

# Peri-Urban Expansion and Agricultural Land Use Change in Hisar District: A Spatial Analysis

Mandeep (Ph. D Research Scholar), Dr. Rohitash (Associate Professor)

Department – Geography, Shri Jagdish Prasad Jhabarmal Tibrewala University, Chudela, Jhunjhunu

DOI: 10.5281/zenodo.19816346

## ABSTRACT

*Peri-urban expansion has emerged as one of the most visible spatial processes shaping contemporary agrarian landscapes in rapidly urbanizing regions of India. Hisar district of Haryana, with its important urban centre, expanding transport corridors, institutional growth, commercial activities and changing rural economy, provides a meaningful context for examining the transformation of agricultural land at the urban fringe. The present article analyses the relationship between peri-urban growth and agricultural land use change in Hisar district from a spatial perspective. It focuses on how residential colonies, roads, educational institutions, industries, warehouses, markets and service-sector activities have gradually altered the structure, function and value of agricultural land near urban and semi-urban settlements. The study is conceptual and analytical in nature and is based on secondary sources, geographical interpretation and a proposed GIS-based framework. It argues that peri-urban expansion does not produce uniform change across the district. Its effects are spatially differentiated according to distance from Hisar city, proximity to highways, accessibility to markets, irrigation availability, land prices, and local socio-economic conditions. Agricultural land located near the urban fringe is increasingly exposed to conversion pressure, fragmentation, speculative purchase and mixed land use. These changes influence cropping decisions, tenancy arrangements, labour availability, irrigation practices and the livelihood strategies of farming households. The article concludes that agricultural land use change in peri-urban Hisar is not merely a physical conversion of farmland into built-up land; it is a wider rural transformation process involving economic reorientation, social mobility, environmental stress and planning challenges. The study recommends the use of spatial planning, land-use zoning, peri-urban agricultural protection, groundwater management and GIS-based monitoring to balance urban growth with agricultural sustainability.*

*Keywords-Peri-urban expansion; Agricultural land use change; Hisar district; Urban fringe; Spatial analysis; Land conversion; Rural transformation; Haryana*

## 1. INTRODUCTION

Urban expansion has become a major force of land transformation in India, especially in regions where cities are growing beyond their administrative limits into surrounding rural landscapes. The zone where urban and rural characteristics meet, overlap and compete is generally described as the peri-urban area or urban fringe. This zone is neither completely urban nor entirely rural. It is marked by mixed land use, rapid land value appreciation, new infrastructure, changing occupations and increasing pressure on agricultural land. In agricultural states such as Haryana, peri-urban growth has a particularly strong significance because land is not only a physical resource but also the foundation of livelihood, food production, social identity and rural economic organization.

Hisar district occupies an important place in the regional geography of Haryana. The city of Hisar functions as an administrative, educational, commercial and service centre, while the surrounding rural areas remain closely linked to agriculture and allied activities. The district is historically associated with canal irrigation, groundwater extraction, wheat and cotton cultivation, livestock economy and the wider agrarian transformations that followed the Green Revolution. However, in recent decades, the growth of Hisar city and nearby urban settlements has changed the spatial organization of agriculture. Residential colonies, institutional campuses, roads, commercial complexes, transport nodes, agro-processing units, warehouses and other non-agricultural uses have expanded into areas that were earlier predominantly agricultural.

The expansion of peri-urban areas produces a series of direct and indirect impacts on agriculture. Directly, agricultural land may be converted into built-up land or fragmented into smaller plots. Indirectly, even land that remains under cultivation may be affected by rising land prices, reduced labour availability, changes in irrigation access, polluted drainage, restrictions on farm operations, and altered expectations among landowners. Farmers near the urban fringe often face a dual situation: agriculture may become more difficult because of land pressure, but non-farm income opportunities may also increase. This makes peri-urban change a complex process rather than a simple decline of agriculture.

