EFFECTS OF URBAN SPRAWL ON AGRICULTURAL LAND USE IN PERI-URBAN AREAS OF WOTE TOWN, MAKUENI COUNTY, KENYA

KWAMBOKA ALICE OMASIRE

A Research Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Environmental Management of South Eastern Kenya University

2024

DECLARATION

I understand that plagiarism is an offence and I therefore declare that this project is my original work and has not been presented to any other institution for any other award.

Signature: _____   Date: _____

Alice Kwamboka

Reg No: I501/WTE/20348/2013

This research project has been submitted for examination with my approval as university supervisor.

Signature: _____   Date: _____

Dr Joshua Matata Kimondiu

School of Agriculture, Environment, Water and Natural Resources

Department of Environmental Science and Land Resources Management

Signature: _____   Date: _____

Dr. Patrick Kariuki

Geothermal Training and Research Institute (GeTRI)

Dedan Kimathi University of Technology (DeKUT)

ACKNOWLEDGEMENT

I thank the Almighty for giving me the gift of life. I am grateful for His love, guidance, and safety.

My supervisors who have been exceedingly helpful and understanding throughout the writing process, deserve my deepest appreciation. Your intellectual guidance, insights, and constructive criticism motivated and inspired me. The feedbacks given were quite helpful, and all of your advice came in handy during the process of formulating the proposal and writing this thesis.

My heartfelt gratitude goes to my family for their consistent support and for giving me inspiration and mental fortitude to persist with my studies despite the difficulties. I would want to offer my deepest appreciation to my support system for their steadfast support during the project development.

DEDICATION

I dedicate this work to my family, my Son Jeremy, my Daughter Eliana, my friends who supported me, above all myself.

TABLE OF CONTENTS

CHAPTER ONE

CHAPTER TWO

CHAPTER THREE

CHAPTER FOUR

CHAPTER FIVE

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABSTRACT

Urban sprawl, often known as unchecked urban growth, is a major global issue because of its impact on the nearby agricultural land. Urban spatial growth is an inevitable process, which is why regulations are necessary. The unchecked growth of urban areas, also known as urban sprawl, poses a worldwide threat to agricultural land because of its impact. The goal of the study was to ascertain how urban sprawl in Kenya's Wote town, Makueni County, affects agricultural land. The specific objectives of the study include; establishing causes of urban sprawl, assessing land use change and spatial extend of town since devolution, reviewing the existing urban and environmental policy and spatial framework in Wote town and documenting the interventions by institutions in dealing with land use change. Structured questionnaires were utilized in conjunction with descriptive and correlational study designs to gather data. The primary data was then acquired through key informants and field observations, while secondary data was gathered from secondary sources. Geographic Information System (GIS) was used to create temporal maps of land use changes in the study region. The data was taken from randomly selected sampling points in the peri-urban regions of Wote town's Kamunyolo and Unoa sectors. The acquired data was analyzed using SPSS and displayed using graphs and charts. The study found that Wote Town's urban sprawl has had an impact on agricultural land in the urban periphery. This is evidenced by the county's shifting labor market, land subdivision, loss of agricultural land, increased land rates, and environmental land degradation. The study established the need for institutionalizing stakeholder participation in urban and land use planning processes is essential.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Urban sprawl, often known as unchecked urban growth, is a major global issue because of its impact on the nearby agricultural land. Urban spatial growth is an inevitable process, which is why regulations are necessary. One of the primary production inputs and a crucial component of any country's socioeconomic growth is land (Aribigbola, 2008; D. Dadi et al., 2016). However, the availability of this rare and precious resource is fixed, necessitating sustainable use (Azadi et al., 2011). Since the majority of people in developing nations depend on agriculture, land is a valuable resource (Tuyen & Huong, 2013). As a result, any modification to the agricultural land usage needs to be carefully planned in order to preserve the land and lower the likelihood of endangering the people's way of life.

Research indicates and records that continued urbanization and economic expansion are inevitable worldwide phenomena that cause urban expansion into agricultural areas (Azadi et al., 2011). Agricultural Land Conversions (ALCs) have been shown to have good effects on local communities in certain studies, but detrimental effects have been reported in others (Chen et al., 2015). Thus, it is beneficial to identify the primary causes of land conversion (LC) and make plans to lessen their effects on the local population's standard of living and the environment.

According to (Dupras et al., 2016) the problems with sustainable urban growth in Canada are primarily related to urban sprawl. It typically results in a variety of effects related to landuse change, such as the loss of delicate natural areas, farming, and ecosystem fragmentation, all of which have a detrimental effect on the generation of a variety of ecosystem services. Scientists have long maintained that the patterns of expansive urban and suburban growth are having unfavorable effects on the environment, including habitat fragmentation, air and water pollution, higher infrastructure costs, inequality, and social homogeneity (Kioko et al., 2022)

According to (Jiang et al., 2013), there is a correlation between decreased agricultural land use intensity and urban land expansion in China.

(Okeleye et al., 2023)Mohammed (2021) also noted that urban growth in Kwara state, Nigeria, is one of the main drivers of land use change, having effects that are felt locally, regionally, and internationally. One such effect is the extension of urban areas onto agricultural land. According to (Kioko et al., 2022) there was a significant conversion of agricultural land to residential estates on the urban periphery between 2000 and 2010, which was developed either by the government, the private sector for their workers, or by property developers for sale. According to Mkumbukwa (2017), Zanzibar City grew by 40% between 2004 and 2013. Constraints related to land usage and the pre-existing construction pattern played a major role in driving spatial patterns of expansion.

The need for land for urban development has increased in Kenya as a result of urban sprawl. There aren't any empty land parcels in Nairobi city, according to (Thuo, 2010) instead, they're located on the rural-urban edges of the surrounding districts. This is due in part to the lower land costs, the high rents in the urban core, and the legal flexibility to utilize land however one pleases in the rural-urban periphery(Thuo, 2010). The conversion of agricultural land into residential purposes has affected the land market, social structure, land ownership, spatial organization, and agricultural output dynamics in these areas.

Kioko et al. (2022) claims that since 1995, Kiambu County, which is located outside of Nairobi, has lost almost 40% of its arable land to city projects as a result of declining agricultural land returns. The protracted production chain and droughts that have reduced harvests haven't helped either. Due to this, the farmers have experienced significant losses and have been forced to look for other uses for their land (Eichsteller et al., 2022). A portion of agricultural land will ultimately be covered by urban expansion, but owners frequently leave land undeveloped because they anticipate profit from selling it or putting it to other non-agricultural uses.

Wote town started as a district headquarters of the Makueni district and is currently the headquarters of Makueni County. This has seen the town expand at a faster rate developing from a peri-urban area to an urban setting with the introduction of Wote Municipality. The expansion has encroached on nearby agricultural area, resulting in a structural shift from agriculture to urban living (Mutua, 2013). The passage of a new constitution in Kenya granted counties authority over land issues and, as a result, the obligation of land conversion since land was recognized as a vital factor in local development (Msofe, 2019). The purpose of this study was to ascertain how urban sprawl affects agricultural land in the neighboring areas of Wote town.

1.2 Problem Statement

Concerns about urban development and its impact on agricultural land are widespread, not just in Kenya but globally. In many regions of the world, population and urban centers are expanding quickly at the expense of the surrounding agricultural land. Cities have been forced to expand into their rural borders in order to accommodate urban developments, which has an impact on the local population and environment (Njiru, 2016). This is a result of the increased demand for land in towns owing to urban sprawl worldwide.

Though there have been prior attempts both internationally and in Kenya to assess the impact of urban sprawl on agricultural land, very little, if any, research has been done in Wote town. This creates a geographic gap that our study seeks to close.

Considering the difficulties, it presents worldwide, very few research have focused on how sprawl affects agricultural land usage (W. Dadi et al., 2023).Geographic information systems and remote sensing have been employed in other investigations, although mostly for change detection giving an example of a conceptual gap (Trivedi et al., 2022). According to (Njiru, 2016), land use planning, monitoring, and controlling the expansion and development of Wote, for example, has proven to be a difficult undertaking. Its development is governed by a highly lax, inadequate, inappropriate, and narrowly focused process; efforts to enforce planning laws are fiercely opposed and infrequently

put into action. The study aimed to ascertain the impact of urban sprawl on agricultural land usage in Wote town in order to close the conceptual gap.

1.3 Objectives

The broad objective of this study was to examine the effects of urban sprawl on agricultural land in peri-urban areas of Wote town, Makueni County.

1.3.1 Specific Objectives

   i.   To establish the causes of urban sprawl in Wote town.

  ii.   To asses land use change and spatial extent of the town since devolution.

 iii.   To establish the role of institutional and policy frameworks on land use change.

1.4 Research Questions

   i.   What are the causes of urban sprawl in Wote town?

  ii.   What are the main land use changes and spatial extent of the town?

 iii.   What are the intervention measures taken to deal with land use change?

1.5 Justification of the Study

Agricultural land is decreasing over time; this will possibly lead to a major food crisis, significantly in African nations wherever increasing agricultural productivity is accomplished by extension instead of intensification. To avoid this catastrophe, governments should manage agricultural land use conversions by implementing sturdy environmental rules and land management frameworks will this be potential (Muigua, 2021).

The Constitution of Kenya, the Land Management Act, Chapter 302, the Government Act, Chapter 265, and the Physical and Land Use Planning Act of 2019 provide guidance on agricultural land-use conversions. However, there is scarce land use management framework to guide agricultural land conversions.

