International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2024: 7.101

# Transformation of Agri-Tracts into Agriculture Plantation in Nainital District: A Case Study of Koshi River Catchment Area

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**Abstract:** ***The terrain of the Kaladhungi and Bealparao areas in the Nainital district of Uttarakhand has experienced considerable changes in recent years, influenced by socio-economic dynamics and changing farming methods. Historically focused on cereal and staple crop farming, large areas of agricultural land are progressively being transformed into orchards, especially for valuable fruit crops that thrive in the region's agro-climatic conditions. This research investigates the trends and factors influencing land use and land cover change (LULCC) in these regions, utilizing a mix of remote sensing data, Geographic Information System (GIS) analysis, and field surveys to measure and illustrate the spatial dynamics of land transition from traditional agriculture to orchard farming. Findings demonstrate a significant rise in orchard areas, frequently at the cost of conventional agricultural fields, driven by elements like market demands, policy encouragements, changing labor conditions, and the quest for improved economic gains. The consequences of this shift for environmental sustainability, soil health, water supplies, and community livelihoods are thoroughly assessed. Results from this study enhance our knowledge of rural land change dynamics in the study area and provide valuable insights for planners and policymakers seeking to reconcile agricultural productivity with ecological sustainability in the Uttarakhand.***

**Keywords:** land use and land cover change, Fragmented landholdings, land Rejuvenation

## 1. Introduction

Changes in Land Use and Land Cover (LULC) serve as an important measure of the relationship between human actions and the natural world. Land use involves the methods by which humans utilize land, including farming, city expansion, and forest management, whereas land cover signifies the physical attributes of the Earth's surface, encompassing plant life, water features, and constructed regions. Alterations in land use and land cover patterns have considerable effects on environmental sustainability, biodiversity, climate management, and socio-economic growth.

Improvements in remote sensing and Geographic Information Systems (GIS) have enabled the effective mapping, classification, and analysis of land use and land cover (LULC) changes over time. Satellite images offer steady and trustworthy information for identifying spatial and temporal changes in land cover, whereas GIS tools facilitate thorough analysis and visual representation of these alterations. This research seeks to evaluate LULC patterns and transformations within the study region through remote sensing and GIS methods, offering insights into the underlying factors and possible environmental effects related to the changes noted.

## 2. Study Region

The Kaladhungi- Bealparao region lies in Nainital district of Uttarakhand state Kaladhungi at Coordinates 29° 17' 0.636" N & 79° 21' 3.6" E. It is well situated in the catchment area of river Koshi. The Kosi River, a significant geographical feature, forms a natural boundary between Nainital and Almora districts before merging with the Ramganga River flows through this region, and the region is well irrigated by these rivers. The region is rich in agriculture and orchards.

## 3. Objectives

The following objectives are sufficient to understand the cause and changes in land use pattern in the study area.

- To study land use Management of the study area.
- Agricultural development and it's challenges due to transformation Agri-tracts into orchards.

## 4. Research Methodology

The spatial data utilized in this research was mainly sourced from multi-temporal satellite imagery to examine land use and land cover (LULC) changes in the Kaladhungi area of Nainital district, Uttarakhand. Data from Landsat satellites, specifically Landsat 5 (TM), Landsat 7 (ETM+), and Landsat 8 (OLI/TIRS), was used because of their reliable temporal coverage and appropriate spatial resolution for regional-scale studies. Furthermore, RESOURCESAT imagery was utilized to improve the accuracy and validation of LULC classification. These datasets offered detailed spectral data necessary for recognizing and delineating different land use and land cover types in the study area. For the primary data collection several interviews of local resident were collected.

