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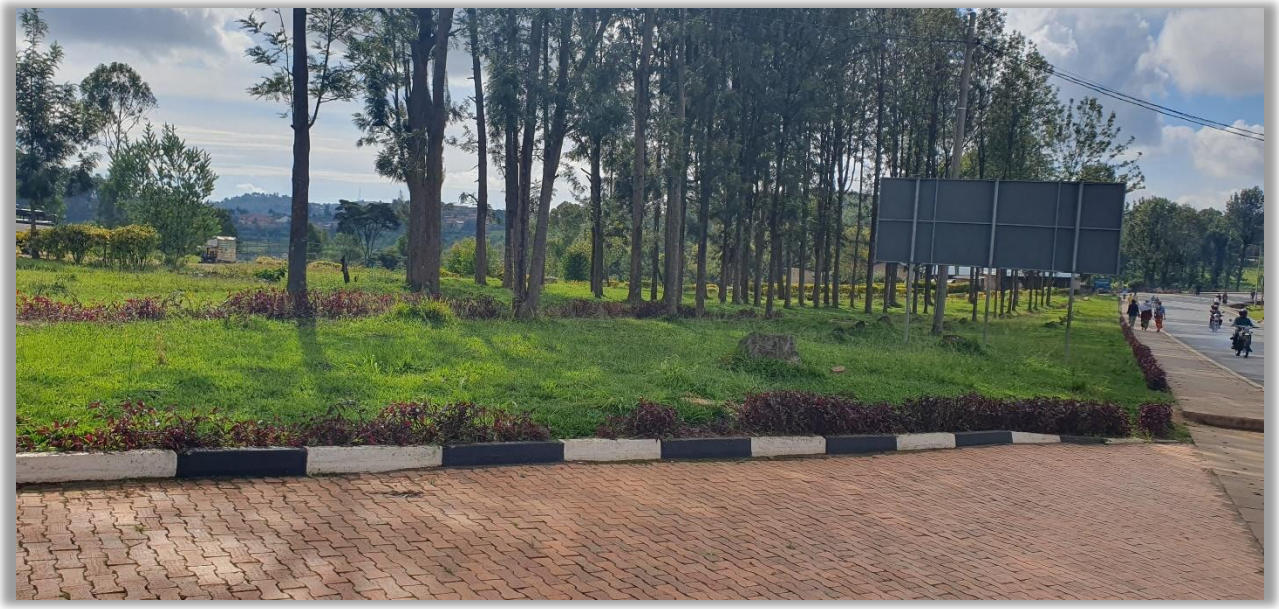
Master of Science in Geo-Information for Environmental and Sustainable Development

Current Trends in Integrating Public and Green Open Spaces in Muhanga City Residential Neighborhoods. Case Study of Nyamabuye Sector



Thesis submitted to the University of Rwanda: College of Science and Technology in partial fulfillment of the requirements for the award of the Degree of Master of Science in Geo Information for Environment and Sustainable Development

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DECLARATION

I hereby declare that this dissertation titled "***Current Trends in Integrating Public and Green Open Spaces in Muhanga City Residential Neighborhoods. Case Study of Nyamabuye Sector***" is the result of my own original work. It is being submitted for the degree of Master of Science in Geo-Information Science for Environment and Sustainable Development and it has not been submitted for any other degree at the University of Rwanda or at any other institution.

Signed: ……. Date: … ... /… … …/ … …

APPROVAL

It is hereby confirmed that this thesis entitled "***Current Trends in Integrating Public and Green Open Spaces in Muhanga City Residential Neighborhoods. Case Study of Nyamabuye Sector***" submitted by Jean de Dieu Nzirorera has been assessed and accepted by the post-graduate coordination team in the School of Architecture and Built Environment.

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ACRONYMS

COK : City of Kigali

EEA : European Environmental Agency

GGGI : Global Green Growth Institute

GIS : Geographic Information System

GPS : Global Positioning System

HHs : Households

LODA: Local Administrative Entities Development Agency

LULC: Land Use Land Cover

NCDs : Non-Communicable Diseases

NISR : National Institute of Statistics of Rwanda

NLA : National Land Authority

NLUDMP : National Land Use and Development Master Plan

NSDI : National Spatial Data Infrastructure

NST2 : National Strategy for Transformation Two

NUP : National Urbanization Policy

OSC : One stop Center

PGOSs: Public and Green Open Spaces

RHA : Rwanda Housing Authority

SDGs : Sustainable Development Goals

UN : United Nation

USA : United State of America

UN HABITANT : United Nations Human Settlements Programme

ABSTRACT

Urbanization in Rwanda has accelerated in recent decades, particularly in satellite cities like Muhanga, where spatial expansion often outpaces sustainable public and green open space planning mechanisms. This study investigates the current trends in integrating Public and Green Open Spaces (PGOSs) within residential neighborhoods of the Nyamabuye Sector, a growing urban zone in Muhanga Satellite City. The research aims to assess the level of integration (functionality and utilization) of PGOSs, identify key challenges hindering their integration, and recommend strategic policy options aligned with both national planning frameworks and international sustainability standards. Data were collected through household surveys, key informant interviews, and field observations and measurements. The data analysis used descriptive statistics and thematic interpretation to investigate spatial patterns, public perspectives, and usage patterns. Results show that 54.2% of respondents lack access to PGOSs near their homes, and 60.4% use existing spaces only rarely. Available spaces are primarily used by children and for community meetings, indicating limited functionality and poor design. The study concludes that PGOSs in Nyamabuye are insufficiently integrated into the urban fabric, both spatially and functionally, failing to meet recommended global standards. This deficiency has significant social and environmental implications, including reduced quality of urban life, heightened climate vulnerability, and spatial inequities. To address these issues, the study recommends comprehensive land-use planning reforms, incentivization of private sector contributions, community-led green initiatives, and awareness campaigns to promote the value of PGOSs. These interventions must be grounded in existing national policy instruments and aligned with Sustainable Development Goal 11.7, which advocates for inclusive, safe, and accessible green spaces in urban areas.

Keywords: Public space, Green open space, urban dwellers, residential neighborhoods, community engagement, GIS.

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CHAPTER 1. INTRODUCTION

1.1. Background

Urbanization is increasing rapidly worldwide, over 56% of the world's population live in cities today, with a projection to reach 68% by 2050(UN-Habitant, 2024). Integrating public and green open spaces into residential urban communities has grown in importance as a component of sustainable urban development(WHO, 2017). According to Michieletto (2022), a key strategy for promoting sustainable urban development worldwide is the incorporation of public and green open spaces into residential communities.

According to Nastiti & Giyarsih (2019) and United Nation (2015), where they state public open spaces as areas that can be accessed by any one and are designed for recreation, leisure and some of those spaces are playgrounds, parks while green open spaces are natural areas or semi natural covered by vegetations including forest, gardens and green corridors. Residential neighborhoods are where most people spend a large fraction of their lives and where many of their social and economic interactions take place (UN-habitant, 2024).

International frameworks, such as the UN-SDGs (Sustainable Development Goals), specifically Goal 11, highlight the importance of making cities inclusive, safe, resilient, and sustainable by ensuring access to open green and public spaces(Galimberti, 2021; UN, 2015). For instance, the average share of green areas in cities and urban areas has been monitored over several decades, where they recommend urban dwellers to have access to a minimum between 0.5 and 1 hectare of green open space in a distance of 300 meters from their residences. This guideline seeks to guarantee that green areas are easily accessible by walking, encouraging frequent usage and accessibility (UN-Habitant, 2024).

However according to Yong et al,(2014) and Xia et al. (2024) many cities worldwide still struggle with maintaining and expanding green open with public spaces due to competing land-use priorities, urban sprawl, and limited policy enforcement. Some statistics from World Bank (2023), highlights only 40% of urban dwellers globally, reside within 15 minutes' walk of public or green open spaces but this varies significantly between high-income and low-income countries. For instance in Europe, more than 85% of European city dwellers have access to public and green open

spaces within 300 meters of their residences and have more than 35 square meters per person (EEA, 2022) while in Asia public and green open space availability is as low as 1.1 square meters per person, compared to the global standard of 9 square meters recommended by UN-Habitat (UN-Habitant, 2020).

The integration of green and public open spaces into residential areas has attracted attention of researchers and planners recently as a key component of sustainable urban development in Africa (UN-Habitant, 2020). For example, African urban planners have been conscious of how it is crucial to include green and public areas into residential areas where they adopt innovative approaches to green space planning, leveraging these areas for multifunctional purposes (Mensah, 2014).

According to World Bank (2023), only 17 percent of urban dwellers In Sub-Saharan Africa, can walk 15 minutes or less to green open spaces. One of the factors of the low share of public and green open spaces is the loss of those spaces at a rate of 3.9% in urban green spaces between 2003 and 2017 and which result in decrease of 51.8% in green space coverage (Stephan et al, 2018). However,some obstacles still exist even if there have been recently various initiatives and some progresses have been made in integrating green and public spaces into African residential neigbourhoods communities (Samah & Shawket , 2022).

For instance, Rwanda government development initiatives place a strong emphasis on urbanization, especially under Vision 2050, which aims to make Rwanda a knowledge-based, middle-income country and social wellbeing of Rwandans by 2035(GoR, 2020). Some achievements in Kigali City development demonstrates Rwanda's commitment to sustainable urban spaces. This is evidenced by integration of green infrastructure, such as the Kigali Car-Free Zone and Nyandungu Eco-Park (GoR, 2020). It shows that 63% of Kigali’s informal settlements lack access to nearby public or green open spaces, intensifying inequalities in urban livability and only 25% of Kigali’s population lives within 500 meters of a park or public space, far below the global average (UN-Habitant, 2022). From that, Kigali Urban Planning Project focuses on developing 20 neighborhood parks and green corridors connecting residential areas to solves these issues (GoR, 2020).

In secondary cities of Rwanda, which are essential to the nation's decentralization program such as Vision 2050, often falls behind in this regard. Urban planning has emphasized the need for green and public spaces to improve the livability and sustainability of cities as part of this vision

(Nsekanabanga & Nyongesah, 2023; Ministry of Infrastructure, 2015). As GGGI (2019), Public spaces play an important role in determining the quality of life for residents that lives in secondary and satellite cities in Rwanda. There is a need to monitor or ascertaining trends in achieving the integration of those spaces into residential neighborhoods.

1.2. Problem statement

Although Rwanda has established itself as a pioneer in advancing sustainable urban development with programs like the Green Growth and Climate Resilience Strategy, the actual deployment of some public and green open spaces in cities frequently falls short of these goals (REMA, 2023). According to GoR (2020), it is a mandatory for residential neighborhoods to have area remained for public and green open spaces in the residential sites. Studies indicate that rapid urbanization in Rwanda often results in fragmented and poorly planned settlements, leaving insufficient room for public parks, green open space, playgrounds, and other communal areas (GGGI, 2020).

The establishment of public and green open spaces within residential areas directly correlates with Rwandans' desire to build habitable and sustainable cities. Such open spaces are generally in high demand among Rwandans, who view them as fundamental elements for better standards of living, sustainability of the environment, and communal relations rather than simply a form of aesthetic beauty. All of these goals are the reflections of the dreams for socially inclusive, green, and economically thriving cities (GGGI, 2019; GoR, 2020; GoR, 2023).

Muhanga City is among three satellite cities in Rwanda within Rwanda's Vision 2050 development framework, and the country's urbanization is accelerating rapidly (GoR, 2020). According to World Bank (2021), Muhanga city current urban development has been marked by limited adherence to spatial plans that prioritize public and green spaces through Muhanga district land use plan. According to GoR (2015), it is recommended that a residential neighborhood should have at least 5% of public and green open spaces of its total surface which is available and functionable and each plot should be developed with 20% of its part remained for green and permeable surface to be used for recreation activities, meeting points, etc.

In the Nyamabuye sector, which comprises a large portion of Muhanga city, integrating public and green spaces into urban residential neighborhoods faces significant obstacles. Weak enforcement of land use and master plan regulations, coupled with insufficient funding and a lack of technical

expertise, makes it extremely difficult to prioritize and implement these essential elements of urban development. This challenge is representative of the broader struggles faced by secondary cities across Rwanda, including Muhanga, in effectively incorporating public and green spaces (REMA, 2023).

While Muhanga city, particularly the Nyamabuye sector, has been the subject of research focusing on various aspects like land use and land cover changes (Salymatu, 2022), structural design of buildings (Singirankabo & Hategekimana, 2024), and solid waste management (Nishimwe, 2019). However, these studies have overlooked the crucial issue of integrating public and green open spaces within residential neighborhoods as one of the country visions 2050. It can shade lights on the trends on integration of PGOSs in residential neighborhoods.

In Muhanga city and reveal any challenges that hinder their development alongside the urbanization process (Zhang,2016). Addressing these issues is critical for the city to achieve its goals of sustainable development, climate resilience, and enhance livability (Bowler et al, 2010) .

1.3. General objective

Generally, this research assessed the trends that are found when integrating public and green open spaces in urban residential neighborhoods. It focuses on space like; community gardens, playgrounds, urban natural reserve areas and publicly accessible courtyards in front of government buildings that are found in Nyamabuye sector**.** This promoted the sustainable urban development and enhance the community wellbeing of Nyamabuye residents**.**

1.3.1. Specific objectives

- To assess the level of integration of public and green open space in residential neighborhoods of Nyamabuye Sector
- To identify challenges hindering the integration of public and green open spaces in Nyamabuye residential areas.
- To suggest policy option to enhance the integration of public and green open space in residential neighborhoods of Nyamabuye Sector.

1.3.2. Research questions

- ✓ What is the current availability and distribution of public and green open spaces in residential neighborhoods of Nyamabuye Sector?
- ✓ What are the key challenges faced when integrating public and green open spaces in Nyamabuye residential neighborhoods?
- ✓ What are policies and innovative approaches to integrate public and green open spaces, and how effective are they?

1.4. Delimitation of the study

This study focuses only on community gardens, playgrounds, urban natural reserve areas, and publicly accessible courtyards in front of government buildings. The decision to focus on these spaces within residential areas is founded on their central role as multifunctional spaces that offer context for social interactions, community cohesion, and neighborhood cultural practices. They serve as a critical meeting point where residents come together for various purposes, including organizing town hall forums to discuss neighborhood issues, accommodating leisure and recreational activities that foster physical and mental wellness, and hosting local rituals that promote social bonding and maintain cultural traditions. In the context of Nyamabuye sector, these spaces are important in enhancing the living standard of families, offering affordable areas where social, cultural, and recreational needs are met close to where they live.

1.5. Motivation and Significance of the Research

Assessing the integration of public and green open spaces in Muhanga City, particularly in the Nyamabuye sector is linked with program of GI-ESD and it directly relates to Rwanda's Vision 2050 and the strategies that support it, especially the National Strategy for Transformation 2 (NST2). NST2 places a strong emphasis on environmental preservation, better quality of life, and sustainable urbanization all of which are closely related to the growth of green and public areas (GoR, 2024). Additionally, the study supports the Green Growth and Green Jobs Initiative's (GGGI) implementation of the Green Growth and Climate Resilience Strategy (GGCRS). Given the critical role that green spaces play in reducing climate change, improving ecosystem services,

and fostering green jobs, the GGGI places a strong emphasis on the value of green infrastructure and sustainable land use practice (GGGI, 2019).

