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Planning and Management of Accessible Urban Green Infrastructure in Addis Ababa, Ethiopia: From Urban Park Perspective

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CERTIFICATION

Ethiopian Institute of Architecture, Building Construction and City Development (EiABC), Office of Graduate Program, Addis Ababa University (AAU)

This is to certify that the PhD dissertation prepared by Sileshi Azagew, entitled; ***"Planning and Management of Accessible Urban Green Infrastructure in Addis Ababa, Ethiopia: From Urban Park Perspective"*** in fulfillment of the requirements of the Degree of Doctor of Philosophy (in Environmental Planning) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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ABSTRACT

Planning and Management of Accessible Urban Green Infrastructure in Addis Ababa, Ethiopia: From Urban Park Perspective

By: Sileshi Azagew

Ethiopia, like most developing countries has becoming increasingly urbanizing. Urban green infrastructure (UGI) are important settings for improving the quality of urban life. However, with the continuation of urbanization, providing UGI in the major cities of the country became difficult. Development of accessible UGI remains a major challenge of the capital city Addis Ababa as well. Many studies have been conducted on the factors that contributed to the inaccessibility and undersupply of UGI in cities of developed countries. Contrary to this, similar studies in rapidly urbanizing cities of Africa like Addis Ababa are scant. The aim of this study is to fill this gap, by examining the status, accessibility and constraints of UGI in general and urban parks (UPs) in particular in rapidly urbanizing city Addis Ababa, Ethiopia.

A variety of socio-spatial data were collected from different sources and analyzed by using various analytical techniques. First, the study mapped and calculated the status of UGI from 2003 to 2016 based on the land use data of the city in ArcGIS. Then, the study analyzed the spatial accessibility of recreational parks based on proximity, per capita green indicators and park quality parameters by using the land use maps, road network, gridded population data, and park audit data. Apart from looking at the spatial perspectives of UPs access, the study also addressed the social perspectives of UPs access based on park users and household survey. The study employed structured questionnaire to collect data from 399 sample park visitors (189) and households (210) surrounding the parks. Besides, descriptive statistics, cross-tabulation, chi-square test and multivariate regression were used to analyze the association between the variables. Finally, the study examined the constraints behind the current states of UGI based on the result of the study, document review, expert interview and field observation.

The land use land cover change analysis result disclosed that the land use of UGI from 2003 to 2016 is decreased by 22.4 percent. The land use of unban agriculture significantly declined (by 86.1 percent) followed by the land use of urban forest (by 15.3 percent). In addition, the spatial accessibility indicators showed that the city residents do not have enough recreational parks. The city's park per capita was very small (0.37m^2) compared to Ethiopian UGI standards (15m^2) and the large portion of the city's population (above 90 percent) has no access to existing parks within the minimum walking distance thresholds. The results indicated that there is high demand of recreational parks in the city. Thus, to satisfy the current demand the city administration should provide 6718.1ha of UPs. Apart from the spatial analysis, the social survey analysis of the study has also revealed important findings about access and the use pattern of UPs.

The result indicated that the socio-demographic variables such as age, income, occupation, and physical factors such as distance, traveled time to the park, and mode of transport were important predictors ($p< 0.05$), and the limiting factors for accessing UPs in the study area. Lack of different programs in the parks and personal constraints such as lack of time, interest and awareness about the available UPs were the other constraints that affect park utilization. The city parks are poor in terms of park quality parameters such as the availability of facility, maintenance, cleanness and safety or security of the parks.

In general, the study revealed that UGI is degrading, and inaccessible to the majority of city residents and different groups of the community in terms of size, proximity, time, transportation, and overall quality. The study identified a number of constraints behind the current state of UGI in general UPs in particular in Addis Ababa. Some of the major constraints include; the expansion of built up area (formal or informal housing, and infrastructure expansion), population and housing density, lack of policy and regulations at national and municipal level, lack of proper planning, insufficient operation of existing urban planning regulations or laws, lack of priority and attention for UGI development, and organizational or management problems.

Finally, the overall results obtained through the combination of the socio-spatial analysis were used to develop the planning and management strategies to maintain and provide accessible UGI in the city and beyond. First, there is a need to properly plan, strictly adhere to the development plan, and implement UGI network at city scale so as to reduce the encroachment and the fragmentation of UGI in the city. Second, improving UPs accessibility by enhancing the availability and quality of UPs as well as the transportation service so as to address the recreational need of the city residents. Third, consideration of the need and preference of different groups of the community during UPs planning and development, and raising the awareness of the community about the importance of UPs have also paramount importance for UPs development. Fourth, formulating a sound UGI policy at a national and municipal level; revisiting the planning system including the quantitative and qualitative standard of UPs; and improving park management system have also a paramount importance to achieve the current demand of UPs in Addis Ababa city. Finally, I hope that this study serves as a benchmark for policy and planning to ensure accessible and adequate UGI in rapidly urbanizing city of Addis Ababa and beyond.

Keywords: Addis Ababa, Park accessibility, Park proximity, Park utilization, Urban green infrastructure, Urban parks

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Abbreviations

AABPCDAA	Addis Ababa City Beautification, Parks and Cemetery Development and Administration Agency
AAEPGDC	Addis Ababa Environmental Protection and Green Development Commission
AAIDPO	Addis Ababa City Integrated Development Plan Project Office
CSA	Central Statistics Agency
EEA	European Environment Agency
FDRE	Federal Democratic Republic of Ethiopia
GIS	Geographic Information System
GTP	Growth and Transformation Plan
LULC	Land Use Land Cover
LDP	Local Development Plan
MoUDH	Ministry of Urban Development & Housing
NDVI	Normalized Difference Vegetation Index
SDGs	Sustainable Development Goals
AAFUADC	Addis Ababa City Farmers and Urban Agriculture Development Commission
UGIS	Urban Green Infrastructure Standard
UGI	Urban Green Infrastructure
UNEP	United Nations Environment Program
UNESA	United Nations, Department of Economic and Social Affairs
UPs	Urban Parks
WHO	World Health Organization

1. Introduction

Urban Green Infrastructure (UGI) are an essential element of the urban landscape and has many benefits for the well-being of the urban community. Generally, it has social, economic, ecological or environmental as well as planning benefits (Tzoulas et al. 2007: Baycan-Levent & Nijkamp 2009; Talen, 2010). UGI has become a major discourse in urban planning and a hot topic in relation with sustainable urban development agenda. Currently, cities of developed countries adopting UGI as a planning strategy to achieve the aforementioned benefits and to build a sustainable urban environment (Foster et al. 2011). However, UGI receiving little attention in cities of sub-Saharan Africa countries. Developing accessible UGI remains a major challenge of many cities across the continent, including the capital city of Ethiopia, Addis Ababa. This PhD dissertation deals with the current status, accessibility as well as various constraints behind the current state of UGI in general and UPs in particular.

This dissertation starts with the introduction of the study including the background, statement of the problem, objectives and research questions, and significance of the study. It continues with theoretical context and conceptual framework prior to explaining the methods and materials used. Then, the study presents the main results and discussions of the results, and finally, present a number of strategies developed for UGI planning and management in the city as well as recommendations for future research.

1.1. Background of the study

The world is becoming increasingly urban and the number of population living in cities is growing rapidly. According to the United Nations, Department of Economic and Social Affairs (UNESA), more than 60% of the world's population will be living in cities by 2030 (UNESA, 2014).

Currently, cities cover the smallest portion (2.7%) of the earth surface (UNESA, 2014). However, they consume 75% of total energy, emit 80% of greenhouse gas to the atmosphere, and have generically a detrimental effect on the natural environment (Gret Regamey et al. 2013). Moreover, urbanization has been a serious negative effects on the biodiversity, natural resources and green space that support life on our planet (Randolph, 2004). Urbanization imposed environmental change is also affecting the well-being of the urban community (Ulrich, 2006). Different strategies and approaches have been proposed to tackle the mentioned impacts of urbanization. Recently, urban green infrastructure becoming a popular strategy to combat these urbanization imposed challenges.

Urban Green infrastructure (UGI) is a broad concept, and defined as the combined structure and connectivity of recreational parks and other types of green spaces that deliver multiple benefits for urban environment (Jennings et al. 2016; Wolch et al. 2014).The benefit of UGI has been widely cited in the literature. Overall, it has four major benefits such as social, economic, ecological or environmental as well as planning benefits (Pincetl & Gearin, 2005; Maruani & Amit-Cohen, 2007; Tzoulas et al. 2007: Baycan-Levent & Nijkamp 2009; Talen, 2010). From ecological or environmental perspective, it conserve biodiversity (Sandström et al. 2006), provides habitat for flora and fauna, and remove air and water pollution (Mohamed & Zhirayr, 2013). From economic point of view, UGI enhances property values and increase attractiveness for business development (Charkiolakis et al. 2008). From the social point of view, it improves social cohesion and interaction (Tabassum & Sharmin, 2013); provide places for physical activity; contribute to the social well-being and the health of the community (Kaczynski & Henderson, 2008). Moreover, UGI offers reserve space for future town-planning (Attwell, 2000). Hence, the provision of

sufficient and accessible UGI should be considered as an important issue during the planning and design of urban development in order to achieve the mentioned benefits.

Currently, cities of developed countries adopting UGI as a planning strategy to achieve the aforementioned benefits and to build a sustainable built environment (Foster et al. 2011). The planning of UGI has becoming a major discourse in urban planning and increasingly accepted as a policy approach (Lennon, 2014; Davies et al. 2015; Girema, 2019). In cities of North American, European and Asian countries UGI planning and management have been receiving more attention and considered as an essential urban infrastructure (Lafortezza et al. 2013). For instance, in the USA the integration of gray and green infrastructures has become an important strategies for storm water management. On the other hand, studies show that components of UGI are on the decline and not well developed in several cities around the world. For example, a study on land use land cover changes of 25 European cities investigated that 7.3-41percent of green spaces converted to other land-uses (Kabisch & haasel, 2013). Similar study in 274 metropolitan areas of USA also revealed that about 1.4 million hectares of green spaces changed to other land uses (McDonald et al. 2010).

