Examining Community Perceptions on the Impacts of Land Use and Land Cover Change on Urban Environments: Evidence from Ayat Tafo Condominium Development in Addis Ababa, Ethiopia.

A thesis submitted to the School of Graduate Studies of the Addis Ababa University, College of Technology and Built Environment, in partial fulfillment of a master's degree in environmental planning and landscape design.

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Title of Thesis: **Examining Community Perceptions on the Impacts of Land Use and Land Cover Change on Urban Environments: Evidence from Ayat Tafo Condominium Development in Addis Ababa, Ethiopia.**

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DECLARATION

I, the undersigned, hereby confirm that this thesis is my work and that it has not been submitted, in whole or in part, for the award of any other degree or qualification from any other institution. To the best of my knowledge and belief, this thesis does not involve any material that has been previously published or written by another person, except where proper acknowledgment and due citation have been made. I declare that all sources of information used in the thesis have been sufficiently referenced and that the work is fully reliable with academic integrity principles of uprightness and originality.

Addis Ababa

December, 2025

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CERTIFICATION

I, the undersigned, certify that the thesis titled: **Examining Community Perceptions on the Impacts of Land Use and Land Cover Change on Urban Environments: Evidence from Ayat Tafo Condominium Development in Addis Ababa, Ethiopia.** A work, submitted to the School of Graduate Studies at Addis Ababa University to be awarded, a Master of Science degree in Environmental Planning and Landscape Design, is the original work of Belhu Fikadu.

Chair of Environmental Planning and Landscape Design, College of Technology and Built Environment, Addis Ababa University

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Abstract

Globally, urban areas face rapid changes in LULC driven by population growth. In sub-Saharan Africa, these changes frequently happen without proper planning, causing biodiversity loss and environmental degradation. In Addis Ababa, condominium developments, including Ayat Tafo, have intensified pressure on green-infrastructure, disturbed-drainage functionality, and degrade ecosystem-functionality. Although quick condominium development and visible environmental dreadful conditions at the Ayat Tafo 20/80 site, the fine-scale biophysical effects of LULC change and the role of community insight and involvement in undertaking these challenges remain mainly undocumented and poorly understood. As a result, this study attempts to examine community perceptions of Land Use and Land cover change impacts on urban environments. The study used a mixed-methods approach using GIS-based time-series LULC analysis (2015–2025), and household surveys (questionnaire), site observations, and key-informant interview were used to collect firsthand data. Sample size of the study was 368 household and 8 key informant, systematic random sampling and purposive sampling technique was used respectively. To analyses quantitative and qualitative data, SPSS, Excel, and ArcGIS 10.8, software were used. The finding revealed wide alteration of vegetated, wetland, and open spaces into built-up areas. About 97% of residents observed foremost LULC changes, with urban development and land conversion as leading trends. Waste administration, loss of green areas, and water deficiencies were identified as serious challenges. Although the result revealed that 73% believed community involvement is effective while, 62% stated no participation due to absence of awareness, economic-constraint, and weak institutional corporation. The study concludes that LULC change at the community scale has created unified ecological, infrastructural, and social challenges, which can't be addressed without participatory planning and green- infrastructure approaches. It recommends combined waste management, re-establishment of green and wetland spaces, viable water controlling, and supported community commitment inside urban planning frameworks to certify ecologically resilient and socially all-encompassing condominium growth.

Key words: Community Participation; GIS and Spatial Analysis; Land Use Land Cover Change; Sustainable Landscape; Urban Environment

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Table of contents

List of figure

List of table

Acronyms

EC	European Commission
EPA	Environmental Protection Agency
ES:	Environmentally Sustainable
FGD	Focus Group Discussion
FPC	Finite Population Correction
GIS	Geographic Information System
IAQ	Indoor Air Quality
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
LED	Leadership in Energy and Environmental Design
LULC	Land Use and Land Cover
MEA	Millennium Ecosystem Assessment
NGO	Non-Governmental Organization
OLI/TIRS	Operational Land Imager / Thermal Infrared Sensor
SDGs	Sustainable Development Goals
SPSS	Statistical Package for the Social Sciences
WCED	World Commission on Environment and Development

Glossary of local terms

Ayat Tafo: Known for 20/80 condominium housing scheme in Lemi Kura sub-city, Woreda 02.

Woreda 02: A sub-city administrative division responsible for local governance and services.

General notes

- Unless specified, the author produces all pictures, maps, tables, and figures.
- To protect the identification of informants, given names are changed.
- All years are in the Gregorian calendar.

CHAPTER ONE: INTRODUCTON

This study examines the Perception of Communities on the Effects of Land Use and Land Cover Change on the urban environment at the Ayat Tafo condominium site**.** Land use changes have accelerated with rapid urbanization and high-density expansions of condominiums, resulting in negative environmental effects and a reduction in green spaces. This chapter provides the basis for this research by outlining key problems in urban planning and the environment, stating the research problem and gap, and setting the objectives and research questions. In addition, it describes the geographic and thematic scope, significance, limitations, and structure of the thesis, which lays a clear foundation for analyzing LULC dynamics and the role of community participation in sustainable urban development.

1.1 Background of the study

Urban areas worldwide are undergoing rapid change in land use and land cover, primarily driven by population growth, infrastructure expansion, and an increasing demand for housing and services (Seto et al., 2011). This change is occurring without enough planning, pose significant challenge to urban sustainability, change natural or agricultural land into urban settlement can lead to biodiversity loss, increase surface runoff, sol erosion, alter local climate ,and a decline urban ecosystem service(UN-Habitat, 2020).

In many developing countries, the rapidity of city expansion is occurring much quicker than the institutional capability to achieve it efficiently. Urban growth into agricultural, peri-urban, and ecologically sensitive zones repeatedly takes place without passable environmental valuation, strong regulatory administration, or adequate infrastructure investment. This unintended expansion typically consequences in reduced vegetation cover, poor storm-water drainage, increased waste generation, and declining ecological value. These challenges highlight the importance of integrating ecological planning and viable landscape management into urban growth processes to confirm resilient and livable urban settings (World Bank, 2015).

In sub-Saharan Africa, urban expansion occurring at a fast-tracked pace, often with limiting regulatory oversight and environmental attention. Rapid urbanization has frequently resulted in the conversion of productive land and natural ecosystem into built-up area, contributing to habitat destruction, loss of green space, and increase environmental pressure in urban neighborhood.

These pattern high light the critical need of for integrating sustainable land management into urban planning (UN-Habitat, 2020).

Ethiopia, specifically Addis Ababa has shifted from sprawling development to vertical housing solution, such as condominium. This approach was introduce to address housing shortage and optimize land use, but it has also placed significant strain on existing green infrastructure, often resulting in the loss of vegetation, inadequate storm water management, and increase waste generation (Mekuria et al., 2018). While these developments aim to meet the increasing demand for urban housing, they frequently fall short in integrating environmental planning and sustainable landscape design principles.

At the city level, policy frameworks like the Addis Ababa Structure Plan (2017-2027) emphasize sustainable development and green infrastructure; however, implementation at the neighborhood level remains weak (Addis Ababa City Planning Commission, 2017). New condominium development frequently overlooks critical environmental considerations, leading to the degradation of green space, disrupted drainage systems, and declining living conditions.

At the local level, the Ayat Tafo 20/80 condominium, situated on the eastern peripheral of Addis Ababa, has undergone rapid transformation from agricultural and semi-natural land to a high-density residential area. The development of condominiums, associated infrastructure, and roads has resulted in vegetation loss, increased impervious surface, disrupted drainage system, and heightened vulnerability to flood erosion and microclimate change (Hailu et al., 2021). These physical changes not only affect environmental quality but also influence the daily experience and well-being of residents (Assefa, 2019).

Understanding community perceptions of Land use and land cover (LULC) change is essential because residents possess local knowledge, experience, and attitudes that can guide sustainable landscape management (Reed, 2008). In fast-growing settlements like Ayat Tafo, community participation is often minimal, weakening opportunities for inclusive and environmentally sensitive planning (Tadesse et al., 2022).

Assessing how local people perceive change in their environment and their willingness to engage in mitigation and management practice is therefore critical for informing strategies that balance housing need with environmental conservation and urban livability (Angel et al., 2011).

1.2 Problem statement

Rapid condominium development and Addis Ababa have resulted in significant LULC change, yet the environmental impact of this change at the neighborhood scale remains insufficiently understood. At the Ayat Tafo 20/80 condominium site, successive construction phases have neglected key green-infrastructure measures, despite the Addis Ababa Structure Plan emphasizing sustainable development (Addis Ababa City Planning Commission, 2017). This has led to environmental decline, reduce vegetation cover, poor drainage and deteriorating living conditions for residents.

Although previous study have mapped general LULC change across Addis Ababa (Negesse et al., 2024), no fine –scale assessment exist for the Ayat Tafo sit .As result , the spatial extent and pattern of current land use and land cover change remain undocumented, planner laving without a reliable bas lain for identifying degraded area or planning priority intervention (Wubie et al., 2021)., likewise, the physical impact of land us land cover change run off behavior, habitat quality, and microclimate remain largely unmeasured (Feyisa et al. 2014) making it difficult to design effective green infrastructure and sustainable landscape management strategies (Seto et al., 2012).

Moreover, community perceptions, which are essential for understanding lived experiences, environmental challenge, and preferred intervention are often overlooked, although research shown that top-down design approach fail when they ignore social and cultural need. (Jurkovic, 2014). Accordingly, the magnitude of LULC-driven environmental change at Ayat Tafo, together with residents' perceptions and the level of participation in addressing the challenge, remains basically unknown.

Research on participatory planning in the Ethiopian condominium context further emphasizes top-down policy, often overlooking resident-based evaluation, local adaptation strategies, and the integration of social, environmental, and institutional dimensions. As a result, the effectiveness, barriers, and mechanisms of community engagement in mitigating the adverse effects of LULC changes at the micro (neighborhood) level remain understudied. Della (2018) highlights weak community structures and limited participation in the Addis Ababa condominium neighborhood, underscoring the need for localized, residence-focused assessments and development of context-specific models for participatory planning that can advance sustainable landscape management.

The motivation for this research stems from the crucial requirement to bridge these knowledge gaps. As a researcher attentive to sustainable urban development and environmental management, I am interested in producing evidence-based, site-specific data that can inform applied involvement, strengthen residents' voices, and contribute to environmentally strong and comfortable urban neighborhoods. By focusing on Ayat Tafo, this study aims to generate actionable understandings that steadiness housing provision with ecological integrity, ensuring that urban development does not compromise environmental value or community well-being.

1.2.1 Research gap

There are still several important gaps in the literature on urban land use and land cover (LULC) changes in Ethiopia and other rapidly growing African cities, particularly at the local scale, where social and environmental processes interact most directly.

Insufficient localized LULC studies in condominium settings: Out of various studies regarding urban expansion and LULC dynamics carried out in Addis Ababa (Forkuor, 2018), not much localized research has examined condominium developments in the light of how LULC changes specifically affect their physical systems (drainage, layout, green spaces, open space distribution) and environmental quality (air, soil, biodiversity). In addition, site ecological data and resident-based evaluations, which are important inputs for sustainable urban planning at the micro-scale (neighborhood scale), remain largely unassessed (UN-Habitat, 2021).

Most studies in Ethiopia emphasis on the Biophysical effects of land use and land cover transformation but they rarely examine how communities perceive these changes (Tadesse, 2023). Little is known about residents' skills and awareness of environmental problems in condominium settings. This creates a gap in understanding the social dimension of urban environmental conversion (Seto et al., 2011). Consequently, this research addresses the deficiency of research on communities' perceptions of land use and land cover impact at Ayat Tafo condominium site.

When we delve into applied strategic involvements at the site level, it's clear that there's a major gap in investigation. Although there are viable urban growth policy outlines in Ethiopia, there is slight observed evidence on what planned involvements have led to real implementation or adaptation in condominiums. There appears to be an insufficient valuation of the existing environmental and land-use administration practices, with gaps in institutional roles (weaknesses

in official coordination), public adaptation, and the integration of landscape design solutions (poor integration of design and planning in condominium sites). Such an assessment failure creates an obstacle to developing contextualized, action-oriented recommendations for site development (Della, 2018).

Understudied role of public (community) contribution in urban environmental response: Community participation is broadly recognized as a keystone of viable urban improvement; however, empirical indication on its real role in responding to LULC alteration at the community scale in Ethiopia remains limited, predominantly in condominium locations such as Ayat Tafo. Most studies on land use and land cover change in Addis Ababa have focused on city-wide patterns, urban development, and environmental effects (Forkuor, 2018), but they rarely examine how dwellers perceive, adapt to, or actively respond to this transformation. This gap constrains understanding of the local-level implications of land use and land cover change, and the possible influence of communities in determining sustainable environmental consequences

1.3 Objectives of the research

1.3.1 General objective

The general objective of this study is to examine community perceptions of Land Use and Land cover change impacts on urban environments, as exemplified by Ayat Tafo condominium development in Addis Ababa, Ethiopia.

1.3.2 Specific objective

- To assess the effects of land use and land cover changes on the biophysical attributes of the condominium site.
- To analysis community perception of LULC changes impact on urban environment.
- To investigate community participation and strategic interventions undertaken to improve the site conditions in responding to the adverse effects of LULC changes.
- To suggest possible strategic interventions for promoting sustainable land use, and environmental management.

1.4 Research questions

To achieve the above-mentioned research objectives, there were some research questions to be answered using the question form of the specific research objectives as follows:

- What are the effects of land use and land cover changes on the biophysical attributes of the condominium site?
- How do community perceive the impact of LULC change on the urban environment in the study area?
- What strategic interventions have been applied to improve the site conditions and how do communities participate in responding to the adverse effects of LULC changes?
- What strategic interventions can be proposed to enhance sustainable land use, and environmental management in the study area?

1.5 Scope of the research

1.5.1 Geographic scope of the study

The research focuses geographically on the Ayat Tafo 20/80 condominium site, located in Woreda 02, Lami Kura Sub-city, in Addis Ababa, Ethiopia. The area contains residential blocks, commercial frontages, and communal spaces that have experienced rapid LULC changes, bringing about different urban environmental challenges.

1.5.2 Thematic scope of the study

The themes assess LULC changes that have impacted the biophysical and environmental qualities of the site, addressing quantifiable physical features and environmental change as a thematic concern. The physical attributes considered include existing land use types (like that of residential, vacant, and paved surfaces), and spatial arrangement. It also assesses the status of drainage infrastructure and conversion of green spaces.

The environmental dimension includes water quality, biodiversity, soil erosion, vegetation loss, loss, and the frequency of environmental risks, such as noise pollution, and flooding. Using tools such as Geographical information system based-mapping, temporal satellite analysis, field

observations, and resident surveys, this objective discovers how land use and land cover variations from 2015 to 2025 have changed the environmental and physical landscape of the site.

The second theme looks to identify strategic involvements that have been applied to recover the site's situation. This section of the study thematically delves into the practical efforts and policies instituted to confront identified environmental challenges and physical risks. Among these principal themes are the development of green infrastructure, such as solid waste management systems, urban parks (recreation area), the establishment of water and storm water management systems, and wetlands restoration.

The third theme aims to investigate the degree and way in which the community participates in handling the adverse effects imposed by land use land cover changes. It also measures how residents observe environmental degradation and their individual role in mitigation. The analysis identifies both the efficiency of previous participation and barriers to more active involvement-such as socio-economy constraint, lack of awareness, and limited institutional support

Furthermore, the study deliberates strategies for enhancing partaking environmental planning through education, localized action planning and inclusive governance which are key to the long-term sustainability of any planned mediation.

1.6 Significance of the study

This research is significant in numerous way , mostly in term is of knowledge advancement guidance for urban planning, and support for sustainable growth initiatives in fast growing environments like that of Addis Ababa. The study assumes excessive significant has concrete real relevance to sustainable urban development in rapidly urbanizing area such as Addis Ababa. Mainly, it carry out localized interdisciplinary study of land use and land cover change and their influences on the biophysical and environmental attributes of condominium development while cross-examining the role of community contribution in improving these influences.

Initially, the study aims to address an important knowledge gap by providing empirical understandings into the dynamic changes in land use and environmental situations at the Ayat Tafo condominium site over the past decades. Most of the literature on land use and land cover change in Ethiopia either broadly covers the topic or does not provide a micro-level contextual

analysis. By focusing on particular high- density residential setting, this study delivers a fine-tuned understating of how infrastructure development, urban extension, and environmental degradation are interlinked at the neighborhood scale.

Secondly, it is extremely valuable as far as policy and planning are concerned. Environmental managers, local authorities, and Planners could benefit from its findings by enhancing their understanding of the consequences that may outcome from unplanned land use changes, including effects on soil quality, drainage systems, biodiversity, vegetation, and public health. Proposed planned interventions, combined with an assessment of their effectiveness, may enable evidence-based landscape design strategies, environmental planning frameworks, and urban policy that can be applied to other alike high-density urban housing contexts.

Finally, the significance of community contribution in the study is for further environmental sustainability. Community member are saw as actively participating in ecological restoration and land management, perceiving their responsibility and duty to protect accordingly. This lens of participatory development is vital for guaranteeing the long-term success of any environmental intervention, making the study valuable reference for community-oriented planning and governance.

1.7 Limitation of the study

The study faced several limitations. Some survey participants provided answers they thought were expected, rather than their true opinions. It was also challenging to find complete historical data, which made it difficult to study long-term trends. Poor coordination between institutions affected the gathering of organized data. Absence of sufficient and latest literature regarding study title.

1.8 Organization of the research

This research paper consists of six chapters. Chapter One introduces the study, including the background, problem statement, objectives, research questions, scope, significance, limitation and paper organization. Chapter Two reviews relevant literature. Chapter Three outlines the research methods. Chapter Four presents the results and discussion. Chapter Five strategy formulation. Chapter six offers conclusions and recommendations.

CHAPTER TWO: LITERATURE REVIEW

This chapter reviews the core concepts and theories associated with land use land cover change. Key terms, such as LULC, sustainable landscape, and urban environment, are defined. The chapter also presents the theoretical foundations, and urban and environmental contexts of the condominium are discussed, followed by a conceptual framework that guided sustainable transformation in high–density urban settings. Lastly, case studies from Bangalore and Nairobi to illustrate best practices.

2.1 Definition of key terms

Community participation: Community participation means being actively and genuinely involved in the planning, decision-making, and implementation process by residents, stakeholders, and other interested parties. It warranties that environmental and growth projects meet the community's wants and desires. Environmental planning have need of community contribution to confirm the longer-term achievement of projects and support sustainable stewardship (Reed, 2008).

Spatial Analysis: reveals patterns, trends, and dealings across space and time that influence decisions in urban and environmental planning. Such tools serves as a vital aspect in monitoring LULC changes and simulating impacts of future development. (Longley, et al., 2015).

LULC: refers to the change of land surface features, such as agricultural or urbanization practice, as well as natural process like floods or droughts. Land use shows the purpose of land use (such as residential or farming), In contrast, land cover refers to the physical features of the land, including vegetation and structures such as buildings. Considerate of LULC changes aids in assessing biodiversity loss, ecosystem degradation, and climate effects, providing a basis for sustainable land management , conservation, and spatial planning (Foley et al., 2005).

Sustainable landscape: is designed and maintained to be environmentally resilient, socially beneficial, and economically sustainable in the long term. It mediates between human needs and natural processes by recognizing and enhancing biodiversity, efficient water use, and low-impact development. These landscapes enhance urban livability, environmental health, and climate resilience, and are essential for realizing long-term solutions through green infrastructure and sustainable urban design (Reed, 2010).

Urban environment: The urban environment covers green spaces, natural systems, the physical infrastructure, and social structure in various cities. It determines the value life in relative to mobility, air quality, clean water, and housing. Rapid urban growth often presents challenges to sustainability, resulting in, habitat destruction, pollution, and resource depletion. A properly achieved urban environment is to integrate the properties of ecology with human desires to create health, resilience, and equity in urban living (UN-Habitat, 2016).

2.2 Theoretical review

The literature generally presents different theoretical perspectives on understanding temporal evolution in LULC dynamics, the impact of LULC changes on ecological and urban systems, and how participatory action can support sustainable landscape planning. These theoretical frames area applied to analyze that Ayata Tafo Condominium site, focusing on the interplay between spatial transformation, environmental degradation, and participatory urban development.

2.2.1 Theoretical perspectives on LULC change

2.2.1.1 Land change science

Land Change Science (LCS) offers a multi-dimensional scope in which ecological, socio-economic, and technological dimensions are integrated to understand how LULC change occurs, as well as its causes and consequences. It emphasizes, particularly, the dynamic interaction of systems by human beings and the environment through time (Turner et al., 2007). LCS discusses the diversity of driving factors of land changes from indifference to population growth, economic activity, policy decisions, and feedback from the environment while emphasizing the consequences under such categories as fragmentation of habitats, altered climate, and inequality within sociocultural space (Lambin, 2006).

2.2.1.2 Theory of urban ecology

Cities are dynamic socio-ecological systems that are complexly adaptive and interact with the surroundings natural and built environment. Urban ecology argues that every land cover change in the city has to be first and foremost dependent on changes in economic and people in and around the city, as well as various forms of ecological processes within and around cities (Alberti, 2008). This framework provides a critical understanding of how land transformations disrupt or

supporting ecosystem processes as nutrient cycling, biodiversity, and microclimate conditioning, thereby affecting urban sustainability (Grimm et al., 2000).

2.2.2 Theoretical understanding of environmental impact appraisal in LULC

2.2.2.1 Theory on urban resilience

Urban resilience theory examine city capacity to absorb shock and recognize to maintain functionality reorganize to maintain functionality (Meerow et al., 2016). In the case of LULC change, this theory helps in understanding the shock impacts of environmental shocks typically caused by flooding, heat islands, and vegetation loss. Resilience emphasizes adaptability, redundancy, and learning regarding approaches toward sustainable responses to land degradation and climate-related vulnerabilities (Ahern, 2011).

2.2.2.2 Theory on landscape function and structure

This theory focuses on investigating the influences of spatial configuration on ecological processes (landscape function). It considers that land-themes include patch size, connectivity, and degree of fragmentation-greatly determining how much a landscape can afford a delivery of functions such as water filtration, erosion control, and habitat provision (Forman, 1995). It is possible to quantify the degradation or improvement of these functions because of LULC change through the determination of landscape metrics and ecological indicators (Wu, 2013).

2.2.3 Theoretical foundations of community participation

2.2.3.1 Participatory planning theory

Participatory planning theory emphasis the collaborative involvement of stakeholders in shaping the spatial development processes. Based on communicative planning traditions (Healey, 1997), it argues that inclusive deliberation, co-decision-making, and local knowledge lead to more equitable and sustainable results in urban initiatives. In the context of LULC and urban greening, participatory planning will ensure that programs are responsive to community needs and offer avenues for reduced conflict and enhanced ownership of environmental initiatives (Innes, J. E., & Booher, D. E, 2004).

2.2.3.2 Theory on collaborative governance

Collaborative governance theory emphasizes that responsibilities regarding the public resources that are supposed to be jointly managed by government, civil society, private sector, and the residents share responsibilities in addressing various complex urban issues. According to (Ansell, C., & Gash, A, 2008), it is a consensus-oriented process that builds trust, transparency, and accountability. Using coordinated action in mainstreaming land use, green infrastructure, and resilience-building strategies brings this approach into effect in urban landscape planning.

2.2.3.3 Theory on environmental stewardship

Environmental stewardship theory gives importance to the individual and collective roles played in the conservation and enhancement of natural resources. The steward proactively maintains ecosystem services, restores degraded land, and preserves urban green spaces (Chapin et al., 2010). Hence, it brings in the aspect of moral commitment and community responsibility, creating a framework for sustainable land management. This is significant in the context of densely populated residential spaces such as condominiums, where common care can enhance the functioning and appearance of shared landscapes (Krasny et al., 2015).

2.3 Conceptual review

2.3.1 Land Use and Land Cover (LULC) change

Land use change and land cover change (LULC) refer to the process of the Earth's surface transformation caused by human activities and natural processes such as deforestation, urbanization, or infrastructure (Lambin et al., 2003). Peri-urban regions like Ayat Tafo experience urban sprawl where agricultural lands and green spaces are converted into built-land, significantly disrupts ecosystem processes (Seto et al., 2011). Understanding these patterns is essential in estimating the impact on local physical and environmental features.

2.3.2 Physical and environmental features of urban landscape

Physical and environmental feature if urban landscape include landforms, soil, water availability, vegetation cover, and local climate conditions, all of which are affected by LULC changes (Alberti, 2008). These feature influence ecosystem services such as air and water filtration, support

biodiversity, and climate regulation. Urban ecological theory emphases that isolation of landscape function due to unregulated land conversion reduces urban resilience and ecological integrity (Forman, 2014).

2.3.3 Strategic interventions for site improvement

Strategic interventions are systematic policy, planning, or design efforts to minimize environmental deterioration. These green infrastructure (e.g., parks, bioswales), eco-sensitive zoning, and sustainable drainage (Ahern, 2011). According to (Newman, P., & Jennings, I, 2008), in dense residential settings, collaborative planning that combines top-down control and bottom-up initiative is key to successful site enhancement. (Kabisch et al., 2017), noted that implementation of nature-based solutions and adaptive landscape planning has been recognized globally as a way of developing ecological and social resilience in rapidly expanding cities.

2.3.4 Community involvement and environmental stewardship

Public involvement is vital in any work of environmental intervention people centered, viable and justifiable. Community participation is imperative in rendering environmental interventions people-centered, sustainable, and equitable. According to Reed (2008), participatory planning increases mindfulness, fosters co-management of public spaces, and builds environmental responsibility. However, particularly in condominium area, supportive efforts among residents play critical role in maintenance of greenery, water management, and waste management. It further noted by Pretty (2003), social capital principles and collaborative governance underscore the community role in environmental sustainability.

2.3.5 Conceptual framework

Conceptual framework of research integrates theoretical and research objectives, and method to use in the study understand and responding to LULC change of condominium area. Deal with in theories like environmental stewardship, urban ecology, land change science, collaborative governance, and urban resilience, the conceptual outline is focused on how community involvement and corporative work promote to creation of urban landscapes sustainability.

As a response, the model practical planned involvements such as planting innate vegetation, rainwater collecting, used successful drainage systems, and creating urban parks achieved through community-based and institutional efforts. These actions aim to enhance ecological quality, biodiversity benefit, and storm-water preservation, and strengthen social cohesion and adaptive planning processes. Overall, the framework offers a comprehensive roadmap for achieving sustainable landscape change through integrated, participatory, and data-informed means.

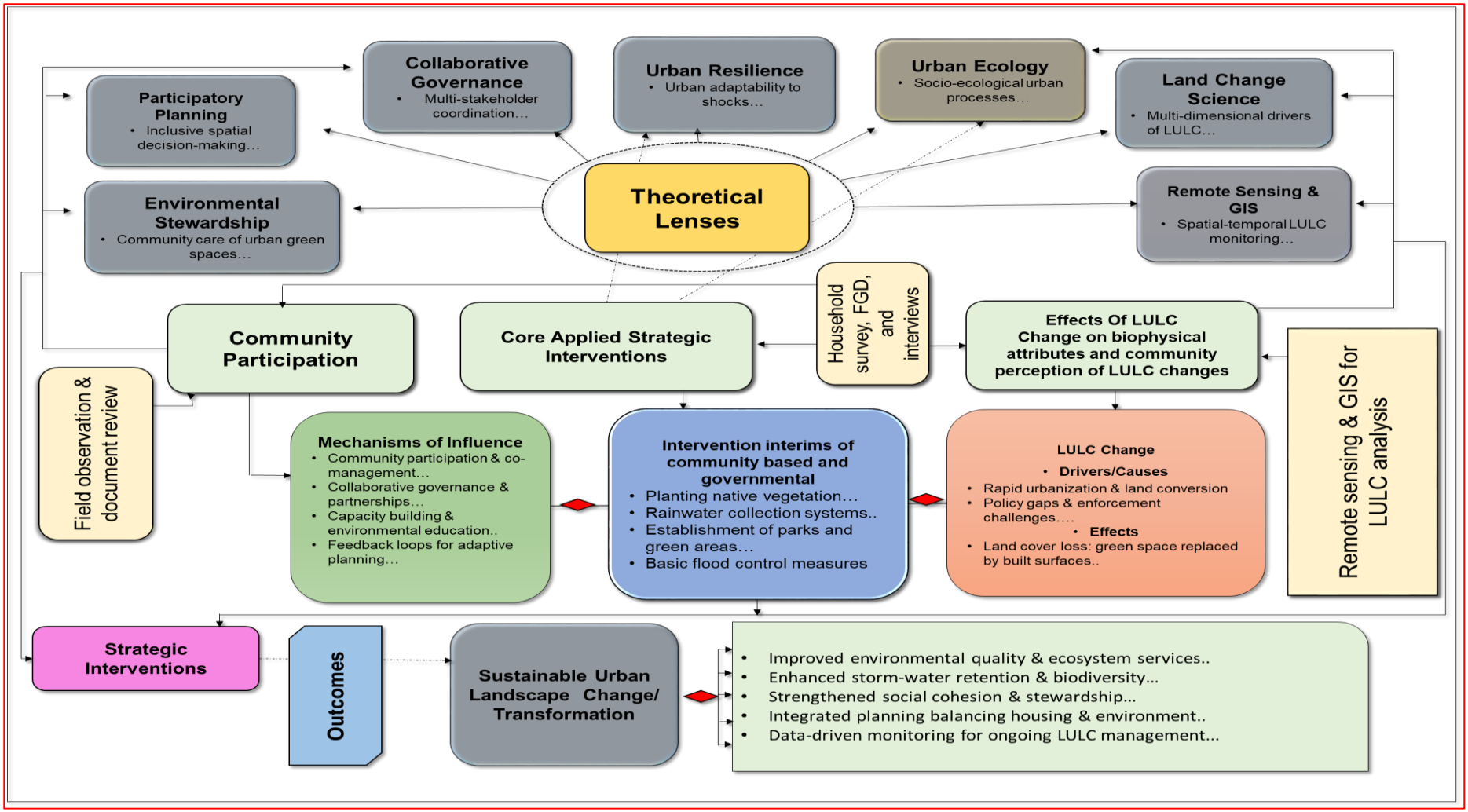

Figure 2:1 Conceptual framework of the study
Source: The Researcher, 2025

2.4 Contextual review

2.4.1 Geographic and urban context

Addis Ababa, the capital city of Ethiopia and has gone through rapid urban expansion in recent decades, resulting in rapid population growth, built environment expansion, and land-use/land-cover (LULC) changes (Negesse et al 2024). The Condominium site developed, located in the northeastern part of Addis Ababa, and reflects the same urbanization trend, characterized by high-density condominium development aimed at satisfying ever-increasing housing demand.

This expansion has led to massive transformation of wetland degradation, green space loss, and alteration of drainage systems (Getahun et al., 2020). Land-cover changes caused in the area from agricultural and wetland ecosystems to mainly built-up surfaces constitute a burden to local environmental quality and ecosystem functions (Tadesse, 2023). This geographic and urban context provides the foundation for analysis how LULC change has affected the physical environment, co system service, and community experience at Ayat Tafao.

2.4.2 Policy and planning context

The government of Ethiopia has paid special attention to condominium housing as one possible strategy to address urban housing shortages and offer affordable housing (Ministry of Urban Development and Construction). However, urban planning and land-use policies practices are regularly challenged in relative to participatory governance, enforcement mechanisms, and environmental sustainability (Mulatu, 2022).

The Addis Ababa structure plan (2017–2027) highlights green infrastructure and community contribution in urban planning; though, these are rarely applied in practice, mainly in peripheral condominium developments such as Ayat Tafo. This rough application affects environmental management effects, including solid waste disposal, storm-water control, and urban green spaces conservation (City Government of Addis Ababa, 2017). Understanding this policy gap helps clarify why environmental problems persist at Ayat Tafo and provides an outline for identifying strategic interventions and valuating planning failure.

2.4.3 Environmental issues and LULC change

Ecological disruption and wetland loss: the development of residential blocks has caused in the damage of natural wetlands that served as biodiversity habitats and ecological buffers.

This results in a significant loss of flood absorption, microclimate regulation, and water purification function. Swamp squalor threatens innate plant and animal types, many of which are sensitive to hydrological turbulences (Negesse et al., 2024).

Drainage and Flooding Problems: Ayat Tafo has very low design of drainage system this lad to cause during rainy season, low water capacity carried, surface run off, and localized flooding. Usual flow pathways have been impassable or unfocussed without enough engineering solutions, and this lad to impact on infrastructure and make worse topsoil erosion. During heavy rainfall, walkway living area, and the recreational (green space) are impassable (Mekonnen, A., & Tsegaye, M, 2023).

