URBAN GREEN SPACES STATUS AND CHANGES OVER TIME: THE CASE OF KISUMU AND ELDORET TOWNS.

BY

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DECLARATION

DECLARATION BY STUDENT

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DEDICATION

This thesis is dedicated first to God for the strength He gave me to carry out my research and also to my Parents Thomas and Joan; Sisters Marlene, Marion and Faith and my brother Ronald for their encouragement throughout the period of undertaking my thesis research and finally to all my friends who participated and supported me to accomplish my research work.

ABSTRACT

Despite their indispensability, green spaces especially in urban environments are under severe threat particularly from urbanization, non-operationalization of urban plans and socio-political factors. Unfortunately, not much is known about how these factors play a role in this decline, more so in the cities of Sub-Saharan Africa (SSA). Consequently, this study sought to fill this gap by studying Kisumu and Eldoret towns of Kenya as cases. The main objectives of this study, therefore, were to assess the status and attributes of urban green spaces, to determine the effect of urban physical expansion on green space availability and to determine per-capita availability of urban green spaces in the two towns. The first objective was to establish the current status of urban green spaces and two tools were used namely the observation checklist matrix and questionnaire. The observation checklist matrix was used to collect the data on the green spaces facilities. A questionnaire survey technique was employed to elucidate data on green space use patterns and the challenges they face. The second objective was to determine urban growth trends and spatial-temporal changes of green spaces, a supervised classification, multi-temporal data was extracted from Landsat images from 1989-2019. In terms of percentages, Kisumu and Eldoret towns expanded seven times in the period between 1989 and 2019. Urban green spaces in both towns were rapidly disappearing and decreasing over the years with Kisumu town decreasing by 50.92% while Eldoret experiencing an increase in 1999 and 2009 although it declined between 2009 and 2019, it increased by 32.11%. Per-capita availability of public and private urban green spaces was also on the decline and the current per-capita was below 1 metres square in the two towns against $9m^2$ as recommended by WHO. Physical expansion was found to be the main reason behind the loss of urban green spaces in Kisumu and Eldoret towns and this occurred from conversion of green spaces into built-up areas. This study demonstrates that urbanization is a threat to urban green spaces and deliberate spatial planning interventions are needed urgently so that green spaces and associated benefits are protected to promote sustainability of urban areas.

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OPERATIONAL DEFINATION OF TERMS

Public Green Spaces - Open areas that can be accessed freely by all citizensand mainly encompass vegetated natural spaces such as parks, gardens, forests, greening squares and plazas.

Urban Green Spaces - Public and private lands in built-up areas that areoverlaid with natural or man-made vegetation.

ACRONYMS AND ABBREVIATIONS

ENVI	Environment for Visualizing Images
ERDAS	Earth Resources Data Analysis System
GCPs	Ground Control Points
GIS	Geographic Information System
GPS	Global Positioning System
KII	Key Informant Interviews
LULC	Land Use Land Cover
MDGs	Millennial Development Goals
NACOSTI	National Commission for Science, Technology and Innovation
RS	Remote Sensing
SPSS	Statistical Package for Social Sciences
SSA	Sub-Sahara Africa
UGS	Urban Green Spaces
UTM	Universal Transverse Mercator

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CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Urban green spaces are defined as those public and private lands in built-up areas that are overlaid with natural or man-made vegetation (Byomkesh *et al.*,2012; Venn & Niemela, 2004). They include the public parks, botanical gardens,

playing grounds, sports grounds, urban trees and vegetation, allotments, urban woodlands and forests.

Urban green spaces are a premium quality commodity to the residents of urban areas and this cannot be overstated (Huang and Rozelle, 2002). Green spaces provide employment opportunities, offer aesthetic values by beautifying the architectural pattern of cities and towns, improves the air quality of towns, conservation of urban biodiversity, elevates ecotourism and supports cohesion and social interaction to the users (Mensah, 2015a; Wolch, *et al*, 2014a; Jim & Chen, 2009). Urban green spaces also play a major role in the development of high-quality human settlements (Jim and Chen, 2009).

It is probably for these reasons that Ebenezer Howard, the originator of the garden city model in urban planning, stresses the concept of putting together urban green spaces such as parks and botanical gardens into the landmass of cities (Howard, 1902) as all these ultimately acts, as Frederick Law Olmsted, a renowned landscape architect puts it ‘‘the lungs of a city” (Jennings, 2012).

Unfortunately, urban green spaces have been on the decline. Findings from studies carried out in the European cities and towns showed a decline in the size of green spaces (Fuller & Gaston, 2009). A study conducted by Kabisch & Haase, (2013) for instance showed a 26% decrease in urban green spaces in the East European cities' from 1990 to 2006. A decline was associated with the demand for more space in the residential areas as a result of the increasing number of small sized households. If what the World Bank (2017) states that by the year 2030 more people will be residing in urban areas is anything to go by, the green spaces decline problemis expected to worsen in the coming future due to increasing urban growth and subsequent deterioration of environmental quality (Amin, 2008a). This is because urban growth requires a lot of land to support transport, residential purposes, commercial, institutional and other structural needs of the growing urban population. Unfortunately, urban green spaces and other natural lands are always the victims as they get converted to support the stated urban needsthereby contributing to their decline (Byomkesh *et al.,* 2012b). This ultimately robs urban areas of the benefits associated with green spaces.

At the centre of all this, urbanization that has been cited as the most importantcause of urban green space decline (Haaland & van den Bosch, 2015). This observation has been witnessed and experienced more in developing countries (Mensah, 2015a; Makworo & Mireri, 2011).

Urban green spaces in precipitously developing cities in Sub-Sahara African (SSA) countries for instance, have experienced more pressure, particularly from the high rate of urbanization (Girma *et al.,* 2019). In Ethiopia 1410.7 hectares of green spaces was lost to built-up areas in a period of 13 years that is from 2003 to 2016 (Girma *et al.,* 2019).

The same scenario about the loss of green spaces has been observed in Kenyawhere comparative studies on urbanization between Ghana and Kenya revealed that Kenya had a higher number of urban centres (350) and the urbanization rate had increased from 8% to 35% percent, which had in turn impacted negatively on urban green spaces (Otiso & Owusu, 2008). Basing on the preceding background this study seeks to establish the role of urbanization in urban green spaces availability in urban towns of Kenya withKisumu and Eldoret as case study towns.

1.2 Statement of the Problem

Urban green spaces in Kenyan Towns have been experiencing a declinecompared to their growing urban populations (Obeng-Odoom, 2010). Unfortunately, urbanization, non-operationalization of plans, socio-economicand political factors are increasingly accelerating their loss. (Owino *et al.*, 2014). This clearly threatens the sustainability of green space benefits to the urban population.

Although literature has pointed out a number of possible causes including pressure from urbanization, non-operationalization of urban planning regulations and socio-economic and political challenges, it is not clear how such causes act and interact to result in decline of these spaces. Consequently, it is imperative that studies investigating how these causes play about to result indeterioration of urban green spaces be conducted. This study is therefore designed to fill this gap taking Kisumu and Eldoret Towns as case studies. Understanding this will certainly contribute in influencing policy on the production and maintenance of urban green spaces in Kenya in as far as promoting urban sustainability and resilience is concerned.

1.3 Objectives of the Study

The main objective of this study is to determine the Urban Green Space Statusand Changes over Time in Kisumu and Eldoret towns of Kenya.

1.4 Specific Objectives

Specifically, this study seeks to:

1. Assess the status and attributes of urban green spaces in Kisumu andEldoret Towns.
2. Determine the effect of urban physical expansion on green spaces availability in Kisumu and Eldoret towns.
3. Determine urban green spaces' per-capita availability trends inKisumu and Eldoret towns

1.5 Research questions

The study is guided by the following research questions;

1. What is the current status and attributes of urban green spaces in Kisumu and Eldoret towns?
2. What is the effect of urban physical expansion on green spaces availability in Kisumu and Eldoret towns?
3. What is the per-capita availability of urban green spaces in Kisumu and Eldoret towns and how has this changed over time?

1.6 Justification and significance of the research

As earlier intimated, urban green space's role to humanity and urban residentsin particular cannot be underestimated (Makworo & Mireri, 2011). Urban green spaces have been on the decline and if unchecked, this decline of urban greenspaces has the potential of causing loss of benefits associated with green spaces such as decrease of urban flora and fauna (Byomkesh et al., 2012) which subsequently exposes urban

areas to natural hazards including flooding, urban heat islands, among others (Dewan & Yamaguchi, 2009; Abdullah-Al-Wadud, Kabir, Dewan, & Chae, 2007). The loss of biodiversity in green spaces also leads to envelopment of pathogens and diseases that contributes to air pollution (Byomkesh et al., 2012d). All these problems will in the long run have damaging impacts on humans and urban environment (Amin, 2008). Therefore, a study similar to this is necessary to help understand these effects on urban green spaces availability. This information will be useful to policy makers, planners, researchers, academicians and governments in putting in place measures to ensure adequate provision of green spaces in urban areas. Further, the findings from this study shall provide additional literature to the pool of scientific knowledge in this discipline.

1.7 Scope of the Study

The study focused on studying urban green space status, attributes, use and change over time of urbanization on its availability in Kisumu and Eldoret towns, Kenya. This study was carried out in seven urban green spaces five in Kisumu namely Jomo Kenyatta, Jamhuri, Oile, Taifa and Victoria and two in Eldoret town namely Nandi Park and Huruma grounds. Urban growth and spatiotemporal changes of urban green spaces was taken into consideration in urban areas of Kisumu and Eldoret towns from the year 1989 to 2019.

1.8 Limitations of the study

During the study as concurrent with other studies world over, lack of interest by respondents who were the public green space users to participate in the study was witnessed. The respondents were not willing and ready to respond to the questions, especially on the part on demographic characteristics of the respondents. The researcher therefore went ahead to allay their fears by convincing them that the

information they will provide was purely academic and it was to be kept confidential. Since the key informant interviews were carried out to find the main challenges facing public urban green spaces, some key informants were not present like the urban green space managers and other officials for the interview. Nevertheless, the information was accurate enough to inform on the reduction of urban green spaces in Kisumu and Eldoret towns.

This study only focused on how urbanization is affecting urban green spaces, thus is limited on other factors such as socioeconomic and political factors. Also, the status and attributes of the green spaces were only focused on the public and not the private ones.

1.9 Structure

The report is organized into six chapters. Chapter One introduces the study while Chapter Two presents the literature review. Chapter Three details the methods employed in the study and includes the study area, the nature, type and source of data, research design, data collection, data analysis and data presentation. Chapter Four presents results of the study which are then discussed in Chapter Five. Chapter Six draws conclusions and mainly recommendations of the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This Chapter reviews the literature on urbanization and its role in urban greenspace change. The first part of this chapter gives a brief description of the importance of green spaces and thereafter presents the problem of urban green spaces decline, trends in urbanization and how remote sensing and GIS have been used in monitoring of spatial change. It finally highlights the research gap and presents the theoretical conceptual framework.

2.2 Green Spaces and its Importance in Urban Areas

Urban green spaces are those open spaces that are covered with green areas (Berkhahn & Tilleke, 2008). Many studies have given evidence demonstrating the importance of urban green spaces in towns and cities which relates to different benefits including socio-economic, health and environmental benefits (Toutakhane, 2018). An extensive review and discussion into detail of these benefits is given in the next section.

2.2.1 Social and health benefits of green spaces

Leisure and recreation are strongly believed to be the major social benefit obtained from urban green spaces in both developed and developing countries (Haq, 2011). Leisure and recreation relates to activities such as relaxation, sports, walking and playing by children.

Manlun (2003) and Pick et al., (2013) observes that most urban residents utilize the green spaces for jogging, walking, relaxing, playing, bird watching, meeting and spending time with other people (socializing) and for whiling away time as one waits for other people.

On the other hand, urban green spaces are meeting places in bringing people together and the local community at large. Green spaces such as botanical gardens and parks have been shown to be the best since they are open and aremeant for the public use and provide the space where all kinds of people cometogether and have fun with others in both developed and developing countries(Miller et al., 2015) and (McLean & Hurd, 2011).

In addition, literature shows that urban green spaces plays an important role in the growth of children. Ferrara et al., (2006) points out that several visits tourban green spaces have been shown to give children the chance to be in a relationship with nature, and this eventually increases their understanding of nature, value of protection for the urban ecosystem, and at long last, their awareness and appreciation of the environment. It has further been found thatyoung people coming together with the natural environment, such as in parksand urban green spaces, is of assistance to them to gain and get a better chanceto help their analytical and strategic reasoning and also allow affective growth(Goudge et al., 2001).

Young ones who play and spend more time in open spaces, grow their physical power, synchronization, communication, rational thinking and interpretation capacity (Little & Wyver, 2008). Mensah et al. (2016) and Corther (2005) found out that urban green spaces assistto educate the people especially students, researchers and students on biodiversity and its importance to the urban ecosystem.

Green spaces have also been shown to have a positive effect on health of people living in towns and cities. Some of the health benefits achieved from using green spaces include enhanced mental health and psychological well-being (Wolch et al., 2014) reduction of stress (List et al., 2009; Yu-Feng et al., 2007)removal of mental illness and anxiety and also things like hyperkinetic reaction of childhood (Yu-Feng et al.,

2007). Grahn and Stigsdotter, (2010) adds that urban green spaces helps to improve the health through stress restoration.

Urban green spaces have also been found to reduce the problem of obesity, heart diseases, musculoskeletal sickness and stroke through participation in physical activities like walking, jogging, running, and different types of sports activities (Taylor *et al.,* 2008). In the northern England studies allude that parks and other green spaces, when used by the old and the young for sports and exercises tend to help them keep physically fit and eases them from lifetime diseases besides helping improve their duration of existence (Abraham *et al.,* 2010).

2.2.2 Environmental benefits of green spaces

It is generally agreed that developed areas such as roads and buildings, concrete surfaces and corridors always easily absorb solar radiation and slowly release it to the environment, leading to heating up of immediate environment that finally causes urban heat islands (Karimipour, 2017). However, Green spaces availability in such areas have been shown to regulate such temperature. This therefore reinforces the role of green spaces in improving the micro climates and subsequently play a role in abating effects of climate change (Mensah et al., 2016; Morgenroth et al., 2016; Baycan-Levent & Nijkamp, 2009).

Bowler et al., (2010) for instance studied how green spaces are important in cooling of towns and cities. In so doing, urban green spaces modifies town and city rising temperatures, bring down the consequences from urban heat islands and therefore make the urban environments conducive for relaxation by the people in towns and cities.

It is further acknowledged that urban green spaces do enhance urban air quality and keeps the environment healthy (Mensah et al., 2016). Some studies carried out in Singapore found out that those buildings with green vegetation at the roofs, showed

a decrease of nitrous oxide and sulphur dioxide in the areas of study (Getter & Rowe, 2006). This is because the presence of urban green spaces is associated with removal of sulphur dioxide, nitrogen oxide, carbon monoxide and other pollutants from the atmosphere (Haq, 2011). Clearly thus the urban vegetation assists in preventing the transfer of agents of pollution and therefore making the urban areas suitable and free from pollution (Escobedo & Nowak, 2009).

Furthermore, the protection of biodiversity and the conservation of the natural environment by urban green spaces is well highlighted in the literature. Many studies on the urban environment have shown that different forms of urban green spaces contain significant amounts of biodiversity (Mensah, 2015).Kümmerling and Müller (2012) in a survey of 15 parks in urban areas of Flanders (Belgium), established that the parks contain about 30 per cent, 50 per cent and 60 per cent of wild plants, birds and amphibians respectively. Another study in the UK revealed that golf courses have a high volume of tree species and wide diversity of birds (Tanner & Gange, 2005).

Related to this contribution is the control of some urban environmental problems by green spaces such as soil erosion. Studies have shown that the presence of different forms of urban green spaces, such as urban trees, forests,golf courses, parks and gardens help to stabilize urban soils, minimize the effects of agents of erosion (wind and water) and ultimately protect urban lands from destructive erosion (Zhou & Shangguan, 2007).

From an architectural point of view, urban green spaces help improve urban design and the overall urban landscape. Manlun (2003) points out that green vegetation helps enrich the urban architecture and beautify the landscape through its different forms and styles. Apart from the beauty that green spaces add to urban architecture, they also

help to enhance urban aesthetic quality, which makes urban areas more uniform and well diverse (Manlun, 2003). According to Baycan-Levent and Nijkamp (2009), green spaces are very important when designing towns and cities because they help to enhance theiridentity which can improve the cities' attractiveness as places to live, work, invest in and as tourist destinations.

2.2.3 Economic benefits of green spaces

Since urban green space projects require a lot of power and labor and high rateof maintenance, they avail jobs such as soil preparation and planting of vegetation as well as maintenance and management purposes. As such, they reduce the rate of unemployment to citizens in both developed and developingcountries. Apart from reducing the rate of unemployment they also improve the economic performance of the country (Wolch et al., 2014).

Baragou et al., (2012), for example, found that many nations and people are offered employment opportunities in various sectors that are managed and are under the green space faculty in Abidjan (Cote D'lvoire).

In Australia studies show that about 80,000 people are being offered well- paying employment opportunities at the green spaces (Aldous, 2007). Furthermore, a study by Space (2011) found out that 50,000 people are employed and benefit from both private and public green spaces in the United Kingdom. Apart from direct employment at the green space some people are employed in industries that are at a point associated with green spaces. These include the manufacturers of green space and park equipment and other staff needed to run these parks. Green spaces also enhance the urban property values (Lutzenhiser & Netusil, 2001) which in turn increase the Government revenue. Studies done in Canada showed that the value of houses near the green spaces and parks was highcompared to those away from the green spaces (Crompton & Havitz,

1999). Another study carried out in Emmen in Netherlands revealed that the houses that had the urban green spaces at view were in high demand (and therefore scarce) as compared to the ones at a long distance from the green space (Jorgensen et al., 2007).

Green spaces also influence the tourism sector, Calderón-Garcidueñas et al. (2010) observed that the establishment of urban green spaces such as the botanical gardens and green parks and forests tends to attract many tourists. The tourists will trigger developments in sectors such as transport, restaurants, hotels, clothing, shelter and other basic needs. In general, it is well known thatwell established, maintained and planned green spaces tend to boost a place'soutward appearance and will therefore bring in more customers, tourists, investors, developers and at the end create a good business opportunity and improve the state's economy and investment (Bykova et al., 2012).

From the preceding review, it is evident that green spaces are indispensable inurban areas and measures should be taken to ensure their availability in urban areas in adequate quantity and quality.

Yet, a lot of literature has shown decline of urban green spaces which not only exposes the urban area to natural dangers, including flooding (Dewan & Yamaguchi, 2009 and Abdullah-Al-Wadud et al., 2007) but also reduces the urban quality of life (Amin, 2008). other consequences associated with urban green space decline includes biodiversity loss and also loss of endangered and rare species (Winter et al., 2006) the rise and introduction of infectious diseases (Ahasan, Chowdhary and Quadir, 2010) and increased atmospheric pollution (Khalequzzaman et al., 2007).

2.3 Main Activities in Urban Green Spaces

Urban public green spaces are those areas where people visit, to relax, socialize, take lunch or snacks, entertainment, enjoy nature and biodiversity and exercising (Banerjee, 2001). People visit urban green spaces with different motives, drives, purposes and reasons. Most of the visitors visit the green space for recreation activities suchas relaxing, reading, including class related activities (Kemperman & Timmermans, 2008), taking a walk or strolling Tzoulas and James, (2010), enjoying nature and the serenity (Qiu & Nielsen, 2015) and also bird watching (Dallimer et al., 2014), sports and exercise (Gladwell et al., 2013). The time ofthe day and the frequency with which green space users visit the green space, the time they take in the green space depends on the green space user and the difference in the green space characteristics and the design and purpose of the green space (Goličnik & Thompson, 2010). Some of the green spaces are only designed for sports and exercise, others for the children and others for relaxing (Schipperijn, 2010).

2.4 Drivers of green spaces change

As already seen in the preceding section, the indispensability of urban green spaces in most urban areas of the world and especially in Africa is at risk due to their rapid depletion (Mensah, 2014). A number of explanations have beenfronted in literature and three of them stand out. These include pressure fromnon-operationalization of urban planning regulations, the socio-economic and political challenges and urbanization (Fanhua, 2005). The next section attempts to interrogate these underlying causes.

2.4.1 Non-operationalization of urban planning regulations

The rationale for any urban planning regulations as a public function is to ensure social, economic and environmental efficiency in the use of space and to ensure that the health, safety and general security of citizens of a country is promoted and

secured (Barasa, 2004). However, urban planning regulations, especially in Africa, have failed to influence land development patterns in the rapidly growing urban areas (Makworo, 2010). Kenya's experience, for example, reveals lack of official government intervention and established procedures in formulating rules for allocation of land, control, approval and regulation of urban development, hence inability of land use planning regulations to hinder the occurrence of the problems associated with contemporary land use activities (Makworo, 2010).