Furthermore, by establishing a vital connection between local reality and wider planning contexts, the research stretches its scope. The research provides a useful tool for urban planners working in the Muhanga District by thoughtfully placing the findings within the wider National Land Use and Development Master Plan (NLUDMP 2050), prevailing district land use plans, and globally adopted sustainable development goals (SDGs). This harmony is required by the need to align local development initiatives with national priorities and global sustainability aspirations. More precisely, the study shows how the integration of green and public open spaces contributes to attaining particular SDGs that pertain to sustainable cities and communities (SDG 11) (GoR, 2020; Ministry of Infrastructure, 2015).

1.6. Analytical framework

The availability and functionality of public and green open spaces (PGOSs) in residential communities is becoming increasingly important for urban sustainability. The analytical framework presented here gives a thorough method to analysing and supporting the integration of PGOSs into urban areas, with the Nyamabuye Sector in Rwanda serving as a case study. The framework integrates national policy directives, theoretical underpinnings, important indicators, and implementation issues into a cohesive model for sustainable urban planning and governance (Majeed & Abaas, 2023).

This part shows the Analytical framework that was used in this research study. It outlines the required parameters and methods to evaluate the availability, distribution, policies and some approaches that can be associated with public and green open space in Nyamabuye residential zones. It emphasizes both practical and theoretical viewpoints to direct this research and its progress while ensuring the gaps in integrating those spaces and their implication on sustainable urban residential neighborhoods (Kabisch et al, 2016).

In fact, according to State of New South Wales (2023), the conceptual foundation was availability for Presence and extent of public and green open spaces. For instance, using GIS mapping and spatial analysis, to evaluate what types of green open spaces are available; such as parks, playgrounds, community gardens and if those spaces are evenly distributed across the sector

or some areas are under-served. Functionality focus on how well the green spaces serve their intended purpose (Zhang et al, 2021).

The theoretical was sustainable urban development theories and ecological cities theory. For example, sustainable urban development theories highlight the necessity of creating a balance between equality for all, economic progress, and environmental preservation (Addas, 2023). Another is ecological cities theory and it focuses on creating urban residential zones that function in harmony with nature as it highlights how crucial it is to apply ecological concepts to urban planning, design, and management (Majeed & Abaas, 2023).

It uses different key dimension in analysis such as availability and distribution of green space where the framework assessed spatial distribution and share of those spaces. For instance, land in Nyamabuye sector dedicated to public and green open spaces was calculated in hectares and mapped to show how they are distributed in the residential neighborhood of this sector.

The other one is challenges in integrating those spaces where there are environmental challenges, some socio-economic constraints, and policy and institutional barriers. The last part was the part of different policies and strategies where it looked at urban development plans, the effectiveness of their implementation, and how communities were engaged (Lee et al., 2015).

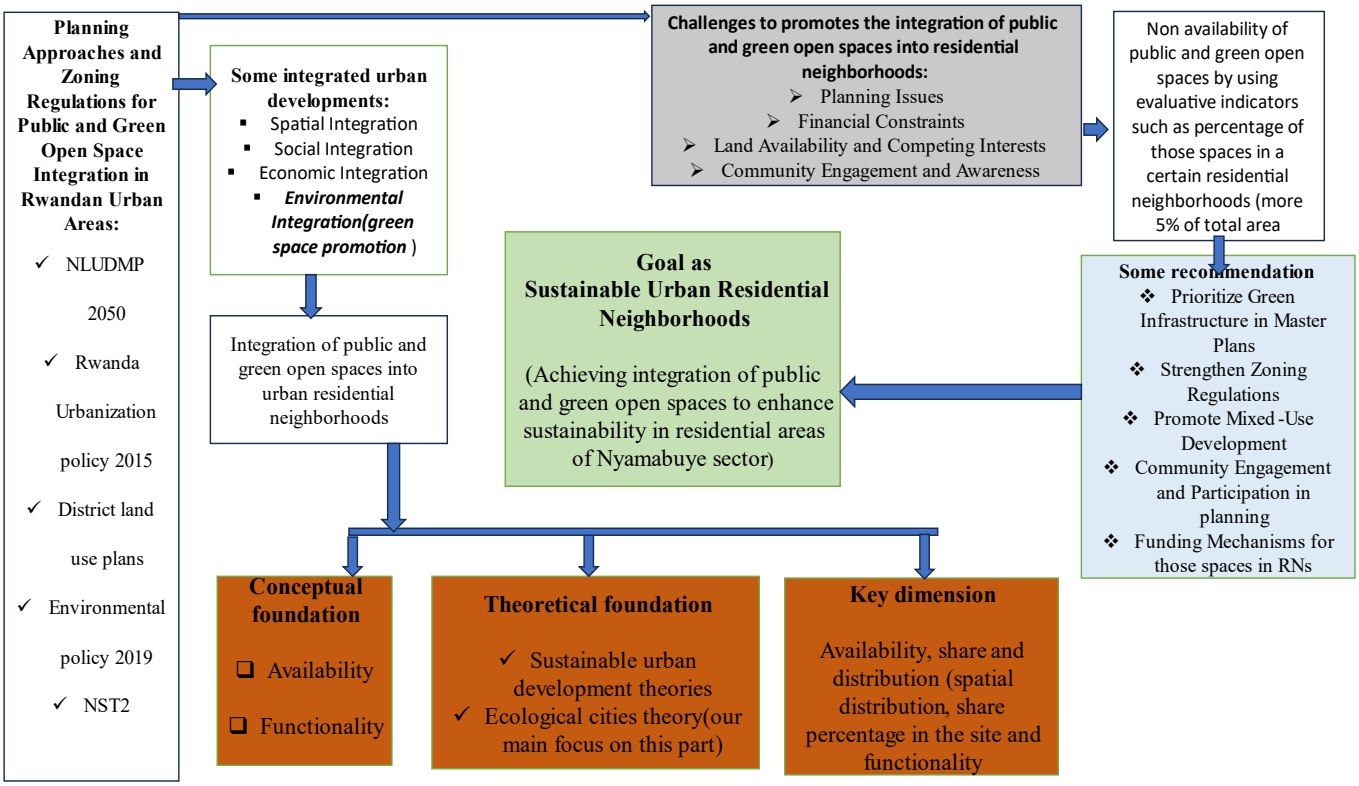


Figure 1: Analytical framework

Source: Adopted from Nshimiyimana et al, (2023), GGGI (2020), GoR (2020) and UN-Habitant (2022)

CHAPTER 2. LITERATURE REVIEW

2.0. Introduction

Due to the rapidly increasing number of urban inhabitants, it has been an urgent problem to form the system and optimize the layout of public or green open spaces in residential areas (Franchino et al, 2024). They add important quality to the city environment, to the social cohesion and the welfare of the people of cities. This paper reviews world and regional trends in incorporation of public and green open spaces in urban residential area with a narrow focus on trends that are found to be applicable to the rapidly urbanizing areas like Nyamabuye Sector (Samah & Shawket , 2022).

It considers theoretical backgrounds, design principles, and policy courses that have shaped the production of such spaces. The review also draws attention to common challenges such as land-use conflicts, lack of planning guidelines and low community participation that encumber successful integration (Ugolini et al, 2022). Drawing insights from comparative studies, it lays the groundwork for evaluating the level of integration in Nyamabuye, understanding existing barriers, and proposing informed policy options to enhance the quality of public and green open spaces in its residential neighborhoods.

2.1. Definition of key concepts

Public spaces: A public open space is an area in a city or any other physically accessible location that is created through inclusive processes and is framed by social, political, and interpersonal relationships (Mehdi et al, 2017; Pojani & Maci , 2015). According to Woolley 2003), the public space is one that we share with others who are not our friends, family, or coworkers. In addition to being a place for peaceful cohabitation and impersonal interactions, this area is used for politics, religion, sports and business.

Green open spaces: Green open spaces refer to area land, predominantly grass, trees, and shrub that is accessible to the public that are mostly undeveloped land into urban settings and constitute recreational areas; that is, parks, gardens, nature trails, and other open spaces for greenery (Nurudeen, 2022; Nastiti & Giyarsih , 2019). According to Franchino et al (2024), Green open spaces are vegetated areas of land that have been intentionally left vacant in urban or developed

spaces and they offer spaces for people to experience the outdoors, to exercise and to develop community and this contribute to protecting the environment and developing the economy.

Residential Neighborhoods: Most people spend a significant portion of their lives in residential areas, which also serve as the site of many of their social and business interactions. residential neighborhoods, which are defined by homes rather than businesses or industry, are places where people predominantly reside (Yannis, 2002). A residential neighborhood is a particular geographic area that is largely intended and utilized for housing within a city, town, or village. It is composed of up of residences, apartments, and other housing building construction.

2.2. Approaches for PGOSs integration in urban development

Providing public and green open spaces within the urban context is the strategic planning and connectivity of green spaces, e.g. parks, gardens, and tree-lined streets. All of these lend themselves to easier access and a variety of uses and are critical for promoting environmental sustainability, community development, and quality of life by creating spaces for social interaction, leisure, and recreation.

Public and green open spaces have many recognized and proven potential benefits, but proper design and continuous preservation are necessary for these benefits to be accomplished (Ugolini et al, 2022). Green and public open spaces are crucial elements of neighborhoods that are well-designed. Some of those methods and strategies are highlighted from 2.2.1. up to 2.2.4.

2.2.1. Strategic Planning and Design

Creating livable, sustainable, and healthy urban environments requires integrating public and green open spaces**.** According to (UN-Habitant, 2024)**,** these methods are mostly used**:**

- ***Integrative Urban Planning***: Embed green spaces into the very fabric of urban planning, ensuring they are integrated with connectivity and accessibility for urban dwellers.
- ***Multifunctional spaces***: Plan green spaces as multipurpose ones, including facilities for recreation, stormwater collection, biodiversity enhancement, and community interaction.
- ***Equity***: Design for diverse needs and promote access for all, including people with disabilities, the elderly, and children through accessible green spaces.

2.2.2. Sustainable strategies for integrating PGOSs into urban environment

Creative designs can incorporate multiple uses into one public or green open space. For example, a park could contain a rainwater retention pond, community garden, and playground to maximize the benefits to the surrounding community (UN-Habitant, 2020).

- ✓ ***Green Infrastructure****:* To incorporate nature into the built environment, use green infrastructure techniques as permeable pavements, vertical gardens, bioswales, and green roofs.
- ✓ ***Urban Greening****:* To enhance the amount of nature in urban areas, put urban greening projects like pocket parks, community gardening, and tree planting into action.
- ✓ ***Brownfield Redevelopment:*** Convert underutilized or abandoned industrial lands into green areas to boost local economies and provide new recreational options.

2.2.3. Community Involvement

It provides for a variety of needs with the inclusion of a diverse range of participants from the community, including various age groups, ethnicities, skill levels, and socio-economic backgrounds. This helps in creating welcoming environments serving all (Pojani & Maci , 2015).

- ❖ ***Participatory Planning***: To guarantee that public and green open spaces satisfy the requirements and preferences of the community, include them in the planning and design stages.
- ❖ ***Community Stewardship***: Promote community participation in public and green open spaces management and upkeep to cultivate a sense of accountability and ownership.
- ❖ ***Environmental Education:*** Offer educational initiatives and events to encourage sustainable behaviors and increase public understanding of the value of green open spaces.

2.2.4. Governance and Policy

Governance and policy are the foundation that supports the integration of public and green open spaces (Nastiti & Giyarsih , 2019). They give direction, guide action, and make sure green spaces are conserved, protected, and continue to be enjoyed by communities in perpetuity and they used as:

- ***Supportive Policies:*** Put into effect laws that encourage the development and preservation of green areas, such as zoning laws, green building incentives, and park and recreation funds.
- ***Inter-sectoral Cooperation*****:** To guarantee the integrated administration of public and green open spaces, encourage cooperation between various governmental entities, private sector players, and neighborhood associations.
- ***Monitoring and Assessment tool:*** To help guide future planning and decision-making, periodically assess the success of green space initiatives.

2.3. Importance of PGOSs for people in residential neighborhoods

community gardens, playgrounds, urban natural reserve areas, and publicly accessible courtyards in front of government buildings have great importance to people. For instance, community gardens serve as areas where people meet to discuss. Playgrounds provide areas for enjoyment and relaxation (Addas, 2023). They encourage interpersonal contact by providing opportunities for unplanned interactions and informal conversations. Furthermore through creating a sense of place, these spaces enhance the visual quality of the neighborhoods and provide a space for recreation (Lee et al, 2015).

Public access to courtyards is vital for fostering civic engagement and cultural celebration. Through spaces for public art, performances and cultural activities, they enrich the lives of residents and advance a sense of common cultural heritage. They offer one opportunity for dialogue and exchange, cultivating acceptance and empathy in an increasingly polarized society. They also act as local meeting points providing space for local stakeholders to meet and mingle, establish a social network, and strengthen relations in the community (Zhang et al, 2021).

2.4. Challenges hindering the integration of PGOSs in residential neighborhoods

Integrating public and green open spaces into residential neighborhoods faces different challenges (Syrbe & Chang, 2018). Urbanization and Land sacristy, policy gaps, financial constraints, infrastructure development pressure, lack of community and awareness and conflict between public private interest are major issues that hinder the integration of public and green open spaces (Franchino et al, 2024; Syrbe & Chang, 2018).

2.4.1. Urbanization and land scarcity

Integrating public and green open space into residentials community is severely hampered by urbanization and land scarcity (Franchino et al, 2024). Factors such as competition of land uses where it prioritizes the land for residential development over public and green open spaces (Kley & Dovbishchuk, 2021). According to Franchino et al (2024), rising land cost make it harder to acquire land that can be used for public open spaces focus on how larger number of urban dwellers find place to settle is more profitable. According to UN estimates, 68% of people on Earth will reside in cities by 2050. The conflict between green space and infrastructure is heightened by the tremendous strain that this fast urbanization places on the land (UN-Habitant, 2020).

2.4.2. Policy gaps in zoning and spatial planning regulations

Lack of vision and inadequate regulation in planning and policy development leads to developers to prioritize building spaces over green open spaces and some policy lack clear vision or comprehensive plan for integrating those spaces into residential neighborhoods (Kley & Dovbishchuk, 2021).

2.4.3. Financial constraints

Budget allocation for some municipalities frequently have to choose on what is more priority over other sector. For instance, when the budgets are low; it is more prior to choose health, agriculture and education sectors over public and green open spaces even the funds that any country can get mostly focus on poverty reduction (World Economic Forum, 2018; Langengen et al, 2024). Development, construction and maintenance costs of public and green open spaces requires more financial budgets such as money for lighting theses spaces every day, maintenance costs, cleaning

costs which are requested to be covered by government which is seems to be a burden for some developing nations (UN-Habitant, 2022).

