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# UNDERSTANDING THE TRADITIONAL ELEMENTS OF LANDUSE WHILE INCORPORATING GEO-SPATIAL TECHNOLOGY

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***ABSTRACT:*** The application of Geographic Information System (GIS) technology and remote sensing to comprehensive local planning is becoming more popular in a number of fields, such as disaster management, agriculture, and urban and rural development. This case study looks at Garhshankar Block in the Hoshiarpur district of Punjab, India, and how remote sensing and GIS are used for micro-level planning. The application of several remote sensing techniques, including digital elevation models (DEM), soil maps, and satellite images from Sentinel-2 and Landsat 8, is examined in this study. These are used in conjunction with GIS programs such as ArcGIS and QGIS to classify and evaluate various land uses, such as agricultural land, woods, and barren areas. In order to comprehend the current infrastructure, the study also looks at the region's socioeconomic and demographic features.

The results of the study show that GIS and remote sensing are useful tools for micro-level planning because they can accurately determine current land use patterns and assess potential changes in use. Planning for the future development of the area requires careful consideration of this information. The research also highlights how the use of remote sensing and GIS improves the accuracy and productivity of data collection and analysis, which in turn leads to better decision-making at the micro-level of planning. The study emphasizes the inclusion of remote sensing and geographic information technology in the planning process to achieve sustainable and equitable development. It also highlights the significant potential of these tools for extensive local planning in rural areas.

**Keywords**: Remote Sensing, Geographic Information System (GIS), Foothill zone, Garhshankar Block, Spatial Analysis, Satellite Imagery.

## INTRODUCTION

The applications of geographic information systems (GIS) and remote sensing technologies are wide-ranging and include comprehensive regional maps, among others. As a result of these technologies, the planning process has changed, enabling effective and efficient plans. This paper examines the use of GIS and remote sensing in micro-planning with special focus on Garhshankar block in Hoshiarpur district, Punjab.

With the advent of GIS and remote sensing, planners have access to a variety of technologies for data collection, analysis, and visualization. These technologies allow us to collect and assess data about the state of the Earth to prepare for the future. You can combine data from multiple sources and present it in a logical way to improve decisions.

The case study of Garhshankar Block shows how planners were able to create a comprehensive plan that meets the needs of the community with the help of remote sensing and GIS applications. Topographic data, satellite images and other sources of information were used to better understand the characteristics of the area. This analysis identified the areas most in need of development, including those vulnerable to natural disasters such as erosion and flooding.

Additionally, planners can view data in an easy-to-understand way thanks to GIS technology, promoting stakeholder collaboration and ensuring a unified approach to work planning. The planners developed a broad and successful strategy by presenting the facts in a simple and concise manner. The ability of remote sensing and GIS technologies to provide real-time data is a major advantage. This allows for a quick and effective response, which is very important in crisis areas. These technologies have enabled Garhshankar Block to respond quickly to natural disasters such as floods, reduce damage and save lives.

## MICRO LEVEL PLANNING

In India, micro planning refers to the careful management and implementation of development plans at the village or community level. It focuses on determining the goals and needs of the community and making plans to achieve them. Micro-planning has been an integral part of India's development planning since the 1970. Implementation of development programs that cater to the unique needs of the community is the main objective of micro-planning, it must have a good understanding of the social and economic aspects. and environmental conditions. Residents actively participate in the creation and implementation of this participatory process.

India's system of local government, known as Panchayati Raj, oversees the country's micro-planning. Each city has a panchayat, or local government body, which is responsible for local development. Panchayat members, the elected members of the district, work with government officials to formulate and implement plans. Micro-plans include development plans such as rural infrastructure, agriculture, water supply, sanitation, health and education. In these areas, the planning process identifies specific community needs and develops plans to meet those needs. For example, micro-planning in the curriculum might involve identifying which children are out of school and making plans to include them.

The ability to adapt development plans to the specific needs of society, including attention to the needs of marginalized groups such as women, children and the poor, is a major benefit of local planning. It also promotes community empowerment and participation, resulting in sustainable development. In India, micro-planning plays an important role in promoting social equity and reducing regional disparities. It addresses issues related to regional development by focusing on the needs of specific communities and ensuring an equitable distribution of development resources. More recently, the UN's Sustainable Development Goals (SDGs) have been linked to micro-level

planning. A key tool for achieving these goals in the region is the micro-level planning recognized in the SDGs, which provides a framework for sustainable development. Many SDGs, such as eradicating poverty, promoting gender equality and ensuring access to sanitation and drinking water, require attention to development planning according to the contexts of the region.
However, despite its advantages, micro-level planning also has its drawbacks. The lack of capacity and resources at the local level is a major obstacle. Lack of resources and poor staff training are challenges for many panchayats in India, preventing successful implementation of development plans. Political interference is another factor that can undermine the participatory nature of the planning process.