A spatial analysis of peri-urban expansion is important because land use change is not evenly distributed. The most intense conversion generally occurs near the city edge, along major roads, near industrial and institutional clusters, and in villages with high accessibility. More distant villages may experience slower or different forms

of transformation. Therefore, a geographical approach helps identify patterns, gradients and zones of change. It can also show how agriculture is reorganized rather than completely replaced in some locations. In Hisar district, such analysis can contribute to better understanding of the relationship between urban growth, land markets, rural livelihoods and agricultural sustainability.

The present article focuses on the topic "Peri-Urban Expansion and Agricultural Land Use Change in Hisar District: A Spatial Analysis." It examines the conceptual basis of peri-urban growth, the spatial context of Hisar district, the major drivers of land conversion, the changing patterns of agricultural land use and the socio-economic implications for farming communities. The article also discusses planning challenges and suggests measures for balancing urban development with the protection of productive agricultural landscapes.

## **2. REVIEW OF LITERATURE**

The literature on peri-urban development has developed across geography, urban planning, rural studies and environmental management. Early studies on urban fringe areas emphasized the transitional character of zones surrounding cities, where agricultural and urban land uses compete for space. These studies showed that the fringe is often a dynamic area where land values rise, land ownership changes, and rural settlements become functionally linked to urban economies. Later scholarship expanded this understanding by treating peri-urban areas not merely as physical margins of cities but as complex socio-economic and ecological zones.

Research on peri-urbanization in developing countries highlights the speed and informality of land transformation. Scholars have argued that urban expansion often extends beyond formal planning boundaries, resulting in irregular conversion of agricultural land, scattered construction, infrastructure gaps and environmental stress. In South Asian contexts, peri-urban zones are frequently characterized by a combination of farming, housing, small industries, transport activities and service-sector growth. This mixed character makes them difficult to govern through conventional urban or rural planning categories.

Studies on agricultural land conversion demonstrate that urban growth is one of the major causes of farmland loss near cities. Conversion is driven by population pressure, road development, market access, rising land prices, real estate speculation and changing aspirations of landowners. The land located near highways and city edges usually becomes more vulnerable to non-agricultural use. At the same time, some studies note that peri-urban agriculture may persist in modified forms, especially where farmers shift to high-value crops, dairy, vegetables, fodder or market-oriented production to benefit from proximity to urban consumers.

Indian studies on peri-urban transformation have paid attention to metropolitan regions such as Delhi, Bengaluru, Hyderabad and Pune, but smaller cities and district towns are also increasingly relevant. In Haryana, the expansion of urban centres and transport corridors has produced major land-use changes in districts close to the National Capital Region. However, districts such as Hisar also require detailed analysis because urbanization here interacts with a strongly agrarian economy, canal and groundwater irrigation, and a settlement pattern in which villages remain closely connected to city-based markets and services.

The literature also emphasizes the value of remote sensing and GIS in land use studies. Satellite imagery, land use-land cover classification, buffer analysis, change detection and spatial overlay techniques help measure the direction and intensity of urban expansion. These tools allow researchers to compare built-up growth with agricultural land decline and identify hotspots of conversion. For a district like Hisar, GIS-based analysis can be useful for mapping peri-urban growth along roads, around the main city, and in villages experiencing rapid land market change.

Overall, previous research suggests that peri-urban expansion has multiple consequences for agriculture. It reduces cultivated land in some areas, changes cropping patterns in others, and creates new non-farm opportunities for rural households. It also generates conflicts over land, water, infrastructure, waste disposal and planning authority. The present article builds on this literature by focusing specifically on Hisar district and by interpreting agricultural land use change through a spatial lens.

## **3. OBJECTIVES OF THE STUDY**

1. To examine the conceptual relationship between peri-urban expansion and agricultural land use change in Hisar district.
2. To identify the major spatial drivers responsible for the conversion and fragmentation of agricultural land in peri-urban areas.
3. To analyse how distance from urban centres, road connectivity, land values and infrastructure growth influence agricultural land use patterns.
4. To assess the possible impacts of urban fringe development on cropping patterns, irrigation practices and farmers' livelihoods.
5. To highlight the planning and environmental challenges emerging from agricultural land conversion in the urban fringe of Hisar district.
6. To suggest spatial planning measures for balancing urban expansion with agricultural sustainability.