Moreover, a considerable number of studies indicated that UGI is inaccessible for the majority of the urban dwellers in many cities around the world. For example, Fuller & Gaston (2009) examined the relationship between green spaces coverage, city area and population size in European cities. They found that the available green spaces ranges from $3m^2$ per capita in the south and east Europe to $300m^2$ per capita in the north and northwest of Europe. Moreover, individuals do not have the same access to UGI in terms of proximity (Van Herzele & Wiedemann, 2003; Barbosa et al. 2007). For example, Sotoudehnia & Comber (2011) found, only 15 percent of the total population in Leicester live within the 300m distance to UPs. Barbosa et al. (2007) also found that 64 percent of

the households in Sheffield (UK) fail to meet the recommended 300m distance from their nearest park.

In addition to quantity and geographic proximity discussed above, recreational parks need to be designed and maintained a high quality standards to increase the accessibility of the residents to these recreational opportunities (Baycant-Levent & Nijkamp, 2009). However, the studies conducted in different countries identified that lack of facilities and amenities in the parks was the major determinant of park usage and access (Giles-Corti et al. 2005; Kaczynski et al. 2008; Shores & West, 2010). For instance, absence of sports fields, green plants, trails, walking paths, and sidewalks (Shores & West, 2010; Kaczynski et al. 2008); running tracks, swimming areas, lighting, shade, and fountains was identified as the major problems of recreational parks and deter its use (Cohen et al. 2006). The presence of litter, vandalism, and unclean washrooms are the other problem of recreational UGI in many cities (Gobster, 2002; McCormack et al. 2010). Building on the above findings, this study also sets out to determine if similar problem of UGI exist within the context of developing countries such as Ethiopia.

Moreover, UGI such as recreational park provision has to be based on the principle of equity, ensuring its access for the entire population regardless of an individual's residential location and socioeconomic background (Jennings et al. 2016). Omer, (2006) and Liao et al. (2009) have evaluated the accessibility of green space to ascertain whether their distribution is equitable for different socioeconomic groups such as age, sex, educational background, income and ...etc. However, their result indicated that some socioeconomic groups do not have the same access to UGI and its distribution is unfair. Germann-Chiari and Seeland (2004) conducted a study in three major Swiss cities (Geneva, Lugano, and Zurich). They investigated mixed findings, indicating that green space is uniformly distributed in Lugano city, but there was no a significant negative

association between green space availability and social group heterogeneity in Zurich city (Germann-Chiari & Seeland, 2004). A considerable number of studies have investigated potential disparities in the availability of UPs among different groups of the community (Van Herzele & Wiedemann, 2003; Barbosa et al. 2007), yet findings vary considerably from context to context, indicating that it is not possible to extrapolate results to other parts of the world or even result of cities in the same country. Therefore, it is important to assess whether all the population segments, regardless of their socioeconomic and demographic background have access to UPs.

As mentioned above, in recent days UGI is embraced by many developed nations to protect their urban environment (Foster et al. 2011). However, in case of developing countries of sub-Saharan Africa, components of UGI can be found in all cities and towns to a greater or lesser extent, but the urban community is not fully benefiting from it. The depletion of these spaces in African countries is more serious than developed nations. Adjei (2014) and Lindley et al. (2015) indicated that components of UGI are depleting at an alarming rate in several cities across the continent. It covered the small portion of the land use in many cities of African countries (Adjei, 2014). Moreover, UGI such as recreational parks are not accessible to the majority of the urban communities in terms of quality, quantity and proximity. For example, the per capita of recreational parks in Luanda (Angola) and Alexandria/Cairo (Egypt) cities was below $1m^2$ (Langer & McNamara, 2011). Moreover, the approach to UGI in urban centers of African countries is at an early stage. Urban development and planning regulations in many urban centers of the continent have failed to provide orderly and sustainable urban development (Ondiege, 1999). This resulted in squatter settlements and informal sector development. Components of UGI have suffered on the same note of failure to provide orderly urban development by the African governments. Moreover,

as the result of high value of land in the urban areas of developing countries, UGI viewed as a luxury and no significant emphasis is given to develop such spaces (Maryanti et al. 2016).

The condition of UGI development in Ethiopia is the most worse than the existing situation of UGI in most Sub-Saharan African countries. The major cities of the country have not yet met enough amount of green space, which give it the image of a city. The quality of urban life is not being considered in many ways. UGI development has not yet got the priority in urban planning (Thomas, 2013). Components of UGI is insufficient both in terms of demand and supply within the cities (Thomas, 2013, Girma et al. 2019). The available green spaces are degraded in most cities of the country. In general, the planning and management approach of UGI in urban centers of the country are not clear and needs more investigation.

A growing body of evidence indicating that there are a number of barriers that influence the availability and accessibilities of UGI across cities (Kendal et al. 2012; Dobbs et al. 2013). For example, rapid urbanization has been identified as a major cause for the degradation of green spaces in urban areas (McDonald et al. 2010; Liu et al. 2014; Adjei, 2014). Studies also indicated, a lack of political desire to enforce regulations (Lara-Valencia & García-Pérez, 2015), population densities, poor administration of planning processes at the local level, and a reluctance to make good planning decisions (Pincetl & Gearin, 2005), lack of involvement of community & stakeholders (Mensah et al. 2017, Girma et al. 2019) can all indirectly affect access to UGI. Thus, a great understanding of such kind of barriers will aid urban managers and planners in providing UGI that optimizes the benefits it can provide within a city.

A variety of methodologies have been used in the literature to assess and quantify the status and accessibility of UGI (Kabisch & haasel, 2013; Yao et al. 2014). The assessment approaches are broadly categorized into objective and subjective approaches. The objective approaches include

the size of UGI in terms of percentage and acreage within a certain geographic boundary (Yao et al. 2014), which can be analyzed by using Geographic Information Systems (GIS). These indicators have been widely used by researchers (Groenewegen et al. 2006; Maas et al. 2006; Witten et al. 2008). The other objective indicators used to assess the spatial accessibility of UGI are per capita green index and proximity indicator.

Per capita is the most commonly used indicator to assess UPs access and described as the total area of UPs or green space divided by the total residents within the certain geographic area (Taylor et al. 2011; Kabisch & Haase, 2013). This indicator vary globally and among cities. For instance, World Health Organization (WHO) suggested $9m^2$ park per capita for the world and $7m^2$ for cities of African countries (WHO, 2016). Moreover, many cities of developed countries use a $20m^2$ park per capita standard (Wang, 2009), and the Ethiopian Urban Green Infrastructure Standard (UGIS) recommended a $15m^2$ park area per capita (MoUDH, 2015). Though the per capita ratio or standard is widely accepted due to its simplicity, it is not considered effective because it does not take in to consideration about the spatial distribution of green spaces (Yao et al. 2014; de la Barrera et al. 2016). Thus, for an integrated assessment of cities UGI access, in addition to per capita green index, proximity indicator is suggested to be studied together (Yao et al. 2014; de la Barrera et al. 2016). Proximity index is defined as the amount of services area of UPs within a given distance and the number of the population within the service area (Heather et al. 2011). The accessibility to parks is adequate when the population is in harmony with the parks' spatial distribution (Langford & Higgs, 2010). Spatial accessibility may also differ in the level of services offered to different population groups (Comber et al. 2008; Tan & Samsudin, 2017). However, the result of spatial accessibility of UPs based on the above objective indicators can significantly vary from

country to country. Moreover, neither such an indicator nor a monitoring system exists for UPs planning at the national or city level of most developing countries like Ethiopia.

The accessibility of UGI is not only measured based on objective measurement indicated above, but also perceived or subjective measurements can indicate the success and real benefit acquired by park users (Wright et al. 2012). A subjective or self-report method involving survey questions, such as perceived access to parks, the amount of parks and the quality of park or park features has been used by a number of studies (Tilt et al. 2007; Sugiyama et al. 2008a). Audit is another measure for identifying quality; this method involves trained raters who apply specific criteria (e.g., presence/absence of various features) to assess internal environments of recreational UGI such as parks (Ellaway et al. 2005; Hoenher et al. 2005; Giles-Corti et al. 2005). However, user reported surveys are often used in measuring the quality of public services.

Compiling or using all the aforementioned indicators and measurements together can facilitate a better understanding of how UGI can be effectively developed or maintained, perceived and used and what constraints affects its success in the city. This study was also used these measurements or indicators to investigate the existing situation of urban green components in Addis Ababa city.

1.2. Statement of the problem and research gaps

As indicated in the background section, UGI provides social, economic, environmental as well as planning benefits (Tzoulas et al. 2007: Baycan-Levent & Nijkamp, 2009; Talen, 2010). From social perspectives, UGI such as UPs provides recreational opportunities, community cohesion, health benefit, aesthetic enhancement and source of knowledge for the urban community (Kaczynski & Henderson, 2008; Tabassum & Sharmin, 2013). Thus, the provision of sufficient amount and accessible UGI in the urban areas is very crucial to achieve these benefits. As mentioned in section 1.1, the supply of accessible UGI in cities of developing countries like Addis

Ababa faces many problems. As the result the accessibility of this spaces is the major question in Addis Ababa.

Frist, Addis Ababa city is experiencing a rapid population growth due to high rate of migration from different part of the country (CSA, 2019). With the rapid population growth, there is an increase in density of built spaces, expansion of housing and infrastructure, and restructuring of industrial areas in the peripheral part of the city (Abeje, 2007; Fetene & Worku, 2013). On the other hand, UGI such as urban forest and other green components in the city are not well developed yet. It is indicated that the existing components of UGI in the city are rapidly distracting and deteriorating (Fetene & Worku, 2013). As studies indicated, the expansion and density of the built environment, and the land use change are the major factors that affect the availability of UGI (Pincetl & Gearin, 2005). In addition, there might be a number of other factors that contribute to the depletion and insufficient accessibility of the green components in the cities. There is lack of attention on the driving factors that causing these problems in the city of Addis Ababa. Thus, it is important to intensively explore all the constraints behind the current sates of UGI supply in the city.