## STUDY AREA

The Garhshankar block, located in the Hoshiarpur district of the Indian state of Punjab, is strategically important and has diverse landscapes. The region is part of the fertile plains of Punjab state, known for its high agricultural production. It is between 31.69°~31.98°N and 75.57°-76.12°E. The block's unique shape and climate are influenced by its location in the foothills of Shivalik Mountain. The Garhshankar block is characterized by a mixture of sloping terrain and flat agricultural areas. The Shivalik Hills, also known as the Outer Himalayas, influence the soil structure and climate while providing a beautiful backdrop. The climate of the region is humid tropical, with hot summers, a windy season from June to September, and cold winters. The warm, rich soil of the sand can produce crops such as sugar, corn, rice and wheat.

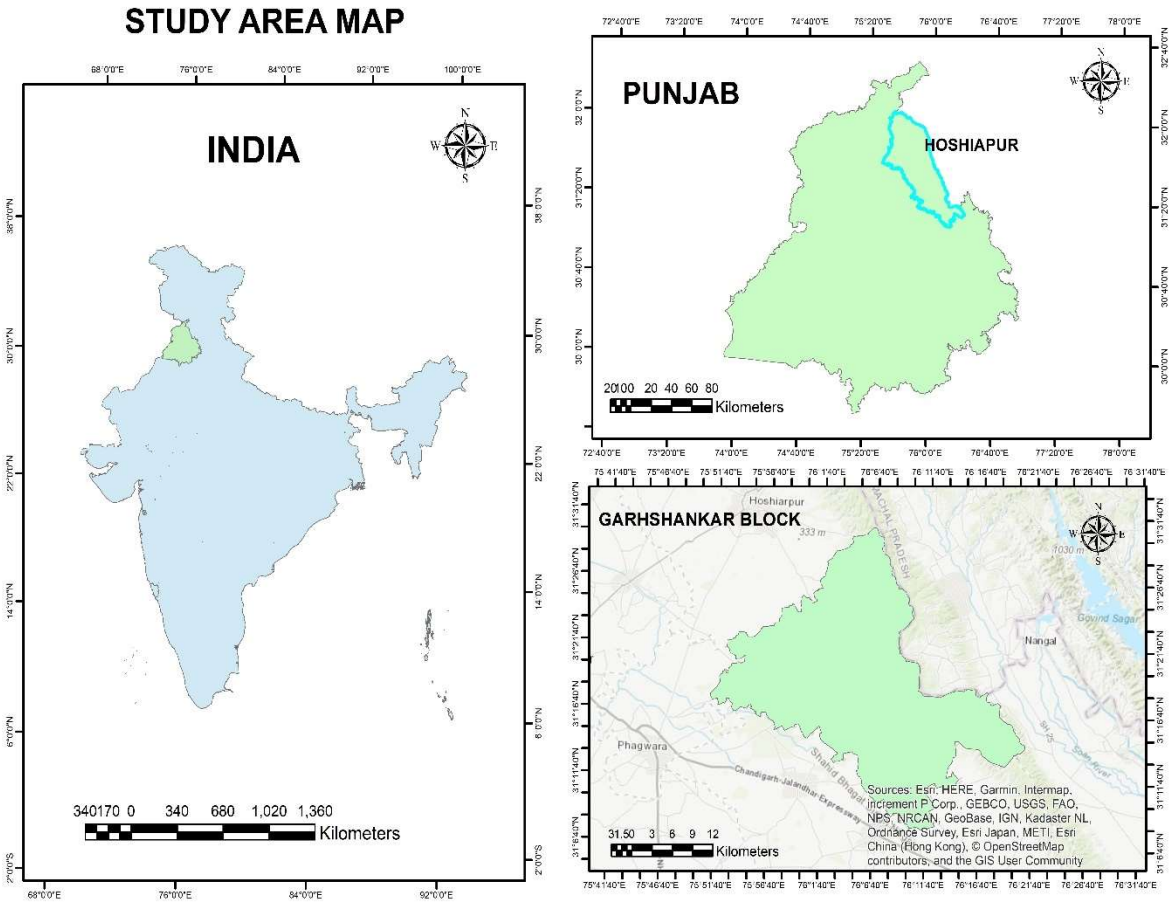



**Fig1: Location map of the study area**

## Objectives of the study

1. To prepare a physical resources base of the study area.
2. To evaluate the village with weak human resource.
3. To identify the villages facing agriculture backwardness.
4. To identify village with weak infrastructure resource base.
5. To suggest micro level plan for village with high problem intensity.