2.4.4. Infrastructure development pressure

In order to promote economic growth, cities frequently place a higher priority on infrastructural development, sometimes at the expense of environmental concerns and the creation of green spaces. This may lead to a preference for development that maximizes profits, even at the expense of public facilities (Kley & Dovbishchuk, 2021). For instance, existing public and green open spaces may become fragmented as a result of infrastructure initiatives such as roads and hospitals becoming smaller, more remote places that are less accessible to locals and have lower ecological value.

2.4.5. Limited of community education and awareness

Absence of community ownership, including disinterest and disuse where locals don't feel like they own the proposed public and green open areas they could be less likely to support their creation or make use of them once they're created (Fransen, 2023; Pena, 2022). According to Samah & Shawket (2022), limited awareness of benefits of those space in residential neibourhoods where numerous advantages of green spaces, such as enhanced physical health, may not be completely understood by many individuals and inadequate community engangement for top down planning aproach where the needs and preferences of community are not referected.

2.4.6. Conflict between public and private interest

Profit is a common motivator for private developers. Setting aside land for open spaces may not always be as important as maximizing the number of dwelling units in residential areas (Ugolini et al, 2022). In urban areas where land is expensive some developers for them it is not financially possible to set aside property for green open spaces where that land can be used for other uses that generate money in short term.

Table 1:Challenges hindering the integration of PGOSs in residential neighborhoods

Category	Challenge	Description
Urban Planning and Design	Lack of integrated planning	Green spaces are often treated as secondary elements, not integrated into the core urban design.
	Poor land-use management	Competing demands for land, especially for housing and infrastructure, limit space for green areas.
Economic Constraints	Limited funding	Insufficient financial resources for the creation, maintenance, and upgrading of public and green spaces.
	High land values	In urban areas, land is often too expensive to allocate for non-revenue-generating spaces like parks and gardens.
Policy and Governance	Weak regulatory frameworks	Inadequate policies or lack of enforcement mechanisms to protect and promote green spaces.
	Lack of political will	Green space integration is often not prioritized in urban development agendas.
Social and Community Factors	Low community participation	Residents are not always involved in planning processes, leading to spaces that do not meet their needs.
	Inequitable access	Green spaces are unevenly distributed, often favouring wealthier neighbourhoods.
Environmental Pressures	Urbanization and land scarcity	Rapid urban growth puts pressure on available land, often at the expense of open spaces.
	Environmental degradation	Pollution and neglect can degrade existing green spaces, making them unattractive or unsafe.
Institutional and Capacity Issues	Poor inter-agency coordination	Lack of collaboration among urban planning, environmental, and community development sectors.

	Technical capacity gaps	Limited expertise in sustainable landscape and green space planning within municipalities.

Source: Adopted from Syrbe & Chang (2018),Kley & Dovbishchuk (2021), Samah & Shawket (2022) and Ugolini et al. (2022)

2.5. Policy option to enhance the integration of PGOSs in residential neighborhood

according to Voinea (2022), Through zoning laws, developer agreements, and financial incentives for the implementation of green infrastructure, it will be possible to improve the integration of green and public open spaces in residential neighborhoods by requiring the inclusion of those spaces in new residential developments, including requirements for specific percentages of green area per housing unit, and encouraging the design of interconnected green networks throughout the neighborhood.

According to (Zonta, 2016; Fletcher et al, 2021; Franchino et al, 2024; Voinea, 2022), Public and green open spaces community land trusts, Public-private partnership for public and green open spaces development, designing infrastructure projects to include public and green open areas into residential neighborhood, Urban public and green open spaces zoning, Economic and Fiscal incetives for public and green open spaces integration and Public participation(communty engagment) for public and green open spaces deveopment projects are some Policy options to enhance the integration of public and green open spaces in residential neighborhood .

Public and green open spaces community land trusts (CLTs): For the good of the community, CLTs, which are nonprofit organizations, own and manage land (Zonta, 2016). Usually, a board including locals, community members, and public representatives governs them. CLTs seek to guarantee that land will always be reasonably priced and available for community uses, such as public and green open areas. They purchase property expressly to create or preserve it while keeping it from being developed for other uses. By encouraging community involvement in the maintenance of public and green open spaces in residential communities, this participatory strategy promotes a sense of ownership (Fletcher et al, 2021).

Public-private partnership(PPPs) for public and green open spaces development: A public sector organization and a private sector business work together to accomplish a common objective in PPPs (Schachter, 2017). Each party contributes their special resources and knowledge. The private sector may provide management capabilities, building experience, or design skills, while the public sector may provide funds, land, or policy assistance. PPPs are being used by numerous developed cities for urban greening initiatives, such as the creation of parks, community gardens, and green roofs.

Incorporating PGOSs into residential infrastructure design: Creating infrastructure projects that incorporate green and public spaces is an excellent way to improve the integration of these important locations in residential neighborhoods. For instance, according to Fletcher et al (2021), designing street with trees and creating parks and green areas alongside roads, or other commuting corridors to enhance air quality and provide recreational options.

Urban public and green open spaces zoning: It is an essential piece of legislation to guarantee that these areas be included into residential communities. Zoning for public and green open spaces involves putting aside particular areas where parks, green spaces, recreational facilities, or other public open space varieties are to be one of the land uses in residential neighborhoods. It helps to protect and preserve those spaces and guide deveopment patterns (Fransen, 2023).

Economic and Fiscal incetives for PGOSs integration: Economic and fiscal incentives are a powerful way to encourage the integration of public and green open spaces in residential neighborhoods. These are instruments that governments employ to promote particular actions or pursuits. When it comes to green spaces, they want to make it more affordable for towns, homeowners, and developers to establish and maintain these areas. For example When public and green open spaces are incorporated into developments, developers can construct more residential units or commercial space, making it financially advantageous for them to give green open spaces first priority (Voinea, 2022).

Communty engagment for PGOSs development projects: The successful integration of green and public open spaces in residential communities is contingent upon community interaction, also known as public participation. It's not only a smart idea; it's a crucial piece of policy. It helps to understand what community needs which helps to built community ownership and ensuring equity and inclusivity (Fletcher et al, 2021; Kabisch et al, 2016).

2.6. Policy and strategic options for enhanced integration of PGOSs in residential neighbourhood in Rwanda

Prioritizing environmental sustainability and green growth has allowed Rwanda to make great progress, which offers a solid basis for improving the integration of green and public open spaces in residential communities. Rwanda can improve the incorporation of green and public open spaces in residential communities by leveraging and strengthening these current policies and strategies (GGGI, 2020; Ministry of Infrastructure, 2015; GoR, 2020).

2.6.1.National Land Use and Development Master Plan (NLUDMP 2050)

With an emphasis on balanced and sustainable land use, the NLUDMP offers a framework for land use planning and development nationwide (GoR, 2020). In order to integrate these places, it can be used to direct the construction of houses and designate areas for public and green open spaces. Enforce the NLUDMP 2050 regulations and make sure District land use plans are in line with its goals to strengthen its implementation.

2.6.2. National Environment and Climate Change Policy 2019

A thorough foundation for environmental management in Rwanda is provided by this policy, which also encourages green spaces and sustainable urban growth as it is indicated in first objective of seven it has as greening economic transformation. It highlights how crucial it is to incorporate environmental factors into all plans and initiatives related to development, including the construction of residential neighborhoods (Ministry of Environment, 2019).

2.6.3. Rwanda Urban Planning Code 2015

It includes provisions for green spaces and public parks, and emphasizes the importance of creating a livable and sustainable city. Apply best practices for integrating green spaces and community involvement into the planning process to other Rwandan cities by using the developed Master Plan as a template. For instance for part of recreation land use they state that "*This zone includes public open space, greenways and green areas, recreation and sports facilities. This may be public park land, amusement parks etc"* (GoR, 2015).

2.6.4. District Land Use Plans(DLUPs)

DLUPs are detailed plans that translate the National Land Use and Development Master Plan (NLUDMP) into specific actions at the district level. DLUPs can include zoning laws that prohibit the development of new green spaces and safeguard those that already exist. To guarantee that these areas are incorporated into the community, they can specify the kind, size, and location of public and green open spaces that must be included in new construction. For example, it is advised that 5% of the land in new residential neighborhoods be set aside for public and green open spaces (NLA, 2025).

2.7.Case study

In the pursuit of sustainable urbanization, the thoughtful incorporation public and green open spaces into residential neighbourhoods has become a top planning objective. Innovative spatial interventions that go beyond conventional design patterns are required due to the complex relationship between social justice, environmental management, and city quality of life. Deconstructing how various urban contexts operationalize these principles through people-cantered and context-sensitive approaches is made easier with the use of case study. This case study of Copenhagen's Superkilen Park demonstrates clearly how the playground and public areas can be transformed into catalysts for egalitarian and sustainable communities through a purposeful fusion of cultural diversity, environmental functioning, and people-oriented design (Fleming , 2023).

Superkilen Park, Copenhagen: A Model of Sustainable and Inclusive Urban Playgrounds

Public playgrounds are being envisioned as more than mere centers of recreation among fast urbanizing cities; they are essential parts of just, sustainable, and livable urban environments. One of the best examples of the same is Copenhagen, Denmark's Superkilen Park. Superkilen, located in the multi-ethnic Nørrebro district, is an outstanding example of how playgrounds in particular can be thoughtfully designed as public space to achieve environmental sustainability, promote social integration, and improve residential areas' overall quality of life (Fleming , 2023; EEA, 2022)**.**

Superkilen Park is the result of a collaborative design effort by privates' sectors (the Bjarke Ingels Group (BIG), Topotek1, and Superflex). The park spans nearly one kilometer and is divided into

three thematic zones: The Red Square, The Black Market, and The Green Park. Each area serves a specific purpose social gathering, everyday community life, and relaxation within green landscapes. The integration of these zones has created a dynamic urban space that encourages diverse forms of interaction, movement, and play for residents of all ages (Fleming , 2023; EEA, 2022)**.**

Figure 2: Superkilen Park, Copenhagen

Source: Fleming ,2023

Superkilen Park serves as an example of how creative playground design can turn public space into an effective instrument for urban renewal when it is guided by the values of inclusion, environmental sustainability, and community involvement. Superkilen provides insightful lessons on how to successfully, fairly, and creatively incorporate public and green open spaces into

residential areas as cities all over the world, including those in Rwanda, continue to look for strategies to do so. The park serves as a place for recreation as well as a symbol of solidarity and shared ownership because of the multicultural environment that promotes a strong sense of identification and belonging among local residents.

Figure 3:Black zone in Superkilen Park; A space for social interaction and casual meetings

Source: Fleming , 2023

CHAPTER 3. RESEARCH METHODOLOGY

This study investigates the integration of public and green open spaces into residential neighborhoods of Muhanga city with focus in Nyamabuye sector (Ram et al., 2021). The establishment of public and green open spaces was assessed using a mixed-methods approach to identify trends, challenges in policies and opportunities. Literatures from different reports, meetings, policies and analysis of important frameworks, including Rwanda's National Land Use and Development Master Plan 2050 (NLUDMP 2050), Rwanda national urbanization policy, geospatial analysis to evaluate the distribution of public and green open spaces, and stakeholder interviews (Households surveys) to obtain local perspectives are all included in the process. By using this method, the research findings were guaranteed to be in line with Rwanda's Vision 2050 objectives for inclusive, sustainable urbanization and to support evidence-based satellite city planning (GoR, 2020).

3.1. Description of the study area

This study was carried out in Muhanga city particularly in Nyamabuye sector. It is located about 29^{0} 45'25'' E and 2^{0} 5'12'' S and it has annual average annual temperature of about 18.7 ^{0}C and rainfall of 1207 mm. According to NISR (2022), This sector have an area of 29,71 square kilometers with a population density of 2018 people per sqaure kilometer which is also one of the most densery in Rwanda. As it is more populated; it has limited number of public and green open spaces mostly in part of Gahogo and Gitarama cell and a large portion of economic activities and administrative offices are in this sector (GoR, 2023).

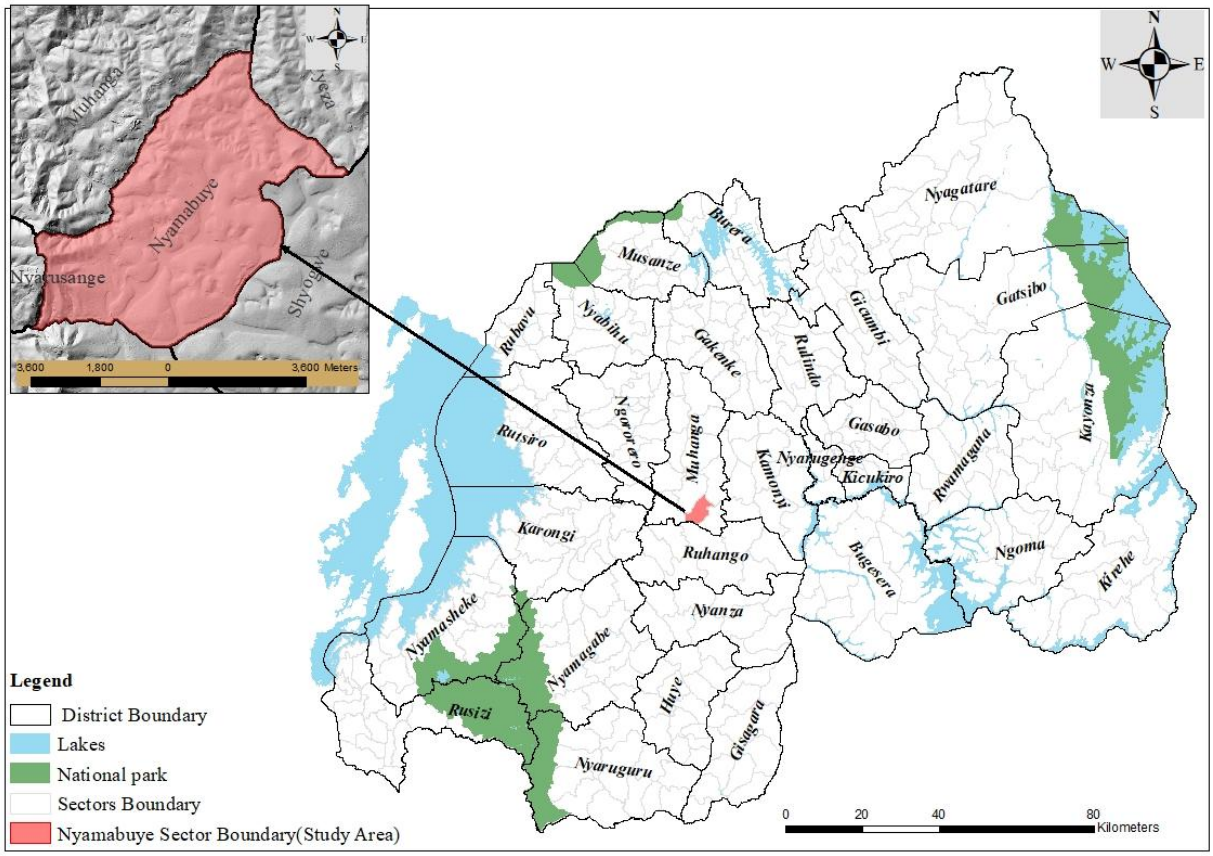


Figure 4:Location of Nyamabuye sector in Muhanga District

Data source*:* NISR (2022)