Generally, in Africa, issues that hinder effective operation of urban planning regulations on green spaces include the dysfunctional nature of urban planning regulations, bureaucratic processes involved in issuing development permits and weakness of the planning institutions as a result of insufficient resources to work with (Muderere, 2011). For example, the Nairobi zoning ordinance of 2004, the Kenya's Physical and Land Use Planning act of 2019, the 1946 town planning ordinance of Nigeria, 1948 town planning act of Malawi among others are still in operation. Other compounding the problem of insufficient operation of urban planning regulations in Africa is the poor enforcement of land planning regulations on green spaces. Inadequate skilled personnel, insufficient logistics, financial constraints, and lack of coordination between planning authorities were found to be the cause of this problem. In addition to corruption, misappropriation and embezzlement of state funds meant for socio economic developments such as projects of green spaces by government officials is a problem undermining the successful development of green spacesin Africa (Okpala, 2009).

2.4.2 Socio-economic and political challenges

Economic and social development always bring in urban growth and it showsup through modernization (Chulu, 2016). Poverty rate in Africa is linked to reduction

of urban green spaces (Cilliers *et al.,* 2013). In Ghana, for instance, inthe year 2004, 65 percent of urban dwellers were found to survive below one dollar. Same were found in Nigeria, Burkina Faso and South Africa. The 2010 state of African towns and cities connected the high rate of urban poverty levelto the destruction of urban green spaces and the green environment at large (Aronson *et al.,* 2017). This is because most of the people depend on the urban vegetation and environment to thrive in their day to day lives like wood, fibre and fuel (Habitat, 2010). Another study in South Africa revealed that many poor people tend to depend directly on green environment provisioning services for income and subsistence like food and timber unlike the rich who depend on the green spaces for ecosystem services such as regulating serviceslike water purification (Cilliers, 2013). This dependence syndrome in Africa has led to over exploitation of urban green spaces which has resulted in their decline.

In African nations, there exists inadequate prioritization on green spaces in the development agenda of some towns and cities. Africa has delayed the expansion of green spaces because the green spaces are not addressed as a priority. In Kenya, for example The Big Four Agenda (2018-2022) that is envisaged to lead to faster growth of the economy focuses on manufacturing sector, universal health coverage, housing, food security and nutrition with noemphasis to green space development. A study by Mensah, (2014) found thatthe lack of green space priority in Kenya and Ghana, has affected the security and safety of urban green spaces and the users since criminals and drug sellersreside in the public green spaces. This insecurity issue has discouraged the urban residents from utilizing these green spaces. Mensah (2014) also found out that matters of poverty decline and provision ofsocial facilities like health, food, housing, education and water are the most concentrated on projects in

African nations. This has led to most national andlocal authorities not to prioritize and finance projects needed for the provision, improvement and maintenance of green spaces.

Bolnick *et al*. (2012) further mentioned that most African nation's give more priority towards the blue economy and not to the green agenda whose main agenda is focused on creating and maintaining the green environment. Furthermore, there are challenges facing institutions that are mandated to maintain and manage the urban green spaces in a country. Some of these challenges include, competing urban land uses brought about by land scarcityand inflation where allocation is prioritized to the land uses which has the highest profit margins such as industrial and commercial (United Nations Human Settlements Programme, 2010). Other challenges experienced are political interference and financial constraint which systematically lead to theloss of urban green spaces.

On political interference, it is seen that poor enforcement of planning regulations and lack of political will to undertake projects on green spaces also is a dominant challenge (Mensah, 2015). Policy makers and planning authorities also lack political will to initiate policies or measures to enhance the development of urban green spaces in African cities (Olaleye, 2013). Furthermore, political instability has resulted in civil wars that led to the destruction of urban green spaces in Africa, for example in Sudan and Somalia where several civil wars have occurred. Over the last ten years in Somalia and Liberia, there have been loss of urban environment, forests and natural resources through cross bombardments (Conca & Wallace, 2009). In Rwanda during the genocide, a great amount of urban green spaces, forests and 70 percent loss of Akagera National Park were destroyed (Ndayisaba *et al.*, 2016).

2.4.3 Urbanization

Urbanization is the major cause of loss of urban green spaces (Baycan-Levent& Nijkamp, 2009). Urbanization is termed as growth within an urban area or growth of the town beyond the set boundary such as urban sprawl (Ji et al., 2006). The variables of urbanization are physical expansion and population growth (Crompton, 2001; McDonald, Forman, & Kareiva 2010).

When urban areas grow, they lead to the translation of urban green spaces into built up areas and greatly damaging the urban environment such as parks andurban forests (Altay et al., 2012). A research done in the European countries found that 9000 Ha of urban green spaces were converted in built up areas and urbanization was mentioned as the main reason behind it (Romano & Zullo, 2016). In the United States of America, there was a massive loss of 14000 square meters of green space land in 1990s to 2000 that was associated with increased urban growth (Heim, 2001).

In greater Dhaka urban green spaces are being destroyed and reduce in number over time and this is attributed to urbanization (Byomkesh *et al.*, 2012d). More so in Dalian, China a study found out that urban green spaces were reducing and this was leading to rise in temperature due to urbanization (Yang *et al.*, 2017). Furthermore, in most developing nations, it is therefore expected that the risein the rate of urbanization is bound to have a great implication on urban greenspaces (Kestemont, Frendo & Zaccai, 2011). This suggests that, when urbanization occurs, green spaces are at risk which subsequently, threatens benefits associated with them. There is therefore need to establish precisely how the growth of urban centres contribute to the decline of green space availability.

2.5 Why focus on urbanization?

According to Angel *et al.,* (2011) about assessment of global expansion, it was found out that cities are growing at twice their population growth rates and the urban areas are now covering an average of 0.5% of the earth's land area. In addition, urban areas in developing countries will face an increase from 300,000km^2 in 2000 to 770,000km^2 in 2010 and will increase to 1,200,000 km^2 inthe year 2050 (Angel *et al.,* 2011). As urbanization increases, the urban green spaces are being infringed and they are being lost because the land meant for urban green spaces is being consumed by the need for urbanization. As already seen, non-operationalization of urban planning regulations, socio-economic causes and urbanization have come out as major forces driving the decline of urban green spaces.

There is need to now focus on studying the effect of urbanization on urbangreen spaces because urbanization is leading to the decrease of the urban green spaces through conversion of urban green spaces for development (Rafiee *et al.,* 2009). Also a case in Nairobi Kenya the green spaces are being threatened by the rate of urbanization that is, the green spaces which were meant to serve 250000 people is now serving 3 million people and thus suffering from destruction (Makworo & Mireri, 2011).

Other challenges affecting urban green spaces have been severally addressed,for example; literature for example, has shown that more and more countries are strengthening urban planning departments so as to save on reduction of urban green spaces (Van Herzele & Wiedemann, 2003). Therefore, an effective effort between the physical planners, the government and the public members is fundamental for effective physical planning and implementation in an organized society (Owino *et al.,* 2014). The socio-economic challenge has also been addressed by ensuring that mechanisms are put in place through physical development plans so that theymay protect existing green spaces and regulations that require developers to set aside

land for green spaces in new developments (Middle *et al.*, 2014). Therefore, it is crucial to the urban planners and city managers to manage urbanization so as to reduce the urban green space conversion to built-up areas (Dallimer *et al.,* 2011). This requires a clear understanding that include quantification of how urbanization affects green space availability.

2.6 Techniques quantifying the effect of urbanization on green spaces availability

In all studies quantifying spatial change, GIS and remote sensing have come in handy. As is well known, these are important tools for change detection that can help in yielding more tangible insights into the underlying process involving land cover and land use changes. This is more important in many applications such as land use changes, habitat fragmentation, rate of deforestation, urban sprawl and other cumulative changes through spatial and temporal analysis techniques (Chandra & Kumar, 2004).

Multi-temporal land-use and land cover data are very essential for carrying out the spatial and temporal analysis of urban growth (Irvine *et al*., 2010). The availability of satellite spatial data has increased significantly in the last two decades, and it constitutes a useful data source for mapping the composition of urban settings and analyzing changes over time (Patino & Deque, 2015).

2.6.1 Procedures in using remotely sensed images to quantify urbangrowth and urban green spaces

Figure 2.1 outlines the procedures for quantifying urban growth and greenspaces.

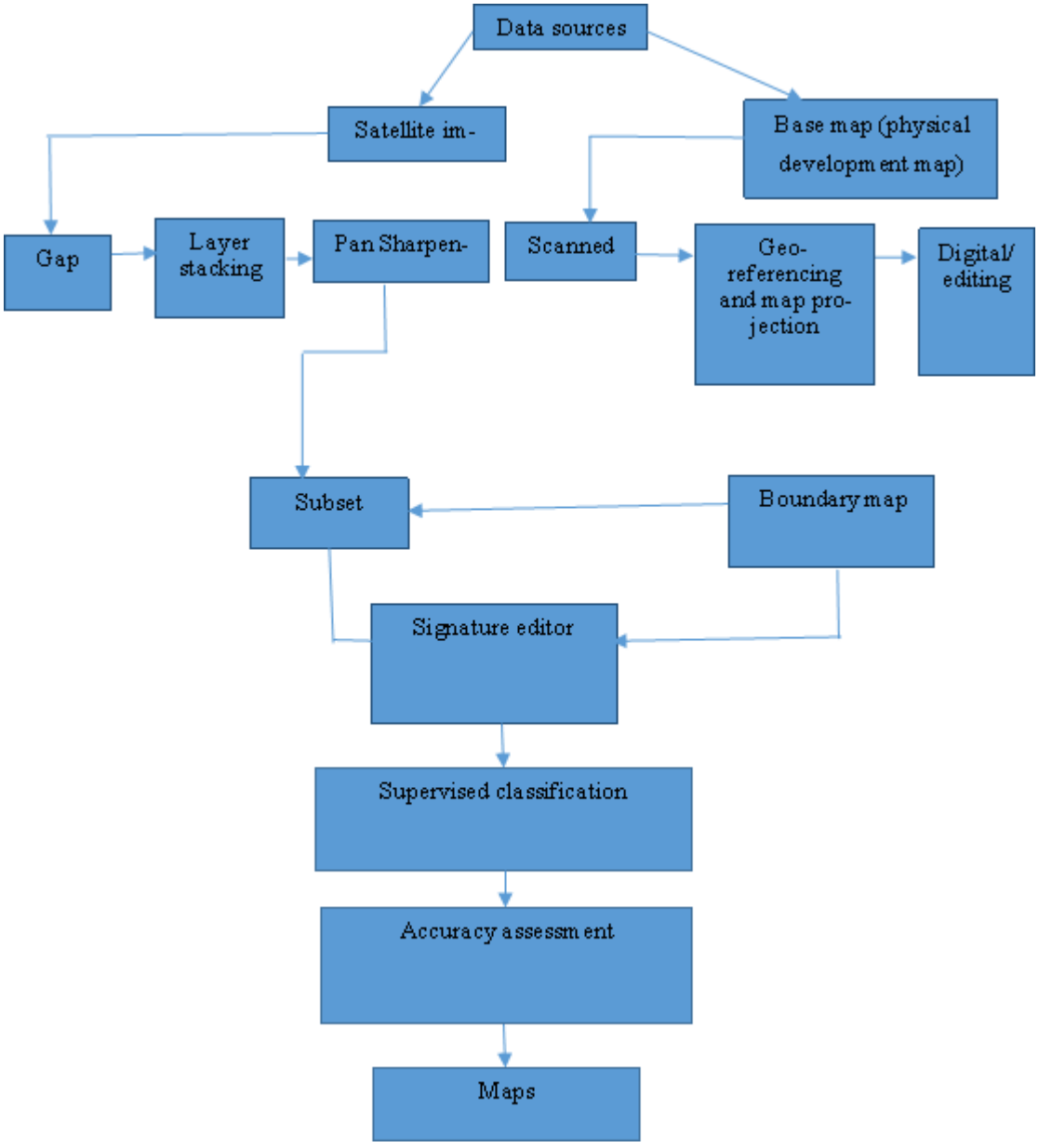

Figure 2.1 1Summary of the image Processing

There are four distinct phases in the quantification process this include; image processing, land use classification, accuracy assessment and change detection analysis. The next section describes each phase. Image processing- as indicated

earlier, remotely sensed images with respect toan area of interest and within the required time periods are required if one intends to quantify spatio-temporal changes of an urban area. With this in place, image processing becomes the first task. Most image processing steps include layer stacking, re-sampling and image enhancement of the imagedataset.

Layer stacking is a technique used to build a new multi-band or multispectral image file from geo-referenced images of various pixel sizes, extents, and projection system (Dauramanzi, 2015). Satellite images are composed of bands and phenomenon as shown below.

Table 2.1 Bands and Phenomenon

Band	Color	Phenomenon
1	Blue	Imaging atmospheric and deep-water elements
2	Green	Imaging vegetation and deep-water structures
3	Red	Imaging non-man-made objects and water up to 30 meters
4	Near infrared	Imaging vegetation
5	Mid infrared	Imaging vegetation, soil moisture content
6	Far infrared	Imaging soil, moisture, geological features, silicates, clays and fires
7	Thermal infrared	Imaging geological features
8	Rader	Detection of various objects and mapping of landscape

(Source: Taulli, 2019)

The preprocessing operations are conducted to reduce positional inaccuracies which stem from the geometric instability of the satellites during the data acquisition (Molla *et al.,* 2018). The coordinates of each output pixel are used to calculate a new value of close-by pixel values in the input map using the nearest neighbor re-sampling method (ILWIS, 2001). Image enhancement makes raw image readily interpretable for a particular application (Anderson, 1976). False color composite, edge enhancement and linear stretching is applied for the improvement of image interpretability (Chib & Devi, 2016).

The land use classification- this is based on the modification of Anderson, (1976) that classifies the image into five classes these include agricultural land, built-up area, green space, and vacant/open land and water bodies. After the selection of training points, the actual supervised classification is carried out using the Maximum Likelihood Classifier (Anderson, 1976).

Accuracy assessment a procedure done to find the quality of remote sensing data. This is important because the quality can be checked and quantified of class samples (Sexton *et al.,* 2013). Accuracy assessment- ground truthing are used to verify and assess the accuracy of the final classification. Accuracy assessment is a measure of similarity of an estimate of the true value (Hailemariam *et al.,* 2016). Accuracy is determined by superimposing the points on the classified image and obtaining the kappa coefficient. According to Congalton and Green, (2019) the recommended standard of accuracy in the identification of the LU/LCC mapping from the remote sensing data should be85% - 100%.

The other information in accuracy assessment is a kappa coefficient (Kc) which is an estimate of the overall agreement between image data and the reference(ground truth) data. According to Gebremedihin et al., (2018), kappa values are classified into

three groups: a value greater than 0.80 suggesting strong agreements, a value between 0.40-0.80 represents a moderate/good agreement and a value below 0.4 represents a poor agreement. Kappa coefficient is calculated using the following formula:

$$Kc = \frac{po - pe}{1 - Pe}$$

Where Kc = Kappa coefficient, Po = the proportion of correctly classified cases,Pe = the proportion of correctly classified cases expected by chance.

Change detection analysis - this analysis is important in studying, monitoringand evaluation of the natural ecosystem and resources together with urbanization. This is because it gives the amount, growth and spread of the areas under study (Lu et al., 2004). Change detection analysis requires relatively medium to high resolution of information. There are three types of change detection which are essential when monitoring natural resources. These are those which reveal (a) the changes that have taken place and the type of change occurred, (b) the size and the extent of change and finally (c) the spatial pattern of change happening (Kenneth Mubea & Menz, 2014).

Overall, change detection methods have been classified into image algebra, transformation and classification. The algebra category includes image differencing, image regression, image rationing, vegetation index differencing, change vector analysis and background subtraction. These techniques involve subtraction of two or more images of almost identical radiometric characteristics;

where subtraction results in positive and negative values in areas of radiance change and zero values in areas of no change.

Successful implementation of change detection analysis using remote sensed data requires careful consideration of the sensor, environmental characteristics and image processing methods (Lu *et al.*, 2014). Failure to understand the impacts of these various parameters can lead to inaccurate results. The basis of using remote sensing data for change detection is that changes in land cover result in changes in radiance values which can be remotely sensed (Mubea etal., 2011).

2.7 Theoretical framework

With the rising interest in the use of green spaces to promote human health, the need to understand the extent to which park users conceptualize these places as a resource for health and well-being have become prevalent. The research on reasons for and benefits of visiting green spaces from among park users' have relied on person-environment theories and models to conceptualize research (Irvine *et al.*, 2013). Several theories provide insight on the person-environment relationship. This section provides an outline to some existing person- environment theories that are can be used to explain observed motivations, behaviors and outcomes of green space users.

2.7.1 Planning with Nature

Planning with nature was a planning concept postulated by Ian Mac Haag (1969). It emphasizes as to why development of urban areas should put into consideration both the ecology and the character of the landscape. This theory was meant to improve the ecological performance and quality of life in cities and towns worldwide. Especially, with the mounting pressure and increasing vulnerability to disasters such as climate change, urban heat island effects, green spaces have been

identified as vital in effectively improving natural cooling of urban environments. As a way of ensuring urban sustainability and ecological wisdom, Ian McHaag examined land use suitability for Staten Islandwith attention to ecological planning by analyzing physical and cultural characteristics of land features and biophysical vulnerabilities such as tidal inundation and coastal flooding. His concept, planning with nature, was a wayof assessing land suitability to promote sustainable planning. This theory is therefore applicable in this study since it is emphasizing on improving the ecological performance which is one of the benefits accrued from urban green spaces. In the event of planning of cities green areas should be given prioritiesso that biophysical vulnerabilities can be dealt with.

2.7.2 Malthusian theory

Malthusianism is the idea that population growth is potentially exponential while the growth of food supply or other resources is linear. This is derived from the political and economic thought of the Reverend Thomas Malthus (1798). The negative effects of society associated with environmental degradation and natural resource over exploitation is population growth. Malthusian theory points out population growth as the primary cause ofenvironmental degradation. Population growth leads to conversion of lands tofit the growing populations leading to natural resource degradation and over exploitation. In this study, green spaces as one of the natural resources is beinginfringed by urbanization which is brought by population increase. As suggested by neo-Malthusian theory and past research, this article hypothesizes that higher rates of population growth in developing countries result in higher rates of natural resources exploitation, all else remaining constant. As opposed to population-based arguments, the modernization perspective argues that environmental degradation is a function of the level and rate of development within

a given country. Based on a range of development from traditional to modern (or, as some argue, postmodern), this perspective considers various socioeconomic characteristics such as economicgrowth, technology, urbanization, transportation, education, and industrialization as indicators of development. Kisumu and Eldoret have beenexperiencing urbanization and green spaces have been lost due to the ever-increasing urbanization.

2.8 Conceptual Framework of Urban Green Spaces Status and Changesover in Kisumu and Eldoret Towns

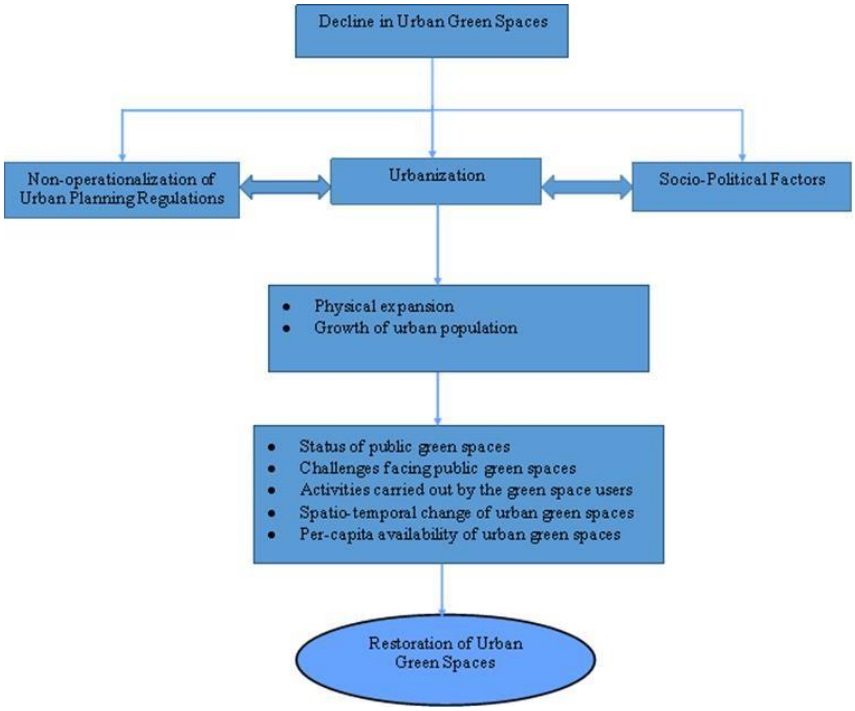

Figure 2.2 Conceptual Framework

Figure 2.2 describes the problem which is the decline of urban green spaces and the status of the public urban green spaces. The factors causing the decline ofthe urban green spaces are the non-operationalization of planning regulations,socio economic and political challenges and urbanization. The variables of urbanization are urban expansion and urban population growth and the variables of the status of public urban green spaces are the challenges facing the park users, activities done at the

park and the park users. Therefore, by analyzing the diagrammatic relationships as presented in Figure 2.2, the stakeholders will be able to adopt the rigorous strategies of restoration of urban green spaces.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This Chapter presents the study methodology that includes the procedures and methods which were applied in data collection, analysis and presentation. It also details the instruments that were used to collect data.