#### **4. RESEARCH METHODOLOGY**

The present article is descriptive, analytical and spatial in orientation. It is based on secondary data, conceptual interpretation and a proposed geospatial framework suitable for studying peri-urban expansion in Hisar district. The research does not depend on a fresh household survey; however, it outlines the kinds of spatial and socio-economic information that can be used for an empirical investigation. The study draws upon geographical literature, government reports, census information, land use records, district-level agricultural data, planning documents and satellite-image-based interpretation.

The spatial approach forms the core of the methodology. Peri-urban expansion can be examined by preparing land use-land cover maps for different time periods with the help of satellite imagery. Built-up land, agricultural land, fallow land, road networks, water bodies and other categories may be classified and compared over time. Change detection techniques can then identify how much agricultural land has shifted toward residential, commercial, institutional or infrastructural use. Buffer analysis around Hisar city and major roads can help determine whether land conversion is higher near accessible locations.

The study may also use village-level data to understand the relationship between urban proximity and agricultural change. Villages may be grouped according to distance from Hisar city, proximity to highways, level of built-up expansion and intensity of land conversion. Such grouping would help reveal whether agricultural decline is strongest in the inner fringe and whether outer fringe villages show different patterns. Agricultural indicators such as cropped area, cropping intensity, dominant crops, irrigation sources and number of operational holdings can be compared with spatial expansion indicators.

The analytical method is both qualitative and comparative. Qualitative interpretation is used to understand the social meaning of land conversion, changing aspirations of farmers, non-farm employment opportunities and the pressure of real estate. Comparative analysis is used to distinguish between villages or zones experiencing high, moderate and low peri-urban influence. The methodology therefore combines physical land use mapping with socio-economic interpretation. This is appropriate because peri-urban transformation is not only a cartographic change but also a livelihood and planning issue.

The study is limited by its conceptual character and dependence on secondary sources. Accurate measurement of land conversion would require high-resolution satellite imagery, field verification and revenue records. However, the framework developed in this article provides a systematic basis for future empirical research on Hisar district. It also helps clarify the major variables and spatial relationships that should guide detailed field-based and GIS-based investigation.

##### **Conceptual Understanding of Peri-Urban Expansion**

Peri-urban expansion refers to the outward spread of urban functions into surrounding rural areas. It is different from simple urban growth because it produces a hybrid landscape in which farms, villages, residential colonies, shops, industries, educational institutions and transport infrastructure coexist. This zone is often unstable and transitional. Land ownership may remain rural, but land values and land-use expectations become urban. Farmers may continue cultivation, yet they may also wait for better land prices or use part of their land for non-farm purposes.

The peri-urban zone is produced by several processes operating together. Population growth creates demand for housing. Improved roads increase accessibility. Educational and health institutions seek cheaper land outside the city core. Commercial activities follow traffic movement. Real estate investors acquire land in anticipation of future urban expansion. Government and private infrastructure projects also create new growth corridors. Together, these factors gradually transform agricultural landscapes into mixed-use spaces.

Agricultural land use change in peri-urban areas may take different forms. In some cases, farmland is permanently converted into built-up land. In other cases, agricultural plots become fragmented by roads, boundary walls and scattered construction. Sometimes farmers shift from traditional crops to fodder, vegetables, dairy-linked production or short-duration crops because market access improves. In other situations, land is left fallow because owners expect conversion or sale. Therefore, the effect of peri-urban growth on agriculture cannot be understood only by measuring land loss; it must also be studied through changes in intensity, crop choice, investment behaviour and livelihood strategy.

In the context of Hisar district, peri-urban expansion must be understood within a semi-arid agricultural environment where irrigation, land quality and market access are crucial. The transformation of land near the city affects not only production but also the social organization of rural life. It changes relationships between landowners, tenants, labourers, real estate agents, local institutions and urban consumers. Hence, peri-urban expansion is both a spatial and socio-economic process.

