Land Use Dynamics in The Periphery of Gondia Municipal Area: Impacts of Urbanization and Agricultural Modernization

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Abstract

Urbanization and advancements in agricultural techniques have significantly reshaped land use patterns around urban peripheries worldwide. This literature review explores the dynamic interplay between urban expansion and agricultural practices in the periphery of Gondia Municipal Area, India. Rapid urban growth, fueled by demographic shifts and economic activities, has exerted pressure on surrounding agricultural lands, altering traditional farming practices and land use configurations. Concurrently, innovations in agricultural technologies, including mechanization, irrigation methods, and crop diversification, have influenced land productivity and management strategies. The review synthesizes empirical studies, theoretical frameworks, and policy analyses to elucidate the multifaceted impacts of urbanization and agricultural modernization on land use dynamics. Key themes include changes in land cover, agricultural intensification, environmental implications, and socio-economic consequences for local communities. By examining these dynamics, the review aims to provide insights into sustainable land use planning and management strategies amidst urban expansion and agricultural transformation in peri-urban areas like Gondia.

Keywords – Urbanization, Land use dynamics, Agricultural modernization, Peri-urban areas, Land cover change

Introduction

Considering land resources are crucial in deciding how far humanity gets in terms of economics, society, culture, and the environment, studying land usage and cover is crucial. Physiological, socioeconomic, and geographical variables consistently define and shape a region's land use and cover. The scientific and technical advances of the previous 40 years have caused a sea shift in land/cover utilisation. Engineers place a premium on research on shifts in land use and land cover. Massive environmental damage has occurred as a result of the exponential rise of the human population. By 2025, experts predict that the global population will have surpassed 10 billion. It has already surpassed 7 billion. One may easily see the catastrophic effects that the increasing human influence on the planet's ecosystems will bring about. In cities, man has transformed the most fundamental resources—land, air, creatures, and water—and this has had the most profound effect on nature. The ability of humans to initiate controlled changes in their environment is shown by cities. The interplay between man, his creations, and the natural world is intricate in these freshly formed ecosystems. As urban areas expand in the contemporary era, the level of complexity increases. By the end of the century, almost 6 billion people were living in emerging nations, and experts predict that this urbanisation trend will only speed up.

To make use of data collected by distant sensors, we lay out the basic structure of a nationwide system for classifying land uses and land covers. The categorization system was created to address the requirements of federal, state, and local entities that need a current picture of land cover and usage throughout the nation. The suggested approach is open to data from distant sensors on aeroplanes and satellites, and it has consistent classification at the first and second levels, which are more generic. Features of popular, already-in-use categorization systems that can handle data from remote sensing sources are included into the suggested system. The purpose of keeping it open-ended is to give federal, state, and local agencies some leeway in creating third- and fourth-level land use classifications that are more specific to their needs while still being compatible with the national system.

Like any contemporary enterprise, a contemporary country needs sufficient data on a wide range of interconnected areas of its developmental endeavours before it can make informed judgements. Land use is one of these factors, but understanding land use and cover is crucial for the country's future in light of the many challenges it faces, including social, economic, cultural, and environmental ones, such as the degradation of our natural resources, the elimination of vital wetland areas, the eradication of prime agricultural land, and the extinction

of many species of animals. In order to enhance or sustain existing living conditions and standards, land use data is necessary for the investigation of environmental processes and issues. In addition to bringing about economic and cultural growth, urbanisation has brought about several diseases and sufferings to humanity. Because of the demands of urbanisation, most cities are expanding rapidly, sometimes even beyond their designated boundaries. A quarter of a city's population lives in its unplanned areas, where accurate spatial data is lacking due to an absence of current maps. Knowledge of current land use patterns as well as historical trends in land use is essential for optimising land use. For better transportation and utility demand projections, future development pressure point identification, and overall development plan implementation, national, state, and local planners, lawmakers, and officials at all levels of government require accurate data on the current distribution and area of such agricultural and urban lands, as well as information on their changing proportions. Having up-to-date, precise, and relevant information on land usage is crucial, according to Clawson and Stewart (1965). For purposes such as water resource inventory, flood management, water supply planning, wastewater treatment, and more, data on land use and land cover are also required by federal, state, and municipal authorities. In order to enhance the administration of public lands, several national agencies need up-to-date, complete inventories of the activities taking place on public lands as well as the uses of nearby private properties, both present and evolving. To manage wildlife resources and minimise human-wildlife ecosystem conflicts, to formulate national policies based on national summaries of land use patterns and changes, to prepare environmental impact statements and assess future impacts on environmental quality, and to assess the environmental impact resulting from the development of energy resources, national agencies also require land use data.