3.2 Study Areas Description

The study focused on Eldoret and Kisumu Towns. These towns were chosen mainly because they are not only the most important towns in Western Kenya but also among the fastest growing towns in Kenya (UN-HABITAT, 2015). Figure 3.1 shows the position of the study areas in Kenya.

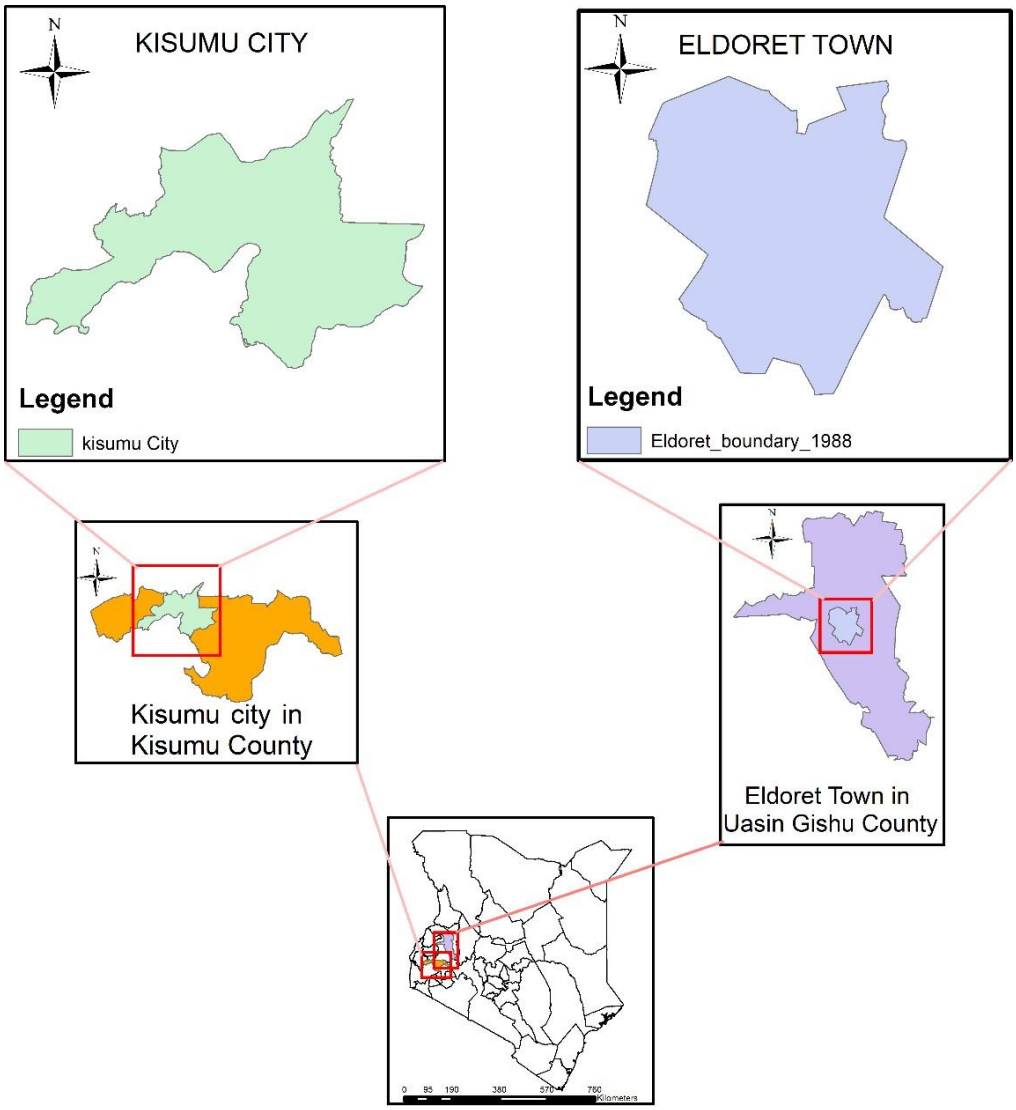

Figure 3.1 Position of the Study Areas in Kenya

(Source: Author, 2019)

The following are the descriptions of each town:

3.2.1 Kisumu town

Kisumu, officially known as Kisumu City, is a Kenyan inland port city on the eastern shores of Lake Victoria and the capital City of Kisumu County. At an elevation 1131m (3711 ft.), the City had a population of 397,957 in 2019 (KNBS). It is the largest city in Western Kenya and the second most important city afterKampala

in the greater Lake Victoria Basin. Kisumu was designated the first United Nations Millennium City in 2006 and had the challenge of meeting the Millennium Development Goals (MDGs). The vision of the city was to become a hub of knowledge, tourism and commerce in the East African region (Obeng-Odoom, 2013). The main public green spaces in Kisumu town are Jomo Kenyatta, Jamhuri, Oile, Victoria and Coke parks.

3.2.2 Eldoret town

Eldoret is a principal town in Western Kenya and the fifth largest by population in the country. It is the second most important city in Western Kenya after Kisumu and also serves as the capital of Uasin Gishu County. Lying South of the Cherangani hills, the local elevation varies from about 2100 metres above sea level (Gitari, 2017). The population was 289,380 in the 2009 census and 475,716in 2019. It is currently the fastest growing town in Kenya. It is also the second largest urban Centre in mid-western Kenya after Nakuru. The main public green space in Eldoret is Nandi Park and Huruma Grounds was added because of its accessibility (personal communication with Uasin Gishu planner).

3.3 Nature, types and sources of data required

In order to fulfil the needs of the study objectives, different types of data from various sources were sought. The next section gives a detailed description.

3.3.1 Objective 1: The status and attributes of urban green spaces inKisumu and Eldoret towns.

The variables studied to determine the status and attributes of urban green spaces in Kisumu and Eldoret towns include; the sizes of public urban green spaces, their positions, the facilities and attributes, the use patterns, the users activities and challenges. The information on the official public green spaces, the activities, use

patterns and challenges was sought from interviewing urban public green spaceusers and key informant interviews of urban planners in Kisumu and Eldoret towns. In addition, the status and attributes of public urban green spaces were sought using observation checklist and tally sheets. This same approach was used by Lee andKim, (2015) and Onyoni, (2015).

3.3.2 Objective 2: Urban expansion and effect on green spaces in Kisumuand Eldoret towns.

The data sought for this objective included the town boundary map, in the base year 1972 and 1981 and trends in the change or urban physical size and urban green spaces over time. This information was obtained through analysis of Landsat images of the years 1989, 1999, 2009 and 2019. Landsat images were selected because Landsat program is the oldest Earth Observation Program, which was started in 1972 (Hu et al., 2013). Therefore, it was important to consider Landsat in order to get the 1989 image. Landsat is a very useful tool for detail mapping of land cover, land use, soil and geology also on the other hand it has a better spectral resolution than Google imagery. (Forkuor and Cofie, 2011). The tables 3.1 and 3.2 gives a description of the images considered for the study.

Table 3.1 Kisumu town image description

Landsat Imagery (Landsat TM)	Path /Row	Platform	Sensor (Thematic Mapper)	Spatial Resolution, Bands 4,5,2/5,6,3	Date of acquisitionn
5	P170R060	5	TM	30m	3/1/1989
5	P170R060	5	TM	30m	2/2/1999
7	P170R060	7	TM	30m	1/1/2009
OLI8	P170R060	8	Operational	30m	1/30/2019

			Land Imager (OLI)		

Table 3.2 Eldoret town image description

LandsatImagery (Landsat TM)	Path /Row	Platform	Sensor (Thematic Mapper)	Spatial Resolution, Bands 4,5,2/5,6,3	Date of acquisitionn
5	P169R060	5	TM	30m	3/1/1989
5	P169R060	5	TM	30m	2/2/1999
7	P169R060	7	TM	30m	1/1/2009
OLI8	P169R060	8	Operational Land Imager (OLI)	30m	1/30/2019

3.3.3 Objective 3: Determination of per-capita availability trends of greenspaces in Kisumu and Eldoret towns

The per-capita availability trends of the two towns' information for the years 1989, 1999, 2009 and 2019 included sizes of the total and public urban greenspaces and the urban population for the years. Data were obtained from analyzing Landsat images and the total number of urban residents for 1989, 1999, 2009 and 2019 were obtained from the population census.

3.4 Research Design

Mixed-method study design was used. Through this design, it was possible to examine the urban green spaces status and changes over time in Kisumu and Eldoret towns. This research design involves integrating quantitative and qualitative data collection and analysis within a single study (Creswell et al., 2003). The underlying logic of mixing quantitative and qualitative data is thaton their own,

neither method is sufficient to capture the details and trends of the problem under study. When used in combination, quantitative and qualitative data complement one another and yield a more complete analysis (Creswell et al., 2004).

3.5 Target Population

The target population of the study were the towns of Kisumu and Eldoret, all green spaces in Kisumu and Eldoret towns and green space users in these towns.

3.6 Sampling Procedures

Purposive sampling technique was used to select the study areas Kisumu and Eldoret towns, all green spaces within the town boundary, public green spaces and the key informants, which included the urban physical planners of Kisumu and Eldoret towns.

Kisumu and Eldoret towns were selected for the study because they are amongthe fastest growing towns in Kenya in terms of population and physical expansion (UN-HABITAT, 2015). Also, in Kisumu town there are five public green spaces (Jomo Kenyatta, Jamhuri, Oile, Taifa and Victoria) while in Eldoret town there are two green spaces (Nandi and Huruma) so this could give a good comparison. The list of the official public green spaces in the two towns were obtained from the Physical Planning Department in Kisumu and Eldoret towns.

The green space users were sampled from those who were present at the public green spaces in Kisumu and Eldoret towns at the time when the questionnaire was issued. The sampling size was derived from the hours of the day and days of the week for the study that is from 8 am to 6 pm and Monday to Sunday in November 2018. Simple random sampling was used and the questionnaires were administered with the help of research assistants. The public green spaces were divided virtually into four quadrants

and one respondent within a quadrant was selected for the interview. In total, 1030 questionnaires were administered in all the public green spaces in Kisumu and Eldoret towns.

3.7 Data Collection Techniques

The data collection techniques employed were survey, tallies, observation, key informant interviews, satellite imagery and photography.

3.7.1 Key informant interviews

Key informant interview data collection technique was used to collect the data and information on the official public green spaces, the design and purpose of each green space and the main challenges facing public green spaces. This was achieved through pre-scheduled arrangements verbally.

3.7.2 Survey

The activities of the park users and the challenges they face were collected using survey data collection technique from 8 am to 6 pm daily for a week 5th to 11th of November 2018. The survey was carried in all the days of the week to ensure the use patterns and different activities associated with different days of the week captured. The questionnaires were administered throughout the hours of the day to cover on the activities carried out within the different hours of the day. The research was conducted for a period of one week so as to capture the pattern of activities conducted on each of the different days of the week (Appendix I). This same approach was used by (Makworo & Mireri, 2011).

3.7.3 Tallies

The number of visitors was estimated using tallies whereby the number of children, men and women were counted from seven in the morning to six in the evening for a whole week, that is, Monday on 5th November 2018 to Sunday on 11th November

2018. Tallies were done in all the hours of the day and all the days of the week to get the use patterns of the public green space during the course of the day and the week. The information was useful for the determination of use patterns of the public parks of Kisumu and Eldoret towns.

3.7.4 Observation

Observation checklist was used to identify the facilities found in the urban public green spaces in Kisumu and Eldoret towns. The data collected includedthe presence of parking space, maintenance and cleanliness, sufficient benches and seats, presence of water, presence of playing facilities and opportunities for sports and the biodiversity found in the Kisumu and Eldoret public urban green spaces. The development of public green space attributes was guided by Physical Planning Handbook. Photography was used to take pictures of the variables under study which were taken at a vantage point to ensure accuracy and wide view of the pictures. The information was used to determine the status and attributesof the public green spaces.

3.7.5 Satellite imagery

Satellite images technique were used to find the data on urban growth and urban green spaces.

3.7.6 Data Collection tools

The tools used to collect the data on the four objectives of this study are key informant interviews (KII) schedule, questionnaire, and an observation checklist while the materials used included a camera and a GPS.

3.7.7 Key informant interview schedule

The key informant interview schedule was used to collect the official information on public green spaces, their design and purpose, and the main challenges facing public green spaces.

3.7.8 Questionnaire

A questionnaire was used to collect demographic characteristics including; age, gender, marital status, level of education, current occupation and average monthly income of the respondents, data on activities carried out by the green space users and the challenges facing them.

3.7.9 Observation checklist

A checklist was used to record observed data on the presence of parking, maintenance and cleanliness, sufficient benches and seats, presence of water, presence of playing facilities and opportunities for sports and the biodiversityfound in the Kisumu and Eldoret public parks (Appendix II). Camera was used to take pictures of the public urban green spaces, activities carried out by the users and the facilities available to aid in presentation of data.

3.7.10 Global positioning system

GPS was used to obtain ground control points used in accuracy assessment.

3.8 Data analysis Techniques

The following analysis process was followed:

3.8.1 Objective 1: the status and attributes of urban green spaces inKisumu and Eldoret towns.

Data collected for the sizes and positions of public green spaces obtained frommaps were geo-referenced and the selected public green spaces digitized. Theshape files were set to projection WGS-1984-UTM-Zone-36N Kisumu and 37N Eldoret then an attributetable was opened and created a field of area in hectares then under Arc Map calculated geometry tool then auto generate their areas. On the attributes/facilities in the public green spaces total percentages were computed by adding the values each green space obtained in a range of 0-1 whereby 1

represented present while 0 represented absent of a facility and converted into percentages. Concerning the activities and challenges faced by the urban green space users, descriptive statistics including mean, frequencies and percentages were used. Tallies were used to get the use patterns of the public green spaces. The number of people who visited the green spaces were analyzed using excel and hourly visitation patterns and daily average green spaces were calculated.

3.8.2 Objective 2: urban expansion and effect on green spaces in Kisumu and Eldoret towns.

a) GIS and Remote Sensing

An important component of the data analysis for urban expansion and spatiotemporal change of urban green spaces was the use of remote sensing and GIS and statistical techniques. Remote sensing and GIS techniques are presented as follows:

Through image processing of the satellite imagery, urban growth information and urban green spaces in the four decades (1989, 1999, 2009 and 2019) in Kisumu and Eldoret towns were obtained. The images were rectified and geo-referenced to the Universal Transverse Mercator (UTM) 37N Eldoret and 36N Kisumu coordinate system by using the Earth Resource Data Analysis System (ERDAS) Imagine system (Version 10.1). The major image processing steps undertaken were layer stacking, re-sampling, and image enhancement of the image dataset.

The re-sampling operations were conducted to reduce positional inaccuracies which stem from the geometric instability of the satellites during the data acquisition. The corrected satellite images were clipped by the boundary map of Eldoret and Kisumu towns using ArcGIS V.10.5 spatial analysis tools and images were ready for classification purpose. Thereafter image classification was done to the identified

images for each yearunder investigation (1989-2019) in a consistent manner. These included built-up area and green space using supervised classification.

In order to verify the classification result, ground truth sites were collected from the field using handheld Garmin Global Positioning System (GPS) and the knowledge of the study area were used. The collected ground control points (GCPs) data were stored in Excel and converted to shapefile using Arc GIS 10.4software for accuracy assessment.

Finally, change detection was established by observing the classified images ofthe years 1989-2019. The area of urban green space and built-up areas was calculated from the pixel counts, then converted into hectares and metres squared and the changes taking place in the span of data observed. After image classification, polygons were converted to shapefile. The green spaces information was extracted only from built-up areas. The green space areas in each analyzed image of a certain year were compared with the area of green space in the images from previous time point of analysis to assess the spatiotemporal change in urban green spaces. This analysis considered green spaces generally and then isolated public green spaces fromthe rest.

3.8.3 Objective 3: Determination of per-capita availability trends of greenspaces in Kisumu and Eldoret towns

Per-capita availability of urban green spaces was analyzed by considering the temporal population data used with urban green space information obtained from satellite imagery to correlate with urban population data. Per-capita availability was calculated as total area of green space/total population of thetown.

3.9 Validity and reliability

Validity is the extent to which an instrument can measure what is supposed to measure and to accomplish what is scheduled to perform (Mugenda, 2003). Itis generally and clearly impossible for an instrument to be 100% correct. Moreover, to achieve a high validity of an instrument, piloting process should be conducted. Therefore, piloting was done in order to pretest this study's questionnaire. The survey focused only on the users of public green space and this was so that the respondents may not give a hypothetical response. The key informant interviews were only administered to the sources that had authority on urbanization and the green spaces in Kisumu and Eldoret towns. The key informants were the urban physical planners and officials in the department ofbureau of statistics. To ensure validity of maps, Google earth was used to compare the findings and accuracy assessment was performed. The data from observation was also compared with those from the responds to ensure accuracy was achieved.

Reliability describes the extent to which a method can be replicated by others under similar conditions with the same results achieved at the end of it (Zohrabi, 2013). The reliability was achieved by training research assistants on ways of probing the respondents that were similar in all the public green spaces. Probing was done by asking different questions on the same issue to counter check the answers.

3.10 Ethical Considerations

In this study, the major ethical consideration included data protection, confidentiality and consent of the participants. The first ethical considered was obtaining approval of the research through a letter from the university of Eldoret board of postgraduate which was also used to apply for the NACOSTI research permit. Consideration of the contributions of other researchers on the effects of

urbanization on urban green spaces for providing guidance and in-depth information was recognized. This was achieved by acknowledging those researches through references and citations.

Finally, the permission was sought verbally from participants who included the public green space users and the key informants from the department of urban physical planning as a way of their acceptability to participate in the study willingly. The study took into consideration confidentiality issues whereby the collected data were solely used for research and study purposes only. This also means that the anonymity of the participants was held throughout the study.

CHAPTER FOUR

RESULTS

4.1 Introduction

This chapter presents study findings. It starts with the presentation of the socio-demographic information of the respondents, followed by detailed reporting with respect to each of the study's objectives.

4.2 Socio-Demographic Information

Socio-demographic data collected included gender, age, level of education, marital status, and occupation and income levels. The findings are shown in Table 4.1.

Table 4.1 Demographic Information

		Kisumu		Eldoret	
		Frequency	%	Frequency	%
Age of respondents	18-30	449	60.7	198	68.3
	31-40	194	26.2	73	25.2
	41-50	40	5.4	13	4.5
	51-60	31	4.2	1	0.3
	61-70	9	1.2	1	0.3
	Over 70	1	0.1	0	0
	Under 18	3	0.4	1	0.3
	No response	13	1.8	3	1
	Total	740	100	290	100
Gender of respondent	Male	457	61.8	185	63.8
	Female	283	38.2	105	36.2
	Total	740	100	290	100
Marital status	Married	309	41.8	110	37.9
	Single	345	46.6	117	40.3
	Divorced	2	0.3	2	0.7
	Separated	5	0.7	2	0.7
	Widowed	8	1.1	1	0.3
	Engaged	54	7.3	55	19
	No response	17	2.3	3	1
	Total	740	100	290	100

Level of education	None	10	1.4	7	2.4
	Some primary education	22	3	11	3.8
	Primary	38	5.1	21	7.2
	Secondary	159	21.5	123	42.4
	Tertiary	494	66.8	128	44.1
	No response	17	2.3	0	0
	Total	740	100	290	100
Current occupation	Own business	230	31.1	61	21
	Employed in thecounty government	63	8.5	13	4.5
	Employed in the national government	27	3.6	13	4.5
	Student	145	19.6	71	24.5
	Employed in the private sector	175	23.6	73	25.2

In terms of age in Table 4.1, 60.7% (449) and 68.3% (198) of the respondents were within the age bracket of 18 to 30 years, followed by 26.2% (194) and 25.2% (73) which fall in 31 to 40 age brackets. The least was 0.1% (1) in Kisumu and 0.3 % (1) in Eldoret town being over 70. The male respondents interviewed were 61.8% (457) and 36.2% (105) while the female respondents were 38.2% (283) and 63.83% (185) in Kisumu and Eldorettowns respectively. Most of the park users were singles 46.6% in Kisumu town and 40.3% in Eldorettown) followed by the married 41.8% and 37.9% in Kisumu and Eldoret respectively) and the least were the divorced 0.3% in Kisumu and widowed0.3% in Eldoret.