##### **Study Area: Hisar District and Spatial Context**

Hisar district is located in the western part of Haryana and is one of the important administrative and agricultural districts of the state. The region has a semi-arid climate, with hot summers, relatively low rainfall and significant dependence on irrigation for stable agricultural production. The district includes the major urban

centre of Hisar along with numerous villages and smaller settlements. Hisar city functions as a regional hub for education, administration, trade, health services, agro-marketing and transport connectivity.

Agriculture has traditionally been a major component of the district economy. Wheat, cotton, mustard, bajra, fodder crops and other crops form important parts of the agricultural landscape. Irrigation through canals and tube wells has influenced cropping intensity and agricultural productivity. At the same time, the district has experienced increasing diversification in non-farm activities. Growth of educational institutions, commercial services, transport facilities and urban housing has intensified the interaction between the city and nearby villages.

The peri-urban zone of Hisar is likely to be most prominent around the expanding boundary of Hisar city and along important road corridors. Villages located closer to the city are more exposed to land price escalation and built-up expansion. Areas near highways and major connecting roads may experience ribbon development, warehouses, petrol pumps, workshops, farmhouses, institutional buildings and residential plotting. This creates a spatial pattern in which agricultural land is converted first in accessible and commercially attractive locations.

The district's spatial context is therefore suitable for studying urban fringe development. It allows examination of how an agriculturally significant region responds to expanding urban functions without becoming fully metropolitan. Hisar represents the type of district-level urbanization that is increasingly common in India, where medium-sized cities create strong pressure on surrounding villages and agricultural land.

### **Agricultural Land Use Change in Peri-Urban Hisar**

Agricultural land use change in peri-urban Hisar can be understood through three major processes: conversion, fragmentation and functional modification. Conversion refers to the direct replacement of farmland by non-agricultural uses such as housing colonies, commercial spaces, roads, institutions and industrial units. Fragmentation occurs when agricultural holdings are divided into smaller parcels due to sale, inheritance, road construction or partial conversion. Functional modification occurs when land technically remains agricultural but its use, management or economic meaning changes because of urban influence.

Conversion pressure is generally highest where land has strong accessibility. Agricultural fields located near main roads or near the expanding city edge become attractive for real estate development. Once a few plots are converted, surrounding fields also become vulnerable because agricultural operations face disturbance from traffic, construction, boundary walls and changing land prices. Farmers may begin to see land more as a financial asset than as a productive resource. This shift in perception is one of the most important features of peri-urban transformation.

Fragmentation affects the efficiency of farming. Smaller and irregular plots make mechanized cultivation difficult. Irrigation channels may be disrupted, field access may be reduced, and conflicts may arise regarding pathways and drainage. Fragmented land also discourages long-term investment in soil improvement, irrigation infrastructure or farm modernization. In the fringe areas of Hisar, fragmentation may be linked not only to family division but also to plotting for residential or commercial sale.

Functional modification is more subtle. Farmers may continue cultivation but alter crops according to market demand and changing labour conditions. Some may reduce labour-intensive crops if farm labour becomes costly or scarce. Others may shift toward fodder to support dairy because nearby urban markets offer demand for milk. Some may rent land temporarily while waiting for land prices to rise. Thus, agriculture in peri-urban areas may not disappear immediately; it may become transitional, uncertain and market-sensitive.

Land use change also affects the continuity of agricultural landscapes. Instead of large connected fields, the peri-urban belt may develop a mosaic of farms, houses, roads, vacant plots and commercial buildings. This scattered pattern creates planning difficulties and environmental pressure. It reduces the ecological and productive coherence of farmland and creates conflicts between farm and non-farm activities.

### **Major Drivers of Peri-Urban Agricultural Land Conversion**

Several factors drive agricultural land conversion in the peri-urban areas of Hisar district. The first major driver is population and housing demand. As the city expands, demand for residential land increases. Middle-income households, migrants, service-sector employees and investors often seek land outside the congested city core. This encourages the development of colonies and plotted housing on former agricultural land.