## Methodological plan

- Selection of study area: Garhshankar block of Hoshiarpur district of Punjab is the study area of the study. The block of approximately 100 square kilometres is located at the foothills of the Shiwalik range.
- Data collection: GIS and remote sensing methods are used to collect research data. Data

includes satellite images, topographic maps, soil maps, land use maps and demographic data. The data is provided by reputed sources like Punjab Remote Sensing Centre (PRSC), Indian Space Research Organization (ISRO) and Census of India.

- Data processing: Remote mapping and GIS programs such as ERDAS Imagine, ArcGIS and QGIS are used to process the collected data. Spatial analysis, image enhancement, georeferencing and classification are all part of the processing.
- Micro level planning: Micro level plans are prepared for Garhshankar block based on analysed data. The plans prioritize socio-economic growth, water resource management and land use planning. The plans are based on identifying the infrastructure, human resources and natural resources of the quarter.
- Approval of plans: To check the prepared plans, local communities and government representatives are consulted as stakeholders. After gathering feedback from stakeholders, the plans are refined and refined.
- Implementation and control: City governments implement the final plans with the support of the community. Implementation progress is monitored through regular evaluation and feedback.
- Data analysis. Data collected from the implementation and monitoring phases are reviewed to assess how well the micro-level plans are working to achieve desired results.

This methodology outlines a possible procedure for conducting a study on the application of GIS and remote sensing in micro-level planning of Garhshankar Block in Hoshiarpur district of Punjab.

**Sources of Primary and Secondary Data**

1. **Satellite Imagery's**
2. **Census of India**
3. **Statistical Abstract of Punjab**
4. **Economic and Health Organisation of Punjab**

## FLOW CHART OF METHODOLOGY

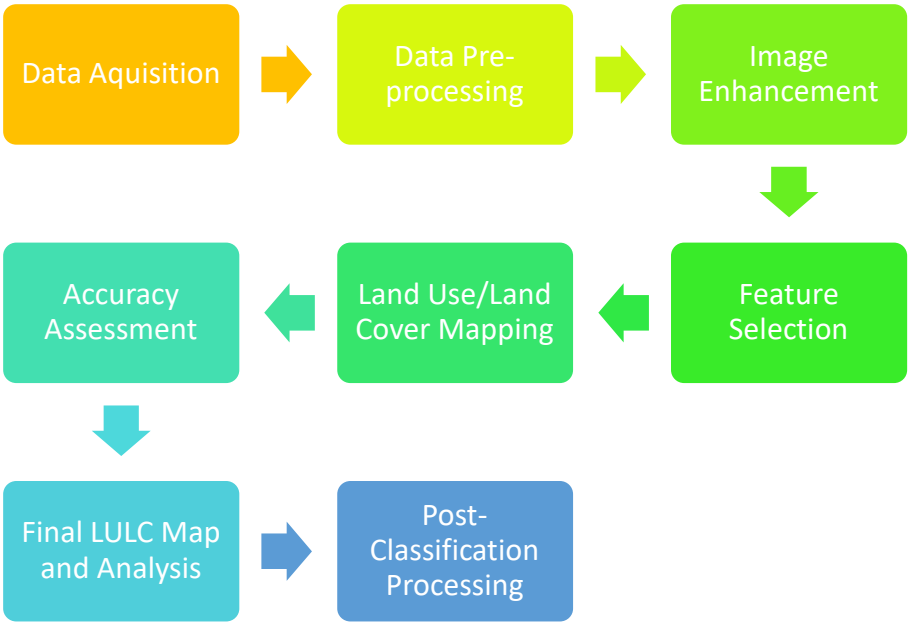



**Fig 2: Flow chart of methodology**

## PHYSICAL RESOURCE BASE

The Garhshankar block, located in the Hoshiarpur district of the Indian state of Punjab, is strategically important and has diverse landscapes. The region is part of the fertile plains of Punjab state, known for its high agricultural production. It is between 31.69°~31.98°N and 75.57°-76.12°E. The block's unique shape and climate are influenced by its location in the foothills of Shivalik Mountain. The Garhshankar block is characterized by a mixture of sloping terrain and flat agricultural areas. The Shivalik Hills, also known as the Outer Himalayas, influence the soil structure and climate while providing a beautiful backdrop. The climate of the region is humid tropical, with hot summers, a windy season from June to September, and cold winters. The warm, rich soil of the sand can produce crops such as sugar, corn, rice and wheat.