3.2. Sampling, data collection and analysis methods

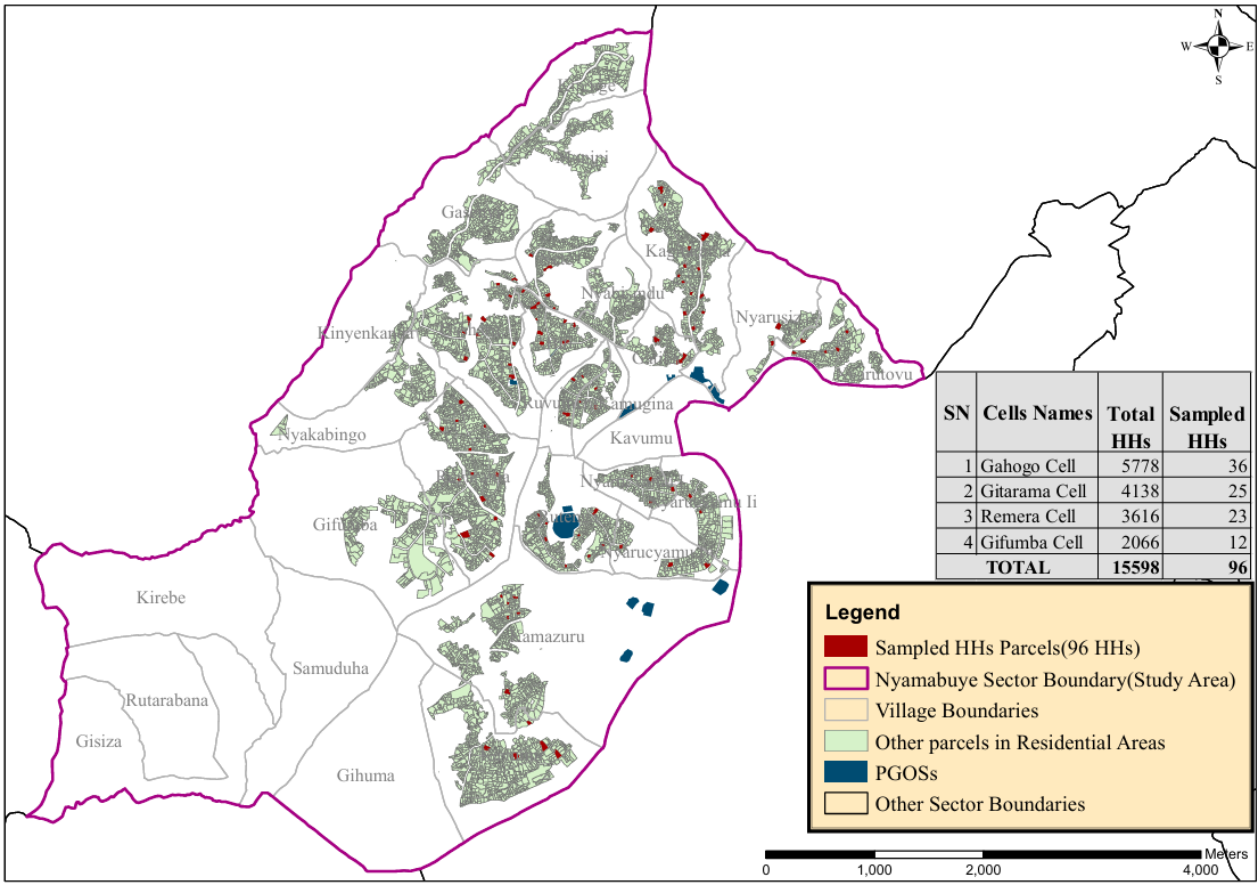
3.2.1. Sampling and sample distribution in different cells of Nyamabuye Sector

The intention is to achieve a standard error and confidence level that complies with recognized norms and criteria for this research studies. To determine the number of households to be chosen for questionnaires in this study, the simple random sampling technique was used in the Nyamabuye sector. The 15,598 households that are in this sector's total population comprise the sample (NISR, 2022). The following formula, which was created for choosing samples from a limited population, was used to determine the sample size for this study (Cochran, 1963)**.**

$$n = \frac{z2 * p(1-p)/e2}{1 + (z2 * p(1-p))/z2 * N}$$

Z is the being the value assigned for the confidence level of 95%, with 1.96 as a confidence level score;
p = the desired proportion for the sample size n, which is 0.5;
e = the marginal error (10% in this study);
N = population size of 15,598 (for the whole study area).
Hence, the sample size for this research study was 96 households, the workers of Muhanga one stop center (OSC) and other district planners.

The samples were distributed based on households in each cell of Nyamabuye Sector.



SN	Cells Names	Total HHs	Sampled HHs
1	Gahogo Cell	5778	36
2	Gitarama Cell	4138	25
3	Remera Cell	3616	23
4	Gifumba Cell	2066	12
	TOTAL	**15598**	**96**

Figure 5:Sample distribution in different cells of Nyamabuye Sector

Source: NISR (2022) and LODA (2025)

3.2.2. Primary data collection

This study gathered information directly from study area. This helped us to collect information about kind of public space, distribution of public and green open space that are in Nyamabuye sector as current status of those space in residential neighborhoods, it helped us to get information about effectiveness of different policies that are implemented in this study (Cilliers et al, 2015). Observation and measurement, structured interviews and questionnaire survey are methods that was used to collect those raw data from households and One Stop Center (OSC) workers.

Field Observations and measurement: this method used to identify current situation of public and green open space that are in residential neighborhoods of Nyamabuye sector and also it gives the ground reality of items that are going to assess (GGGI, 2019)**.** It provided clear information about the availability, distribution, challenges, and possible solution for improving these areas**.** Using GPS to capture spatial distribution of those space into residential area and through spatial analysis tools it determined distances from residential and areas that are covered by those spaces. By analyzing the physical characteristics of these areas, observation was also be important in determining the obstacles that prevent the successful integration of green and public open spaces in Nyamabuye residential areas (Cilliers et al, 2015).

Structured Interviews: this was used to get information and planification of local leaders that leads this study area such as officer in charge of land utilization, cell leaders and planning unit in Muhanga District specifically on Nyamabuye sector. This gives overview on different future plan of this area on land uses with focus on public and green open spaces with limits on study delimitation their importance, and what they recommend, etc. For instance, it gives insight on different barriers when implementing land use plans such as lack of commitment in providing land for public and green open space. This clarify which extent community were involved when planning for public and green open space in Nyamabuye residential areas (Stephan et al, 2018).

Households Survey: This technique helped to collect data from various respondents with different opinions on the integration of public and green open space in residential areas where surveyed households were sampled, and this helped to capture a wide range of comprehensive understanding from those target respondents. Open- and closed-ended questions were used to collect qualitative and quantitative data such as the availability of those spaces near their homes, if there are enough,

etc. It gives insight into people's knowledge, like if the key informants have a common understanding of the importance of those spaces, what their contribution is, and how they preserve them for better sustainability (GGGI, 2019).

3.2.3. Secondary data and spatial data

Secondary data was gathered by reviewing publications from international organizations, such as the United Nations, as well as various national and international reports such as National Land Use and Development Master Plan (NLUDMP 2020-2050), Muhanga District Land Use Plan (MDLUP 2023-2050), Rwanda National Urbanization Policy together with scientific papers, and other policy documents (Saumya et al, 2017). This approach is regarded as essential, reliable, and highly preferred because it was used to choose the topic, collect background information, define the problem, and set objectives**.**

Spatial data was given by Muhanga One stop center and other retrieved from Google Earth and United State Geological Survey (USGS) and National Spatial Data Infrastructure (NSDI) hub. secondary spatial data such as existing house footprints, existing playgrounds and Muhanga administrative shape file were used to map existing situation. For classification of land use and land cover; this table summaries:

Table 2: Source of spatial data and their respective applications

Data Type	Source	Time Period	Purpose
Landsat 4 and Landsat 8 Imagery	USGS Earth Explorer	2004, 2024	Land-use and land-cover classification and change detection
Training Samples	Generated in ArcGIS 10.8	2024	Supervised classification (Maximum Likelihood Classification)
Sample Points (300)	Field Data/Reference Maps	2024	Accuracy assessment using confusion matrix and Cohen’s Kappa coefficient
Land-use Categories	Defined in Study	2004, 2024	Classification into Dense vegetation, Agriculture, Built-up Area, bareland, and Water bodies
Change Detection Maps	Generated in ArcGIS 10.8	2004, 2024	Visualization of land-use changes over time

To validate the classification with a confusion matrix, 300 sample points were created at random over the study area. Cohen's Kappa coefficient was then calculated, with the goal of reaching a number over 0.8, signifying 'nearly perfect' agreement.

3.2.4. Data analysis

The process of data analysis was based on the record of recorded data from questionnaire surveys answered by sampled households' interviews, and observation. For the purpose of facilitating simple creating comprehension and interpretation, this process involved cautious editing, coding, and tabulation of any important information (Nsekanabanga & Nyongesah, 2023). Qualitative analysis where different information such as Nyamabuye sector residents' perception on how easily they can access those spaces was considered.

Moreover, in order to determine the distance between public and green open spaces in relation to residential neighborhoods in Nyamabuye sector, spatial dataset analysis was carried out using GIS with its related tools, such as the spatial multibuffering technique where households footprints in that residential area together with layers of different distance determined by different policies and other international reports on best standards such as UN-Habitant report on urban livelihoods was considered to show the households that are inside in determined distances (Anita et al, 2021).

The spatial location of existing public and green open spaces were displayed in ArcMap, and then after some calculation is made to find their size in relation to residential neighborhood size, the distance from residential house footprints to these public and green open spaces were calculated in order to categorize the travel distances the residents use to reach any public spaces that are in the Nyamabuye residential zone.

3.3. Research Design

The following figure illustrates the research design was used for this study from problem identification to conclusion and recommendation.

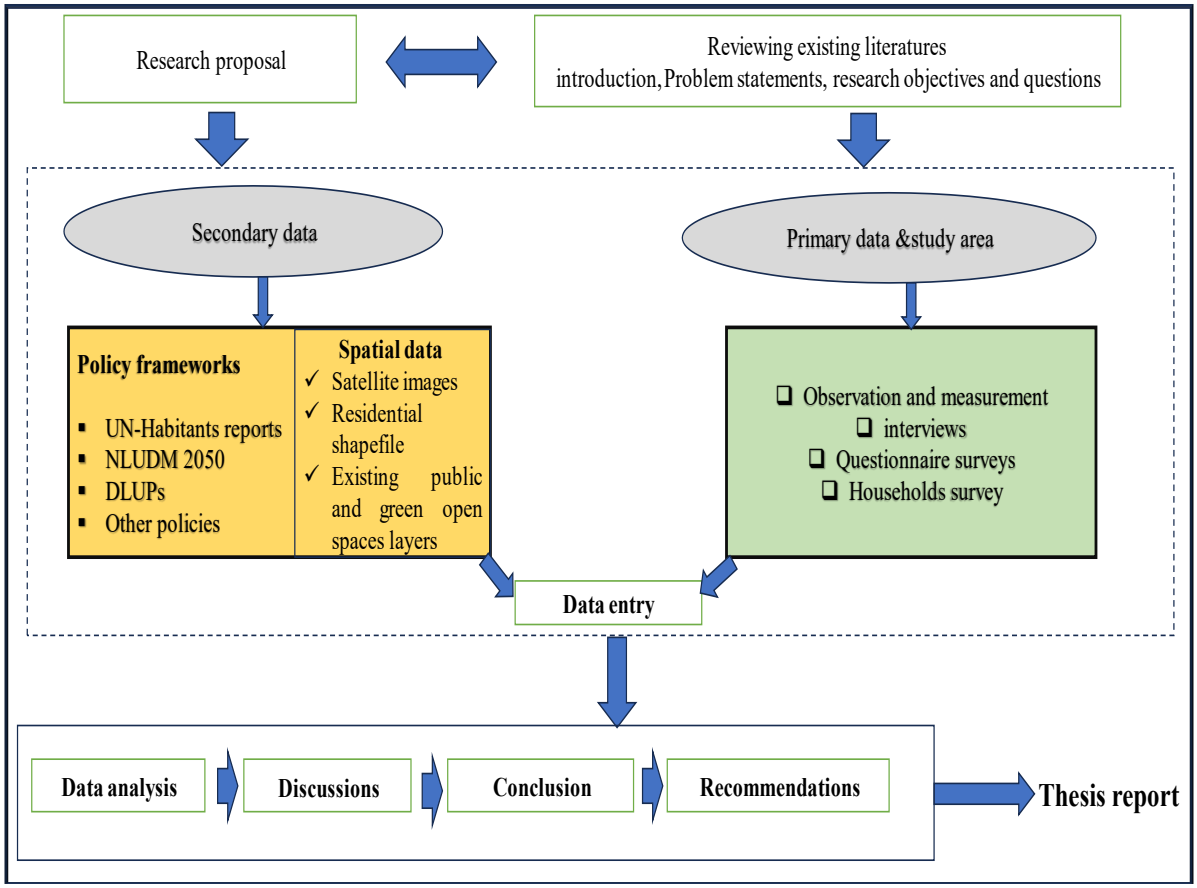


Figure 6: Research Design

Source: McCombes (2021), Singh (2023) and Sileyew, (2019)

3.4. Thesis structure

This study is broken up into five chapters, which are as follows: In Chapter One: General Introduction, problem statement, objectives, research questions, motivation and significance are presented. The literature review in chapter two was given specifics on the latest literatures about the integration of public and green open spaces into residential areas. In the third chapter, Research Methodology; the study area and all of the methodologies and/or procedures that was employed during this research was described. The results were produced in Chapter four, Results and Discussion, while Conclusion and Recommendations from the current study was presented in Chapter five.

CHAPTER 4. RESULTS AND DISCUSSION

This chapter presents and interpret the key findings of the study, which assessed the trends in relation to the integration of public and green open spaces in urban residential Neighborhoods, particularly in Nyamabuye Sector. The report is structured around the three main objectives of the research: assessing the level of integration between green open spaces and public space, determining the key factors discouraging this integration, and suggesting policy interventions to facilitate enhanced future practice. The results are informed by field surveys, spatial analysis, and stakeholder consultation with particular attention being paid to the areas of community gardens, parks, urban natural reserve areas, and public spaces in government buildings. The results are critically appraised against the literature, formulating an integrative perspective for the local situation while providing insight into larger implications for urban planning.