The second driver is transport connectivity. Roads play a decisive role in shaping peri-urban growth. Land near highways, bypasses, link roads and transport junctions becomes attractive for shops, workshops, warehouses, petrol pumps and other commercial uses. Improved accessibility reduces the friction of distance and brings villages closer to the urban economy. As a result, agricultural land along road corridors is often converted faster than interior land.

The third driver is rising land value. When land prices increase rapidly, the opportunity cost of farming rises. Agriculture may appear less profitable compared with selling land or converting it for rent-based income. This creates speculative behaviour. Some landowners hold land without cultivation, expecting future appreciation. Others sell small parts of their holdings for immediate financial gain. Rising land value therefore transforms the farmer's decision-making environment.

The fourth driver is institutional and commercial expansion. Educational institutions, coaching centres, hospitals, godowns, cold storage units, agro-processing activities and administrative facilities often require large land parcels that are more easily available outside the city. Their location in peri-urban areas creates further demand for housing, transport and services. This multiplier effect accelerates land use conversion.

The fifth driver is changing livelihood aspirations. Younger members of farming households may prefer education, government service, business, transport, real estate or other non-farm activities over agriculture. When occupational aspirations change, the emotional and economic attachment to farming may weaken. Land then becomes a resource for financing education, migration, business investment or urban-style consumption.

### **Spatial Pattern of Urban Fringe Development**

The spatial pattern of peri-urban expansion in Hisar district is likely to show a clear relationship with distance and accessibility. Areas closest to Hisar city may form the inner fringe, where agricultural land is under the strongest pressure from residential and commercial development. These locations usually experience rapid land price growth, mixed land use and visible decline in continuous cultivation. The inner fringe is also more likely to contain scattered colonies, shops, institutions and transport-related activities.

The middle fringe may show a transitional pattern. Agriculture remains important, but urban influence becomes visible through improved roads, non-farm employment, partial land sales and changing crop choices. Villages in this zone may still retain substantial cultivated area, yet farmers increasingly interact with urban markets and services. Some households may combine agriculture with transport, dairy, rental income or employment in the city.

The outer fringe may be less affected by direct conversion but may experience indirect changes. Farmers may adopt market-oriented crops, mechanization or dairy activities due to improved urban demand. Land speculation may begin along major routes even before actual construction becomes widespread. Thus, peri-urban influence spreads unevenly and may appear first in accessible pockets rather than across a continuous belt.

A GIS-based spatial analysis can identify these zones through buffer mapping around Hisar city and major road corridors. Built-up expansion can be measured at different distances, such as 0-5 km, 5-10 km and 10-15 km from the urban edge. Such analysis can reveal whether agricultural land loss follows a radial pattern around the city or a linear pattern along transport routes. In most peri-urban settings, both patterns operate together.

### **Indicative Spatial Zones of Peri-Urban Change**

<b>Spatial Zone</b>	<b>Dominant Character</b>	<b>Agricultural Condition</b>	<b>Likely Transformation</b>
Inner fringe	High accessibility and intense built-up pressure	Declining and fragmented agricultural land	Residential colonies, commercial plots and institutional expansion
Middle fringe	Mixed rural-urban interaction	Agriculture continues with partial land sale and crop adjustment	Dairy, fodder, market-oriented crops and scattered construction
Outer fringe	Lower direct conversion but growing urban influence	Cultivation remains dominant	Speculation, road-side development and gradual livelihood diversification

### **Impact on Cropping Pattern, Irrigation and Farm Management**

Peri-urban expansion influences cropping patterns in several ways. Farmers near urban markets may shift toward crops that have quicker returns or direct demand in the city. Fodder cultivation may increase where dairy becomes a profitable activity. Vegetables and short-duration crops may be adopted in some locations if water, labour and market access are favourable. However, in areas where land is expected to be sold or converted, farmers may reduce investment and prefer low-risk crops.

Traditional crop choices may also be affected by labour availability. Urban construction, transport and service activities provide alternative employment to rural labourers. This can increase wage rates and reduce the availability of farm labour during peak agricultural seasons. Farmers may respond by shifting to less labour-intensive crops, increasing mechanization or leasing out land. Thus, the urban fringe changes not only land use but also the labour relations of agriculture.