Moreover, as aforementioned the population of the city is increasing at an alarming rate since the last three decades (CSA, 2019). With the increase of the city population, the demand for accessible UGI such as recreational parks is also increasing. Thus, there is a need to look at the spatial accessibility and distribution of this spaces within the city in relation to the booming city population. Examining their location in relation to population distribution will show if the recreational UGI are easily accessible from the major residential areas or are inaccessible to most of the city residence. In addition, there is a shortage of data on the current state and accessibility

of UPs in Addis Ababa city, and the available information is inadequate, fragmented and need more improvement.

Second, in Addis Ababa, the UPs that provide recreational service for the inhabitants of the city are not sufficient (Abeje, 2007; Kahsay, 2016). Although a number of UPs developed in the city, it is mentioned that except a few major parks, the others are barely utilized. The city residents also mentioned that some existing parks are not active and vibrant, and they are not fully utilized. As studies indicate, a number of accessibility factors may contribute to their underutilization. These factors may be physical (distance, time, transport), socio-demographic (age, gender, education, income & occupation), and physiological (knowledge gaps & safety concerns) factors (Mowen et al. 2007; Grow et al. 2008; Zhang et al. 2015). In addition, the quality of UPs is also mentioned as another important factor that may affect UPs access (Romero et al. 2012), because high-quality UPs can attract many visitors than low-quality UPs. For instance, the availability of facilities and amenities in the UPs can determine their level of usage (Giles-Corti et al. 2005). Thus, it is important to explore all these possible factors that may influence park access and utilization in Addis Ababa city, so as to evolve plausible policies and strategies that help to improve their access in the city.

Third, maintaining and developing a sound multifunctional UGI in general and accessible recreational parks in particular requires proper policy, planning, and legislation (Nor Akmar, 2011). Policy and legal frameworks are either directly or indirectly contributed to the success of accessible UGI in a city. For instance, the decision on how much to be invested in the maintenance and development of UPs, the type of UPs to be built and which land in the city should be reserved for UPs development are all influenced by the policies and legal frameworks (Bengston Fletcher & Nelson, 2004). In developing countries cities there is lack of such policies and legal frameworks.

In cities of African countries UPs and other green space development is an ad-hoc rather than strategic. Thus, it is important to examine whether similar problem is exist in Addis Ababa city as well. This helps to understand whether the lack of policy and legal frameworks are contributed to the currents state of UGI in the city.

Furthermore, even though the majority of the world's urban population is found in developing countries, there has been very little research regarding UGI access and success in such rapidly urbanizing cities of developing countries (Willemse, 2010). Rather, the majority of previous studies have focused on developed countries (Giles-Corti et al. 2005; Baycan-Levent & Nijkamp, 2009; Kabisch & Haase, 2013). In other word, the highly urbanizing African countries significantly differ from developed nations in sociocultural, political and economic aspects. As a result, recommendations for cities of developed countries may not necessarily be valid for such rapidly urbanizing cities. Thus, more additional studies are needed from rapidly urbanizing cities of African like Addis Ababa. Moreover, the findings of the previous studies that conducted on UGI are inconsistent and vary. For example, some studies indicated that high-socioeconomic group of the community have better access to parks (Almohamad et al. 2018), whereas, some other results revealed that low-socioeconomic groups enjoy better access to green spaces than others (Rigolon et al. 2018). Studies also indicated, proximity has strong influence on park access (Cohen et al. 2006; Nielsen & Hansen, 2007; Kaczynski & Henderson, 2008), however, other studies indicated proximity to the park was not associated with the frequency of park use (Kanczyki et al. 2014). Such inconsistency of findings across studies cause confusion for policy makers and urban planners in order to take decisions for UPs development (Koohsari et al. 2015). Hence, this study aims at understanding the association between frequency of urban park utilization, and socio-demographic and physical factors in the context of rapidly urbanizing cities of Africa.

Finally, there are very scant empirical research and information on the spatial accessibility and utilization pattern as well as constraints of UPs from Ethiopian context. Most of the previous studies that were conducted in Addis Ababa have focused on general aspect of UGI. For instance, the effects of urban development on green space (Gashu & Gebre-Egziabher, 2018; Abo El Wafa et al. 2018), dynamics of urban green space and heat island (Abebe & Megento, 2016), implications of urban green spaces for climate change adaptation (Lindley et al. 2015, Teferi & Abraha, 2017), conservation of urban forestry (Fetene & Worku, 2013), establishing a functional UGI (Herslund et al. 2018), and ecosystem service (Kahsay, 2016). These studies did not address UGI from accessibility point of view. Even though, some of these studies attempted to address the constraints of UGI development, they didn't investigate the root causes of UGI problems in the city. This has created a knowledge gap, and it was the target of this PhD study to fill this gap. Besides, the previous studies in the city didn't provided clear strategies for addressing the constraints of UGI in general and UPs in particular in the city. This has made challenges for the city authority to take necessary actions and enhances sustainable UGI in the city.

1.3. Objectives of the study

The broad objective of this study is to examine the status, accessibility and constraints of urban green infrastructure in general and recreational parks in particular, and to develop strategies for planning and managing accessible urban green infrastructure in Addis Ababa city.

Specific Objectives

1. To analyze the status of urban green infrastructure in general and urban parks in particular.
2. To evaluate the city residents use pattern and access to recreational parks.
3. To evaluate the status of policy and organizational frameworks of urban green infrastructure planning and management.

4. To examine the constraints or challenges behind the current states of urban green infrastructure.
5. To develop the planning and management strategies that can enhance urban green infrastructure development in Addis Ababa city and beyond.

1.4. Research questions

The specific research questions dealt within each objectives are as follows:

1. To analyze the status of urban green infrastructure in general and urban parks in particular.
   - What is the trend and current status of urban green infrastructure components in the city?
   - How much urban parks are spatially accessible for the city residents and what amount is needed to fulfill the current demand?
   - Are the available recreational parks have better facilities and amenities?
2. To evaluate the city residents use pattern and access to recreational parks.
   - How is the use patter of urban parks in the city?
   - Are socio-demographic characteristics of the community and physical factors associated with the frequency of park visit?
   - Are there any motivational and personal constraints that hinders urban park access in the city?
   - How the community does perceive urban park quality and what quality factors affect access to the parks?
3. To evaluate the status of policy and organizational frameworks of urban green infrastructure planning and management.

- What policies, legal frameworks and norms are exist to address the planning and management of urban green infrastructure? What are the gaps?
- To what extent different stakeholders are involved in urban green infrastructure planning and management?

4. To examine the constraints or challenges behind the current states of urban green infrastructure.
   - What are the challenges or constraints behind the current states of urban green infrastructure in general and UPs in particular in the city?
5. To develop the planning and management strategies that can enhance urban green infrastructure development in Addis Ababa city and beyond.
   - What type of planning and management strategies are needed to enhance UGI in Addis Ababa city and beyond?

1.5. Scope of the research

The scope of the study is limited to UGI of Addis Ababa city. The term UGI is quite wide, and it is classified based on the land use or its function such as parks, green ways, working farms, cemeteries, forests, etc... Or blue areas like lakes, rivers, streams and wetlands (McDonald, 2005), geographic scale (e.g. Region, citywide, sub-city, or parcel), location or accessibility, and vegetation structure (e.g. parks, grassland, woodland, waterside zones) (Burgess, 2015; Girema, 2019). Thus, it is difficult to address all these components and function of UGI in this single dissertation.

Accordingly, the scope of the study in terms of content wise was focused on the current status, accessibility, and the constraints behind the current state of UGI in general UPs in particular. In terms of geographical coverage, the study conducted at three scales. The status and trend analysis

(from 2003-2017) of UGI components was undertaken at the city scale. Whereas, the accessibility analysis of UGI was undertaken at the city, sub-city and local (park level) scales. In this study, UGI accessibility analysis is based on the definition of Coles and Grayson (2004), which define UGI based on their access and function criteria. Thus, the accessibility analysis was conducted on UGI covered by vegetation and used for recreational purpose by the urban community. In Addis Ababa city, UGI that serves for recreational purpose is urban parks (UPs). Hence, the main focus of the accessibility analysis was on UPs. Here, two types of accessibility analysis was undertaken. The spatial accessibility analysis includes the variables of park per capita, proximity and park deficit analysis at the city and sub-city scale. While, the investigation of perceived park access and utilization was undertaken in purposefully selected UPs of the city. Finally, based on the result of the aforementioned analysis, constraints of UGI in the city were examined and strategic solutions were forwarded.

1.6. Significance of the study

Addis Ababa is a rapidly urbanizing city with more land being utilized for commercial, residential, industrial, and road infrastructure, yet there are very few UGI developed in the city. There is, therefore, a need to provide more UGI in the city, and this study is important in that it intends to answer how much the expansion of the aforementioned built environment affecting the existing green space of the city, and what other constraints behind the current states of UGI in the city. This study also intended to bring out the role of maintaining UGI for sustainable urban development and human well-being.

The population of Addis Ababa city is increasing at an alarming rate since the last three decades (CSA, 2019). With the increase of the city population, provision of sufficient amount of accessible UGI is very crucial. Thus, there is a need to look at the spatial accessibility and distribution of this

spaces within the city. Examining their location in relation to population distribution will show if the recreational parks are easily accessible from the major residential areas or are inaccessible to most of the city residence. Such information can help to correct the situation by aiding planners in getting the best location for future parks. Moreover, the spatial accessibility analysis can also aid planners and decision makers by showing the gap or the amount of recreational park that is needed in the future.

In addition to the spatial accessibility, understanding people's perceptions of access to public facilities such as UPs is an important source of information in urban planning and management to improve the quality of urban life (Van Herzele & Wiedemann, 2003). Understanding park utilization pattern of the residents is of great importance for cities in order to have a sustainable recreational plan. It is only then, the city managers and decision makers will make sure that a number of recreational areas, their size, and facilities are adequate to meet the various recreational needs of the city residents. Thus, this research was designed to augment and update existing information on patterns of park utilization by the city residents as currently little attention has been paid to this aspect. Moreover, the importance of analyzing park access in association with people's socio-demographic background was also highlighted by Payne et al. (2002) in terms of providing local authorities with the opportunity of adapting green space strategies in ways that can meet the needs of different social groups. Therefore, learning about the attitudes, perceptions and requirements of different social-demographic groups regarding access to UGI such as recreational parks are as important as the spatial analysis of UGI access.

