026** and **6.72 MLD for 2036**, excluding fire demand. In addition, fire-fighting requirements of **15,870 L/min (2026)** and **19,400 L/min (2036)** have been considered separately for system design and emergency storage planning.

Land requirement for Water Supply System

Identification of land for water infrastructure is an essential parameter. It is necessary to earmark land for Water Treatment Plant (WTP) in Development Plans. Also land for ove rhead reservoirs, pumping stations should be marked at the zonal level or local area plan level. However land requirement may vary based on the capacity of WTPs and up-gradation of technology. Below is the table, which recommends land requirement based on different capacity. (*URDPFI Guidelines*, 2018)

Table 18 Recommended land Requirement based on capacities *Source: CPHEEO Manual, 1999*

S. No.	Identified Capacity	Land Requirement (Hectares)
1	5 MLD	0.10
2	10 MLD	0.19
3	50 MLD	0.93
4	100 MLD	1.87
5	200 MLD	3.73

6	500 MLD	9.34

The capacity of the proposed water treatment plant has been considered as 10 MLD based on standard planning practice,. As shown in table 16. CPHEEO guidelines, the land requirement for a 10 MLD treatment plant is approximately 0.19 hectares.

In addition, an area of 0.63 hectares has been allocated for staff quarters and associated facilities. Therefore, the total land required for the proposed water treatment plant is estimated to be approximately **0.82 hectares.**

7.5.2 Sewage Generation

The estimation of sewage generation for the study area has been carried out based on the projected population for the design year 2036. As per standard practice and CPHEEO guidelines, it is generally assumed that about 80% of the total water supplied returns as wastewater.

For the year 2036, the total average daily water demand has been estimated to be 6.72 MLD. Accordingly, the sewage generation is calculated as follows:

- Sewage Generation (80% of water demand):
  $0.80 \times 6.72 = 5.38$ MLD

Thus, the total sewage generated in the study area for the year 2036 is estimated to be approximately 5.38 million litres per day (MLD).

For planning and design purposes, a higher value is generally adopted to account for infiltration and inflow within the sewerage system. Therefore, the design sewage flow is considered to be approximately **6 MLD**.

Sewage Treatment Plant (STP) Capacity and Land Requirement

Based on standard planning practice, the capacity of the proposed Sewage Treatment Plant (STP) is taken as 10 MLD, i.e., the next higher standard capacity above the calculated sewage flow.

As per CPHEEO guidelines, the land requirement for an STP of 10 MLD capacity is approximately 0.8 to 1.0 hectares, depending on the treatment technology adopted.

For the present study, a provision of **1.0 hectare** of land is considered adequate to accommodate treatment units, sludge handling facilities, internal roads, green buffer, and future expansion.