Deficiencies in Waste Management: Due to no systematic solid waste management system in place, illegal dumping of wastes has been prevalent in most open and green areas. With this, the environment is contaminated in soil and water, causing health hazards from vector-borne diseases and air pollution. Residents are complaining about infrequent of waste collection and absence of campaigns to raise awareness on waste segregation and recycling (Kebede, F., & Abebe, Y, 2023).

Deforestation and Clearance of Vegetation: Construction has facilitated the clearing of a wide area of native trees and other plants, depriving the site of shade cover, causing increased urban heat island effect and disruption of the local microclimate. Reduced green buffers between buildings, decreased recreational opportunities, with adverse effects on mental well-being and urban aesthetics (Tesfaye et al., 2022).

Noise and Air Pollution: Coming together with all the vehicular traffic and construction activity, coupled with informal street vending within and around the site, has worsened the dust, noise, and air pollutants. This, combined with poor road surfacing and high interaction between pedestrians and vehicles, brings into the picture worsened respiratory health and lowered overall quality of life, as borne most by children and the elderly (Getahun et al., 2010).

Surface degradation and soil erosion: A land those found near the development of condominium and some pocket land those found in condominium area has poor land grading and lack of ground cover and this lead to erosion of top soil and storms dust especially in the dry season. Most of the open space land haven't any grass like vegetation, so this also lead to losing ecological and aesthetical function**.** The absence of absorptive surfaces impedes ground-water recharge (Gebremedhin, 2023).

Loss of micro climate regulation and heat stress: The lack of absorptive land surface and the minimum existence of green infrastructure continues to rise temperature during dry season. Most of residential are lack of street tree, rooftop gardens, or shaded courtyards, so thus contributing to thermal dissatisfaction and higher energy demand. (Tesfaye et al., 2022).

The presence of poorly managed land us**e** land covers change of Ayat Tafo environment has not only affect sustainably but also affect social wellbeing of residents. According Seto et al. (2011), “unregulated land conversion and urban expansion accelerate ecological disturbance and reduce urban quality”. “These challenges can be addressed by integrating land use planning and investments in green infrastructure” (McDonald, et al., 2015), “as well as community participation in landscaping management and decision making” (Healey, 1997).

2.4.4 Community engaging and participatory planning in Addis Ababa

According to Asnake, (2021), “community commitment for all level in urban planning is gaming befit for livable urban growth in Ethiopia”. However, according to Gebremedhin, (2022), “in condo-based studies, public participation is not merely in the decision-making processes for the management of environmental problems or land use decisions.”

The participation of stakeholder is weak in Ayat Tafo, community participate any issues related to planning or maintenance activities is without communication and consultation of residents. This aligns with (Arnstein, 1969), ladder of citizen participation, which highlights that insufficient consultation limits meaningful participation, and Healey (1997), who argues that planning is improve local level decision-making and have good outcomes when have been collaboratively.

According to Tzoulas et al. (2007). Participatory managment enhance social and ecological benefits of urbans setting. Consolidation public contribution at Ayat Tafo is possible to enhance green space stewardship and native environmental conditions. This context directly support objective in examining community participation and provides the conceptual basis for analysis Ayat Tafo residents’ involvement in planning dicision-making and environmental.

2.5 Empirical review

2.5.1 Empirical studies on LULC change and Its biophysical environmental impacts

Empirical studies across Sub-Saharan African towns show that fast urban development commonly results in the loss of vegetation, weakening of green spaces, and increased environmental susceptibility. For example, Woldegerima et al. (2017) stated the main change of open spaces and agricultural land into Built settlement in Addis Ababa between 1984 and 2015, leading to disjointed ecosystems and reduced resilience. Similar patterns were observed by Seto et al. (2011) in fast-rising urban cores universally, where unplanned construction replaced natural habitats and damaged ecological functions.

Studies also determine that land use and land cover alteration directly disturb microclimate, runoff, soil stability, and metropolitan flooding. Feyisa et al. (2014) indicate that built-up growth in Addis Ababa increased land surface heat and weakened urban cooling capacities.

Similarly, Alberti (2008) highlighted that the elimination of natural buffers—such as swamplands and vegetative floorings—reduced cities' ability to absorb floods and control climate. Research in peri-urban Ethiopia by Kebede and Abebe (2023) also identified the dreadful conditions of green areas and poor storm-water structures as the foremost eco-friendly consequences of rapid condominium growth.

2.5.2 Empirical evidence on community perceptions of environmental change

Studies show that community perceptions offer valuable primary warnings about environmental degradation and urban susceptibility. In South Africa, Chiesura (2004) found that residents perceived the loss of nearby green spaces as disadvantageous to well-being, urban well-being, and mental health.

Research in Ethiopian urban settlements by Kebede and Abebe (2023) revealed that residents often report drainage failures, waste mismanagement, and the decline of urban green spaces as top environmental concerns.

In Addis Ababa, Woldegerima et al. (2017) revealed that dwellers' perceptions frequently reflect spatial truths: societies living in extremely built-up areas expressed greater concern about heat stress, flooding, and loss of recreational spaces related to those in greener communities. In the same way, Douglas et al. (2008) argued that community insights into drainage and flooding problems often precede official assessments, making them critical for urban risk planning.

2.5.3 Empirical studies on community participation in addressing urban environmental problems

Global and regional research shows that meaningful community contribution is often limited by socio-economic limits, official weaknesses, and a lack of mindfulness. Reed (2008) highlighted that involvement requires enabling situations—such as information access, coordination, and institutional support—to translate awareness into accomplishment. Brown & Kristiansen (2009) found that in many Sub-Saharan African cities, economic burdens and limited incentives reduce community participation in environmental actions, except when they yield direct livelihood benefits.

In the Ethiopian context, studies on condominium extents by Kebede and Abebe (2023) revealed that community involvement in environmental development activities such as tree planting, waste sorting, and stewardship is characteristically low due to limited funding from local authorities, inadequate continuation, and lack of environmental teaching. Likewise, Watson (2009) argued that top–down urban planning initiatives often fail because they do not align with residents' priorities, perceptions, or cultural practices, leading to weak ownership and low contribution.

stwardship.

2.6 Case studies

Best Practice One: Bangalore, India – Integrated urban water management in apartment complexes

Introduction

Bangalore (official name Bengaluru), India's fast-growing metro town, is facing critical water shortage, unpredictable monsoon cycles, and frequent urban flooding. Urbanization through apartment complexes has been increasing at a rate beyond the carrying capacity of the city's centralized water supply and sewage system, prompting the adoption of Integrated Urban Water Management (IUWM) strategies. Its decentralized approach incorporates rainwater harvesting (RWH), grey-water reuse, storm-water infiltration, and green infrastructure at building or gated community levels.

A number of residential complexes in Bangalore—medium- to high-rise condos, more specifically—have adopted rooftop rainwater harvesting systems, on-site wastewater

treatment and reuse, bioswales, permeable pavements, and rooftop gardens. They are not only policy-compliance-led but also through Resident Welfare Associations' (RWAs) self-initiatives and through green building certifications. These combined systems reduce dependence on tanker water supply and the centralized sewer system, improve storm-water management, and the microclimate and urban aesthetics.

Principles Check

a) **Water Sensitivity:** In Bangalore precipitation collection (rain water harvesting) is mandatory for all location that found with a size of about 2,400 square feet. As a result, several apartment complexes have installed rooftop rainwater harvesting systems connected to collection tanks or groundwater recharge pits. The same-true for saving potable water in house area they used grey-water from shower, sink, and from laundry for reused for non-potable purpose such as toilet flushing, car washing, and landscape irrigation.
b) **Aesthetic Benefit:** The presence of fountains, green roof and wall, and innate plant landscape in condominium area has given visual value for high-density living area. The top-roof garden also control and decrease heat island effect, decrease noise, and create community recreation.
c) **Surrounding Area Integration:** rather than over flow of into the street, many of the apartment project their water systems according to natural paths of drainage, so excess storm-water is channeled into percolation tanks or neighborhood-scale storm drains. In new developments, permeable pavers and grassed swales are incorporated into parking lots and sidewalks to manage runoff on-site.
d) **Appropriate Design:** The water facilities are modular and tailored to the size and needs of each complex. Small-scale Sewage Treatment Plants (STPs) treat grey-water to safe levels of reuse. Others use bio-sand filters, reed bed systems, or membrane filtration technologies. These designs usually have certified environmental engineers and are operated by trained on-site staff.
e) **Adaptability:** The solutions' scalability has been demonstrated by their adoption in thousands of apartment complexes in Bangalore. The model depends on adjustable policy environments, open building codes, and public-private partnerships. The strategies can be replicated for other fast-developing cities in the Global South with similar infrastructure issues.
f) **Public Involvement:** The success depends on public involvement. Resident volunteers and RWAs are important in:

1), Selecting contractors and service providers 2), observation of water quality and efficiency of reuse, 3), organization of awareness drives and water budgeting exercises, 4), initiation of STP and rainwater tank maintenance cycles. This bottom-up implementation guarantees long-term utilization and popular acceptance.

g) **Reasonable Costs:** The initial investment in grey-water treatment plants is moderate to high depending upon size, but this is generally regained within 3–5 years through reduced water bills, reduced water tanker usage, and government incentives. Additionally, the Karnataka Government and BBMP (urban municipality) also offer subsidies, tax exemptions, and technical support on green infrastructure to render these solutions cost-effective.

What can be learnt from the city & flexibility to other cities?

The Bangalore experience indicates that high-density urban housing can maintain its water footprint in control with decentralized, nature-based solutions. Key learnings are:

- Policy + Practice Alignment: Mandatory policies supported by succinct guidelines mean actual implementation.
- Resident-Led Sustainability: Involving local citizens and RWAs creates long-term performance and innovation.
- Design Flexibility: Modular and low-maintenance designs facilitate scalability across various socio-economic conditions.
- Triple Benefits: The systems yield environmental, economic, and social benefits—delivering water security, mitigating urban heat, and improving community life.

Adaptability:

This model is highly adaptable for implementation in other fast-growing Asian, African, and Latin American cities, especially where:

1), Centralized infrastructure does not exist, 2), Real estate-led urban growth dominates3, Floods or water stress are perennial problems, 4) Individuals are willing to be engaged in environmental management. Urban areas like Lagos (Nigeria), Accra (Ghana), Dhaka (Bangladesh), Nairobi (Kenya), and Lima (Peru) can benefit from emulating and customizing similar decentralized urban water management.

Best Practice Two: Participatory Greening – Nairobi, Kenya – greening of community housing estates.

1. Overview

In response to deteriorating environmental conditions and inadequate living environments in high-density housing areas, residents of Kibera (Soweto East) and Huruma Estates in Nairobi have engaged in participatory greening as part of broader urban upgrading and condominium-style housing initiatives. Spearheaded by community-based organizations (CBOs), non-governmental organizations (NGOs), and the Nairobi City County, the objective was to transform overcrowded, concrete-dominated residential spaces into more livable, ecologically

2. Location

Two of the most known and populated and historically informal settlement of Nairobi (the capital of Kenya, in at Africa) those the participatory greening program was conduct in Huruma and Soweto east (Kibera). Huruma located in the northeast part of Nairobi and characteristics by limited open space area, flooding, and high-density housing and most part of Huruma was redeveloped into low-rise, high-density condominium-types residential blocks under government -led slum upgrading initiatives.

Huruma is found in the northeast part of Nairobi, within the jurisdiction of the Mathare Constituency. Huruma is characterized by high-density housing, limited open space, and open environmental exposures such as flooding and litter. On the contrary, most sections of Huruma were subsequently redeveloped into low-rise, high-density condominium-type residential blocks under government-led slum upgrading initiatives.

Soweto East is known as one of the largest Africa slum and is located in southern Nairobi. It is located in the Lang'ata sub-country and is also known by environment problem, such as drainage matters, uncontrolled dumping, and a lack of vegetation coverage. The Kenya slum upgrade program (KENSUP) initiated a pilot housing scheme here, with condominium type's house and a primary focus on infrastructure.

3. Participatory approach

A decidedly wide-ranging and community-driven ideal was adopted to guide the greening efforts:

- Community Engagement: Regular public forums and the use of a housing cooperative facilitated open dialogue and planning.

- Leadership by Local Groups: Youth and women's groups took lively roles in founding plant nurseries, tree planting, and garden repairs.
- Hands-On Contribution: Residents directly partaken in the design, planting, and preservation of green yards, street trees, and public gardens.
- Capacity Building: Training work-shops on urban agriculture, vertical gardening, and composting allowed skills transfer and long-term stewardship.
- Collaborative Governance: The model emphasized co-production-residents preferred plant species, shaped the design of green spaces, and formed green committees accountable for ongoing care and decision-making.

4. Outcomes

- Environmental Benefits: Noticeable improvements in microclimate regulation, air quality, and shade provision within housing clusters.
- Social Cohesion: Shared green spaces became sites for interaction, strengthening community bonds and local identity.
- Food Security: Community and household gardens contributed to food resilience, particularly during economic hardships.
- Pride and Stewardship: Increased resident ownership and pride in the living environment, leading to reduced littering and better maintenance.
- Policy Influence: The success of the program prompted Nairobi's Urban Planning Department to formally integrate community greening into future upgrading schemes.

What can other cities be learned from this case & adaptability to other cities?

a) Co-Production Builds Permanent Ownership: This method help a strong sense of accountability and confirms the durability of greening initiatives.
b) Community Knowledge Enhances Relevance: The choice of drought-resistant innate plants and the combination of outdated food crops confirmed ecological appropriateness and cultural importance.
c) Multi-Stakeholder Partnerships Enable Success: The teamwork between residents, NGOs, government bodies such as KENSUP, and intercontinental development partners shows the value of harmonized, cross-sectorial action—specifically in resource-constrained urban contexts.
d) Greening Must Be Integrated (Not Isolated): Rather than being an attractive add-on, greening was entrenched in wide-ranging urban promotion efforts. This confirmed synergy

between environmental and infrastructural components, improving resilience and habitability.

e) Affordability and High Impact: The initiative relied on low-cost, locally obtainable resources and unpaid labor, showing that impactful urban greening does not require large-scale investment. The touchable co-benefits—cooling, food, social connection—magnify its value.

Adaptability to other cities

- In Africa: Cities like Kampala, Accra, and Addis Ababa can replicate this model in informal settlements or high-density condominium environments, particularly where there is a need to combine housing upgrades with ecological resilience.
- In Asia: Cities with compactly populated kampungs or low-income lands (e.g., Jakarta, Dhaka, and Manila) can accept vertical greening, comestible landscaping, and public gardens to address land shortage and urban food anxiety.

CHAPTER THREE: RESEARCH METHODS AND MATERIALS

This chapter contain the overall procedure of study area starting with description of the study and beyond this also raised methodological matters of research design, data collection methods, sampling approaches, analysis procedures, and research ethics concerns addressed in this parts. The section also delivers the procedural outline within which the validity and reliability of the study are recognized, and helps frame the study findings in the next chapter.

3.1 Description of the study Area: Ayat Tafo Condominium

Ayat Tafo 20/80 condominium is located in Lemi Kura in woreda 02, in Addis Ababa lies on the Ethiopia plateau at a an altitude of 2,400 meters above sea level and geographical coordinates of the research area are 9.0380°N latitudes and 38.8250°E longitude. The total coverage of study area is 2018.6 hectares. Even the study are known by 20/80 condominium schemes and also the characterized by quarry sit near to the river and informal settlement around it.

Historical the study are known by wetlands, riparian ecosystems particularly proximity of the river side and agricultural land. However this has been extremely those natural land being changed to built-up land a form of condo blocks and a years of later informal settlement is developed.

The study area known by moderately rainfall followed by dry seasons with occasional rain between June and September, and dry months between Octobers to February the Same is tru.th presence of uncontrolled construction, lad to environmental problem like altered drainage pattern, flooding and soil erosion. The site has further deteriorated since proper green buffers and storm-water infrastructure have not been provided.

Diverse socio-economic actors have been exist in the condominium, thus its levels of income, education, and employment. Although the housing solution implemented in this area addresses some challenges, others remain, including poor waste management, deteriorated public space maintenance, and low community participation in environmental planning and upkeep. These conditions then make Ayat Tafo an important site for investigating the relationships between changes in land use, environmental impact, and sustainable urban planning concerning condominium dwellings.

Ayat Tafo condominium was chosen as the research because it represent a rapidly urbanizing high-density residential area in Addis Ababa. It show clear example of LULC changes, such as loss of green space, drainage issues, and environmental stress, making it ideal for studying the interaction between urban development and community perceptions .

Also the site was chosen due to its distinctive spatial and social characteristic, which contrast intensified condominium development with adjacent informal settlement, this spatial configuration provide a unique context for examining the interaction between formal and urban housing project and organically developed neighborhoods within Addis Ababa rapidly transforming urban landscape. The kind of formal and informal settlement types create valuable opportunity to analysis variation in community dynamics, environmental management, infrastructure provision and land use.

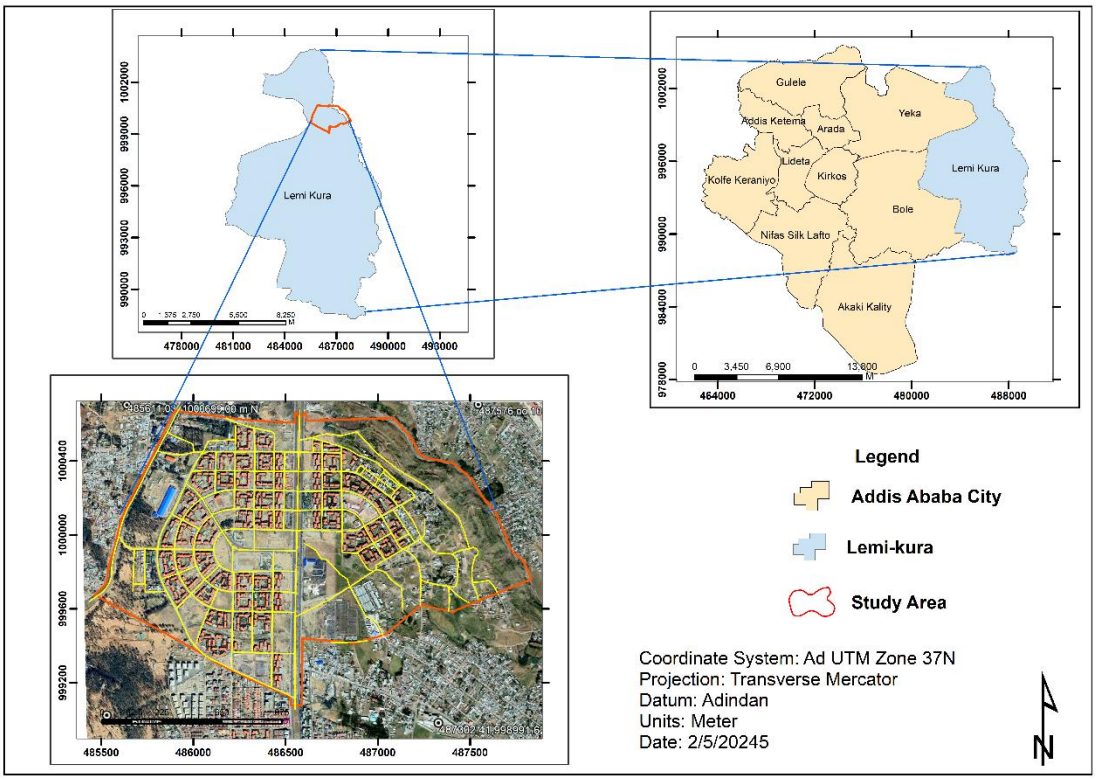

Figure 3:1 Location map of the study area: Addis Ababa Regional Plan, Lemi Kura Sub-City, and the Study Area
Source: The Researcher, 2024

3.2 Research design

Depending on the study purposes, this research used descriptive, explanatory, exploratory, or a combination to examining the effects of land use land cover change and its physical, environmental and social implication.

Descriptive Research Design: The descriptive design was used in reporting predominant conditions, which include the level of land use and land cover change, environmental issues, and demographic characteristics of respondents

Explanatory Research Design: The explanatory design used to explain the causal relations among land use land cover changes and physical/environmental effects, grounded in both respondent's perceptions and spatial data**.**

Exploratory Research Design: The exploratory design helped to the examination of community participation, exploring perceptions, fences, and enabling conditions for appointment in sustainable urban involvements.

3.3 Data types and source

To achieve the study objectives study were used both primary and secondary data types and sources.

3.3.1 Data types

This research employed both primary and secondary data, giving it status in addressing objectives. Primary data consisted of household surveys, focus group discussions (FGDs), key informant interviews, and field observations. Those data were empirical for giving the effects of land use and land cover (LULC) changes, community interventions, and levels of participation. Secondary data included satellite imagery for LULC analysis and documents, and previous studies dealing with contextual and historical aspects of the study area.

3.3.2 Data source

Primary data were collected from Ayat Tafo Condominium residents through direct field-based site observations, local officials and planners, and representatives of Ayat Tafo Condominium. At the same time, it refers to the environment as a whole, communities' perception of the development of land use and land cover (LULC), and levels of participation by different communities in the reaction to environmental issues. Secondary data included satellite images (Landsat 8), GIS datasets, various planning documents, government reports (Lemi Kura sub-city, Woreda 02 land management office), and Literature. It covers historical, spatial, and policy-related information that are important towards a long-term understanding of LULC trends.

3.4 Sampling

3.4.1 Sampling technique

This study employed a combination of probabilistic and non-probabilistic sampling methods to obtain both community-wide quantitative data and in-depth qualitative insights.

Systematic random sampling for household survey: systematic random sampling was used to select household respondents from the total condominium population. A complete household list was obtained from the Lemi Kura Sub-city CRRSA Office (information provided by Mr. Bikila Olana, Head of the Resident Information and Documentation service Unit). From this list, respondents were selected at regular intervals starting from a randomly chosen point. This approach minimizes sampling bias and is appropriate for large, high-density communities.

Purposive sampling for Key Informants : In addition, purposive sampling for Key Informants (a non-probabilistic method) was used to select individuals who are likely to provide in-depth insights into LULC change and sustainability efforts—such as condominium site committee, head of land management, condominium specialist (woreda 02), waste collection site worker, local business owners.

Systematic environmental sampling for spatial data: Systematic sampling was also applied to collect environmental and spatial data. Sampling point were established at regular spatial interval across the condominium to measure vegetation condition, physical environmental condition and ground –truth observation for LULC verification. These environmental measurements were later cross- analyzed with community perception data to strengthen the validity of the finding and ensure that survey responses reflect actual on site condition.

Figure 3:2 Household Areas Selected for Sampling
Source: The researcher, 2025

3.4.2 Population and sample size

The total study population consists of approximately 45,000 residents, calculated using the condominium's 10,000 households and the current average households size of 4.5 persons for Addis Ababa (Lemi Kura Sub-city CRRSA Office).

N=10,000 households *4.5 persons per household= 45,000 residents

To determine the appropriate sample size for a study the researcher use the Cochran formula, which is suitable for large populations, followed by the Finite Population Correction (FPC) to adjust the sample size for a finite population. The Cochran formula (Cochran, 1977). For calculating sample size for large populations (assuming infinite or very large) is:

$$n = \frac{Z^2 * p * (1-P)}{e^2} - - - - - \quad \text{Equation 3:1 Cochran's Sample Size Formula}$$

Where:

Z=1.96 (this corresponds to a 95% confidence level), p=0.5 (this assumes maximum variability in the population), e=0.05 (which is the margin of error, set at 5%). Substituting the values into the formula based on Equation 3:1 above

$$n = \frac{1.96^2 * 0.5 * (1 - 0.5)}{(0.05)^2} = \frac{3.8416 * 0.25}{0.0025} = 384.16$$

So, the initial sample size for a large population is 384 respondents, since the population is finite (N=45,000), we apply the Finite Population Correction (FPC) to adjust the sample size. The formula for this correction is:

$$n\_adjusted = \frac{n}{1+\frac{n-1}{N}}$$ *--- Equation 3:2 Adjusted Sample Size Using Finite Population Correction*

Where:

n=384 (the initial sample size from the Cochran formula), N=45,000 (the actual population size). Substituting the value into the formula based on Equation 3:2 above

$$\boldsymbol{n_{adjustd}} = \frac{384}{1 + \frac{384 - 1}{45{,}000}} = \frac{384}{1 + \frac{383}{45{,}000}} = \frac{384}{1 + 0.0085} = \frac{384}{1.0085} \approx 381$$

The adjusted sample size, which considers the finite population correction, works out to approximately 381 respondents for a population of 45,000. They call for surveying 381 individuals in this particular study to achieve a 95% confidence level with a 5% margin of error, considering the finite nature of the population. Although the recommended sample size is 381, the study successfully collected 368 valid response. Thus the final sample size used in this study is 368 respondents.

Table 3:1 summary for sampling techniques, population, and sample size

Component	Description
Sampling Techniques	✚ Systematic random sampling: Based on proximity to green/open spaces (50–100 meters) ✚ Purposive sampling: Key informants ✚ Systematic sampling: For spatial/environmental observation
Study Population	✚ 45,000 residents.
Sample Size Calculation	✚ Cochran formula (initial n = 384) ✚ Adjusted with Finite Population Correction (FPC)

Final Sample Size	368 respondents, ensuring a 95% confidence level with a margin of error ±5%

Source: The researcher, 2025

3.5 Method of data collection

These methods entailed the use of both primary and secondary sources, providing the study area with a comprehensive view through triangulation.

3.5.1 Primary data collection methods

Surveys/Questionnaires: Managed to respondents as an arranged structured data concerning environmental responsiveness, perceptions of change in land use and land covers, and involvement in planning. The research employs dual administration methods: self-overseen paper surveys targeting permanent residents, and face-to-face interviews at peak usage times to ensure full involvement and clarity for any unclear responses. . Hence, this approach achieved for 368 targeted participant completing the survey and 8 key informants providing extensive qualitative data.

Key Informant Interviews: The study taken key-informant data from Ayat Tafo 20/80, Woreda 02 (condominium site committee, head of land management, condominium specialist, waste collection site worker, and local business owners) to ensure a precise understanding of policy implementation and its participatory process. Overall, the researcher interviewed 8 key-informants from the responsible administrative stakeholders and some of the informant those taken from different area but they raised the same idea in the same profession a result were merge.

Table 3:2 Key informants on issues of the research

Subject/ Purpose	Interview type	Respondents context	Number of respondents
To obtain rich, and in-depth insights for different issue of the study.	Semi-structured and unstructured	Ayat Tafo 20/80 Condominium Site Committee	2
	Semi-structured and unstructured	Head of Land Management ,and Condominium specialist(Woreda 02)	2

	Unstructured	Waste collection site worker	2
	Unstructured	Local Business Owners	2

Source: The researcher, 2025

Field Observations: This study used field observational as primary data collection method. Field observation used to evaluate vegetation status, environmental issue like drainage condition, physical quality of green space, space usage, waste disposal activities, and management mechanism. Data were collected by standardized checklists and supported with photographs as needed, and to compare the respondent's data

Figure 3:3 show sample point's area for site observation
Source: Google earth pro (2025)

Focus Group Discussions (FGDs): A single focus group discussion was conducted to gather in-depth qualitative insight from residents regarding their perception on land use land cover change and their suggestion for the urban setting. The FGD method was selected because it encourage interactive dialogue and collection, allowing participant to express shard concern and compare lived experience related to environmental change.

Participants and organization: The focus group discussion include community those living in study area, and a mix of demography group. This composition ensured variety of

perspective while keeping the group small enough to maintain active participation. Respondent include youth, middle aged-adult, elderly residents, and local business owners

Themes discussed in focus groups: Focus group discussion followed a semi-structured guide, with key themes explored and the following core themes were addressed during the discussion. Firstly on perceptions of existing green spaces – participants shared their experiences with current green infrastructure. Secondly on Design preferences – discussions covered desired features such as walking paths, shaded areas, water elements, and leisure facilities.

Thirdly themes convenience and inclusivity – concerns were raised about barriers for people with incapacities, the need for elderly-friendly facilities, and the equitable distribution recreational space. Finally community contribution in management – members discussed the role of residents in maintenance, volunteer programs, and decision-making processes.

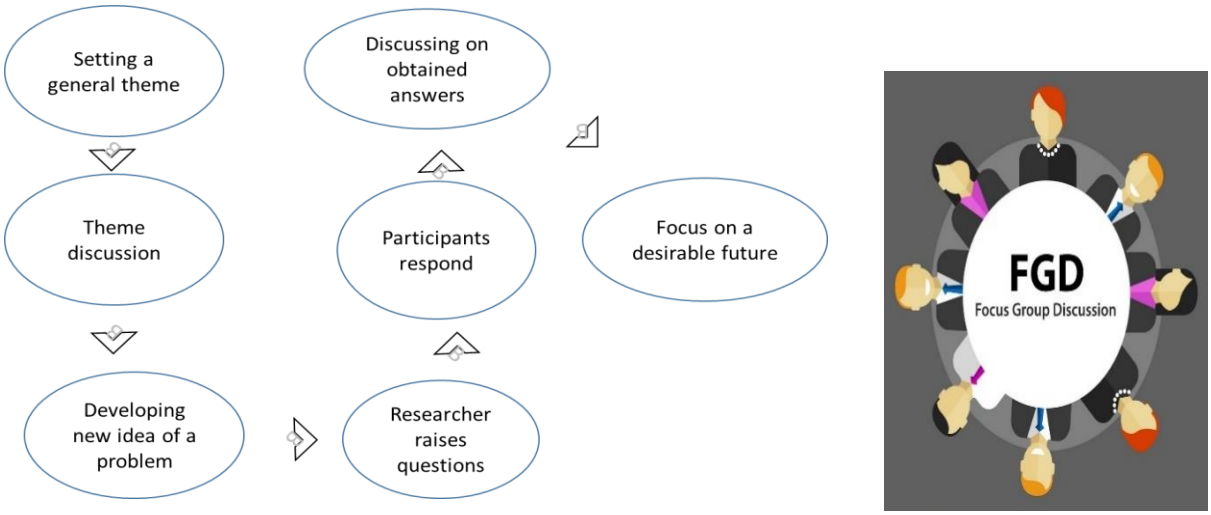

Figure 3:4 show steps of FGD
Source: The researcher, 2025

3.5.2 Secondary data collection method

Document Review: review of appropriate unpublished and published previous document to formulate conceptual and theoretical outline of the study and also dig out the gap what on the previous study then to fill on this paper.

Case Study Review: A comparative investigation of related initiatives in other urban areas that yield transferable lessons and best practices on viable setting planning. GIS-based and

remote sensing data: Used for spatial patterns of LULC variations by interpreting satellite imagery.

3.6 Data analysis methods

The data analysis for this study involved a mix of quantitative and qualitative techniques to address the research objectives. The analysis focused primarily on the responses from questionnaires, which were used to understand key dynamics, such as communities' perceptions of LULC and the impact of LULC on community involvement at the Ayat Tafo Condominium site.

- **Methods for LULC analysis**

To understand changes in land use and land cover (LULC) at the Ayat Tafo condominium site, a method based on remote sensing and GIS was followed. Multi-temporal satellite imagery from Landsat 8 (OLI/TIRS) and resolution of 30m was downloaded from the USGS Earth Explorer. Landsat 8 satellite images from the years, 2015, in acquisition date of 01/03/2015 and 2025, in acquisition date of 01/03/2025 were selected to study diachronic LULC dynamics.

- **Image Pre-processing**

Radiometric and geometric corrections were conducted to eliminate atmospheric distortions and ensure spatial alignment. Layer stacking and sub-setting beyond that to clip the images to the boundaries of the condominium (study area) were also executed. The effect of cloud masking was applied using the quality assessment band for the cause of having less classification errors.

- **Image classification**

A supervised classification approach with a maximum likelihood algorithm was used based on field training samples and high-resolution Google Earth imagery as references. These five major land cover categories are: built-up areas, vegetation, forest cover, open/bare land, and agricultural lands.

- **Accuracy Assessment**

A confusion/error matrix for comparative purposes relevant to ground truth data collected from field surveys and high-resolution images was constructed.

- **Change Detection Analysis**

The post-classification comparison was used to detect changes that occurred during the periods (2015-2025). The area statistics of each land cover class were calculated, and percentage changes identified trends such as urban expansion, loss of vegetation, and reduction of agricultural area.