1.6 Assumptions of the Study

The research assumed that the subject region lacked distinct environmental policies and planning framework. Furthermore, the study considered that there is insufficient data/documentation on the degree of urban sprawl and its consequences on plant cover and other livelihood activities such as agriculture, as well as family settlement disturbances in the studied region.

1.7 Scope of the Study

The study solely looked at Wote town's peri-urban regions and the consequences of urban sprawl on agricultural land in two sub-locations of Wote ward in Makueni County namely; Unoa and Kamunyolo. This was determined by purposive sampling since the town is heavily concentrated in these locations.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

This chapter provides a review on the literature of the study variables. The chapter will discuss scholarly studies and literature on causes of urban sprawl, effects of urban sprawl, policy frameworks on Kenya regarding urban planning and the conceptual framework.

2.2 Causes of Urban Sprawl

The causes of urban sprawl on agricultural land are many and varied, among which is rapid population growth caused by two factors: population growth and migration to metropolitan areas (Morelli et al., 2012). Lack of planning rules and guidelines in providing solutions to reduce the distribution of agricultural land is another challenge for urban growth, which is due to local decision makers not being experts in planning and management work(Dupras et al., 2016). Trade and government industry efforts based on false predictions of future development may also contribute to urban sprawl(Bhatta, 2010). Misinterpretation of by-laws by many people contributes to urban sprawl with the exception of major cities. As a result, many engineers and individuals believe that some areas are better than others. The expansion of cities is due to the desire of municipalities to expand their cities in order to increase revenue through tax control. As a result, the farmland is converted into residential and commercial areas.

Farmers are often urged to sell rather than keep a risky farming business on the outskirts of urban areas(Abu Hatab et al., 2019; Beckers et al., 2020). Because farm production includes farming, housing, and other public buildings, the cost of restoring the built infrastructure is much lower than the value of agricultural land products. Since urban planning organizations are separated from economic and social planning activities, regulatory concerns arise, necessitating long decision-making and legislative procedures. Sprawl can be induced by unsuitable physical topography, such as rocky terrain, marshes, mineral deposits, or water bodies. As a result, providing infrastructure services comes at a significant financial cost.

Some of the factors contributing to urban sprawl include the shortage of affordable housing for low-income residents. This is due to the high cost of land and the lack of access of developing on it (Chiesura, 2004). Due to the lack of comprehensive land use plans and government-approved planning strategies and policies in areas outside the boundaries of cities and towns, slum areas have resulted to urban sprawl as (Tarawneh, 2014) makes reference to (Jaradat, 2009). To plan a city, special area limits are used. Many poorer governments have planning strategies, but they are rarely used (Tarawneh, 2014).

2.3 The Effects of Urban Sprawl

Land is one of the significant natural resources. Once the agricultural land has been converted for urban use, its effects fall under the irreversible category (Slätmo, 2017). These effects are classified into; economic effects, environmental effects and social effects.

One of the immediate effects of agricultural land reform is the decline in food production which is detrimental to national food security. Urban sprawl undermines key natural resources such as agricultural land, which is considered one of the most important in the economy. Thus, each of the world's low productive agricultural producers (Balandi et al., 2023). Taxes are being raised (bad for the people are good for the government).

The proliferation of urban areas can contribute to desertification. The United Nations Development Program (UNDP) defines desertification as the development and spread of desertification conditions that lead to lower biodiversity production and, as a result, food insecurity (UNDP, 2013). Desertification is defined by the United Nations Conference on Desertification (UNCCD) as a critical and low-energy force, leading to desert-like conditions. As a result, soil fertility is lost, and the soil lacks the nutrients needed for plant development, making it unsuitable for farming. Due to urban growth, temperatures are rising. Those with significant urban sprawl face more than twice as much as cities with denser developmental patterns (Balandi et al., 2023)

As a result of sprawl, people are becoming emotionally disengaged, less physically and socially engaged (Balandi et al., 2023). The reason for this is because people in large nations like to drive more. Urbanization is to blame for the disintegration of social communities. The sprawls' houses are massive, with large backyards that separate neighbors. As a result, social contact between neighbors in rural regions is far lower than in cities. (Tarawneh, 2014).

2.4 Policy Framework in Kenya

Some of the relevant policies affecting agricultural land use conversions to urban uses in Kenya are discussed in this section. They include national land use policy, National Land Policy, Agricultural Sector Development. The section also discusses existing legal framework that governs land use and planning in Kenya such as the constitution of Kenya, 2010. Physical and Land Use Planning Act of 2019, and The Housing Act.

2.4.1 National Land Use Policy

The Kenyan National Land Use Policy underscores the importance of sustainable land management practices to optimize land resource utilization. It advocates for integrated land use planning to mitigate conflicts among various land uses, encourages community participation in decision-making processes to foster local ownership, and endorses secure land tenure systems to stimulate investment and promote sustainable management practices.

Concerning agricultural land conversion, the policy prioritizes the safeguarding of agricultural land critical for food production, discouraging its conversion to non-agricultural uses without comprehensive assessment. It establishes stringent regulations to assess the impacts of such conversions, thereby ensuring that food security remains a central concern. Furthermore, the policy advocates for sustainable agricultural practices that enhance productivity while minimizing land degradation, ensuring that any conversions are both justified and environmentally sound.

2.4.2 Kenya Land Use Policy gaps and Challenges

Kenya did not have a clearly defined and integrated national policy from its independence until the end of 2010, when it was established. A complex system of land administration and management has emerged from this, along with a host of land laws, some of which are contradictory. Kenya has had a world crisis since the formation of the colony; successive rulers have not been able or willing to solve it. As a result, there are now environmental, social, economic, and political problems. Land degradation, and landlessness are just a few examples. Other factors include the legacy of groups and individuals, urban sprawl, limited agricultural land use and disposal, settlement instability and violence. To address these issues, the Kenyan government created a National Global Policy in 2010, with the aim of guiding the country towards a sustainable future.

As a result, this policy promotes the development of a National Land Use Policy on the basis of comprehensive land use terms and conditions. In addition, the strategy acknowledges that land use has become a major concern for Kenyans in both urban and rural regions. At the level of land use policy, a few key challenges identified by the policy must be addressed. Land disputes over land use competition, uncontrolled subdivision of agricultural land, especially in areas with high levels of small farmland, low productivity, poor quality of land due to poor land use practices, indiscriminate land sales and purchases, lack of alternative land use and diversity planning of the rural economy, and untested urban sprawl are just a few examples.

Other challenges include unproductive and speculative home ownership, unrestricted development, and widespread disregard for planning rules. In addition, concerns involving unsustainable agriculture, adequate land use planning, environmental abuse, and the protection and management of an ineffective ecosystem are all too common and require legal intervention. In addition, urban agriculture did not benefit from good governance and simplicity. This points to Kenya's lack of planning and control of land use. As a result, it is at risk of experiencing unstable growth and environmental degradation.

2.4.3 The Agricultural Sector Development Strategy

Kenya's main national policy document for all agricultural sector stakeholders is the Agricultural Sector Development Strategy 2010-2020 (ASDS). The Agricultural Rehabilitation Strategy has been revised (SRA). Agriculture is linked to food security, poverty reduction and overall development. The expansion of the industry is driven by two strategic objectives: product growth, development, and management of key production components.

According to ASDS, land is the most vital commodity in agricultural production. In addition, a lack of rich soil is a major impediment to increasing agricultural output (. The lack of a cohesive land-use policy, according to the approach, has resulted in unprofitable property subdivisions and bad land-use practices. Soil deterioration has escalated as a result of these approaches, and land yield has dropped. Agricultural land conversion is unquestionably a problem that must be addressed by a capable land use management framework before things worsen. Kenya's rain-fed agriculture is largely reliant, and lush rain-fed agricultural land is scarce. It is necessary for Kenya to fulfil her objective of a food-secure and wealthy nation, as envisioned by ASDS.

2.4.4 National Spatial Plan

The national spatial plan (2015-2045) taken by governments to determine the future distribution of activities in space is known as spatial planning. It aims to balance development demands by simplifying the national land use framework and forging ties with environmental protection. It also regulates the repurposing of land and property. In essence, the National Spatial Plan seeks to improve people's social and physical growth, as well as their quality of life, in order to promote a healthy competitive economy and provide the finest possible environment.

Despite the fact that having a National Spatial Plan (NSP) is beneficial for a variety of reasons, Kenya does not have one. Both the Kenya Vision 2030 and the National Land Policy stressed the need of a national spatial plan, stating that a National Spatial Plan must be prepared and implemented in order to achieve the above goals. The Kenyan

government, on the other hand, has commenced work on a comprehensive National Spatial Plan (NSP) that will guide physical development projects for the next 50 years.

2.4.5 Land Use Regulatory and Institutional Frameworks in Kenya

The various and different bodies in charge of land management in both urban and rural Kenya are the consequence of a century's worth of legislative and administrative mandates. In general, Kenya's land institutions are seen as highly centralized in the Ministry of Lands and the Presidency; underperforming in service provision and underfunded; corrupt, and failing to incorporate stakeholders in decision-making. Furthermore, the institutions use a manual, inefficient, and desperately needed computerized land information system, as well as intricate legal and administrative processes that users do not understand or that are not handled as effectively as they should be (The National Land Policy, 2010).

To promote efficient, effective, and fair service delivery, the National Land Policy urged a complete overhaul of the current land administration and management system, as well as related institutional structures. The new suggested institutional framework, on the other hand, is still being put together and is not yet in place.