From the results on the level of education of the park respondents, 66.8% (494) in Kisumu and 44.1 % (128) in Eldoret town had attained tertiary level of education while

21.5% (159) and 42.4 % (123) secondary education, and the leastis no education with 1.4 % (10) and 2.4% (7) in Kisumu and Eldoret town respectively.

According to the current occupation of the park respondents those with own business and those who work in the private sector had the highest percentageof 31.1% and 25.2% in Kisumu and Eldoret towns respectively. This was followed by those who work in the private sector 23.6% in Kisumu and own business 21% in Eldoret town and the least is a volunteer, driver, jua kali worker and priest 0.1% in Kisumu and farmer 0.7% in Eldoret.

4.3 Status of Public Urban Green Spaces

The first objective of the study was to determine the status and attributes of the green spaces studied in the two towns. The description includes the position ofpublic green spaces, sizes and distribution, the facilities present, their use patterns, the common activities in the public green spaces and the challengesfacing the park users.

4.3.1 Sizes of selected public urban green spaces in Kisumu andEldoret towns

Table 4.2 and 4.3 presents the identity of green spaces in Kisumu and Eldoret and their respective sizes.

Table 4.2 1Kisumu city and Eldoret town public urban green space sizes

Green space	Size Ha
Jomo Kenyatta	7.77
Jamhuri park	3.30
Oile park	0.75
Taifa park	0.740
Victoria park	0.61

Huruma	31.68
Nandi	0.69

As can be seen in Table 4.2, Jomo Kenyatta Park is the largest green space surface in Kisumu Town with an area of 7.77 Ha (77774.74 $M^{2)}$, followed by Jamhuri Park with 3.30 Ha (33087.4729 $M^{2)}$ and the least is Victoria Park withan area of 0.61 Ha (6116.33M^2).

On the other hand, the largest public green space in Eldoret town is Huruma with an area of 31.6 Ha (316861.1 $m^{2)}$ and the smallest being Nandi Park 0.69Ha (6939.58 m^2) as can be seen in Table 4.3.

Table 4.3 Eldoret town public urban green spaces

Green space	**Size Ha**
Huruma	31.68611
Nandi Park	0.6939585

4.3.2 Position and distribution of urban public green spaces inKisumu towns

Figure 4.1 and Fig. 4.2 presents the map of Kisumu and Eldoret towns showing spatial distribution.

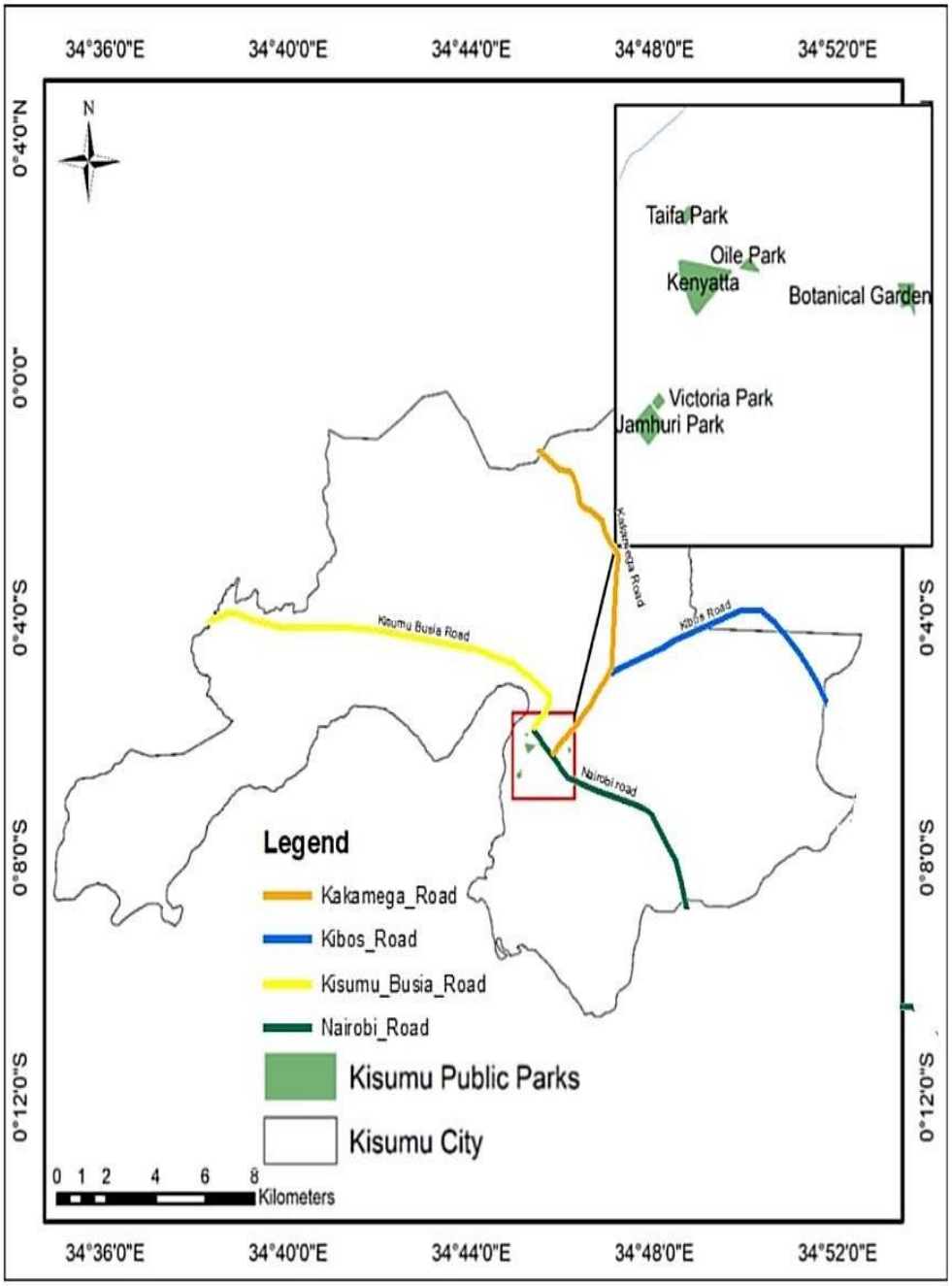

Figure 4.1 Spatial distribution of urban public green spaces in Kisumu town (Source; Author, 2019)

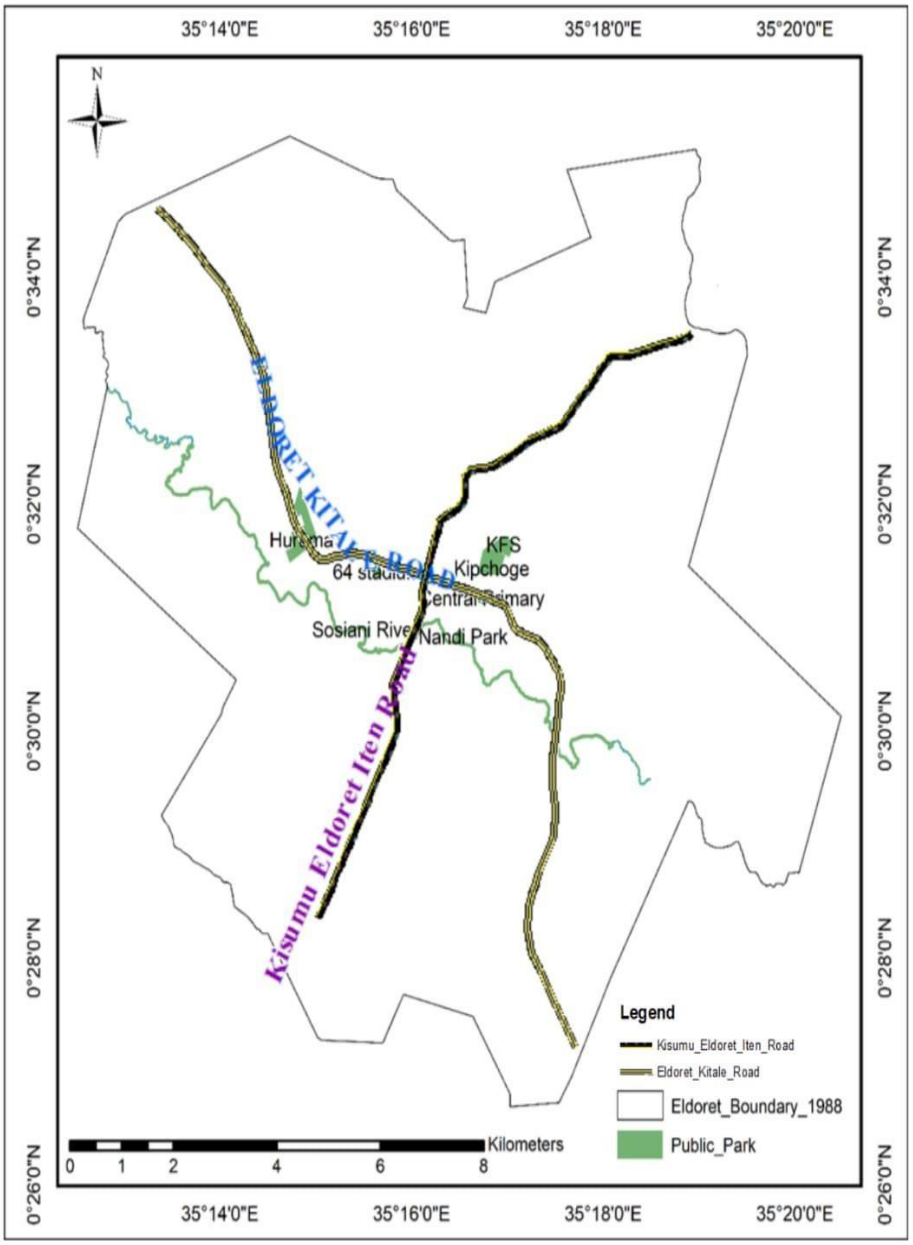

Figure 4.2 Spatial distribution of urban public green spaces in Eldoret town (Source; Author, 2019)

As can be seen from Fig. 4.1 and 4.2, the public parks are apparentlyconcentrated within the central business district in the two towns.

4.3.3 Facilities in the Public Urban Green Spaces in Kisumu andEldoret Town.

Table 4.4 gives a summary of the facilities observed in the urban green spaces studied.

Table 4.4 Facilities in the Public Parks of Kisumu and Eldoret Town

Urban green spaces **Attributes**	**Jomo .K**	**Coke**	**Oil e**	**Victoria**	**Jamhuri**	**Nandi**	**Huruma**
Fenced	1	0.5	0.5	0.5	0.5	1	0
Accessibility conditions	1	1	1	1	1	1	1
Cleanliness and maintenance	1	0	0	1	0	1	0
Sufficient benches	0.5	0.5	0.5	0.5	0.5	0.5	0
Security	1	0	0	1	0	1	0
Park biodiversity (plants and animals)	0.5	0.5	0.5	05	0.5	0.5	0.5
Presence of water	1	0	0	1	0	1	0
Existence of playground and playing facilities	0.5	0.5	0	0	0	0.5	0.5
Existence of car parking	0.5	0	0	0.5	0	0	0.5
Economic activities	1	0.5	0.5	0.5	0.5	0.5	0.5
Sanitation facility	1	0	0	1	0	1	1
Opportunities for sports	1	0	0	0	0	0	1

Ranking	**10(83.3%)**	**3.5(29.2%**	**3(25.0%**	**7.5(62.5%)**	**3(25.0%)**	**8(66.6%)**	**5(41.7%)**

Findings reveal that all green spaces in the two study sites were fenced except for Huruma ground in Eldoret town. In addition, all green spaces were found to be freely accessible to the residents. Kenyatta and Victoria green spaces in Kisumu and Nandi Park in Eldoret were the cleanest and well maintained. The other parks like Jamhuri, Oile and Victoria in Kisumu and Huruma in Eldoret were found not to be well maintained littered most of the time during this study. In Nandi and Victoria green spaces, there were benches provided for the visitors though not sufficient. Table 4.4 shows these findings on facilities in the green spaces studied.

It was further found out that the green spaces with security personnel in Kisumu were Kenyatta, Victoria and in Eldoret Nandi Parks. On the other hand, security in Oile, Jamhuri and Coke parks in Kisumu and Huruma in Eldoret was not manned by security personnel.

In all the parks there were biodiversity which included trees, flowers, shrubs and grass. It was also found that there were children's playing facilities in Kenyatta and Coke green spaces in Kisumu and Nandi Park in Eldoret.

In addition, there was presence of car parking in Kenyatta and Victoria in Kisumu and Huruma grounds in Eldoret. In all the parks, economic activities such as hawking and shops in other greenspaces were observed. There was a hotel in Jomo Kenyatta grounds in Kisumu. Sanitation facilities were present in Kenyatta and Victoria in Kisumu and Nandi and Huruma in Eldoret. It was observed that water was available in these facilities except for Huruma ground in Eldoret. In Kenyatta and Huruma grounds there were play fields for football and netball.

According to ranking of richness in facilities in the public green spaces, Jomo Kenyatta came first with a score of 10 followed by Nandi Park 8, Victoria 7.5, then Huruma 5, followed by coke 3.5 and the least is Oile and Jamhuri green spaces.

Images in the next plates show some of the facilities identified in the green spaces studied.

Plate 4.1 Children playing in Jomo Kenyatta Park in Kisumu (Source; Author, 2019)

Plate 4.2 A worker maintaining Victoria public green spaces in Kisumu

(Source; Author, 2019)

Plate 4.3 A park seat, park vegetation and a user sleeping on the bench in the background in Taifa green space in Kisumu.

Source; Author, 2019)

Plate 4.4 A church function at Taifa Park, Kisumu

(Source; Author, 2019)

4.3.4 Public green spaces use patterns

An assessment was done to ascertain users of green spaces, and time of the dayand the days of the week when visitors visit the green spaces.

a) Hourly visitation patterns

Figure 4.3 represents the time of the day for urban green space utilization inKisumu and Eldoret town.

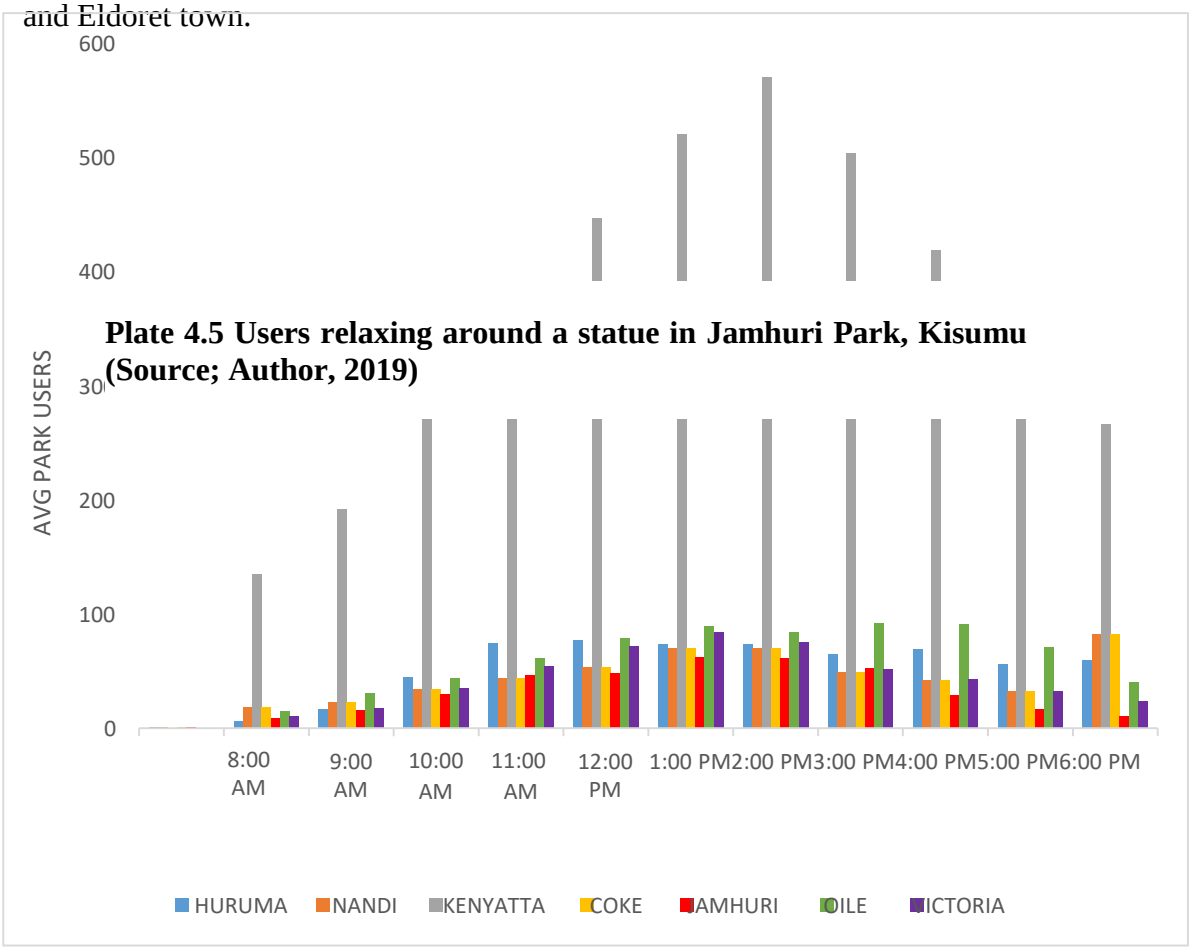

Plate 4.5 Users relaxing around a statue in Jamhuri Park, Kisumu (Source; Author, 2019)

Figure 4.3 Hourly visitation patterns.

As evidenced in Figure 4.3, Huruma ground and Victoria had the highest number of visitors at 12 pm, Jamhuri park at 1 pm. Jomo Kenyatta park 2 pm,Oile park at 4 pm, Nandi park and Coke park had their peak at 6 pm. At 7 am there are no visitors at the park.

b) Daily average green space utilization

Figure 4.4 shows daily green space utilization by gender.

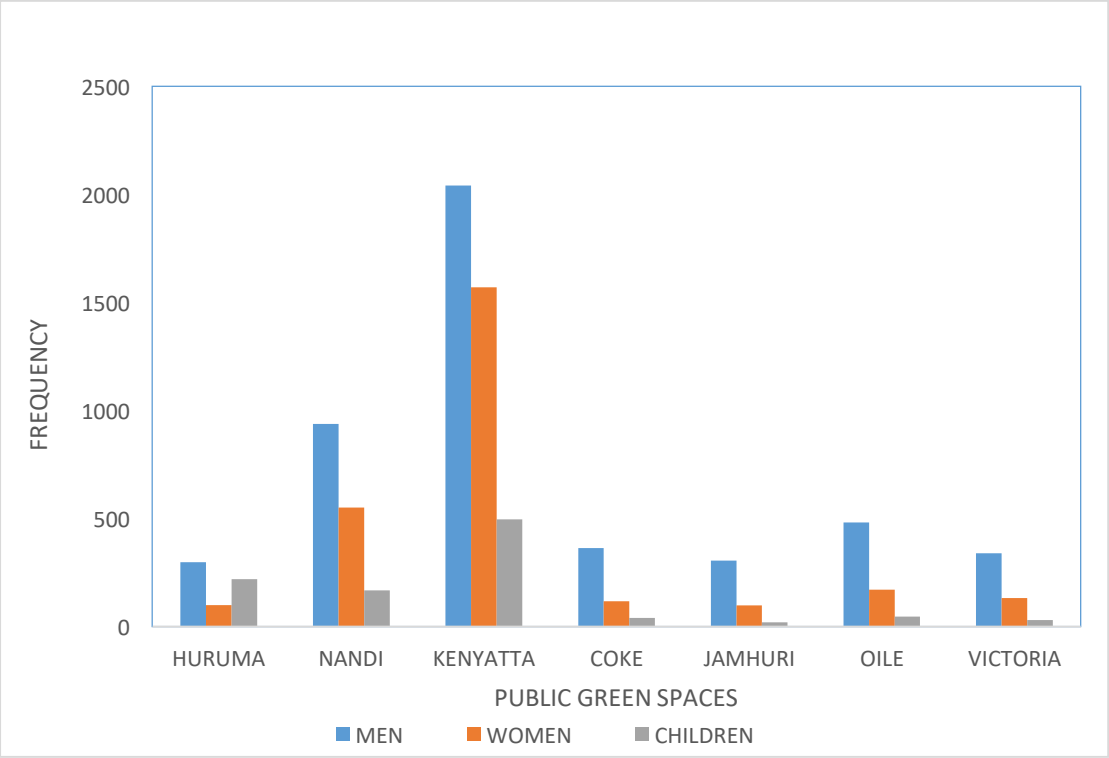

Figure 4.4 Average daily green space utilization by gender

From analysis, Kenyatta public green space in Kisumu had the highest averagedaily visitors (4108) individuals for the entire week, followed by Nandi in Eldoret (1658) and the least used public green space was Jamhuri green space(423). The highest daily average public green space usage was observed in Kenyatta where men dominated (2041) in Kisumu while in Nandi (939) Eldoret. Kenyatta in Kisumu had the highest women green space users (1570) while Jamhuri being the least (99) in the same town. Furthermore, children green space userswere highest in Kenyatta (496) in Kisumu while the highest in Eldoret being Huruma (220) while Jamhuri in Kisumu had the lowest average daily green space (19).

