Engineering and Technology Journal e-ISSN: 2456-3358

Volume 11 Issue 05 May-2026, Page No.-10095-10102

DOI: 10.47191/etj/v11i05.45, I.F. – 8.595

Assessment of Land Use and Land Cover Change in Talavera, Nueva Ecija from 2020 to 2025 Using GIS Mapping

Sherina Tracy L. Fajardo[1], Mc Klein T. Magsanoc[2], John Rouel S. Gloria[3], Sherwin S. Dela Cruz[4], Joacaz Kisley R. Gonzales[5], John Florenz T. Policarpio[6], Rosel V . Babalcon[7]

[1,2,3,4,5,6,7] Nueva Ecija University of Science and Technology, Sumacab Este, Nueva Ecija

ABSTRACT: This study assessed the land use and land cover (LULC) changes in Talavera from 2020 to 2025 using Geographic Information System (GIS)-based spatial analysis. The study aimed to identify land cover categories, determine their area and percentage distribution, and analyze spatial changes and trends within the municipality. A descriptive-comparative research design was employed using pre-classified LULC datasets obtained from Geoportal Philippines and processed through QGIS. Spatial analysis techniques, including area computation and post-classification change detection, were applied to compare land cover conditions between 2020 and 2025.

Findings revealed that annual crops remained the dominant land cover in both years, although agricultural land decreased by 66.08 hectares, while built-up areas increased by 71.17 hectares. Spatial trends indicated that urban expansion was concentrated near transportation corridors and existing settlements. The observed changes suggest a gradual transition from agricultural to urban land uses which may be associated with increasing development activities and accessibility. The findings demonstrate the usefulness of GIS-based spatial analysis in supporting land use planning and environmental management.

KEYWORDS: Land use, Land cover, GIS mapping, QGIS, Talavera, Nueva Ecija, Change detection, Urban expansion, Agricultural land.

CHAPTER 1 - INTRODUCTION

1.1 Background of the Study

Land use and land cover (LULC) change is a critical issue in environmental management and urban planning as it reflects the transformation of the Earth's surface due to both human activities and natural processes. Over the past decades, rapid population growth, urban expansion, agricultural intensification, and infrastructure development have significantly altered land cover patterns across the globe. These changes influence environmental sustainability, hydrological processes, and ecosystem balance. For instance, the conversion of vegetated or agricultural land into built-up areas can increase surface runoff, reduce groundwater recharge, and elevate flood risks.

In the Philippine context, land use changes are largely driven by population increase, economic development, and regional urbanization. Central Luzon, known as one of the country's major agricultural regions, has experienced increasing pressure from urban expansion and infrastructure development. Agricultural lands are gradually being converted into residential, commercial, and industrial uses, particularly in municipalities located near major transportation corridors. These changes highlight the need for effective monitoring and management of land resources.

Geographic Information Systems (GIS) have become essential tools in analyzing and monitoring LULC changes. GIS allows for efficient handling, visualization, and analysis of spatial data, enabling researchers and planners to assess temporal changes and identify patterns in land use. Through the use of official and standardized datasets, GIS-based analysis provides reliable information that supports planning and decision-making processes.

Talavera, Nueva Ecija, is a predominantly agricultural municipality that plays an important role in regional food production. However, due to its strategic location and accessibility, the municipality has experienced gradual development over time. Visible changes in land use, particularly the expansion of built-up areas, have raised concerns regarding the sustainability of agricultural land and environmental management. Despite these changes, there is limited localized research that quantitatively assesses land use and land cover changes in Talavera over time.

Given this context, there is a need to analyze how land use and land cover in Talavera have changed over a defined period. This study aims to assess LULC changes between **2020 and 2025** using official GIS datasets, providing a data-driven basis for understanding spatial trends and supporting future planning efforts.

1.2 Statement of the Problem

Talavera, Nueva Ecija, has undergone significant land development over the past decade due to its strategic location and increasing economic activities. These developments have led to visible shifts in land use, particularly the conversion of agricultural lands into residential and commercial zones. However, there is a lack of updated spatial data that accurately quantifies and visualizes the extent of these transformations over the last five years.

This study aims to assess the land use and land cover change in Talavera, Nueva Ecija from 2020 to 2025 using official GIS datasets.

Specifically, it seeks to answer the following:

1. What land use and land cover categories were present in Talavera in 2020 and 2025?
2. What were the total area and percentage distribution of each category in both years?

3. What changes, trends, and transitions occurred between 2020 and 2025?
4. What possible drivers and implications may be associated with the observed land cover changes?