The Kenyan Constitution is the country's supreme law, binding all individuals and government organizations at all levels. The Land Control Act, Chapter 302, and the Physical and landuse planning Act of 2019, are two other statutory frameworks for land use control in Kenya. The enforcement of these restrictions is the responsibility of municipal land control boards and local governments. Local land control boards have the jurisdiction to allow agricultural land use amendments under the Land Control Act.)

2.4.6 The Constitution of Kenya (2010)

In a functional world, the constitution can express and direct broader concepts about land and provide an effective and equitable institutional framework for land ownership, and administration. Land policy reform is difficult to achieve without strong constitutional support. However, in the history of the Republic of Kenya, the expected constitutional

amendment was not adopted until the end of 2010. The government did not take responsibility for its own administration, which took place under a framework that did not allow for genuine public participation, which resulted in a large number of cases. in the context of the negligence of land resources.(Government of Kenya, 2016). According to Article 10 of the new Constitution, law, democracy, and citizen participation, as well as good governance, integrity, transparency, and accountability, are among the values and principles of governance that bind all organs of State, State officials, government officials, and the general public. Section 232 also sets out the principles and principles of public service, such as high ethics, efficiency, effectiveness, and economic resource management, accountability, speed, efficiency, fairness, and equity of service delivery, public participation in policy making, administrative accountability, and transparency and timeliness right, accurate public information, to name a few.

In addition, Article 43 (b & c) of the new Constitution, which deals with economic and social rights, states that everyone has the right to accessible and appropriate housing, to fair sanitary standards, to be free of hunger, and to have adequate food of acceptable quality. This means that the government must make every effort to provide appropriate and cheap housing, as well as adequate agricultural production to feed the population. These two conflicting objectives will not be met until effective and suitable land use management strategies are implemented.

2.4.7 The Physical and Land Use Planning Act, 2019 No. 13 of 2019 Laws of Kenya

This is an Act of Parliament that governs the design and implementation of building development plans, and other related matters. In the interests of the proper and orderly development of their area, local governments may restrict or restrict the development of land and buildings, the subdivision of buildings, and the implementation of approved spatial development programs, among other things, under this Act. As a result, no one should be able to expand within the area of jurisdiction of the local council without obtaining development approval from the authorities. The development request should be sent to the relevant local council secretary, along with any applicable plans and details, and forwarded to the Director of Construction Planning for comment.

Other relevant authorities, such as the Director of Research, the Director of Agriculture, and the Director of Urban Development, may be consulted as required by the local council. The following factors should influence local government decisions: effective regional or local programs, public health, resources, and resources. Any application for development that includes the subdivision or modification of agricultural land use must be reported to the relevant local land administration board.

The local council may grant (conditionally or unconditionally) or refuse (state reasons for refusal) development permit, subject to any comments made by the Director of Construction Planning on the development application submitted to it. The law also stipulates that user change notices must be published in two daily newspapers and included in the package of the building in question. Consequently, unlike the Constitution, this Act does not provide for public consultation (2010).

2.4.8 The Housing Act, Chapter 117, Laws of Kenya

An Act of Parliament to provide for public money loans and grants for the building of residences, as well as to establish a housing fund and a housing board for these objectives. As a result, this Act does not govern housing building per se; rather, it is intended to direct the National Housing Corporation's activities, which are a tiny part of the housing industry. As a result, one might argue that the housing market is unregulated. Because this Act is ineffectual, Kenya's government is working on establishing a new Housing Law to control the housing sector.

2.4.9 Land Use Planning in Kenya

The search for acceptable land uses, as well as efficient and sustainable management techniques, is complicated by links between the environment, the economy, and society, and proper land use planning, design, and management needs a careful balancing of multiple aims. As a result, land use planning is a procedure for creating and implementing spatial frameworks for the efficient management of human activities. The fundamental purpose is to ensure that such activities are conducted in a manner that maximizes economic, safety, aesthetic, land-use harmony, and environmental

sustainability. As a result, legislative, legal, and institutional frameworks address land use planning and management (Masakazu, 2003).

Guidelines or regulations are developed at the policy level to guide decisions and promote fair land use. Policies are then implemented by legal and institutional frameworks, which suggest that policies should be developed before legislation is enacted, and that institutions are responsible for setting policies and regulations in place. (Wasrag, 2012).Land use planning is widely regarded as essential for effective and long- term use and land management and land-based resources. In Kenya, however, adequate efforts have been made to ensure that these systems are fully developed and implemented. This is due to clear operational differences between planning and agency authorities, lack of adequate technical and institutional capacity within local government, and lack of adequate human resources in the planning system.

This situation is exacerbated by the lack of national land use policy. Unchecked urban sprawl, land use disputes, and environmental degradation are examples of these challenges. In addition, development control (also known as Police Force), which is the Government's mandate for the administration of property rights in the world, has never been used extensively across the country to restrict or otherwise regulate land use and enforce sustainable land use practices. In addition, Police Force is exercised by various government agencies, all of which have different functions, leading to ineffective regulatory framework (Government of Kenya, 2016)

Kenya also lacks current land use plans (for example, Agriculture Land Use Master Plans) and development control guidelines, resulting in urban sprawl and indiscriminate agricultural land conversion (The Kenya Vision 2030, (2007), the Nairobi Metro 2030 (2008) Strategy, and National Land Use Policy and Agricultural Sector Development Strategy 2010–2020).

In a good world, government will give all planning agencies in the country the authority to regulate land use for the benefit of the community, establish clear standards that go

beyond private land use procedures, and enforce enforcement measures. There should be a framework for international law in place, in particular. National agreements and policies relating to sustainable land use and conservation; ensure that the use of Police Force takes into account local or community principles regarding land use and environmental management and ensures effective participation in the use of Police Force (*Draft National Land Use Policy May 2016.Pdf*, n.d.)

2.4.10 Adequate and effective policy framework

According to the (*Draft-National-Agricultural-Soil-Management-Policy-NASMP-September-2020.Pdf*, n.d.), suitable and efficient policies and policy instruments should guide sustainable agricultural land use changes. The applicable policies should identify the situation of agricultural land and the desired future state, as well as the steps to be followed to achieve the desired future condition. As a result, policy should guide law before institutions implement it. Because certain land uses are "inferior" to others, for example, agricultural land use cannot compete with residential or commercial land use, policies should establish the general objectives of diverse land uses and safeguard against land use conflicts. As a result, we can confidently assert that a purposeful regulatory framework should exist to preserve agricultural land against unsustainable conversions to other uses.

2.5 Conceptual Framework
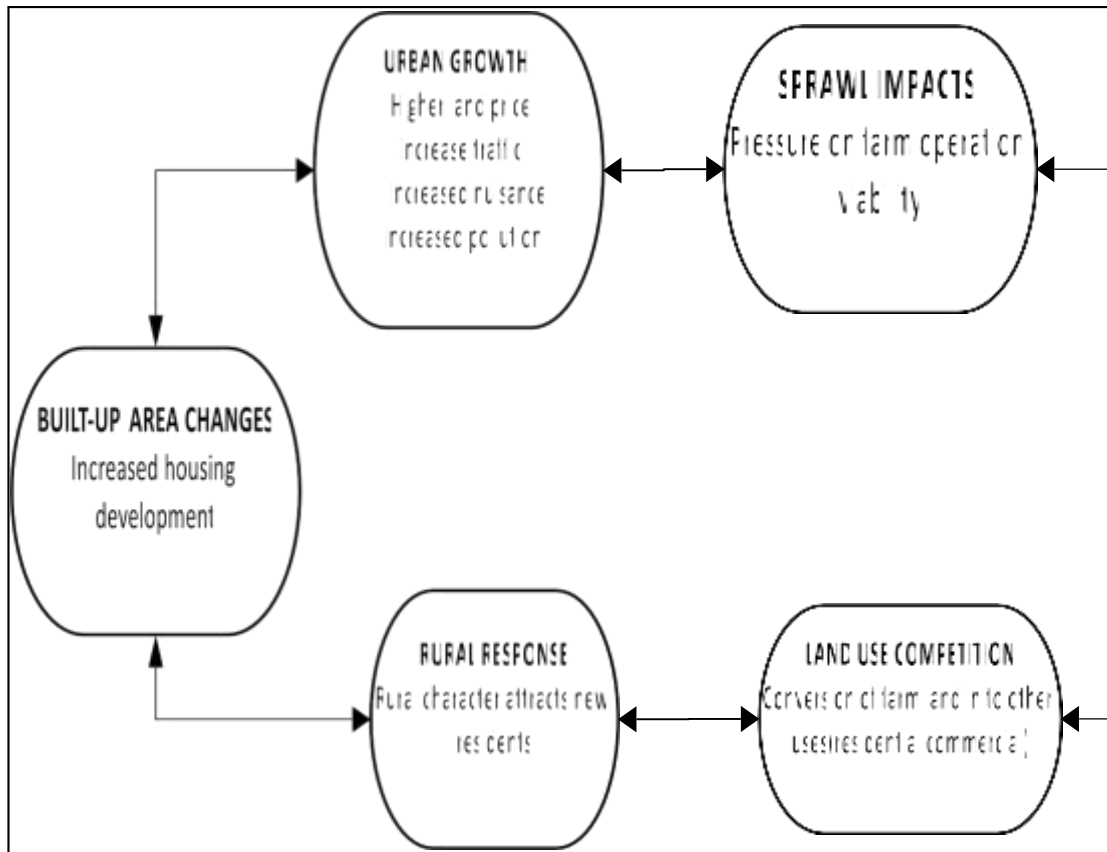
Figure 2.1: *Conceptual Framework.*

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Study Area, Materials and Methods

Wote is a Kenyan town located 106 kilometers east of Nairobi in Makueni County. With latitude 1.7833 degrees south and longitude 37.6333 degrees east, the town is located at a height of 1151 meters above sea level and has an area of 2.75 kilometers. . The town has a population of 5,542 and is connected to Machakos and Makindu (on the Mombasa – Nairobi route) by a C99 asphalt road (2019 Population census).