In the overall, men were the dominant users of the public green spaces in both Kisumu and Eldoret towns (56%). Women comprised 32%, while children were the least public green space users (12%) as shown in Figure 4.5.

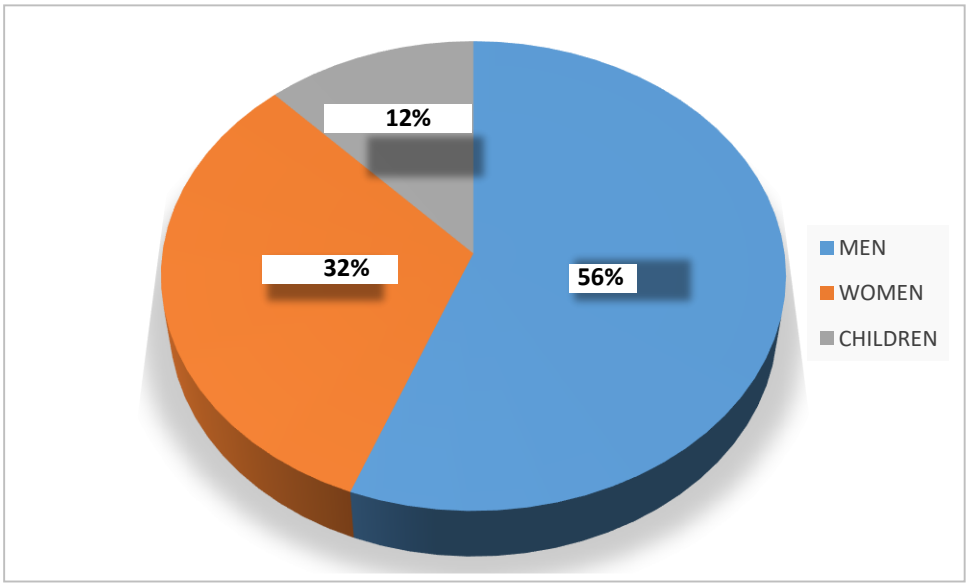

Figure 4.5 Green space usage by Gender

4.3.5 Activities carried out in public green spaces in Kisumu

c) Green space users' main activities

The study established the main activities undertaken by visitors in the Kisumu green spaces are presented in Figure 4.6.

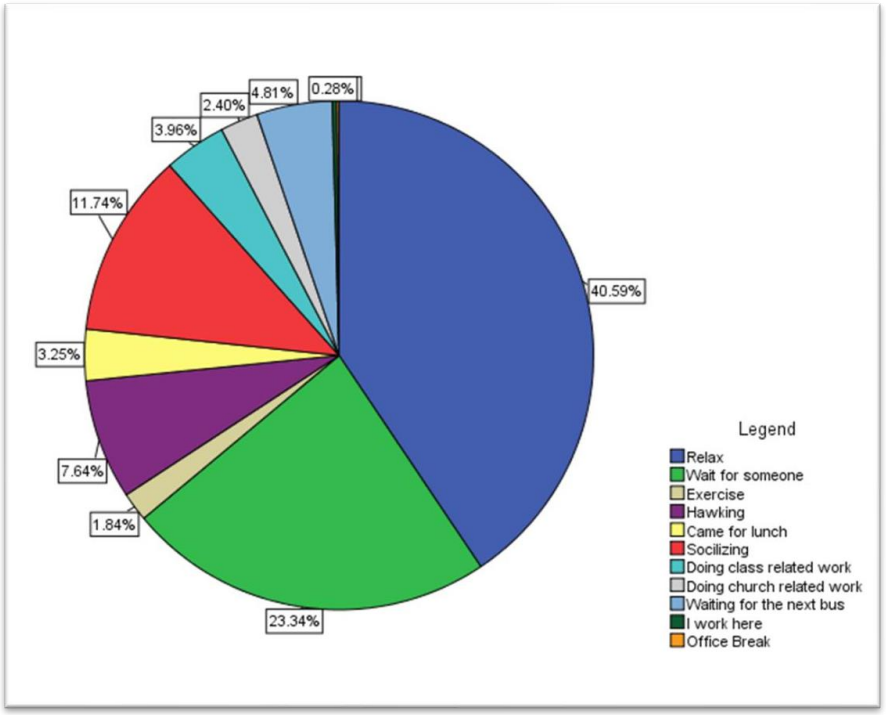

Figure 4.6 Main activities carried out by green space users in Kisumu town

In all the public green spaces in Kisumu town, relaxing (40.59%) is the major activity done by the park users followed by waiting for someone (23.34%) as an activity, socializing (11.74%), hawking (7.64%) and the least is working at thegreen space and having an office break (0.28%) as the activities. Figure 4.6provides a list of activities carried out in the public green spaces of Kisumu.

d) Green space users' activities carried out in each green space in Kisumu town.

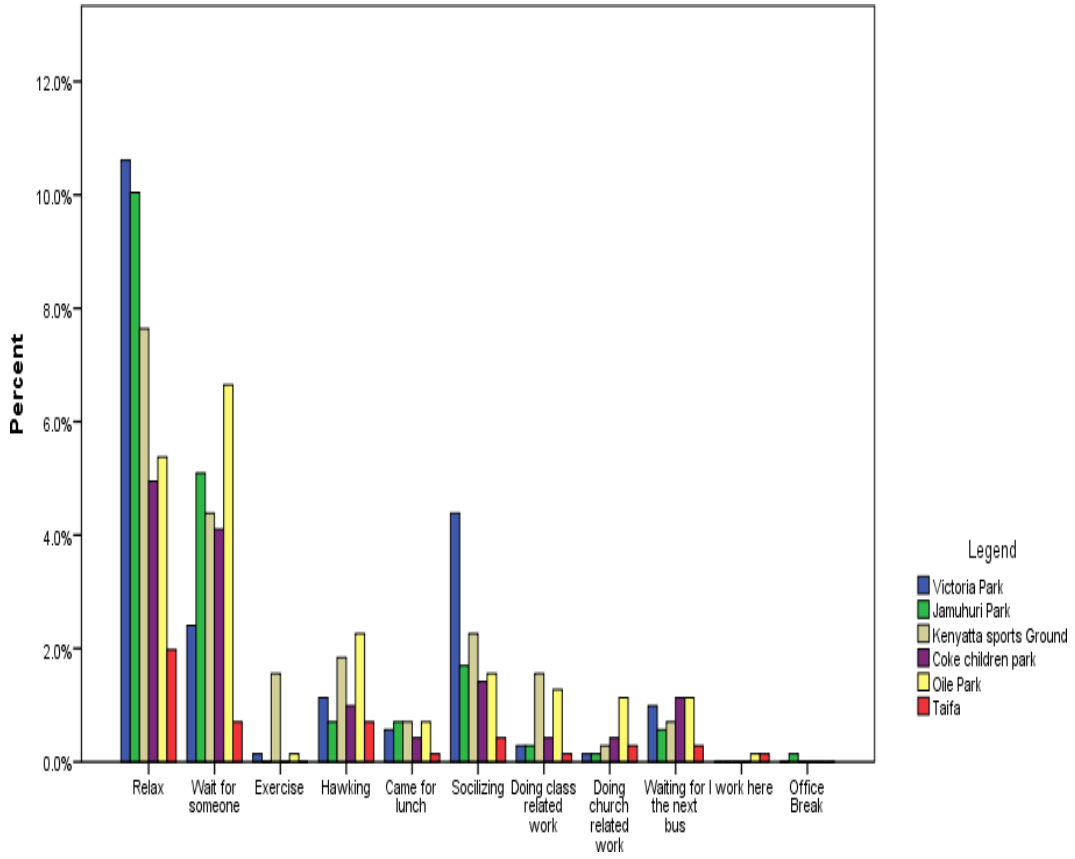

Figure 4.7 Activities carried out in each public green space in Kisumu town

In terms of disaggregated data, relaxing was highly practiced in Victoria green space (10.61%) followed by Jamhuri (10.04%) and Taifa (0.71%) was the least as shown in Figure 4.7. Waiting for someone was mostly pacticed in Oile green space (6.65%) followed by Jamhuri (5.09%) and was least done in Taifa green space (0.71%). Exercising had the highest value in Kenyatta Sports Ground (1.56%) followed by Oile and Victoria (0.14%). Hawking was mostly practiced in Oile green space (2.26%) followed by Kenyatta (1.84%) and the least green space with hawking is Taifa (0.71%). Coming for lunch was witnessed in all the green spaces but was highly practiced more in Jamhuri Kenyatta and Oile (0.71%) and the least green space with users taking lunch is Taifa green space (0.14%). Further, socializing was mostly witnessed in Victoria (4.38%), then Kenyatta (2.26%) while Taifa (0.42%) was the least. Doing class related

activities had highest value in Kenyatta green space (1.27%) followed by Oile (1.23%) and the least being Taifa (0.14%).

Doing church related activities had high percentage in Oile public green space (1.13%) followed by Coke (0.28%) and the least is Victoria and Jamhuri (0.16%) with a tie. Coke and Oile public green spaces (1.13%) had the highest value with respondents who were waiting for the next bus followed by Victoria (0.17%) and the least respondents who mentioned waiting for the next bus is Jamhuri green space (0.28%). The respondents who mentioned working at the green space were only in Oile and Taifa green spaces green spaces (0.14%) and also those who were taking office break were only in Jamhuri green space (0.14%).

4.3.6 Activities carried out in public green spaces in Eldoret

a) Green space users main activities

Figure 4.8 presents a synthesis of the main activities carried out in the greenspaces studied in Eldoret town.

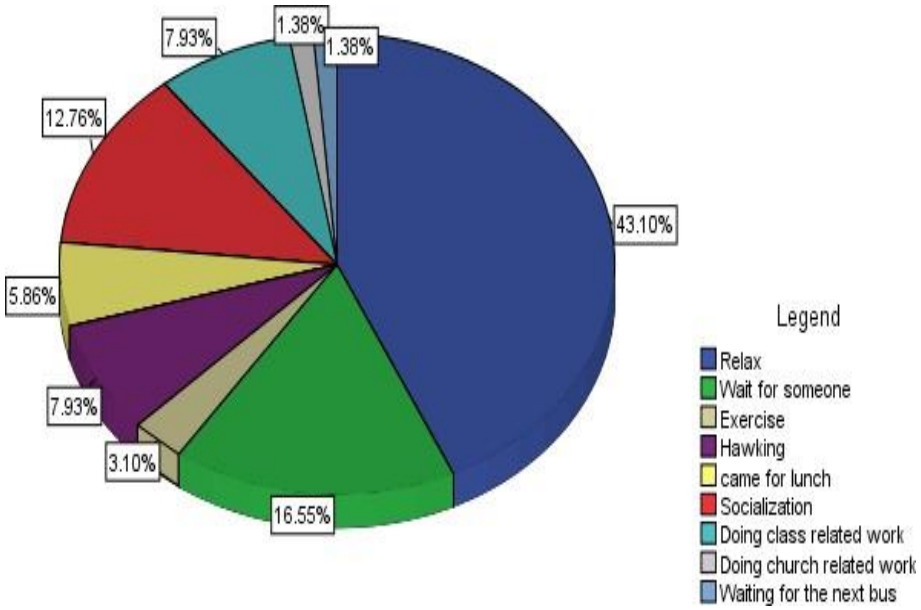

Figure 4.8 Main activities carried out by green space users in Kisumu town.

It was found that relaxing (43.10%) was the leading activity in all the green spaces in Eldoret town, while only 16.55% and 12.76% were to wait for someoneand socializing respectively and the least being doing church related work (1.38%) and waiting for the next bus (1.38%) as activities carried out in the greenspaces in Eldoret town as shown in Figure 4.8.

b) Green space users' activities carried out in each green space in Eldoret town.

Detailed analysis of activities carried out in public green spaces in Eldoret town revealed that, relaxing, waiting for someone, exercising, hawking, takinglunch, socializing, doing church and class related activities and waiting for thenext bus as portrayed in figure 4.9.

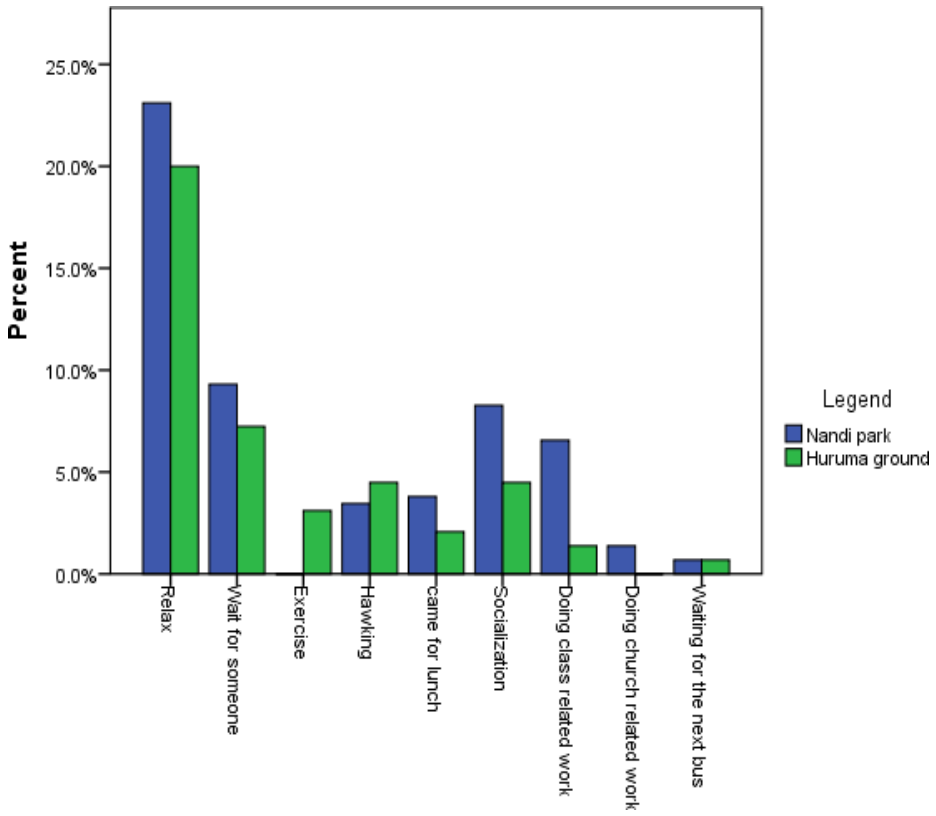

Figure 4.9 1Activities practiced in each public green space in Eldoret town

Figure 4.9 shows that relaxing was the most common activity in Nandi green space (23.10%) compared to Huruma green space which had only (30.00%) of visitors relaxing. On the other hand visitors who were waiting for someone was high in Nandi green space (9.31%) as opposed to only (7.24%) at Huruma green space. Exercising was only observed in Huruma green space (3.10%). Hawking was the prevailing activity in Huruma green space (4.48%) unlike in Nandi green space which accounted for (3.45%). Lunching in Nandi green space was (3.78%) while in Huruma green space it was 2.07%. Socialization was more prevalent in Nandi green space (8.28%) while huruma green space recorded the least (4.48%). Doing class related work was highly practiced by Nandi green space visitors (3.55%) compared to Huruma green space visitors (1.38%). Doing church related activities was only recorded in Nandi green

space (1.38%), While those who were waiting for the next bus was equal in both the green spaces in Eldoret town (0.69%).

4.3.7 Challenges experienced by green spaces users in Kisumu towns

The main challenges elicited included overcrowding, dirty parks, insecurity, noise disturbances, insufficient benches, absence/inadequate shade, lack of washing facility and less grass which was done in the two parks in Eldoret andfive in Kisumu towns. Below are the findings on the challenges experienced by green spaces' users in Kisumu town.

a) Main challenges facing green space users in Kisumu town

Figure 4.10 presents the main challenges faced by the green space users in Kisumu town.

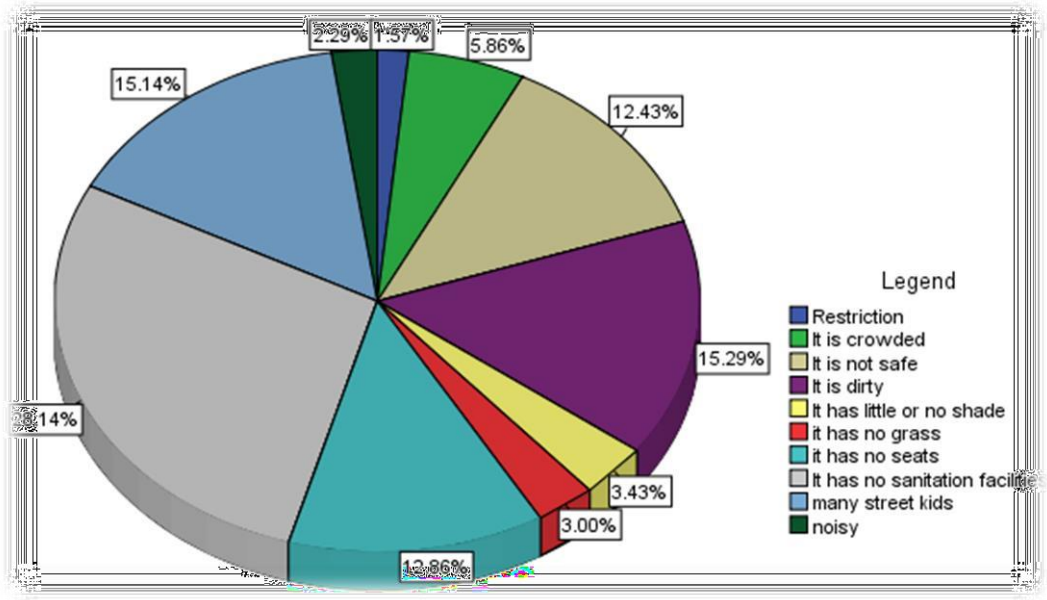

Figure 4.10 Main challenges facing green space users in Kisumu town.

In Kisumu town the main challenge experienced by the green space users is lack of sanitation facilities (28.14%) this is displayed in Figure 4.10. This was closely followed by dirtiness or uncleanliness (15.29%) in the green spaces and presence of street kids

(15.14%) in the green spaces of Kisumu town. The least challenge faced by the public green space users is restriction (1.57%) at the green space.

b) Challenges facing green space users in each green space in Kisumu town.

The specific details of challenges per green space in Kisumu is as presented in Figure 4.11.

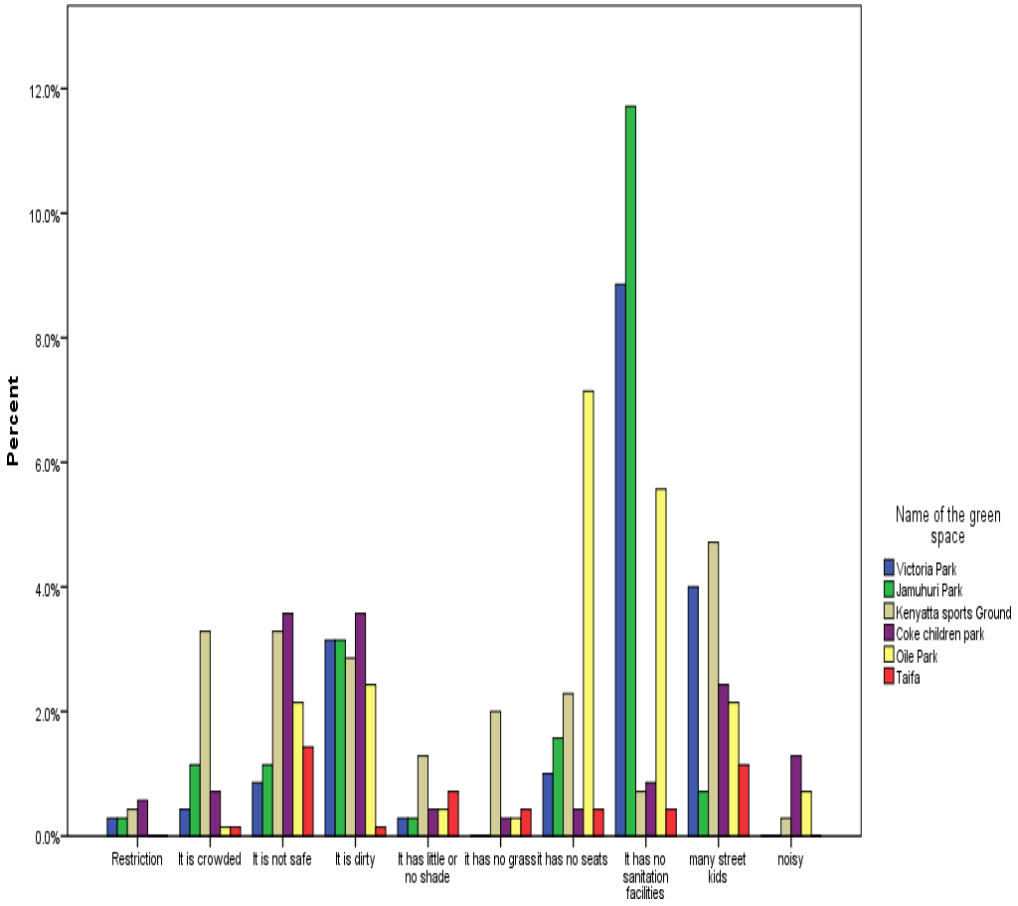

Figure 4.11 Challenges facing green space users in each green space in Kisumu town.