Addis Ababa as the capital city of Ethiopia has been a popular center of various studies. Studies carried out in the city have covered almost all the major land use and socioeconomic issues of the city with little information about the land use of UGI. UGI has been one area that has not received

a reasonable attention by researchers. Thus, there is a need to study the status and accessibility of UGI in the city of Addis Ababa, so that, such information can add to the existing literature of the city. It provides a good starting point for future research and more in-depth evaluation of UGI from different angles in the city. Moreover, UGI is very important for achieving sustainable urban development and human well-being (Conghong et al. 2017). To achieve these goals, UGI development requires adequate policy, planning and management tools. Since, this study brought together park users and non-user views, and the planners and administrator's opinion, it will help city planners on suitable policies to adopt. It provides scientific knowledge and information that serve as an input for formulating policies. Furthermore, this study can serve as the benchmark information for decision makers to ensure adequate and accessible UGI in Addis Ababa city.

1.7. Structure of the dissertation

The dissertation comprises eight chapters. **The first chapter** is introduction and followed by theoretical context & literature review. The primary aim of the review is to explain and discover the existing body of knowledge related to the study. Theories, analytical techniques, research findings and discussions on UGI in general and UPs in particular are critically reviewed and presented. This part of the study has five issues. It discusses about the definition of basic concepts and benefits of UGI; the current condition of UGI; factors affecting UGI access and success; and the idea of planning norms and standards of UPs. Based on the review of existing literature this section also discussed the conceptual framework of the study that illustrated the major concepts and variables that are addressed in this study.

Chapter three is about the research methodology used for addressing the research objectives and questions. The methods used in this study came from various literature that were utilized for addressing similar issues. The chapter began with the description of the study area including why

the study area is selected. Then, the next section presents the methodological framework. The other sections of the chapter give a detailed account of what was done during the study, how the population was chosen; sampling methods that were used; the manner in which data was gathered and managed up; and the analytical techniques used to address each research objective.

Chapter four, five, and six of the study presented the analysis and discussion of the empirical evidence gathered for the study. It outlined the analysis of four main areas of the study, namely the nature and trend of UGI, spatial accessibility of UPs, perceived accessibility and utilization pattern of UPs, and qualitative analysis of policy and organizational framework of UGI. These chapters also present the discussion of the results and contextualize them against the research objectives and questions outlined in chapter one. **Chapter seven** continuous with the constraints, prospects, and planning and management strategies of UGI. Based on the result of the major research themes mentioned in chapter four, five and six, in this chapter challenges or constraints behind the current state of UGI in the city are discussed in detail. Moreover, this part of the study presented the planning and management strategies of UGI. Various strategies for UGI planning and management were elaborated in detail. This section provided useful information that can support urban planners, decision makers and the municipality of the Addis Ababa city and beyond, so as to enhance and maintain accessible UGI within the city.

Chapter Eight is the last chapter of the study, which contains conclusions, contribution of the study and a brief list of future research. It presents a brief summary of the main points of the dissertation in line with the research questions raised in chapter one. Then, it ends with the contribution of the study and a brief list of future research.

2. Theoretical Context & Review of Literature

In this part, major theories and literature that found relevant to this study are discussed and analyzed. The primary aim of this analysis was to examine and discover the existing body of knowledge related to the study and to identify the gap. Theories, research findings, discussions and methodological techniques of UGI in general and UPs in particular are critically reviewed and presented. Hence, this part of the study is broken down into the following major sections. The first section begins with the definition of basic concepts related to the term UGI. The next section presents the reviews of benefits provided by UGI. The third section is about the current condition of UGI in different parts of the world. Section four is about factors affecting UGI access and success, and section five is about norms and standards of UGI planning. Finally, this chapter discussed the conceptual framework of the study that illustrated the major concepts and variables that are addressed in this study.

2.1. Definition of major concepts

Many studies have been undertaken on UGI, urban green space and UPs worldwide. However, some researchers considered the definition of these terms as the same and unknowingly uses interchangeably. There are also a variety of definitions found in academic and gray literature. Swanwick et al. (2003) also highlighted that, there is lack of consistency in definitions of these concepts. Even though, these concepts are interrelated, they are different in terms of definition. Moreover, the mentioned terms have no commonly accepted or authoritative definition in the Ethiopian context. Therefore, defining these concepts to avoid confusion is very important. The mentioned concepts are also used frequently throughout this dissertation and it is important to be familiar with how these concepts are defined in the context of this study.

Green space

In the literature, there is no consensus on the definition of urban green space (Bununu, 2012). Different disciplines such as ecology, landscape architecture, and environmental or urban planning have proposed varying definitions from their own professional perspectives. From ecological perspective, green spaces are defined as places for contact with birds, animals, and more attractive insects like butterflies, and places with visual variety, where children can learn about nature and social life through contact with animals and green plants (Beer, 1997). Bununu (2012) define green spaces from the landscape planning and urban design perspectives, and defined it as all the areas within the city and its surrounding regions, that enable city residents to contact natur. Bununu (2012) broadly defined green spaces as the range of vegetation in urban landscapes, both publically and privately owned, directly or indirectly available to city users. The above definitions clearly indicate the expanding and divers definition of the concept of urban green spaces. In majority of studies, the term urban green spaces include parks and natural and nature reserves, however the term also encompasses street trees, residential gardens and any other vegetation found in the urban environment (Loram et al. 2007; Goddard et al. 2010; Kendal et al. 2012). Having considered the various definitions of green space in the literature, this study defines urban green spaces as any vegetated area, water bodies and other green elements within the boundaries of the urban area, and it can cover large or small areas, from private gardens to street trees and public spaces including cemeteries.

Urban green infrastructure

Urban green infrastructure (UGI) is the recent term, and it has numerous definitions in the literature (McDonald, 2005, Kambites, 2006). Lundgren (2000) defined UGI as continuous network-like

structure connecting the internal green areas inside the inner city with the natural, agricultural, and semi-urban areas in the outlying parts of the city. Boyle et al. (2012) denotes UGI as natural and engineered ecological systems which integrated with the built environment to provide the widest possible range of ecological, community and infrastructure services. Benedict & McMahon (2002) also defined UGI as an entire system to protect and restore natural functioning ecosystems by providing a framework for future development that fosters a diversity of ecological and socioeconomic benefits. From these three definitions, Benedict & McMahon (2002) & Lundgren'S (2000) definitions seem the most widely used in the literature.

In this research, the term 'UGI' is defined as the combined structure and connectivity of different types of green spaces, including UPs in the city, which together enable the delivery of multiple social, economic and environmental benefits to both humans and built urban environment. The components belonging to UGI in this definition include all the natural green elements, fashioned green spaces (urban parks, green ways, working farms, urban forests, etc...) and blue areas or water bodies (lakes, rivers, streams and wetlands) in the city. Even though there is no interconnected UGI in Addis Ababa city, in this study the phrase UGI is used throughout this dissertation to indicate or refers to the aforementioned components of UGI.

Urban parks

As stated above, UGI has many components. Urban parks (UPs) is one of the major components of UGI. The features and uses of UPs have been discussed extensively. For instance, UPs defined as a delineated open space in the urban area, mostly dominated by vegetation and water, and generally reserved for public use (Konijnendijk et al. 2013). UPs also refers to spaces that have the maximum human interference with the natural environment and the highest level of accessibility for populations, commonly found within or adjacent to built-up areas (Maruani &

Amit-Cohen, 2007). Hiruy (2003), defined UPs as a specific piece of ground within the city or town, excluding natural green spaces and forests, and set apart for recreational use by the public. It includes trees, lawns, and other shrubbery, as well as sports, leisure, and recreational facilities. Thus, this study use the definition forwarded by Hiruy.

2.2. Benefits of urban green infrastructure

As will be shown in this section, the planning of UGI aimed to augment the benefits it provides to the urban society. UGI benefit is concerned with the services provided by the UGI that promote human or societal wellbeing, either directly or indirectly. Thus, this section reviews the various benefits associated with the presence of UGI to confirm that their absence can be harmful. UGI is multi-functional (Pauleit et al. 2011).

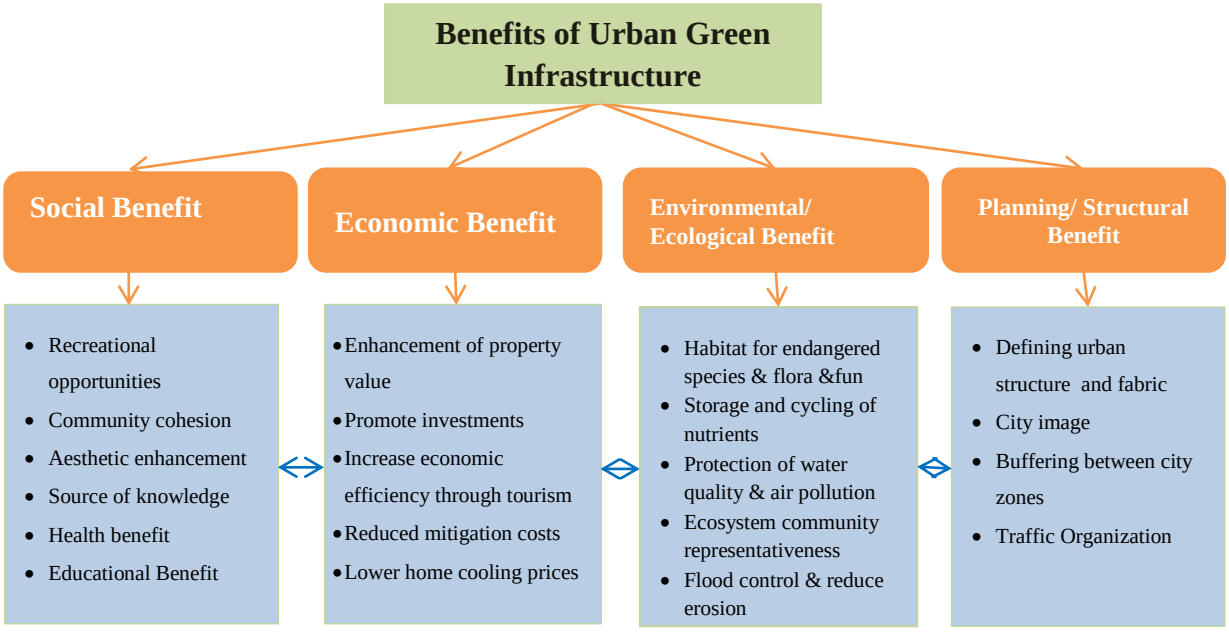


Fig 2.1 Benefits of urban green infrastructure

Multifunctional in a sense that it offers social, economic, environmental and planning/structural benefits (Maruani & Amit-Cohen, 2007; Tzoulas et al. 2007, Baycan-Levent & Nijkamp, 2009;

Pauleit et al. 2011; Wolch et al. 2014). These benefits are very often interrelated and interdependent, which ultimately converge in the rationale for UGI planning (Fig 2.1).