Figure 3.1: Location of Wote town, Makueni County

3.1.1 Location of the Study Area in Makueni County

Figure 3.2: Wote development plan showing current zones areas that have changed User and subdivisions

Source: Government of Makueni County

3.1.2 Physiographic Conditions

Low lying grassland with sandy loams and clay loamy soils characterizes the township region. It is located in the country's arid and semi-arid zones. It is mainly a low-lying a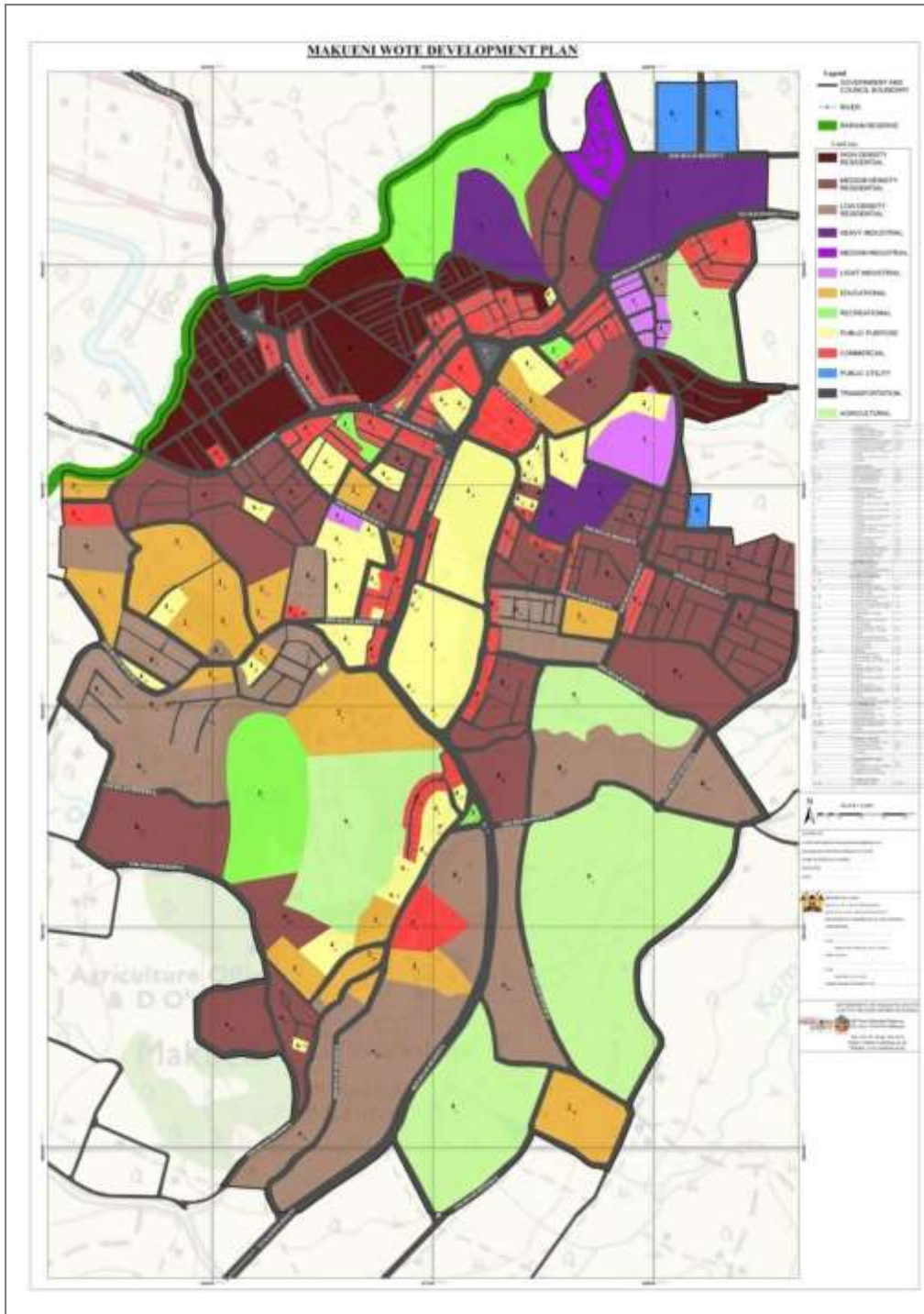rea with a maximum elevation of 1151m above sea level. The town is in an agro-ecological zone with annual rainfall ranging from 300mm to 550mm. The yearly temperature ranges from 20.20 degrees Celsius to 24.6 degrees Celsius. The town is drained by a series of seasonal streams that flow in an east-west direction. The village is surrounded by sloping farmlands and open pastures.

3.2 Research Design

Due to its adaptability for data collection and ability to characterize the features of the population, circumstance, or phenomena, the study used a descriptive research design(Budnick et al., 2017). Features from both the qualitative and quantitative methodologies were incorporated into the design to preserve triangulation in the findings.

3.3 Population and sample size

The population under study was the households in Unoa and Kamunyolo location. According to the(KNBS, 2019) household census, the total households in the two locations was 10,104 with Unoa having 4996 households and Kamunyolo having 5108 households(KNBS, 2019). The study area was divided into two groups using Google Earth Maps and an exploration visit to the study area under the direction of the town planner (Kamunyolo and Unoa). The indigenous people who own the land and live in the study area were the target population of the study. The study also utilized key informants in the department of lands, landowners from the selected estates, real estate developers, town planners and, agricultural officers.

3.4 Sampling and sampling techniques

The study utilized the stratified simple sampling method for the households. This ensured that all the households in the two strata (locations) stood an equal chance of being selected. In the selection of key informants, purposive sampling was adopted that

included meaningful and simple selection. From each category five respondents were selected.

3.5 Sample size determination

The sample size for the study is calculated at 95% confidence level with a margin of error of 5%

The sample size was calculated using the formula below as given by (Mugenda & Mugenda, 1999)

$n = Z^2 pq / e^2$

Where:

n = is the preferred sample size for a target population of > 10,000

Z = table value from the normal table for a confidence level of 95% which is 1.96

 p = the percentage in the target population that assumes the characteristics being sought.
In this case a 50:50 basis is assumed which is probability of 50% or 0.5

q = (1-p) is the balance from p to add up to 100%. That is 1-p, which in this case is 100%- 50% which is 50% or 0.5

e = acceptable error at the confidence level of 95% which is 5% or 0.05.

The formula for the sample size was:

$n = n = Z^2 pq / e^2$

$n = (1.96^2 \text{x } 0.5 \text{ x} 0.5) / 0.05^2$

 n = 384

The sample size for a population of less than 10,000 is adjusted as shown below using the formula recommended by c

nf = n/ (1+n)/N

Where:

nf = the preferred sample size

n = the sample size

N = the target population which in this case is 4996 for Unoa and 5,108 for Kamunyolo

After substitution we get:

unoa

n = n/ (1+n/ N)

n = 384/ (1+384 /4996)

n = 216

kamunyolo

n = n/ (1+n/ N)

n = 384/ (1+384 /5,108)

n = 357

3.6 Data Analysis

3.6.1 Major Causes of Urban Sprawl

Data on the key drivers of urban sprawl was compared among study clusters among respondents. Ones that promote agricultural land preservation were compared to factors that promote land conversion from agricultural to commercial and residential usage. The perspectives of respondents on the economic, technical, and ecological advantages of agriculture were compared among clusters. SPSS was used to analyze descriptive statistics, and Chi-square tests were used to test the means.

3.6.2 Effects of Urban Sprawl on Agricultural Land

The data on the effects of urban sprawl on agricultural land was analyzed using SPSS and tested for significance and means separated using chi square tests at 5% level of significance.

3.6.3 Land Use Changes and Spatial Extent

The shift in land use with remote sensing is a rapidly growing topic due to the presence of remote sensing data, especially satellite imagery, and the easy interpretation provided by Geographical Information Systems (Ayuyo, 2012) Land use changes for different clusters between 1980 and 2015 were calculated by examining local landscape images over a period of 35 years. This required periodic and temporary data analysis from time to time to assess changes in land use due to the spread of the town.