- **Geographical setting**: The Garhshankar block, located in the foothills of the Siwalik range, is part of the Himalayas. The main sedimentary rocks that make up the geology of the area are sandstones, shales and conglomerates.

- **Terrain**: The Garhshankar block is defined by a number of topographical features, including plains, hills, valleys and ridges. The hills are steep, rough and mostly sandy. The

valley is characterized by abundant alluvium and flat land. The narrow ridge is rocky and rocky.

- **Drainage system**: The Garhshankar block is drained by several small rivers and streams, including the Swan, Shahpur and Tanda rivers. Another feature of the region is the number of seasonal rivers that receive their nourishment from the rain. The landscape appears to have been heavily influenced by the watershed, which eroded the slopes and deposited sediments in the valleys.

- **Soil:** Most of the soil in the Garhshankar block is clayey and very fertile. The soil is suitable for growing a variety of crops, including sugarcane, rice and wheat.

- **Natural risks**: Garhshankar block is prone to landslides and floods due to landslides and heavy rains. These problems threaten the lives and livelihoods of residents.

- **Human impact**: The nature of the Garhshankar block is affected by human activities such as mining, agriculture and forestry. Deforestation has caused erosion and soil erosion, while agriculture has caused soil erosion and water loss. Other impacts of mining include soil erosion and environmental degradation.

- **Geomorphological processes**: The Garhshankar Block is defined by several geomorphological processes, including transport, deposition, weathering and erosion. Physical, chemical and biological weathering processes contribute to the breakdown of rocks and soils. Rivers, wind and gravity are some of the processes that created hills, ridges and valleys. Mass movement, wind, and rivers are examples of transport factors that have a significant impact on sediment deposition in valleys.

## LANDUSE PATTERN

The physical and economic characteristics of a region are reflected in land use and land cover. The term "land use" describes the use of land by people and their settlements, typically focusing on the use of land for commercial purposes. The term "land cover" refers to the characteristics of the earth's surface determined by the distribution of vegetation, water, soil and other land features, including the characteristics of people's activities, such as villages. Information on land use and land cover change is important for large-scale planning and regional and local planning. Land cover change is slow, but land cover is changing rapidly.

The assessment of consumer liability for fires and changes relies heavily on high-resolution remote sensing data collected at different times. As a result, spatial and spatial aspects are important for regional planning. Current earth dynamics data can be maintained using geographic information systems (GIS) and global positioning systems (GPS) and spatial and temporal analysis methods. This leads to rational strategies and economic decision-making processes.