4.1. Distribution of PGOSs in residential neighborhoods of Nyamabuye Sector

In Nyamabuye sector there are about eight playgrounds, two publicly accessible courtyards in front of Governmental buildings, one existing community Gardens is being renovated to be of good quality near Kibuye Road, and none urban Natural Reserve areas is found.

Table 3: Types of *PGOSs* available in Nyamabuye Sector.

Name of PGOS based on delimitation of the study	Number of PGOS	Total areas in Square meters (Sqm)
Playgrounds	8	91,277 m^2
Publicly accessible courtyards in front of Governmental buildings	2	27,099 m^2
Community Gardens	1	7,923 m^2
Urban Natural Reserve areas	N/A	N/A
TOTAL	**11**	**126,299 m^2**

Source: Field survey, May 2025

Even though the study revealed that 126,299 square meters of public and green open spaces are in the Nyamabuye sector, big parts are in the Gahogo and Gitarama cells. The analysis revealed that Gifumba Cell lacks designated Public and Green Open Space. The map below highlights the spatial disparity in PGOS distribution across the sector.

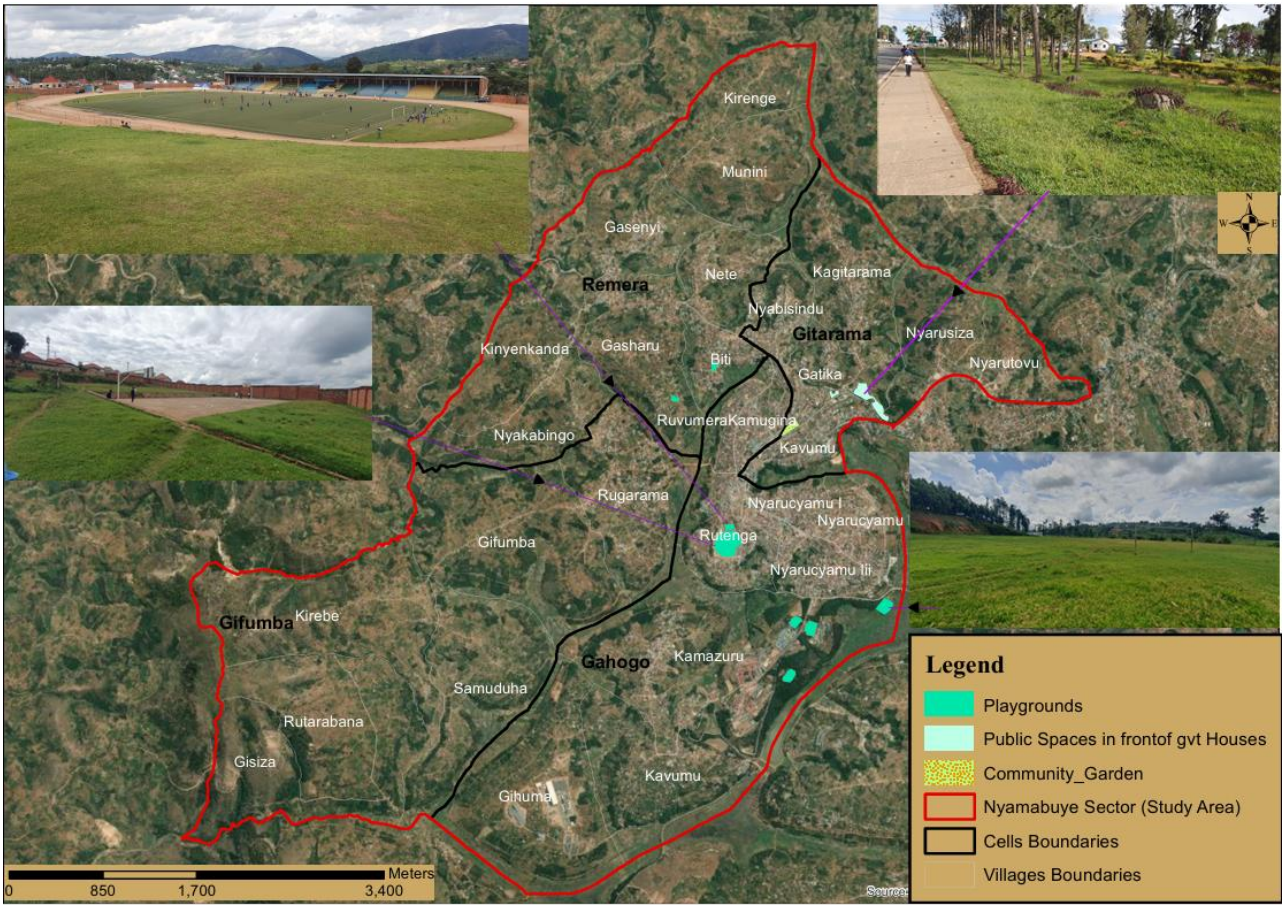


Figure 7:Location of Public and Green Open Spaces in Nyamabuye Sector

Source: NLA (2025), NISR (2022),World Imagery (2025) and Field Survey (2025)

It found that all those spaces are found in the urban area of this sector, where most of them are in Gahogo Cell. For instance, six out of eight playgrounds are found in this cell, and also four of them are in one village named Kamazuru village. Those four playgrounds in Kamazuru villages are owned by Kabgayi Basilica and are freely accessible to anyone for leisure purposes, mostly football sports.

Figure 8: Publicly accessible space in front of IPOSITA in Nyamabuye sector

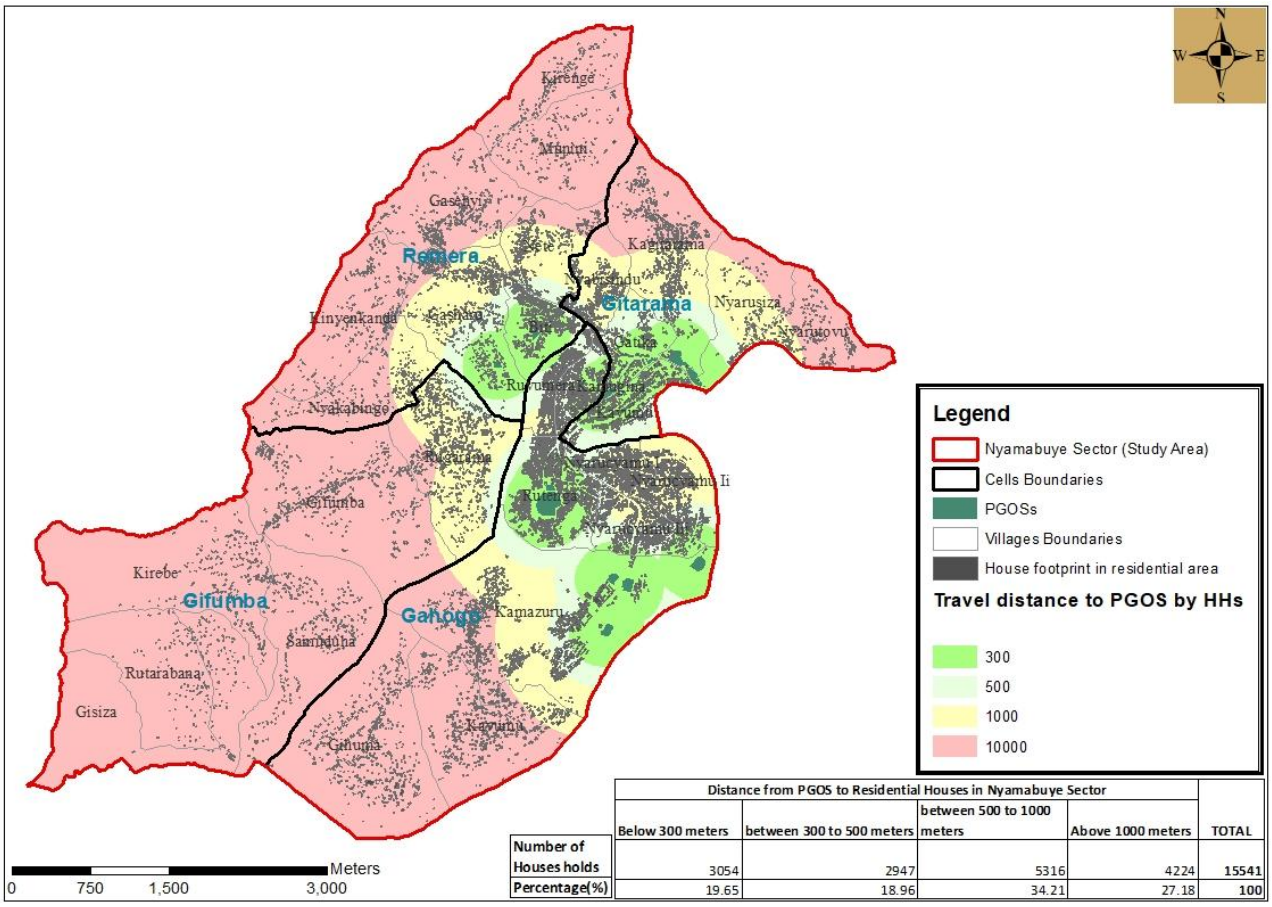
Source: Field Survey, May 2025

4.1.1. Household distribution by distance to PGOS

The average share of green areas in cities and urban areas has been monitored over several decades, where they recommend urban dwellers to have access to a minimum between 0.5 and 1 hectare of green open space in a distance of 300 meters from their residences. This guideline seeks to guarantee that green areas are easily accessible by walking, encouraging frequent usage and accessibility (UN-Habitant, 2024).

In Nyamabuye Sector, have about 15,541 residential house footprints. It is found that 19.65% of these residential dwellers travel less than 300 meters from their homes to PGOS. This percentage indicates that in Nyamabuye Sector, most people spend a lot of time reaching these spaces based on the international standard of how a good PGOS is integrated into residential neighbourhoods.

The big percentage of households in the Nyamabuye sector are found between 500 and 1000 meters to PGOSs, where 5316 households (34.21%) travel this distance to be able to reach these spaces. There are also about 27.18 percent of Nyamabuye sector residential dwellers that travel more than 1 kilometre to be able to access the PGOSs.



Distance from PGOS to Residential Houses in Nyamabuye Sector				
	Below 300 meters	between 300 to 500 meters	between 500 to 1000 meters	Above 1000 meters	TOTAL
Number of Houses holds	3054	2947	5316	4224	15541
Percentage(%)	19.65	18.96	34.21	27.18	100

Figure 9:Travel distance to PGOSs by Households

Source: NLA (2025), NISR(2022) and Field Survey (2025)

4.1.2. Overview of different respondent categories

This research employed different respondent from different categories. The sample size of 96 Households located in 4 cells, it found that 74 households were head by male while 22 by female. It found that 61.6 % were below 45 of age, 27% between 46 and 55 while 11% were above 56 of age. The sampled households, 46.7% have completed only primary education while 35.4 % have secondary certificate and 10.4 % have university degree while 7.3 % have other certification such

as short courses and some of them did not finish primary schools. It is found that more than half of the respondents means 61.5% have lived in Muhanga between one to five years while 25% live there more than ten years.

4.2. Level of integration of PGOS in residential neighborhoods of Study area

This section assesses the extent to which public and green open spaces (PGOSs) are integrated into the study area's residential neighbourhoods. It investigates the physical closeness and functional utilization of PGOS in comparison to nearby settlements. The analysis identifies disparities in distribution and access, which reflect different levels of integration.

4.2.1. Land-Cover and Land-Use Change and its Impact on PGOS Integration in Nyamabuye Sector

Landcover and land use change (LCLUC) significantly impacts the number, quality, and spatial distribution of public and green open spaces (PGOSs) (Mutabazi et al, 2023). Compared two different decades to elaborate what happened during these periods. First, Landsat images were used to find land use and land cover of Nyamabuye sector in 2004 with five categories as, built up areas, bare land, dense vegetation like forests, agriculture land and water bodies.

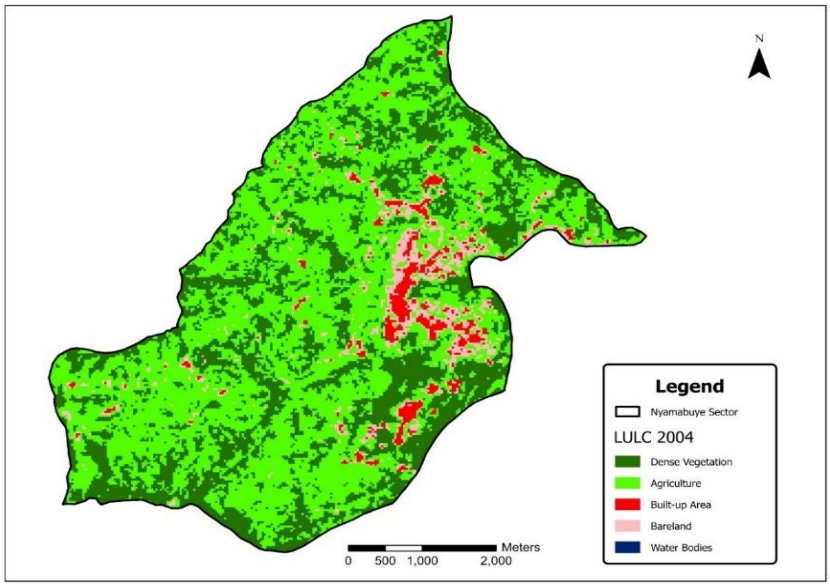


Figure 10:Land use and land cover of Nyamabuye sector in 2004

Source NISR (2022) and Landsat -4 image courtesy of the U.S. Geological Survey (2025)

The 2004 land use composition of Nyamabuye Sector reveals a predominantly agricultural landscape (58.13%), reflecting its rural nature but also exposure to urban encroachment. Dense vegetation (32.89%) holds ecological importance and potential for PGOS integration, though it faces urbanization threats. Bareland (5.82%) represents degraded zones suitable for green space rehabilitation. Built-up areas remain minimal (3.15%), offering an opportunity for early integration of PGOS in future urban plans. Water bodies are nearly absent (0.01%), underscoring the need for artificial water features to enhance ecological and recreational functions.

The 2024 LULC data reveals that land use pressures in the Nyamabuye Sector are increasing, with urban expansion displacing natural green spaces. This shift emphasizes the critical need for policy-based, community-driven, and sustainable measures to reintegrate PGOSs into the urban landscape. Without action, the sector risks losing the natural capital required for sustainable, resilient, and equitable urban living.