3.6.4 Land Use Changes and Spatial Extent

Satellite data analysis and interpretation was used to evaluate changes in land use over time. This included determining the internal and exterior borders of the research region, as well as interpreting and analyzing the satellite images from 1980 to 2015 for land use/cover change.
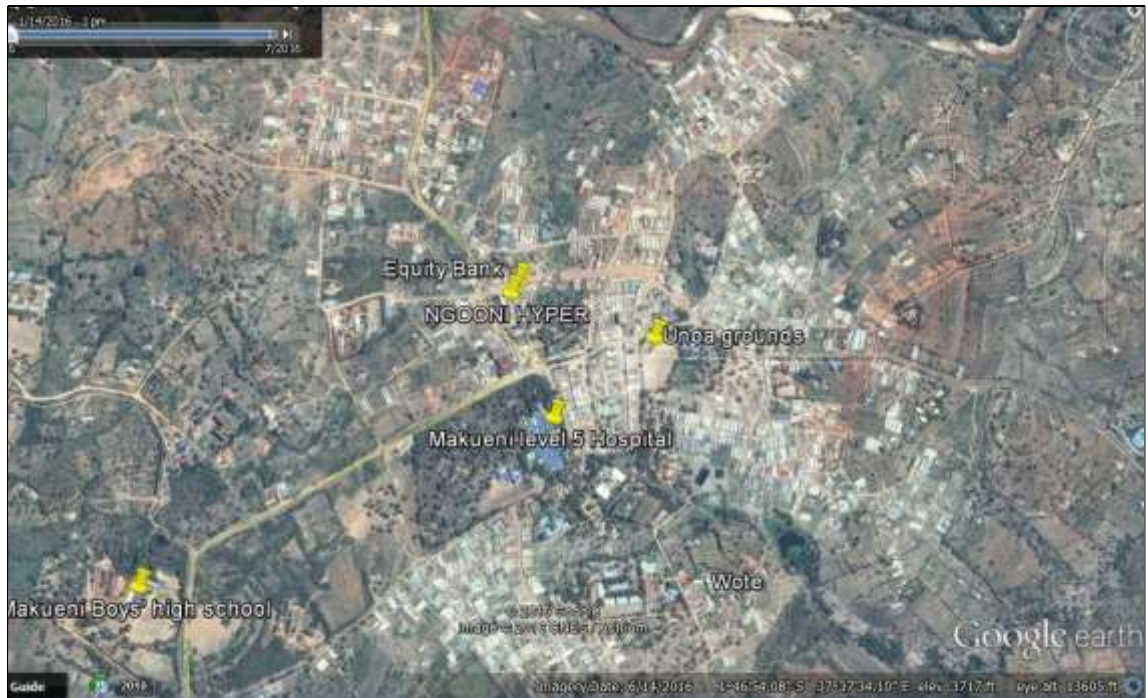

Figure 3.3: Satellite imagery showing urban sprawl in Wote town.in 2016. Source (Google earth)

CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

4.1 Introduction

The purpose of this study was to look at the effects of urban sprawl on agricultural land in the vicinity of Wote town, Makueni County. The findings serve as a basis for subsequent analysis and presentation, as well as a basis for conclusions and recommendations. Tables, graphs, and diagrams were used to present the study findings. Tables are chosen because they present facts in a logical way. Figures have been used to help convey the results in a way that reflects the current situation on the ground during the study as closely as possible.

4.2 Causes of Urban Sprawl in Wote Town

Based on the results, the causes of urban sprawl in the study area are many and varied and can be summarized in the following categories; low agricultural returns, demand for housing, increased urban population, weak and ineffective land institutions, subdivision of agricultural land, inadequate public participation and improvement in infrastructure as shown in figure 4.1 below.
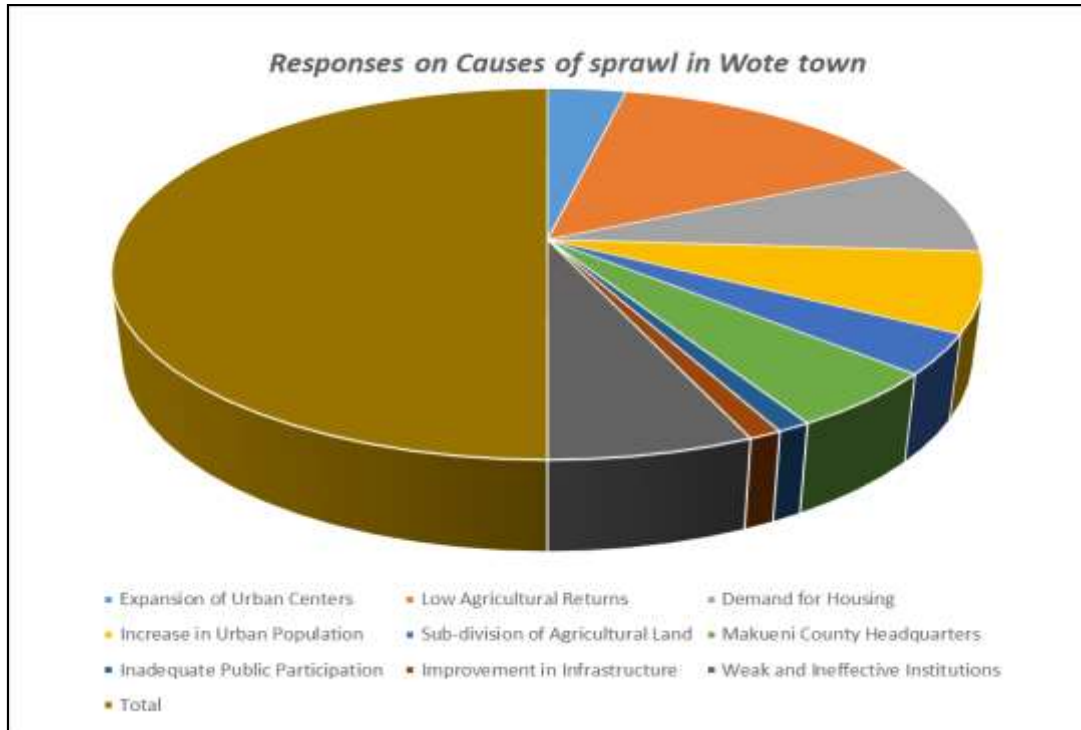
Figure 4.1: Responses on Causes of sprawl in Wote town. Source Author, 2024.

4.2.1 Low Agricultural Returns

The expansion of urban areas has often encroached on surrounding agricultural land, impacting local food production. As agricultural activities shift further from the town center, farmers may face challenges related to access to markets and resources. The need for housing and commercial spaces has resulted in the loss of prime agricultural land, raising concerns about food security and sustainable land management practices. According to the study, small economic profits from agriculture (29%) has had a significant impact on urban sprawl in the region. Multi-farm production and profit (especially on a small scale) are not enough, leaving smallholder farmers to remain poor.

This is due to lower profits from agricultural activities compared to other applications such as residential business. In addition, the study found no benefits (87 percent) for farmers to protect their agricultural land from the conversion of other consumers. For example, all respondents (100%) indicated that property prices increase when agricultural land is transferred to other purposes. For that reason, agricultural land use is considered

to be lower than other land uses; as a result, farmers were forced?? to convert their farms to increase their profits.

The low agricultural returns lead to an increase agricultural land conversion into residential areas. Many developers pay farmers large sums of money to buy agricultural land in order to develop habitats, which can take years, if not decades, for agricultural activities. A hectare of post conversion agricultural land could be sold for an estimated KSh. 8 million in Kenya, according to several housing consulting firms operating in the study area, such as Lloyd Masika Limited and Knight Frank Kenya, 2017. These findings are in line with the findings of a study done by(Kioko et al., 2022) on the conversion of agricultural land in urban areas.

4.2.2 Demand for Housing

Housing demand (16%) has the second largest impact on agricultural land use transitions. this might be explained by Kenya's present housing demand of about 165,000 units each year according to the Kenya Vision 2030 (GoK, 2015). Developers are enticing farmers to sell their farms for a higher and faster return on their real estate investment as demand for affordable homes rises. Furthermore, according to placement theories, households prefer to maximize utility while lowering commuting expenses to metropolitan areas.

The study findings are in line with the findings of (Msofe, 2019). The findings indicated that high flow of population in the urban areas increases the demand for housing. This further threatens the sustainability of agricultural land and simultaneously threatens the strategic role of agricultural land near urban areas.

4.2.3 Increase in Urban Population

Another element affecting housing demand is the growing urban population. According to the study findings, urbanization has the third highest impact (14 percent) on agricultural land use transitions. The need for housing in Wote has increased as the town's population has grown, resulting in a rise in building projects throughout the town and its vicinity. Increasing population has inevitably resulted in increased housing

demand, placing strain on agricultural land in peri-urban regions. The population of Wote town has grown from 14423 in 2009 to 18300 in 2019 according to the (*Makueni-County-Statistical-Abstract-2022.Pdf*, n.d.) by Makueni County Government. This has led to the sale of the once agricultural land for housing and development purposes in Makueni County.

These findings are in line with the findings of a study by (Mutua, 2013) which indicated that as the population grows, there is a rising need for housing and food, yet there is a limited amount of land available. This results in rivalry between agricultural and nonagricultural land uses, which leads to the conversion of agricultural land into other uses such as industrial and housing. In addition, Wote has experienced significant urbanization, driven by population growth and economic development. As the town serves as the administrative and commercial hub of Makueni County, there has been an increase in residential, commercial, and institutional developments.

4.2.4 Weak and Ineffective Land Institutions

A report by World Bank (2019) on the law enforcement and land transfer concurs with these findings. The report indicated that it has been demonstrated that land concerns, particularly those involving the transfer of roles, have a profoundly negative impact on the community, as has occurred in the conversion of agricultural land for housing and other uses. The report further indicated it has been demonstrated that land concerns, particularly those involving the transfer of roles, have a profoundly negative impact on the community, as has occurred in the conversion of agricultural land for housing and other uses.

In the research region, agricultural land subdivision (7%) adds to urban sprawl. According to the respondents, agricultural land parcels/farms are being fragmented into agriculturally unviable sizes that cannot generate significant returns, leaving conversion to other uses as the only viable option. Furthermore, in order to gain larger prices, farmers are subdividing their farms into tiny plots before selling them (in real estate, the bigger the parcel, the cheaper it is and vice versa).