GIS analysis was applied to map spatial transformations and visualize the extent of environmental change. Remotely sensed images are vital in land use and land cover change detection, as they provide spatial and temporal information on the land use and land cover condition of the Town. In this Study 10 year time span change detection have been made a period between 2015 to 2025, from initial to final years changes which is Moderately enough in showing long history of land use and land cover.

The LULC change detection was assessed using a post-classification cross-tabulation approach in ArcGIS software. Land use and land cover change detection method used in this study was post classification comparison and multi-date composite image change detection. This method is widely used and easy to understand

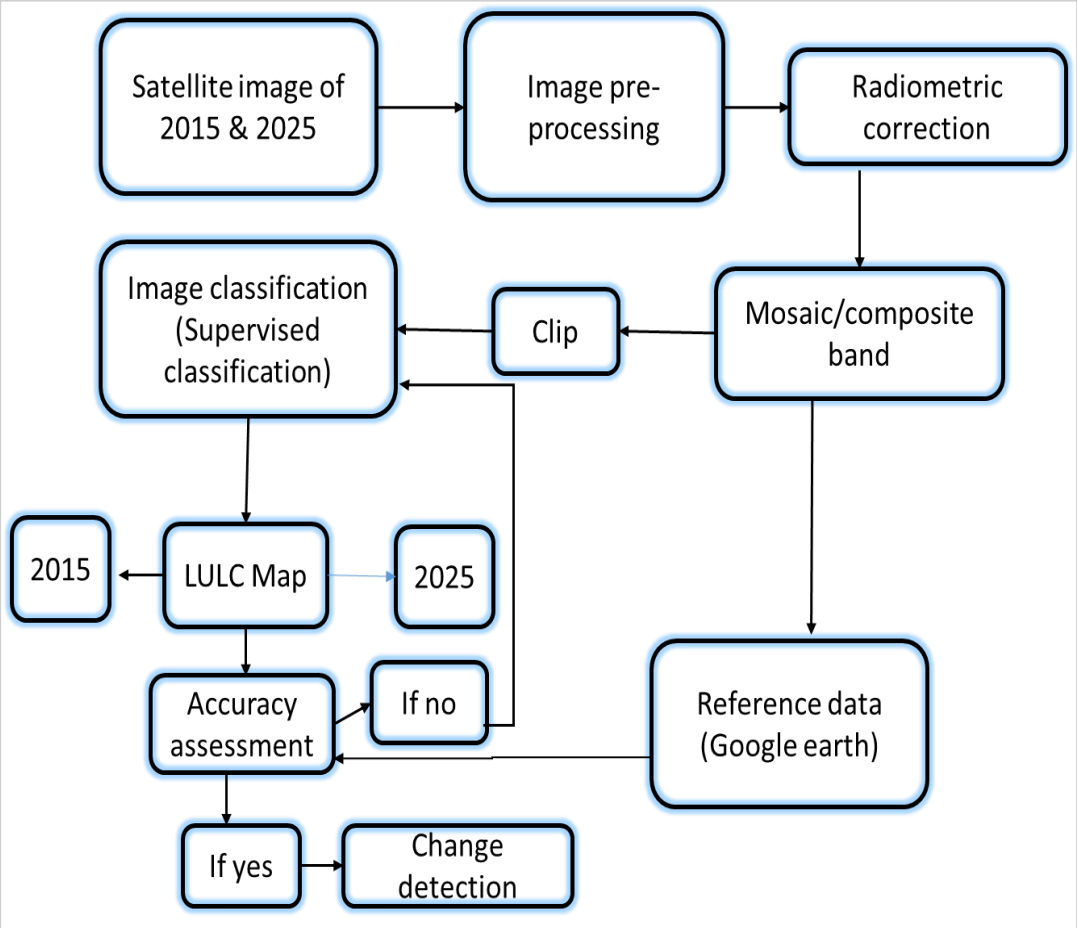

Figure 3:5 Methodology for LULC change detection

Source: The researcher, 2025

ArcGIS 10.8 software: the thesis was used the integration of field data with satellite images, ground data, land classification, and change detection over time. It allowed the subset of the study area-given the rich possibilities of post-classification overlay and area calculation statistics-and the mapping patterns displaying urban growth, loss of vegetation, and wetlands.

SPSS 27-based statistical analysis and Excel 2013: These were used to analyze the numeric data (Quantitative Data**)** from the questionnaires, such as demographic data, green space use patterns, and involvement in planning procedures. Descriptive statistics (one form of frequencies, percentages).The qualitative data were gathered from interviews and field observations.

3.7 Method of data presentation

The method of presentation is critical in presenting clear and reliable research results. In the present research on the Ayat Tafo condominium site, the following methods were used to depict the data. Photos, tables/graphs, and maps are crucial resources for presenting data in the right manner.

Maps: maps are important tools for understanding spatial patterns and their development over time, thus for this study used for illustrate for LULC change, location map of the study and other related map like matters of study.

Photographs: photograph used for presenting the ground truth of study area. It shows the impacts of LULC changes on physical site attributes, such as green space amount and infrastructure. Photographic documentation may also reveal issues in priority areas for future sustainable management action.

Tables and Charts (Graphs): present quantifiable data—such as population density, vegetation cover, or access to green space—that directly support the evaluation of LULC change and its environmental impacts. Graphs can show trends in community participation and outcomes of local initiatives.

3.8 Ethical considerations

Good ethical practices are important because research results may be upset by the personal values and beliefs of the researchers, which necessarily manifest themselves in the analysis of the data. (Creswell, 2018) , emphasizes that ethics in research include respecting the rights of participants, gaining informed consent, and maintaining confidentiality. Ethical practice

ensures the well-being and privacy of, as well as those who are impacted by it. The questioner was translated from English to Amharic to ensure, fairness, and full understanding for participants.

In this study, ethical integrity is ensured by adhering to the basic standards of voluntary participation, study intention transparency, and informed consent. The participants are properly informed of the study and have the right to participate or choose out without compulsion. Their confidentiality and anonymity are treated with the highest degree of carefulness, and participants' information is respected and treated securely. Additionally, accurate referencing and sourcing of used sources guarantee academic sincerity, and, furthermore, accurate referencing and sourcing ensure academic integrity and prevent plagiarism (Saunders et al., 2019).

3.9 Validity and reliability of the data

To ensure the accuracy, precision, and appropriateness of the data collection mechanism, multiple forms of validity and reliability were assessed.

Face validity: before taken the final sample of the study population it was examined pilot taste about 20 respondents that selected from study population, with a sample extent of 10-30 considered adequate (Van Teijlingen, 2001). Respondents evaluated the relevance of questions, its clarity, flow, and wording to improve comprehensibility, after all the research advisor was approved the questionnaire for administration to 368 respondents.

Content validity: content validity was proven by research advisor and other academic experts, confirming that the items sufficiently reflected the research objectives and key themes, including LULC changes, and community involvement. Construct validity was strengthened through methodological triangulation, combining respondent survey, key informant interviews, and field observations to cross- verify results (Patton, 2002).

Reliability: reliability of the study was checked using Cronbach's alpha (α) in SPSS, a widely used measure of internal reliability (Gliem, 2003). A multi-item scale (Annex 2), including the priority environmental issues scale and community participation on environmental considerations, was tested. After reviewing items with low corrected item-total correlations (<0.30), Cronbach's Alpha values ranged from 0.70 to 0.81, including acceptable to good reliability. For instance, in the *Priority Environmental Issues* scale, the item "*Waste Management*" had allow item-total correlation (0.226) and its removal increased the scale's

reliability from 0.70 to 0.80; the final four-item scale achieved a **α = 0.75**. The *community participating scale* demonstrated **α = 0.79**.

3.10 Methodological framework

The methodological framework for this study employs a mixed-methods approach, which combines qualitative and quantitative strategies. It has descriptive, explanatory, and exploratory designs built into it to meet the description of the three core objectives of the research: LULC changes assessment and effects on the environment, core applied strategic interventions, and community participation. The methodological framework of the study contain research question, data types and source, data collection method, data analysis tool, and expected output of the study.

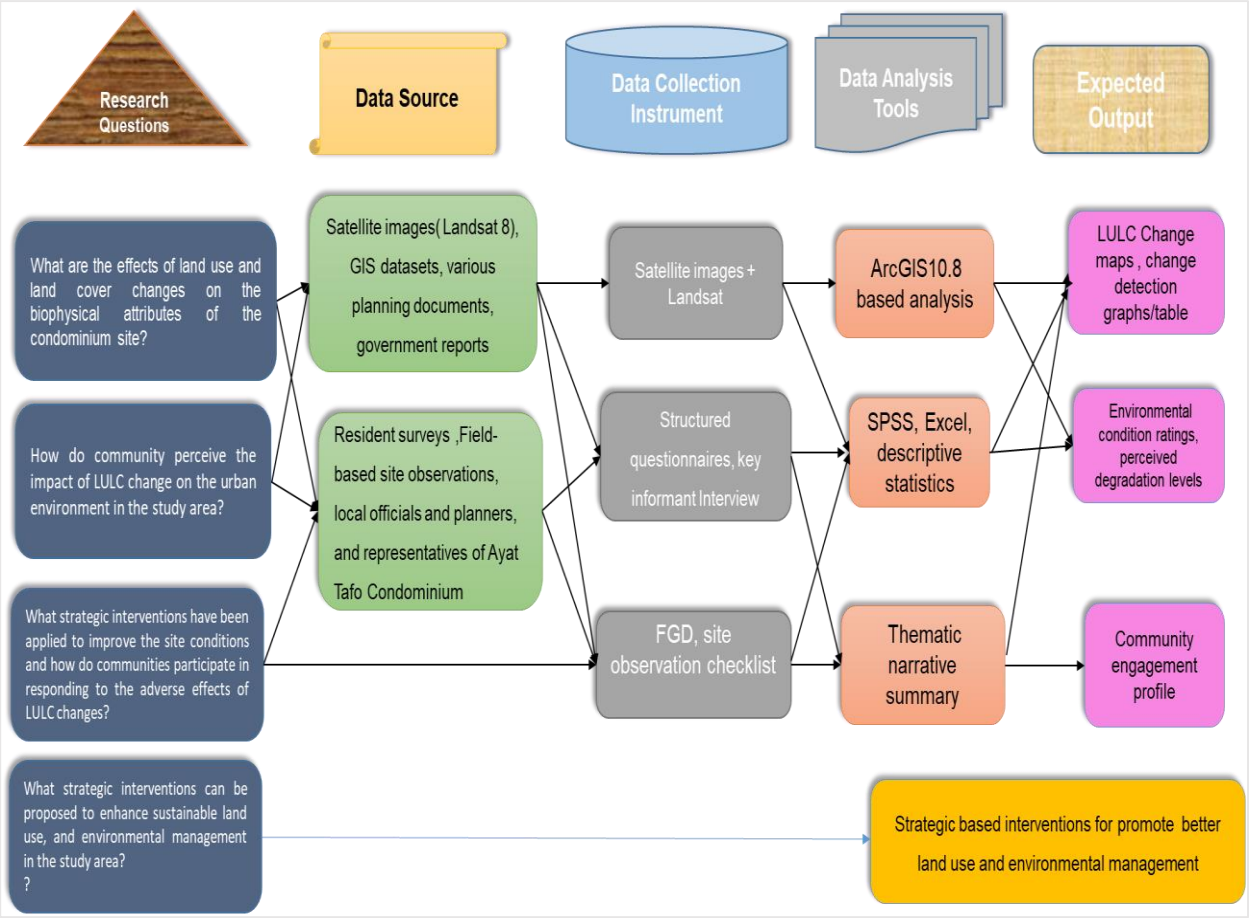

Figure 3:6 Methodological framework of the study
Source: By the author (2025)

CHAPTER FOUR: RESULTS AND DISCUSSIONS

This section presents the results and discussion of the study in relation to the objectives of the study. So, the results are structured according to the study's objectives: assessing LULC changes in the area, evaluating the current LULC changes' environmental impact, examining the community perception regarding to the LULC change, identifying the strategic interventions, and analyzing community participation in these changes.

the result this study used both quantitative and qualitative data, containing surveys from 368 participant, Focus group discussion (FGD), 8 key informants, and field observation. For presented the finding table, figures (maps, photographs and text other than stated all the figure and photograph are created by researcher.

4.1 Socio-economic background of the respondents

4.1.1 Sex distribution of respondents

The survey shown out of 368 respondents, 147 of whom were male (40%), and 221 were female (60%). This illustrates that predominance of females among respondents also has direct relevance to this study, as women tend to be more consumers of daily urban environments and local green spaces.

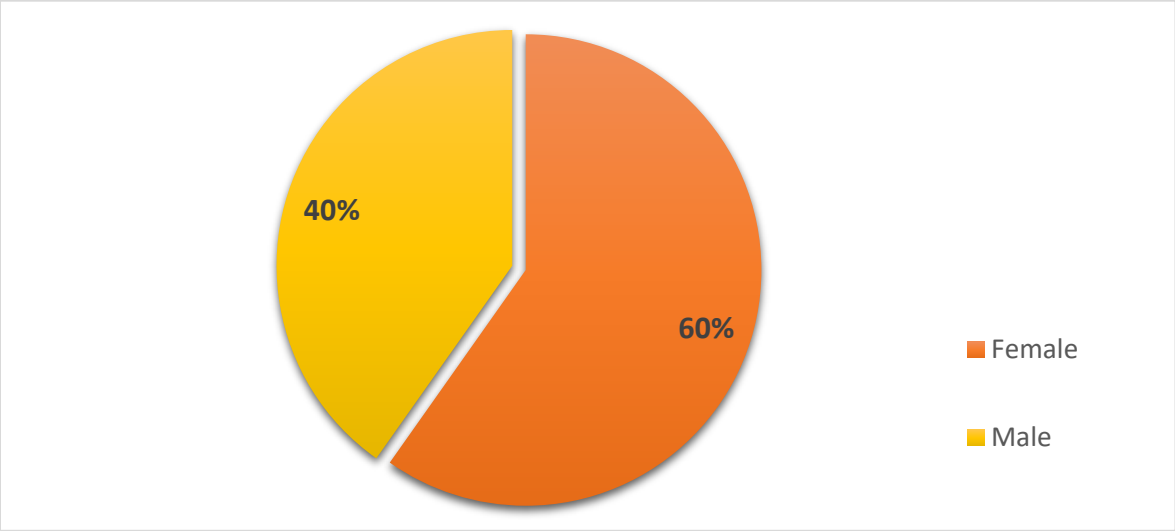

Figure 4:1: Distribution of respondents by sex

Source: The researcher, 2025

4.1.2 Age distribution respondents

The result reveal that, the largest age group found a year between 25- 54, it contain 55%. Persons aged 55 through 64 (18%), while the older group (65+) accounted for 7%. Youth under the age of 15 years represented 6%, while those in the range of 16-24 represented 14%. This age distribution indicates that the population is fully engaged in or entitled to environmental changes related to land use. The high proportion of working-age respondents is particularly relevant, as it is affected by local-level environmental changes (seen in Table 4:1 below).

Table 4:1 Age Distribution of respondents

Age Group	Frequency	Percentage
Less than 15	21	6%
16-24	52	14%
25-54	201	55%
55-64	67	18%
65 and above	27	7%
Total	**368**	**100%**

Source: The researcher, 2025

4.1.3 Educational level distribution of respondents

The survey result of respondents show that the largest portion had reached secondary schooling, at 22%, followed by equal proportions of preparatory school and diploma holders, respectively 18% and 19%, and degree holders at 15%. The primary school graduates represented 13%, while 10% had undergone TVET training. Only 2% had received postgraduate education, with 1% being illiterate. This revelation implies that most of the respondents at least attained a secondary level of education, which would likely influence their degree of awareness and perception of land use and land cover (LULC) changes, thereby supporting the study's objective of examining community understanding and responses to urban environmental issues (see Figure 4.2).

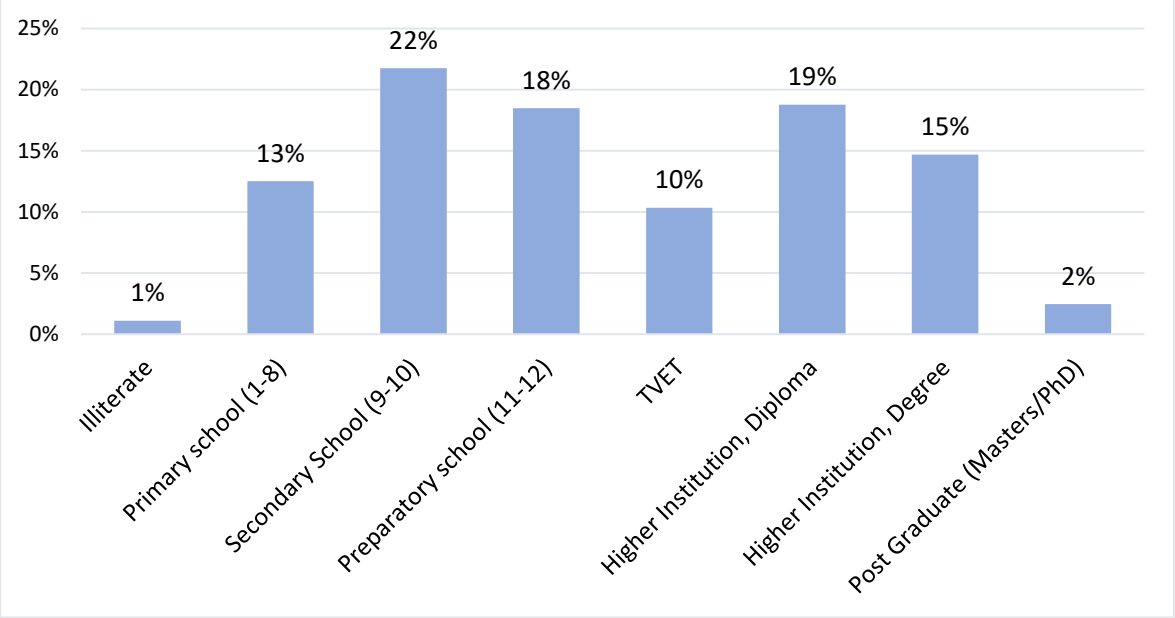

Figure 4:2 Educational level distribution of respondents
Source: The researcher, 2025

4.1.4 Occupation distribution of respondents

Figure 4:3 illustrates the distribution of respondents by occupation. Most respondents were formally employed (29%), and the second largest category was self-employed private business work (28%). Unemployed respondents accounted for 16%, housewives for 14%, and students for 13%. This indicates a significant active role of the sample respondents, who could potentially influence perceptions of changes in land use and land cover (LULC) and their effects on sustainable urban development.

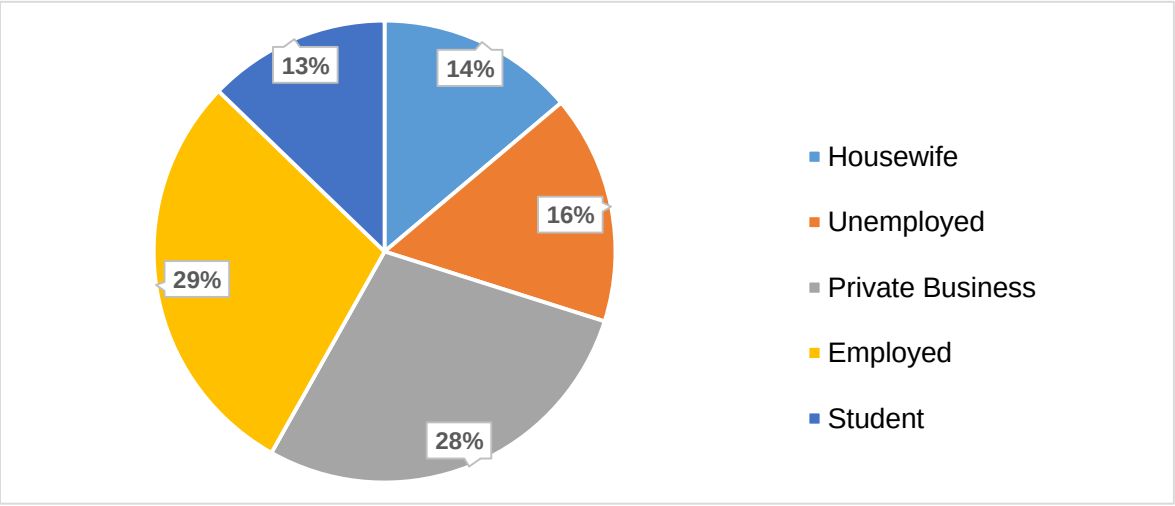

Figure 4:3 Occupation distribution of respondents
Source: The researcher, 2025

4.1.5 Family size distribution at Ayat Tafo condominium

The family size distribution at the Ayat Tafo condominium clearly reflects age diversity among household members, which is determined to be the families with children between the ages of 6 and 14 years. Such families comprise the second-largest group, amounting to 23.46% of the total households, whereas those whose members are aged between 36 and 65 years make up a higher grouping of 26.16%, indicative of middle-aged adults. Young adult households (19-35 years) account for 20.89%. Families with children under five years old account for 12.81%. Families with teenagers (15-18 years) account for 9.71%, while the smallest group at all consists of those with elderly people aged 65 years and above, at 6.96%. The generalization of this age structure of the population suggests that the community is largely comprised of active and reproductive age groups, as planned by the research, to assess how such community demographics would influence perceptions of LULC changes and urban environmental quality.

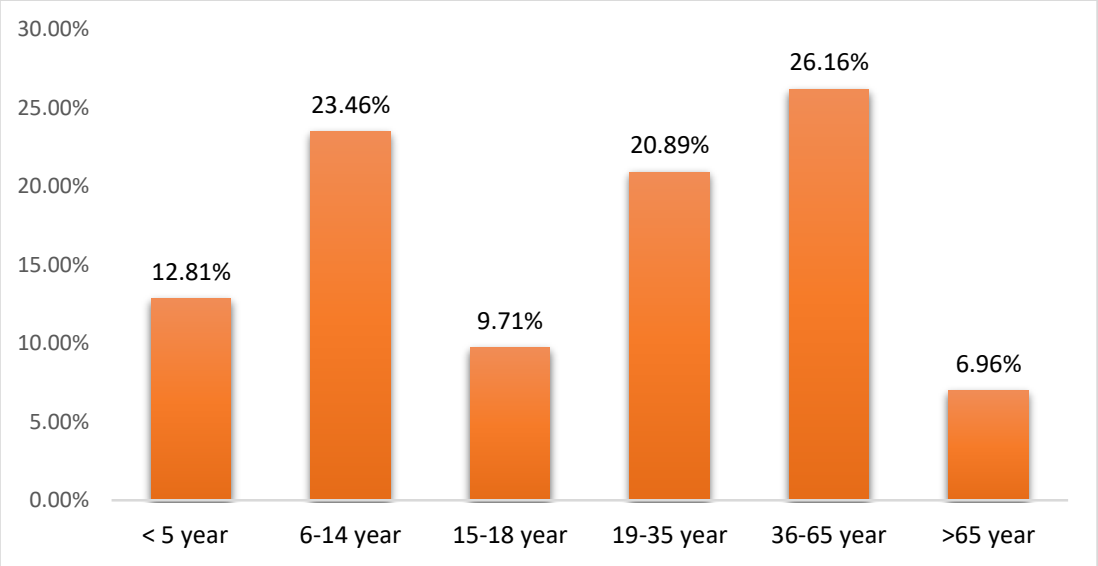

Figure 4:4 Family Size Distribution in the Study Area
Source: The researcher, 2025

The demographics profile indicate a mostly female, economically active, and moderately educated community, primarily composed of middle-aged and young adults. These socio-economic feature are important because they influence how residents experience and engage with environmental management. This understanding supports the study's analysis of community perceptions, participation, and responses to LULC changes.

4.2 Effects of LULC changes on the biophysical attributes of the condominium site

4.2.1 Time-series analysis of LULC changes (2015–2025)

As indicated in the (Figure 4:5) below, the classification scheme includes the major LULC classes. The researcher downloaded different satellite images from USGS (Landsat8, which is freely accessible, has eleven bands, and was acquired on 2015-03-01 and 2025-03-01). (Landsat 8 Contains 11 bands. Of its 11 bands, only those in the very shortest wavelengths (bands 1–4 and 8) sense visible light –all the others are in parts of the spectrum that we can't see.) The true-color view from Land sat is less than half of what it sees. As a result, the images need to be -enhanced (or stretched).Generally, the researcher prepared the following LULC map using the above procedure and ArcGIS.

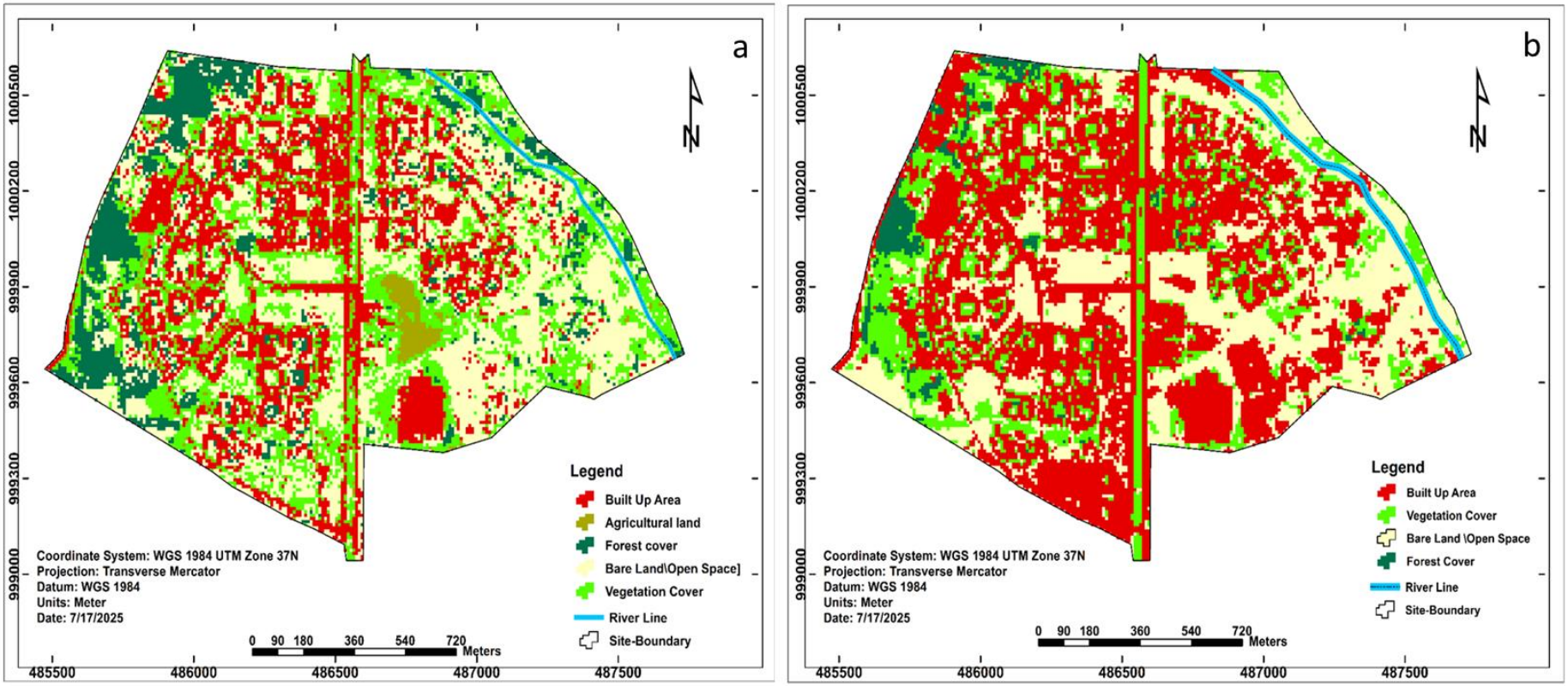

Figure 4:5 the 2015 (a) and 2025(b) LULC map of study area

Source: Landsat 8 (OLI/TIRS), 2025

Table 4:2 2015 and 2025 Land use land cover analysis of study area

Years		Land Use Land Cover					
		Agriculture	**Bare Land [Open Space]**	**Built-Up**	**Forest**	**Vegetation Cover**	**Total**
2015	**Area (ha)**	7	80.3	55.6	24.2	51.5	218.6
	Percentage	3.2%	36.7%	25.4%	11.1%	23.6%	100%
2025	**Area (ha)**	0	69.3	104.4	6.5	38.4	218.6
	Percentage	0	31.70%	47.70%	3.00%	17.60%	100%
	Land cover change 2015-2025 (%)	- 3.2% Decline	- 5% Decline	22.3% Rise	- 8.1% Decline	- 6% Decline	

Source: The researcher, 2025

Based on Table 4:2, the 2015 Land Use and Land Cover (LULC), it reveals that 36.7% of the area is either bare or open land, which points toward underuse or recent clearing, Built-up areas account for 25.4% ,Green spaces (forest and vegetation) take up 34.7%,,and Agricultural land accounts for a very low 3.2%,

The built-up areas, according to Land Use/Land Cover 2025, have increased to cover almost 47.7% of the site, approximately doubling from 2015. It indicates high urban sprawl with immense pressure on the natural and open spaces. Bare land/open space has decreased to roughly 31.7%, indicating that development is still taking place on lands that were previously vacant. Vegetation cover now constitutes 17.6% of the area and is slowly decreasing, while forest cover has been substantially diminished to just 3.0%, resulting in massive losses to the ecosystem. The total trend for LULC 2025 emphasizes the growth of a city and necessitates acquisition of green infrastructures and increasing ecological conservation, and (table 4:3), below show detail change detection analysis of the area that conversion.

Change Detection Analysis

Change detection was done for 2015 -2025 to get information of changes in land use land cover and specially to see the rate (trend) of the Settlement, Bare land /Open space, forest

cover, agricultural and vegetation coverage of study area. The researcher used codes to shorten the longest word in the legend as shown below: AL=Agricultural Land, BL (OS) =Bare land/ Open Space, VC=Vegetation Cover, BUA=Built-Up Area, and FC=Forest Cover.

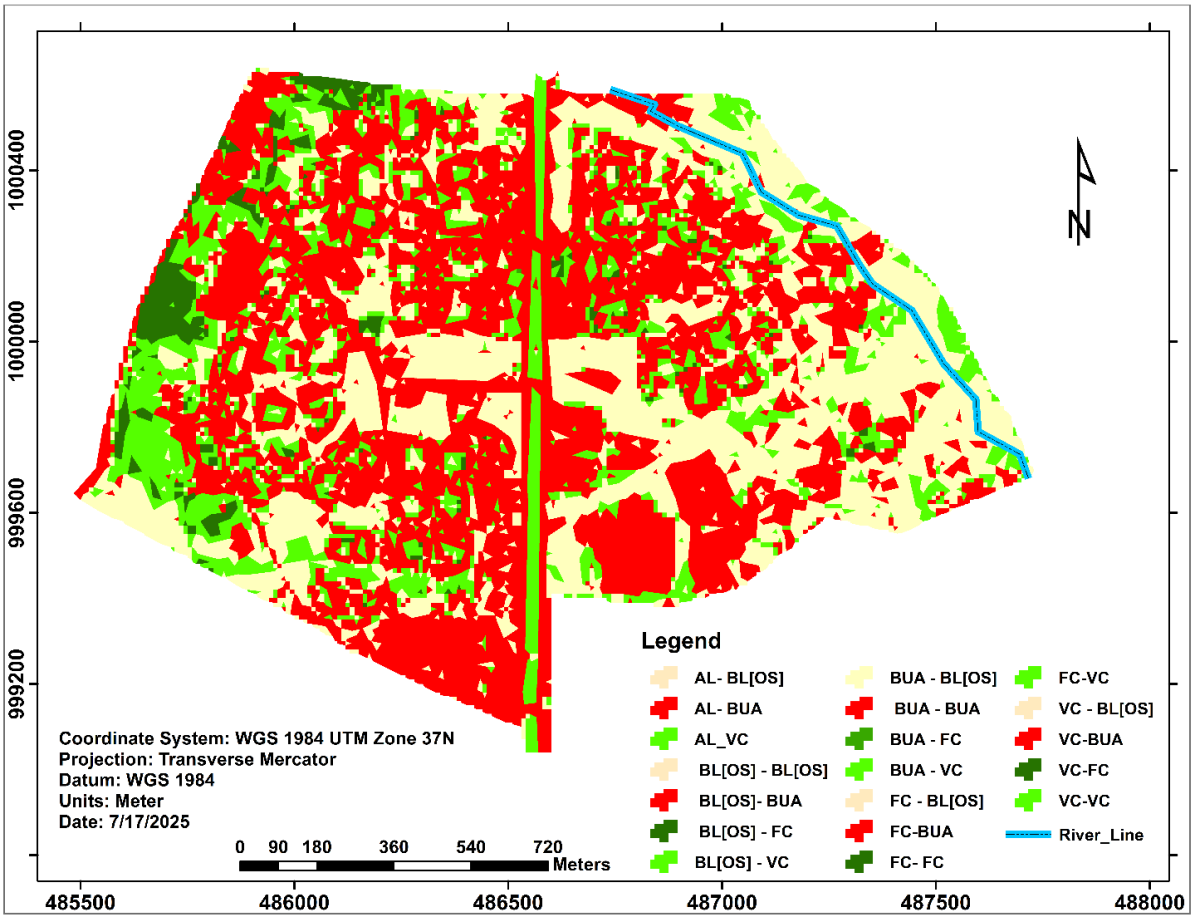

Figure 4:6 LULC change detection map of Ayat Tafo from 2015 to 2025
Source: The researcher, 2025

Table 4:3 Land use /Land cover change detection

From \ To (2025)	Built-Up Area		Agricultural Land		Forest Cover		Vegetation Cover		Bare Land [Open Space]		Total (2015)	
	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)
Built-Up Area	48.92	22.4%	–	–	0.05	0.02%	3.75	1.7%	2.81	1.3%	55.53	25.4%
Agricultural Land	3.78	1.7%	–	–	–	-	0.97	0.4%	2.55	1.2%	7.31	3.2%
Forest Cover	3.23	1.5%	–	–	5.52	2.5%	10.85	5.0%	4.57	2.1%	24.17	11.1%
Vegetation Cover	15.95	7.3%	–	–	0.21	0.1%	10.90	5.0%	24.39	11.2%	51.46	23.6%
Bare Land [Open Space]	32.73	15.0%	–	–	0.60	0.3%	11.95	5.5%	34.86	15.9%	80.14	36.7%
Total (2025)	104.4	47.7%	–	–	6.5	2.92%	38.40	17.6%	69.3	31.7%	218.6	100%
Change (2015-2025)		+22.3%		-3.2%		-8.1%		-6%		-5.0%		

Source: The researcher, 2025

As per changes in land use data between 2015 and 2025, drastic land changes are seen within the study site (Table 4:3). The major change has seen the conversion of 32.73 hectares (or 15%) of land from bare land/open space to built-up area, followed by the direct persistence of built-up areas from 2015 to 2025 at 48.92 hectares (or 22.4%). This signifies more intense urban development in the area under study.