According to Figure 4.11 above, restriction was highly felt in Coke green space (0.59%), followed by Kenyatta green space (0.37%) and was least felt in Victoria and Jamhuri green spaces (0.29%) and was not experienced in Oile and Taifa green spaces in Kisumu town. Kenyatta green space (3.29%) was found to be overcrowded followed by Jamuhuri green space (1.14%) and the least crowded green space in Kisumu town being Oile andTaifa green spaces (0.14%). The problem of insecurities in public green spaces were highly cited by respondents inCoke green space (3.57%) followed by Kenyatta green space (3.29%) and the green space with less insecurity insues is Victoria green space. The other challenge experienced by the green space users in Kisumu town is poor sanitation, which was highly identified in coke (3.57%), followed

by Jamhuri and Victoria (3.14%) which were equal while the least green space with poor sanitation is Taifa green space (0.14%). Furthermore, the other challenge experienced by the green space users is littleor no shade at the green spaces which was highly felt in Kenyatta green space (1.29%)followed by Taifa green space (0.71%) and Jamhuri and Victoria recorded the same percentage (0.29%).

Little grass in the green spaces in Kisusmu was one of the many challenges faced by the green space users. It was highly recorded in Kenyatta green space, followed by Taifa green space and the least being in Coke and Oile green spaces with a tie (0.29%). Lack of sitting facilities was ranked high in Oile green space (7.41%) followed by Kenyatta (2.29%) and the least is Coke green space (0.43%). Lack of sanitation facilities, was recorded as the highest in Jamhuri green space (11.71%), Victoria (8.86%), Oile (5.57%) and Taifa (0.43%).

Street kids in the green spaces is a manace as in Kenyatta green space respondents recorded (4.71%), Victoria (4.00%) Coke (2.43%) Oile (2.41%) and the least is Jamhuri (0.71%). Finally, in comparison to other green spaces in Kisumu town, noise was higher in Coke green space (1.29%), followed by Oile green space (0.71%) and theleast green space which recorded noise being Kenyatta green space (0.29%).

4.3.8 Challenges experienced by green spaces users in Eldoret town

Below are the findings on the challenges experienced by green spaces' users in Kisumu town.

a) Main challenges facing all the green space users in Eldoret town

Figure 4.12 presents the main challenges facing all the green space users in Eldoret town.

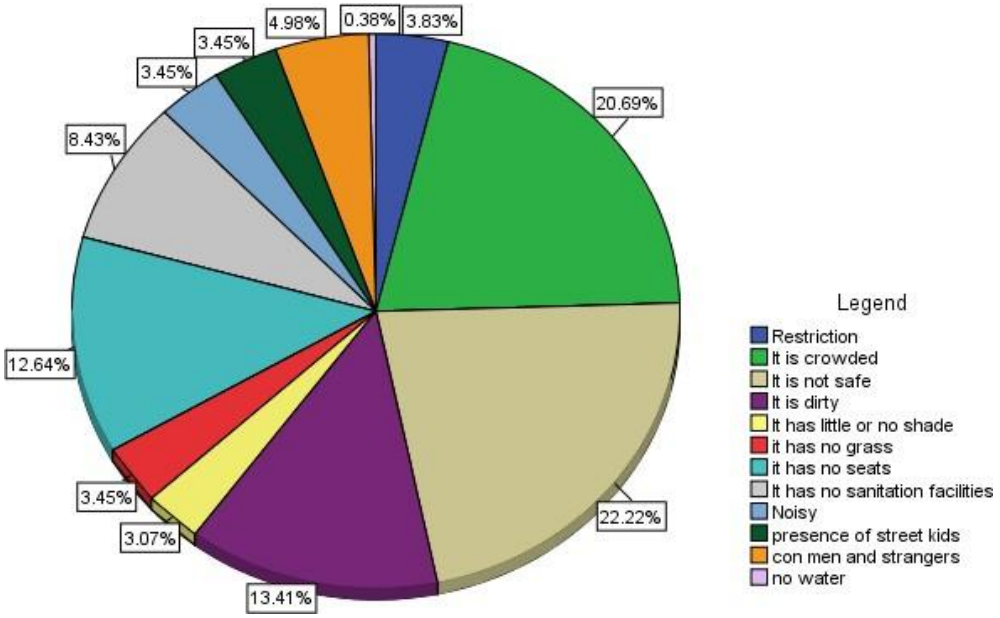

Figure 4.12 Main challenges facing all the green space users in Eldoret town

The main challenge experienced by the green space users is insecurity (22.22%) as displayed in Figure 4.12, followed by overcrowding, dirty and inadequate seats at the green spaces (20.69%), (13.14%), (12.64%) respectively. The least challenge faced by the public green space users in Eldoret is lack of water (0.38%) in the green space as shown in Figure 4.12.

b) Challenges facing green space users in each green space in Eldoret town

Figure 4.13 gives the findings on the challenges experienced by the green space users in each green space in Eldoret town.

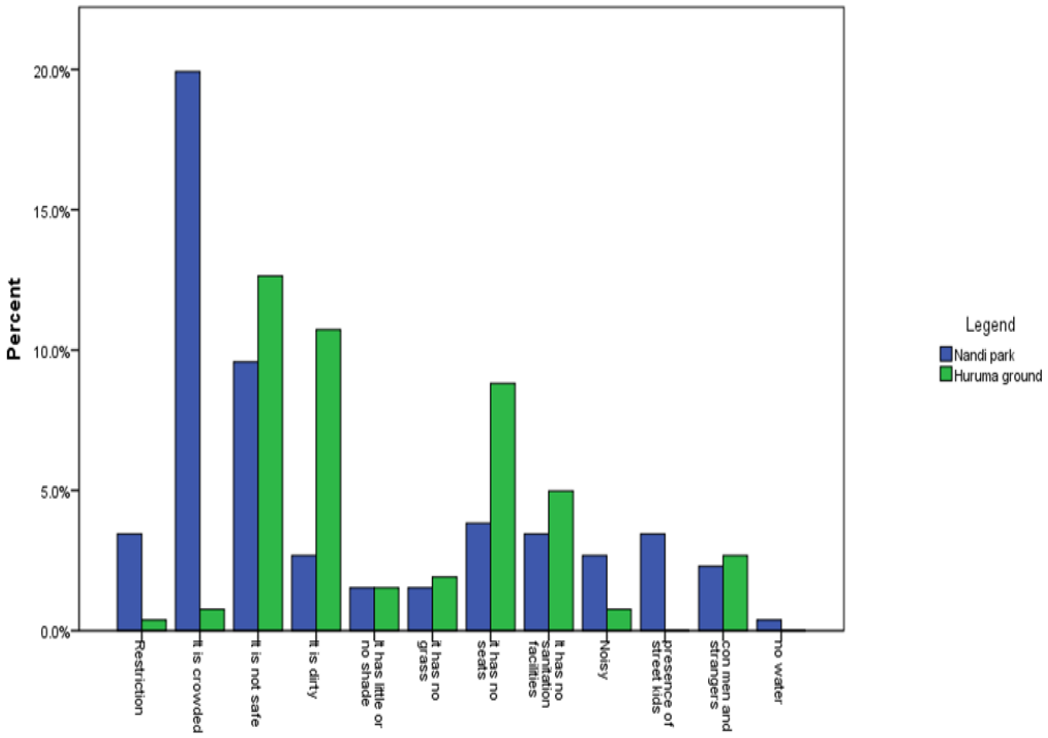

Figure 4.13 Challenges facing green space users in each green space in Eldoret town.

According to Figure 4.13, restriction was highly felt in Nandi green space (3.45%), and in Huruma green space was (0.38%). Overcrowding was also high in Nandi green space (19.92%) than in Huruma green space (0.77%).

Green space insecurity was highest recorded in Huruma green space (12.64%) and was less in Nandi green space (9.56%). The other challenge experienced by the green space users in Eldoret town is poor sanitation, which was highly recorded in Huruma (10.73%) and least recorded in Nandi green space (2.68%). Respondents cited that there was little or no shade at the green spaces and this challenge was equally felt in Nandi and Huruma green spaces (1.53%).

Little grass cover in the green spaces in Eldoret town was highly recorded in Huruma green (1.92%) space and least in Nandi green space (1.53%). Insufficient seats were high in Huruma (8.81%) compared to Nandi green space (3.53%). Lack of sanitation facilities, cited by respondents in Huruma green space (4.99%) as compared to (3.45%) in Nandi Park, Noise levels was considered as high in Nandi greenspace (2.68%) and least in huruma green space (0.77%).

Street kids in the green spaces contributed to unattractive use of green space in Nandi green space as reported by 3.45% respondents. While con men and strangers was found to be common in Huruma green space (2.68%), than in Nandi green space with (1.92%. Nandi green space is not served with water supply as indicated by (0.36%) of respondents.

4.4 Effect of urban physical expansion on green spaces availability inKisumu and Eldoret towns

The second objective of this study was to quantify the effect of urban physical expansion on green spaces availability in Kisumu and Eldoret towns. The variables analyzed were the urban growth and spatiotemporal change of urban green spaces as presented in Table 4.5.

4.4.1 Urban Growth in Kisumu

a) Urban growth rates

Table 4.5 presents changes in urban size of Kisumu Town. It should be noted that the planned area according to the 1972 Urban Development Plan was 7338.68Ha.

Table 4.5 4.5 Kisumu built up area change from 1972-2019

Year	Built up area (ha)	% change
1972 plan	7338.68	Planned area
1989	1316.20	0
1999	5740.02	336.11
2009	9236.43	60.91
2019	11086.38	20.03
Total change	**9970.18**	**742.30**

From Table 4.5, it is evident that the town has been growing steadily. It is also evident that it grew beyond the 1972 planned area in 2009. In 1989, the town had 1316.2 ha of its land built which increased to 5740.02 hain 1999 and 9236.43 in 2009 representing an increase of 60.91%. Finally, there was an increase of 20.03% in 2019. The highest increase was recorded between 1989 and 1999 with an increase of 4423.82 ha. The urban built up area increasedfrom 1316.2 ha in 1989 to 11086.38 ha in 2019, a net increase of 9770.18 ha (742.30%) in urban area from 1989 to 2019, suggesting a huge growth in urban growth of the town.

b) Urban Expansion Patterns

Figure 4.14 presents an analysis of the growth patterns in Kisumu from 1989 to2019.

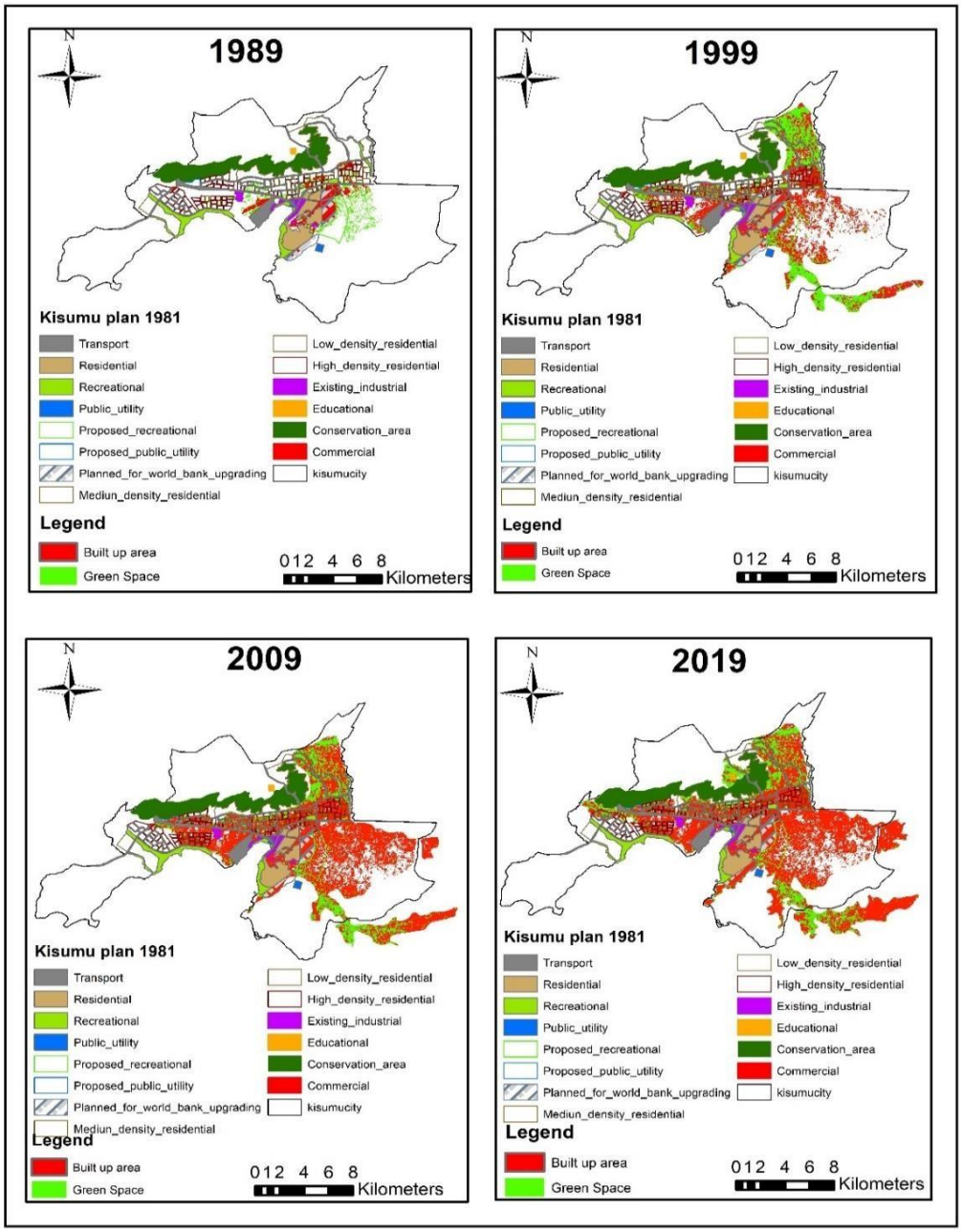

Figure 4.14 Urban Expansion Patterns under laid by the 1972 plan in Kisumu Town

(Source; Author, 2019)

From figure 4.18, it can be seen that growth in Kisumu was within the township boundary in accordance to the 1972 town plan presented in Figure 4.18 in 1989. It can be further seen that the urban area expanded towards the southeast sideof the town (Buoye) between the year 1989 and 1999, where the low, mediumand high-density residential areas started to develop. The planned area for residential, transport and commercial areas also were developing. In 2009 to 2019, Kisumu town expanded further towards eastern part. New developments appeared to dominate in the central part of the town during this period and there was almost no growth in the northern part. In 2009 built-up areas had taken up the area planned like proposed recreational land cover and land usesaccording to the 1972 plan of the town.

4.4.2 Urban growth in Eldoret town

a) Urban growth rates

It is evident that there is rapid urban expansion rates of Eldoret Town from the period 1981 to 2019. Similarly, the size of the urban area, according to the 1981 Urban Development Plan is approximately 3532.73Ha. Table 4.6 presents metamorphosis of Eldoret town from 1981- 2019.

Table 4.6 Eldoret built up area change from 1981-2019

Year	Built up area (ha)	Change
1981	3532.73	Planned Area
1989	391.59	0
1999	1814.04	363.24%
2009	3928.77	116.57%
2019	9002.88	129.15%

Overall change	**8611.29**	**2199.06% Increase**

The built-up area in Eldoret town expanded from 391.59 ha in 1989 to 9002.88 ha in 2019 as can be seen in Table 4.6. This means that net increase in Eldoret urban area was 8611.29 ha from 1989 to 2019. The highest expansion of 129.15% was experienced between 2009 and 2019. The overall change of built-up area is in the period considered by this study is 2199.06%.

b) Urban Expansion Patterns

As at 1989, there was very minimal built-up area in Eldoret town. Development was only within the town boundary as presented in Figure 4.15.

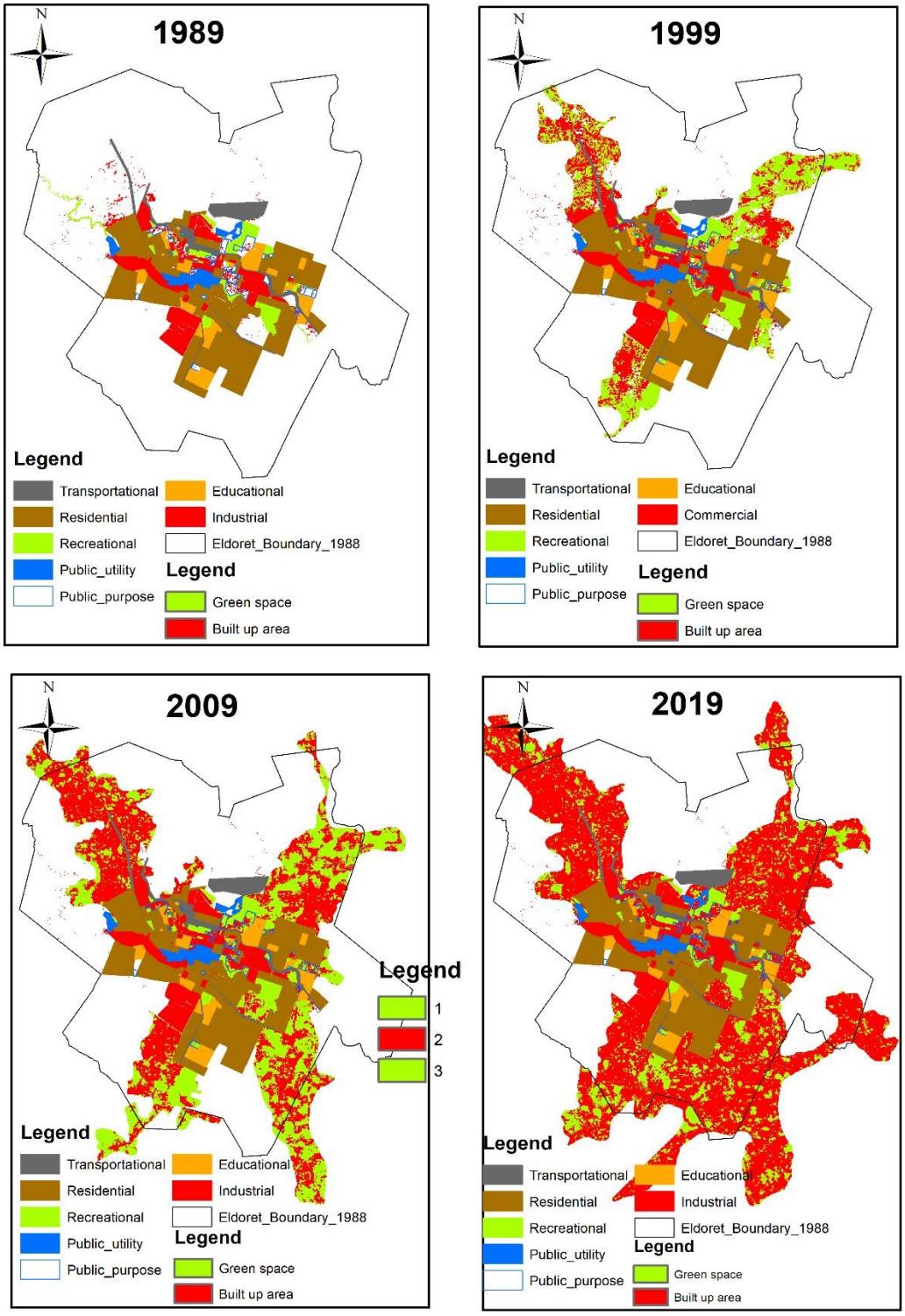

Figure 4.15 Urban Expansion Patterns in Eldoret Town

(Source; Author, 2019)

As can be seen in Figure 4.19, Eldoret town expanded in all directions. The growth pattern can be classified as linear since the growth followed the majorroads like

Uganda Nairobi road, Eldoret Kisumu and Eldoret Iten road and new developments in the suburbs. In 1999, growth was still within the town soevident within the town. In 2019, the town had grown in all directions exceptthe west side of the town and the area designated for public purpose and utility had fully developed. Urban expansion between 2009 and 2019 extendedtowards the northern part of the town and also the southern part. It was however not strictly following the town plan.