4.2.5 Inadequate Public Participation

Inadequate public engagement in land use changes is another problem identified by the research as a contributor to urban sprawl (2 percent). The Physical and land use planning Act of 2019, laws of Kenya, has maintained insufficient public engagement in agricultural land conversions/land use decision-making processes. The Act makes no express provision for public engagement. According to UNEP (2002), effective public knowledge and engagement in land use decision-making are required for long-term land management. Public engagement is seen as a source of empowerment and a necessary component of democratic governance.

These findings are in line with the study by (Njiru, 2016) on the implication of conversion of agricultural land. The study findings indicated that public participation is crucial in the sustainable management of land resources. The citizens should be involved in the decisions process of the conversion of agricultural land into other uses. The involvement of public will ensure good governance and provide guidance on the use of land and sustainable conversion of land into other uses while taking into consideration the need for agricultural productivity.

4.2.6 Improvement in Infrastructure

Infrastructure improvements were mentioned as a factor in agricultural land conversions (2 percent). This is due to the improvement of the road network, particularly in the previous five years. It is clear from the preceding data that the reasons of urban expansion in the study region are numerous and interconnected. This may result in the sub-division of agricultural property on the outskirts of towns into uneconomical proportions, pushing landowners to change their agricultural lands/farms to other uses with greater returns than farming. The condition is made worse by the existence of weak and ineffective land institutions, as well as a lack of public engagement.
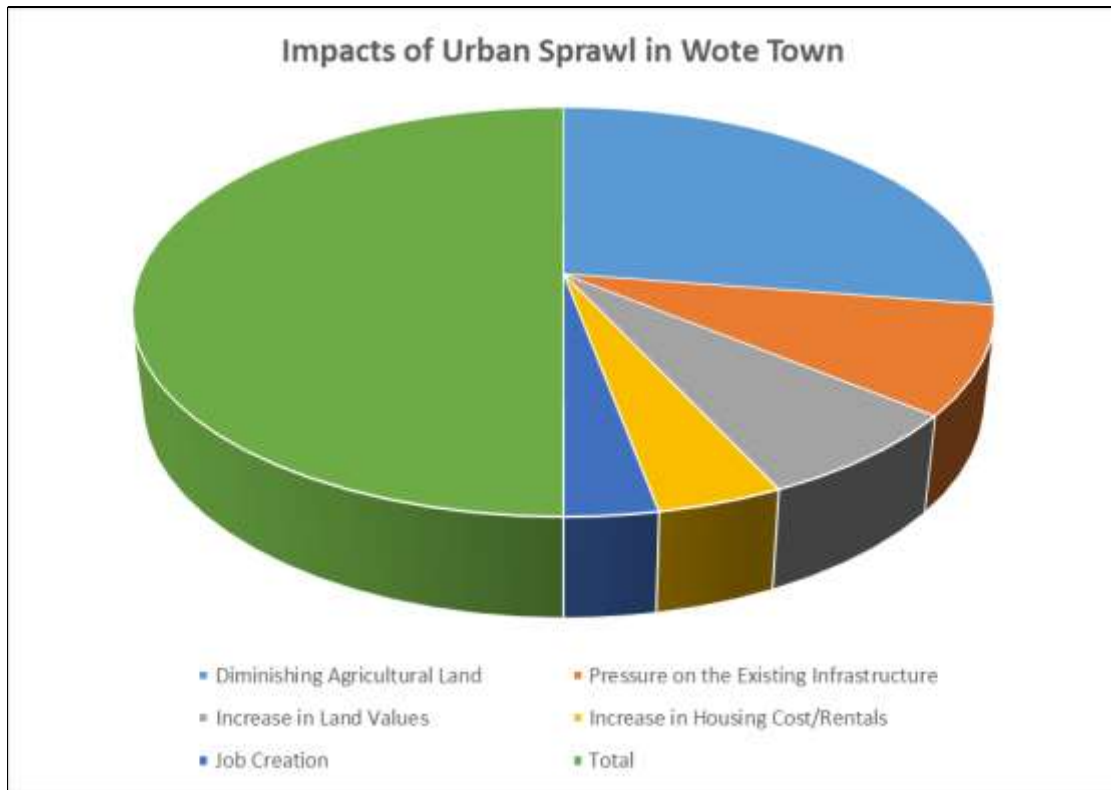
4.3 Land Use Change and Spatial Extent of the Town

Figure 4.2: Land Use Change and Spatial Extent of the Town. Source (Author,2023).

4.3.1 Diminishing Agricultural Land

According to the findings, urban sprawl has both positive and negative consequences. Loss of arable land has a very negative impact (55 percent). The study also found that urban sprawl is more common in the study area (75 percent), low agricultural land has a number of adverse internal and related effects, including food shortages, declining agricultural exports, and consequently reducing foreign exchange; and loss of agricultural employment opportunities, among others(Agricultural Industrial Development Strategy (ASDS) 2010-2020).

According to these findings, the value and quality of arable land has decreased over time, as has agricultural production. Wote, in particular, is still plagued by droughts and famines that are catastrophic, long-term, and unpredictable. As a result, in order for

Makueni to achieve its two goals of food security and sustainable development, urbanization must be managed continuously.

A report by World Bank (2019) indicates that a common misconception about urbanization's effects on agriculture is that it results in the loss of agricultural land due to urban expansion and a bias in public spending for infrastructure, services, and subsidies that favors urban areas. However, the extent of urban poverty shows that there is little indication of urban bias for the majority of the urban population, and it is obvious that urban demand for agricultural products has a significant impact on rural incomes. A vast range of goods and services, including access to markets, are dependent on urban-based businesses for agricultural producers and rural consumers.

4.3.2 Pressure on the Existing Infrastructure

Urban sprawl and uncontrolled developments have contributed to increased pressure on existing infrastructure by seventeen percent (17 (World Bank, 2019)(Gorgulu et al., 2023) Road network, water supply and electricity supply is increasing and there is more pressure due to the increasing demand for new accommodation as this was not considered during the initial installation. In the ideal case, infrastructure and services must be provided before development can take place, however, in the study area the provision of services and infrastructure is done without improving the capacity of the old infrastructure. The study agrees with (Gutu Sakketa, 2023) that indicated that the demand for electricity, water, and other essential resources rises as cities expand. This can put a heavy burden on the infrastructure required to provide and distribute these resources, especially in places with poor access to natural resources or where water scarcity is being made worse by climate change. Additionally, the increased population density in metropolitan areas may result in higher pollution levels, which may have an adverse effect on the quality of the air and water and provide health hazards to locals.

4.3.3 Increase in Land Values and Housing Cost/Rentals

Land value increases (14%) and housing costs/rentals (8%) were identified as implications of agricultural land use transitions. These have both good and bad consequences, depending on how they are seen. On the one hand, rising land values and housing costs/rents result in better profits for real estate investors/landowners.

For example, once a farm is converted to residential use, the value rises and the investor earns a higher return on his investment. Similarly, if the farm is developed, the resulting housing costs/rentals will be greater to allow the investor to cover the increasing cost/value of the property while still making a profit. On the side of the real estate investor/landowner, this is desired (positive).

On the other hand, when land prices and housing costs/rents rise, local residents/farmers who cannot pay the high land values and housing costs/rents are likely to be removed off their lands as living conditions become expensive.

4.3.4 Creation of Jobs

The study area's employment creation (6 percent) is perhaps the only apparent beneficial outcome of agricultural conversions. The development of residential estates creates work possibilities for a variety of local citizens in a variety of tasks such as land clearing, estate building, and transportation of construction supplies, among others. However, because the employment is restricted to the life of the building project, they cannot be depended on to support the livelihoods of local inhabitants. This was discovered during a field investigation in which people were observed working on construction sites. After questioning several of them, it was discovered that the majority of them are working on a part-time basis (usually on daily basis).

The findings are in tandem with a report by World bank (2019) which indicated that Cities have historically been the center of economic growth, employment creation, and the eradication of poverty.

4.4 Institutional Intervention in Dealing with Urban Sprawl

The findings concur with the report by (Verweij et al., 2014)which indicate that urban planning initiatives are ingrained in complex urban systems where people, non-profits, commercial players, and several interdependent governmental agencies transform metropolitan environments. Institutional interventions are founded on boundary choices on the institutional arrangement's substance, who participates in the planning process, and how it will be implemented.

These boundary choices allow for activity in intricate urban systems: "Boundaries protect the delineated territory from environmental intrusion by serving to seal off the productive core, buffer it, level or smooth variability inputs and outputs, forecast variations and uncertainty, and impose rationing". In addition, other relevant rules, such as the county spatial plan, must be in place to govern land use changes.