1.3 Objectives of the Study

This study aims to assess the Land Use and Land Cover (LULC) changes in the municipality of Talavera, Nueva Ecija, from 2020 to 2025 using Geographic Information System (GIS) and Remote Sensing technology. Specifically, it intends to achieve the following:

1. To identify the land use and land cover categories present in Talavera, Nueva Ecija in 2020 and 2025.
2. To determine the total area and percentage distribution of each land use and land cover category for both years.
3. To quantify and analyze the spatial changes, trends, and transitions of land cover classes between 2020 and 2025.
4. To analyze the possible drivers and implications associated with the observed land use and land cover changes.

1.4 Significance of the Study

The findings and results of this study will provide valuable insights and data that will be beneficial to the following:

Local government unit (LGU) of Talavera, the findings may serve as a basis for updating the Comprehensive Land Use Plan (CLUP), improving zoning decisions, and strengthening land monitoring strategies. Accurate information on land cover changes can assist in identifying areas that require regulation or protection.

Farmers, the study may increase awareness of the ongoing conversion of agricultural land and its potential implications for food production and livelihood sustainability. Understanding these changes can help stakeholders recognize the importance of preserving productive farmland.

Engineers and planners, the results may support infrastructure development by providing insights into spatial growth patterns. This includes planning for road networks, drainage systems, and urban expansion in a manner that considers environmental and land use constraints.

Researchers, the study serves as a baseline reference for future GIS-based investigations on land use and land cover. It contributes to the growing body of knowledge on local-scale spatial analysis using official datasets.

1.5 Scope and Limitation

This study focuses on the municipality of Talavera, Nueva Ecija, and analyzes land use and land cover data for the years 2020 and 2025. The study utilizes official datasets obtained from the Geoportal Philippines and applies GIS-based spatial analysis techniques, including area computation and change detection.

The study is limited by the accuracy and resolution of the available datasets. Since the research relies on secondary data, any inherent errors in the source data may affect the results. No field validation was conducted to verify the classifications. Additionally, the study does not include predictive modeling, causal statistical analysis, or detailed socioeconomic factors at the barangay level.

1.6 Conceptual Framework

This study analyzes land use and land cover (LULC) changes in Talavera, Nueva Ecija from 2020 to 2025 using Geographic Information System (GIS) mapping. It shows how different factors influence land use changes over time. The independent variables include population growth, urban development, agricultural activities, and environmental factors, which affect how land is used and modified. The process involves collecting satellite images and spatial data, then analyzing them using GIS through mapping, classification, and change detection to identify changes in land cover. The dependent variable is the change in land use and land cover. The results provide information on trends and patterns of land transformation. The output of the study will support land use planning, environmental management, and decision-making for sustainable development.

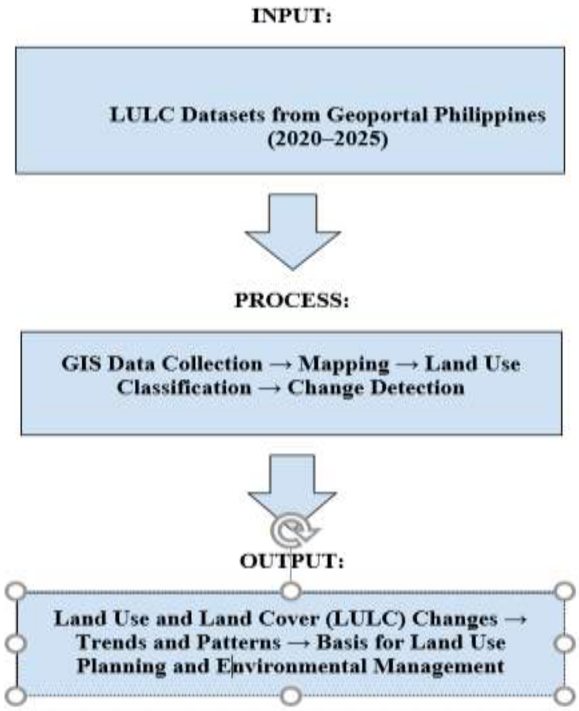

Figure 1. Conceptual Framework

CHAPTER 2

Review of Related Literature and Concepts

Foreign Literature

Recent international studies emphasize the growing importance of Geographic Information Systems (GIS) and remote sensing in analyzing land use and land cover (LULC) changes and their environmental impacts. A comprehensive review by Ali and Bilal (2025) highlighted that GIS and remote sensing technologies are essential tools for monitoring spatial changes and assessing their effects on environmental systems, particularly groundwater and land resources. Their findings showed that integrating geospatial analysis enhances both the accuracy and efficiency of land-use planning and environmental management.