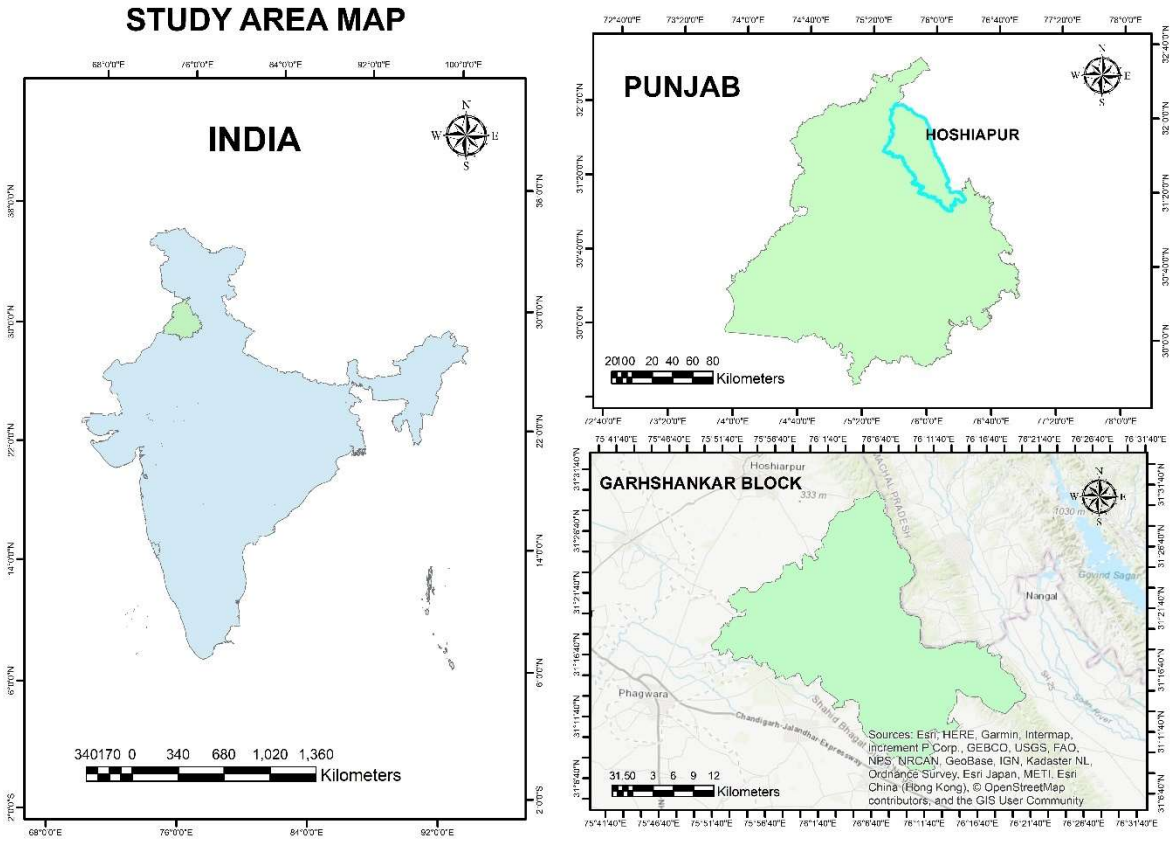



**Fig 3: Location map of the study area**

## RESULTS AND DISCUSSION

### Land use/land cover analysis with remote sensing data

Various land types and land cover classifications are interpreted in the study area: built-up land, agricultural land (including cropland and wasteland) and forestry (including plantations and forest ravines). The following sections provide an in-depth description of the different land use/land cover groups in the study area, and are shown on maps from 2001 to 2021.

The land use and land cover of Garhshankar block in Hoshiarpur has changed significantly over time. The unique characteristics of the region, the variety of vegetation and the abundance of natural resources have played an important role in the development of the region. After examining historical data on land use and land cover changes in the Garhshankar block, we found some interesting patterns.

### Agricultural expansion

Agriculture is the main land use in Garhshankar Block. The abundant soil and favorable climate led to extensive agricultural production, including the cultivation of crops such as corn, rice, wheat, and sugar. However, we have seen a significant increase in agricultural land in the Garhshankar block over time due to changing socio-economic conditions and increased demand for food. This

increase has converted forests, woodlands and other habitats into agricultural areas, changing land cover and affecting the local environment.

**Urbanization and Infrastructure Development**

Urbanization and infrastructure development have affected land and use changes in Garhshankar block. Urbanization and population growth have increased the demand for businesses, housing and infrastructure. As a result, ecosystems such as forests and agricultural lands are transformed into cities and industrial areas. This urbanization has a significant impact on local land use and land cover, including changes in vegetation cover, loss of wildlife habitat, and changes in watershed patterns, among others.

**Mining and Industrial activities**

Mining and industrial activities have had a significant impact on land use and land cover changes in the Garhshankar block. Due to the area's rich mineral resources, coal mining has been active in the area for many years. The conversion of forests and agricultural areas into mining sites is just one example of how these activities change land use and have significant social and environmental impacts. The appearance of the Garhshankar block has been altered by infrastructure, roads and other structures, and the addition of industrial units has altered the land cover of the area.

**Environmental effects of land use and land cover change**

The land use and land cover of the Garhshankar block have significant impacts on the ecosystem, with significant benefits for natural resources, biodiversity and local people. We now analyze the most important environmental impacts of land use and land cover changes in the Garhshankar block.

**Deforestation and Loss of Biodiversity**

The conversion of forests and other natural habitats into agricultural land, towns and mining areas has led to deforestation and loss of biodiversity in the Garhshankar block. Forests provide habitat for animals, support the local economy and maintain environmental balance. However, deforestation has negatively affected local biodiversity and ecological integrity through loss of vegetation cover, destruction of wildlife habitats, and degradation of natural resources.

**Changes in Hydrological Patterns**

Changes in land use and land cover in the Garhshankar block have also changed local hydrological patterns, affecting the quantity and quality of water in the area. Regional hydrologic patterns are affected by changes in the water cycle and changes in vegetation cover due to deforestation. The removal of vegetation disrupts the natural water catchment process, increasing runoff, soil erosion and groundwater alteration. This may adversely affect water access, quality and overall safety in the Garhshankar block.

**Air and Water Pollution**

In the Garhshankar block, mining activities, industrial growth and urban growth also contribute to air and water pollution. Dumping of untreated waste into waterways, increased industrial emissions, and increased traffic emissions have contributed to air and water pollution that harms

animals, human health, and aquatic ecosystems. Environmental degradation causes a significant degradation of air and water quality, affecting plants, animals and human health.

**Socioeconomic Impacts**

Changes in land use and land cover in the Garhshankar Block will have environmental and social impacts. The conversion of agricultural land to non-agricultural activities affects local economies, agricultural practices and the livelihoods of local farmers.