4.4.3 Spatiotemporal change of urban green spaces in the study sites

This Section begins with the presentation of the spatio-temporal changes of green spaces in Kisumu Town before delving in to Eldoret Town.

a) Spatiotemporal change of urban green spaces in Kisumu Town

When analyzing spatiotemporal changes all the private and public green spaces were plotted and Table 4.7 presents results on the spatio-temporal changes of green spaces in Kisumu Town from the year 1989 to 2019.

Table 4.7 Spatiotemporal change of urban green spaces in Kisumu town

Year	Green space area (ha)	% Change
1989	2794.05	0
1999	2687.22	-3.82
2009	2210.76	-17.73
2019	1371.24	-37.97
Total change	**-1422.81**	**- 50.92**

It can be seen from Table 4.7 that the amount of urban green spaces in 1989 was 2794.05 ha, which decreased to 2687.22ha in 1999, then to 2210.76 ha in 1999 and finally to

1371.24 ha in 2019. This means that the total decrease was -50.92%between 1989 and 2019. There was a great decrease in the period 2009 and 2019(-37.97%) as indicated in Table 4.7.

b) Visualization of the urban green space change in Kisumu town

Change detection analysis was carried out and the results showed a sizeable reduction in green spaces in the last 4 decades in Kisumu town as shown in Figure 4.16.

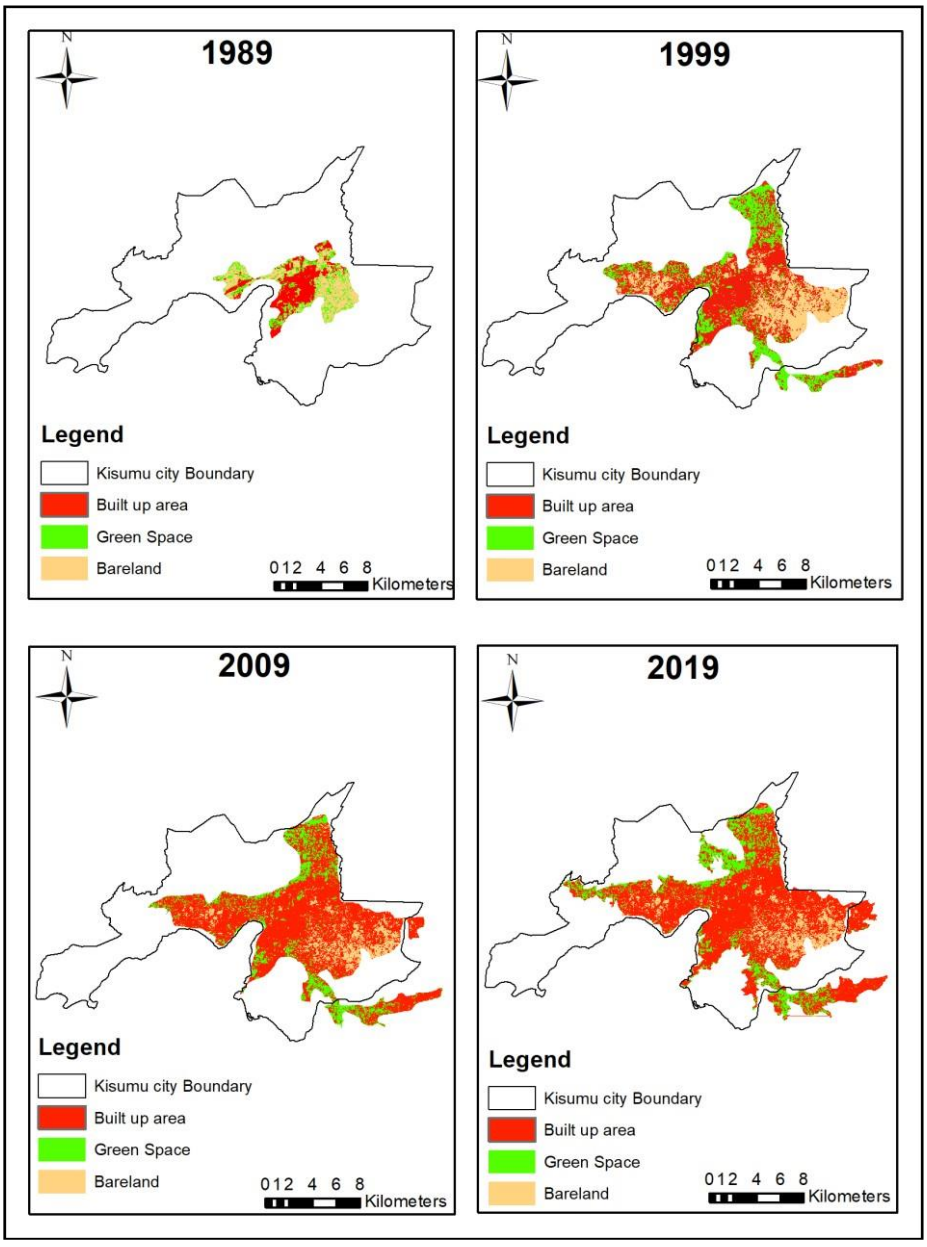

Figure 4.16 Urban Green Space change in Kisumu town

(Source; Author, 2019)

In 1989 the green spaces were abundant, especially in the core of the town. However, the green spaces had experienced loss in 1999 as evident in Figure 4.20. In 2009 and 2019 the green spaces had reduced and taken up by the built-up areas.

c) Spatiotemporal change of urban green spaces in Eldoret town

Unlike Kisumu, the green spaces in Eldoret increased from 1305Ha in 1989 to 1724.94Ha in 2019 (32.11%) as shown in Table 4.8.

Table 4.8 Spatiotemporal change of urban green spaces in Eldoret town

Year	Green space area (ha)	% Change
1989	1305.63	0
1999	2535.30	94.18
2009	2632.59	3.85
2019	1724.94	- 34.48
Overall change	**419.31**	**32.11 Increase**

There was a slight increase of urban green spaces (3.85%) between 1999 and 2009. Moreover, between the year 2009 and 2019 urban green spaces experienced a substantial decrease as can be seen in Table 4.8. The overall change is 419.31 ha and 32.11%.

d) Visualization of the urban green space change in Eldoret town

Figure 4.21 presents a visual impression of the changes in urban green spaces between 1989 and 2019 in Eldoret Town.

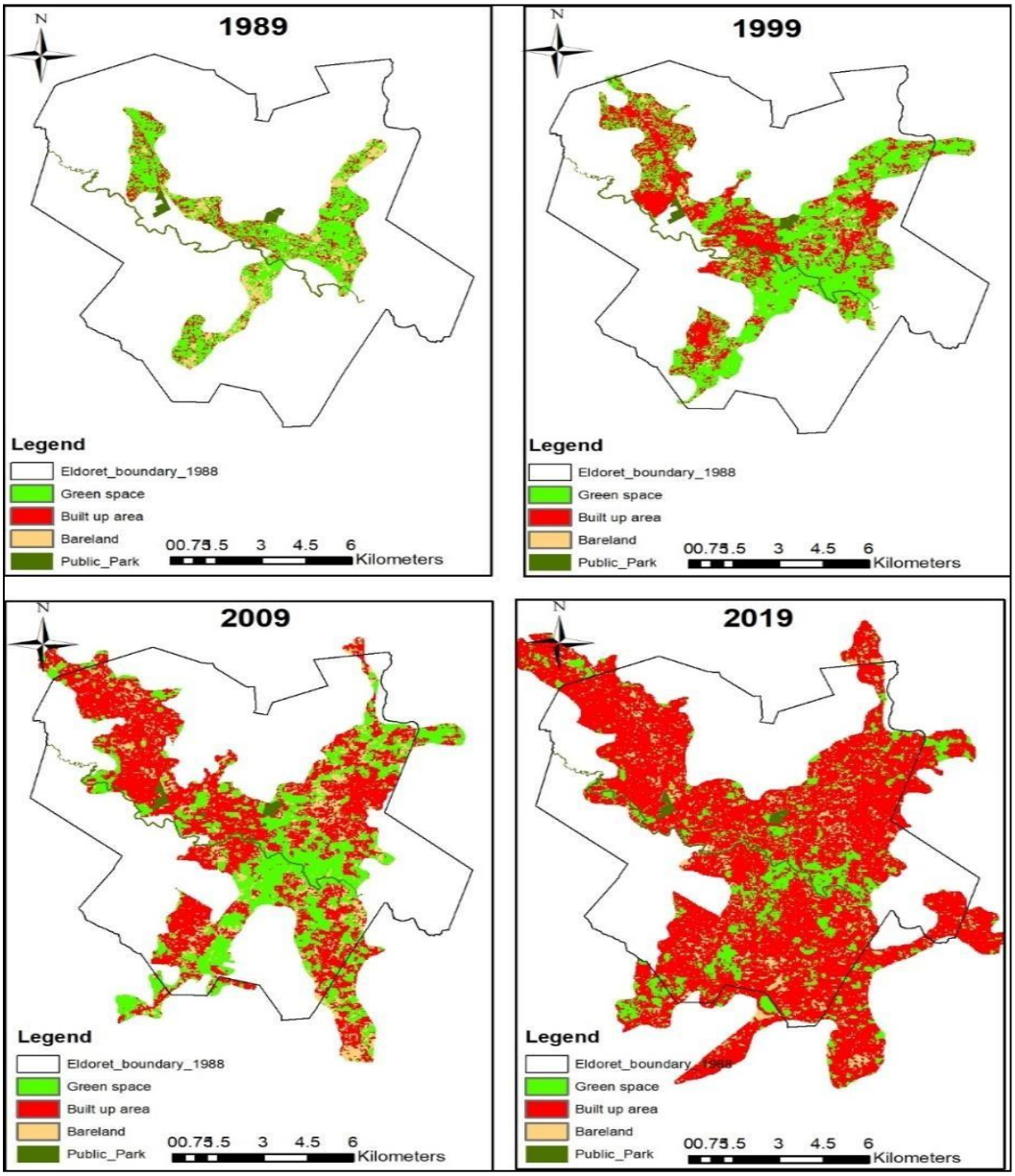

Figure 4.17 Urban green spaces change in Eldoret Town from 1989-2019 (Source; Author, 2019)

According to Figure 4.21, in 1989 the town was green and there were less developments, in 1999, some of the green spaces were covered by built-up areas. In 2019, there were fewer green spaces in the town. From 1989 to 2009, there were

a lot of green space in Eldoret town and increased all through until 2009 when it experienced a sizeable reduction.

4.5 Per-capita availability of public urban green spaces

The third objective was to determine per-capita availability of public urban green spaces. This section presents findings from the assessment of change inper capita availability of green spaces in Kisumu and Eldoret Towns. Green space per-capita expressed as Total area of green space (M^2) / the total urbanpopulation (TT).

4.5.1 Sizes of public urban green spaces in Kisumu and EldoretTowns

The public green spaces in Kisumu and Eldoret include Jomo Kenyatta, Oile, Victoria Park, Taifa Park, Jamhuri, Huruma and Nandi. They occupy a total area of 13.19 Ha and 32.38 Ha in Kisumu and Eldoret respectively as presented in Table 4.9.

Table 4.9 Kisumu and Eldoret public urban green space sizes

Kisumu		**Eldoret**	
Green space	**Size Ha**	**Green space**	**Size Ha**
Kenyatta	7.77	Huruma	31.68
Jamhuri park	3.30	Nandi Park	0.69
Oile park	0.75		
Taifa park	0.74		
Victoria Park	0.61		
Total	13.19	Total	32.38

4.5.2 Population trends of Kisumu and Eldoret towns

Kisumu and Eldoret towns are experiencing rapid urbanization and that in 1989 the population of Kisumu town was 192733 which is low compared to other years.

There was a high increase 50.18% from 2009 to 2019 and low in 1989-1999 (0.85%).

It is evident that the population of Eldoret town has increased from 1989-2019 as presented in Table. 4.10. In 1989, the population of Eldoret town was 111882, in 1999, the population had increased to 167016, In 2009, population had increased to 289380 and in 2019, the population had increased to 475716. The percentage change in population in Eldoret was high in 1989 to 1999 (49.27%), followed by 1989 to 2009 (42.28%) and the least increase was between 2009 to 2019 (39.17%). Table 4.10 depicts population trends of the two towns.

Table 4.10 Population trends of Kisumu and Eldoret towns

Census Year	Kisumu town population (thousands)	% Population increase	Eldoret town population (thousands)	% Population increase
1989	192733	----------	111882	----------
1999	194390	0.85	167016	49.27
2009	390164	50.18	289380	42.28
2019	721082	45.89	475716	39.17

4.5.3 Per-capita availability of total and public green spaces in Kisumu and Eldoret towns.

Figure 4.18 and Table 4.11 presents the per-capita availability of public urbangreen spaces in Kisumu and Eldoret towns.

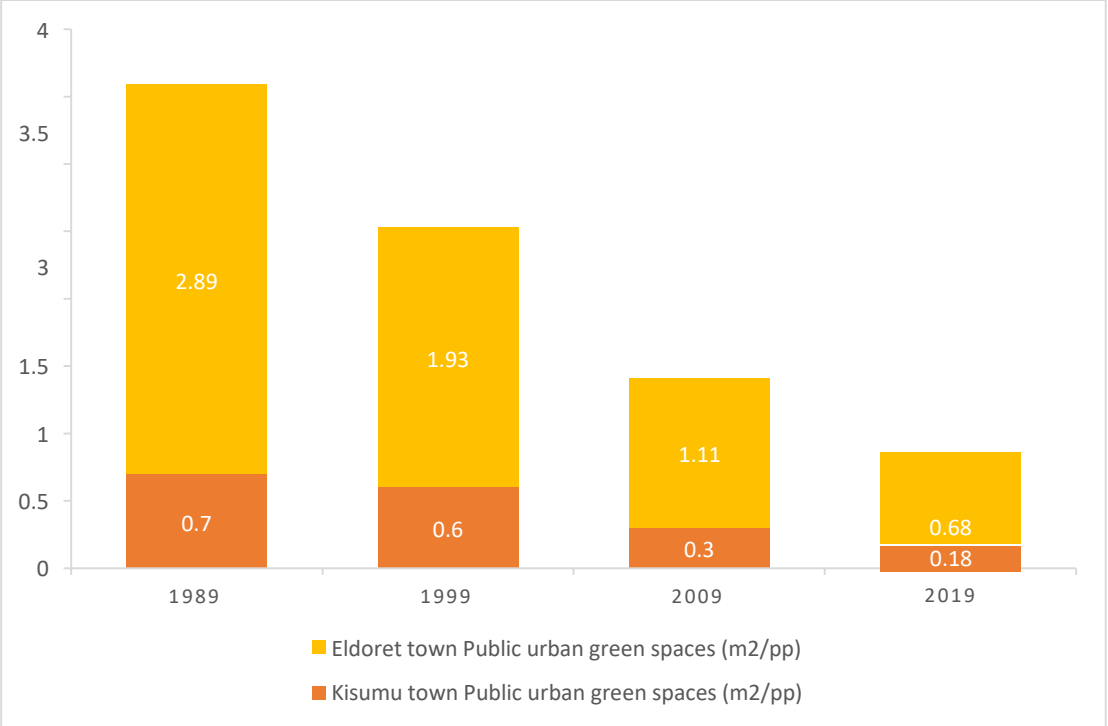

Figure 4.18 Per-capita availability trends of the public green spaces in Kisumu and Eldoret towns.

The per-capita availability of public green spaces has been reducing from1989to 2019.

Table 4.11 Per capita availability of the total and public green spaces in Kisumu and Eldoret towns

	Kisumu town		**Eldoret town**	
Year	Total urban green spaces (m^2/pp)	Public urban green spaces (m^2/pp)	Total urban green spaces(m^2/pp)	Public urban green spaces (m^2/pp)
1989	144.96	0.7	116.70	2.89
1999	138.23	0.6	151.80	1.93
2009	56.66	0.3	90.97	1.11

2019	19.02	0.18	36.25	0.68

It was established that the per capita availability of entire green space in Kisumu in 1989 was 144.96m^2. In 1999, it reduced to 138.59m^2 and to 56.66m^2 in 2009. On the other hand, the per-capita availability of urban public green spaces in 1989 was 0.7 and a decrease is witnessed all along. In 1999, the per- capita of green space had reduced to 0.6 and between 1999 and 2009 it decreased by 0.3. In 2019 it decreased to 0.1.

Findings in Table 4.11 show that the per-capita availability of urban public green spaces in Eldoret town in 1989 was 2.89m^2. In 1999, it decreased to 1.93 m^2 and further to 1.11 m^2 in 2009 before finally getting to the current per-capita availability of 0.68m^2. The overall green space per-capita availability(considering both private and public urban green spaces) in Eldoret town was 116.70 m^2 in 1989 but this decreased to 151.80 m^2 in 1999 and 90.97 m^2 in 2009. The current per-capita availability of urban green spaces is 36.25 m^2.

Figure 4.18 shows the per capita green space availability in Kisumu and Eldoret towns. From the figure it is evident that per capita green space availability has been declining from 1989 to 2019.

4.6 Overall Corresponding Kappa Statistics

The overall accuracy of 2019 is 93 in Kisumu town and 85.00 in Eldoret townand their corresponding kappa statistics is 90 and 80. The producer's accuracywas high in green spaces and was low in built up area in the two towns and theuser's accuracy was also consistently high, ranging from 80-100% in Kisumu and 70 to 100% in Eldoret town.

CHAPTER FIVE

DISCUSSION

5.1 Introduction

This Chapter presents a discussion of results of the findings of the study on urban green spaces status, attributes, use and changes over time, with reference to Kisumu and Eldoret towns. The discussion is presented with the context ofresearch problem and the stated objectives.

5.2 Status and attributes of urban green spaces in Kisumu and Eldoret towns

This objective was aimed at determining the sizes, distribution, facilities, use patterns, activities and challenges of the public green spaces in Kisumu and Eldoret town. In terms of the distribution of public urban green spaces in Kisumu and Eldoret towns it was attributed that public urban green spaces are not evenly distributed within the town in Kisumu and Eldoret towns. In Kisumu town thegreen spaces are clustered within the town and there are no urban public green spaces, for example in the residential neighborhood areas except for Jamhuri which is located in Milimani. According to the key informant interviews from Kisumu and Eldoret towns, this distribution is attributed to lack of approval and implementation of urban plans. This distribution of public green spaces limits efficient and effective utilization of public green spaces since users haveto travel from far to the central business district. Those who cannot afford to travel are thus limited.

A desirable green space should have the following attributes; fenced with gates, accessible, clean and well maintained, enough seats, security personnel, biodiversity, water, playgrounds and facilities, parking areas, economic activities, sanitation facilities and opportunities for sporting. In performance ranking of the public green spaces in Kisumu and Eldoret towns, Jomo Kenyatta came first, the

second being Nandi park and Victoria, followed by Huruma, Coke and the last ones were Jamhuri and Oile green spaces.

Regarding the facilities found in public urban green spaces in Kisumu and Eldoret towns the study found out that cleanliness and proper maintenance was lacking and not enough, sanitation facilities, water, enough playing facilities, security, poor fencing, insufficient benches or seats, insufficient shade and parking areas in some public green spaces of Kisumu and Eldoret towns. These are essential things that every user ought to enjoy in a green space but inKisumu and Eldoret towns they are limited or not enough.

On the Activities practiced in public urban green spaces in Kisumu and Eldorettowns the study identified relaxing, socializing, exercising, hawking, begging, doing church and class related work, breakfast and lunching and waiting for the next bus and office time in. In Kisumu town, it was found that more greenspace users visited the green space to relax. Relaxing is practiced mainly by those who work within the town and mainly visit during the office break, lunchhours and in the evening before they go home. This is because the public greenspaces in Kisumu are only found within the central business district. This is incongruence with other findings from other areas such as the Netherlands where most people visited the green spaces went to relax (Muratet et al., 2015)and USA (Byrne 2015).

In Eldoret town the many green space users visited the green space to exercise. This alludes to the presence of Huruma green space where most youth visitedto carry out sports activities. Also, from the demographic characteristics of green space users, the youths were found to be the majority in the utilization of the green space and similarly these are the members who are actively involved in sports. The sports carried out are football, netball and athletics. Studies in some green spaces in the world had the

same findings recorded for instance, in the United Kingdom visitors went there for sporting reasons such as jogging and walking (Henderson, 2013) USA (Rice et al., 2018). In Budapest, the park users visited the park for activities like relaxing, walking and sportingas the main reasons (Song et al., 2015). In Gyeongsan City and Denmark, the citizens gave reasons of relaxing, walking and socializing (Lee & Kim, 2015). Franck & Stevens (2006) found out that the park users always visit to sit and talk, carrying out meetings, ceremonies, sports activities and socializing while in the parks. In Hong Kong and Pakistan Maruthaveeran & van den Bosh (2015) found that people visit the park to exercise such as walking around the park and doing sports such as football. (Ochengo, 2018) and (Fadamiro & Adedeji, 2014) found that most park users visited the park for walking and strolling.