In relation to this, Geographic Information Systems (GIS) and remote sensing are essential tools in analyzing land use and land cover (LULC) changes due to their ability to provide accurate spatial data. Geographic Information Systems enables efficient spatial analysis and mapping of land transformations, while Remote Sensing supports continuous monitoring of environmental changes through satellite imagery. A global assessment of LULC studies highlighted remote sensing as the most widely used method for detecting land transformations and monitoring environmental changes (Afuye et al., 2024). Advances in geospatial technologies have improved the accuracy of LULC mapping and support better land management and planning.

Similarly, Li et al. (2023) reviewed global and regional LULC mapping products and emphasized the significant advancements in satellite-based datasets and classification techniques. Their study demonstrated that high-resolution data and improved accessibility contribute to more reliable land cover assessments, strengthening the application of GIS in spatial analysis.

The importance of data accuracy in geospatial analysis was further emphasized by Brovelli et al. (2025), who discussed the development and validation of high-resolution global land cover maps. They stressed that accurate spatial datasets are fundamental for environmental monitoring and policy-making, reinforcing the necessity of using reliable GIS tools in LULC studies.

In addition, Jian et al. (2025) examined the relationship between land use changes and climate systems using satellite-based observations. Their findings revealed that large-scale land transformations significantly contribute to climate variability, highlighting the broader environmental implications of LULC change.

Advancements in predictive modeling have also improved LULC analysis. A study by Dumdumaya and Cabrera (2023) demonstrated the use of artificial neural networks combined with remote sensing to predict future land use changes. Their results showed that integrating machine learning with GIS can effectively simulate urban expansion and land conversion trends, providing valuable insights for sustainable planning.

Moreover, Zhao et al. (2023) explored land use and land cover classification using deep learning techniques. Their research indicated that combining satellite imagery with advanced computational methods improves classification accuracy and enhances the detection of land cover patterns.

Urban expansion and its spatial impacts have also been widely studied. Iizuka et al. (2017) analyzed urban growth in the Laguna de Bay area and found that rapid urbanization leads to the reduction of vegetated and agricultural lands. Their study emphasized the importance of temporal analysis in understanding long-term land transformation trends.

Furthermore, cloud-based geospatial platforms have emerged as powerful tools in LULC studies. Xiong et al. (2021) demonstrated that platforms such as Google Earth Engine improve data processing efficiency and enable large-scale environmental monitoring. Their findings highlight how cloud computing enhances accessibility and scalability in geospatial analysis.

The environmental impacts of land use changes were also discussed by Quintal et al. (2018), who found that increasing built-up areas significantly alter environmental conditions, including temperature and land surface characteristics. Their study underscores the importance of sustainable land-use planning in rapidly developing areas.

Local Literature

Land use and land cover change has become a critical focus in environmental studies in the Philippines, particularly in regions experiencing rapid population growth and urbanization. These changes significantly influence environmental sustainability, resource management, and spatial planning. The integration of GIS and remote sensing technologies has improved the ability to monitor these transformations by providing accurate spatial and temporal data.

A study by Bulaong et al. (2022) analyzed agricultural land cover changes in Nueva Ecija using GIS and remote sensing. The results revealed a significant shift from agricultural lands to built-up areas due to increasing urbanization, highlighting the pressure on agricultural resources in Central Luzon.

Similarly, Tumbaga (2023) examined land cover changes within and around Minalungao National Park. The study identified transitions among forest, water, and barren lands, demonstrating the effectiveness of GIS tools in monitoring environmental changes at the local level.

In Mega Manila, Mishra et al. (2021) investigated the implications of urban expansion on land use. Their findings showed that rapid urbanization contributes significantly to the conversion of agricultural lands into built-up areas. The study emphasized the importance of integrating geospatial technologies in urban planning to balance development and environmental sustainability.

In addition, Fargas Jr. et al. (2021) examined agri-urban land conversion using remote sensing and GIS techniques. Their study demonstrated how agricultural lands are increasingly being transformed into urban areas, reinforcing the need for continuous monitoring and policy intervention.

Another relevant study by Ornetsmüller et al. (2015) combined participatory mapping with remote sensing to monitor land-use changes in Mindanao. The findings highlighted the value of integrating community-based data with geospatial analysis to improve the accuracy and relevance of land use assessments.

Chapter 3

METHODOLOGY

3.1 Research Design

This study employed a descriptive-comparative research design using GIS-based spatial analysis to assess land use and land cover changes in Talavera, Nueva Ecija between 2020 and 2025. The approach focused on analyzing existing spatial datasets to identify differences in land cover distribution over time.

To evaluate changes, **post-classification change detection** will be applied to compare LULC maps from 2020 and 2025. The analysis will quantify the area and percentage distribution of each land cover class and identify patterns of land conversion, particularly the transition from agricultural and vegetative areas to built-up zones. The results will be presented through maps, tables, and graphs, providing a clear and data-driven basis for land use planning and environmental management.