Changes in land cover, such as deforestation, affect the heritage of local people, alter their culture and limit the amount of forest resources available. Garhshankar block planning and decision-making for sustainable development must take into account the socio-economic impacts of land use and land cover changes.

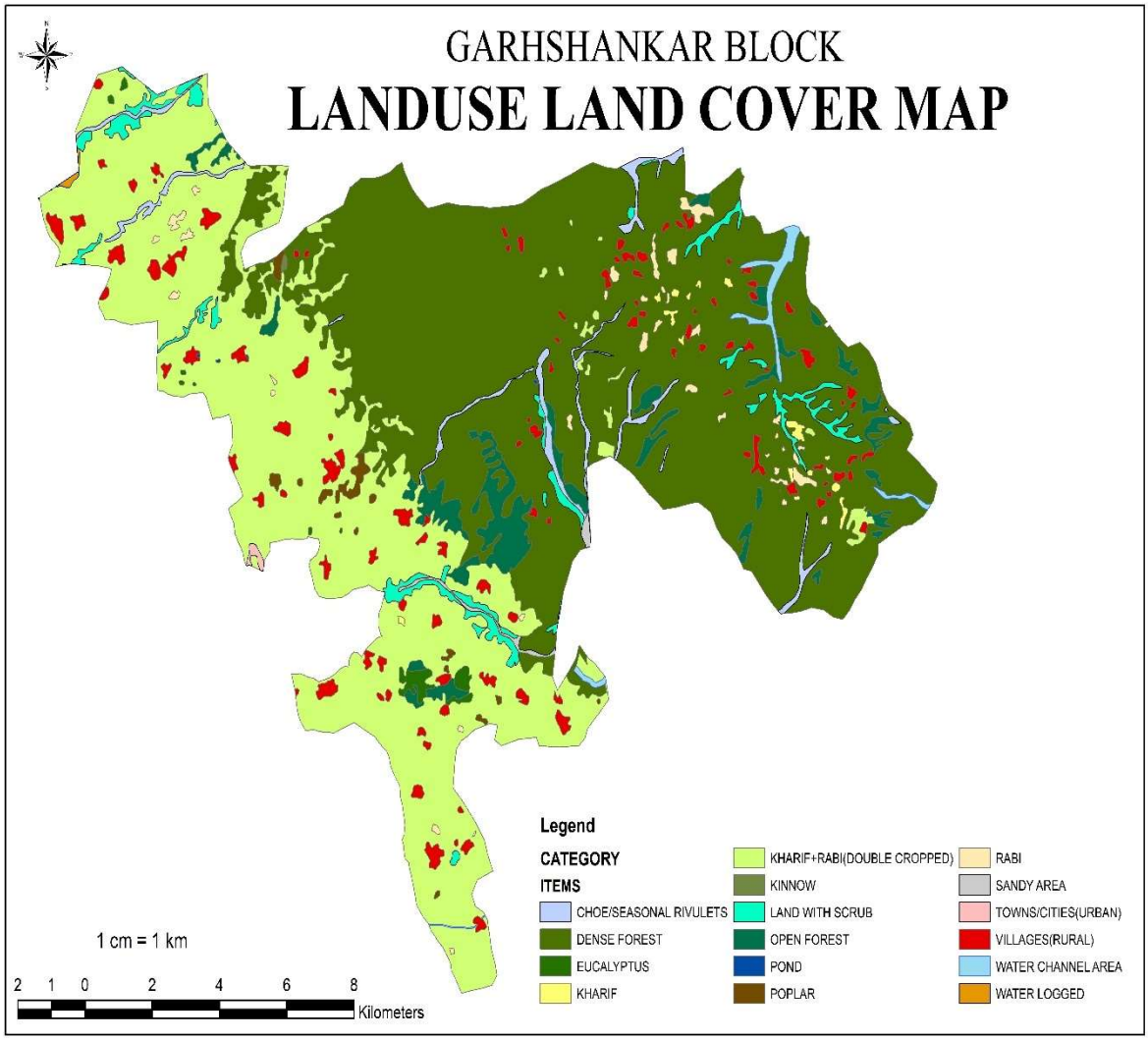



**Fig 4: LULC map Garhshankar Block**

**Strategies for Sustainable Land Use and Land Cover Management**

Considering the environmental and socio-economic impacts of land use and land cover change in Garhshankar block, it is important to implement strategies for sustainable land use and land management.