7.6 Infrastructure Land Requirement

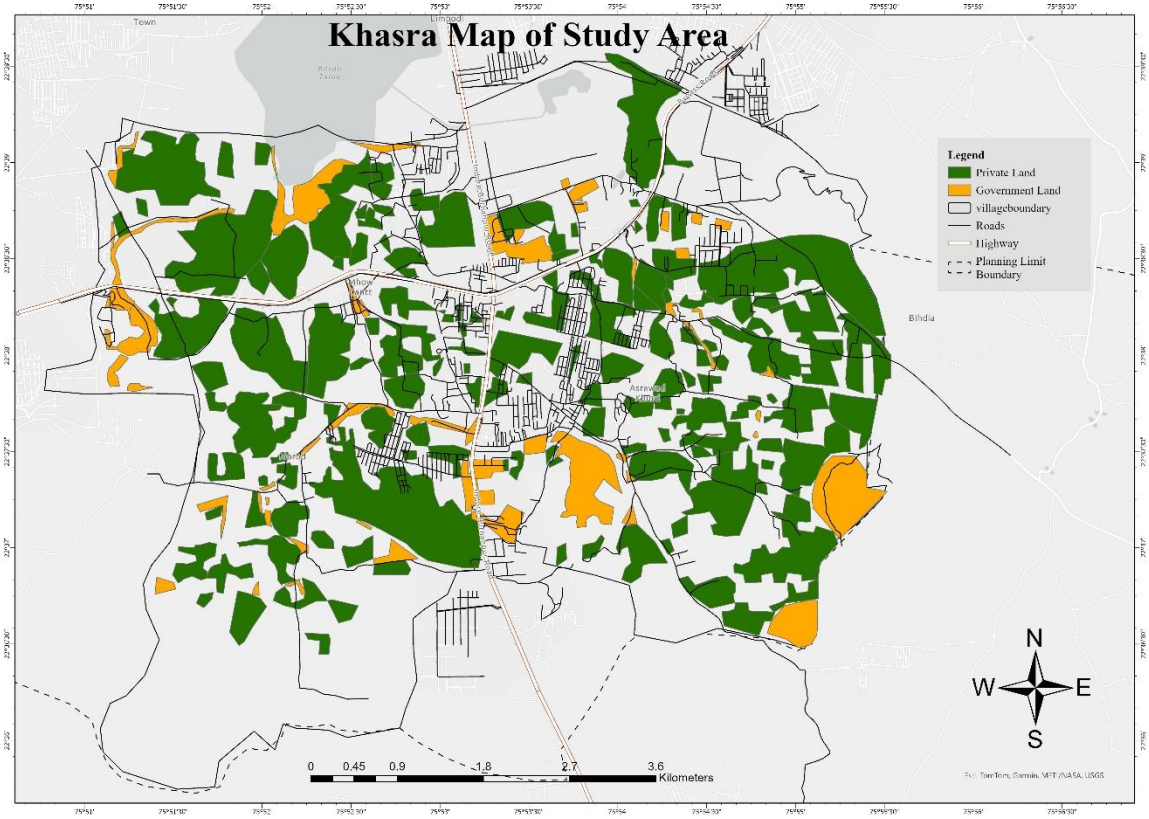


Figure 21 Khasra Map of study area So urce- Author ,MP bhuelekh

The Khasra map of the study area as shown in fig.19 represents the land ownership pattern within the total area of **36.4 sq.km**. The dark green areas indicate privately owned land, which constitutes approximately **14.56 sq.km**, forming a significant portion of the study area. The dark orange areas represent government-owned land, covering around **2.56 sq.km**. The remaining land parcels, which are not highlighted in the map, represent unrecorded or unlinked land where cadastral information is either unavailable or not yet defined. This distribution highlights that a large portion of the land is under private ownership, while government land is comparatively limited, making it a critical resource for future planning and infrastructure development.

The total land requirement for infrastructure in the study area has been assessed based on standard URDPFI and CPHEEO guidelines. The cumulative land required for social infrastructure, including health, socio-cultural, recreational, safety, and commercial facilities, is estimated to be approximately 12.50 hectares. In addition, physical infrastructure comprising the water treatment plant (0.82 hectares) and sewage treatment plant (1.00 hectare) requires about 1.82 hectares. Therefore, the overall land requirement for all proposed infrastructure facilities, including water supply and sewerage systems, is approximately **14.32 hectares**. This is significantly lower than the available government land of 2.56 square kilometres (256 hectares), indicating that the study area has ample land to accommodate all proposed developments along with provisions for future expansion.

7.6.3 Development Norms

S. No.	Road Width	Minimum Plot/Land Size (sq.m.)	Frontage (m)	FAR	Ground Coverage (%)	Building Height (m)	M.O.S. Front Side (m)	M.O.S. Sides/Rear (m)
1	30 m and above	2500	30 m	1:2.25	30	Up to 45 m	15.0 m	7.5 m
2	36 m and above	3000	40 m	1:2.50	30	Up to 60 m	18.0 m	9.0 m
3	45 m and above	3500	45 m	1:2.75	30	Up to 75 m	21.0 m	9.0 m
4	60 m and above	4000	50 m	1:3.0	30	Up to 90 m	24.0 m	10.0 m
5	75 m and above	4500	60 m	1:3.0	30	Above 90 m	30.0 m	12.0 m

Table 19 DEVELOPMENT NORMS FOR PLOTS *Source-M.P. Bhumi Vikas Rules, 2012*

1. In commercial use premises of planning areas, the authority may allow maximum FAR of 1:5.0 through utilization of TDR FAR and Premium FAR for serial no. 4 and 5 mentioned in above table.

2. In commercial use premises under Central Business District and Transit Oriented Development Corridor, the authority may allow maximum FAR of 1:7.0 through utilization of TDR FAR and Premium FAR for serial no. 5 mentioned in above table. Central Business District and Transit Oriented Development Corridor shall be as mentioned in respective development plan.

3. The rate of premium FAR shall be as may be decided by the State Government.

Norms for Information Technology

1. Land required for plot :- Minimum area of plot shall be 3000 sq.m.
2. Information Technology (Investment) Planning Area :- Such area shall be termed as Information Technology Investment Area which bears a minimum area of 2 Hectare (5 acre) and such area which shall be notified by Science and Technology Department, Madhya Pradesh Government.
3. Floor Area Ratio (FAR):- Plots for Information and Technology, and in Information and Technology Investment Area shall have maximum FAR of 1:2.50 or maximum FAR permissible in the relevant development plan, whichever is higher