**Figure 1.1:** Landsat Images of Kaladhungi region

LULC Kaladhungi Bealparao region (2015-16)

LULC Kaladhungi Bealparao region (2023)

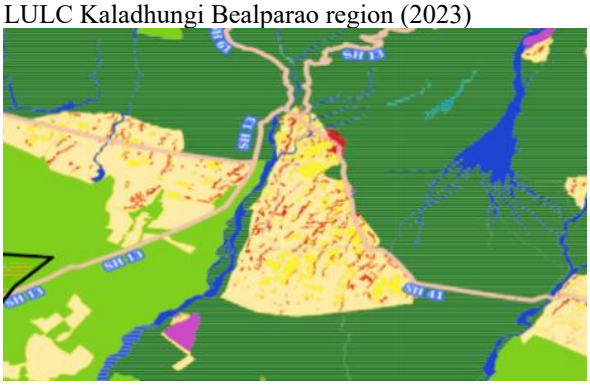

**Fig 1.2 Legend**


**Figure 1.3**

**Figure 1.4**

**Figure 1.5**

Farmers in Kaladhungi, located in Nainital district, Uttarakhand, encounter numerous obstacles due to the region's unique geographical, climatic, and socio-economic conditions. The primary challenges are outlined below:

a) **Water Scarcity and Irrigation Constraints** Limited irrigation infrastructure, such as canals or tube wells, exacerbates dependence on seasonal rains, while fluctuating groundwater levels add to the challenge.
b) **Limited Access to Modern Agricultural Practices** Access to extension services and training programs is often limited, particularly for smallholder farmers in remote areas.
c) **Market Access and Pricing Issues:** Farmers face difficulties reaching markets, often relying on intermediaries who purchase produce at low prices. Poor road connectivity and the absence of cold storage facilities lead to significant post-harvest losses, especially for perishable crops.
d) **Small and Fragmented Landholdings:** Land fragmentation, resulting in small and scattered plots, hinders efficient mechanized farming and limits crop diversification.
e) **Labor Shortages Due to Migration:** Limited economic opportunities in agriculture drive young people to migrate to urban areas, resulting in a shortage of farm labor. This leaves an aging population to manage agricultural activities, further reducing productivity.
f) **Insufficient Financial Support:** Farmers often face challenges accessing credit, insurance, or government subsidies. Bureaucratic complexities and lack of awareness prevent many from benefiting from agricultural support programs designed to enhance resilience and productivity.

**Orchards as an Alternative to Agricultural Practices**

In recent years, farmers in Nainital district have increasingly shifted from traditional agricultural practices to establishing orchards, a trend that has gained significant momentum over the past decade. Many farmlands have been converted into orchards, reflecting a significant transformation in land use patterns (as told by the residents).

**Benefits of Orchards Compared to Agricultural Tracts**

a) **Economic Viability**: Orchards offer greater financial returns compared to traditional agricultural fields, making them a more economically attractive option for landowners seeking to maximize profits.
b) **Reduced Maintenance Requirements**: Unlike agricultural fields, which require consistent upkeep, orchards demand less maintenance once trees are

established. This lower maintenance burden makes orchards a practical alternative for landowners.

c) **Lower Labor Dependence**: Orchards require fewer laborers, addressing a critical challenge faced by traditional agriculture, where labor shortages during harvest seasons often lead to delays and crop losses due to unseasonal rains or hailstorms. The reduced need for labor makes orchards an appealing option for farmers.

d) **Leasing Opportunities**: Many landowners lease their orchards to interested parties through 11-month legal contracts, transferring maintenance responsibilities to the lessee.

## 5. Conclusion

- **Community Awareness**: Increase public awareness of the importance of preserving agricultural land and traditional practices.
- **Land Rejuvenation**: Map abandoned terraces to identify opportunities for revitalization, focusing on high-value crops suited to the region's microclimate.
- **Labor Assessment**: Evaluate labor needs and availability to support sustainable agricultural practices.
- **Zoning Regulations**: Implement strict zoning policies to protect agricultural land from conversion to non-agricultural uses.
- **Entrepreneurship in Agriculture:** New entrepreneur are needed, as it plays an effective role in strategically investing the money and other resources in a directional manner. They might add benefits up by following.
- **Value addition**: Instead of trading raw materials, entrepreneurs can establish local processing facilities (for instance, converting raw cacao into gourmet chocolate or medicinal plants into essential oils). By securing a larger portion of the value chain, small parcels stay financially sustainable.
- **Direct to Consumer:** Business owners are utilizing technology to eliminate intermediaries. Platforms linking urban consumers with small-scale farmers guarantee that the "diversity premium" (the additional amount consumers spend on organic or heirloom types) returns directly to the land caretaker**.**

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## Author Profile

**Aprajit Puri** received his Masters degree in Geography from Uttarakhand Open University (Haldwani) in 2025.