Factors in the natural environment, including soil type, weather, terrain, and flora, clearly limit land usage. Land is a scarce resource that is essential for many human endeavours, such as farming, manufacturing, forestry, energy generation, habitation, leisure, and water storage and catchment. A growing economy has often gone hand in hand with the expansion of land holdings, as land is an essential component of industry. All sorts of environmental damage may be traced back to inappropriate land use. According to Balak Ram and Kolarkar (1993), land usage is the result of complex interplay between a society's cultural heritage, physical requirements, and the land's inherent potential. A region's land use and cover pattern is the product of human activity over time and geography, as well as environmental and socioeconomic variables. The tremendous agricultural and population pressures are making land a precious commodity. Therefore, in order to choose, organise, and execute land use schemes that can satisfy the growing demands for fundamental human requirements and welfare, data on land usage/cover and potential for their best use is crucial. Massive swaths of land have become wasteland due to an unfavourable bioclimatic climate and an increase in human activities. An essential function of remote sensing satellites is to collect data on the most up-to-date land use/cover pattern in a given region, as well as how this pattern has changed over time. Given the digital nature of the data, it may be included into a Geographical Information System (GIS) to provide an appropriate framework for data analysis, updates, and retrieval. Using digital satellite data from IRS-1C and Toposheet No.64c/3, this research aimed to assess the current state of land use/cover in the Gondia area on a scale of 1:16,000.

NECESSITY FOR STANDARDIZATION

Land data has been collected for some time by agencies at various levels of government, but they have mostly operated independently and without collaboration. The result has been the need to repeat efforts much too often. Existing land use and land cover, as well as changes in these areas, may be found in a variety of sources. The detailed and monitored data collected during ground surveys is used by local planning bodies. There has also been extensive use of the interpretation of large-scale aerial photos (Avery, 1968).

Value connections, construction permits, and other comparable data may sometimes be used to infer further information. The use and understanding of the available data are the primary areas where issues arise. Incomplete data coverage, data that is susceptible to change in age, categorization systems that do not match, and source agencies that alter their definitions of

categories and data collection techniques are all examples of such issues. More and more, the need for comparable collaboration in land use inventories is being highlighted by recent advances in data processing and remote sensing technologies. The immediate prerequisites include the creation and authorization of a system to categorise land use data mostly derived from remote sensing methods, while still being compatible with current categorization systems. Using aerial images captured in the late 1930s and early 1940s, Francis J. Marschner started mapping significant land use associations for the whole US in the mid-1940s. Using aerial photo mosaics, Marschner created a series of state land use maps at a scale of 1:1,000,000 and a map of significant land uses at a scale of 1:5,000,000 (Marschner, 1950).

The use of traditional aerial photography and other remote sensing methods may effectively integrate surveys derived from ground observation and inventory, opening the door to the possibility of a precise and up-to-date inventory of the nation's land resources. Simultaneously, data processing methods provide the storing of vast amounts of precise data that may be structured in many ways by need. Use and demand patterns for resources are dynamic and ever-changing. The good news is that new developments in remote sensing technology, interpretive methods, and data processing have increased the possibility of collecting data on land uses associated with resource development (National Academy of Sciences, 1970).

CONCEPTUALISING A CLASSIFICATION SYSTEM FOR APPLICATION WITHOUT TERMINAL SENSING

Neither land use nor land cover can be neatly categorised, and it seems doubtful that such a system will ever emerge. Classification, even when approached using an objective numerical method, is inherently subjective due to the many viewpoints involved. Since land use and land cover patterns fluctuate in response to demands for natural resources, it is illogical to assume that a single comprehensive inventory would be sufficient for an extended period of time. Most users will be happy with an inventory that satisfies most of their demands as each categorization is designed to fit their needs. It is necessary to set certain assessment criteria and rules before developing a categorization system for use with remote sensing methods. This will ensure that the system can meet the demands of the majority of users. First, people have different ideas about what counts as land use, but everyone agrees that the current use of land is an important factor in planning and management. The idea that "man's activities on land which are directly related to the land" constitute land use is a valid and worthwhile one (Clawson and Stewart, 1965). “The vegetation and artificial constructions covering the land surface” (Burley, 1961) is what land cover refers to. Classification systems for land capability, susceptibility to specific management practices, and potential for any given activity or intrinsic or speculative land value can all be connected to the land use and land cover categories offered in this report.