3.2 Research Locale

The study was conducted in Talavera, a first-class municipality located in the province of Nueva Ecija within the Central Luzon region. Talavera lies approximately 120 kilometers north of Manila and is strategically positioned along the Maharlika Highway, making it highly accessible and a key transit point for agricultural and commercial activities.

Geographically, Talavera is bounded by the municipalities of Muñoz to the north, Guimba to the west, Cabanatuan City to the south, and San Jose City to the northwest. The municipality is characterized by generally flat terrain and fertile alluvial soils, making it highly suitable for agricultural production, particularly rice and vegetable farming. Due to these characteristics, Talavera is widely recognized as one of the major agricultural contributors in the province.

In recent years, Talavera has experienced noticeable changes in land use and land cover due to increasing population growth, urbanization, and economic development. Agricultural lands are gradually being converted into residential, commercial, and infrastructure areas. These transformations make the municipality an ideal site for analyzing spatial changes using Geographic Information Systems (GIS) and remote sensing techniques.

The selection of Talavera as the research locale is appropriate for this study because it reflects the common trend in developing municipalities where agricultural landscapes are transitioning into urbanized zones. Through GIS mapping and satellite image analysis from 2020 to 2025, the study aims to examine these spatial changes and provide data-driven insights for sustainable land use planning and environmental management.

Figure 2. Map of Talavera

3.3 Research Instrument

The primary research instrument used in this study is the Geographic Information System (GIS) software, specifically QGIS, which was utilized for processing, analyzing, and visualizing spatial data. QGIS served as the main tool for handling the Land Use and Land Cover (LULC) datasets, enabling the computation of area, classification review, and spatial comparison.

The study also relied on secondary geospatial datasets obtained from the Geoportal Philippines. These datasets include pre-classified LULC shapefiles for the years 2020 and 2025, as well as the administrative boundary of Talavera, Nueva Ecija. Since the datasets are already classified, no image processing or classification algorithms were applied.

Additional tools such as spreadsheet software (e.g., Microsoft Excel) were used to organize tabulated data, compute percentage distributions, and generate charts for presentation. Maps produced in QGIS were used as visual instruments to support spatial interpretation and analysis.

3.4 Sampling Procedure

This study employed a **non-probability sampling approach**, specifically a **purposive sampling method**, in selecting the study area and datasets. The municipality of Talavera, Nueva Ecija was intentionally chosen due to its predominantly agricultural land use and observable development trends over time.

The datasets used in the study were also selected purposely. Only LULC datasets corresponding to the years 2020 and 2025 from the Geoportal Philippines were included, as these datasets provide consistent and comparable spatial information for the study period.

Spatial filtering was applied by clipping the datasets to the administrative boundary of Talavera. This ensured that only relevant features within the study area were analyzed. No random sampling of features was performed, as the study utilized the complete LULC dataset within the defined boundary.

3.5 Data Gathering Procedure

The data gathering process involved the collection and preparation of spatial datasets required for the analysis of land use and land cover (LULC) in Talavera, Nueva Ecija.

1. Identification of Data Requirements

The required data for the study were identified, including Land Use and Land Cover (LULC) datasets for the years 2020 and 2025, as well as the administrative boundary of Talavera. These datasets were necessary to analyze spatial distribution and changes over time.

2. Acquisition of LULC Datasets

The LULC datasets were obtained from the Geoportal Philippines. The datasets were selected based on availability, consistency, and suitability for representing land cover conditions within the study area.

3. Download and File Preparation

The selected datasets were downloaded in shapefile format and extracted from compressed files. The files were organized into designated folders to ensure proper data management and easy access during processing.

4. Importation to GIS Environment

The downloaded datasets were imported into QGIS. The layers were checked to ensure that all necessary attributes and spatial features were properly loaded.

5. Boundary Data Integration

A municipal boundary shapefile of Talavera was added to the GIS environment. This boundary was used as a reference for limiting the analysis to the study area.

6. Data Clipping and Selection

The LULC datasets were clipped using the Talavera boundary to extract only the features within the study area. This ensured that irrelevant data outside the municipality were excluded from the analysis.

7. Data Verification and Cleaning

The datasets were visually inspected to check for errors, missing features, or inconsistencies. Attribute data were reviewed to ensure that land cover classes were properly labeled and suitable for analysis.

8. Preparation for Analysis

The cleaned and clipped datasets were prepared for further processing, including area computation and change detection. The datasets were saved in an organized format to ensure consistency throughout the analysis phase.