Significant vegetation cover conversion to built-up land has been observed (15.96 ha or 7.3%), further indicating the depletion of green infrastructure. Conversion from forest cover to vegetation and bare land has occurred (10.85 ha, which corresponds to 5%, and 4.57 ha, which corresponds to 2.1%). This show fragmentation of natural area and deforestation (clearing of forest) did not stop. But, open land has remained constant through, ranging to 34.86 ha (15.9%).

Bare land area are provides a chance for different uses tends to give way to nature and this study area showed that noticeable changed occurred from vegetation covers to open/bare land and an area of 24.39 ha or 11.2% so, this type of converting showed that sign of degradation in environmental quality. Agricultural land converted bare land and built-up area it combine 6.3 ha this show increasing pressure on productive land. This emphasize needed to integrated urban planning solution to land conversion strategies.

4.2.2 Effect of current land use on environmental factors

The survey result revealed that 40% observed the impact as moderate in Vegetation Health, whereas 21% observed a very high impact. In Biodiversity, 40% perceived the impact to be moderate, and 20% perceived the impact to be high. On Water Quality, 43% indicated the impact to be high, whereas 36% indicated the impact to be very high. On Soil Stability, 57% perceived moderate impact, whereas 21% perceived very high impact. Few of the respondents indicated no impact or low impact for most of the environmental factors, with 6% indicating no impact on Vegetation Health, 10% on Biodiversity, 3% on Water Quality, and 17% on Soil Stability.

The survey revealed 39% of the respondents viewing a high or very high effect on Vegetation Health (18% high + 21% very high). For Biodiversity, 31% viewed the effect as high or very high (20% high + 11% very high). For Water Quality, 79% viewed the effect as high or very high (43% high + 36% very high). For Soil Stability, 26% had very high or high impact (5% high + 21% very high). Few respondents only reported no impact or low impact for most of

the environmental aspects, with 6% saying no impact for Vegetation Health, 10% for Biodiversity, 3% for Water Quality, and 17% for Soil Stability. This is a reflection of a general concern with land use changes (see figure 4:7 below).

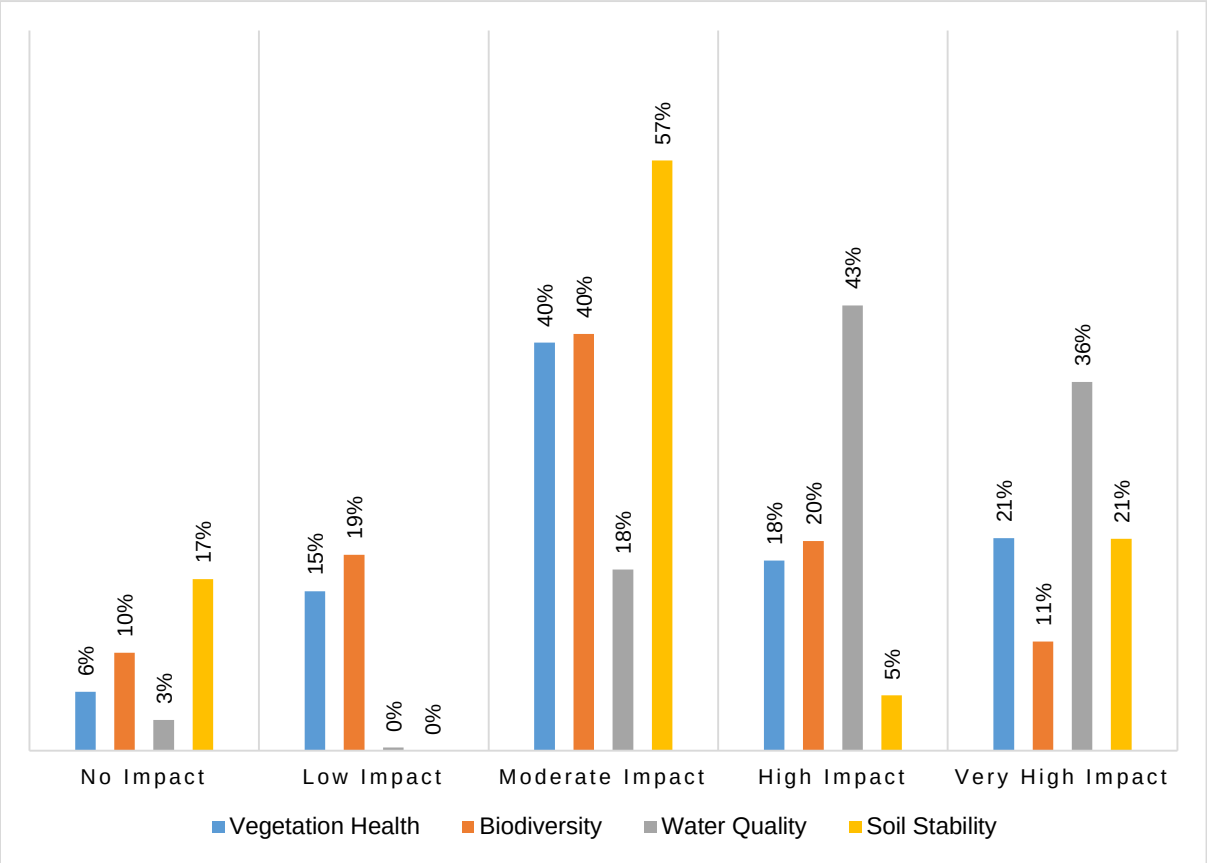

Figure 4:7: Respondents' perceptions of land use and land cover effects

Source: The researcher, 2025

4.2.3 Environmental challenges related with LULC changes

The study results identified several environmental challenges related with the current LULC at study area, as shown in the figure below 4:17 below. Poor waste management was the most reported issue, its response about 22.11%, and Water Pollution closely followed at 19.90%. 15.70% of respondents identified the loss of green spaces as another major issue. Flooding was another environmental issues, accounting for 15.40%, Noise pollution was noted at 14.08%, reflecting disturbances from traffic and urban activities, while soil erosion was reported at 12.82%, indicating land degradation risks due to improper land use practices (see Figure 4:8 below). The overall result need significant waste disposal site and management systems, controlling mechanism of the impact of urban expansion enhance adequate drainage and water management infrastructure.

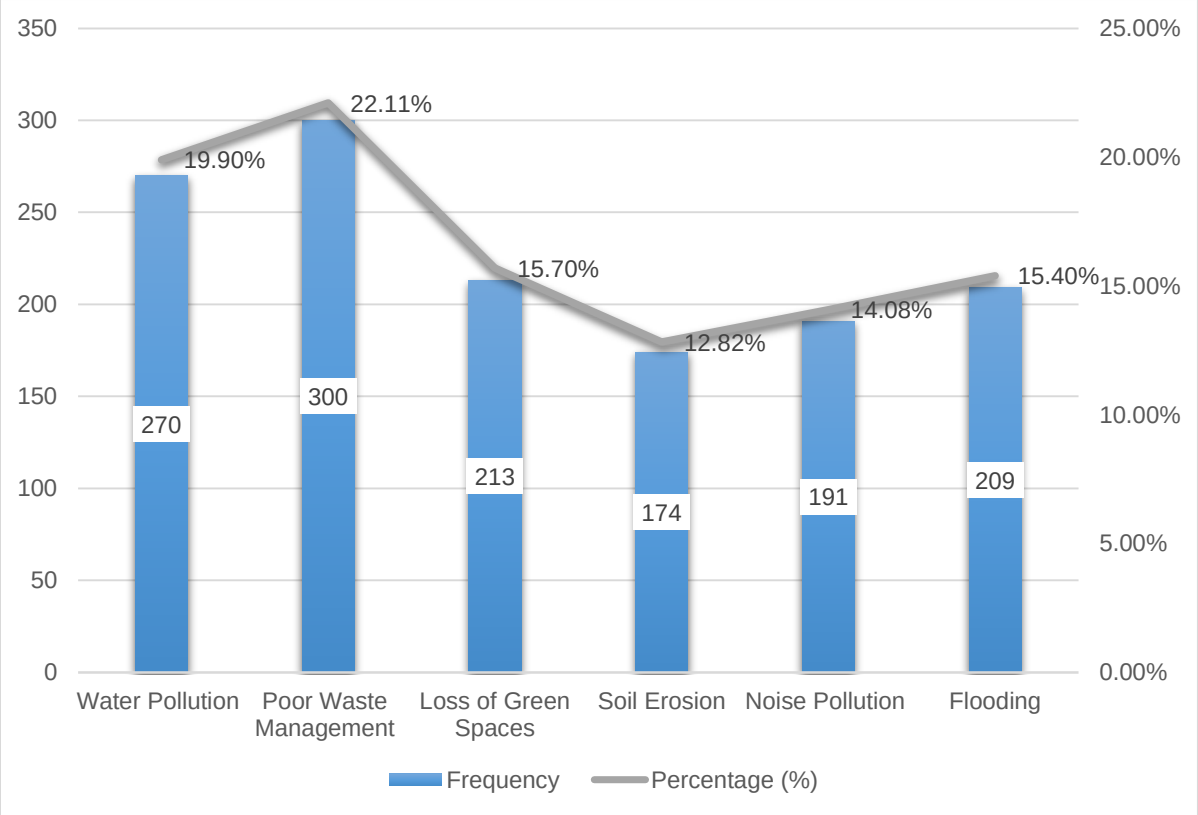

Figure 4:8: Respondents' insights of key environmental challenges at the study area
Source: The researcher, 2025

These results highlight the persistent need for viable urban planning approaches to alleviate environmental hazards and recover the livability of the area. Two of key informants they work on waste collection site and complained about the negative point on the waste management mechanism as follows:

> "*We have been working in this field for five to nine years, and the biggest challenges we have observed is that people do not fully understand how difficult this type of work is. The community often does not recognize the benefits of maintaining a clean environment or the significance of beautifying their living spaces. Major issue we have noticed is that waste collection services are not timely. The dumping trucks do not arrive as scheduled (on time), causing waste to accumulate and produce an unpleasant odor that disturbs the environment and affects communities ' quality of life. To address these challenges, we believe that new technologies should be introduced to develop waste management methods. Specifically, waste should be transformed into useful products through reutilizing and other innovative systems from the outset. Implementing such solutions would help to create healthier, cleaner, and more viable urban setting.*"

Figure 4:9 LULC challenges observed at the study area
Source: Google Earth Pro and the researcher, 2025

Figures 4:9-A to F showcase the effects of unplanned land use, and improper landscape administration of LULC patterns within the condominium area. Certainly, in contrast, Figure 4:9 represents land cover degradation in Figure 4:9-A as a clear example of the absence of vegetative planning on a site. In contrast, Figure 4:9-B depicts the paved roadside land converted into informal dumps.

Figure 4:9-C illustrates LULC dynamics on sloped land, highlighting the loss of vegetation and hazards from erosion. In contrast, Figure 4:9-D presents drainage areas where LULC dynamics on sloped land are not illustrated, revealing evident vegetation loss and erosion hazards. In contrast, Figure 4:9-D shows drainage areas where non-maintenance has altered both land cover and water flow characteristics.

Figures 4:18-E and F further reveal the expansion of barren open spaces replacing functional green cover, marking a shift from vegetated to non-vegetated land cover types. All these figures give proof of the effect of wilting change at this site by undeveloped, ill-planned, and poorly mobilized community-based green interventions.

4.2.3.1 Water pollution resulting from poor land use practices

Survey result determines major environmental pollution causes inside the site in the opinions of the respondents. The outcome demonstrates that leakage of sewage accounts for the leading cause at 36.79%, cited as the most significant among the respondents' answers. There

follows the second one of chemical agricultural with a percentage point contribution of 33.08%, followed by plastic waste contributions at 18.98% then industrial/manufacturing waste contributions at 11.15% for more, see Figure 4:10 below. These results are informative to the interpretation of the site's biggest environmental concerns and correlate with broader worldwide trends in sources of contamination.

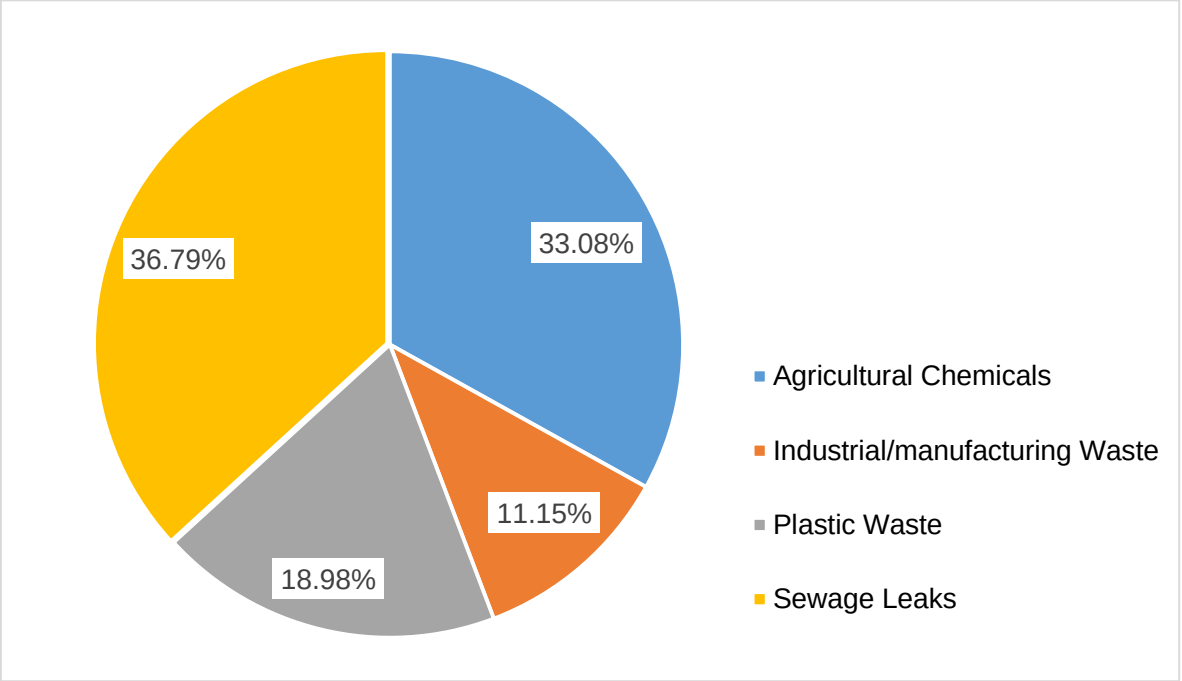

Figure 4:10: Primary Causes of Water Pollution Reported by Respondents
Source: The researcher, 2025

4.2.3.2 The Cause of waste management and its environmental consequences

As shown in (Figure 4:11) below, the analysis of the Ayat Tafo condominium area's waste management problems identifies the top five primary problems. Inadequate regulations are the leading problem at 24.36%, indicating loopholes in enforcement, policy implementation, and institutional control of waste management. Lack of public awareness ranks contain 22.59%, signifying lack of information and community participation as factors contributing to inappropriate dumping conduct.

Illegal dumping contain 20.53%, showing the well-known dumping of garbage in unauthorized places (unplanned), which pollutes the environment and poses health risks to the community. One of the municipal waste management challenge was no waste collection services

(18.76%). Lastly, no recycling facilities encompass 13.75%, reflecting insufficient initiatives to minimize waste and use resources sustainably.

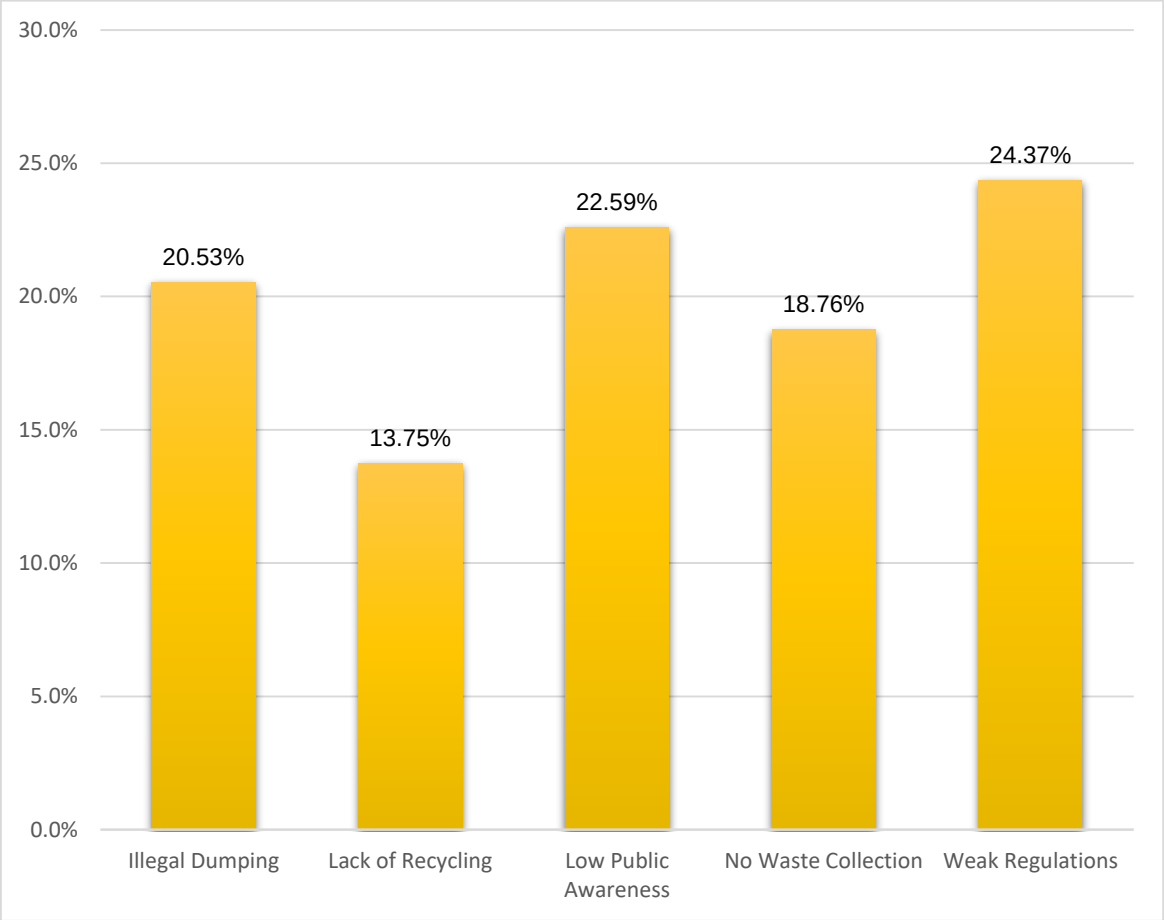

Figure 4:11: causes of poor waste management at study area
Source: The researcher, 2025

4.2.3.3 The cause of soil erosion in the study area

The survey result reveals that the most significant driver of soil erosion is rainfall, which accounts for 36.40%, emphasizing the area's susceptibility to intense rainfall events that can possibly lead to waterlogging flooding, and erosion,. Approaching in as a close next is deforestation (forest clearance), with 29.50%, indicating large-scale tree felling, possibly for urban extension or agrarian purposes.

Construction-correlated effects contribute 18.10%, reflecting the effects of urbanization, including soil compaction, habitat damage, and amplified runoff. Lastly, unsustainable agriculture contain 16.00%, reflecting farming actions that effect in loss of biodiversity, soil potential water resource depletion and erosion, (see Figure 4:12)

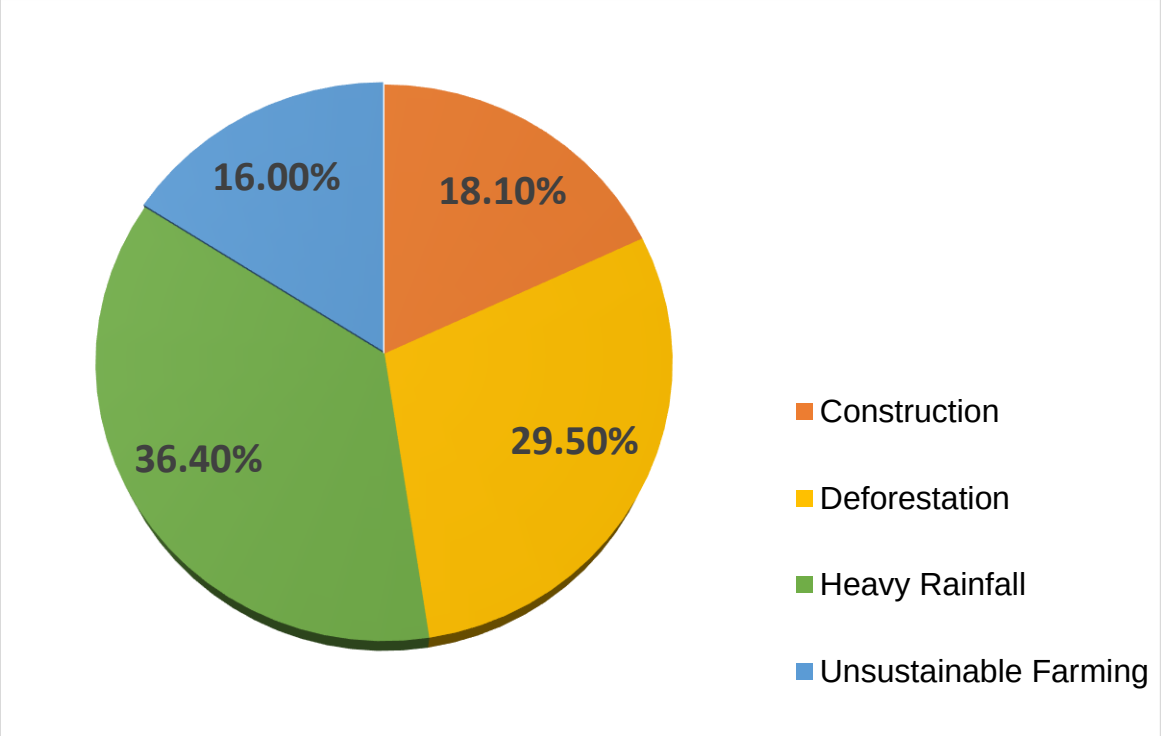

Figure 4:12 Causes of soil erosion in the study area
Source: The researcher, 2025

4.2.3.1 Multifactorial causes of urban flooding in study area

Figure 4:13 provides the relative contributions of different factors towards an environmental issue, such as flooding or land degradation. The poorest contributor is inadequate drainage at 33.49%, which accounts for a third of the problem. Inefficient drainage facilities lead to waterlogging, an increased frequency of flooding, and land degradation; therefore, there must be improved infrastructure and sustainable water management practices. Wetland loss is the next ranking as the second-largest at 24.45%, which means that wetland degradation has an enormous effect on the environment via reduced natural water consumption and increased possibilities of floods. This justifies the maintenance and restoration of wetlands to avert such outcomes.

Forest loss and soil erosion contributes significantly, at 21.03%, possibly because it involves the loss of vegetation that fixes the soil, regulates the hydrological cycle, and prevents erosion. Together, these show the interconnectedness of environmental issue and the essential for incorporated solutions, such as reforestation (Afforestation), wetland preservation, and improved land use planning, to solve drivers of flooding, and land degradation.

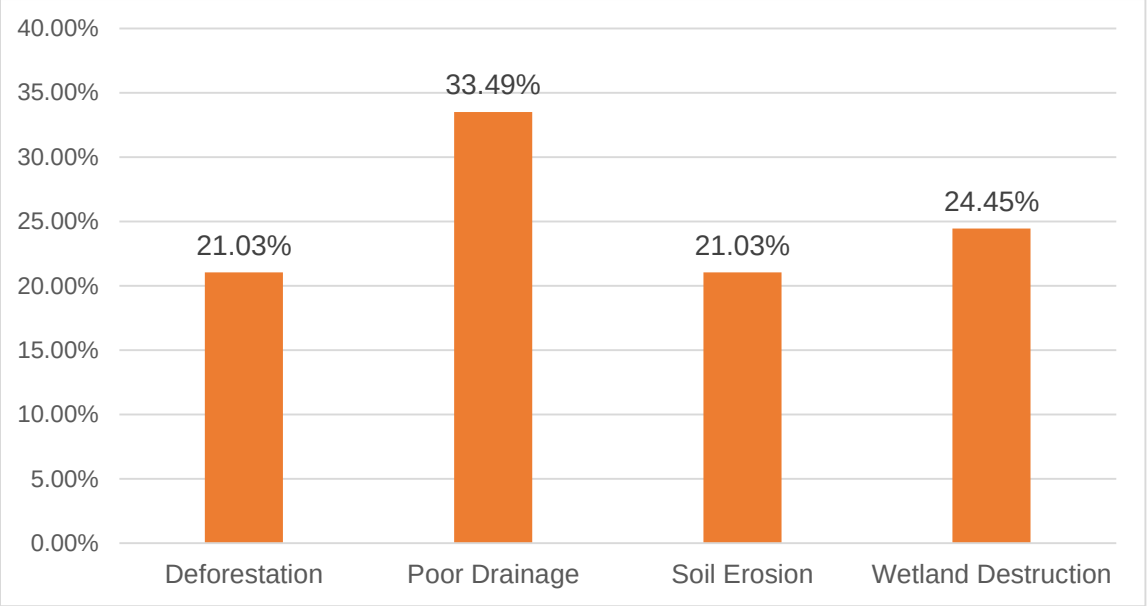

Figure 4:13: Distribution of Perceived Causes of Flooding
Source: The researcher, 2025

One of key informants, from Ayat Tafo 20/80 condominium committee (Blocks 162–168) and she live there, for five year compliant on drainage system limitations, and flood risks as follows: *For five (5) year now, a community has been existing (living) in the Ayat Tafo 20/80 condominium suffering regular flooding problems, especially during the rainy time of year. This is primarily induced by runoff from higher-elevation western areas and an inadequate local drainage system which cannot contain the water volume. It would rain; water would rush into the complex, overflowing the small drainage lines, causing property damage and posing health threats. According to the resident, without tackling both upstream water flow and drainage capacity, flooding continues to get worse*

4.2.3.2 The main cause of noise pollution in the study area

The results show that vehicular emissions and traffic are the main contributors to noise pollution, accounting for 33.30% of the total noise. This shows the extent to which road traffic and other vehicular action contribute to noise pollution in the area. The next donor to noise pollution is loudspeakers and events at 32.14%, indicating the major role that events, announcements, or other recreational events containing the use of loudspeakers play in generating noise pollution. Construction (building) activities also contribute considerably, on behalf of 22.23% of the noise pollution, likely due to the use of machinery, and ongoing development actions. While industrial and manufacturing noise is the account lowest at 12.33% (see Figure 4:14 below).

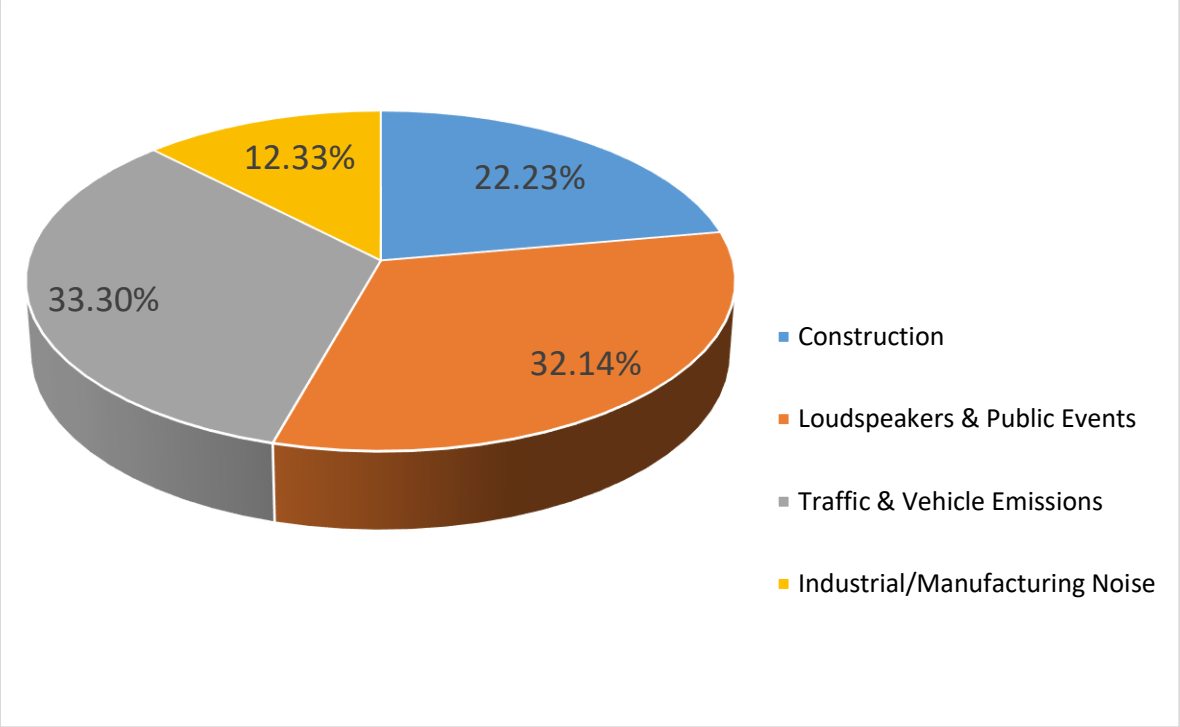

Figure 4:14: Showing causes of noise pollution at study area
Source: The researcher, 2025

Together, the noise sources show the various causes of pollution and emphasize the need for action to solve each source. Two key informants, they works in a local business, raised a same point about the increasing matters of noise pollution as follows.