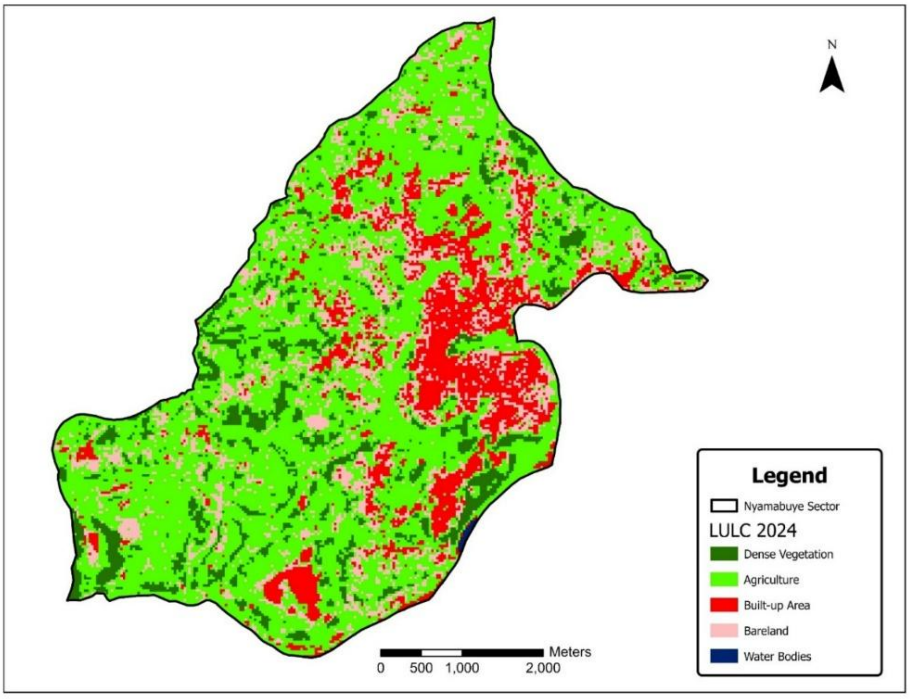


Figure 11:LULC of Nyamabuye sector in 2024

Source: Source: NISR (2022) and Landsat -8 image courtesy of the U.S. Geological Survey (2025)

The above figures (Fig. 11 and fig. 12) show that there are a lot of changes. This has a lot of implications for PGOSs' integration in urban residential neighbourhoods. For instance, the built-up area is increasing without integration of PGOSs in residential zones of Nyamabuye Sector. This trend has a direct impact on people's livelihoods. The comparison of the Nyamabuye sector from the years 2004 and 2024 and its implications are tabulated below.

Table 4: Nyamabuye sector from the years 2004 and 2024 on LULC

LandUse Category	**Area (Ha)**	**% of Total (Approx.)**	**Changes since 2004**	**Implications**
Agriculture	1711.65	~53%	+7.23 ha *(minor gain)*	Agricultural land slightly increased or remained stable, indicating urban pressure is not fully displacing farmlands but may reflect boundary shifts or low-density peri-urban farming.
Bareland	475.26	~15%	**+304.63 ha**	Sharp increase in unused/degraded land. May indicate deforestation, soil degradation, or land awaiting development. Critical area for **PGOS restoration or intervention**.
Built-up Area	440.32	~14%	**+347.95 ha**	Nearly **5× increase** in built-up land, confirming **rapid urbanization**. Major pressure on land availability for PGOS integration.
Dense Vegetation	302.04	~9%	**–662.5 ha**	Alarming decline (~69%) in vegetation cover. Indicates large-scale **green space loss** a direct threat to PGOSs.
Water Bodies	3.04	~0.1%	**+2.68 ha**	Modest gain. An artificial ponds projects have been implemented near Kabgayi basilica. Could support future PGOS design with ecological and recreational functions.

Source: Field survey (2025) Adopted from Kabisch et al., (2018), Bowler et al., (2010) and UN-Habitat (2020)

The data demonstrates that the Nyamabuye Sector is undergoing rapid and uneven land cover changes, resulting in significant ecological degradation and an expanding urban footprint. This emphasizes the urgent need to integrate PGOS planning into physical plans, focusing on: protecting remaining dense vegetation, rehabilitating degraded lands as green commons, embedding PGOSs into new residential expansions, and using land cover change maps to inform zoning and investment decisions.

4.2.2. Integration of PGOSs in residential neighborhoods of Nyamabuye sector

The spatial availability and proximity of Public and Green Open Spaces (PGOSs) within Nyamabuye Sector reveal substantial gaps when measured against both national policy frameworks and globally accepted urban planning standards. Based on survey data, 54.2% of residents reported that PGOSs are located too far from their homes to be considered conveniently accessible. This percentage underscores a significant accessibility deficiency, which is a critical element of equitable and inclusive urban design. Accessibility is not only about physical distance but also about the ability of different social groups especially vulnerable populations such as children, the elderly, and low-income households to benefit from public amenities that support health, recreation, and social cohesion.

The World Health Organization (WHO, 2017) and UN-Habitat (2018) emphasize that urban dwellers should have equitable access to at least 9 to 10 square meters of PGOS per capita, ideally within a 300 to 500-meter radius of their place of residence. The results show in Nyamabuye the percentage of PGOSs is about 6.2 square meter per HH and about 2 square meter per person which shows the big gaps with references to those standards. (NISR,2022). These benchmarks are set to ensure that PGOSs are integrated as essential components of healthy urban dwellers and are available for daily use without requiring substantial travel. In contrast, in Nyamabuye Sector, most PGOSs are sparsely distributed and situated at considerable distances from the majority of residential clusters, making them largely inaccessible for regular or spontaneous use by the community.

The playgrounds that are most used for both children playground and Community meetings are Muhanga Regional stadium (left side) located in Gahogo cell, Rutenga Village and other soccer fields located in Kamazuru village where they are owned by Kabgayi Basilica (right side).

Figure 12:PGOSs which are used as playgrounds in Nyamabuye sector

Source: Filed survey, May 2025

The field survey conducted in May 2025 identified major multifunctional PGOSs in the Nyamabuye Sector that serve both recreational and social purposes. Muhanga Regional Stadium, located in Gahogo Cell (Rutenga Village), is particularly popular as a children's playground and a location for community events. Similarly, Kabgayi Basilica owns the soccer grounds in Kamazuru Village, which are used for both informal sports and local meetings. These examples show how the community relies on multi-use areas, emphasizing the significance of recognizing and incorporating such PGOSs into future urban and land use planning frameworks.

4.3. Challenges hindering the integration of PGOS in Nyamabuye sector

Analysis reveals that the primary impediment to the establishment and preservation of Public and Green Open Spaces (PGOSs) is competing land development which leads to land scarcity identified by 43.3% of respondents (52 out of 120 total responses). This finding is consistent with observed trends in rapidly urbanizing contexts, such as the Nyamabuye sector, where escalating

demand for commercial, residential, and infrastructural expansion progressively reallocates land resources, frequently at the expense of PGOS designation. This dynamic underscore a fundamental tension between immediate economic growth imperatives and the requisites for long-term urban environmental sustainability and public welfare. The prevalence of this barrier strongly suggests the necessity of implementing more robust and enforceable land-use zoning regulations to safeguard the provision of essential urban public and green open spaces infrastructures.

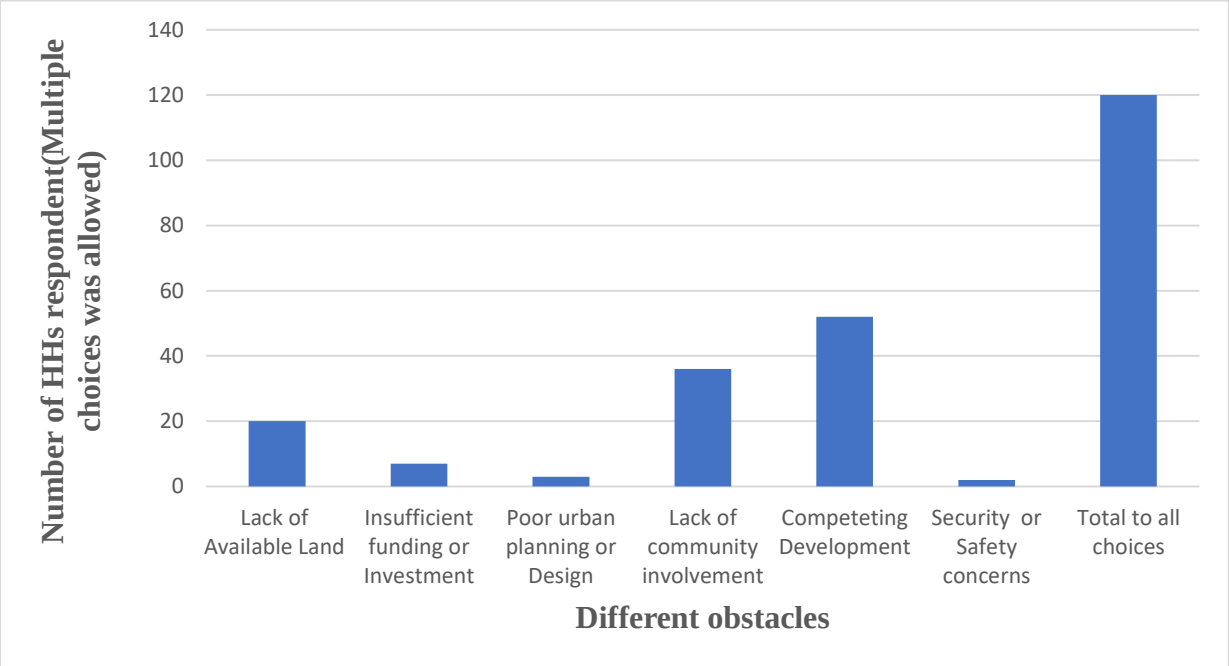


Figure 13:Main barriers for the integrating PGOSs in Nyamabuye sector

Source: Field survey, May 2025

Moreover, about 30% of respondents cited a lack of community involvement as a serious issue. This implies that top-down planning methods prevail, with little participatory involvement from communities. According to sustainable urban governance principles (UN-Habitat, 2020), genuine public participation is required to ensure that spaces meet local needs, obtain public ownership, and become socially rooted. For example one respondent said" *They are buildings roads and big houses which is good but they did not asked us what we really needs, for instance you can see I need a place where I can have a good refreshment of my mind if my wife stressed me but In Muhanga it is not Possible like Kigali where they go to Nyandungu Eco park, here if you are stressed you go to the bar and drinks beer".*

In addition, only a small share of households cited funding as a problem of about 5.8%, indicating that while financial constraints exist, they are not the primary limitation. This suggests that the issue may lie more with resource allocation and planning priorities rather than sheer budgetary absence. Few respondents see urban design as a main obstacle where 2.5% of the respondents, perhaps because planning deficiencies are not as visible or understood by the general population. Nevertheless, this could also mean that residents see broader structural or political issues (like land competition and exclusion) as more urgent. Safety issues were cited the least of about 1.7%, suggesting that perceived physical security may not be a major deterrent in Nyamabuye's case but they should light the existing one so that during at night you can do some exercise freely without fear.

However, the absence in some villages; fewer and unevenly distributed of PGOSs in some spaces of Nyamabuye's residential area exacerbates urban vulnerability, inhibits social resilience, and weakens the area's environmental health. From key responded the result was merged with scientific thoughts on these impacts associated with lack of PGOSs in residential neighborhoods. the responds showed and then classified to social and environmental challenges. The results show significant portion of residents over 54.2% report having no PGOSs near their homes, and 60.4% rarely utilize those that exist, indicating a disconnection between urban spatial planning and everyday community needs.

In fact, Social challenges are *Reduced Social Interaction and Community Cohesion*, for instance PGOSs serve as "social commons" where neighbors interact, build trust, and form informal support networks. Their absence leads to social fragmentation, weaker community ties, and fewer opportunities for civic engagement (Gehl, 2011). *Health and Well-being Impacts is another,* the lack of green open spaces and physical activity opportunities has been linked to an increase in noncommunicable diseases such as obesity, hypertension, and depression (WHO, 2017). It also lowers psychological well-being, particularly among the elderly and vulnerable groups.

In addition, environmental challenges are reduced Biodiversity and Ecological Fragmentation where Green spaces serve as urban habitats for birds, insects, and plants. Their absence leads to a loss of urban biodiversity and weakens the ecological resilience of the built environment. Water Runoff and Drainage Problems are other environmental challenge for instance Without green surfaces to absorb rainwater, surface runoff increases, contributing to localized flooding and soil

erosion, especially during heavy rains. Poor Air Quality and Pollution were cited as another environmental challenges. where most respondent shows Vegetation cover in PGOSs serves as a natural air filter. Without it, there is more exposure to toxins from traffic and urban dust, which can worsen respiratory ailments.

Table 5: Challenges arise from the lack of PGOSs in residential Neighborhoods

Category	Challenges	Description / Impact
Social Challenges	Reduced Social Cohesion	Fewer spaces for community interaction weakens neighbourhood bonds.
	Limited Recreational Opportunities	Children lack safe play areas; increased sedentary behaviour.
	Negative Health Outcomes	Higher risks of NCDs like obesity and stress due to lack of physical activity.
	Spatial Inequality	Low-income areas have less access to green space, increasing urban injustice.
Environmental Challenges	Urban Heat Island Effect	Less vegetation leads to higher local temperatures.
	Poor Air Quality	Fewer trees and green areas to absorb pollutants.
	Loss of Urban Biodiversity	Fewer habitats for flora and fauna in residential zones.
	Increased Surface Runoff	Lack of permeable surfaces leads to flooding and drainage problems.

Source: Field Survey, May 2025; adopted from Gehl, (2011) and WHO (2017)

4.4. Policy options for improving PGOSs integration in Nyamabuye residential areas

An integrated set of policy alternatives with strategies should be implemented to improve the integration of Public and Green Open Spaces (PGOSs) in Nyamabuye Sector (Muhanga City's residential neighbourhoods). These must be consistent with Rwandan national urban planning instruments and guided by international frameworks that promote sustainable urban development, inclusion, and ecological resilience.