3.6 Data Analysis Procedure

The data analysis was conducted using GIS-based spatial analysis techniques to quantify and compare land use and land cover changes between 2020 and 2025.

First, the LULC datasets obtained from Geoportal Philippines were imported into QGIS. The datasets were then clipped using the municipal boundary of Talavera to ensure consistency in spatial extent. The land cover classes were reviewed and standardized to maintain uniform classification categories across both datasets.

The area of each land cover polygon was calculated using the Field Calculator tool in QGIS. The computed values were expressed in hectares and aggregated according to land cover classes to determine the total area for each category.

The percentage distribution of each land cover type was then computed by dividing the area of each class by the total land area and multiplying by 100. This allowed for the identification of dominant land cover types within the municipality.

To analyze changes over time, the total area of each land cover class in 2020 was compared with that of 2025. The difference in area was calculated to determine the magnitude of change, while percentage change was computed to assess the rate of transformation.

The results were organized into tables and graphical representations, such as charts and thematic maps, to facilitate interpretation. Observed trends were analyzed to identify patterns of land conversion, expansion, or stability across the study period.

CHAPTER 4
RESULTS AND DISCUSSIONS
4.1 Land Use and Land Cover Profile (2020)

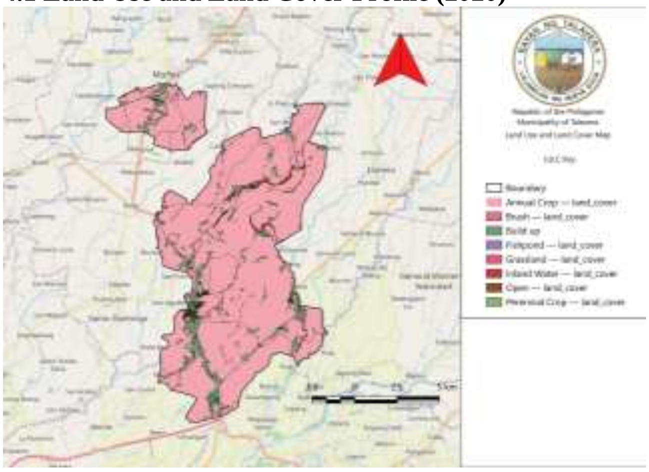

Figure 4.1 Land Use And Land Cover Map of Talavera, Nueva Ecija (2020)

The 2020 Land Use and Land Cover (LULC) map of Talavera, Nueva Ecija, serves as the study's baseline, capturing the municipality's spatial characteristics during this period. During this year, the landscape was overwhelmingly defined by vast tracts of agricultural land, which remained widely distributed across the town's boundary. This dominance underscores Talavera's established identity as a primary farming hub, where natural and cultivated surfaces far outweighed any artificial structures or urban modifications.

In contrast, built-up areas during this baseline year were relatively limited and primarily clustered near the town proper and along major transportation routes. This concentration suggests a trend where urban development was still concentrated, with residential and commercial expansion yet to reach the outlying areas. While vegetation and water bodies occupied smaller portions of the map, they remained critical environmental components, particularly for Figure 4.2 Land Use And Land Cover Map of Talavera, Nueva Ecija (2025)supporting the irrigation needs of the surrounding fields. Overall, the 2020 data reflects a predominantly rural setting with only small, concentrated pockets of urban growth.

Table 4.1 Land Use and Land Cover Table of Talavera, Nueva Ecija (2020)

Land Cover Type	Area (ha)	Percentage (%)
Annual Crops	11,363.65	86.24%
Built-Up	1446.89	10.98%
Inland Water	167.75	1.27%
Grass Land	6.16	0.05%
Open or Barren	51.75	0.39%
Perennial Crop	119.41	0.91%
Brush/Shrubs	13.36	0.10%
Fish Pond	7.32	0.06%
TOTAL	**13,176.29**	**100%**

The updated table provides a snapshot of how land was distributed across Talavera during the 2020 baseline year. Based on the mapping results, it is evident that Annual Crops continue to dominate the municipality's landscape, covering 86.24% of the total area, which underscores the town's strong agricultural identity during this period.

This is followed by Built-Up areas, which represent the second-largest land use at 10.98%, indicating a significant presence of residential and commercial infrastructures. Meanwhile, Inland Water systems and Perennial Crops occupy smaller portions of the map. Other categories, such as Open or Barren lands, Brush/Shrubs, Fish Ponds, and Grasslands, represent the most minimal shares of the total land area, reflecting a landscape that is primarily divided between intensive farming and growing urban centers.