Here are some good strategies you can use:

**1. Promoting Sustainable Agriculture**

Examples of sustainable agricultural practices that can be promoted to reduce the negative impacts of agricultural expansion on land use and land cover in the Garhshankar block include agroforestry, organic farming and conservation agriculture. Sustainable agricultural technologies can improve soil health, reduce chemical use, and promote biodiversity-friendly agriculture that can support sustainable land management.

**2. Implementing Land Use Planning and Zoning**

Spatial planning and zoning strategies should be used to manage land use changes in the Garhshankar Block. This may mean identifying areas suitable for different land uses, such as mining, urban development or agriculture, and managing land use changes based on these requirements. This can help plan, manage and stabilize land use changes.

**3.Promoting Forest Conservation and Restoration**

Protecting and restoring the forests of the Garhshankar Block is important to protect biodiversity, protect water resources and curb climate change. Using methods such as afforestation, replanting and forest conservation can help restore degraded areas, promote sustainable land cover management and reduce deforestation.

**4. Strengthening Environmental Regulations and Enforcement**

Environmental laws related to air and water pollution can be applied to reduce the negative impact of mining and industrial activities on land use and land cover in the Garhshankar Block. Achieving this requires monitoring and controlling emissions, waste management and other environmental impacts of human activities. Failure to comply will result in penalties.

**5.Engaging Local Communities and Stakeholders**

Stakeholders and local people need to be involved in decision-making processes related to land use and land cover management to achieve sustainable outcomes. Communicate with local farmers, villagers and indigenous groups to understand their views, needs and traditions. Land use plans and master plans may contain some considerations.

In conclusion, land use and land cover change in the Garhshankar Block will have significant environmental and social impacts. Agriculture, urbanization, industrialization, forestry, and mining have contributed to agricultural expansion, biodiversity loss, changing water patterns, land degradation, gas and water pollution, and economic recession. Addressing these challenges requires the use of sustainable land and land cover management practices. The Garhshankar block promotes more sustainable land uses by promoting sustainable agriculture, implementing land planning and zoning, protecting and restoring forests, strengthening environmental laws and empowerment, and community and stakeholder engagement and land cover management. The use of these technologies can protect the environment, reduce the negative effects of land use and land

cover change, and maintain the social and economic well-being of local people.

It is also essential for educating the public, decision-makers, and other interested parties about the value of sustainable land use and land cover management. Knowledge and skills linked to sustainable land use and land cover management can be enhanced through educational campaigns, training programs, and capacity building activities. This is because these topics are critical to decreasing the environmental and socioeconomic implications of land use change in Garhshankar Block. This will promote responsible conduct and thoughtful decision-making. By implementing strategies that support sustainable agriculture, effective land use planning, forest conservation and restoration, environmental regulation and enhancement, and community participation, the Garhshankar Block ensures a healthier and stronger environment for current and future generations future It is also proposed to create an evaluation and monitoring system to follow the progress of the micro plan and make the necessary adjustments.

The study concluded that the use of remote sensing and GIS technologies can address the challenges faced by Garhshankar Block and improve the micro-level planning process. Actions planned based on accurate data and analysis provided by technology can improve the local socio-economic situation and infrastructure. Involving local people and providing them with the training and capacity building they need is essential to ensure the sustainable development of the region. In summary, our research on the use of remote sensing and GIS in Garhshankar micro block planning shows how these tools can be used to address challenges facing society. In addition to providing a conceptual review of the planning process, the report provides specific recommendations for actions aimed at improving the social and structural environment of the county. If these concepts are implemented, Garhshankar Block can expand and become a sustainable development model for India.

## PLANNING PRIORITIES FOR THE PROBLEMATIC AREA

Garhshankar Block is located in the Indian state of Punjab, an area with many structural and economic problems. These areas require careful planning and prioritization to meet specific needs and improve the quality of life for residents.

### Healthcare Facilities

Providing adequate health care is one of the main objectives in the challenging Garhshankar block area. In many places, even basic health services are not available, so people travel long distances for treatment. Governments can coordinate the development of new medical facilities and provide financial incentives to attract doctors to the region.

### Education Facilities

Education is another issue that needs to be addressed. In many communities, there is no access to quality education and children sometimes have to travel long distances to get to school. Governments can be the first to build new schools and offer incentives to encourage qualified

teachers to move to the area.

**Employment Opportunities**

Employment is essential for the socio-economic growth of the region. Due to the lack of employment opportunities in many areas, the people of the Garhshankar block are forced to migrate in search of work. Governments can invest heavily in new industrial developments and offer incentives to companies looking to set up in the region.

**Infrastructural Development**

Building infrastructure is important for regional development. Many areas lack basic infrastructure such as roads, water supply and electricity. Governments can prioritize infrastructure development and provide financial incentives to encourage private sector participation.