Irrigation practices may face both opportunities and stress. On one hand, farmers close to the city may have better access to markets and input suppliers, enabling investment in tube wells, pipelines and farm equipment. On the other hand, land fragmentation, construction activity and drainage problems may disrupt traditional irrigation channels. Groundwater extraction may also increase due to the combined demands of agriculture, households, commercial uses and institutions. In a semi-arid district like Hisar, such pressure can create long-term sustainability concerns.

Farm management becomes uncertain in peri-urban areas. Farmers may hesitate to invest in orchards, soil improvement or long-term irrigation structures if they expect conversion in the future. Tenancy arrangements may become short-term because owners do not want long agricultural commitments. This reduces the stability of agricultural planning. In some cases, land may remain underused or fallow because owners wait for profitable sale. Such underutilization represents a hidden form of agricultural decline.

The impact on agriculture is therefore multidimensional. It includes reduction in cultivated area, fragmentation of holdings, changing crop choices, labour shifts, irrigation stress and altered investment behaviour. These

changes must be studied together to understand the full effect of peri-urban expansion on agricultural land use in Hisar district.

### **Socio-Economic Implications for Farmers**

Peri-urban expansion creates both opportunities and vulnerabilities for farmers. The most visible opportunity is the rise in land value. Landowners near the city may benefit financially from selling land or converting it into rental properties, shops, warehouses or residential plots. Some households use land sale income for education, business investment, housing construction, vehicles or social mobility. This can improve short-term economic status and diversify income sources.

However, the benefits are unevenly distributed. Large landowners may gain substantially from land appreciation, while small farmers may sell land under pressure and lose their long-term livelihood base. Landless agricultural labourers may be more vulnerable because land conversion reduces farm employment without guaranteeing stable non-farm jobs. Tenants may lose access to cultivated land when owners decide to sell or convert it. Therefore, peri-urban transformation can increase socio-economic inequality within rural communities.

The social meaning of land also changes. In traditional agrarian society, land is associated with identity, security and status. In peri-urban areas, land increasingly becomes a market asset. This shift influences family decisions, inheritance disputes and intergenerational aspirations. Younger people may see agriculture as less attractive compared with urban employment or business. Older farmers may experience uncertainty because the familiar rural environment changes rapidly around them.

Peri-urban expansion also changes the relationship between villages and the city. Rural households become more dependent on urban services, markets, education and employment. Mobility increases, and daily commuting becomes common. Consumption patterns may become more urban, and village economies may diversify. While this can be positive, it may also weaken agricultural continuity and traditional rural support systems.

For policy analysis, it is important to recognize that farmers are not passive victims of land conversion. They actively negotiate, adapt and respond to changing opportunities. Some intensify agriculture, some diversify, some sell land, and some combine farming with non-farm livelihoods. A spatial study should therefore examine variations among households and villages rather than assuming a single uniform impact.

### **Environmental and Planning Challenges**

Peri-urban expansion creates major environmental and planning challenges. Scattered development often occurs without adequate drainage, waste management, road planning or open-space protection. When built-up land expands into agricultural fields in an unplanned manner, natural drainage channels may be blocked, leading to waterlogging or localized flooding during rainfall. Construction waste and solid waste may be dumped on vacant or agricultural land, reducing soil quality and creating health risks.

Groundwater stress is another serious concern. Hisar district already operates within a semi-arid environmental setting where irrigation depends heavily on water availability. Peri-urban growth increases water demand for domestic, commercial and institutional uses. If groundwater extraction expands without regulation, agriculture and urban uses may come into competition. Declining groundwater levels can increase the cost of irrigation and reduce the sustainability of farming.

Land use conflict is also common in peri-urban areas. Farmers may complain about damage caused by traffic, animals, construction dust, blocked access roads or polluted runoff. New residents may object to farm operations such as tractor movement, burning of residues, use of manure or operation of tube wells. These conflicts arise because urban and agricultural functions coexist without clear planning norms.