> *"Local business owners have raised concerns about the incremental cause of noise pollution, which has become a main challenge for communities and businesses alike. The main sources of the noise are automobile traffic emissions, ongoing construction activities, and public gatherings with loud music (volume) and amplified sound systems. Such disruptions not only affect the daily life of the residents but also reduce the overall quality of life in the area. To address this problem, business owners suggest several potential solutions. First, residential buildings should be strategically planned and constructed at a reasonable distance from major roads and other noise-generating sources. This would help minimize direct exposure to excessive noise levels. Second, Simple solutions can help: separating business and residential areas, planting trees as natural sound barriers, enforcing quiet hours at night, and promoting quieter electric vehicles. Additionally, they recommend constructing buildings with a minimum height of G+3 or higher, as higher floors tend to experience less noise interference from ground-level disturbances".*

4.2.3.3 Depletion of urban green spaces

As shown in (Figure 4:15) below, the environmental difficulties observed at the Ayat Tafo condominium site are distributed across a series of major issues. Ineffective urban planning is the largest issue, at 25.73%, and indicates inefficiencies in land use, infrastructure planning, and settlement patterns. Lack of water is the second major issue, at 23.72%, indicating serious concerns over access to a reliable source of water. Invasive species contribute 21.04% to environmental degradation, which suggests interference of native ecosystems by non-native plant or animal species. Land conversion that such changes, including land use change for development and other constructions contributes 14.84%, indicating the impact of urbanization on natural habitats. Deforestation contributes 14.67%, a loss of vegetation cover through settlement expansion or resource utilization.

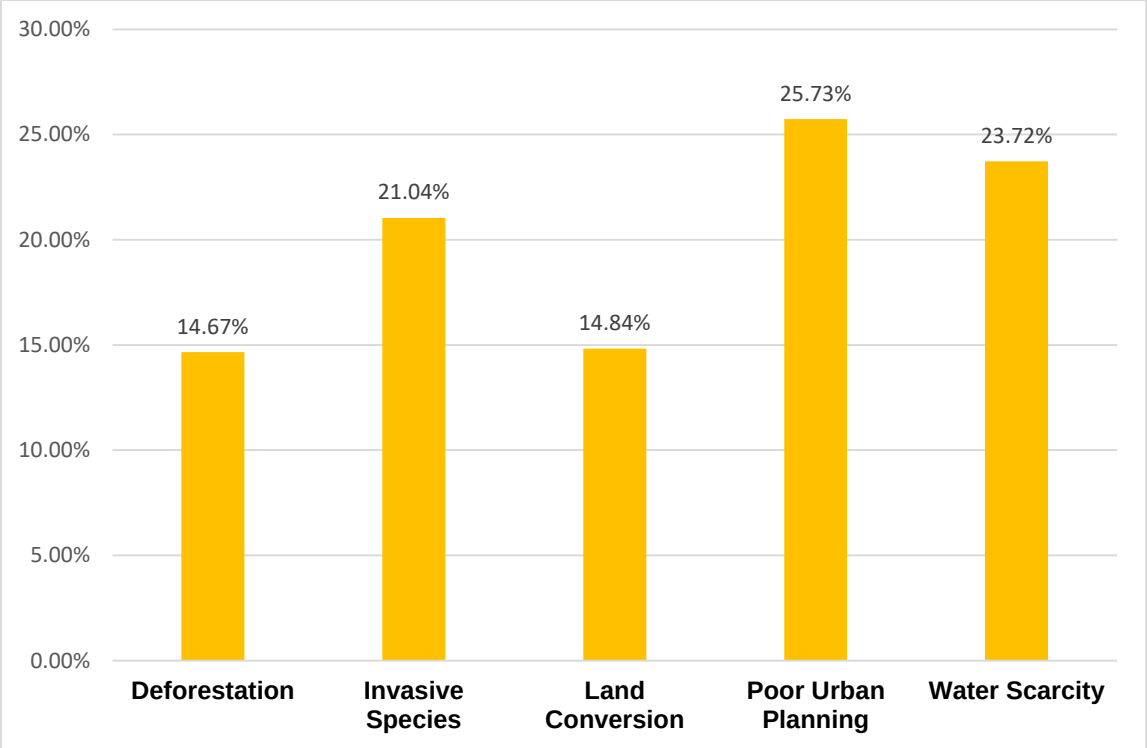

Figure 4:15: Distribution of Causes of Loss of Vegetation or Green Spaces
Source: The researcher, 2025

As the result of this, one of key informants –a condominium specialist /expert working in Lemi Kura sub-city, **(**Woreda 02) forwarded his feelings about the *green or recreational spaces* as:

> *"The existence of green or recreational spaces as designated, especially green and blue infrastructure, is not sufficient in itself. They asserted that in order for sustainable urban design to succeed, it needs to integrate such environmental elements with*

fundamental services such as water supply, provision of electricity, and proper systems of waste management. Green spaces, they argued, should not be treated in isolation, but integrated into a unified and livable urban environment. In addition, the adoption of alternative energy technology was viewed as a strategic and necessary step. Energy efficient technologies (such as solar power) are essential they are not optional. They decrease national grid dependency and enable a long-term energy sustainability. Linking renewable energy and basic services with city green initiatives increase resilience and ensures that communities are environmentally friendly and functionally sustainable."

4.2.4 Assessment of drainage functionality in the study area

The assessment of drainage functionality at study area reveals a significant performance gap and overwhelming 75% surveyed result marked the drainage as being partially functional, this indicate that it is not entirely responsible for water flow or flooding. Conversely 20% declared the drainage to be Non-Functional, which means it doesn't deliver even the minimum requirements. Just 5% of respondent reported a Functional, testifying that the majority of residents find it wanting in terms of meeting their demands (see Figure 4:16 below).

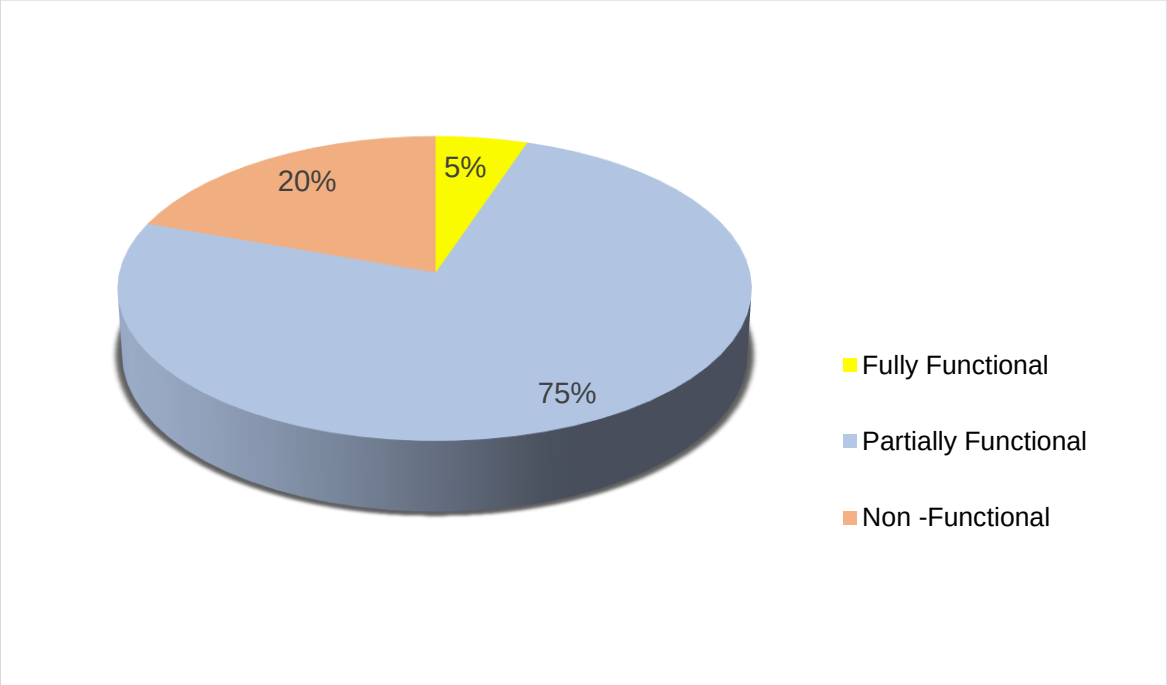

Figure 4:16 Assessment of Drainage at the Ayat Tafo condominium Site
Source: The researcher, 2025

Figure 4:17: Drainage conditions at Ayat Tafo condominium
Source: Photo taken by the researcher, 2025

Figure 4:17 above describes different drainage conditions at the Ayat Tafo condominium site. Some areas have adequate drainage, where water flows without obstruction. However, other sections exhibit partially functional drains with sediment accumulation, while certain locations have completely inadequate drainage due to blockages caused by solid waste. The existence household, garbage, debris, and plastic waste within the drainage channels significantly hampers the system's effectiveness.

4.2.5 Effect of environmental challenges on key aspects in the study area

Based on the study result, respondents indicating most impacted, with 37% of health of resident's are a high impact and 20% accounts a moderate impact. Out of that 13% stated no effect. This is also true for daily activities, as 36% of respondents stated a high effect and 22% stated a moderate effect. Just 8% reported no effect, suggesting that environmental concerns are hindering productivity and lifestyle, possibly through issues such as flooding or poor weather conditions, indicating that environmental concerns are indeed impacting productivity and lifestyle.

Particularly high is the influence on local biodiversity, as 41% of the respondents pointed out high and 23 % very high influence. Only 5% showed no influence, which refers to widespread degradation of the ecosystems, most likely through habitat loss, pollution, or climate change. Infrastructure is also highly affected, with 24% of respondents showing a very high influence and 32% showing a high influence. Just 8% reported no impact, which translates to buildings, roads, and other infrastructure deteriorating due to environmental stressors such as flooding or erosion (see figure 4:18 below).

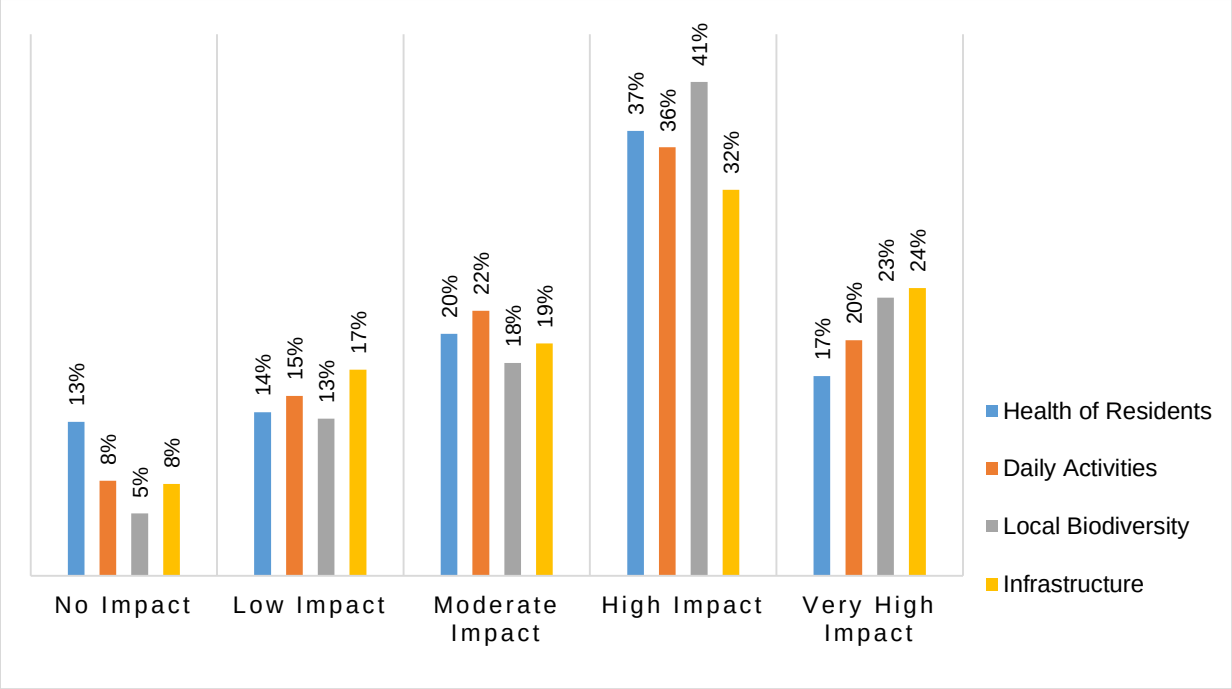

Figure 4:18: Respondents' ratings of environmental challenges' impact on various aspects
Source: The researcher, 2025

4.3 Community perception of LULC changes on urban environment

4.3.1 Community perception on the LULC changes of past 10 years

As shown in Figure 4:19 below, the results from the household survey reveal that 97% of respondents have observed significant land use and land cover (LULC) changes at the Ayat Tafo condominium site over the past decade. This indicates that residents are acutely aware of the transformation occurring in their environment, which reflects a trend of rapid, continuous, and often unregulated land alteration.

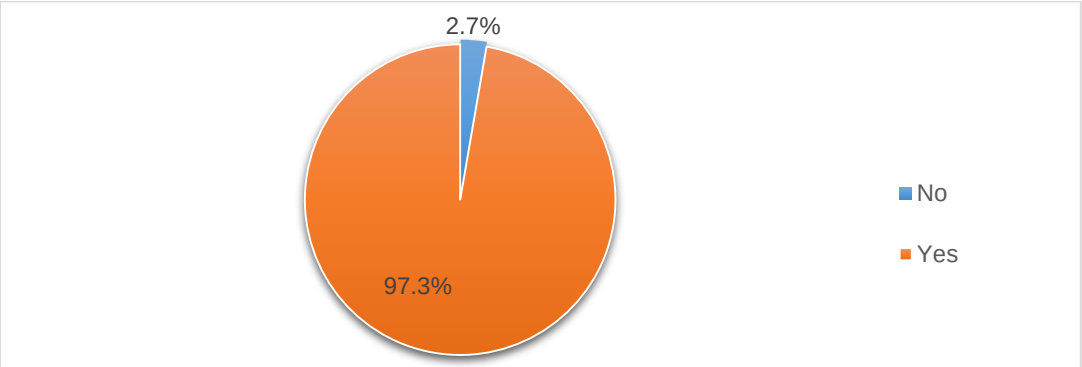

Figure 4:19 Survey Response on Land Use and Land Cover Changes Over the Past 10 Years
Source: The researcher, 2025

4.3.2 Perceptions of LULC change effects by the community

Results from respondents indicate that the main land use and land cover (LULC) changes perceived by the dwellers of the Ayat Tafo Condominium site between 2015 and 2025 year are urban expansion (33%); land conversion (32%); loss of green spaces (19%); and loss of biodiversity (16%). Urban sprawl is referred to as the predominantly perceived change due to the expansion of residential and infrastructure developments over previously open or natural areas.

The land conversion was observed extensively where cultivated and underdeveloped areas were rapidly being transformed into built environments. Most respondents noticed a decline in green spaces, as denoted by the decreased presence of vegetated and recreational areas that previously supported local environmental quality. Last but not least, biodiversity loss emerged as a consequence of habitat disruption and ecosystem fragmentation due to the rapid growth of urban areas.

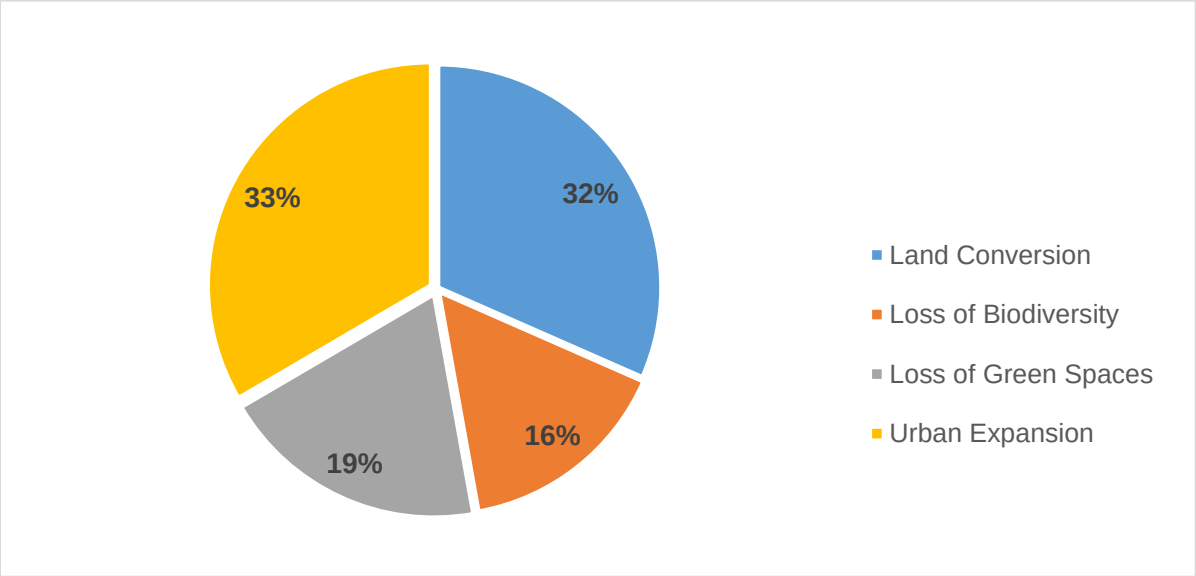

Figure 4:20 Community Perceived Effects of LULC Changes (2015-2025)
Source: The researcher, 2025

Focus group participants emphasized the scarcity of accessible and functional green spaces in and around the Ayat Tafo condominium. Some residents considered even a modest effort at vertical planting with plastic bottles a worthwhile endeavor; almost everyone else thought such efforts did little to fulfill the ecological and recreational needs of the residents. "*We need real green spaces, not greens on barriers. Somewhere we can relax, take a walk, and be near nature," stated one resident*. This statement implies a serious community perception: meaningful and inclusive green infrastructure is needed, and such needs are urgent, in

response to the negative impetus that has been given to LULC changes, the most visible being the impact on the ecological and recreational functions of the place.

As indicated in Figure 4:21 below, land conversion in the study area has occurred through both formal (Figure 4:21 B) and informal (Figure 4:21 A) developments. Informal settlements are especially concentrated around the forested areas at the outskirts of the site and along the riverside. In contrast, most of the formal settlements are located along the main street within the site, suggesting that earlier planners had designated these areas for structured development. While the study does not question the legitimacy of formal development, it is evident that both formal and informal expansions have contributed significantly to the changes in land use and land cover across the site.

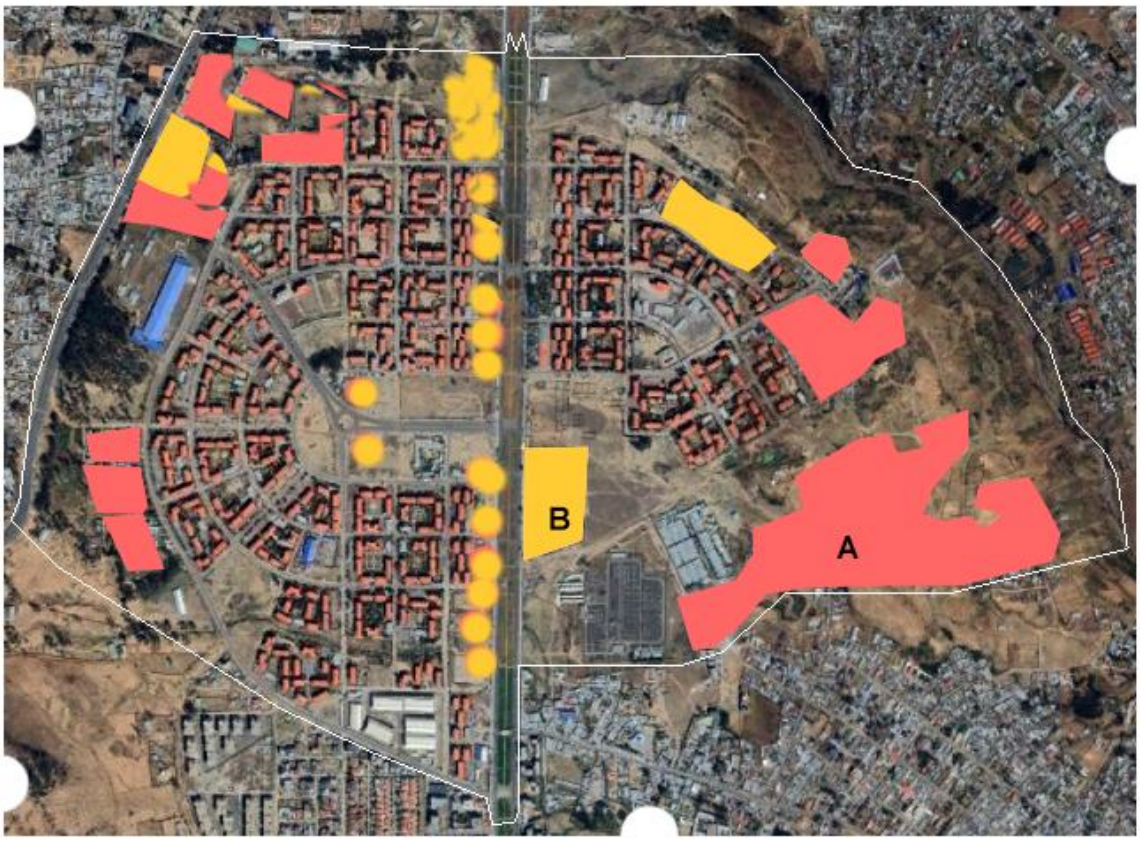

Figure 4:21 Show the land conversion area

Source: Google Earth Pro (2025) and the researcher (2025) (A and B)

4.3.3 Community perceptions of urban expansion and its effect on the living environment

Analysis of the survey results produced an informal diffusion of community perceptions on the effects of urban expansion on the living environment at the Ayat Tafo condominium site. Out

of 368 respondents, only a very small fraction (6%) reported views on very positive effects, highlighting the potential benefits, such as accessibility to housing and services. Approximately 18% thought of the effects as somewhat positive and mentioned some conveniences that came along with the expansion.

But the most of respondent had negative views of urban expansion. Approximately 39% of them indicated somewhat negative effects, another 37% indicated very negative effect, (see Figure 4:22). The combination of those result show uncontrolled urban expansion increased congestion, loss of green spaces, and strain on local infrastructure, extensive environmental damage, and decreased overall quality of life. These results signal a significant awareness among communities of the impediments that come with frenzied urban growth and call for concerted efforts to address growth in sustainable ways.

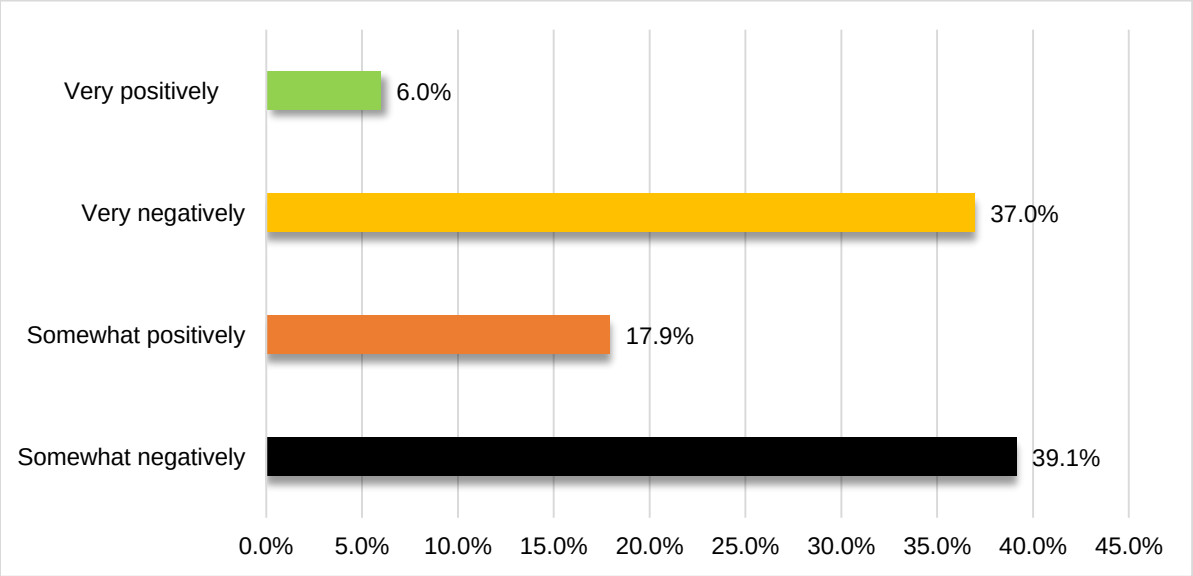

Figure 4:22 respondents perceptions on the impact of urban expansion
Source: The researcher, 2025

4.3.4 Community perceptions of environmental conditions

Figure 4:23 below illustrates the survey results on varying perceptions of environmental quality across different respondent categories. For air quality, 54% of the respondents considered it poor, 23% considered it excellent, and merely 2% considered it very poor. Most respondents rated water quality as poor, with 56% giving it a rating of poor and 4% giving it a rating of very poor, while no respondent rated it as excellent. Waste management was most severely criticized, with 54% of the respondents terming it as very poor and 36% as poor, but only 9% as good. Vegetation and green spaces were also negatively viewed, with 42% terming them

as poor and 14% as very poor, and no respondents terming them as excellent. Soil erosion was also considered serious, with 29% perceiving it to be very poor and 49% perceiving it to be poor, yet 9% described it as excellent. Panoramic landscape perception was polarized as well, with 31% describing it as fair and 18% describing it as good, but 17% describing it as very poor. Lastly, block beauty was perceived as very poor by 29% and poor by 37%, and only 8% perceived it to be excellent. Overall, the results suggest significant issues, particularly in waste disposal and water quality, with other issues, such as air quality and landscape, receiving more varied responses.

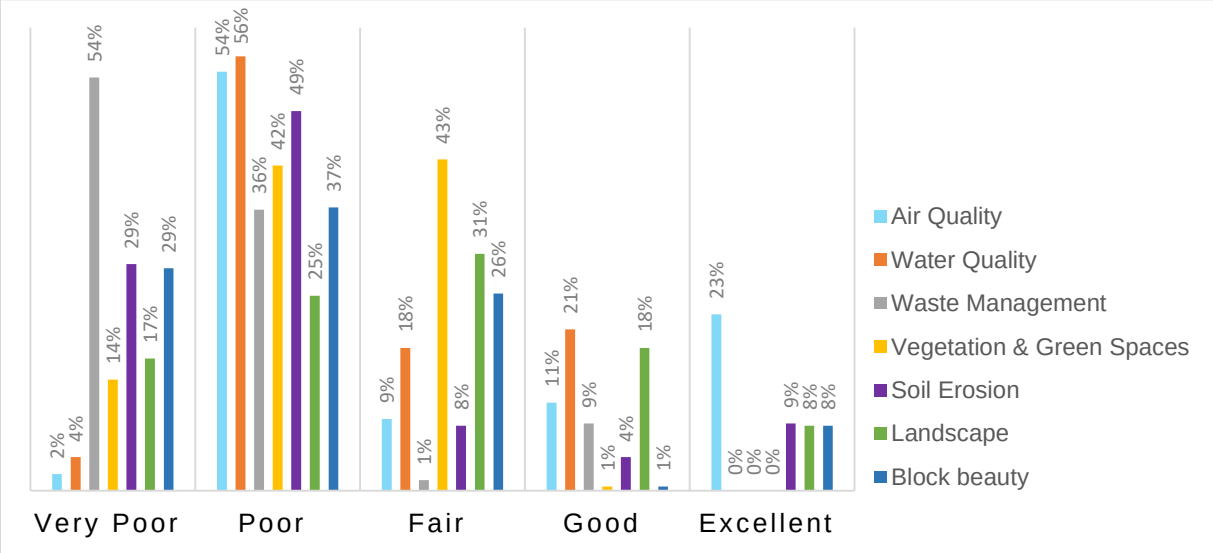

Figure 4:23: Respondents' ratings of environmental conditions at the site
Source: The researcher, 2025

Figure 4:23 solid waste management method in study area: solid waste along local street (a), solid waste around open ditch (b), accumulated garbage near residential areas(c & e), land fill site(d), and solid waste station (f).
Source: Google earth pro and the researcher, 2025

Figure 4:23 above illustrates an area within the Ayat Tafo condominium where waste has accumulated due to improper disposal practices. Masses of garbage, including plastic waste, food scraps, and household debris, are visible in open spaces and near residential buildings.

The presence of uncollected waste contributes to several environmental and health problems. Decomposing organic waste produces foul odors, while plastic waste clogs drainage systems, increasing the risk of flooding. Additionally, the accumulation of garbage attracts pests, such as rodents and insects, posing a public health risk. One of the key informants, a Degree holder working in Ayat Tafo condominium as a committee member -Block 86-94, responded to the reasons why many residents perceive open spaces for other functions and described his perception as follows:

> *"Key informants from the Ayat Tafo condominium site committee emphasized the importance of properly developing open spaces to prevent misuse and improve their functionality. According to the key informant, most of community and foot-user look open spaces as vacant (open) land, which leads to wrong uses such as makeshift latrines or waste dumping areas. Such like things not only harms the environmental value of the site but also cause for public health risks (due to unsanitary conditions). To solve this, the key-informant stressed the need to change this type of vacant space to functional. Alternatively, they could serve other vital purposes, such as public gardens, urban forests, or chosen meeting places for social and cultural events. Well-organized vacant or open space would not only reduce inappropriate use but also develop the overall aesthetic value of the condominium sitting".*

4.3.5 Community perception of green spaces adequacy

The survey results (Figure 4:24) reveal a sharp contrast in community attitudes toward the adequacy and effectiveness of green spaces within the Ayat Tafo condominium neighborhood. There is a vast majority of respondents with 42% strongly disagreeing and 41% disagreeing that the current green spaces are not adequate to support biodiversity and increase people's well-being. It indicates that the residents are not satisfied or effective, as over 83% show such a deficiency in the critical environmental and social functions. However, only a small number of respondents, or 17%, 7% of whom agree and 10% strongly agree to consider the greening spaces as good enough to sustain biodiversity and enhance the health of the community.

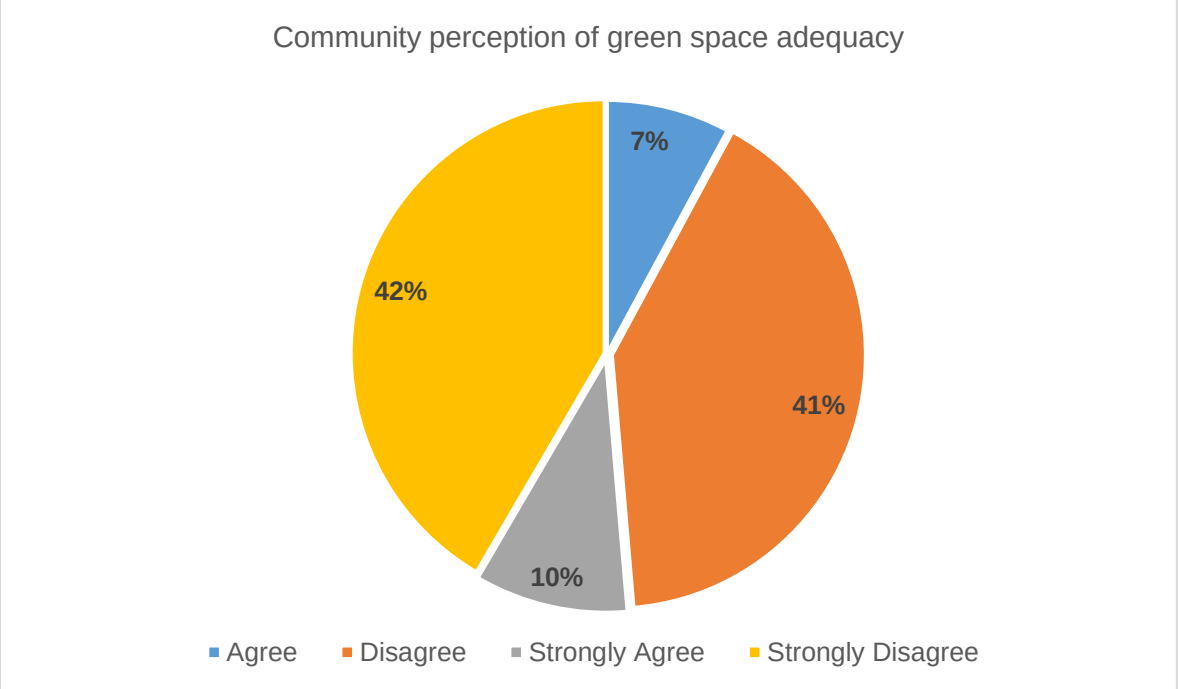

Figure 4:24: perceived adequacy of green spaces in study area
Source: The researcher, 2025

4.3.6 Land use priorities for enhancing environmental functionality

The surrey result show participant choice of land use for increasing environmental functionality were as follows (Figure 4:25). As result most of the participant choice were mixed-use development it account 52.9% .19.6% favored recreational areas, while 14.2% selected residential use and 8.4% chosen urban agricultural use. Only 4.8% of respondent's choice business case (commercial land use). These result indicate mixed-use development was the most preference as result this approach enhance effective environmental functionality. The same is true recreational area development is also supportive for robustness of biodiversity and ecosystem.