2.2.1. Social benefits

The social benefits of UGI are the advantages that it proved for the communities and societal well-being. It includes health, educational, social cohesion and recreational benefits. The health benefit of UGI has been widely acknowledged by the health and planning community (Beer, et al. 2003). The health benefits include; personal fitness, stress relief and relaxation (Lee & Hong, 2013). UGI has been found to positively influence physical health and mental health of the urban community (Maas et al. 2009b). Essentially, parks contribute to physical health because they give the urban residents a place to exercise through some type of physical activity. For instance, children can impacted physically by the use of UPs. Through exercising in the parks, children will not only have a lower chance for obesity, but will also reduce the amount of other health problems related to obesity (Strife & Downey, 2009). Fjørtoft (2001) also discovered that, children playing in nature experienced positive effects with their motor skills.

Moreover, UGI has also mental health and emotional benefits. Viewing nature in the parks has been shown to reduce stress, which leads to better physical health (Maller et al. 2006). The same research discovered employees with a view of nature exhibit less job stress, less sickness, and more positive views of their job (Maller et al. 2006). Crime was also mentioned as one indicator of environmental stress. Studies have found that neighborhoods with more UPs have lower crime reports (Kuo & Sullivan, 2001). Kuo and Sullivan (2001), suggest that the addition of greenery to the neighborhood will encourage more residents to walk outdoors and putting more people on the street. It appears, therefore, that the addition of green areas can help lower stress which may leads to lower crime rate.

From educational perspective, students can better perform in school when they have a proper view of nature (Tennessen & Cimprich, 1995), or have access to natural settings in the school environment (Taylor et al. 2001). For instance, Tennessen & Cimprich (1995) identified that college students with a view of nature from their dormitory performed better on attention based tests. In addition, UPs increasingly use as an outdoor classroom for disciplines related to environmental studies and provide valuable settings for research projects. It provides an opportunity for creating research partnerships with universities, scientific and industrial research organizations to examine a wide range of issues related to biophysical aspects of green in the parks (Conner, 2005). Thus, if UPs are well-established, they can serve as laboratories for various professionals such as geographers, biologists, environmentalists and social scientists.

An additional benefit outside of the health and educational benefits, UPs can serve as a place for social cohesion and recreational activities. UPs facilitate and strengthening social cohesion by creating space for social interactions (Maas et al. 2009), and provide the opportunities for physical recreation and relaxation (Thomas, 2013). They create the opportunities for high levels of interaction between individuals of different ethnic and socioeconomic background (Fainstein, 2005). Moreover, neighborhood parks create a chance for children to interact with their peers, while having independence from adults (Day & Wager, 2010). Through this interaction children are able to get, confidence and competence by the negotiation of limited risks (Day & Wager, 2010).

2.2.2. Economic benefits

The economic benefits of UGI can be defined as "the total amount of welfare that UGI generates for the society" (Rodenburg et al. 2001). The economic benefit of UGI can be expressed in terms of direct (paying for recreational or sports facilities) and indirect benefits (spill over benefits from

health, lack of crime and business opportunities) as well as symbolic values (sense of place) (Cabe Space, 2005).

The direct economic benefits of UGI include values of the market-priced products, such as those generated through wood production, recreational service, urban horticultural industry and urban agriculture etc. However, the most important values of UGI are their indirect economic values, and they have no market-price (Tyrväinen et al. 2005). These indirect economic values of UGI include value gained by reduced costs for environmental control, energy consumption, public health protection, enhancement of local and regional economy by promoting tourism and attracting investment and human resources, improvement of business benefits through drawing customers and increasing workers' productivity (Cabe Space, 2004).

Economically, UGI can raise property values depending on the quality, contents and size of a park (Crompton, 2001). Heidt & Neef (2008) indicated that greening and landscaping increase property values and financial returns for land developers of between 5 percent and 15 percent depending on the type of project. Moreover, the real estate market consistently demonstrates that, many people are willing to pay a larger amount for a property located closer to UPs and other green spaces than residential areas that does not have this space (Crompton, 2001). The study on the effect of forests on property prices in Knoxville city, USA, also investigated that proximity to green spaces has a positive effect on property prices (Cecil et al. 2013). Brander & Koetse (2011) concluded that green spaces raise the value of nearby properties, whether it is houses or apartments. The same study also concludes that green spaces such as recreational parks are more highly valued than forests and agricultural lands.

2.2.3. Environmental or ecological benefits

From an environmental point of view, UGI is a basic set of conditions for both humans and other species. This view emphasizes the role of UGI in biodiversity conservation and enhancing natural processes such as facilitating water infiltration, flood water retention, providing shade, acting as windbreaks, reducing urban heat island effect, improving air quality, and enabling organic waste recycling (Sandström et al. 2006; Tzoulas et al. 2007; Kong et al. 2010).

UGI is important for biodiversity conservation in the cities (Sandström et al. 2006). It provides wildlife corridors and habitat for various animals, birds, and wildflowers. UGI helps to alleviate the impact of habitat loss and isolation by increasing overall vegetation cover (Tzoulas et al. 2007) and providing a connectivity of habitat to improve species movement across the landscape (Rudd et al. 2002; Kong et al. 2010). It also maintains ecological integrity, preserve biodiversity (Luck et al. 2011), and enhance the health of urban ecosystems (Tzoulas et al. 2007). Moreover, UGI is important in handling and recycling organic matters. Nowadays, organic waste in the city is seen as not just a problem to the society, but also a resource of nutrients, energy and compost (Werquin et al. 2005). Urban green spaces have the potential to accommodate the ecological cycles of organic waste of cities and towns.

UGI is vital for water management and climatic regulation. It controls flood, retain rainwater and purify polluted water (Hough, 2004; Mohamed & Zhirayr, 2013). Many countries are using UGI as strategy for water management. For instance, greening flood plains in the urban areas is used as a strategy for flood control (Werquin et al. 2005). Moreover, green vegetation within UGI are a major contributor to stabilizing the urban climate and serve as the lungs for towns and cities. They counter air pollution by removing particulates, nitrogen oxide and sulfuric dioxide (Rabare et al. 2009), and adding oxygen to the atmosphere. Green cover within the city reduces surface

temperatures or mitigate the heat island effect in the cities and reduce the rate of ozone production. It provides shade, enhance ventilation, windbreaks, reduce temperatures and improve air quality (Werquin et al. 2005). For example, green along road corridors, play a positive role for ventilation and air quality of a city, accumulating dusts and slowing down air circulation (Rabare et al. 2009; Mohamed & Zhirayr, 2013). A dense network of urban green is important for meeting these requirements.

2.2.4. Planning and structural benefits

UGI define the urban fabric and structure**.** The structural functions of UGI indicates that it can provide a vital link between green space functions and urban land use that could accommodate many competing demands. UGI is structurally influential for the urban physical environment and for providing continuity and integration of planning by a logical determination of the optimal uses of land (Wilkinson, 1983). At the city scale, it functions as "city-forming", influence the structure, configure the urban areas and guide future development (Wilkinson, 1983). Together with other types of land use, UGI plays a key role in shaping and controlling the large-scale land use structure of the cities. The planning concept of the 1882 "Linear City" concept by Spaniard Arthuro Savia, the 1898 "Garden City" by Englishman Ebenezer Howard, the 1974 "Finger Plan" for Greater Copenhagen as well as the 21st century "green infrastructure" concepts can be mentioned as an example of structural function of urban green spaces. All of these planning concepts have more or less applied urban green space as an over-all physical control in the use of urban land. Currently, many cities around the world arranging and configuring UGI in their urban planning process.

UGI not only make up the structural framework of the physical urban environment, but also improve the overall image of a city and create a unique branding and a sense of identity. UGI in a city is one of the key qualities that make the city visually appealing (Nasar, 1997; Swanwick,

2004). As Lynch (1960) argues, because water and vegetation are pleasant to most people, they are among the city elements with high image ability, which contribute to the formation of a mental map and a positive image of a city. A positive city image created by UGI can greatly promote its amenities and livability and thus, attract people to live, visit or stay in a city, and further encourage investment (Chiesura, 2004).

Moreover, UGI such natural landscapes in the city have architectural values. Vegetation in the urban centers is used in integrating the buildings to the surrounding urban environment. As architectural characteristics, plants form walls, canopies or floors of varying heights and building densities. Landscape variation is created through different colors, textures, forms and densities of plants in the city (Tyrväinen et al. 2005). Green spaces can be used to frame scenes and to provide backgrounds and foreground for landscape structures (Tyrväinen et al. 2005). Moreover, on a smaller scale, components of UGI are often used in urban planning to separate urban zones. The planning concept of 'Albertslund South', a new town planned in the southwest of Copenhagen in the late 1960s (URGE, 2004) can be mentioned as an example. Buffering noise from highways and providing a quality environment for the new town were among the major planning concepts for this area (URGE, 2004).