The absence of effective peri-urban planning can lead to inefficient land consumption. Instead of compact urban expansion, scattered colonies and ribbon development consume more land and infrastructure per household. This pattern is costly for public services and harmful for agriculture. It also makes future planning more difficult because fragmented construction creates irregular land parcels and mixed ownership patterns.

Environmental and planning issues must therefore be treated as central to the study of agricultural land use change. Agricultural land is not only an economic asset; it also provides ecological functions such as groundwater recharge, local climate regulation, open space and food supply. Its unplanned conversion may create long-term costs that are not visible in immediate land market transactions.

## **5. SUGGESTIONS AND PLANNING IMPLICATIONS**

A balanced approach is necessary to manage peri-urban expansion in Hisar district. Urban growth cannot be stopped completely, but it can be guided through proper spatial planning. The first requirement is regular mapping of land use-land cover change using GIS and satellite imagery. Such monitoring would help identify hotspots of agricultural land conversion and areas where planning intervention is urgently needed.

Second, land-use zoning should be strengthened. Productive agricultural zones, groundwater-sensitive areas and environmentally important open spaces should be identified and protected from haphazard conversion. Urban

development should be encouraged in planned clusters rather than scattered ribbon development along every road. This would reduce pressure on agricultural land and improve infrastructure efficiency.

Third, peri-urban agriculture should be supported rather than ignored. Farmers near the city can benefit from high-value crops, dairy, vegetables, floriculture, agro-processing and direct marketing if proper support is provided. Extension services, cold chains, farmer markets, water-saving irrigation and urban-rural supply linkages can make agriculture more profitable in the fringe. If agriculture remains economically viable, unnecessary land conversion may slow down.

Fourth, groundwater and drainage management should be integrated into peri-urban planning. New colonies, institutions and commercial developments should follow rules for rainwater harvesting, wastewater treatment and drainage protection. Agricultural irrigation needs should also be considered when approving large non-agricultural projects. In semi-arid regions, water planning is inseparable from land planning.

Fifth, farmers and village communities should be included in decision-making. Peri-urban planning often fails when it treats rural land only as vacant space for urban growth. Local farmers possess knowledge about soil, water, crop conditions and village-level needs. Their participation can help design more practical and socially acceptable land-use strategies.

Finally, policy should address livelihood transition. Where land conversion is unavoidable, affected farmers, tenants and labourers should receive support for skill development, alternative employment and financial planning. Land sale income alone does not guarantee long-term security. Sustainable rural transformation requires planned economic diversification rather than uncontrolled land market dependence.

## 6. CONCLUSION

Peri-urban expansion in Hisar district represents a significant spatial process through which urban growth reshapes agricultural land, rural livelihoods and environmental conditions. The transformation is not limited to the physical spread of built-up areas. It includes changes in land values, ownership decisions, cropping patterns, labour availability, irrigation practices, household aspirations and village-city relations. Agricultural land near the urban fringe becomes exposed to conversion, fragmentation and functional uncertainty.

The study shows that agricultural land use change is spatially differentiated. Areas close to Hisar city and along major transport corridors are likely to experience stronger pressure than more distant villages. The inner fringe may show rapid conversion and mixed land use, while the middle and outer fringes may show gradual modification of agriculture and livelihoods. This spatial variation makes GIS-based analysis essential for understanding the direction and intensity of change.

Peri-urban expansion creates opportunities such as higher land values, non-farm employment, market access and livelihood diversification. At the same time, it also creates serious challenges such as farmland loss, inequality, groundwater stress, unplanned construction, land fragmentation and weakening of agricultural sustainability. The benefits and costs are not evenly distributed among farmers, tenants and labourers.

The central conclusion is that agricultural land in peri-urban Hisar should not be treated merely as reserve land for future urban construction. It is a productive, social and ecological resource that requires careful planning. A balanced strategy based on spatial monitoring, land-use zoning, support for peri-urban agriculture, groundwater management and community participation can help reconcile urban expansion with agricultural sustainability. Such an approach is essential for ensuring that rural transformation in Hisar district remains inclusive, planned and environmentally responsible.

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