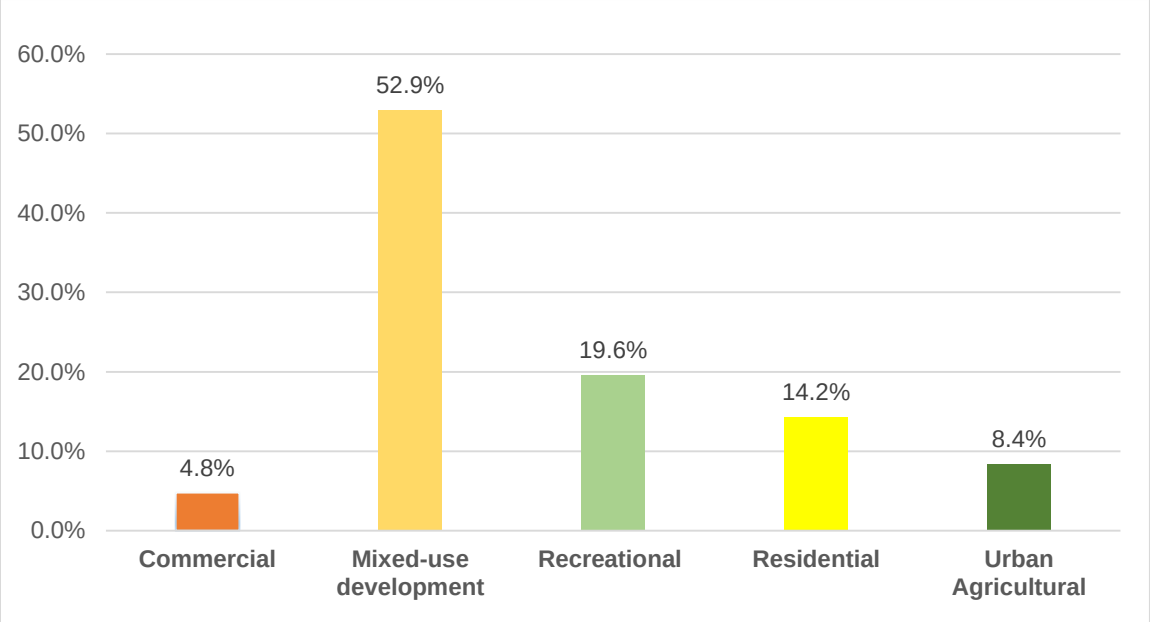

Figure 4:25 land use prioritization for improved environmental functionality

Source: The researcher, 2025

4.4 Community participation and strategic interventions undertaken to improve the site conditions

4.4.1 Strategic interventions for improving site conditions

4.4.1.1 Environmental challenges identified by the community for immediate intervention

As shown (Figure 4:26) below survey result indicates the following distribution of environmental issues: waste management (20.8%), loss of green areas (18.2%), water shortage (15.8%), loss of biodiversity (13.9%), water pollution (12.6%), soil erosion (10.1%), and loss of wetlands (8.6%). The results indicate that waste management is the most frequently cited environmental problem, followed by the loss of green areas and water shortages. Loss of biodiversity, water pollution, and soil erosion also rank high, with the loss of wetlands being the least mentioned but equally relevant.

The result identify a broad range of environmental concerns, with waste control being the most critical, reflecting rising challenges linked with expansion and resource management in the area. Collectively, these findings reveal that numerous of the persistent environmental issues are deep-seated in non-planned or poorly-managed land use land cover shifts, underlining the need for maintainable land-use policies, participatory urban planning, and green infrastructure.

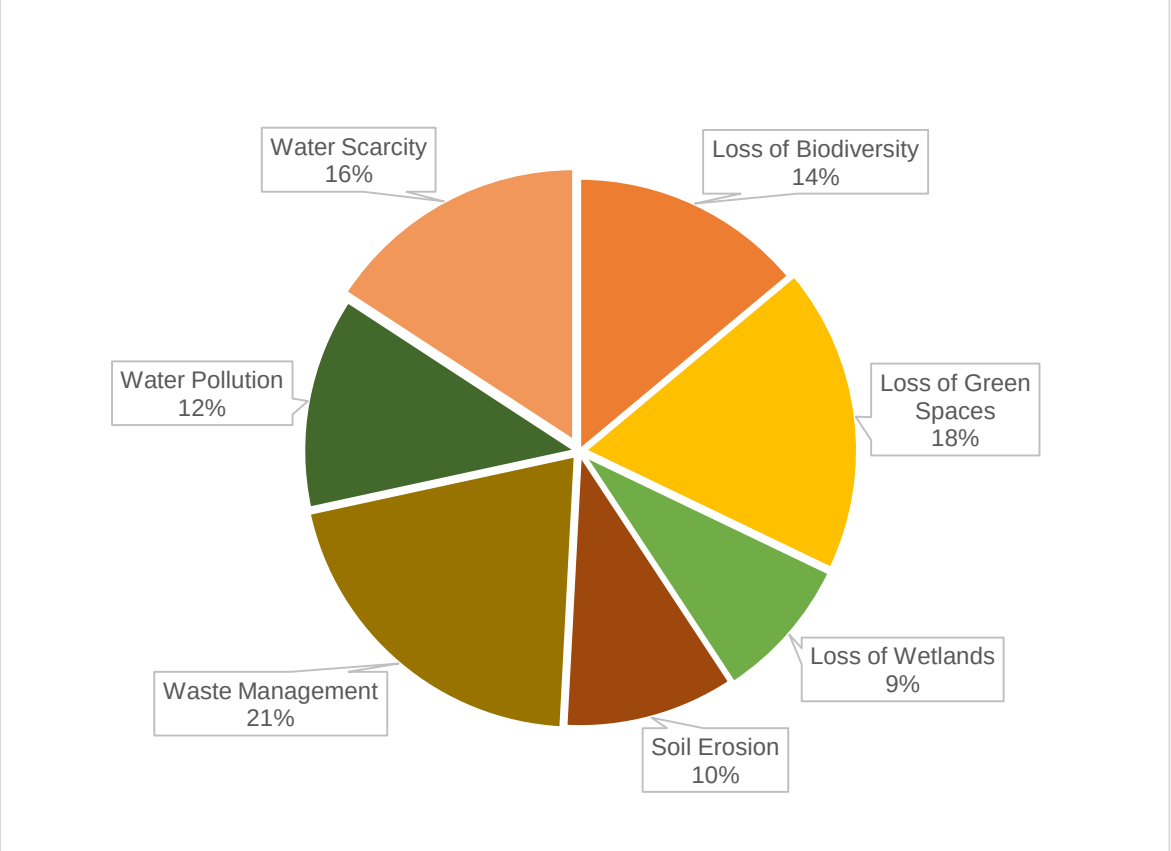

Figure 4:26: Priority environmental challenges requiring immediate intervention
Source: The researcher, 2025

4.4.1.2 Community-supported interventions for enhancing environmental quality

As shown in Figure 4:27, participant recognized for improving environmental quality in the study area are four key landscape–based result. From this key landscape-based solution was planting native plants (28.12%), which highlighted ecological balance and biodiversity restoration. Next, Rainwater collection systems account (26.04%), the necessity for sustainable water management. The third-place, founding parks and green areas (24.41%) was recognized as a vital involvement for enhancing the artistic and leisure (recreational) quality. The last issue related to flood control measures (21.43%) was regarding fair discharges and storm water runoff. Therefore, vegetation restoration and water management become the two most significant landscape methods in the region for achieving sustainable transformation, as indicated by these results.

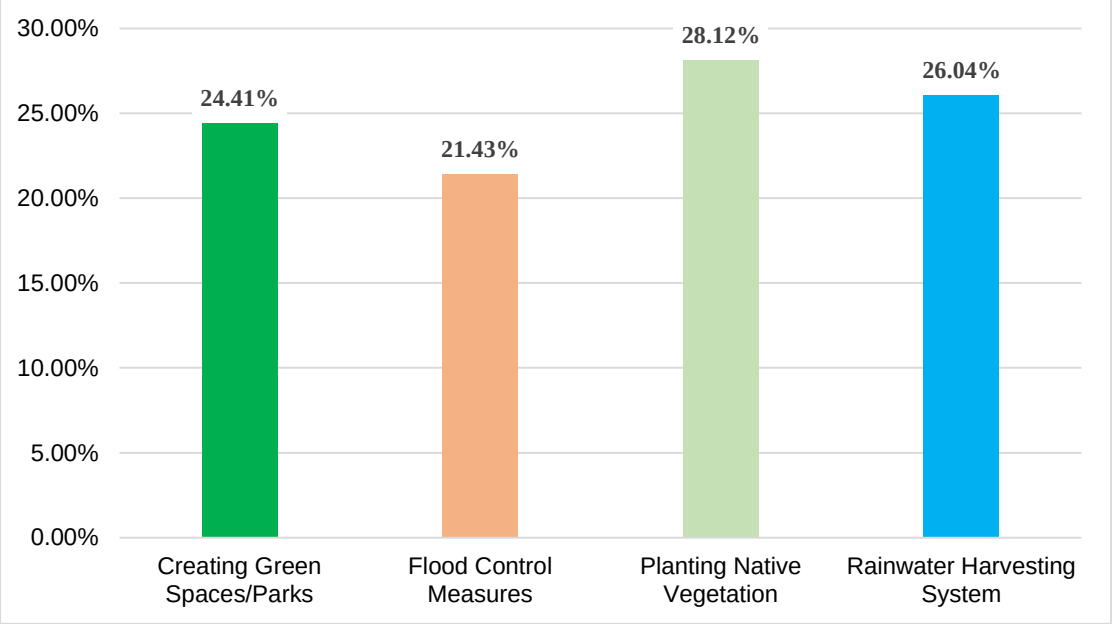

Figure 4:27: Community-supported solutions
Source: The researcher, 2025

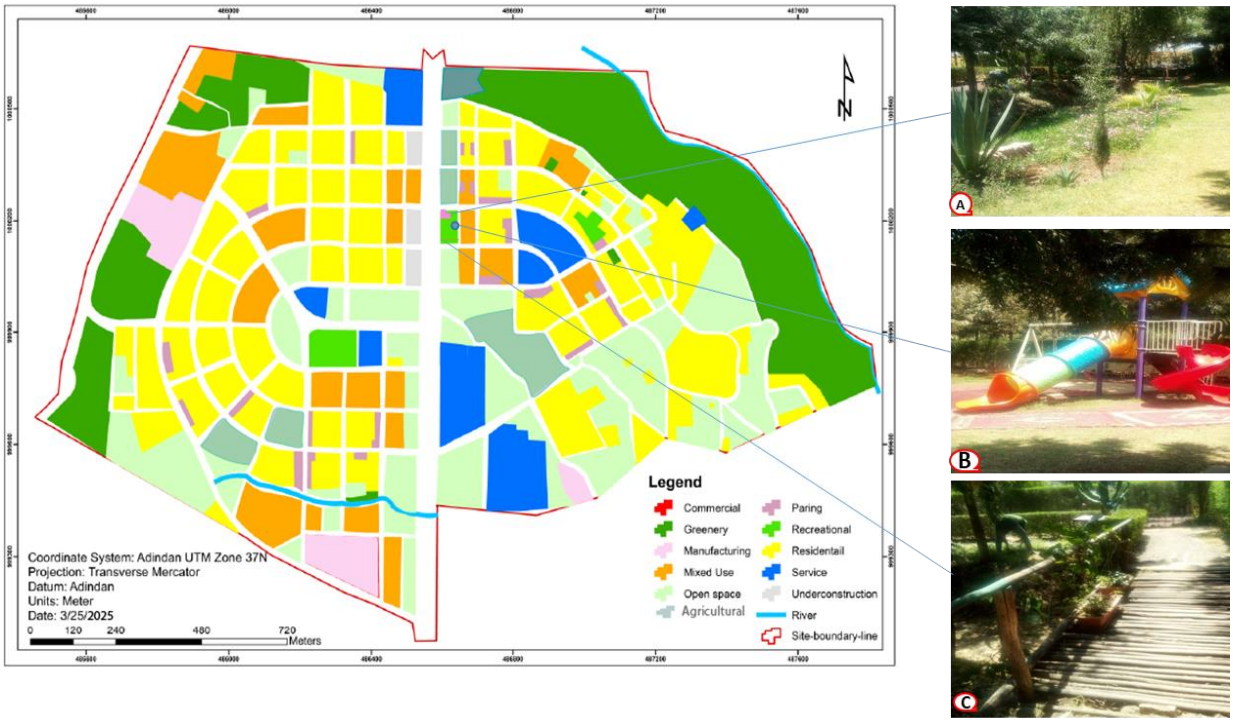

Figure 4:28: Community-supported landscape interventions, native plant landscaping (A) community playground (B) wooden walkway (C)
Source: The researcher, 2025

According to Figure 4:28-A (native plant landscaping), it is the deliberate planting of native and ornamental vegetation along the footpath. Layered plants, such as agave, shrubs, and small trees, indicate a conscious effort in biodiversity enhancement and ecological restoration,

as they contribute to native plants, which is the top-rated community priority for improving environmental quality (28.12%).

According to Figure 4:28-B (recreational space), this brightly colored children's play area set against a green background. It is an example of the community-defined intervention for the establishment of parks and green spaces (24.41%). That allows for recreational use as well as urban greening. The play facilities within a natural setting provide an additional aesthetic and social value to the area.

According to the focus group and Figure 4:28-C (pathway), the wooden footbridge and accompanying landscape, which are sensitive to drainage, can be seen here, aligning with flood control and sustainable water management practices. The use of permeable materials and bordered plantings illustrates attention to rainwater management and the base surface is covered by grass (26.04%), which was stipulated as high by the stakeholders.

4.4.1.3 Interventions introduced by government for addressing environmental challenges

According to survey data, the community perceives little follow-through on environmental issues by the government in the study area. Green space development is the most frequently reported measure among those carried out. Still, only 17% of respondents reported seeing it in effect, indicating that 83% do not recognize its presence in the study area.

Next were waste management and reforestation, with both being reported as "seen" by only 16.3% of respondents. The data show that 14.4% of respondents noted the efforts made in soil erosion control and 14.3% water conservation, while 10.1% recognized measures aimed at biodiversity conservation. Even fewer mentioned interventions concerning environmental education (6%) and pollution control (4.6%).

These results designate that not a single involvement was saw by more than one-fifth of the respondent, thus showing gaps in handling, perceptibility, or community commitment. The over-all low recognition rates recommend that governmental involvements in the study area are either inadequate or unwell- connected, or applied in an inconsistent way. (See Figure 4:29.)

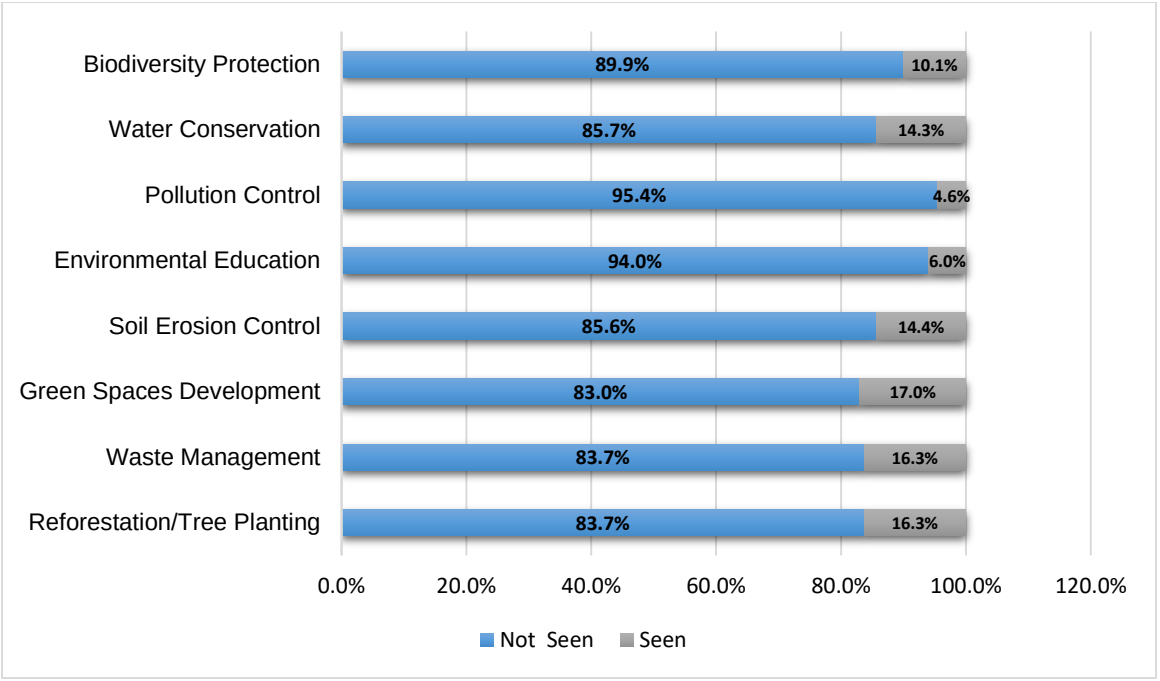

Figure 4:29: Governmental Interventions for Addressing Environmental Challenges
Source: The researcher, 2025

Figure 4:30: Governmental intervention area of environmental matters at study area

Source: Google earth pro (a) and the Author (2025) (b, c, and d)

Figure 4:30 (b) the governmental-made a basketball field at the Ayat Tafo condominium as part of its effort to improve recreational infrastructure. Though, the intervention stay incomplete, as the facility lack essential components such as lighting, siting area and other infrastructure. These deficits limit the field usability and reduce its possible influence to public well-being. This reflects a wider challenge in governmental interventions, where initial development is not convoyed by sufficient planning, maintenance, and finishing.

Figure 4:30 (c) shows that the whole area is not adequate waste management scheme. To further exacerbate the issue, the designated dumping site is positioned immediately near to the main road, indicating an unwell designed choice by the accountable authorities.

Erosion control methods, including retaining walls on both sides of the condominium part, constructed as big open ditches (Figure 4:30 (d). The constructions (structure) serve a dual function: to control erosion and to drain rainfall (rainwater). However, a post-implementation management plan has not been established, so communities have improvised spaces, fenced by retaining walls, for dumping waste, and in some cases as informal toilets. These misuses highlight the importance of consistent maintenance and monitoring, as well as real (effective) community awareness, following government interventions.

According to FGD they stated about lack of playgrounds for children and recreation areas (usable for social interaction). This indicate proper land use planning and design/ landscape design gap in condominium siting. From focus group they put the need of social space for necessity of interchangeable activity or events. From FGD, one participant stated that*, space needed "where there's tripartite space for sitting and space for chatting, people tend to meet, children play, mothers have an interaction-everybody benefits."* It shows that this part of the communities acknowledged how land-use selections could take away from social communication and impact individual well-being.

4.4.2 Community participation in responding to the adverse effects of LULC changes

4.4.2.1 Participation in governmental or committee supported environmental initiatives

The survey results indicate a generally low level of community participation in most environmental activities within the Ayat Tafo condominium area. The most active areas were Urban Gardening and Community Farms (15.76%) and Tree Planting and Reforestation (14.95%). Waste Management and Recycling Programs (13.04%) and Water Conservation

and Restoration (13.86%) also registered relatively higher response than Environmental Education and Awareness Campaigns (12.23%) and Plastic-Free Communities (10.87%). These findings reveal that the majority of respondents are not currently engaged in these environmental sustainability practices, with the "No" responses exceeding 84%, reaching as high as 89.13% for Plastic-Free Communities (see Figure 4:31 below).

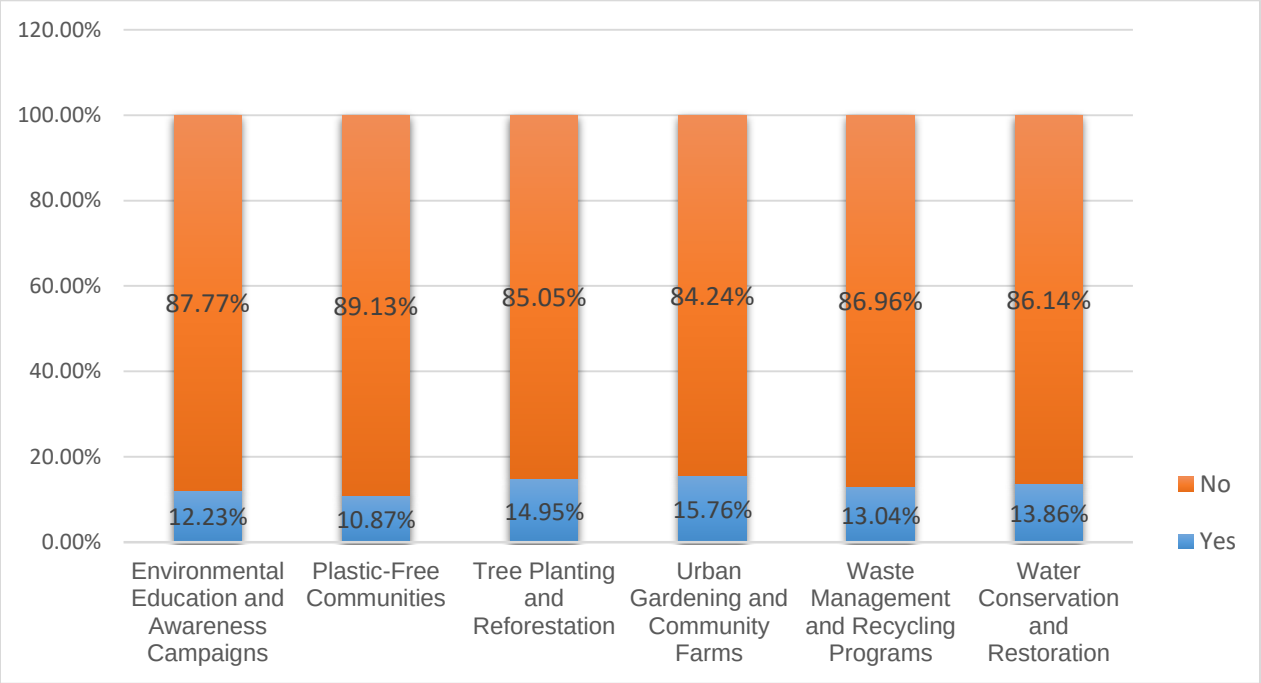

Figure 4:31: governmental and committee -led environmental initiatives
Source: The researcher, 2025

Furthermore, it suggests that although environmental concerns are present, very little is currently being mobilized and set in motion in terms of a minimal community-led response indeed, a very serious gap in participatory environmental governance. The community participation in promoting a sustainable urban landscape, and also points to an urgent need for raising people's consciousness, institutional support, and inclusive environmental planning. One of key informants, he work the head of land management, in lemi Kura sub-city ,Woreda 02 mentioned main issue preventing community participation in environmental concerns as follows:

> *"The main issue preventing community participation in environmental concerns is a lack of awareness. Additionally, there are funding problems, and some people feel uncomfortable working together. This gap exists because there hasn't been a responsible body or awareness created for the community. Furthermore, the government has not given adequate attention to this area. However, nowadays, there*

are no open spaces available, and at the very least, one functional area should be provided for recreation or another purpose. Before moving forward with any implementation, it's crucial to first create awareness within the community."

4.4.2.2 Frequency and forms of participation in addressing the environmental condition of the study area.

The data on participation rates in environmental sustainability initiatives at the Ayat Tafo condominium site shows an alarming trend. Majority of participant about 62.22%, said they do not take part in such initiatives at all (see Figure 4:32). This reveals that a lack of involvement in activities like water conservation, waste management, and, tree planting which are important for the sustainable development of the land.

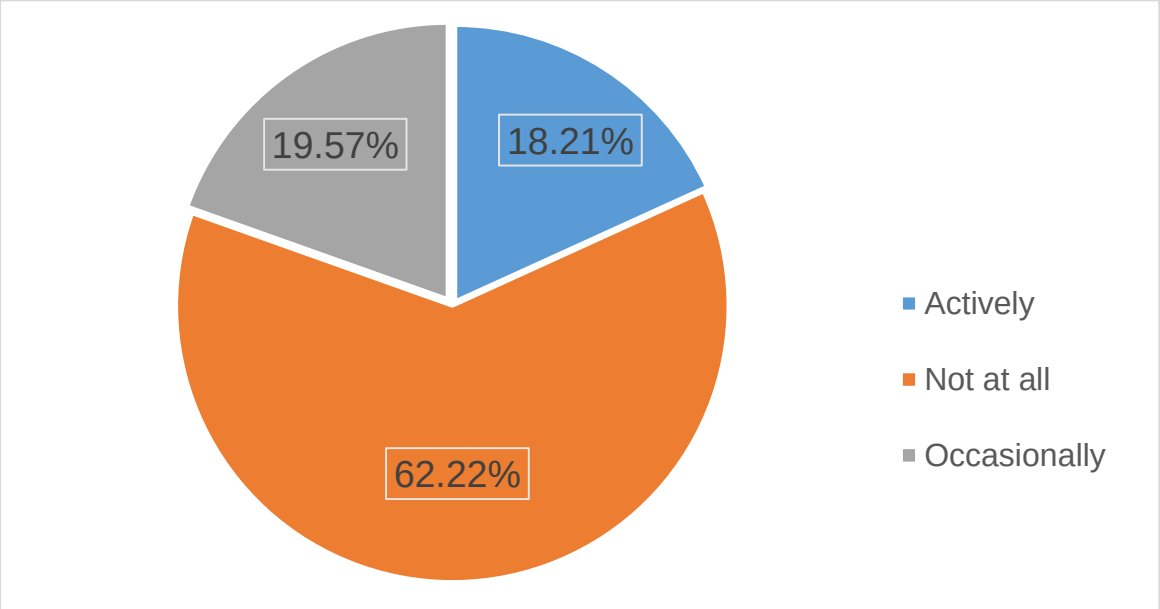

Figure 4:32: communities' participation in environmental sustainability initiatives
Source: The researcher, 2025

4.4.2.3 Effectiveness of community actions in addressing LULC challenges

The finding of the survey show that majority of the respondents Put, community participation was "Very Effective it account that 73.9%, while 20.7% stated it as "Moderately Effective". 5.4% of the respondents ranked it as "Slightly Effective," and only 1.09 % respondents valued "no effective",(see figure 4:33 below).

As results community identifies the significant of their participation in initiatives such as garbage collection and management, urban gardening, tree planting (reforestation), water conservation and restoration programs. The fact that the community had the highest positive response shows an understanding on the part of the community concerning the significance of environmental care and their will to contribute to sustainable landscape change.

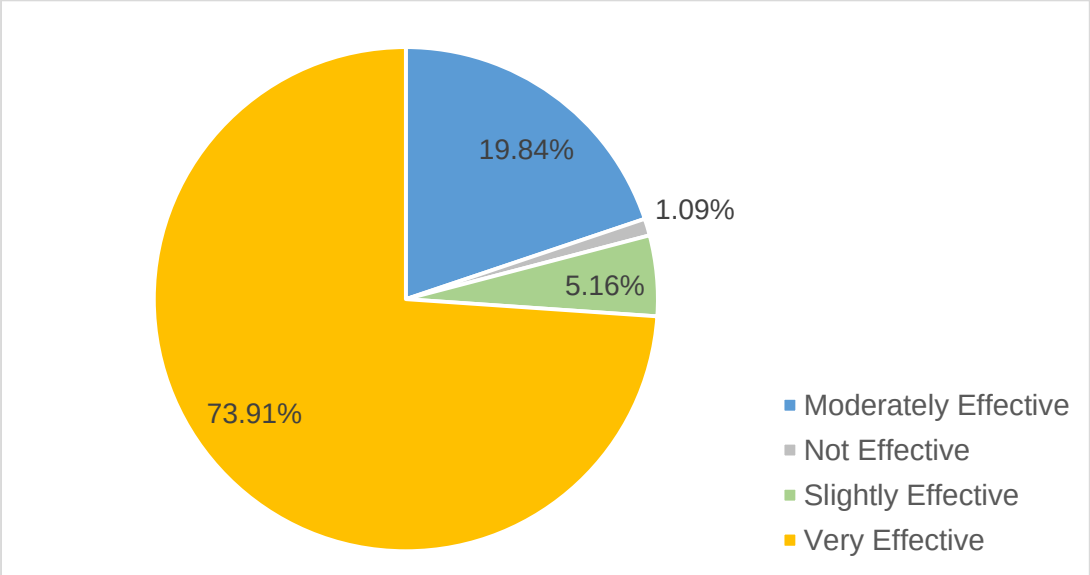

Figure 4:33: effectiveness of community participation
Source: The researcher, 2025

4.4.2.4 Barriers to active community engagement

The survey results show that numerous hindrances exist to active community involvement in environmental planning. The major challenge, as noted by 34% of the respondents, is limited awareness and environmental education, which limits the community's understanding of sustainable practices and their commitment in environmental safeguarding. Moreover, 28% of the participants mentioned economic constraints and time scarcity as foremost obstacles, as citizen’s consensus higher priority to get-together their daily needs over getting involved in volunteer environmental struggles.

The lack of government provision, quoted by 27% of the participants, also hinders participation due to technical assistance, deficiency of infrastructure, and policy mechanisms. Furthermore, 11% of the participant stated the absence of incentive (motivations) for involvement, such as fiscal incentives and public credit, as an aspect that discouraged (see figure 4:34 below). To

solve or break these listed barriers it should be need to raise awareness, applied finical incentive, create coordination with local authorities.

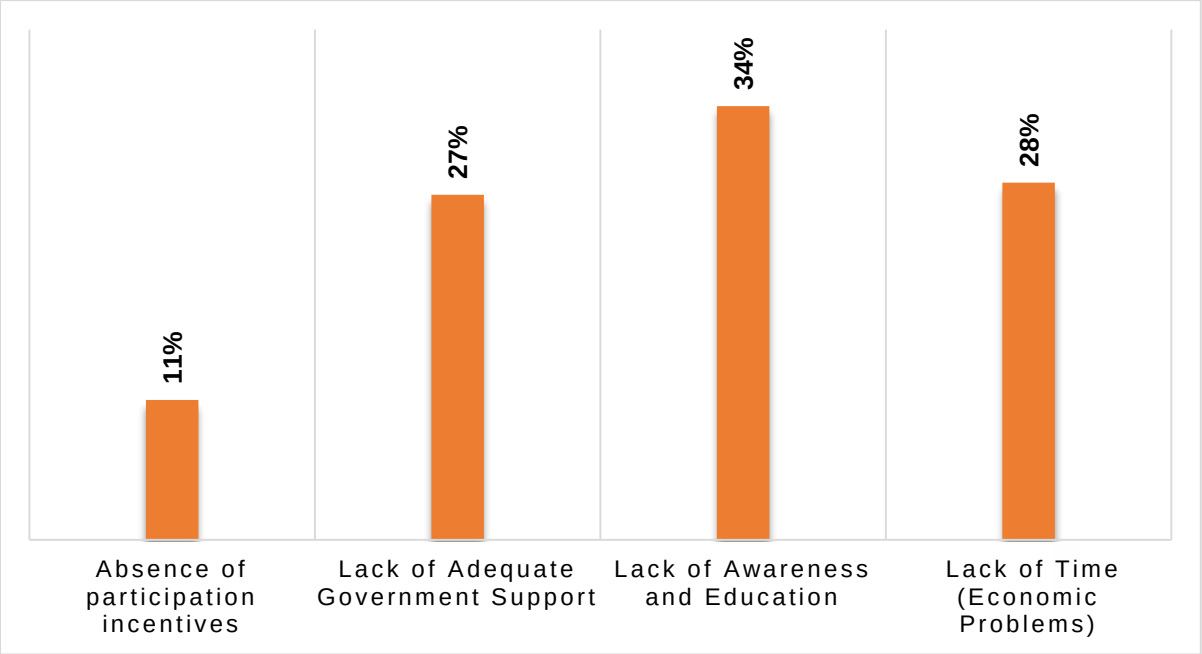

Figure 4:34: Key barriers hindering community engagement in environmental planning
Source: The researcher, 2025

Summary of Findings

The demographic profile for the Ayat Tafo condominium indicates that most residents are working-age adults (25–54 years), who call for sustainable development and green urban spaces. Senior citizens residing here (55–64 years) demand accessible medical care, and youth demand urban planning to make cities friendlier to them. Education levels have a connection to green awareness, but there is a need for more mass communication at lower education levels. Occupational data indicate a mix of regular and self-employment, and unemployment and housewife unemployment provide challenges to be incorporated in participatory planning.