4.2 Land Use and Land Cover Profile (2025)

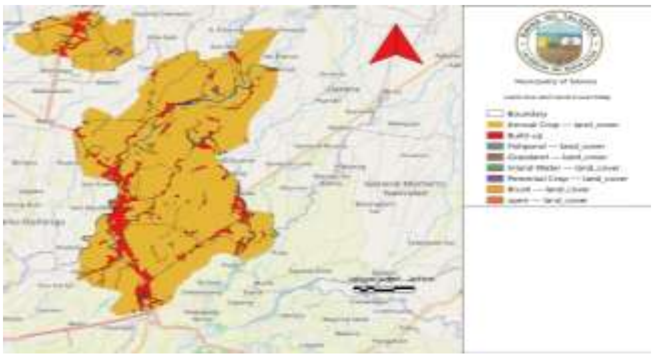

Figure 4.2 Land Use And Land Cover Map of Talavera, Nueva Ecija (2025)

The land use and land cover distribution for the year 2025 is illustrated in Figure 4.2. In comparison to the 2020 baseline data, the municipality has seen a rise in built-up areas, which suggests a trend of ongoing urban expansion. While Talavera remains largely an agricultural landscape, the 2025 map captures the visible transition of several farming plots into residential and commercial zones. This spatial shift may be associated with the town's continuous physical development and the increasing demand for infrastructure to support its growing local economy.

Table 4.2 Land Use And Land Cover Table of Talavera, Nueva Ecija (2025)

Land Cover Type	Area (ha)	Percentage (%)
Annual Crops	11,297.57	85.74%
Built-Up	1,518.06	11.52%
Inland Water	168.79	1.28%
Grass Land	6.16	0.05%
Open or Barren	51.75	0.39%
Perennial Crop	113.28	0.86%
Brush/Shrubs	13.36	0.10%
Fish Pond	7.32	0.06%
TOTAL	**13,176.29**	**100%**

Table 4.2 illustrates the updated land cover distribution across Talavera for the year 2025. Based on the current mapping results, Annual Crops continue to be the most dominant land cover within the municipality, covering 11,297.57 ha (85.74%) of the total area. However, there is a visible transition in land use compared to previous years. This is followed by an expansion in Built-Up areas, which now represent the second-largest category at 11.52% (1,518.06 ha). The municipality's Inland Water systems and Perennial Crops also maintain a steady presence, while other classifications including Open or Barren lands, Brush/Shrubs, Fish Ponds, and Grasslands occupy the remaining smaller portions of the total area. This distribution reflects a trend of physical changes in Talavera's landscape as it balances its agricultural foundation with increasing urbanization.

4.3 Area and Percentage Changes
Comparative Analysis of LULC (2020-2025)

Table 4.3 LULC Area and Percentage Changes Table of Talavera, Nueva Ecija (2020-2025)

Land Cover Class	2020 Area (ha)	2025 Area (ha)	Area Changes (ha)	Changes (%)
Annual Crops	11,363.65	11,297.57	- 66.08	- 0.50%
Built-Up	1446.89	1,518.06	+ 71.17	+ 0.54%
Inland Water	167.75	168.79	+ 1.04	+ 0.01%
Grassland	6.16	6.16	0	0%
Open or Barren	51.75	51.75	0	0%
Perennial Crop	119.41	113.28	- 6.13	- 0.05%
Brush/Shrubs	13.36	13.36	0	0%
Fish Pond	7.32	7.32	0	0%
TOTAL	**13,176.29**	**13,176.29**	**0**	**0%**

The comparison of land cover between 2020 and 2025 indicates a continuing transition in Talavera's landscape, even within a shorter five-year interval. While the **total boundary is maintained at 13,176.29 hectares**, the internal shifts suggest a municipality that is steadily balancing its agricultural roots with gradual urban growth.

The most observable trend is the reduction in **Annual Crops**, which decreased by **66.08 hectares (-0.50%)**. This change appears to be associated with the expansion of **Built-Up areas**, which saw an increase of **71.17 hectares (+0.54%)**. This pattern suggests a trend of conversion where farming plots may be transitioning into residential or commercial spaces to support local development. Meanwhile, areas classified as Grassland, Brush/Shrubs, and Fish Ponds remained stable with no recorded changes in area during this period.

Other land classes showed minimal movement, further suggesting a stabilized but evolving land use distribution. There was a decrease of **6.13 hectares** in Perennial Crops, while Inland Water saw a negligible increase of **1.04 hectares (+0.01%)**. These subtle shifts, particularly the consistency in water systems and specialized land uses, indicate that while urbanization is a possible driver of change, the municipality's overall spatial structure remains largely intact as it moves toward 2025.