Table 4.1*: State of agricultural land use management framework*

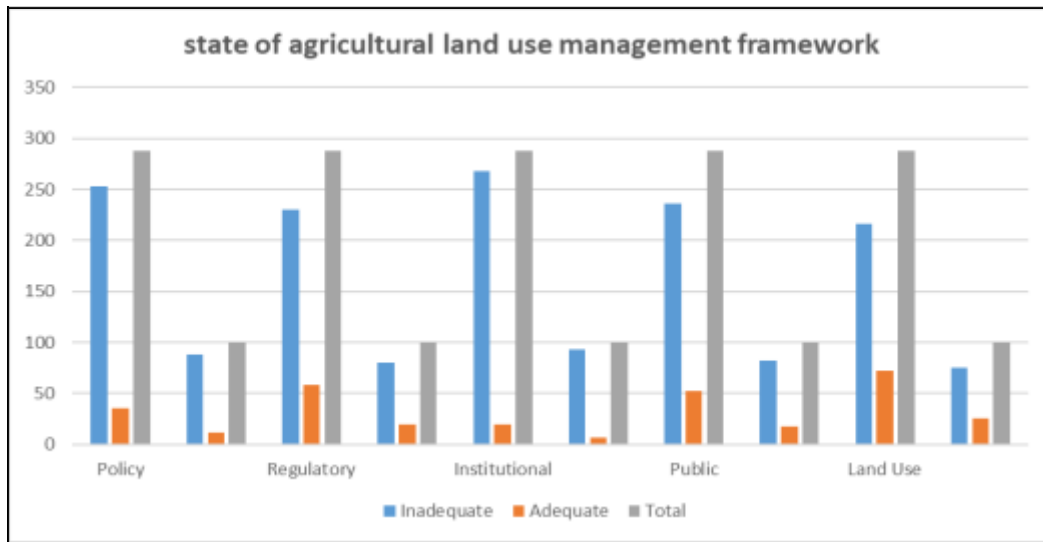| State	Policy Framework		Regulatory Framework		Institutional Framework		Public Participation		Land Use Planning	
	Responses	%	Responses	%	Responses	%	Responses	%	Responses	%
Inadequate	253	88	230	80	268	93	236	82	216	75
Adequate	35	12	58	20	20	7	52	18	72	25
Total	**288**	**100**	**288**	**100**	**288**	**100**	**288**	**100**	**288**	**100**

Figure 4.3: State of agricultural land use management framework.

32

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The study findings indicated that there was a positive and significant relationship between the consequences of urban sprawl and the decline in agricultural land and environmental challenges. The study came to the conclusion that urban sprawl has resulted in disputes, increased land/environmental degradation, loss of agricultural land, and depletion of fertile agricultural land. The study also found that the effects of urban sprawl included rising land prices, loss of agricultural land, greater subdividing of land, and altered labor and market circumstances.

The results shows that urban sprawl is caused by a variety of variables, including low agricultural yields, increased demand for housing, a rise in urban population, and weak and ineffective land institutions. Other factors include urbanization, subdividing agricultural land into agriculturally unviable areas, infrastructural improvements, and a lack of public engagement in land use transitions. These have been shown to be interconnected.

Furthermore, the research has revealed that the management structure in place to control urban sprawl is either insufficient or inefficient. Policy, legal, and institutional frameworks are non-existent, new, insufficient, and/or ineffective. Furthermore, there is a lack of public engagement and planning for land use.

5.2 Recommendations

5.2.1 Policy recommendations

In light of the foregoing findings, a number of proposals for an effective management framework to control urban sprawl in Wote town are essential.

Objective one: Causes of urban sprawl

- The county government should implement measures (incentives) to encourage farmers to keep their agricultural land rather than convert it to other uses. To make agricultural land usage more lucrative and competitive, this might be accomplished by developing strong markets for agricultural output, providing farm tools, and providing agricultural extension services.

Objective two: main land use changes and spatial extent of the town

- Urban sprawl should be addressed holistically by incorporating as many technical officials/experts as feasible, including County Agricultural Officers and unbiased private specialists. All essential institutions must work together effectively. Institutional frameworks should always be guided by relevant policies and legislation.

Objective three: intervention measures taken to deal with land use change

- Public knowledge and engagement of all stakeholders are required to enable sustainable agricultural land use transformations. Proper and efficient methods of advising local populations of land use transformations, such as part of agricultural extension programs, should be developed. All stakeholders must actively participate in order for development choices to be more predictable, fair, and objective.

- In order to ensure the sustainable use of land resources, public institutions must perform their functions and manage public services in a transparent and transparent manner. Decision-making processes and the implementation of decisions should be adequately informed and, in the national, current and future interests. In order to facilitate sustainable land use reform, good governance will ensure that effective policies, laws, operational institutions, and effective public relations work. Good governance will also reduce corruption, increase government stability, and provide sound public education, all of which may contribute to land mismanagement.

- The changes in land use have also implications for the local environment. Increased urbanization can lead to habitat loss, changes in local hydrology, and potential increases in pollution due to runoff from developed areas. There is a need for effective land management policies to balance development with environmental conservation, ensuring that the ecological integrity of the region is maintained hence theres need for integrated land use planning and sustainable practices to support both economic development and environmental sustainability in the region.

5.2.2 Recommendations for Further Research

Land use management is a very wide subject. Concerning urban sprawl, the following issues may form basis for further study.

A study of how the introduction of Wote Municipality which covers a larger geographical area has the socio-economic situation of the population. With the introduction of the new Emali-Sultan Hamud, a further study can be conducted to establish if the findings of this report can be duplicated. Another area of study will be to establish the synergies and trade-offs between urban sprawl and environment and climate change.

REFERENCES

Abu Hatab, A., Cavinato, M. E. R., Lindemer, A., & Lagerkvist, C.-J. (2019). Urban sprawl, food security and agricultural systems in developing countries: A systematic review of the literature. *Cities*, *94*, 129–142 https://doi.org/10.1016/j.cities.2019.06.001

Aribigbola, A. (2008). Imroving Urban Land Use Planning And Management In Nigeria: The Case Of Akure. *Theoretical and Empirical Researches in Urban Management*, *3*(9), 1–14. https://ideas.repec.org//a/rom/terumm/v3y2008i9p1-14.html.

Ayuyo, I. O. (2012). *Geospatial analysis of land cover and land use change in the Mau forest complex of Kenya*.

Azadi, H., Ho, P., & Hasfiati, L. (2011). Agricultural land conversion drivers: A comparison between less developed, developing and developed countries. *Land Degradation & Development*, *22*(6), 596–604. https://doi.org/10.1002/ldr.1037.

Balandi, J. B., To Hulu, J. P. P. M., Sambieni, K. R., Sikuzani, Y. U., Bastin, J.-F Musavandalo, C. M., Nguba, T. B., Molo, J. E. L., Selemani, T. M., Mweru, J.-P. M., & Bogaert, J. (2023). Urban Sprawl and Changes in Landscape Patterns: The Case of Kisangani City and Its Periphery (DR Congo). *Land*, *12*(11), Article 11. https://doi.org/10.3390/land12112066.

Beckers, V., Poelmans, L., Van Rompaey, A., & Dendoncker, N. (2020). The impact of urbanization on agricultural dynamics: A case study in Belgium. *Journal of Land Use Science*, *15*(5), 626–643. https://doi.org/10.1080/1747423X.2020.1769211.

Bhatta, B. (2010). Causes and Consequences of Urban Growth and Sprawl. In B. Bhatta (Ed.), *Analysis of Urban Growth and Sprawl from Remote Sensing Data* (pp. 17–36). Springer. https://doi.org/10.1007/978-3-642-05299-6_2.

Budnick, A., Kreutz, R., & Draeger, D. (2017). Research Methods: Qualitative and Quantitative Approaches. *Innovation in Aging*, *1*, 231–232. https://doi.org/10.1093/geroni/igx004.861.

Chen, J., Chen, J., Liao, A., Cao, X., Chen, L., Chen, X., He, C., Han, G., Peng, S., Lu, M., Zhang, W., Tong, X., & Mills, J. (2015). Global land cover mapping at 30 m resolution: A POK-based operational approach. *ISPRS Journal of Photogrammetry and Remote Sensing*, *103*, 7–27 https://doi.org/10.1016/j.isprsjprs.2014.09.002.

Chiesura, A. (2004). The role of urban parks for the sustainable city. *Landscape and Urban Planning*, *68*(1), 129–138. https://doi.org/10.1016/j.landurbplan.2003.08.003.

Dadi, D., Azadi, H., Senbeta, F., Abebe, K., Taheri, F., & Stellmacher, T. (2016). Urban sprawl and its impacts on land use change in Central Ethiopia. *Urban Forestry & Urban Greening*, *16*, 132–141. https://doi.org/10.1016/j.ufug.2016.02.005.

Dadi, W., Mulugeta, M., & Semie, N. (2023). Impact of urbanization on the welfare of farm households: Evidence from Adama Rural District in Oromia regional state, Ethiopia. *Heliyon*, *10*(1), e23802. https://doi.org/10.1016/j.heliyon.2023.e23802.

Draft National Land Use Policy May 2016.pdf. (n.d.). Retrieved September 5, 2024, from https://www.kpda.or.ke/documents/Policies/Draft%20National%20Land%20Use%20Policy%20May%202016.pdf.

Draft-National-Agricultural-Soil-Management-Policy-NASMP-September-2020.pdf (n.d.). Retrieved September 6, 2024, from https://kilimo.go.ke/wp-content/uploads/2021/01/Draft-National-Agricultural-Soil-Management-Policy-NASMP-September-2020.pdf.

Dupras, J., Marull, J., Parcerisas, L., Coll, F., Gonzalez, A., Girard, M., & Tello, E. (2016). The impacts of urban sprawl on ecological connectivity in the Montreal Metropolitan Region. *Environmental Science & Policy*, *58*, 61–73 https://doi.org/10.1016/j.envsci.2016.01.005.

Eichsteller, M., Njagi, T., & Nyukuri, E. (2022). The role of agriculture in poverty escapes in Kenya – Developing a capabilities approach in the context of climate change. *World Development*, *149*, 105705. https://doi.org/10.1016/j.worlddev.2021.105705.

Gorgulu, N., Foster, V., Straub, S., & Vagliasindi, M. (2023). *The Impact of Infrastructure on Development Outcomes: A Qualitative Review of Four Decades of Literature*. Washington, DC: World Bank. https://doi.org/10.1596/1813-9450-10343.