The study represent the transitions between LULC in 2015 and 2025, from which it is possible to observe that there is rapid urban expansion in the site of the Ayat Tafo condominium, where built-up areas increased from 25.4% to 47.7%, taking over green and agricultural lands. The area under vegetation declined by 6% while the forest cover reduced to just 3%, indicating increasing primary resource depletion or ecological degradation. LULC changes at the site have indeed been largely observed by the residents, with more than 97% affirming major shifts, thereby necessitating greater improvement in land use planning.

The environmental influences are indeed harsh, most residents valued the impacts on water quality as high (79%), next impacts vegetation health (39%), and lastly, impacts on biodiversity (31%). Waste management was poorly ranked, with 90% saying it was either poor or very poor. Among the other environmental issues were water contamination, soil erosion, humble drainage, and inappropriate us of open space.

The decline of green spaces was credited to poor urban planning, the attack of unknown species, water shortage, and deforestation. Furthermost soil erosion was considerably attributed to heavy rains, accounting for 36.4%, followed by forest clearances at 29.5%. The major causes of flooding are poor drainage systems (33.5%), wetland loss, and forest degradation. There was a growing concern concerning noise litter from traffic, construction, and social events. These environmental challenges would have a great impact on the health of community's, daily activities, biodiversity, and infrastructure.

Waste management, water scarcity, and loss of green spaces received priority from the community. Respondents preferred supporting actions like planting local vegetation, rainwater harvesting, creating parks, and flood prevention measures as access ways to intervene. Though, government contribution in greening was quite limited—only 17% had seen green improvement, and less than 16% contributed in community-led environmental actions.

Community action was reflected "very effective" in solving environmental like issues by 73.9% of respondents, despite a comparatively low level of participation. Barriers to community participation included, inadequate institutional support, lack of finances, and poor awareness. The community so-called for development in environmental education, increased governmental support, channels of communication, and launch of local environmental organizations. FGD revealed a joint need by the community for well-designed green spaces and inclusive urban environments, suggesting strong potential for community-based, sustainable landscape transformation if planned and supported by infrastructure developments.

4.5 Discussion

The socio-economic characteristics of respondents of the Ayat Tafo 20/80 condominium indicates majority female, economically active, and moderately educated. The dominant family size were children, middle-aged, and young adults. This is reliable with the results of Smith (2018), which also emphasized that education rises the community's involvement in environmental planning. However there is the inappropriate link between having knowledge

and acting it to live a feasible life (Johnson, 2020). Previous study has tended to highlight education as a driver of participation, but this study finds that even existence of educated and economically well-off persons, levels of actual maintainable actions are low, underlining the necessity of bridging the knowledge-action gap by applying actions -focused interventions and enabling systems.

LULC changes a year between 2015-2025 in the Ayat Tafo 20/80 condominium site reveal the rapid urban development and encroachment into land without manageable way such bas areas under vegetation, open space, and forestland. Developed (built-up) areas are increasingly replacing green structure in an environment that has been under pressure through informal expansion. This trend agrees with changes described by Woldegerima et al. (2017) for Addis Ababa and Seto et al. (2011) for other quickly urbanizing cities on the African landmass, where urban development outpaces planning, and effectively decline ecological systems.

The loss of urban vegetative cover and urban forests, not only effect on biodiversity but also cause for flooding erosion, and urban heat stress .This provides support to the argument made by (Alberti, 2008) that the elimination of natural buffers reduces a urban resilience to ecological(environmental) stress. The degradation of green and agrarian land into built-up reveals the destruction of habitat and biodiversity strips, an issue concerning ecosystem degradation that Grimm et al. (2008) elevated in fast-attacking landscapes.

The existence of flat topography in some part of Ayat Tafo condominium site, the drainage system has been hindered the flow system which was largely overlooked in the construction of built-up spaces. As a consequence, unsuccessful storm-water utilization program was arrived at, related to the views stated by UN-Habitat (2020), which dealt with the prohibiting of bio-physical constraints in the form of urbanism, mostly in the perspective of peri-urban improvement zones. Local testimony approve these patterns, as respondents report drainage problems and a lack of green infrastructure as day-to-day challenges. They echo Chiesura (2004), who noted that the deficiency of available green space in densely constructed environments is corrosive to the well-being of communities and their satisfaction with the usual environmental state of affairs.

The environmental consequences of LULC changes (loss of vegetation, biodiversity, soil stability, and water quality) argue for an environmental balance so, delicate that it stirs the stakeholders at the site. Such indicators parallel the findings of McDonnell & Hahs (2008) and

Grimm et al. (2008), who show that unplanned development events are diminishing urban ecosystem health.

In the same vein, field observation, and photo documentation reveal that many of these open spaces are utilizing for informal dumping sites and inappropriate voids, rather than functioning as civic green spaces. This judgment aligns with the result of Kebede & Abebe (2023) in other condominium sites in Ethiopia, where environmental degradation was linked to weak municipal structures and informal (unplanned) land-use performs.

While alike in numerous aspects to former studies, this study adds a localized, respondent - focused angle to the argument by taking community insights (perceptions) along with spatial truths (reality). Community surveys, along with focus group discussions (FGD), indicate a heightened insufficient infrastructure. Dwellers stated grave concern about the loss of green areas, along with the non-functional drainage system, which strongly agrees with Douglas et al. (2008), who identify unwell kept storm-water schemes as a cause contributing to urban (municipal) risk in cities of African origin.

However, this study highlights the gap among environmental awareness and actual community involvement. Communities perceive local engagements as effective, but are not participating themselves. This is proven by low turnouts for actions such as plastic-free movements, and environmental education, while involvement in urban gardening and tree planting though, slightly higher still remains low to moderate. It exemplifies Reed's (2008) view that the not willing to participating in planning commonly arise not from opposition, but from lacking allowing situations such as tools, consciousness, financial provision, and institutional promise.

The barriers to participation facing Ayat Tafo condominium site are -low levels of consciousness, economic burdens, and lack of government provision mirror the results of (Brown, 2009) that postulate urban environmental partaking in Sub-Saharan Africa is repeatedly rendered a less urgency in the presence of livelihood challenges but for entwined with direct welfares. Focus group participants indicated that while the community has ideas and capacity such as setting in seasonal walkways they often lack the official support to withstand viable environmental initiatives.

The lack of correspondence b/n respondent priorities and government actions is also glaring. Communities/respondent would have needed to engage in activities such as fixing native trees, gathering rainwater, and making entertaining green areas that would have satisfied the

values for sustainable landscape put out by (Ahern, 2013). Though, less than one in five respondents showed having perceived any government interferences concerning the increasing of green spaces or up-keeping soil conservation. Even when such interventions did occur, they were misused, poorly maintained, or fallen short in post-intervention follow-up, such as, drainage canals were changed into informal dumping estates. This is what (Watson, 2009) referred to as failure for top-down planning efforts, where interventions themselves did not directly align with realities lived by their intended putative benefactors.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The study showed on the Ayat Tafo 20/80 condominium site originate that changes LULC have multi-layered and interlinked effects on the bio-physical environment, ecological integrity, and sustainability of cities. The fast extension of cities (mostly through informal settlements that lack adequate regulations) and mapping has devastated their green spaces, led to the degradation of wetland (swamp land), the destruction of natural habitats, and compromised natural drainage structures. Such changes have worsened flooding problem, increased temperatures, deteriorated air and water quality, and unsettled biodiversity corridors, thereby impairing the ecological well-being and resilience of the area.

Ecological (environmental) stressors have the proposal or attempted implementation of various efforts. Community based-solutions the planting of innate vegetation, managing rainwater, offer green spaces, and alleviating floods. Actually, such interventions prove an understanding of ecological rebuilding and viable landscape principles, reflecting a vibrant grassroots demand for green arrangement. Though, those creativities are sparse, less visible, or unwell maintained, and government-led. As a result, some configurations, such as drainage structures, have been repurposed offhandedly or permitted to deteriorate, indicating a severe weakness interrelated to post-implementation monitoring and community engagement.

The massive community is also aware of the urgency of environmental stewardship and strongly believes in the efficacy of local action. Still, the level of actual involvement remains q low. Thus, here the engagement gap is linked by various walls built by factors such as a lack of education, financial resources, institutional support, and time constraints. However, FGD and evidences from community reveal creative initiatives, local knowledge, and a desire to be involved on (self-built footbridges and calls for functional, inclusive green and social spaces are examples).

Lastly, it is a continuing sound for integrated, multi-scalar solutions considered by the interrelation of ecological repair, community contribution, and official management. It would be an open-minded strategy (schemes) for strengthening urban environmental control, encouraging all-encompassing decision-making, and scheming sustainable landscapes. If these methods are well applied, Ayat Tafo condominium site can serve as a dynamic, just, and habitable model of urban development, providing invaluable lessons for other rapidly urbanizing areas in Ethiopia and beyond.

5.2 Recommendation

The outcomes of this study on land use and land cover change within the Ayat Tafo 20/80 condominium site prove the need for cooperative action on sustainable measures for improving the undesirable environmental and physical effects resulting from LULC. Loss of ecological systems has been noted, including the loss of green areas, loss forest cover, and absence of wetlands, due to unplanned expansion of urban stretch. It is for this reason that a more comprehensive and site-sensitive approach is needed.

- ✓ The crucial need for strategic multi-level involvement in environmental and land use matters, as showed by the Ayat Tafo 20/80 condominium site, stems from study findings. The fast and unregulated growth of built-up areas has led to bio-physical and ecological worsening, increased pressure on infrastructure, and reduced community resilience. To address these critical problems, the suggested measures should focus on viable land use, effective environmental controlling, and expressive community involvement in landscape planning.
- ✓ In the first place, it should offer a well-organized and modern waste management scheme. This approaches along with reliable waste management (collection) networks, the introduction of parting (separation) at source, and the development of composting and recycling. Education of community for responsible waste disposal should follow this.
- ✓ Greening infrastructure must be the greatest direct reality to which future plans for the city self-control drive. Services, like enhanced better tree canopy coverage, public parks, and designing green spaces should help alleviate urban heat island effects, improve the quality of life, and promote increased biodiversity.
- ✓ Creative interventions such as urban agriculture should be promoted to supplement ecological resilience and local food security.
- ✓ Water management schemes (strategy) must be developed in the twofold directions of flooding and scarcity. Resource preservation systems, such as rainwater gathering, waste-water recycle (reuse), and appropriately planned drainage infrastructure, must be applied to decrease risks related to runoff. Watery and wetland management practices and rehabilitation are significant in ensuring a hydrological balance, without which disaster-causing ecosystem collapse is inevitable.
- ✓ Hence, it is vital to reorient urban planning practice towards partaking and all-encompassing approaches. The active participation of elderly people, youth, women, and socially marginalized groups is critical throughout decision-making practices so, it

should be partake on land use and eco-friendly involvements because comprehensive planning not only encourages social unity but also certifies that the various needs inside urban seats.

- ✓ To prevent further environmental degradation, applying regulation, develop standard, and formulate land use zone consolidation of governance frameworks and regulatory institutions is required. They should be capable of well cooperating institutionally between government organizations, NGO, urban planners, and community to attain responsibility, transparency, and application of viable police (rules).
- ✓ In addition, targeted efforts for acoustic pollution reduction and enhanced urban mobility, it should be inspire electric vehicles and non-motorized transportation, are essential requirements for improving livability in urban seat.
- ✓ Lastly, the achievement of all the recommended interventions be subject to on greater community commitment, funding, and administrational management. These would contain establishing economic (finical) instruments to promote planning innovations and simplified procedures for implementation, leading to an adaptive, receptive, and all-encompassing urban growth structure. All of these recommendations form a concrete roadmap in transforming Ayat Tafo 20/80 condominium site into a resilient, environmentally sound, and socially inclusive urban landscape.

5.3 Strategic intervention to promote better land-use and environmental management

This part of the study focuses on strategic interventions to promote improved land-use and environmental management at the Ayat Tafo condominium site. Following the findings from the land-use and land-cover (LULC) analysis, community perception studies, and environmental assessments, context-specific solutions are recommended, focusing on sustainability, ecological restoration, and participatory planning. The strategies directly respond to the research objective of identifying pathways that lead to the actionable, sustainable transformation of the urban landscape.

5.3.1 The strategic intervention guiding principles

The guiding principles of the interventions are as follows:

- Ecologically sustainable: Protection and restoration of natural ecosystems
- Community inclusiveness: Enhancing participatory planning and stewardship

- Multi-functionality of land use: To promote integrated uses of urban space
- Resilience and adaptability: Interventions are tailored to local terrain and climate challenges.

5.3.2 Strategic interventions

5.3.2.1 Restoration and expansion of green infrastructure

- Setting up functional green spaces like small urban parks, pocket forests, and shaded corridors would help enhance ecological connectivity and microclimate regulation.
- Along with the resident community, vertical greening and rooftop greening of buildings aim to help standardize current informal efforts.
- Protect and rehabilitate degraded wetlands and natural watercourses that have been affected by uncontrolled urban expansion.

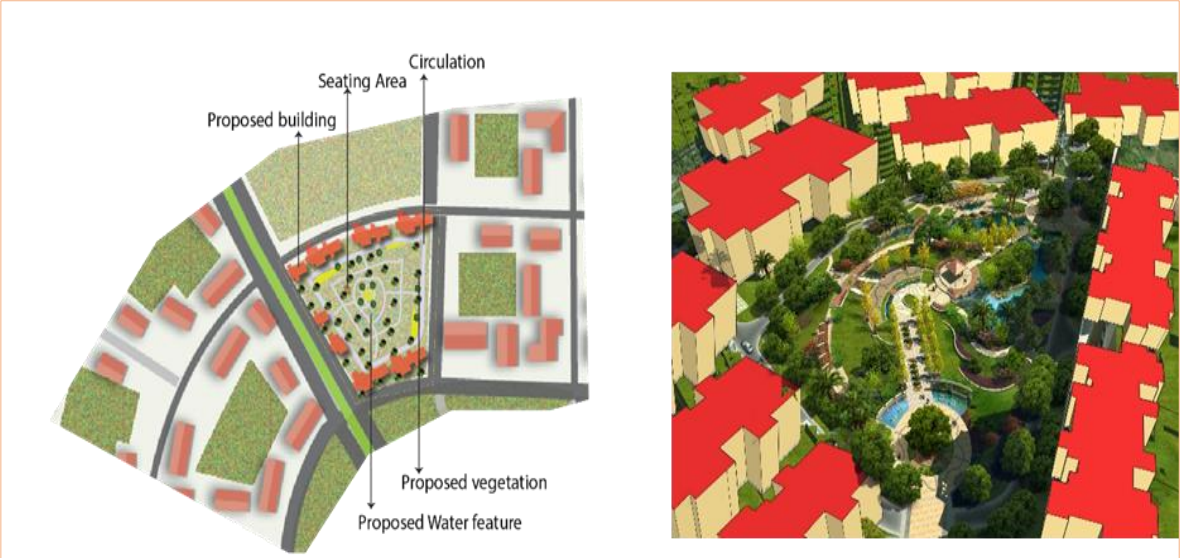

Figure 5:1: Show proposed green spaces
Source: The researcher, 2025

5.3.2.2 Creation of socially inclusive spaces

- Design and install child-friendly playgrounds and multi-generational seating areas in common courtyards to energize social activities and mitigate isolation.
- Set up community gardens as multifunctional tools that yield food, provide shade, and foster social value, thereby enhancing both land use and social cohesion.

5.3.2.3 Water and storm-water management interventions

- Set up small-scale rainwater harvesting systems, from rooftops to storage tanks, for non-drinking purposes to relieve some of the burden on urban infrastructure.
- Introduce sustainable drainage systems (SuDS), such as bioswales and infiltration trenches, for managing storm-water runoff and minimizing erosion hazards at stream channels.
- Restore the natural flow paths and limit hard-scaping in sensitive topography areas.

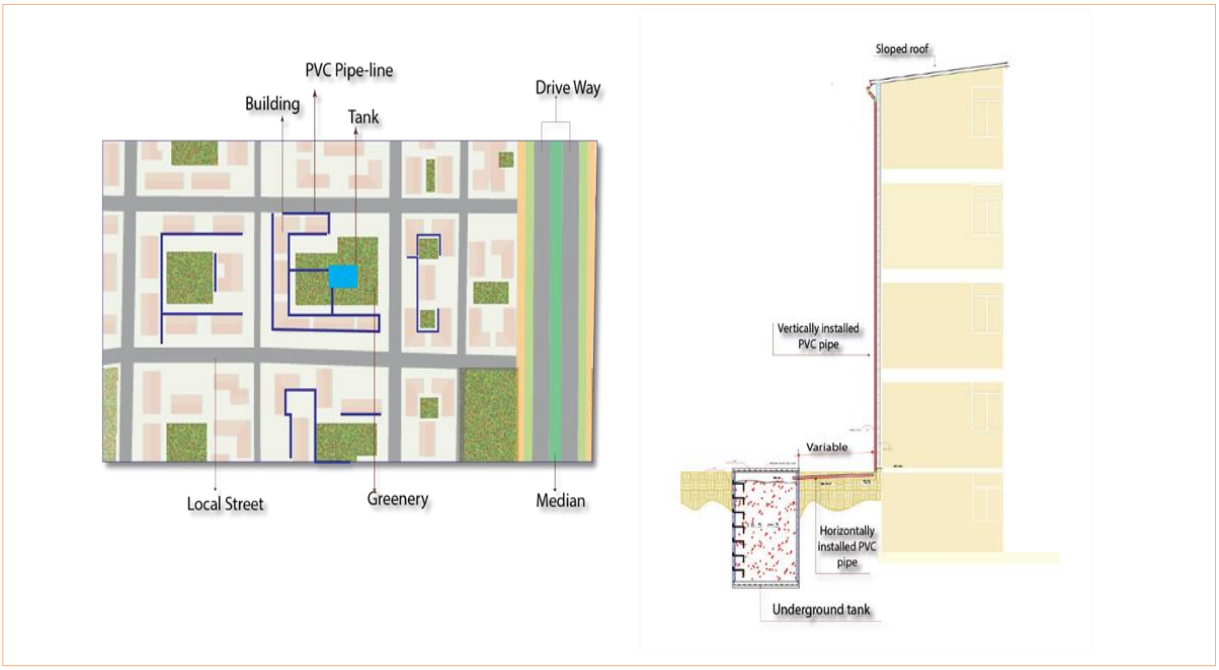

Figure 5:2: Shows the way to manage rainwater
Source: The researcher, 2025

5.3.2.4 Waste management and pollution reduction measures

- Effect community solid waste separation and recycling programs complemented with awareness campaigns.
- Set up decentralized composting for organic wastes, useful for the maintenance of nearby green spaces.
- Foster partnerships with local institutions for periodic clean-up and pollution-monitoring programs.

5.3.2.5 Participatory governance and capacity building

- Set up a green committee to be populated and run by local residents, which will co-manage shared open spaces and lead environmental awareness campaigns.

- Institutionalize community participation in future planning decisions through regular forums and collaborative design workshops.
- Set up training programs in environmental stewardship, urban agriculture, and other low-costing sustainable practices (e.g., building bridges, native planting).

5.3.3 Implementation framework

Table 5:1 Strategic environmental and community interventions plan

Intervention Area	Key Stakeholders	Timeframe	Resources Needed	Expected Outcome
Green space development	Residents, Local Admin	Short–Medium	Land allocation, plants	Improved ecology and recreation
Playgrounds and seating	Housing association, NGOs	Short	Construction materials	Strengthened social networks
Water management	Engineers, Local Gov't, Residents	Medium-Long	Technical design, funding	Reduced flooding and water reuse
Waste & composting systems	Youth groups, Waste agency	Short	Training, bins, space	Cleaner, more efficient waste system
Participatory planning	All residents, researchers	Ongoing	Meeting space, facilitation	Empowered and engaged community

5.3.4 Monitoring and evaluation indicators

A separate monitoring and evaluation (M&E) framework must first be defined and put in place so that successful implementation, adaptability, and longer-term impact of the proposed

interventions can occur. This outline, by creating quantifiable benchmarks, would thus be able to measure development and define whether modifications are required, thereby maintaining answerability between stakeholders. To confirm everlasting success, the following indicators should be tracked:

Increase in green cover (% change): Track spatial and quality increase and improve the lot vegetated-the result of ecological restoration and adaptation to climate.

Community satisfaction about access to open space: Examines direct user perception and fairness of function in green and active spaces through periodic reviews and response from focus groups.

Number of community-led environmental initiatives: Tracks the frequency and scale of activities organized by dwellers, containing tree planting, cleanup campaigns, and awareness creation, signaling active community stewardship and ownership.

Reduction in storm-water runoff and flooding incidents: Assesses the success of workable drainage systems and water-sensitive urban design measures in alleviating surface water bearings.

Waste diversion rate (the recycling and composting uptake): Measures the share of waste that had been diverted from landfill through separation, composting, and reuse-as an extent of progress toward sustainable waste supervision.

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Appendices

Annex 1: Questionnaire

UNIVERSITY OF ADDIS ABABA

COLLEGE OF TECHNOLOGY AND BUILT ENVIRONMENT

CHAIR OF ENVIRONMENTAL PLANNING AND LANDSCAPE DESIGN

Section I: Questionnaire

This questionnaire is designed to collect information for research on the **Examining Community Perceptions on Land Use and Land Cover Change Impacts on Urban Environments: Evidence from Ayat Tafo Condominium Development in Addis Ababa, Ethiopia.** The purpose is not to identify or track any individual or group but to support the research. You are kindly required to answer the questions as correctly as you can. Your contribution will be very much appreciated and you are also assured of anonymity and confidentiality.

Note: All information gathered will be used solely for research purposes Thank you.

Questionnaire No..... Date of Interview.....Name of interviewer ……..

Respondent Name……..Telephone number (If any)……

Demographic Data

1. Sex ☐ Male ☐ Female

2. Age (in years)? ☐ Less than 15 ☐16-24 ☐25-54 ☐55-64 ☐ 65 and above

3. Educational Status.

☐ Illiterate ☐ Primary school (1-8) ☐ Secondary School (9-10)

☐ Preparatory school (11-12) ☐ TVET ☐ Higher Institution, Diploma

☐ Higher Institution, Degree ☐ Post Graduate (Masters/ PhD)

4. Occupation ☐ House wife ☐ Unemployed ☐ Private Business ☐ Employed ☐ Student

5. Family size. (Write the number of people in each age category in the boxes below)

<5 year ☐ 6-14 year ☐ 15-18 year ☐ 19-35 year ☐ 36-65 year ☐ >65 year ☐

Effects of LULC changes on the Bio-physical attributes

6. To what extent do current land use and land cover impact the following? (Rate 1 = No Impact to 5 = Very High Impact):

Vegetation health: 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

Biodiversity 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

Water availability and quality: 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

Soil stability: 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

7. What are the primary environmental challenges associated with the current land use and land cover at the site? (Multiple responses allowed):

☐ Water pollution ☐ Poor waste management ☐ Loss of vegetation or green spaces ☐ Soil erosion ☐ Noise pollution ☐ flooding

8. What do you believe are the primary causes of Water pollution ? (Multiple response allowed):

☐ Industrial waste ☐ Agricultural chemicals ☐ Sewage leaks ☐ Plastic waste

9. What do you believe are the primary causes of Poor Waste Management? (Multiple response allowed):

☐ No waste collection ☐ Lack of recycling ☐ Illegal dumping ☐ Low public awareness ☐ Weak regulations

10. What do you believe are the primary causes of Soil Erosion? (Multiple response allowed):

☐ Deforestation ☐ Unsustainable farming ☐ Construction ☐ Heavy rainfall

11. What do you believe are the primary causes of Noise Pollution? (Multiple response allowed):

☐ Industrial/Manufacturing noise ☐ Construction ☐ Traffic& vehicle emission ☐ Loudspeakers and public events

12**.** What do you believe are the primary causes of Flooding? (Multiple responses allowed):

☐ Deforestation ☐ Poor drainage ☐ Soil erosion ☐ Wetland destruction

13. What do you believe are the primary causes of Loss of Vegetation or Green Spaces? (Multiple responses allowed):

☐ Deforestation ☐ Land conversion ☐ Invasive Species ☐ Water Scarcity ☐ Poor Urban Planning

14. How have environmental challenges impacted the following aspects? (Rate 1 = No Impact, 2=Low Impact, 3= Moderate Impact, 4=High Impact & 5 = Very High Impact):

a. Health of residents	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
b. Daily activities and livelihoods:	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
c. Local biodiversity:	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
d. Infrastructure	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐

15. Does the site have adequate natural drainage to prevent issues such as erosion or flooding?

a) Yes, the drainage is adequate. b) The drainage is partially adequate. c) No, the drainage is inadequate.

<u>Community perceptions of LULC changes on the urban environments</u>

16. Have you observed any significant changes in land use or land cover over the past 10 years?

☐ Yes ☐ No

17.Perception of communities on LULC changes the past 10 year (Multiple response allowed)

☐ Urban Expansion ☐ Loss of Green Spaces ☐ Land Conversion ☐ Loss of Biodiversity

18. In your opinion, how has urban sprawl affected the living environment of your community?

☐ Very positively ☐ some-what positively ☐ some-what negatively ☐ Very negatively

19. Is site have adequate green spaces to support biodiversity and community well-being?

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

20. How would you rate the following environmental conditions at the site? (Scale: Very Poor to Excellent)

Air Quality: ☐ Very Poor ☐ Poor ☐ Fair ☐ Good ☐ Excellent

Water Quality: ☐ Very Poor ☐ Poor ☐ Fair ☐ Good ☐ Excellent

Waste Management Practices: ☐ Very Poor ☐ Poor ☐ Fair ☐ Good ☐ Excellent

Vegetation and Green Spaces: ☐ Very Poor ☐ Poor ☐ Fair ☐ Good ☐ Excellent

Soil Erosion ☐ Very Poor ☐ Poor ☐ Fair ☐ Good ☐ Excellent

Landscape ☐ Very Poor ☐ Poor ☐ Fair ☐ Good ☐ Excellent

Block beauty ☐ Very Poor ☐ Poor ☐ Fair ☐ Good ☐ Excellent

21. What type of land use do you think should be prioritized for this area to improve ecosystem functionality?

☐ Residential ☐ Commercial ☐ Recreational ☐ Agricultural ☐ Mixed-use development

The applied strategic interventions & Community participation in responding to the adverse effects of LULC changes

22 In your opinion, what specific environmental challenges require urgent attention? (Multiple responses allowed)

☐ Water pollution ☐ loss of green spaces ☐ Loss of biodiversity ☐ Loss of wetlands ☐ Water scarcity ☐ Waste management ☐ Soil erosion

23. Which interventions would be most effective? (Multiple responses allowed):

☐ planting native vegetation ☐ Creating green spaces/parks ☐ Rainwater harvesting system ☐ Flood control measures

24. in your opinion, what governmental interventions are addressed for minimize environmental change?

☐ Reforestation ☐ Waste Management ☐ Green Spaces ☐ Erosion Control ☐ Pollution Control ☐ Community Education ☐ Water Conservation ☐ Biodiversity Protection

25. Do you participate in Governmental and committee support-led environmental initiatives?

☐ Plastic-Free Communities ☐ Environmental Education and Awareness Campaigns

☐ Water Conservation and Restoration ☐ Waste Management and Recycling Programs

☐ Tree Planting and Reforestation ☐ Urban Gardening and Community Farms

26. How often have you participated in such initiatives?

☐ Actively ☐ Occasionally ☐ Not at all

27. How effective has community participation been in addressing environmental challenges?

☐ Very Effective ☐ Moderately Effective ☐ Slightly Effective ☐ Not Effective

28. What barriers prevent more active community participation in environmental planning (Multiple response allowed?

☐ Lack of awareness and education ☐ Absence of participation incentives

☐ Lack of adequate government support ☐ Lack of time (economic problems)

Thank you for sharing your though experiences. Your input is very valuable to my research

Section II: <u>Site Observation Checklist Form</u>

Observation Category	Details/Criteria	Options	Notes/Comments
1. Demographic Context	Presence of Residents by Age Group	☐ <15 ☐ 16-24 ☐ 25-54 ☐ 55-64 ☐ 65+	
Gender Representation in Public Spaces	☐ Male ☐ Female		
2. Land Use	Land Use Types Observed	☐ Residential ☐ Commercial ☐ Industrial ☐ Agricultural ☐ Recreational ☐ Vacant land	
3. Land Cover	Dominant Land Cover Types	☐ Buildings/Paved surfaces ☐ Grasslands ☐ Tree cover ☐ Water bodies ☐ Bare soil	
Changes in Land Use/Land Cover	☐ Significant ☐ Minor ☐ None	Specify visible changes, e.g., deforestation or urban sprawl.	
4. Environmental Conditions	Air Quality	☐ Clear ☐ Moderate pollution ☐ High pollution	
Water Quality	☐ Clear ☐ Polluted ☐ Stagnant water		
Vegetation	☐ Dense ☐ Moderate ☐ Sparse ☐ None		
Green Spaces	☐ Well-maintained ☐ Neglected		

5. Infrastructure & Maintenance	Drainage Systems	☐ Functioning ☐ Blocked	
Waste Management	○ Adequate bins present ○ Litter observed ○ Illegal dumping sites		
Building and Road Conditions	☐ Good condition ☐ Poor condition		
6.Environmental Challenges	Common Issues Observed	☐ Loss of vegetation ☐ Flooding/Waterlogging ☐ Soil erosion ☐ Air pollution ☐ Noise pollution	
Causes of Environmental Challenges	☐ Urbanization ☐ Poor services ☐ Lack of awareness ☐ Climatic factors		
7. Community Involvement	Community Activities Observed	☐ Gardening ☐ Waste cleanup ☐ Tree planting ☐ Recreational use	
8. Landscape Interventions	Visible Interventions	☐ Rainwater harvesting ☐ Parks ☐ Flood control ☐ Native vegetation	
9. Additional Notes	Provide any unique or notable observations.		

Section III: <u>Interview Guide</u>

Purpose: To gather in-depth insights from **<u>key informants</u>** (Ayat Tafo Condominium Site Committee, Head of Land Management, and Condominium specialist (Woreda 02) , Site waste collection worker, Local Business Owners

1. How are open spaces currently perceived and used by residents in the Ayat Tafo condominium site?
    a. What types of inappropriate or unintended uses happen in these open spaces, and what factors lead to their misuse?
2. How do you describe the current waste management system in the Ayat Tafo condominium site?
    a. What challenges do you observe regarding the timeliness and effectiveness of waste collection services?
    b. How do waste buildup and delays in trash collection impact the living environment and residents' daily routines?
3. How would you describe the current situation of noise pollution at the Ayat Tafo condominium site?
    a. What are the major sources of noise affecting residents and business activities in the area?
    b. In what ways does noise pollution impact daily life, health, or business operations?
    c. What kinds of planning or design solutions do you believe could reduce noise levels in the condominium environment?
4. How do flooding and drainage system problems affect daily life in the Ayat Tafo condominium site?
    a. What factors do you think contribute most to the repetitive flood risks in the area?
5. How do you evaluate the availability and integration of green or recreational spaces with essential urban services (such as water, electricity, and waste management)?
6. What do you think are the major factors that limit community participation in environmental management activities in the Ayat Tafo condominium area?
    a. How do issues such as lack of awareness, limited government attention, funding problems, or absence of functional open spaces affect the community's willingness and ability to participate?

"Thank you for sharing your though experiences. Your input is very valuable to my research."

Annex 2: Cronbach's Alpha Reliability Tables

Priority Environmental Issues Scale

Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Water Scarcity	1.7166	1.685	0.718	0.662	0.613
Loss of Wetlands	1.9401	1.942	0.594	0.408	0.670
Loss of Biodiversity	1.7766	1.961	0.477	0.574	0.711
Water Pollution	1.8174	1.871	0.569	0.370	0.676

Community Participation Scale

Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Urban gardening	1.5652	1.576	0.614	0.569	0.710
Tree planting	1.5734	1.559	0.657	0.495	0.701
Waste management	1.5924	1.714	0.503	0.469	0.736
Water conservation	1.5842	1.584	0.652	0.525	0.703
Environmental education	1.6005	1.788	0.428	0.386	0.751
Plastic-free community	1.6141	1.714	0.564	0.660	0.725

Community participation in responding to the adverse effects of Land Use Land Cover changes: A Case of Ayat Tafo Condominium, Addis Ababa

A thesis submitted to the School of Graduate Studies of the Addis Ababa University, College of Technology and Built Environment, in partial fulfilment for master's degree in environmental planning and landscape design.