4.4 Spatial Trends and Transition

The spatial distribution of land cover changes in Talavera follows a distinct pattern characterized by urban expansion that is spatially concentrated along transportation corridors, indicating linear growth patterns typical of road-driven development. New built-up developments are visibly stretching along the municipality's primary and secondary road networks, creating a connectivity-driven expansion between various barangays and the town center (see Figure 4.1 and Figure 4.2).

Consequently, this expansion has created specific agricultural reduction zones. These are the areas immediately surrounding the town proper and the highway corridors, where once-productive rice fields are now being transitioned into non-agricultural uses. The maps suggest that as the **zones (built-up)** cluster together, the neighboring **zones (annual crops)** are often the first to be displaced. This indicates a steady outward push of urbanization into the town's farming heartland, reflecting the physical transition of the landscape between 2020 and 2025.

4.5 Possible Drivers of Change

While several factors may have influenced these transitions, the following are considered primary contributors to the town's shifting landscape. These drivers are inferred based on the observed spatial patterns and the land cover data presented in this study.

Population Growth, This factor contributes to the increasing demand for housing and essential commercial services. As the number of residents in Talavera rises, the need for residential subdivisions naturally expands, putting direct pressure on existing **agricultural lands** and leading to the conversion of annual crops into built-up areas.

Highway Accessibility, May encourages development, particularly for businesses, logistics, and residential projects. The town's strategic location and well-maintained road networks make it an attractive spot for commercial investments. This accessibility is a primary driver of the **linear development patterns** observed along the municipality's primary corridors, often resulting in the conversion of roadside agricultural plots.

Land Value Increases, Rising property values may significantly influence land conversion. Property owners may find it more economically viable to develop land for residential or commercial purposes rather than maintaining it for traditional farming, especially in areas near the urban core and major transportation routes.

Overall, these drivers collectively facilitate the transition of Talavera from a predominantly agricultural landscape toward a more urbanized setting as it moves toward 2025.

4.6 Possible Implications

The observed land use changes bring several critical implications that the municipality may need to address in the coming years:

The reduction in agricultural space in Talavera may be associated with shifting land priorities, as the loss of **66.08 hectares** of farming land suggests a trend where local food production capacity and the primary livelihood of many residents could be affected. This transition also points toward a possible increase in drainage demand; as concrete and other **impervious surfaces** replace open soil, it may encourage a higher volume of surface runoff, potentially requiring more robust and efficient drainage systems to prevent localized pooling. Additionally, the clustering of developments and expansion along major roads suggests a trend toward traffic growth, which may lead to increased vehicle volume along major corridors, necessitating future road widening or improved traffic management.

The rapid pace of these transitions highlights a possible driver of zoning pressure, emphasizing the importance of consistent implementation of the Comprehensive Land Use Plan (CLUP) to balance development with the preservation of remaining agricultural zones. Furthermore, these shifts may be associated with heightened flood management concerns. With fewer natural absorption areas like grasslands and crops, the municipality might encounter challenges in managing heavy rainfall, as the landscape loses its natural capacity to penetrate excess water.

CHAPTER 5
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Summary

This study examined the land use and land cover (LULC) changes in the municipality of Talavera, Nueva Ecija using Geographic Information System (GIS) tools and spatial analysis techniques. The analysis was based on secondary geospatial datasets, specifically pre-classified LULC shapefiles obtained from the Geoportal Philippines and processed using QGIS. The study focused on a five-year period, comparing land cover conditions between 2020 and 2025.

The results indicate that Talavera remained predominantly agricultural in both years, with annual crops occupying the largest share of land area. However, there was a measurable increase in built-up areas and a corresponding decrease in agricultural land, particularly annual crops. Spatial patterns further suggest that development tends to expand along major road networks and near existing settlements, indicating a gradual and observable trend of urbanization. These changes suggest a transition in land use that may be associated with increasing development activities while the overall agricultural character of the municipality remains largely intact.

5.2 Conclusions

Based on the objectives of the study, it can be concluded that the land use and land cover categories in Talavera were successfully identified for both 2020 and 2025, including annual crops, built-up areas, inland water, and other minor classifications. The total area and percentage distribution of each land cover category were also determined, showing that agricultural land remained dominant while built-up areas comprised the second largest share in both years.

The study further quantified and analyzed spatial changes between 2020 and 2025, revealing a decrease in annual crops and an increase in built-up areas, along with observable patterns of land transition, particularly near roads and urban centers. The findings suggest that these changes may be associated with factors such as development pressures, accessibility, and land value, and may have implications for land use planning, agricultural sustainability, and infrastructure management. Overall, while Talavera remains largely agricultural, the results indicate a gradual shift toward increased urban development, highlighting the importance of continuous monitoring and balanced land management strategies.