Government of Kenya. (2016). *National Land Use Policy*.

Gutu Sakketa, T. (2023). Urbanisation and rural development in sub-Saharan Africa: A review of pathways and impacts. *Research in Globalization*, *6*, 100133. https://doi.org/10.1016/j.resglo.2023.100133.

Jiang, L., Deng, X., & Seto, K. C. (2013). The impact of urban expansion on agricultural land use intensity in China. *Land Use Policy*, *35*, 33–39 https://doi.org/10.1016/j.landusepol.2013.04.011.

Kioko, V., Mwendwa, P., & Imteyaz, A. (2022). *The Effects of Urban Sprawl on Agricultural Land Use on the Rural Fringes of Towns; a Case of Machakos Town*. 196–212.

KNBS. (2019). *Kenya Population and Housing Census* (Census No. Volume IV; pp. 1–498). KNBS. https://www.knbs.or.ke/2019-kenya-population-and-housing-census-reports/ *Makueni-County-Statistical-Abstract-2022.pdf*. (n.d.). Retrieved September 6, 2024, from https://makueni.go.ke/sandbox/site/files/2023/11/Makueni-County-Statistical-Abstract-2022.pdf.

Mkumbukwa, A. (2017). *The History of Use and Conservation of Marine Resources in Zanzibar: Nineteenth Century to the Present*.

Morelli, V., Sateriano, A., Bartolomei, R., & Salvati, L. (2012). Urban Sprawl and the Environment. *Geography, Environment, Sustainability*, *5*, 46–62. https://doi.org/10.24057/2071-9388-2012-5-4-46-62.

Msofe, N. (2019). Socio-Ecological Drivers of Land Use Change and Wetland Conversion in Kilombero Valley Floodoplain, Tanzania. *American Journal of Environmental and Resource Economics*, *4*, 1. https://doi.org/10.11648/j.ajere.20190401.11.

Mugenda, O. M., & Mugenda, A. G. (1999). *Research methods: Quantitative and qualitative approaches*. African Centre for Technology Studies.

Muigua, K. (2021). *Promoting Sustainable Land Use Practices and Resources Management for Biodiversity Conservation*.

Mutua, R. M. (2013). *The Effect Of Peri-urban Development On The Livelihoods Of Indigenous Households: The Case Of Lower Kiandani Area, Machakos Municipality* [Thesis, University of Nairobi]. http://erepository.uonbi.ac.ke/handle/11295/55696.

Njiru, B. E. (2016). ` [Kenyatta University]. http://ir-library.ku.ac.ke/handle/123456789/14936.

Okeleye, S., Okhimamhe, A., Sanfo, S., & Fürst, C. (2023). Impacts of Land Use and Land Cover Changes on Migration and Food Security of North Central Region, Nigeria. *Land*, *12*, 1012. https://doi.org/10.3390/land12051012.

Slätmo, E. (2017). Preservation of Agricultural Land as an Issue of Societal Importance. *Rural Landscapes: Society, Environment, History*, *4*(1). https://doi.org/10.16993/rl.39.

Tarawneh, W. M. A. (2014). Author Details. *No. 20(2014)*, *no 4*(ISSN (Paper)2224-3216 ISSN). https://www.iiste.org/Journals/index.php/JEES/search/authors/view?firstName=W afa%20Madallah&middleName=&lastName=Al%20Tarawneh&affiliation=&cou ntry=.

Thuo, A. (2010). Community and social responses to land use transformations in Nairobi rural-urban fringe, Kenya. *Field Actions Science Reports*.

Trivedi, A., Rao, K. V., Rajwade, Y., Yadav, D., & Verma, N. S. (2022). Remote Sensing and Geographic Information System Applications for Precision Farming and Natural Resource Management. *Indian Journal of Ecology*, *49*, 1624–1633. https://doi.org/10.55362/IJE/2022/3707.

Tuyen, T. Q., & Huong, V. V. (2013). Farmland Loss and Poverty in Hanoi's Peri-Urban Areas, Vietnam: Evidence from Household Survey Data. *Agris On-Line Papers in Economics and Informatics*, *v*(Number 4), 199–209 https://ageconsearch.umn.edu/record/162302/files/agris_on-line_2013_4_tuyen_huong.pdf.

UNDP. (2013). *Combating Desertification in Kenya Emerging Lessons from Empowering Local Communities* (pp. 1–44). UNDP.

Verweij, S., van Meerkerk, I. F., Koppenjan, J., & Geerlings, H. (2014). *Interventions In Complex Urban Systems: Coping With Boundary Issues In Urban Planning Projects* (SSRN Scholarly Paper No. 2551509). https://papers.ssrn.com/abstract=2551509.

Wasrag. (2012). *Guidelines for Planning Sustainable Sanitation Projects and Selecting Appropriate Technologies*. 1–40.
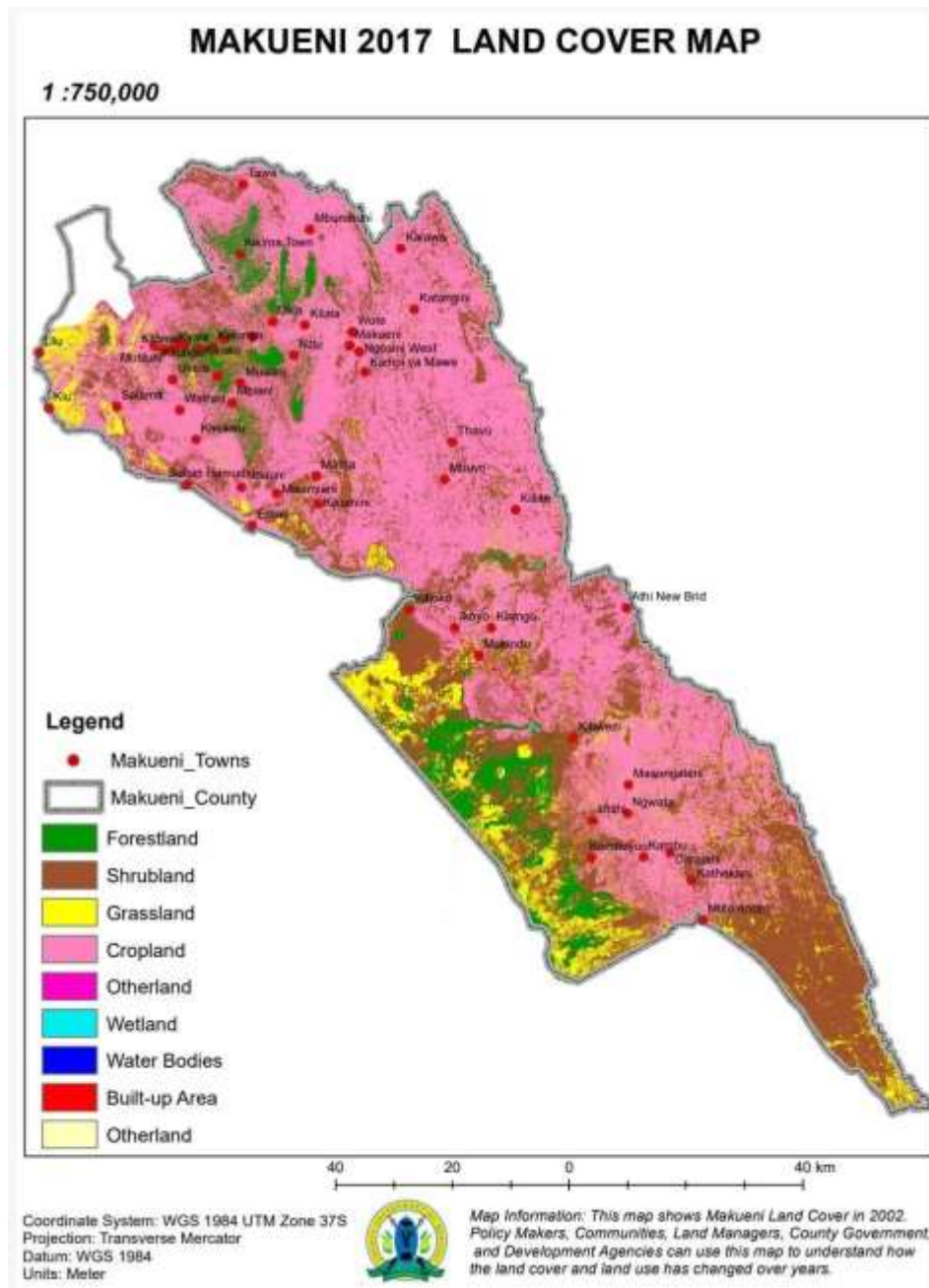
Appendix i: Makueni 2017 Land Cover Map

Figure 11: Wote land cover high-resolution image 2010.spatial resolution 30meters,data from landsat 8 RCMRD and analysis done Makueni county government

Appendix ii: Satellite Images Analysis

Supervised classification was conducted using the **Support Vector Machine (SVM)** tool in **ArcGIS Pro** to assess land cover changes from 2010 to 2024. The results show the expansion of built-up areas in 2010, built-up areas occupied **3,000,000 square meters** (4%) of the total area, while vegetation (crops, trees, and forests) covered around **60%**. By 2015, the built-up areas had increased to **6%**, reflecting a **2%** growth attributed to enhanced urban planning following devolution, **8%** in 2020 and projected to cover **10%** by the end of 2024. This indicates increase in urban development