5.2.1 The most utilized parks

From the findings, the most utilized parks, is Jomo Kenyatta in Kisumu and Nandi Park in Eldoret. In Kisumu, Jomo Kenyatta sports ground is most utilized because it is most preferred for relaxation activities as well as sportingactivities such as football because of the availability of the pitches. JomoKenyatta also has children playing facilities including the skating area for kids.It is mostly visited because of its outstanding facilities such as the pavilion, fishpond, shops, hotel and the washrooms. Presence of many seats and vegetation and the famous monument of Od Mikayi with Luo culture attracts the users. This suggests that urban green spaces rich in facilities attract more users. This study is in equivalence with other researches in Jomo Kenyatta by(Ochengo, 2018) and (Onyoni, 2015). Rabare et al., (2009) mentioned how Jomo Kenyatta has been improving over time from the time it was used for hawkingand dominated by street children. On the other hand, the most utilized green space in Eldoret town is Nandi gardens. This could be due to

the finding that, it is well maintained and clean,has the playing facilities that is why parents bring their kids there, has benchesand seats, has better security personnel, is connected with water and allows economic activities. The economic activities such as shops encourage the usersto visit during lunch breaks to take lunch from the green space and also enjoya nap thereafter. The security personnel give the users the assurance of safety from the street urchins who often take shelter and beg during the day. Another reason could be due to the fact that Nandi green space is the only public green space in the Central Business District of Eldoret town so users working within the town have limited options.

5.2.2 Time of the day for visiting the parks

As regarding time of green space visitation, findings also showed that the green space users increase in numbers from afternoon towards the evening. For example, Huruma Ground, Kenyatta, Jamhuri and Victoria Park had peak visits in the afternoon while Nandi, Oile and Coke parks was mostly visited inthe evening. This could be because of for example, the people who visit Huruma grounds in the afternoon are workers from the Raiply who wait to getto jobs in the afternoon and the users who come to the park for sports activities such as football which is always done in the evening hours. Kenyatta, Jamhuri and Victoria parks were visited in the afternoon. Those who visited the greenspace in the evening were found to be doing church related activities, especially the youth members and the students and those waiting for the night shifts likethe soldiers and security officers within the town. This was found in Nandi, Oile and Coke green spaces. These findings are similar to those of (Himanen, 2010) who found out that most people visit the parks during the afternoon to have lunch as they await their work shifts.

On the challenges facing the park users in Kisumu and Eldoret parks, the main challenges experienced by the green space users included; lack of sanitationfacilities and water, lack of safety posed by street urchins and overcrowding.Lack of drinking water within the green space was highly felt by the users in the green spaces and this forced them to buy from the shops or hawkers. Insome green spaces the sanitation facilities were locked, and some were not maintained or cleaned, also the sanitation facilities were charged a fee. Street urchins make the parks unsafe since they harassed the users by stealing and using abusive language which is unpleasant for the users. Safety is essential to the park users and also a basic requirement in all the parks (Carr et al., 1992). (Rabare et al., 2009) did a research in Kenya and found that the visitors to the green spaces were faced with a challenge of facilities there in the parks due to poor maintenance (Brunton-Smith & Sturgis, 2011) also noted one of the constraints reported was fear of crime and insecurity in the parks.

5.3 Urban expansion patterns and Spatiotemporal change of urban green spaces in Kisumu and Eldoret towns

The results indicated that Eldoret and Kisumu towns have been expanding since 1989. Overall, Kisumu and Eldoret towns expanded by 742.30% and 2199.06% respectively. In both towns the direction of urban expansion is linear (refer Fig. 4.14 and 4.15). For Kisumu, the findings showed Eastward expansion while in Eldoret town the expansion follows major roads and new developments in the suburbs and leapfrog development.

The growth in the two towns is triggered by the increase in urban population as seen again in table 4.11. Kisumu and Eldoret towns are among the rapidly urbanizing towns in Kenya in terms of population and physical expansion (Ngetich, Opata, et al., 2014). This is expected to continue in the next 20 years (Ngayu, 2011). The rise in population

has led to the necessity of allocating more land towards residential expansion (Surya et al., 2020). A research done in Eldoret from 1979 to 2006 showed that Kapsoya built-up area had grown to a percentage of 242.5%, Pioneer built-up area 97.9% and Kipkaren 137.9% (Wafula & Gichuho, 2013). Eldoret town although being among the fastest growing towns in Kenya it stillhas a lot of undeveloped lands (Korir et al., 2015) this is the reason why therewas slight increase in urban green spaces in Eldoret town from 1989 to 2009. Furthermore, in Eldoret town most of the land is zoned under agricultural landuse thus a lot of instances of green spaces. New developments in the region require application for change of user from agricultural to commercial from (Ngetich, Mulongo, et al., 2014).

The towns too, took a growth of their own without following the town plans. This is as a result of several plans which have not been approved. From the keyinformant interviews at the department of physical planning, Kisumu and Eldoret towns have experienced urbanization problems that are associated with imprudent spatial planning approaches, weak planning policies and non-implementation of plans this is according to the urban physical planning office. Furthermore, the results indicated that urban green spaces have been decreasing from 1989-2019 by 1422.81 in Kisumu town and from 2009-2019 by 907.65 in Eldoret town (refer Table 4.7 &4.8). This trend of reduction is similar to findings in China Jinan city, where loss of urban green spaces was associated with urban growth (Byomkesh et al., 2012d).

According to Ghosh (2019), physical expansion has a great effect on the land cover, for example it leads to conversion of agricultural and forest lands to urban dwellings. As the built up area increase the urban green spaces also reduce this is because the green spaces were converted into built up areas. This similar observation was made in Addis Ababa where loss of urban green spaces from 19639-14920 ha was

witnessed (Woldegerima et al., 2017). To explain this, (Teferi & Abraha, 2017) found that built up areas expanded in Addis Ababa and reduction of urban green spaces declined including the urban forests. Another research by (Girma et al., 2019) found out that 1410.7 ha of land had been converted to built-up areas. According to (Wiechmann & Pallagst, 2012)increase in urban growth brings about translation of many urban spaces into buildings that involves the massive conversion of green environment, parks and green spaces. (Haaland & van den Bosch, 2015) concurs findings noting adecrease in urban green spaces that is attributable to urban growth and whose increase has led to conversion of lands reserved for green spaces to other usesof urban green space was converted to build up area. Although urban green spaces reduced in Eldoret town from 2009 to 2019 all through from 1989 to 2009 increase was witnessed. This is because of leapfrogdevelopment which from the analysis joined together by totaling the green spaces in between the built-up areas resulted in more green spaces that was later developed from 2009 hence reduction. Physical growth of built up area and urbanization of the town core constitute of the major reasons for the decline of urban green spaces and the conversionof green space to built-up. Therefore, the physical expansion is the main variable that led to decline and change in urban green spaces in Kisumu and Eldoret towns.

5.4 Per-capita availability of urban green spaces in Eldoret and Kisumu towns

The per-capita availability of public urban green spaces of Kisumu and Eldorettowns has decreased from 1989 to 2019 (refer Table 4.13) compared with urban population which has been increasing all through. The current public urban per capita availability of green space for Kisumu and Eldoret town is below 1 metre per capita. This shows that there are fewer green spaces against an ever-increasing urban population. In Kisumu town, there are only five green spacesthese include; Jomo

Kenyatta, Jamhuri, Victoria, Oile and Taifa green space. In Eldoret town, the official green space is Nandi Garden only. Huruma ground was included in the study because it is freely accessible by the public and suitstheir recreational needs. An important standard of what urban green spaces are required to sustain an urban environment is dependent on the green space available per person. World Health Organization (2016) recommends a minimum of 9 square metres of green space per person in a sustainable town and it is acknowledged that a town should have between 10-15 metres per capita.

The amount of per-capita clearly demonstrates the fact that urban public green spaces have not grown in tandem with population growth in these towns. In addition, when there is a high urban population, then the availability of urban green spaces is infringed and this is attributed to conversion of available urbangreen space land to accommodate other land uses required by the rising population (Hall & Tewdwr-Jones, 2019). Such needs include residential, transportation, schools and commercial land uses.

According to (Miller et al., 2015), unplanned population growth together with urbanization has led to increase of urban communities' mostly in developing countries and has caused a lot of problems for people living in the urban area including a decline in urban green spaces.

Urban green spaces are reduced and are being converted to other land uses to meet the needs of the growing urban population (Kabisch et al., 2016). The existing public green spaces in these two towns cannot carry the current population of the town, thus causing congestion and over utilization of these green spaces.

CHAPTER SIX

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATION

6.1 Introduction

This Chapter presents a summary of major findings, draws, conclusions makes recommendations as well as putting out areas requiring further research.

6.2 Summary of findings

The study was set to quantify the urban green spaces status, attributes, usesand changes over time in Kisumu and Eldoret towns.

6.2.1 Status and attributes of public green spaces in Kisumu and Eldorettowns.

The following are the key findings with regard to the first objective.

a) It is supported by the results that the public green spaces existing in Kisumu and Eldoret towns are concentrated within the CBD.
b) In terms of attributes, Jomo Kenyatta had the highest percentage 88.5, followed by Nandi and Victoria (73.1%), Huruma (50%), Coke (42.3%), Jamhuri and Oile had the lowest percentage 26.9%.
c) The main green space users are males.

6.2.2 Urban expansion patterns and Spatiotemporal change of urban green spaces in Kisumu and Eldoret towns

The second objective explained the urban growth (physical expansion) and the spatiotemporal change of urban green spaces in Kisumu and Eldoret towns asthey were established.

a) Kisumu town increased by 3747.7 Ha in the period 1972 to 2019 while Eldoret town increased by 5470.15 Ha from 1981 to 2019.
b) The growth of the two towns did not follow the existing plan as expected.

6.2.3 Spatiotemporal changes of green spaces in Kisumu and Eldoret towns.

a) The statistical results of the findings established that the urban green spaces in Kisumu reduced by 1422.81 Ha from 1989 to 2019.

b) In Eldoret town it increased by 419.31 Ha in the same period.

c) In Eldoret town however, major increase was in the year 1989 to 1999 by 1229.67 and this was as a result of slow rate urbanization attributed toEldoret town.

6.2.4 Per-capita availability of public urban green spaces in Kisumu andEldoret Towns

The third objective of the study involved the per-capita availability of urban green spaces.

a) Results indicated that the overall per-capita availability of public urbangreen spaces in Kisumu town in reduced from 0.7 in 1989 to 0.18 in 2019.

b) On the other hand, the overall per-capita availability of urban greenspaces in 1989 was 144.96 and decrease to 19.02 in 2019.

c) The findings established that the per-capita availability of urban publicgreen spaces in Eldoret town in 1989 was 2.89 and 0.68 in 2019.

d) The overall per-capita availability of urban green spaces in Eldoret townshows that in 1989 it was 116.70 and further decreased to 36.25 in 2019.

6.3 Conclusion

Regarding the public urban green spaces in Kisumu and Eldoret towns, Jomo Kenyatta, Victoria and Nandi Park were the outstanding green spaces becausethey had the highest percentages in terms of facilities present. The facilities present in the green space goes hand in hand with the green space utilizationand the activities carried out by the users. Kisumu and Eldoret towns have experienced urban growth

742.30% and 2199.06% respectively over the study period of 1989 to 2019. In addition, urban green spaces have been decreasing over time in Kisumu (-50.92%) and a slight increase (32.11%) in Eldoret town. Moreover, the urban physical growth (expansion) is leading to the decrease of urban green spaces through conversion of green areas to built-up. These green spaces should be rescued from conversion to other land uses as a result of urbanization. Also, urban expansion is not going according to the plan of the towns and therefore it is getting a growth of its own. Although some of the growth like in the earlier years of 1989 it adopted the plan but later spilled over beyond the planned area. Furthermore, although the populations of Kisumu and Eldoret has been increasing, the per-capita availability of urban public green spaces in Kisumuand Eldoret has been on a decline from 1989 to 2019 and it has never met the WHO requirement of 9 m^2 per-capita in all towns.

6.4 Recommendations of the study

Based on the findings of this study, the following recommendation were made;

a) Public parks should be properly planned to ensure that they are well distributed around the town so that they can be nearer to the users and also to cut on the expense of travelling far to access a green space. Moreover, most public green spaces in Kisumu and Eldoret should notbe closed in the evenings and opened in the morning, so that the users can visit the green spaces at their own time.
b) Available private land can be shared to be used by the public like Huruma green space since it will cover some public green space deficit.
c) The facilities recommended in the public green spaces include playing facilities for all the users and also provision of sanitation facilities, water, seats, walking paths, and biodiversity. In addition, security should be provided to unsafe parks due threats from street urchins who inhabit them.

d) Design urban green spaces in a way that promotes the needs of low- income earners who happen to be the frequent users of public green spaces and are young people. It should also consider ways of attracting the older generations.

e) Furthermore, the public green spaces should be increased in size, forexample the Nandi Park, which is the only official green space in Eldoret and the smallest in size, is supposed to serve all the urban residents.

f) The public green spaces should be well equipped with facilities to meetthe user needs as according to the physical planning handbook.

g) Public awareness should be created so as to educate the green spaceusers on the importance of green spaces. This is in line with the findings on land use ratings.

h) Ensure that the plans are approved and implemented because theexisting plans are timeworn, so as the towns can have a plan to follow other than taking a growth of their own as seen in this study.

i) Updating the existing development plans to fit the needs of the currentgreen spaces and the users by including in the new law.

j) Urban planners and city managers should demonstrate a great commitment to monitor the developments and the effects of land use change as a result of urbanization in the urban areas so as to reduce the urban green space conversion to built-up areas.

k) The county government should plan for green spaces and ensure adequate resource and land allocation like facets of urban development and also considering funding from like private partnerships.

l) Considering promotion of public participation like NGO's, FBO's and the community in green spaces development and management of the green spaces. This will be bring a sense of ownership of the green spaces.

m) The study of urban green spaces per-capita availability comparison to the urban population showed a decrease below the recommended standard. Therefore, the county government, city and municipal boardsshould provide and create more public green spaces to ease on congestions and to meet the required minimum per-capita standards.

n) Other public green spaces should be provided in High Density Residential Neighborhoods for example Langas, Munyaka and Kamukunji.

6.5 Recommendation for further study

This study focused on studying the effect of urbanization on urban green space change in Kisumu and Eldoret towns. The findings presented in this study are based on the observations within urban green spaces. Thus, there is need tocarry out a similar study within different settings other than urban areas in order to assess the similarities and differences that may prevail or establish whether the findings of the study hold. Furthermore, there is need to carry out such a study in other towns in Kenyan region in order to assess whether there are any regional or country-specific characteristics with regard to the topic of investigation. There is also need to carry out further research using a mixed method approach by including a qualitative review such as in-depth interviews in order to gain further understanding about the phenomenon of urbanization and triangulatethe findings of the quantitative findings.

Finally, the study factored in, only urbanization as a factor, there could be other relevant factors that may be perceived as important by the city planners but were excluded from this study. Therefore, future researchers may consider more factors, like social economic, non-operationalization of urban plans and political factors to critique and contrast with the current study in enhancing increase of green space in urban areas in Kenya.

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APPENDICES

8.1 APPENDIX I: HOUSEHOLD QUESTIONNAIRE: THE ROLE OF URBANPLANNING IN GREEN SPACE PRODUCTION

Name of the Town……..…….

Name of the Household……

SECTION A: GENERAL

Please respond by ticking [□] or filling appropriately in the spaces provided.Please provide the following:

1. Gender

Male ☐ Female ☐

2. Age

20-24 years ☐ 25-29 years ☐ 30-34 years ☐ 35-39 years ☐ 40-44 years ☐

45-49 years ☐ 50-54 years ☐ 55-59years ☐ >60 years ☐

3. Level of education

Primary ☐ Secondary ☐ Collegeersity ☐

Others ☐

specify……

….

4. What is your current occupation……

5. Name of your neighborhood/zone…….

Use of Green Spaces

6. Distance to the green spaces……..

7. How often do you visit green spaces.....?

8. For how long do you relax in green spaces per visit? ..... hrs.

9. Please rate the usage of the following green spaces. (Tick One).

Name of green space	**Very good**	**Good**	**Satisfactory**	**Poor**
1.				
2.				
3.				
4.				

5.				
6.				
7.				
8.				
9.				
10.				

9. What challenges do you face when accessing green spaces?.....
.....
.....
.....

.....
.....

.....
.....

10. What facilities do you think should be provided in this green

space?.....

.....

.....

.....

.....

.....

11. In terms of your priority needs, please provide in a scale of 1-3 ranking forthe following land uses

Land use	Rank from 1-3
RESIDENTIAL/Housing	

INDUSTRIAL/Industries	
EDUCATIONAL/Schools	
RECREATION/Green	
PUBLIC PURPOSE/offices	
COMMERCIAL/shops	
PUBLIC UTILITIES/water	
TRANSPORTATION/roads	

12. Have you ever participated in any Town planning activity? 1. Yes 2. No

13. If yes explain

……

……

……

……

. . . . . .

. . . . . .

. . . . . .

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. . . . . .

12. What other information would you like to add on green spaces?

. . . . . .

. . . . . .

. . . . . .

. . . . . .

8.2 APPENDIX II: OBSERVATION CHECKLIST

Urban green/ space: Attributes	Jomo. K	Coke	Oile	Victoria	Jam huri	Nandi	Huruma
Fenced							
Accessibility conditions							
Cleanliness and maintenance							
Sufficient benches							
safety							
Park biodiversity(plan ts and animals)							
Presence of water							
Existence of playground							

an d playing facilities							
Existence of car parking							

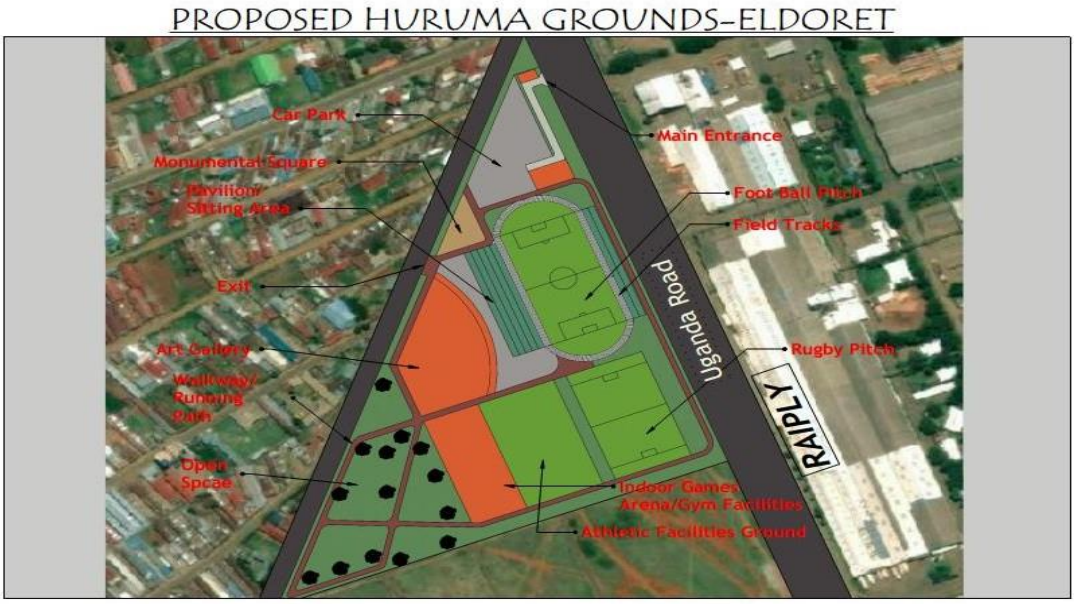
Size of the green space							
Presence of car parking							
Economic activities							
Sanitation facility							
Opportunities for sport activities							
Frequency of visitors							

8.3 APPENDIX III: KEY INFORMANT INTERVIEW SCHEDULE

1. Which are the official of public green spaces in Kisumu and Eldorettown?
2. What are the main challenges facing public green spaces in Kisumu andEldoret towns?
3. What are the main purposes and design of public green spaces in Kisumu and Eldoret towns?

8.4 APPENDIX IV: PUBLIC GREEN SPACE FACILITIES PROPOSALS IN KISUMU AND ELDORET TOWNS.

(Source; Author, 2019)



(Source; Author, 2019)

8.5 APPENDIX V: RESEARCH PERMIT

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8.6 APPENDIX VI: PLAGIARISM REPORT

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