Street parks in the cities have played an important role in traffic organization. They separating pedestrians and vehicles, and organizing traffic for over 2000 years in different parts of the world (Yu et al., 2006). For instance, the 1950s of the boulevards in European cities and greenways in American cities developed for such purpose (Yu et al., 2006). Street Park has a fundamental function in allowing us to move around on foot, by bicycle, by car, motorbike or public transport. Moreover, well-designed street parks encourage walking and cycling, and promote a safer

environment by reducing vehicle speeds and use (Cabe Space, 2004). Thus, the design and management of green spaces need to reconcile the needs of the conflicting modes of transport.

In general, it is evident from the above discussion that incorporating UGI in cities and towns is beneficial for the numerous reasons mentioned above. Therefore, it is important to integrate UGI within urban environment for sustainable city development.

2.3. Studies on the condition of urban green infrastructure

As indicated in section 2.2, UGI is multi-functional (Pauleit et al. 2011). It offers social, economic, environmental and planning or structural benefits (Talen, 2010; Wolch et al. 2014). Thus, integrating UGU in the landscape of built environment is very crucial for the functioning of the city in sustainable ways (Sandstrom, 2002). As discussed above, UGI is a recent term, but it is not a new idea. It has roots in planning and conservation efforts that started 150 years ago in the USA (McDonald, 2005). In the UK, the term first came to prominence following the work of the PCSD in the work of the Urban Task Force and the Department for Environment, Transport and the Region's Proposals for the Urban Renaissance (Mell, 2010). At present days, UGI is embraced by many developed nations as a strategy to protect their urban environment and create sustainable cities (Foster et al. 2011). The planning and delivering of networked UGI has become a major discourse in urban planning and increasingly accepted as a policy approach (Lennon, 2014; Davies et al. 2015; Girema, 2019) in many countries.

In most North American, European, and Asiatic countries UGI development and management have been receiving more attention and considered as essential urban infrastructure (Lafortezza et al. 2013). For instance, in the United States the integration of green and gray infrastructures has become an important strategy for storm water management (Pauleit et al. 2017; Girema, 2019). New York City also prepared plans that combined engineering structures with UGI to tackle the

wider challenges of climate change (Pauleit et al. 2017). In Europe, cities such as Barcelona are now noted for equally ambitious strategies that put emphasis on increasing connectivity of green spaces (Pauleit et al. 2017; Girema, 2019). In addition, the Berlin Landscape Program emphasizes a well-networked green infrastructure that act as a habitat network, moderates urban climate and serve as corridors for human uses (Hansen et al. 2016). The aforementioned review indicates that the policy makers and practitioners of developed countries have recognized the potential of UGI in tackling the current and future challenges of urban environment (Lafortezza et al. 2013). Thus, they have established a fertile ground for implementing UGI and exploit its benefits (Davies et al. 2015; Hansen et al. 2016).

On the other hand, studies show that components of UGI are on the decline and not well developed in several cities of the world. For instance, a study conducted on changes in land-use of 25 European cities found that 7.3 to 41 percent of green spaces changed to different land-uses (Kabisch & haasel, 2013). Similarly, in the USA, a study on land-use land cover change in 274 metropolitan areas revealed, about 1.4 million hectares of green spaces converted to different land use (McDonald et al. 2010). Moreover, a considerable number of studies investigated that recreational UGI is inaccessible for the majority of the urban dwellers in many cities across the world. For instance, the study conducted in European cities found that per-capita park provision ranges from low values (3-4m^2) in the south and east to increased provision in the north and northwest of Europe (300m^2) (Fuller and Gaston, 2009). Studies also indicated, individuals do not have the same access to UGI within the minimum walking distance and its distribution is not even (Van Herzele & Wiedemann, 2003; Balram & Dragicevic, 2005; Barbosa et al. 2007). For example, Sotoudehnia & Comber (2011) found that only 15% of the total population in Leicester live within the 300m distance to UPs.

In case of developing countries of sub-Saharan Africa, components of UGI can be found in all cities and towns to a greater or lesser extent, but not considered as UGI. Moreover, the urban community is not fully benefiting from the available green components. The depletion of these spaces in African countries is more serious than developed nations. Components of UGI are depleting at an alarming rate in several cities across the continent (Adjei, 2014; Lindley et al. 2015). Currently, it occupied a small fraction of the land use of several urban centers of African countries (Adjei 2014). Moreover, recreational UGI is not accessible to the majority of the urban communities. For instance, recreational parks in Alexandria (Egypt), Luanda (Angola) and Cairo (Egypt) cities were below $1m^2$ per city dweller (Lange & McNamara, 2011). Moreover, the approach to UGI in urban centers of African countries is at an early stage. Urban development and planning regulations in many urban centers of the continent have failed to provide orderly and sustainable urban development (Ondiege, 1999). This resulted in squatter settlements and informal sector development. Components of UGI have suffered on the same note of failure to provide orderly urban development by the African governments. Moreover, as the result of high value of land in the urban areas of developing countries, UGI viewed as a luxury and no significant emphasis is given to develop such spaces (Maryanti et al. 2016).

In summary, the past three decades have brought some major changes in green space planning and practice in developed countries. The perspective of green space planning has been shifting from technical design to a relational process, while the objective of green space development has been shifting from a single function focus to multi-functionality. The scale of concern has been shifting from single green spaces to integrative urban green structure. In Europe, the so-called green structure planning approach has gradually emerged in this context. However, in developing countries of sub-Saharan Africa green infrastructure planning approach is at an early stage.

2.4. Barriers and constraints of urban green infrastructure access

Components of UGI are highly patchy and dynamic (Elmqvist et al. 2004). They are shaped by the ongoing interactions between humans and the urban environment (Gaston, 2010). Studies mentioned that the accessibility of UGI is affected by biophysical and ecological factors on one hand, and socioeconomic (user's characteristics) and policies on the other hand (Elmqvist et al. 2004; Giles-Corti, 2005; Kaczynski et al. 2008). Different literature also identified various factors that hinder the access and success of UGI in a city. The major barriers are discussed as follows:

2.4.1. Urban policy and planning

The availability or absence of policy, legislations, and guidelines have an important role in influencing the provision and management of UGI. Studies indicated that the national, regional or municipal level policies can drive the acquisition of UGI or loss of existing UGI in cities (Kong & Nakagoshi, 2005; Dallimer et al. 2011), while local urban policies have strong influences on the availability and accessibility of urban green space (Sadler et al. 2010). For instance, the study conducted in the cities of African countries found out, the inadequacy, ad hoc provision and poor management of components of UGI as a result of weak policy, legal and regulatory framework (Zakka et al. 2017). Moreover, UGI and other publically managed recreational areas are controlled by local municipalities and therefore, management decisions and regimes are directed by urban planning policies (Kendal et al. 2012). Green space policies and legislations can also affect the accessibility of green spaces. The category of policies includes issues related to park design, policies, park management practices, and budget procedures (Bedimo-Rung et al. 2005). Some park organizations may have unwritten policies of building and maintaining facilities that are more accessible to their user population and leaving the less accessible parts of their park undeveloped and/or not well maintained (Bedimo-Rung et al. 2005; Ariane et al. 2005).

2.4.2. Land use land cover and urban density

Green space cover and biodiversity decrease as the proportion of urban land use and land cover increase (Loram et al. 2007; Dobbs et al. 2013). For instance, Abebe & Megento (2016) found the shrinking of urban green spaces with the increasing of built-up land uses. The study conducted by Teferi & Abraha (2017) also pointed out the dramatic expansion of built-up areas and at the same pace decline of UGI components. Urban density is also another negative predictor of the accessibility and availability of urban green space (Fuller & Gaston, 2009). Studies frequently cited population density as a driver of decreasing in urban green spaces (Yuan et al. 2005; Tan & Samsudin, 2017). Studies also reported, urban growth with a high density of residential area has been a major factor that determining the biosphere in the urban environment (Yuan et al. 2005; Teferi & Abraha, 2017).

2.4.3. Distance, time and transport

A considerable amount of research has investigated the effect of different physical factors on park accessibility (Mowen et al. 2007; Grow et al. 2008; Zhang et al. 2015). For example, several studies have found that distance to UPs, the size of the park, travel time, and mode of transport influence residents' likely to use public parks (Giles-Corti et al. 2005). Distance or proximate is a very important factor that can affect the accessibility of UPs (Talen & Anselin, 1998; Nicholls, 2001; Cohen et al. 2006). It has also received increasing attention by researchers and different field of studies. Some studies cover the proximate and levels of access of UPs within the minimum walking distance (Reyes et al. 2014; Dony et al. 2015) and others studies identify areas of lacking park accessibility (Nicholls, 2001; Barbosa et al. 2007; Lee & Hong, 2013). McCormack et al. (2010) also found out the proximity to the park encouraged park usage. Various studies also indicated, urban residents prefer to visit nearer recreational areas and that the frequency of use

decrease as the distance from the home increases (Kaczynski & Henderson, 2007; Nielsen & Hansen, 2007). A shortest walking distance (300 m) has been mentioned as a 'threshold' for the most intensive use by a resident. However, Kanczyki et al. (2014) found out that proximity to the park was not associated with park use, but the features in the parks significantly influenced park access. Time and transport expense can also influence how and why people will use parks and other forms of green space. For instance; studies indicated access to public transportation, travel expenses, insufficient leisure time can negatively influence park usage (Floyd, 1999; Lee et al. 2001; Schwartz & Lin, 2006).

2.4.4. Socioeconomic and demographic variables

There is a two-way relationship between UPs access and neighborhood socioeconomic and demographic composition. On the one hand, access to UPs influences the socioeconomic composition through the provision of environmental, social and health benefits (Goddard et al. 2010). People with a higher educational level tend to have a greater understanding and appreciation of vegetation and hence choose to live in the neighborhoods with more tree cover (Kendal et al. 2012). In addition, UPs provide benefits that make a neighborhood a more appealing place to live, which is reflected in higher housing market prices (Kong et al. 2007).