A multi-pronged strategy based on urban sustainability policies can improve PGOS integration in Nyamabuye Sector residential zones. Key approaches include the deliberate allocation of public park land within zoning and master plans, the promotion of community-driven greening initiatives to foster local stewardship, and the implementation of incentive-based regulatory mechanisms that encourage private developers to incorporate PGOSs into housing and infrastructure projects. Furthermore, establishing regular public awareness campaigns and ensuring adequate security measures are critical for promoting equitable access and long-term functionality in these spaces. These strategies are intended to align local planning with broader sustainable urban development goals. The results from respondents are displayed below

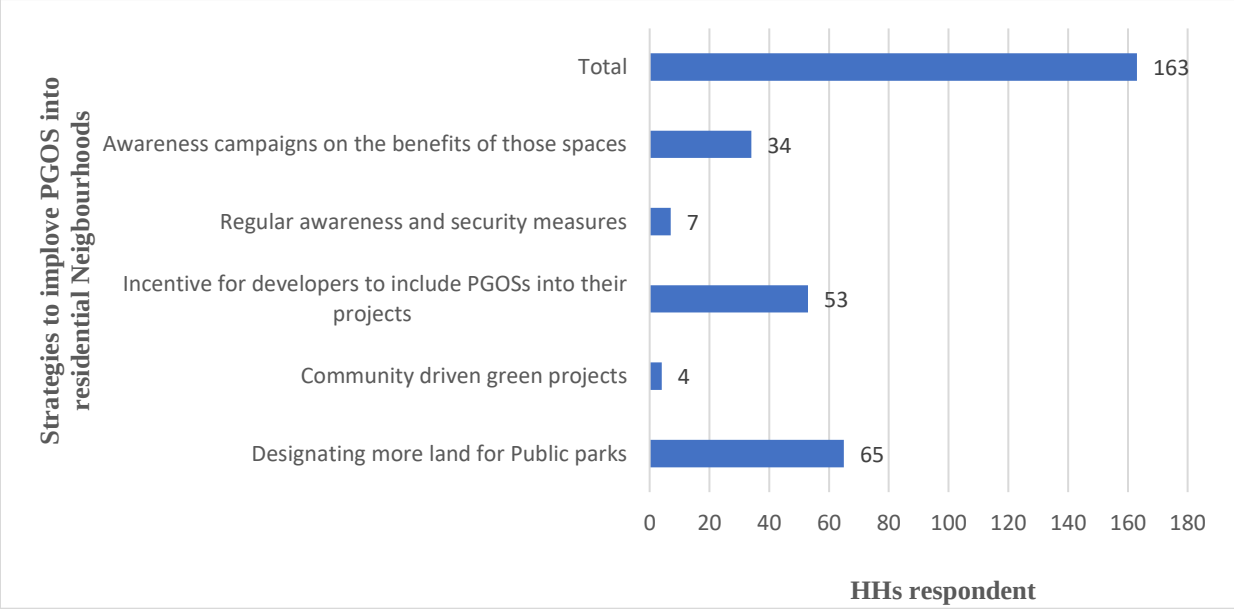


Figure 14:Policy option to enhance the integration of PGOSs in residential area

Source: Field survey, May 2025

From figure 14, The results reveal a pronounced preference for spatial planning strategies that prioritize the allocation of land to Public and Green Open Spaces (PGOSs) within residential neighbourhoods of Nyamabuye Sector. The most frequently cited strategy designating more land for public parks (40%) highlights a growing public demand for accessible green infrastructure among ongoing urban densification. This observation substantiates the policy recommendation under Land Use and Zoning Reform, which advocates for the mandatory allocation of 10–15% of residential land to PGOSs, as stipulated in the Rwanda National Land Use and Development Master Plan (2050) and aligned with the UN-Habitat New Urban Agenda (2016).

Implementation through statutory planning instruments such as master plans and detailed physical development plans is critical to institutionalizing PGOSs equity and spatial justice. For instance, the proposed spatial distribution of new PGOSs in Nyamabuye sector in relation to existing land use of Nyamabuye sector is displayed below:

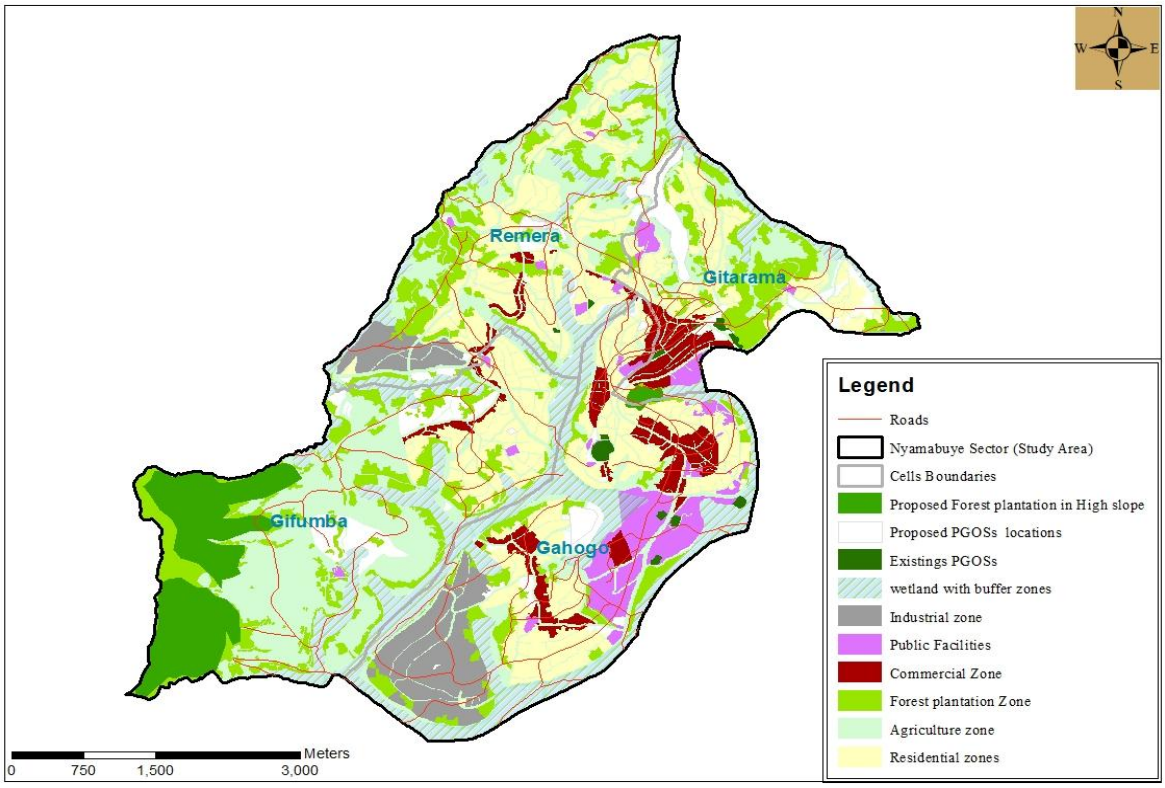
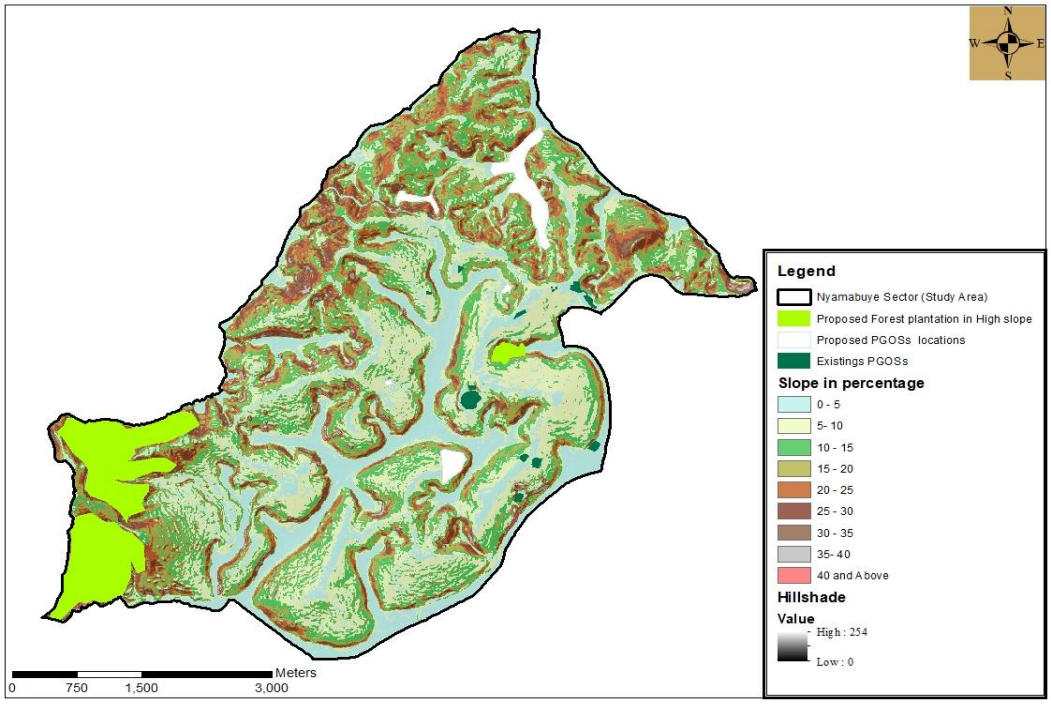


Figure 15:Proposed PGOSs location in Nyamabuye sector in relation to existing land use

Source: NLA (2025), NISR(2022) and Field Survey (2025)

A close examination of the distribution patterns indicates a clear spatial disparity in the presence of existing PGOSs, which are largely concentrated in and around the urban cores of Gitarama and Gahogo cells. These zones are characterized by a high density of commercial and institutional land uses, suggesting that PGOSs have historically been aligned with administrative or economic activity nodes. Conversely, peripheral cells such as Remera and Gifumba cell show limited availability of PGOSs.The proposed PGOSs, strategically located throughout the sector, suggest a progressive planning initiative aimed at improving both spatial equity and ecological resilience. However, the efficacy of these proposals depends on their functional integration with existing land use.

The spatial distribution of proposed and existing Public Green Open Spaces (PGOSs) in Nyamabuye Sector, as presented in the slope and hillshade-integrated map, reveals a number of critical insights that are essential for guiding environmentally sustainable urban planning. The map overlays slope percentage classes, hillshade, and PGOS locations to inform the placement of PGOSs in relation to topographic constraints.



Source: NLA (2025), NISR(2022) and Field Survey (2025)

Figure 16:Proposed PGOSs location in relation to slope and hill shade Nyamabuye sector

The analysis reveals that several proposed PGOSs have been appropriately located in areas of relatively gentle slope, particularly within the 0–15% slope range, which is conducive to safe public use and recreational development. In contrast, steeper areas exceeding 30% slope have been designated for forest plantation.

The second most supported option (32.5%) incentivizing developers to integrate PGOSs into residential projects corresponds with international policy prescriptions on Green Infrastructure Mandates. The integration of green elements (e.g., tree-lined pathways, community gardens) into real estate developments is strongly recommended in the Kigali City Master Plan and the WHO Urban Green Spaces and Health (2017) guidelines. Embedding such requirements within urban development control regulations particularly through green compliance checklists and permit conditions will enable forward-looking landscape urbanism in rapidly transforming peri-urban areas like Nyamabuye (WHO, 2017)

Awareness campaigns on PGOSs benefits (20.8% support) suggest that informational interventions are also perceived as vital. This supports the proposition under Environmental and Urban Awareness that educational outreach especially through school curricula, media, and local forums can enhance behavioural change and civic stewardship (REMA, 2019). This aligns with the UNESCO Learning Cities framework and Rwanda Environmental Management Authority (REMA) recommendations on building environmental consciousness at the grassroots level (UNESCO, 2021; REMA, 2019). For instance, they are renovating an existing abandoned land into a good PGOS where it will have all necessary to function. It will be located former Mbonyumutwa stadium.

Figure 17:Implementation of project named "Muhanga Greenery in progress

Source, Field survey, May 2025 and Muhanga district (2025)

Less frequently cited but strategically important were community-driven green projects (2.5%) and regular awareness and security measures (4.3%). These findings point to an implementation gap in participatory and governance-oriented approaches. However, Participatory Planning and Local Governance for Maintenance are globally recognized as essential enablers of inclusive, sustainable green infrastructure. Mobilizing Umuganda structures, decentralized governance bodies, and PGOS user committees as recommended in the Rwanda Urbanization Policy (2015) and UN-Habitat Urban Governance Guidelines could bridge this gap, ensuring co-ownership, maintenance, and long-term functionality of PGOSs (GoR, 2015)

CHAPTER 5. CONCLUSION AND RECOMMENDATION

5.1. Conclusion

The study conducted in Nyamabuye Sector, one of the biggest residential zones within the emerging satellite city of Muhanga, highlights a growing disparity between urban expansion and the provision of inclusive Public and Green Open Spaces (PGOSs). The empirical findings reveal critical gaps in both the spatial and functional integration of PGOSs. Over 54.2% of households reported a lack of green or open spaces near their residences, indicating a clear deficiency in the spatial planning and equitable distribution of PGOSs. Furthermore, 60.4% of households with access to such spaces noted they used them rarely, pointing to deeper issues of functionality, usability, safety, and lack of awareness or interest.

The findings are further supported by the nature of PGOS use, which largely involves youngsters using the accessible spaces as informal playfields and, to a lesser extent, for community meetings. While these functions are important in society, the limited scope of activities indicates underutilization and a lack of multifunctional planning. The study's findings do not align with international urban planning standards, such as those set by the World Health Organization (WHO, 2017) and UN-Habitat. These standards recommend that urban residents live within 300 meters of PGOSs, with a minimum of 9-15 m² per person. In Nyamabuye, these thresholds are far from being met.

The questioned households clearly identified the challenges to effective PGOS integration. The most significant challenges were competing development pressures (52 families), a lack of community involvement (36 households), and a scarcity of usable land (20 homes). These difficulties highlight a contradiction between fast urbanization and sustainable land use, reflecting a larger national trend in satellite cities where housing and infrastructure expansion take precedence over ecological balance and social well-being.

Residents prioritized initiatives such as dedicating more land for public parks (65 responses) and offering incentives to developers (53 responses) among potential solutions. Although less frequently chosen, awareness efforts (34 replies) and security measures (7 responses) were also deemed vital. These preferences indicate a population that understands the benefits of PGOSs but

lacks the agency or chance to alter their surroundings directly. the reality in Nyamabuye reflects implementation challenges, resource constraints, and weak enforcement of land use planning laws. Without deliberate intervention, the green space deficit in Muhanga's residential neighbourhoods may continue to worsen, with significant implications for urban health, environmental quality, and social cohesion.

5.2. Recommendation

In response to the significant results and identified obstacles, a set of actionable and scientifically supported recommendations are provided in order to achieve the fully integration of PGOSs into urban residential neighborhood:

- ✓ **Spatial Planning Reform and Land Allocation**

The implementation of PGOSs necessitates a fundamental shift in how land is allocated and managed. Local government, together with the National Institution in charge of Land Management (NLA), should guarantee that land-use zoning in residential communities allocates enough space for green spaces in accordance with WHO and UN-Habitat guidelines. This should be enforced by District Development Plans (DDPs) and land use laws and regulations. Reserved land must be legally protected against future encroachment by competing developments, including commercial and residential enterprises.

- ✓ **Community involvement and participatory urban planning**

To bridge the gap between planning and implementation, local individuals' involvement in public and green open space design, development, and preservation must be institutionalized. Community Green Committees and Participatory Land Use Mapping are two mechanisms that help develop a sense of ownership while also ensuring that spaces represent local needs. Umuganda, a community service program, could be used to develop and sustain small-scale green infrastructure such as tree planting, community gardens, and informal recreation areas.

- ✓ **Integrated Safety and Functionality Design**

PGOSs must be designed with safety, aesthetics, and usefulness in mind. Parks and green spaces should include lighting, clear routes, signage, and amenities like benches, water sources, and playground equipment. According to studies, when parks are safe and multipurpose, usage

increases dramatically, particularly among excluded groups. In Nyamabuye, such designs would increase utilization and satisfaction.

- ✓ **Awareness Campaigns and Environmental Education**

The usage and conservation of green spaces is influenced by behavioural and cultural beliefs. Local governments, in collaboration with civic society and schools, should initiate extensive awareness campaigns emphasizing the benefits of PGOSs, such as better air quality, lower stress, increased physical activity, and climate resilience. Such advertising should address concerns of diversity, encouraging women, the elderly, and children to confidently use these spaces.