**Women Empowerment**

In the troubled Garhshankar block region, women's empowerment is a priority. These women face many challenges in pursuing education, health and career opportunities. The government should make it a priority to establish women's development centers and training programs to improve their careers and skills.
Addressing the unique needs and challenges of Garhshankar block problem areas requires planning and prioritization. For the region to survive, adequate health and education facilities, employment opportunities, infrastructural development and women empowerment are needed. By giving support and priority to these institutions, the Garhshankar Block can reach its full potential and develop in the field of socio-economic development.

**Sustainable Agriculture**

Sustainable agriculture is important to the economy of the Garhshankar block and should be prioritized above all else. Some of the problems facing the region include soil erosion, water scarcity and climate change. Governments can prioritize the promotion of sustainable agricultural practices such as crop rotation, organic farming and irrigation practices. This will not only help the long-term survival of the agricultural industry in the region, but also increase the country's productivity.

**Environmental Conservation**

The long-term sustainable growth of the Garhshankar block depends on environmental protection. Many types of plants and animals live in this area, so the ecosystem is unstable. Governments should make it a priority to establish protected areas and encourage environmentally friendly travel

practices. This helps promote economic prosperity and preserve the environment.

**Disaster Management**

Considering the problem areas of Garhshankar block, disaster management is very important. Natural disasters such as earthquakes, droughts and floods can affect this area. Governments may decide to build disaster management centers and provide training programs to improve the preparedness of the local population. Prioritizing sustainable agriculture, environmental protection and disaster management is essential for the long-term sustainable development of the Garhshankar Block. This will ensure the safety of residents and reduce the effects of natural disasters. Addressing these issues will spur local economic growth and improve the quality of life for residents. Providing incentives and support is key to attracting private sector investment and ensuring continued growth in the region.

## CONCLUSION

Garhshankar Block is a village located in Hoshiarpur district in the Indian state of Punjab. The block houses approximately 270,000 people (as of the 2011 Census) and occupies an area of 410 square kilometers. Located at the foothills of the Shivalik range, this block is characterized by rolling hills, flat plains and meandering rivers. The main industries of the region are the production of vegetables, sugar, wheat and rice. The main industry of the region is agriculture. Selling wood is the main source of income for many people living in this predominantly forested area.

However, the region faces several challenges that are hindering its progress. Damage to infrastructure such as roads, electricity and water supply is also a major problem. The lack of medical and educational resources in the region results in low literacy rates and poor health outcomes. In addition, the Garhshankar block is vulnerable to droughts, floods and landslides, which cause significant damage to crops and infrastructure. Inadequate planning and management can exacerbate the effects of these disasters and lead to other economic problems. The local population consists of people of various castes and religious traditions. Most of the residents are economically and socially classified as scheduled castes and other backward classes. The region is home to many Muslims and Christians.

The Garhshankar block study area is important because it serves as a model for the problems faced by rural communities in India. Although the region's land and natural resources offer significant potential for the growth of agricultural and forestry enterprises, poor planning and infrastructure have slowed development. Lack of resources and vulnerability to extreme weather events have compounded the socio-economic challenges facing the region.

The use of new technologies such as GIS and remote sensing can help address these challenges by providing fast and accurate data on local resources, infrastructure and population. These technologies can help identify specific areas in a block where specific interventions are needed to improve physical infrastructure and economic conditions. Garhshankar Block's learning space is important in understanding the challenges facing rural India and how new technologies can address these challenges. By identifying areas that need intervention, policy makers and legislators can

formulate plans that focus on goals to ensure sustainable development and improve the lives of the region's residents.

In addition, due to its location in the foothills of the Shivalik range and extensive forest cover, the Garhshankar block is vulnerable to environmental degradation, including landslides and deforestation. These environmental issues have a significant impact on the region's overall ecological health, water availability, and agricultural productivity.

To address these problems, the government has launched several plans and projects to improve the region's physical and social infrastructure. For example, the improvement of road connectivity in the district has been greatly helped by the Pradhan Mantri Gramme Sadak Yojana. In this context, the Rural Employment Law improved the economic situation of the residents by creating jobs. The use of GIS and remote sensing for micro-level planning techniques is another advance in this field. The Garhshankar block study used these methods to identify areas that needed treatment. These technologies provide information to help planners and policymakers formulate and implement effective development strategies for the region.All things considered, the Garhshankar block study area is an example of the infrastructure and social issues being addressed by rural communities in India. These problems can be solved with new technologies such as remote sensing and GIS that provide accurate and fast data. By developing policies and procedures, officials can ensure ustainable growth and improve the lives of local residents.

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