The terms land cover and land use activities have often been used interchangeably due to their close relationship (Anderson, 1976). Forest, agricultural, residential, and industrial cover types are often related with the uses of a given piece of land. Devices that create images using remote sensing do not capture actions in a direct manner. The remote sensor gathers data that depends on a number of land surface properties, such as the presence or absence of man-made or natural cover. The interpreter extracts information about land use activities from what is essentially data on land cover by analysing patterns, tones, textures, forms, and site associations.

Nevertheless, there is no clear correlation between the kind of land cover and certain human activities. Remote sensor data is not well suited for interpreting leisure activities that span vast areas of land. Partially determined by the size and resolution of the initial data source (e.g., remote sensors) used to identify and interpret the land use is the minimal area that may be shown as belonging to any given land use category. Both the initial data collection size and the ultimate display scale of the land use data have a role (Sreenivasulu and Bhaskar, 2010). It is challenging to depict any unit area smaller than 0.10 inch (2.54mm) on a side when maps are intended as the medium for conveying land use data. Also, the map reader has trouble seeing tiny regions. In a similar vein, the smallest possible computer printing size limits the use of computer-generated visuals.

Objectives of the study

- To Assess Changes in Land Use Patterns: Investigate how urbanization has influenced

the conversion of agricultural land and natural habitats in the periphery of Gondia Municipal Area.

- To Examine Agricultural Modernization: Analyze the adoption of new agricultural technologies and practices in response to urban expansion, and their implications for land productivity and environmental sustainability.
- To Evaluate Environmental Impacts: Assess the environmental consequences of changing land use patterns, including effects on biodiversity, water resources, and soil quality.

Research methodology

The research methodology employed for studying land use dynamics in the periphery of Gondia Municipal Area, focusing on the impacts of urbanization and agricultural modernization, integrates both quantitative and qualitative approaches. Quantitatively, the study utilizes remote sensing techniques and geographic information system (GIS) mapping to analyze changes in land cover and land use patterns over a specified period. This involves acquiring satellite imagery to track urban expansion, agricultural intensification, and changes in natural landscapes. Additionally, quantitative data is gathered through structured surveys distributed among landowners and residents to assess perceptions of urban growth, agricultural practices, and socio-economic impacts. Qualitatively, the research employs semi-structured interviews and focus groups with key stakeholders such as farmers, urban planners, and local authorities to explore in-depth perspectives on policy impacts, community responses, and environmental concerns. The qualitative data complements the quantitative findings, providing a holistic understanding of how urbanization and agricultural modernization interact with local contexts in shaping land use dynamics. Ethical considerations include obtaining informed consent from participants, ensuring data confidentiality, and adhering to ethical guidelines throughout the research process. This mixed-methods approach aims to yield comprehensive insights into sustainable land use planning and management strategies in peri-urban areas like the periphery of Gondia Municipal Area.

Discussion

This research will focus on the Gondia urban complex. Fulchur village was the principal community until the end of the 19th century, when Gondia was a little hamlet. The first development of Gondia town was the laying of the wide gauge railway line between Nagpur and Bengal in 1905 and the small gauge line between Jabalpur and Jabalpur in 1906. The small gauge railway line between Gondia and Chandrapur was built in 1911. Gondia town's trade and commerce had picked up speed at this point, mostly as a result of the enhanced communication facilities offered by the railways. The interior of Gondia is covered in verdant forests that are a treasure trove of Tendu, Palas, Teak, bamboo, yen, and other valuable species. Also, between 1910 and 1920, some sources were encased. Some Bidi industries in the town were founded because of this. The town also saw the establishment of a number of rice mills and a handful of shellac enterprises. In 1930, Gondia had developed into a fully functional regional economic hub. A rehabilitation camp in Birsi, close to Gondi, was home to a sizable refugee community that arrived in India after independence.

From 1950 to 1960, Gondia likewise made significant progress in terms of infrastructure, NMD degree level In 1958–1959, the college was founded; in 1960, TB-Hospital began operations; and in 1954, Over Bridge was built. Improvements to the infrastructure were insufficient after the first review. A college of engineering named Manoharbhai Patel was established in 1983. In addition to developing the Kudwa ring road in 1991, GMC built Indira Gandhi stadium in 1992. The Gondia district was established by the government of Maharashtra on May 1, 1999. Bordered by the states of Madhya Pradesh and Chhattisgarh, the Gondia district is in the northeastern part of Maharashtra State. There are 1,610,511 people living in the District. Most of the area is covered in forest, and this region is undeveloped. The district's most significant and biggest river, the Wainganga, flows through it. Since paddy is the primary agricultural product, the area is home to several rice mills.