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Advisor: Mulugeta Maru (PhD)

December, 2025

Addis Ababa, Ethiopia

Community participation in responding to the adverse effects of land use and land cover changes: A Case of Ayat Tafo Condominium, Addis Ababa

Abstract: *Urban expansion and environmental degradation accelerated the need for participatory, people-focused environmental initiatives. In rapidly developing urban areas such as Ayat Tafo condominium, it is important to know participation patterns in order to design sustainable land use and green infrastructure. For this study, a mixed-methods approach, combining household surveys with key informant interviews, was employed, and descriptive statistics and thematic interpretation grounded on participatory planning and collaborative governance theories were utilized in data analysis. Outcomes show that despite residents' recognition of the value of being engaged in environmental activities such as urban farming and tree planting, participation is irregular and highly project-dependent. The primary barriers are low awareness, economic limitations, and poor institutional support. Despite high awareness of LULC changes, particularly urbanization, green space loss, and biodiversity loss, structural and motivational constraints limit sustained participation. The research concludes that closing the gap between environmental consciousness and actual participation needs focused capacity-building, enhanced institutional commitment, and inclusive governance systems. Integrating participatory and collaborative strategies into LULC management can foster enhanced ecological resilience as well as community ownership of urban green infrastructure.*

Key Words: *Condominium Living; community participation; land use/land cover change; participatory planning*

1. INTRODUCTION

Globally, participatory planning has emerged as a transformative approach to achieving sustainable urban development. Involving communities in planning and decision-making processes ensures that development reflects local needs, builds social cohesion, and enhances stewardship of green infrastructure. Participatory landscape design integrates ecological, aesthetic, and social values, making urban environments more resilient and inclusive (Andersson et al., 2019).

Urbanization in Ethiopia, particularly in rapidly expanding cities like Addis Ababa, has resulted in major land use changes and increased environmental pressures. Among government-led responses to housing shortages is the 20/80 condominium scheme, which aims to provide

affordable housing for middle- and low-income citizens. However, these developments are often characterized by high density, limited green infrastructure, insufficient environmental planning, and lack of community involvement in the design and management of spaces (World Bank, 2017)

Participatory planning also plays a critical role in promoting climate resilience. Green and blue infrastructure—such as parks, wetlands, and storm-water systems—designed with community input not only improve microclimates and air quality but also reduce flood risk and urban heat effects. This is especially important in Addis Ababa, where climate variability and rapid population growth exert additional stress on urban systems (UN-Habitat, 2019).

Moreover, incorporating local knowledge into planning fosters context-sensitive solutions. Communities often have indigenous and practical knowledge of how to adapt to environmental challenges, which can be harnessed to co-create multifunctional landscapes that serve ecological, social, and economic purposes. These include vertical gardening, informal green spaces, and traditional water management systems (Beatley, 2016).

In light of these challenges, this study examines how participatory planning and community involvement contribute to sustainable landscape change at the Ayat Tafo condominium site. It aims to demonstrate that involving local residents not only improves the ecological outcomes of urban spaces but also fosters a sense of ownership and long-term sustainability in high-density settings. It investigates the perceptions, needs, and contributions of residents and stakeholders in shaping a more livable and environmentally integrated community.

While high-density housing schemes such as the Ayat Tafo condominium address urban housing shortages, they often lack environmental foresight. This study therefore asks: How does participatory planning influence sustainable landscape transformation in such settings? In answering this, the research aims to explore how collective community involvement can act as a catalyst for ecological and social change in rapidly urbanizing areas.

The outcomes of this study contribute to the growing discourse on sustainable urban development in Ethiopia by highlighting the tangible benefits of inclusive planning processes. By centering community voices in design and decision-making, this research offers practical insights for urban planners, environmental designers, and policymakers working on similar housing developments.

It further demonstrates how participatory approaches can lead to more resilient, equitable, and ecologically sound urban landscapes.

2. LITERATURE REVIEW

2.1. Key terminology

2.1.1. Condominium Living

Condominium living presents both opportunities and challenges for sustainable landscape management. Shared governance structures may limit residents' direct influence on planning decisions, but they also allow for collective management and economies of scale. As noted by (Yuen, B., & Weng, L., 2011), sustainable living in condominiums depends on participatory governance, equitable access to green spaces, and active community collaboration.

2.1.2. Community Participation

Community Participation is the active involvement of local citizens and stakeholders in decision-making, planning, and implementation of projects that affect their livelihood and environment. It is empowerment, participation, and shared responsibility, ensuring that community needs, knowledge, and preferences drive development outcomes. Effective community participation fosters social cohesion, enhances project relevance and sustainability, and facilitates inclusive governance (Pretty, 1995)

2.1.3. Land Use/Land Cover (LULC) Change

The alteration of the earth's surface through natural phenomena or human activities, for instance, vegetation cover alteration, built-up areas, and water bodies, that influence ecological systems and resources availability. These modifications may lead to loss of habitat, soil erosion, altered hydrological processes, and alterations in biodiversity. Land cover and land use changes are typically driven by urbanization, agricultural expansion, deforestation, and infrastructure development, significantly impacting environmental sustainability and human well-being (Lambin et al., 2003).

2.1.4. Participatory Planning

Participatory planning emphasizes involving stakeholders—particularly local communities—in the design and decision-making processes of urban development. According to (Arnstein, 1969), participation lies on a ladder of citizen power, with higher levels involving real citizen control. This framework has become a cornerstone for inclusive urban governance, particularly in housing developments like condominiums where resident needs are diverse and evolving.

(Healey, P, 1997) Further argues that participatory planning fosters collective ownership and sustainable outcomes by integrating local knowledge with professional expertise. In the context of condominium living, such planning helps align landscape interventions with community priorities, enhancing acceptance and maintenance.

2.2. The Role of Community Involvement in Sustainable Landscape change

The involvement of local communities in planning and implementing landscape projects ensures that interventions reflect social realities, cultural priorities, and practical needs. According to (Ramaswami et al., 2016), engaging communities improves stewardship, increases social equity, and fosters a shared sense of responsibility. This is particularly important in rapidly urbanizing contexts like Ayat Tafo, where top-down planning often overlooks socio-environmental challenges.

Community-led green infrastructure, such as urban gardens, rainwater harvesting, and recreational spaces, has shown higher sustainability, especially when co-managed with local governments or housing cooperatives (Müller et al., 2016). Participation also builds social capital, enabling long-term collaboration, maintenance, and adaptive responses to environmental challenges.

2.3. Theoretical Foundations of Community Participation

2.3.1 Participatory Planning

Participatory planning theory espouses the collaborative involvement of stakeholders in shaping the spatial development processes. Based on communicative planning traditions (Healey, P, 1997), it argues that inclusive deliberation, co-decision-making, and local knowledge lead to more

equitable and sustainable results in urban initiatives. In the case of LULC and urban greening, participatory planning will ensure that programs are responsive to community needs and offer avenues for reduced conflict and enhanced ownership of environmental initiatives (Innes, J. E., & Booher, D. E, 2004).

2.3.2. Theory on Collaborative Governance

Collaborative governance theory emphasizes that responsibilities regarding the public resources that are supposed to be jointly managed by government, civil society, private sector, and the residents share responsibilities in addressing various complex urban issues. According to (Ansell, C., & Gash, A, 2008), it is a consensus-oriented process that builds trust, transparency, and accountability. Using coordinated action in mainstreaming land use, green infrastructure, and resilience-building strategies brings into effect this approach in urban landscape planning.

Table 1: Principles and Relevance of Planning

Theory	Core Principles	Relevance to Ayat Tafo
Collaborative Planning	Multi-stakeholder engagement, negotiation, interdisciplinary dialogue	Encourages joint problem-solving between residents and planners
Participatory Planning	Bottom-up decision-making, use of local knowledge, empowerment	Enhances legitimacy and local ownership

Source: The researcher, 2025

2.3.3. Theory on Environmental Stewardship

Environmental stewardship theory gives importance to the individual and collective roles played in the conservation and enhancement of natural resources. The steward proactively maintains ecosystem services, restores degraded land, and preserves urban green spaces (Chapin et al., 2010). Hence, it brings in the aspect of moral commitment and community responsibility creating a framework for sustainable land management. This is significant in the context of densely populated residential spaces such as condominiums where common care can enhance the functioning and appearance of shared landscapes (Krasny et al., 2015).

2.4. Participatory Planning and Community Engagement in Addis Ababa Condominiums

Contextually community engagement in urban planning is gaining recognition for sustainable urban development in Ethiopia (Asnake, M., & Kassahun, D, 2021). However, in condo-based studies, public involvement is not merely in the decision-making processes for the management of environmental problems or land use decisions (Gebremedhin, 2022).

Protocols concerning stakeholder participation appear weak around Ayat Tafo, with residents raising issues over lack of communication with or consultation during planning or maintenance activities to strengthen community participation is likely to enhance green space stewardship and local environmental conditions.

2.5. Evidence from Practice: Community Participation in Landscape change

Case studies from cities like Curitiba, Copenhagen, and Bogotá demonstrate that community-led initiatives—such as green corridors, shared gardens, and open space revitalization—have resulted in improved environmental quality and social well-being (Beatley, 2016). In contrast, areas lacking community involvement, like Ayat Tafo, often experience neglect, poor maintenance, and underutilized green spaces.

Empirical research by (Lynch, K., & Hack, G., 2014) shows that participatory processes enhance multi-functionality in landscape design by accommodating diverse user needs (e.g., recreation, drainage, biodiversity, and aesthetics). For Ayat Tafo, where environmental degradation and lack of community ownership are evident, participatory planning offers a practical pathway for transformation.

2.6. Gaps in the Literature and Implications for Ayat Tafo Condominium

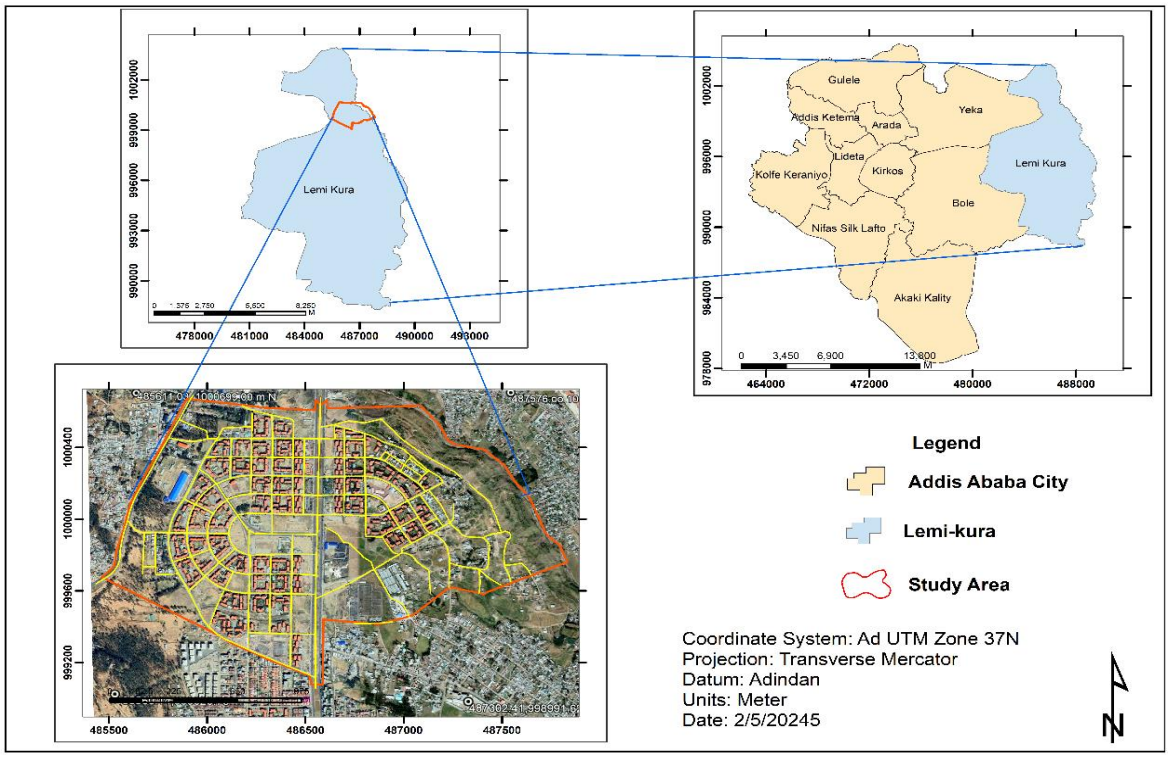
Despite strong theoretical backing for participatory landscape planning, limited studies focus specifically on condominium developments in the Ethiopian context. At Ayat Tafo, past urban expansion neglected inclusive processes, leading to deteriorating ecosystem services, poor landscape aesthetics, and weak community attachment.

This study addresses the gap by examining how community involvement can enhance landscape transformation outcomes, restore ecosystem functionality, and improve urban quality of life. It also identifies barriers to participation (e.g., lack of awareness, institutional gaps) and proposes frameworks for integrating residents in design and maintenance phases.

3. MATERIAL AND METHODS

3.1. Description of study area

The study area is located in Lemi Kura Sub-city, specifically within Woreda 02, in Addis Ababa, the capital city of Ethiopia. Situated in the central part of the country, Addis Ababa lies on the Ethiopian Plateau at an altitude of approximately 2,400 meters above sea level. The geographical coordinates of Ayat Tafo Condominium are approximately 9.0380° N latitude and 38.8250° E longitude. Ayat Tafo, an area known for its rapid urban development, is positioned in the northern part of the city. It is part of the city's ongoing expansion initiatives to address housing shortages and urban sprawl, especially within the 20/80 housing scheme.



Map 1: Showing Location map of the study area: Addis Ababa Regional Plan, Lemi Kura Sub-City, plan and the Study Area

3.2 Research Design

This study adopts exploratory, and explanatory research design to examine the role of participatory planning in promoting sustainable landscape transformation within the Ayat Tafo 20/80 Condominium site. The exploratory design supported the identification of underexplored dynamics in community involvement, stakeholder interactions, and the practical application of participatory planning principles in landscape design processes. This approach allowed the study to uncover new variables and emerging patterns that influence how residents, local authorities, and planners collaborate within the urban landscape transformation context.

Meanwhile, the explanatory design was employed to investigate the relationship between the level of community engagement and the effectiveness of sustainable landscape interventions. It enabled the research to draw conclusions about how participatory practices influence environmental outcomes, such as green space functionality, ecosystem health, and long-term maintenance of the transformed landscape. Together, these designs contributed to a deeper understanding of the cause-and-effect relationships underlying participatory planning and its role as a catalyst for sustainable landscape transformation.

3.3 Data Collection Methods

Data for this study were gathered from both primary and secondary sources to ensure a comprehensive understanding of participatory planning and its role in sustainable landscape transformation. Surveys were conducted using a structured questionnaire distributed to 368 residents, covering themes such as community participation, environmental awareness, and satisfaction with the existing green infrastructure. Semi-structured interviews were held with local administrators, community representatives, and urban planners to gain deeper insights into the participatory planning processes at play. Additionally, focus group discussions (FGDs) were organized with selected resident groups to explore shared visions, challenges, and local practices related to landscape use and stewardship. Field observations were carried out through on-site visits to assess the physical condition, functionality, and design quality of the green spaces within the condominium area. Complementing these, document reviews were undertaken, analyzing planning documents, policy guidelines, and prior studies relevant to the site, further contextualizing the findings within broader urban planning and environmental frameworks.

3.4 .Sampling Technique

A stratified random sampling method was used to ensure representation across different blocks and demographic groups within the condominium. Interview and FGD participants were purposively selected based on their roles and relevance to the study.

3.5 .Data Analysis

Quantitative data obtained from the surveys were analyzed using descriptive statistical methods, including frequencies and percentages, to summarize residents' responses regarding participation, environmental awareness, and satisfaction levels. Meanwhile, qualitative data derived from interviews and focus group discussions were examined through thematic content analysis. This approach enabled the identification of recurring patterns and themes related to community engagement, perceptions of the environment, and the effectiveness of participatory planning in guiding sustainable landscape interventions.

4. RESULT AND DISCUSSION

This section presents and interprets the key findings of the study, drawing from both quantitative and qualitative data gathered from the Ayat Tafo condominium site. The results are organized thematically to align with the study's objectives, focusing on the extent and impact of community participation, the effectiveness of participatory planning practices, and community perceived on LULC change.

4.1. Results

4.1.1. Community participation in responding to the adverse effects of LULC changes

4.1.1.1 Community-Led Environmental Initiatives at Ayat Tafo Condominium

The results of the survey show a generally low level of community participation in the majority of the environmental activities in the Ayat Tafo 20/80 Condominium project area. The most active was Urban Gardening and Community Farms (15.76%), followed by Tree Planting and Reforestation (14.95%). Waste Management and Recycling Programs (13.04%) and Water

Conservation and Restoration (13.86%) also registered relatively higher response than Environmental Education and Awareness Campaigns (12.23%) and Plastic-Free Communities (10.87%). These findings reveal that the majority of respondents are not currently engaged in these environmental sustainability practices, with the "No" responses well above 84%, reaching as high as 89.13% for Plastic-Free Communities.

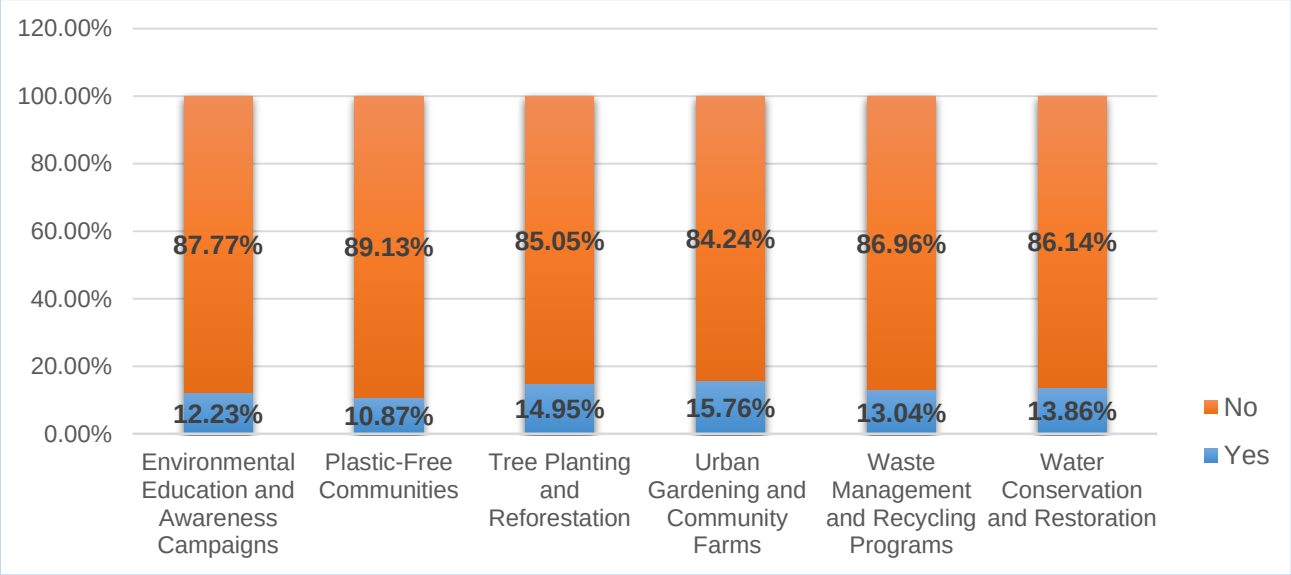


Figure 1: Community-Led Environmental Initiatives

Institutional Perspectives on Participation and Planning Gaps

Institutional insights from local governance bodies provide critical context for understanding the limitations of community involvement in environmental planning at the Ayat Tafo condominium site. A key informant, the Head of Land Management in Woreda 02, highlighted several systemic barriers:

"The main issue preventing community participation in environmental concerns is a lack of awareness. Additionally, there are funding problems, and some people feel uncomfortable working together. This gap exists because there hasn't been a responsible body or awareness created for the community. Furthermore, the government has not given adequate attention to this area. However, nowadays, there are no open spaces available, and at the very least, one functional area should be provided for recreation or another purpose. Before moving forward with any implementation, it's crucial to first create awareness within the community."

4.1.1.2. Frequency of Participation in Environmental Sustainability Initiatives

The data on the frequency of participation in environmental sustainability initiatives at the Ayat Tafo 20/80 Condominium site reveals a concerning trend. A significant majority of respondents, 62.2%, reported that they do not participate in such initiatives at all. This indicates a lack of engagement in activities like tree planting, waste management, and water conservation, which are crucial for the sustainable transformation of the landscape.

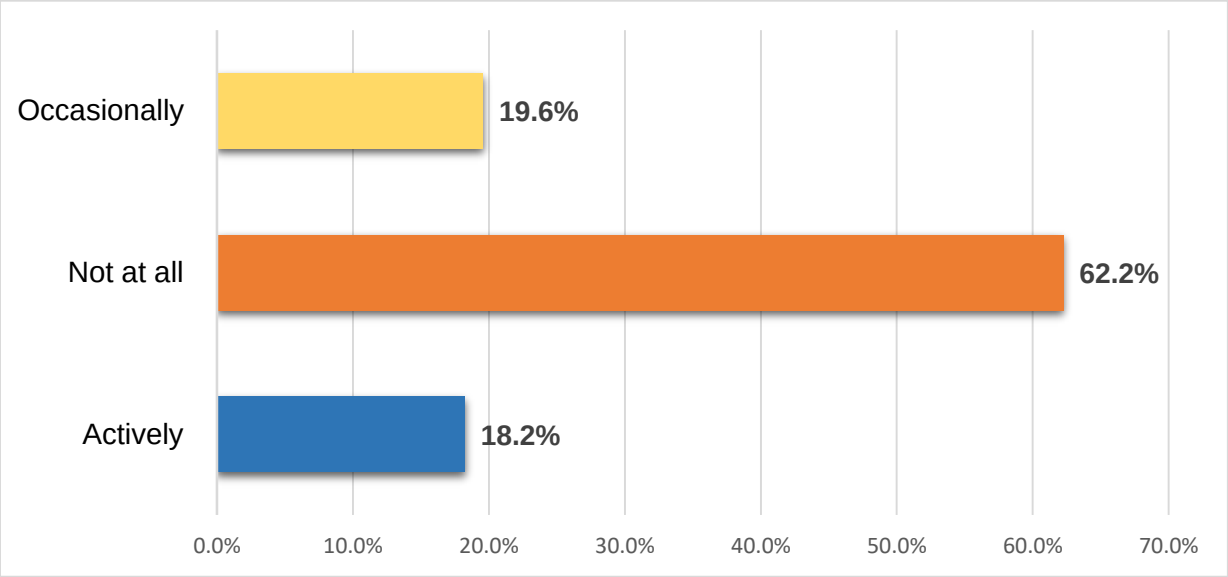


Figure 2: Frequency of Participation in Environmental Sustainability Initiatives

4.1.1.3. Effectiveness of Community Participation in Addressing Environmental Challenges

The results of the survey indicate that community participation in environmental issues within the Ayat Tafo condominium complex is much valued by the majority of the respondents. Specifically, 73.9% of the respondents answered that community participation was "Very Effective", while 20.7% reported it as "Moderately Effective". 5.4% of the respondents rated it as "Slightly Effective" and only 1.09% respondent's rated "no effective".

These results show that the community perceives the positive impacts of their participation in environmental activities such as tree planting and reforestation, garbage collection and management, urban gardening, and water conservation and restoration programs. The fact that

the community had the highest positive response shows a realization on the part of the community regarding the importance of environmental protection and their willingness to contribute to sustainable landscape transformation.

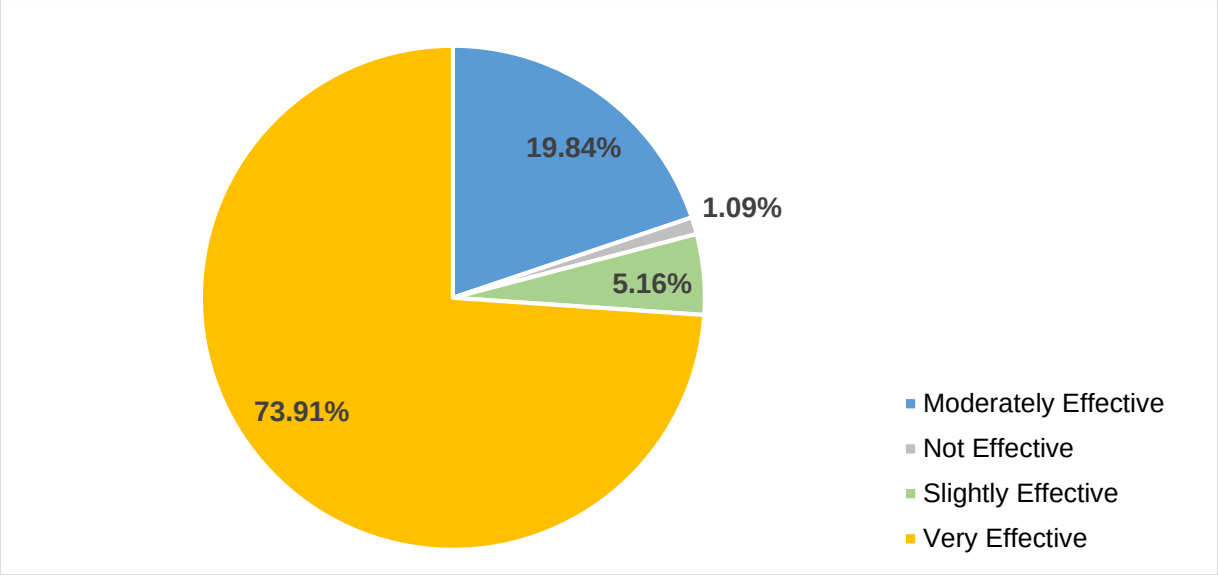


Figure 3: Community Participation's Effectiveness in Addressing Environmental Challenges

4.1.1.4. Barriers to Active Community Participation in Environmental Planning

The survey findings reveal that there are several hindrances to active community participation in environmental planning within the Ayat Tafo condominium community. The most significant challenge, as noted by 34% of the participants, is limited awareness and environmental education, which limits the community's knowledge of sustainable practices and their engagement in environmental conservation. Additionally, 28% of the respondents cited economic constraints and time scarcity as major obstacles, as citizens' accord higher priority to meeting their daily needs over getting involved in voluntary environmental efforts. Absence of government support, cited by 27% of the respondents, also hinders the involvement due to the absence of infrastructure, policy mechanisms, and technical assistance.

Moreover, 11% of the respondents listed the absence of incentives for involvement, such as financial incentives and public recognition, as an aspect that demotivated them. There is a need to break these barriers by raising awareness, financial incentive structures, tight coordination with

local authorities, and incentive schemes to enhance individuals' engagement and achieve sustainable landscape transformation.

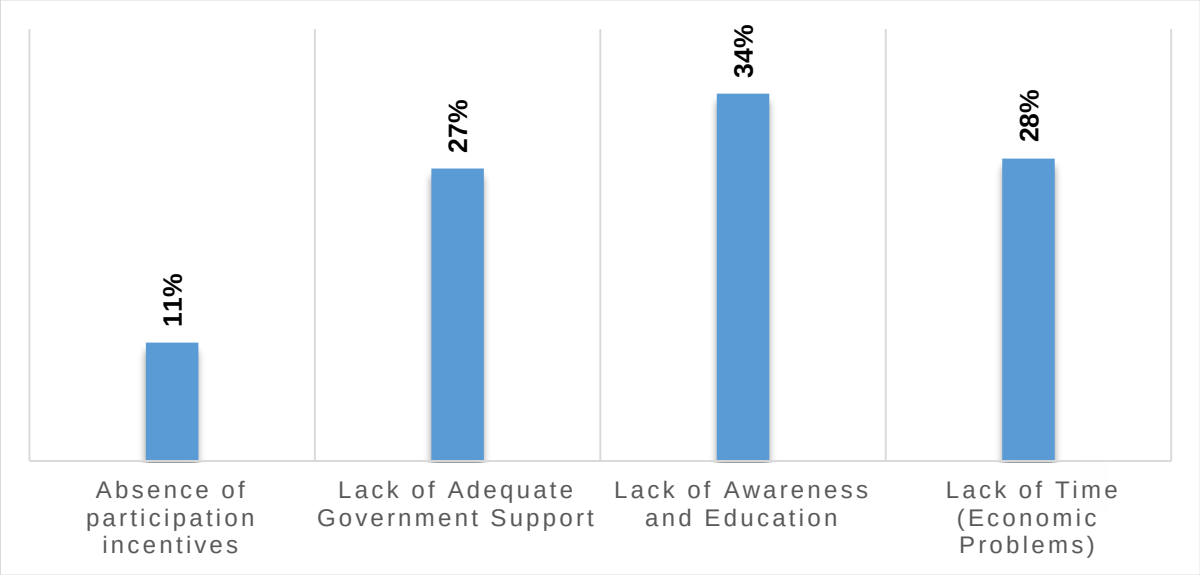


Figure 4: Key Challenges Hindering Community Engagement in Environmental Planning

4.2. Discussion

The findings indicate that public participation in environmental activities in Ayat Tafo condominium is practically low but residents perceive it to be useful and effective. Urban gardening, tree planting, waste management, and water conservation activities exist but not within a strong or continuous tradition of participation. This resonates with (Pretty, 1995) description of "functional participation" whereby engagement is sporadic and often project-based rather than being institutionalized as a long-term grassroots process. As (Healey, P, 1997) argued in her theory of communicative planning, meaningful engagement requires openings and inclusive processes that draw local voices into decision-making. Also (Innes, J. E., & Booher, D. E, 2004) underscored that collaborative processes yield sustainable results if citizens have the capacity and opportunity to act—conditions not yet met fully in Ayat Tafo.

Institutional observations account for the underlying obstacles to participation. Local government representatives reported awareness gaps, lack of government commitment, and the fact that there are no specific areas for environmental collaboration. This aligns with (Ansell, C., & Gash, A, 2008), collaborative governance theory, which cites trust, leadership, and institutional

commitment as pillars of effective citizen–government collaboration. As (Lassa, J. A, 2019) , discovered in similar urban contexts, willingness to collaborate is usually there, but without enabling structures, participation is minimal.

Residents showed high sensitivity to land use and land cover change, specifically urban sprawl, land conversion, loss of green areas, and loss of biodiversity. These perceptions reflect conclusions by Seto et al. (2011), who attributed urban sprawl to environmental degradation, and confirm the assertion by (Alberti, 2008) that urban ecological well-being relies on an educated public that can push for sustainable development. While a few residents saw benefits of urban growth, like improved access to housing and amenities, the majority were worried about congestion, environmental deterioration, and loss of lifestyle quality—echoing (Pacione, 2009) remark on the expenses of urban growth and (Douglas, 2018) warning that unplanned urbanization in African cities has a tendency to degrade environmental assets and community wellbeing.

Participation constraints are both structural and motivational. Knowledge gaps, livelihood pressures, and institutional support shortages, as discovered in this study, align with (Boon et al., 2009), while the lack of incentives is reminiscent of (Ostrom, 1990) note that collective action problems often require moral and material incentives. But the fact that the community proposed solutions emphasizing education, increased government support, and community-led environmental organizations suggests that there is readiness to act if the right conditions are created. These recommendations are consistent with (Tosun, 2006) view that participation flourishes where stakeholders possess resources, clear roles, and open fora for communication, and with (Fung, 2006), argument that communication channels are crucial to link local action to broader governance structures.

Overall, the results residents value involvement and see it as essential to nature conservation, but a range of barriers prevents ongoing participation. As emphasized by (Reed, 2008), effective stakeholder engagement is a recursive process of trust building, capacity development, and institutional sensitivity. For Ayat Tafo, this points to the necessity of embedding participatory planning in land use and environmental management action so that community voices are heard from problem diagnosis to implementation and long-term monitoring.

Conclusion

The study indicates the existing gap between the recognized importance of community participation in environmental activities and reality at Ayat Tafo 20/80 Condominium. Even with the established high awareness of residents on land use and the environment, motivational, institutional, and structural barriers continue to limit their participation. The findings emphasize the need for governance structures that provide not only space for participation but also dissolve underlying limitations by targeting strategic capacity-building, strong institutional support, and participatory decision-making. Synthesizing participatory and collaborative approaches to LULC management can shift community participation from project-based, ad hoc participation to a permanent, bottom-up process, which creates both ecological resilience and social ownership of urban green infrastructure.

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