On the other hand, access to UPs are influenced by an individual's socioeconomic conditions (e.g., income, education, employment) and socio-demographic (e.g., ethnicity, age, gender) characteristics (Van Herzele & Wiedemann, 2003; Jim & Shan, 2013). For instance, the study conducted in London identified that certain age groups were more likely to be low or nonusers of UPs; these were people from 12-19 years old and over 65 (Dunnett et al. 2002). Gender was also found to be another important factor in many studies and the findings revealed that females participate in recreational activities less frequently than males. Cohen et al. (2006) found out men

regardless of their age were more likely to use UPs compared to women. Women, children and the elderly are more likely to perceive UPs as risky places due to worries of personal safety (Sanesi & Chiarello, 2006), which would dampen their use (Miles, 2008). Previous studies have also found out that there is a significant relationship between education level and the use of UPs. Those who have Bachelor and above degree are the most users of UPs (Ahmad et al. 2011) while, those below bachelor degree are infrequent park users (Shores et al. 2007; Ayeghi & Ujang, 2014). Income also plays an important role in encouraging people to participate in recreational activities (Shores et al. 2007). Jennifer et al. (2014) observed that people in high-income level visit UPs more frequently than the ones in the low-income level. The availability or absence of different social events or programs in the park and personal factors like lack of interest, time limitation and life style are as some of the constraints that can affect park access (Cohen et al. 2010; Jansson et al. 2013).

2.4.5. Park characteristics and facilities

Studies suggested that the accessibility of UGI such as UPs is not only related to physical factors such as geographic proximity, but also related to the quality of the park that may encourage or discourage park users (Giles-Corti et al. 2005; Boone et al. 2009). The physical characteristics of a park can be strong predictors of access to UPs. For instance, Giles-Corti et al. (2005) indicated the availability of facilities and amenities in the UPs can determine their level of usage. Park features and amenities in the parks such as the presence of sports fields (Floyd et al. 2008); green plants, trails, walking paths, and sidewalks (Shores & West, 2008; Kaczynski et al. 2008); running tracks, swimming areas, lighting, shade, and fountains may promote park use and physical activity (Cohen et al. 2006). The quality of parks will also affect citizens' activity patterns and frequencies of use of the recreation opportunities to relax from daily stress. For instance, negative perceptions

of these areas can develop if they are congested, unsafe, poorly maintained, or neglected, all of which can lead to deter in access or use (Boone et al. 2009). The presence of litter, damage of facilities, and unclean restrooms may also discourage park use and access (Gobster, 2002; McCormack et al. 2010).

2.4.6. Perception of the community about park quality

People's perception about park quality also plays a significant role in the utilization of recreational spaces. Community perception of park attractiveness, cleanliness, affability and feelings of safety are key determinants (Burgess et al. 1988; Gobster, 2002; Loukaitou-Sideris & Stieglitz, 2002; Kaplan et al. 2004). For instance, when park users feel insecure or sense that their personal space is threatened, they develop negative feelings towards the park, thus, discouraging them from accessing and using the park (Kaplan et al. 2004). This makes such parks to be associated with negative emotions, thus, become a barrier. Many studies have found that women, children and the elderly are more likely to perceive UPs as risky places due to worries of personal safety (Sanesi & Chiarello, 2006), which would dampen their use (Miles, 2008).

2.4.7. Management of urban green infrastructure

The role of UGI organizations is important in ensuring UGI access and success. They are responsible for the planning, maintenance and controlling green space development process (Randrup & Persson, 2009). They provide particular leisure and nature opportunities for residents through choosing vegetation density and green space diversity (Burgess et al. 1988). However, absence in organizational structure and lack of coordination among them affects the availability, accessibility and success of UGI in the city. For example, studies indicated, the lack of integration was an obstacle to coherent and efficient implementation of UGI at different levels of the city (Wiens et al. 2002). Ottitsch et al. (2005), made a comparative analysis of urban green space policy

making and management in selected major European cities, and they identified large differences in coordination, in terms of formulating legislation and regulations at different levels of land management.

2.5. Planning standards and norms of urban park development

UGI can play a vital role in sustainable urban development. It is, therefore, useful to consider how planners have planned for UGI especially UPs. The use of standard for urban park planning has a long history and dating back to the early 20th century (Spencer et al. 2015). The notable 20th century formal national standards for green space planning were the USA and Great Britain green space planning standards (Theobald, 1984, Maharina & Beau, 2018). In 1920, the National Playing Fields Association (NPFA), now Fields in Trust (FIT) of Britain, recommended 6 acres of open space per 1000 population (24m^2 per person). While, in the USA, the National Recreation and Park Association (NRPA) standards prescribed a park allocation of 10 acres (4 ha) per 1,000 residents (Theobald ,1984, Maharina & Beau, 2018).

Currently, many countries developed their own norms and standards for park or green space planning. These planning standards vary from country to country and city to city as well. Standards may also reflect the priorities of local planning bodies (Maharina & Beau, 2018). The most commonly used indicator, is a quantitative standard, proximity indicator, and quality indicators. However, it must first be noted that the park standards used throughout the world are determined by the population number, density, demographic profiles, and recreation preferences (Maharina & Beau, 2018). In addition to the standard approach mentioned above, recently 'Need based assessment' approach is becoming popular planning strategy.

2.5.1. Quantity standard

Increasing the quantity of UPs is among the first priorities of city administrations and there is therefore, a need for guiding standards. Area of green space per city coverage is one of the indicators used to show the quantity of available UGI or UPs in the city. This indicator has been widely used by researchers (Groenewegen et al. 2006; Maas et al. 2006; Witten et al. 2008). It indicates the percentage (%) of UPs, green spaces, open areas or playgrounds of the total built-up area. According to United Nations Environment Program (UNEP) a minimum green space area should be 10-20% of a city's total area. Most European cities have a percentage of 30-40%, and some cities even reach 50%. However, this indicator may not be a reliable standard, but it is still a rough indicator of the average supply of parks in the city.

Per capita green index is the other most widely used quantity indicator and described as the total area of UPs averaged by the total population within the geographic area (Talen & Anselin, 1998; Taylor et al. 2011; Kabisch & Haase, 2013; Anguluri & Narayanan, 2017). This indicator varies globally and among cities. For instance, World Health Organization (WHO) suggested $9m^2$ park per capita for the world and $7m^2$ for cities of African countries (WHO, 2016). Most developed countries adopt a $20m^2$ park area per capita (Wang, 2009). Though the per capita ratio standard is widely accepted owing to its simplicity in application, it is not considered effective as it does not consider the spatial distribution of green spaces to users (Yao et al. 2014; de la Barrera et al. 2016). This indicator can also be misleading, as population and building densities vary dramatically within the city.

2.5.2. Proximity indicator

Proximity refers to how close the city residents should be to their nearest usable recreational parks. It is expressed in terms of the level of services area of UPs at a given distance and the number of

the population within the service area (Wright et al. 2011). Proximity is typically measured by calculating the percentage of residents within certain minutes walking distance of UPs or some similar metric (Tan & Samsudin, 2017). Proximity to parks is adequate when the population of the city is in harmony with the parks' spatial distribution (Langford & Higgs, 2010). The European Environmental Agency (EEA) recommends that people should live within a 15-minute walking distance or 1000m walking distance from their place of residence (Chiesura, 2004). Studies also indicated three possible proximity or walking distance indicators. The first is 400 meters (10 minute walking), which represents the maximum distance that an adult who is physically unfit, older or not able bodied would be likely to cover (Nicholls, 2001; McCormack et al. 2006; Byrne & Sipe, 2010). The second distance is 800 meters and represents the maximum average distance that a fit or an able-bodied adult could be expected to cover in a 10 minute walk. The final zone is 2.5 kilometers and represents the maximum average distance that a physically fit adult could be expected to cycle over the same time period (Nicholls, 2001; McCormack et al. 2006; Byrne & Sipe, 2010). The Natural England, an independent public advisor working to conserve, protect and improve England's natural environments, created the "Accessible Natural Green space Standards" that indicate different walking distance based on the size of green space (Natural England, 2010).

2.5.3. Quality standard

The quality standard is a matrix that identifies what physical features of UPs are suitable in the UPs that satisfy the users. The quality of UPs or urban green space is a function of the size and shape of UPs as well as the elements in the UPs (Taylor et al. 2011; Tian et al. 2014; Dobbs et al. 2014). Rating the quality of green spaces by the public from 'bad', 'good', 'better' to 'very good' is one of the quality assessment technique. One key element of green spaces is vegetation, being one of the main providers of ecosystem services; hence, vegetation cover can be used as a measure

of the quality of green space (Cilliers et al. 2013; Zhouand Kim, 2013). The amount of facilities and amenities in the parks such as the presence of sports fields (Floyd et al. 2008); green plants, trails, walking paths, and sidewalks (Shores & West, 2008; Kaczynski et al. 2008); running tracks, swimming areas, lighting, shade, and fountains are the others quality indicators (Cohen et al. 2006).

2.5.4. Needs-based approach in urban parks planning

In the denser parts of a city, the population is seldom homogeneous. Due to the heterogeneity of the population in such areas of a city, a number of park determinants must be considered when seeking to meet the park needs of those higher density areas. The alternative to a standard approach in this part of a city is a "needs based assessment", which considers the socio-demographic and bio-physical characteristics of an area (Smoyer-Tomic et al. 2004). The need based assessment also assume that the population for whom a recreational space is planned should be calculated according to the need (Nicholls, 2001; Smoyer-Tomic et al. 2004; Harnik, 2009; Byrne & Sipe, 2010), and the spatial distribution of both populations and resources within a given city (Talen & Anselin, 1998; Nicholls, 2001; Cohen et al. 2006).

A needs based planning approach' considers not only the absolute number of residents within a given geographic area, but importantly also considers their socio-cultural and ethnic sub-groups, leisure and recreation preferences, and the type and number of facilities required to serve those needs (Byrne & Sipe, 2010). It should also reflect projected residential densities, which can change population compositions. A need based assessment is necessarily based on the analysis of census data and where possible, on detailed community surveys, participant observation, focus group discussion, ethnographic data, and detailed assessments of UPs to determine the demand and rates of participation in certain activities in the parks (Anderson & Heyne, 2000; Byrne & Sipe, 2010).