Norms for Industrial Plots

Table 20 Norm for Industrial Plots *Source-M.P. Bhumi Vikas Rules, 2012*

Sr. No.	Minimum Plot Area	Max. Ground Coverage (%)	Front MOS (m)	Side/Side MOS (m)	Rear MOS (m)	Max. FAR
1	Upto 0.045 Hect.	60	3.20	2.10 / 2.10	2.10	1.25
2	More than 0.045 Hect. and upto 0.10 Hect.	60	4.50	3.00 / 3.00	3.00	1.25
3	More than 0.10 Hect. and upto 0.20 Hect.	60	7.50	3.75 / 3.75	4.50	1.00

4	More than 0.20 Hect. and upto 0.50 Hect.	60	9.00	4.50 / 4.50	4.50	1.00
5	More than 0.50 Hect. and upto 0.75 Hect.	60	12.00	6.00 / 6.00	6.00	1.00
6	More than 0.75 Hect. and upto 1.00 Hect.	60	15.00	7.50 / 7.50	7.50	1.00
7	More than 1.00 Hect. and upto 1.25 Hect.	60	18.00	9.00 / 9.00	9.00	1.00
8	More than 1.25 Hect. and upto 2.00 Hect.	60	21.00	10.50 / 10.50	10.50	1.00
9	More than 2.00 Hect.	60	24.00	12.00 / 12.00	12.00	1.00

Outcome of the Study

The outcome of this study is the development of an integrated understanding and planning framework for identifying and managing potential growth points in peri-urban areas. The research successfully demonstrates that peri-urban regions are not merely transitional fringe spaces, but highly dynamic zones influenced by continuous interaction between urban expansion and rural transformation. Through literature review, theoretical analysis, case studies, and spatial assessment, the study establishes that peri-urban growth is primarily driven by connectivity, infrastructure development, industrial influence, economic opportunities, and accessibility to urban centers. At the same time, the research highlights that the absence of proper planning and governance in these regions leads to unregulated land conversion, infrastructure deficiencies, environmental stress, and fragmented development patterns.

One of the major outcomes of the study is the identification of measurable parameters that can be used to recognize potential growth points in peri-urban regions. Parameters such as proximity to highways and transport corridors, industrial and commercial influence, land availability, population growth, infrastructure potential, land-use transformation, and

environmental suitability were systematically analyzed and converted into a practical evaluation framework. This framework provides a structured approach for planners and development authorities to identify future urban expansion zones before uncontrolled growth takes place.

The study also produced a detailed assessment of the peri-urban region of Indore, where multiple villages and gram panchayats were analyzed as emerging growth points likely to experience urbanization over the next 10 to 20 years. Using spatial analysis, topographic assessment, buffer analysis, and land suitability mapping, the research identified areas with high development potential and examined the opportunities and constraints associated with future growth. Based on projected population trends for 2036, infrastructure requirements related to healthcare, water supply, sewage, recreational facilities, commercial areas, and social infrastructure were estimated to support planned urban expansion.

Another important outcome of the research is the preparation of a proposed land-use and development strategy for the selected study area. The study demonstrates how peri-urban growth can be guided through zoning regulations, infrastructure planning, and integrated regional development approaches rather than allowing haphazard expansion. It emphasizes that future urban development should extend beyond municipal boundaries and include peri-urban areas within the formal planning framework to ensure balanced and sustainable regional growth.

Overall, the study concludes that peri-urban growth points have strong potential to function as future urban nodes if supported through proper infrastructure, coordinated governance, and sustainable planning interventions. The research provides a planning-oriented model that can assist policymakers, urban planners, and development authorities in managing peri-urban transformation more effectively while minimizing environmental degradation, infrastructure imbalance, and unplanned urban sprawl

Conclusion-

The study on **"Dynamics of Peri-Urban Area – An Integrated Approach for Potential Growth Points"** highlights the rapidly transforming nature of peri-urban regions and emphasizes the urgent need for planned and integrated development strategies in these transitional spaces. The research was undertaken with the understanding that peri-urban areas are no longer simply rural fringes of cities, but dynamic zones where urban and rural systems continuously interact, overlap, and reshape one another. These areas are becoming the primary directions of future urban expansion, especially in rapidly growing Indian

cities, yet they remain among the least planned and least regulated regions within the urban development framework.

The study initially identified the fundamental problems associated with peri-urban growth in India. One of the major issues observed was the absence of effective planning control in fringe areas lying outside municipal boundaries but within the influence zone of cities. Due to weak governance structures and overlapping jurisdictions between municipal bodies and gram panchayats, development in these regions often takes place without proper zoning regulations, infrastructure planning, or environmental safeguards. Agricultural land gets rapidly converted into residential, commercial, and industrial uses without long-term spatial vision. This results in fragmented land-use patterns, haphazard construction, poor infrastructure provision, traffic congestion, environmental degradation, and increasing pressure on natural resources. The study also found that infrastructure development in peri-urban areas usually lags behind population growth, creating disparities in access to water supply, sanitation, drainage, transportation, healthcare, and public amenities. These issues collectively reduce the quality of life and create unsustainable urban expansion patterns.