5.3 Recommendations

In light of the findings, it is recommended that the Comprehensive Land Use Plan (CLUP) of Talavera be regularly updated to reflect current land use conditions, including changes in area and distribution of land cover categories. The protection of high-value agricultural lands should be prioritized to help sustain agricultural productivity despite observed changes. Areas experiencing increasing development may be identified and monitored as growth corridors to better manage spatial expansion and land transitions. In addition, improvements in drainage and infrastructure planning are recommended to support the increasing built-up areas and address possible environmental implications of land use change. Lastly, future studies may be conducted at the barangay level to provide more detailed analysis, as well as to further explore the possible drivers and implications associated with land use and land cover changes.

REFERENCES

1. Afuye, G. A., Nduku, L., Kalumba, A. M., & Santos, C. A. G. (2024). Global trend assessment of land use and land cover changes: A systematic approach to future research development and planning. *Journal of King Saud University - Science*, *36*(1), Article 102994. https://doi.org/10.1016/j.jksus.2024.103262
2. Ali, A., & Bilal, M. (2025). A comprehensive review of GIS and remote sensing applications in assessing land use and land cover impacts on groundwater systems. *Environmental Science and Pollution Research*. https://doi.org/10.1007/s11356-025-36787-5
3. Brovelli, M. A., et al. (2025). High-resolution global land cover maps and assessment strategies. *ISPRS International Journal of Geo-Information*. https://doi.org/10.3390/ijgi14060235
4. Bulaong, E. B., Camaso, E. E., Alberto, A. M. P., & Mapanao, K. (2022). Assessment of agricultural land-cover change in Nueva Ecija using GIS and remote sensing technologies. *ResearchGate*. https://www.researchgate.net/publication/366633964
5. Dumdumaya, C. E., & Cabrera, J. S. (2023). Determination of future land use changes using remote sensing imagery and artificial neural network algorithm: A case study of Davao City, Philippines. *Artificial Intelligence in Geosciences*, *4*, 111–118. https://doi.org/10.1016/j.aiig.2023.08.002
6. Fargas Jr., D. C., Narciso, G. A. M., & Blanco, A. C. (2021). Monitoring and assessment of agri-urban land conversion using multi-sensor remote sensing and GIS techniques. *ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, *V-3*, 117–124. https://doi.org/10.5194/isprs-annals-V-3-2021-117-2021
7. Iizuka, K., Johnson, B. A., Onishi, A., & Magcale-Macandog, D. B. (2017). Modeling future urban sprawl and landscape change in the Laguna de Bay area, Philippines. *Land*, *6*(2), 26. https://doi.org/10.3390/land6020026
8. Jian, M., et al. (2025). Satellite-based land-use change and its impacts on climate systems. *Atmospheric Chemistry and Physics*. https://doi.org/10.5194/acp-25-4251-2025
9. Li, X., et al. (2023). A review of regional and global land use and land cover mapping products. *ISPRS Journal of Photogrammetry and Remote Sensing*. https://doi.org/10.1016/j.isprsjprs.2023.11.014
10. Mishra, B. K., Mebeelo, K., Chakraborty, S., Kumar, P., & Sahu, N. (2021). Implications of urban expansion on land use and land cover: Towards sustainable development of Mega Manila, Philippines. *GeoJournal*, *86*, 2293–2307. https://doi.org/10.1007/s10708-020-10153-1
11. Ornetsmüller, C., et al. (2015). Monitoring land-use change by combining participatory mapping and remote sensing in Mindanao, Philippines. *International Journal of Applied Earth Observation and Geoinformation*, *36*, 69–82. https://doi.org/10.1016/j.jag.2014.11.007
12. Quintal, A. L., Gotangco, C. K., & Guzman, M. A. L. (2018). Forecasting urban expansion using the land transformation model in San Pablo City, Philippines. *Environment and Urbanization ASIA*, *9*(1), 69–85. https://doi.org/10.1177/0975425317748531
13. Tumbaga, J. R. A. (2023). Assessment of land cover change within and around Minalungao National Park in Nueva Ecija using remote sensing and QGIS. *Research*, *21*(4), 3591–3613. https://doi.org/10.15666/aeer/2104_35913613
14. Xiong, J., Thenkabail, P. S., Tilton, J. C., & Gumma, M. K. (2021). Socio-environmental land cover time-series analysis using Google Earth Engine. *Remote Sensing Applications: Society and Environment*, *21*, 100458. https://doi.org/10.1016/j.rsase.2020.100458
15. Zhao, S., Tu, K., Ye, S., Tang, H., Hu, Y., & Xie, C. (2023). Land use and land cover classification meets deep learning: A review. *Sensors*, *23*(21), 8966. https://doi.org/10.3390/s23218966