Because of its abundance of rice mills, Gondia City is often referred to as RICE CITY. Latitudes 20039′ to 21038′ North and Longitudes 790 45′ to 800 42′ East are the coordinates

of the Gondia district. A number of smaller towns, including Tirora, Amgaon, Goregaon, Deori, and Salekasa, make up the Gondia urban complex. Positioned at an elevation of 318.82 metres above mean sea level, it lies on the central plateau of the Sakoli formation, with the coordinates of 21º 27’ 26" N latitude and 80º 12’ 53" E longitude. Figure 1 shows that GMC has an area of 18.60 sq. km. The 2001 census recorded a population of 120902, while as of 2011, the estimated population of GMC is close to 132888. According to Panday and Jain (2010), the number of households increased from 27,702 in 2001 to 30472 in 2009. The South-East Central Railway's wide gauge Nagpur-Kolkata route passes via this railway junction. There is a "A" class municipal council in Gondia. In 1919, it came into being.

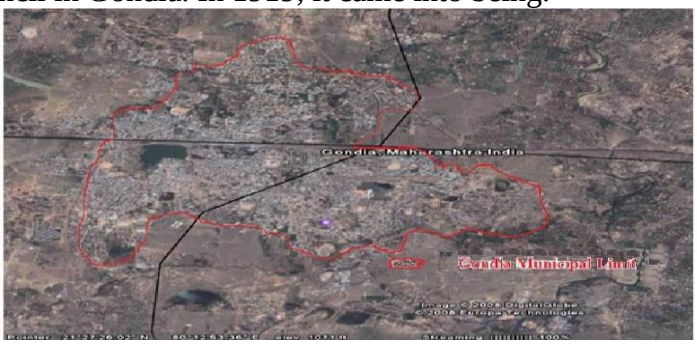

Figure 1: Showing the Land Cover/Use of GMC Courtesy

LANDSCAPE

The settlement sits on flat ground. Along the crest of the region runs the east-west, Kolkata–Mumbai railway route. The terrain gradually slopes north, north-east, and south, south-east from the Gondia railway station. Except for the western side, which is partially covered by hills and forest land, the region immediately around the town is mostly flat paddy fields, cut across by a network of sub-drains and punctuated by a network of irrigation tanks. Within the built region, you won't find many bodies of water. Because of the high population density in the region, these sources of water have turned into firths. The western section of the landscape shows more flat ground, whereas the eastern half is mostly undulating plain. There are spots where the slopes are quite steep, revealing the rocky outcrops. Rising at a height of around 180 MSL, the hills are a portion of the southern-western branch of the Gangazhari Hill. A multitude of small drainages create sinuous curves or a fluted pattern on the slope. Narrow plateaus, not steep ridges, characterise it.

Conclusion

The investigation into the land use dynamics in the periphery of Gondia Municipal Area, shaped by urbanization and agricultural modernization, reveals a complex interplay of socio-economic and environmental factors. The study highlights significant shifts in land use patterns, with urban expansion encroaching upon agricultural lands and natural habitats, driven by population growth, economic development, and infrastructural advancements. This urbanization process has prompted the adoption of newer agricultural techniques aimed at increasing productivity and sustainability, such as advanced irrigation methods, crop diversification, and mechanization. However, these changes have also led to environmental concerns, including soil degradation, water scarcity, and biodiversity loss, necessitating a balanced approach to land management.

Qualitative data gathered from local stakeholders underscores the socio-economic implications of these transformations. Farmers and residents express concerns over the loss of agricultural land, changes in livelihoods, and the pressures of adapting to new agricultural practices amidst urban encroachment. The study also reveals a need for more effective policy interventions that support sustainable urban planning and agricultural development. Such policies should address the dual objectives of accommodating urban growth while preserving agricultural viability and environmental health.

In summary, the study underscores the importance of an integrated land use strategy that considers the multi-dimensional impacts of urbanization and agricultural modernization. By balancing development and conservation, stakeholders can work towards a sustainable future for the Gondia Municipal Area. Future research should continue to monitor these dynamics,

incorporating technological advancements in remote sensing and GIS, and expanding the scope to include more comprehensive socio-economic and environmental impact assessments. This holistic approach is essential for fostering resilient and sustainable peri-urban landscapes.

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