Another important problem identified through literature review and case studies was the lack of a structured framework to identify and manage potential growth points in peri-urban regions. Although cities continue to expand outward, growth often occurs randomly along highways, industrial corridors, and transport routes without strategic planning intervention. The absence of predictive planning mechanisms results in uncontrolled sprawl rather than organized urban growth. This highlighted the need for an integrated approach capable of identifying those peri-urban settlements that possess the highest development potential and can function as future urban growth nodes.

To understand these dynamics comprehensively, the study first established a conceptual understanding of urban areas, rural areas, peri-urban regions, and growth points using URDPFI Guidelines (2014), regional planning theories, and existing scholarly literature. The research explained how peri-urban areas differ from conventional rural and urban settlements due to their mixed land-use character, transitional economy, and rapidly changing socio-spatial structure. The study also explored the increasing interdependency between urban and rural areas, demonstrating how cities depend on rural regions for land, labor, resources, and ecosystem services, while rural areas depend on urban centers for employment, markets, infrastructure, and services. This rural–urban relationship was identified as one of the key drivers behind peri-urban transformation.

The theoretical foundation of the research was strengthened through the study of Central Place Theory, Growth Pole Theory, and Spread and Backwash Effect Theory. These theories helped explain how economic activities, infrastructure investment, and regional connectivity influence the emergence of growth nodes and shape spatial development patterns. The study concluded that peri-urban growth points generally emerge where strong transport connectivity, industrial influence, economic opportunities, and land availability coexist. Such areas attract population inflow, real estate development, commercial activities, and infrastructure expansion, eventually transforming into future urban centers. Based on these observations, the study developed a parameter-based framework for identifying potential growth points. The parameters included connectivity and accessibility, proximity to highways and transport corridors, industrial and economic influence, population growth trends, land-use transformation, infrastructure availability, governance structure, environmental suitability, and development potential. These parameters were categorized into broader themes to create a systematic evaluation framework that could be applied in real-world planning practice. The research emphasized that peri-urban growth cannot be managed effectively through isolated approaches and instead requires integrated planning combining spatial analysis, governance coordination, infrastructure planning, and environmental management.

The second phase of the study focused on applying this framework to the peri-urban region of Indore, which was selected due to its rapid urban expansion, strong economic growth, and increasing pressure on surrounding rural settlements. Indore represents one of the fastest-growing urban regions in Madhya Pradesh and exhibits intense peri-urban transformation driven by industrialization, trade, transportation development, and real estate expansion. The study identified multiple gram panchayats around Indore that are likely to emerge as urban growth points over the next 10 to 20 years. These settlements were analyzed based on their population, location, accessibility, and development potential.

Detailed spatial analysis was carried out using data collection, mapping, topographic analysis, buffer analysis, and land suitability analysis. The study examined physical features, transport corridors, environmental constraints, and growth patterns to understand which areas possess the highest potential for future urban development. Infrastructure requirements for the projected population of 2036 were also estimated, including healthcare facilities, socio-cultural infrastructure, recreational spaces, commercial

facilities, water supply systems, sewage generation, and physical infrastructure requirements. Based on these projections, proposed land-use zoning and development norms were prepared to guide future growth in a structured and sustainable manner.

The study ultimately concludes that peri-urban areas should not be treated as neglected peripheral zones but rather as strategic spaces capable of supporting balanced regional development. If properly planned, peri-urban growth points can function as organized urban extensions that absorb future population growth while reducing pressure on core city areas. However, without timely intervention, these same areas may continue to experience uncontrolled sprawl, environmental degradation, and infrastructure deficits. Therefore, integrated planning becomes essential to ensure that future growth remains inclusive, sustainable, and spatially efficient.

The research further concludes that planning for peri-urban regions must go beyond conventional municipal boundaries and adopt a regional perspective. Coordination between urban local bodies, gram panchayats, development authorities, and infrastructure agencies is necessary to manage growth effectively. The integration of GIS-based spatial analysis, predictive modeling, land suitability assessment, and participatory planning can significantly improve decision-making processes and help planners identify priority growth corridors before uncontrolled development takes place. Infrastructure investment must also be phased alongside urban expansion to avoid future service gaps and social inequalities.

In the context of the selected study area around Indore, the proposed approach demonstrates how peri-urban settlements can be systematically evaluated and incorporated into future urban planning frameworks. By identifying emerging growth points, analyzing their strengths and constraints, and proposing infrastructure and land-use strategies, the study provides a practical model for managing peri-urban transformation in rapidly growing Indian cities. The research therefore contributes not only to the academic understanding of peri-urban dynamics but also offers a planning-oriented framework that can support policy formulation, regional development strategies, and sustainable urban expansion in the future.

Annexure

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