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Appendices

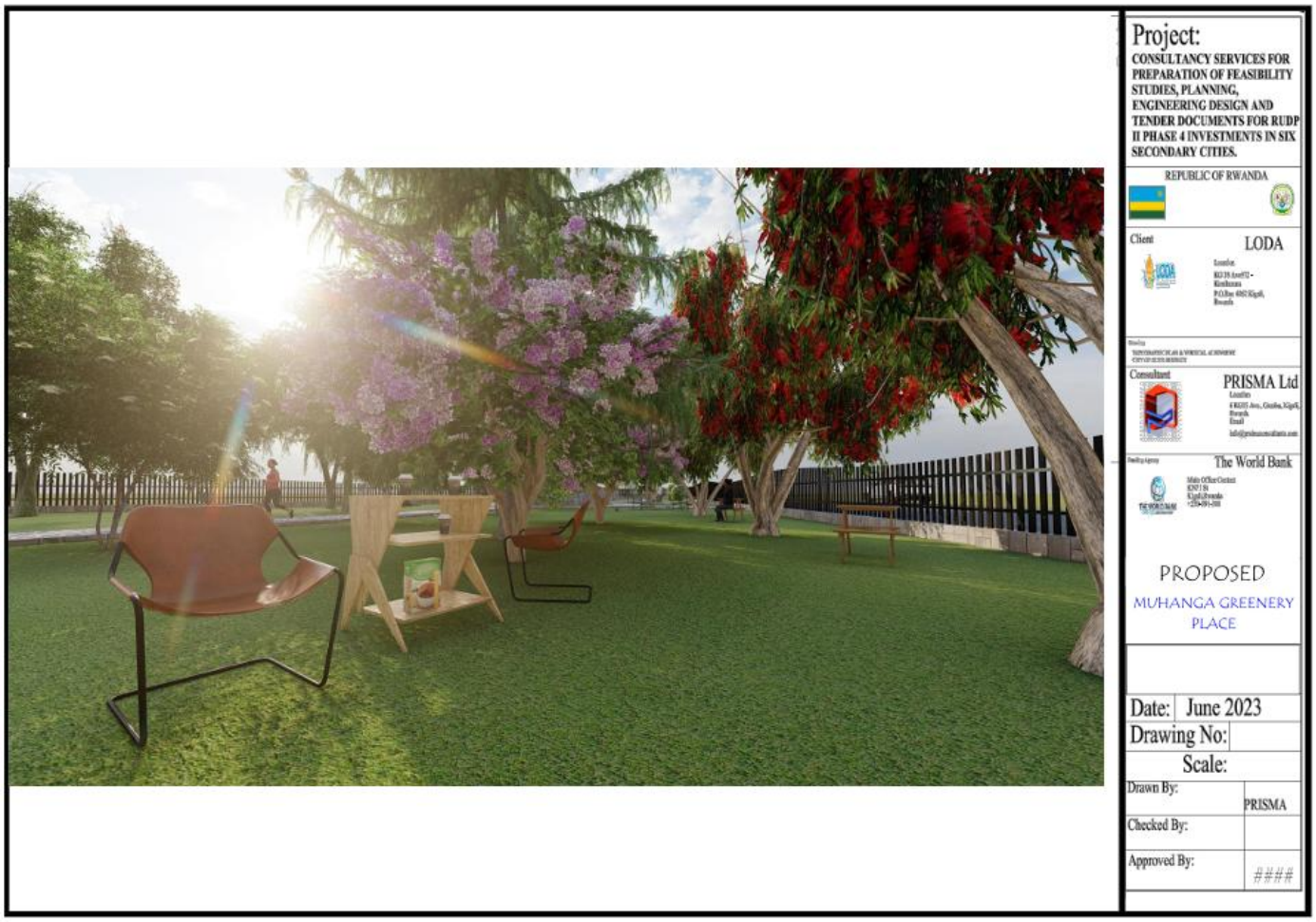

Figure 18: Muhanga greenery field under rehabilitation

Source: Muhanga District, 2025

Figure 19: This Rehabilitated Public open space will have all basics needs

Source: Muhanga District, 2025

Table6: Land use land cover change detection table (2004 and 2024)

SN	Changes	Area in Ha
1	No Change	1346.3
2	Dense Vegetation->Agriculture	652.2
3	Agriculture->Bareland	359.1
4	Agriculture->Built-up Area	218.9
5	Bareland->Built-up Area	100.8
6	Agriculture->Dense Vegetation	100.4
7	Dense Vegetation->Bareland	63.9
8	Dense Vegetation->Built-up Area	46.4
9	Bareland->Agriculture	27.4
10	Built-up Area->Bareland	11.4
11	Built-up Area->Agriculture	6.1
12	Dense Vegetation->Water Bodies	3.0
13	Bareland->Dense Vegetation	1.1
14	Water Bodies->Dense Vegetation	0.3
15	Water Bodies->Built-up Area	0.1
16	Built-up Area->Dense Vegetation	0.1

Source: Landsat-7 image courtesy of the U.S. Geological Survey.

Figure 20: PGOSs in front of Governmental Buildings (Muhanga District Office and continues to Muhanga District POLICE office)

Source: Field survey, May 2025

Research Martix

This research study uses the following as research matrix where it shows the objectives, research questions, methodology and data sources and the expected data.

Table 7: Research Matrix

Research objectives	**Research question**	**Methodology and data sources**	**Expected data**
1. To assess the level of integration of public and green open space in residential neighborhoods of Nyamabuye Sector.	1.What is the current availability and distribution of public and green open spaces in residential neighborhoods of Nyamabuye Sector?	• Field surveys (using Handled GPS). • Observation of existing public space like playgrounds, meeting points. • Interviews with OSC unity and planners at District level on how those spaces are integrated into districts plans. • Collection of satellite imagery.	✓ Map that shows spatial distribution of public and green open spaces. ✓ Overview of current situation in the study area. ✓ Data on a certain extent those spaces are integrated into district plans and how are monitored. ✓ Share of public and green open spaces in relation to residential neighborhoods

2. To identify challenges hindering the integration of public and green open spaces in Nyamabuye residential areas.	**2.** What are the main challenges to effectively integrating public and green open spaces in Nyamabuye?	• Interviews with people living Nyamabuye will be taken about the challenges they meet. • Review on the literature publication such as Muhanga district land use plans, NLUDMP 2050, Rwanda urbanization policy 2015, etc.	✓ Challenges to integrate public and green open spaces in Nyamabuye. ✓ Possible solutions for better integration of those spaces in residential areas.
3. To suggest policy option to enhance the integration of public and green open space in residential neighborhoods of Nyamabuye Sector.	**3.**What policies or strategies have been implemented in other contexts to successfully integrate public and green open spaces in residential neighborhoods?	• Review of policies and guidelines related to urban developments in relation to public and green open spaces. • Review on DDS in relation to its target on public spaces development • Interviews with Muhanga OSC unity on better option that can be used to integrate those space.	✓ Existing frameworks and strategies for public and green open spaces integration. ✓ Perspectives ideas from planners, OSC unit members on how these spaces can be developed into residential neighborhoods of Muhanga.

Work plan

It was anticipated that this research was to be finalized within six months, specifically from January 2025 to June 2025, as illustrated in the table below, which delineates the planned activities and their anticipated duration.

Table8: Work plan

Activities	January	February	March-May	April-June
Compilation of preliminary literature on research topic				
Proposal writing and presentation				
Literature review				
Data collection				
Thesis writing (Data analysis, interpretations, Presentation & submission)				

UNIVERSITY of RWANDA

COLLEGE OF SCIENCE AND TECHNOLOGY

SCHOOL OF ARCHITECTURE AND BUILT ENVIRONMENT

OFFICE OF THE DEAN

Kigali, 06 May 2025

TO WHOM IT MAY CONCERN

Dear Sir,

Dear Madam,

Data Collection for the MSc Dissertation by Mr. Jean de Dieu NZIRORERA

Through this letter, we would like to confirm that **Mr. Jean de Dieu NZIRORERA** is a final year student in the MSc of Geo-Information Science for Environment and sustainable Development (GI-ESD) under the School of Architecture and Built Environment (SABE), College of Science and Technology (CST), at the University of Rwanda (UR). He is currently working on the MSc dissertation, with the topic "***Current Trends in Integrating Public and Green Open Spaces in Muhanga City Residential Neighborhoods. Case Study of Nyamabuye Sector***" under the supervision of **Dr. UWAYEZU Ernest**.

From February up to May 2025, he will be collecting data which are relevant to that topic in the sector of Nyamabuye of Muhanga District. Data collection will include the household surveys and interviews with local leaders, and various government officials. In addition, he will need access to various spatial datasets and documents that are held by both public and private organizations. We would therefore like to request for your support so that he can get access to those data and documents. For any question related to his research, do not hesitate to contact any of us on the tel. or email below.

We do appreciate your support to that UR Student in his academic journey.

Sincerely yours.

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Tel:0783347939

Date: 22/05/2025

To: The Mayor of Muhanga District

Subject: Request for Authorization to Conduct Field Data Collection

Dear Sir/Madame,

I hope this letter finds you well.

I am a Master's student in Geo-Information for Environmental and Sustainable Development at the University of Rwanda. I am currently conducting research as part of my academic requirements, under the topic: " Current Trends in Integrating Public and Green Open Spaces in Muhanga City Residential Neighborhoods. Case Study of Nyamabuye Sector."

The objective of this research is to assess the trends that are found when integrating public and green open spaces in urban residential neighborhoods. It will focus on space like; community gardens, playgrounds, urban natural reserve areas and publicly accessible courtyards in front of government buildings that are found in Nyamabuye sector**.** This will promote the sustainable urban development and enhance the community wellbeing of Nyamabuye residents.

I kindly request permission from your esteemed office to conduct field data collection in Nyamabuye Sector. The research will involve interviews, questionnaires, and spatial data analysis, and will be conducted with the full consent and cooperation of all participants. Attached to this letter is recommendation letter from The university. I would be grateful for your support and authorization to carry out this important work.

Thank you very much for your attention and kind consideration.

Yours sincerely.

NZIRORERA Jean de Dieu

Republic of Rwanda
Southern Province
Muhanga District

Muhanga, on 03/06/2025
Ref N°: 1675/07.0207

Mr NZIRORERA Jean de Dieu
University of Rwanda – College of Science and Technology
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RE: Authorization for collecting field data collection

Dear Mr,

1. Reference is made to your letter of May 26th, 2025 requesting the authorization for conducting a research in Muhanga District entitled "**Current Trends in Integrating Public and Green Open Spaces In Muhanga City Residential Neighborhoods. Case Study of Nyamabuye Sector**";

2. We have the pleasure to inform you that the authorization for conducting a research is granted with the condition that the findings from the research will be submitted to Muhanga District for information and consideration.

Thank you.

AKARERE KA MUHANGA

KAYITARE Jacqueline
Mayor of Muhanga District

CC:
- Mr Vice Mayor in Charge of Social Affairs / Muhanga District
- Mr Executive Secretary of Nyambuye Sector

Households and Interviews guided questions

Google form link: https://forms.gle/LQbsk8Z4yKeCevqWA

Research topic: **Current Trends in Integrating Public and Green Open Spaces in Muhanga City Residential Neighborhoods. Case Study of Nyamabuye Sector**

Introduction

Generally, this research will assess the trends that are found when integrating public and green open spaces in urban residential neighborhoods. It will focus on space like; community gardens, playgrounds, urban natural reserve areas and publicly accessible courtyards in front of government buildings that are found in Nyamabuye sector**.** This will promote the sustainable urban development and enhance the community wellbeing of Nyamabuye residents**.**

Specific objectives of this study:

- To assess the level of integration of public and green open space in residential neighborhoods of Nyamabuye Sector.
- To identify challenges hindering the integration of public and green open spaces in Nyamabuye residential areas.
- To suggest policy option to enhance the integration of public and green open space in residential neighborhoods of Nyamabuye Sector.

N.B: Your responses will remain confidential and will only be used for academic purposes

Student name: Nzirorera Jean de Dieu **Supervisor: Dr. Uwayezu Ernest**

On……May 2025

Section A: Personal identification

1. What is Your Name?

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2. What is your age?

- 18-25
- 26-35
- 36-45
- 46-55
- 56 and above

3. What is your gender?
    - Male
    - Female
4. What is your highest level of education?
    - Primary education
    - Secondary education
    - University education
    - Other
5. How long have you lived in Nyamabuye Sector?
    - Less than 1 year
    - 1–5 years
    - 6–10 years
    - Over 10 years

Section B: Assessing the Level of Integration of Public and Green Open Spaces

5. Are there public or green open spaces near your home?
    - Yes
    - No
    - Not sure
6. If yes, how often do you use these spaces?
    - Daily
    - Weekly
    - Monthly
    - Rarely
    - Never
7. What activities do you typically do in these spaces? *(Select all that apply)*
    - Exercise (e.g., walking, running)
    - Relaxation or leisure
    - Social gatherings or events
    - Community meetings
    - Children's playtime

- Gardening or nature activities

8. On a scale of 1–4, how satisfied are you with the availability of public/green spaces in your neighborhood?
    - Strongly satisfied
    - Satisfied
    - Unsatisfied
    - Strongly unsatisfied
9. Do you think public and green open spaces are enough into the neighborhood design?
    - Yes
    - No
    - Unsure
10. What improvements would you like to see in existing public/green spaces? *(Open-ended)*

Section C: Identifying Challenges Hindering Integration

11. What do you think are the biggest obstacles to integrating Public and Green Opens Spaces in your neighborhood? *(Select up to 3 options)*

- Lack of available land
- Insufficient funding or investment
- Poor urban planning or design
- Lack of community involvement
- Competing development priorities (e.g., housing, businesses)
- Security or safety concerns

12. Have you ever been involved in community discussions about public and green open space development?

- Yes
- No

13. Do you feel that local authorities prioritize creating and maintaining public/green open spaces?

- Yes

- No
- Not sure

14. In your opinion, what social or environmental challenges arise from the lack of public and green open spaces? *(Open-ended)*

Section D: Policy Suggestions to Enhance Integration

15. What strategies do you think would improve public and green space integration? *(Select all that apply)*

- Designating more land for public parks
- Community-driven green projects (e.g., urban gardens)
- Incentives for developers to include green spaces in residential areas
- Regular maintenance and security measures
- Awareness campaigns on the benefits of public and green open spaces

16. Would you be willing to participate in community initiatives for creating or maintaining green spaces?

- Yes
- No
- Maybe

17. What role do you think local authorities should play in enhancing public and green open space integration? *(Open-ended)*

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18. Do you think policies should mandate a minimum percentage of public and green open space in every residential area?

- Yes
- No
- Not sure

19. If you could suggest one change as recommendation to improve public and green open spaces in your community, what would it be? *(Open-ended)*

Final Thoughts:

20. Would you like to be informed of the research findings or future community initiatives?

- Yes (provide contact info):
- No

Thank you.