While, considerably more time consuming and resource intensive than a standard approach, a needs-based assessment may provide the capability to better estimate the amount of green space, the facilities and programs that required, and the design of that space. As mentioned above, this approach is especially important in densest area and where there is little or no opportunity for additional green space.

2.6. Conceptual framework of the study

A theoretical approach most UGI studies used is the so-called socio-ecological model. This model is widely used within the field of leisure research (Raymore, 2002) and physical activity research (Owen et al. 2004). In a socio-ecological model, different accessibility factors have been distinguished that influence on a person's behavior to utilize and access urban green spaces. According to Giles-Corti (2005), these factors can be broadly categorized into users or individual factors (e.g. age, education, income, education, personal experiences, family or friends, etc.) and environmental factors (e.g. physical environment, organizational environment, and policy environment). Based on this socio-ecological model (Giles-Corti, 2005; Hutzler, 2007; Schipperijn, 2010) and through a review of literature, this study also developed the conceptual framework of the study (Fig 2.2).

The conceptual framework illustrated the way the major concepts of the study are interlinked. It also outlines the key factors and elements affecting access and use of UGI in the study area. The conceptual framework illustrated that park access or utilization is a function of the amount of UGI supply or available UGI (the presence or absence of parks, park facilities and amenities), physical factors (proximity of parks, density, transport network & services), user's characteristics (income, education, employment, ethnicity, age, and gender), personal factors (leisure time, person health...etc.), perceived park quality (security or safety, maintenance and cleanness of parks), and

policy and management issues (Burgess et al. 1988; Talen & Anselin, 1998; Giles-Corti, 2005; Kaczynski et al. 2008). A growing body of researchers from different disciplines has begun to investigate the association of these concepts with park access and its implications. Although, conflicting results have been reported (Talen, 1998, Talen & Anselin, 1998, Lindsey et al. 2001, Nicholls, 2001) most studies suggest that park inaccessibility may be widespread (Nicholls, 2001, Pincetl & Gearin, 2005, Wolch et al. 2005). Moreover, researchers have paid scant attention to UGI accessibility from cities of developing countries context such as Addis Ababa.

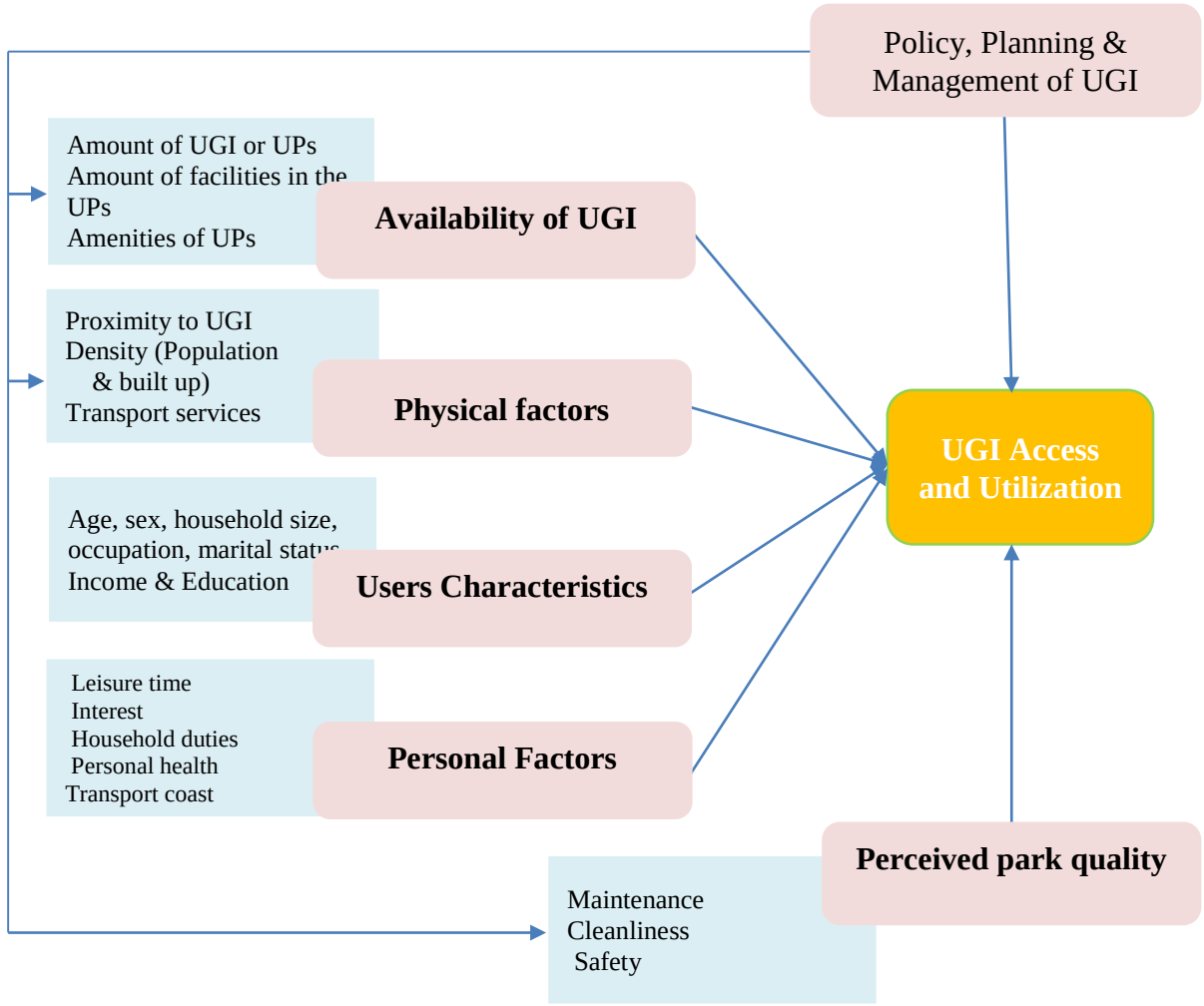


Fig 2.2 Conceptual framework of the research

Thus, these concepts are the major issues that addressed in this study. To sum up, the conceptual framework asserts that one must consider the interplay of several factors in order to understand UGI access and utilization pattern in a city.

2.7. Conclusion

This part of the study reviewed the existing theories & literature related to the current study. It discussed the existing body of knowledge related to the study and identified the gaps. It presented theories, analytical techniques, research findings and discussions on UGI in general and UPs in particular. The review began with the definition of major concepts related to the current study. Followed by the review of socioeconomic, environmental/ecological, and planning and design benefits of UGI. The environmental benefits of UGI, include reducing air temperatures and urban heat island effects, providing shade, enhancing air quality, reducing air pollution and excess water run-off, cleaning contaminants, noise abatement and enhancing biodiversity. From economic perspective, UGI has a positive impact on property value, improve businesses, create tax revenue, combat urban sprawl, produce urban food and attract tourists. From a social point of view, UGI has health, educational, social cohesion and recreational benefits. It promotes neighborliness, improve the experience of youth and children, provide ideological and spiritual capital, creating and reflecting cultural value. The planning benefit includes defining urban structure and urban form, regulating urban development, buffering between city zones, serving as architectural use and organizing traffic in the cities/towns.

In addition, this review identified different determinant factors that affect UGI access and success in a city. The review of past studies of UGI particularly recreational parks have demonstrated that urban policy and planning, land use land cover, urban density, physical factors (Distance, time and transport), socioeconomic and demographic variables, park characteristics and facilities, and

management system determine the success and access of UGI. This literature review has also discussed the planning norms and standards of recreational parks used by different cities across the world. The most commonly used standards are quantitative and qualitative standard, and proximity indicator. Alternative to these standard approaches a "need based assessment" approach has also recently been used by cities. Based on the review of literature this part of the study also discussed the conceptual framework of the research that illustrated the major concepts and variables that are addressed in this study. The framework also illustrated the way the study variables are interlinked.

3. Research Methodology

This part of the study presents the research methodology used for gathering and analyzing data in order to achieve the objectives of the study. The methods used in this study came from various literature that were utilized for addressing similar issues. Thus, the chapter began with the description of the study area, including why the study area is selected. Then, the second section presents the methodological framework. The other sections of the chapter give a detailed account of what was done during the study, how the population was chosen; sampling methods that were used; the manner in which data were gathered and managed up; and the analytical techniques used to address each research objective.

3.1. Description of the study area

This study was conducted in Addis Ababa city, Ethiopia. Addis Ababa is the primate city and the capital of the Federal Democratic Republic of Ethiopia (FDRE). The selection of the city as a case study area can be justified as follows. Firstly, the city has undergone or is undergoing a major urbanization process and as a result components of UGI and the urban landscape have been threatened. Second, the city and its districts are under immediate threat of environmental externalities and diminishing of quality of life. Third, the city has also considerable variations in both formal and informal settlements. Fourth, ineffective urban planning practice in Addis Ababa has similarities with many cities within the emerging economies. In addition, in Addis Ababa city few empirical studies have been carried out on the issue of UGI in general and UPs in particular.

3.1.1. Location, administrative area and demography

Addis Ababa city is found almost at the center of the country (Fig 3.1). Astronomically, the city lies at $8^0$57'0" to 9^0 04'0" N and $38^0$42'0" to $38^0$47'0"E. The administrative area of Addis Ababa is about 526.99 km^2. It is a chartered city having three layers of government: one municipality, 10+1

sub-cities (at the completion stage of this study one sub-city is added but not considered in this study) and 116 Woreda (districts) administrations (Fig 3.1). Addis Ababa city is serving as a social, economic and political center of the country. It is a seat of the African Union (AU), United Nations Economic Commission for Africa (UNECA) and other regional and international organizations. The city is therefore, often referred to as "the political capital of Africa" for its, political, historical, and diplomatic importance for the continent.

Fig 3.1 The study area

As per 2018/19 population projection, the total population of Addis Ababa city was 4592000 (CSA, 2019). In 1950, the population of the city was 392,000. The city population has grown by 922,914 since 2015, which represents a 4.37% annual change and expected to reach 8,938,683 in 2035 (Fig 3.2).

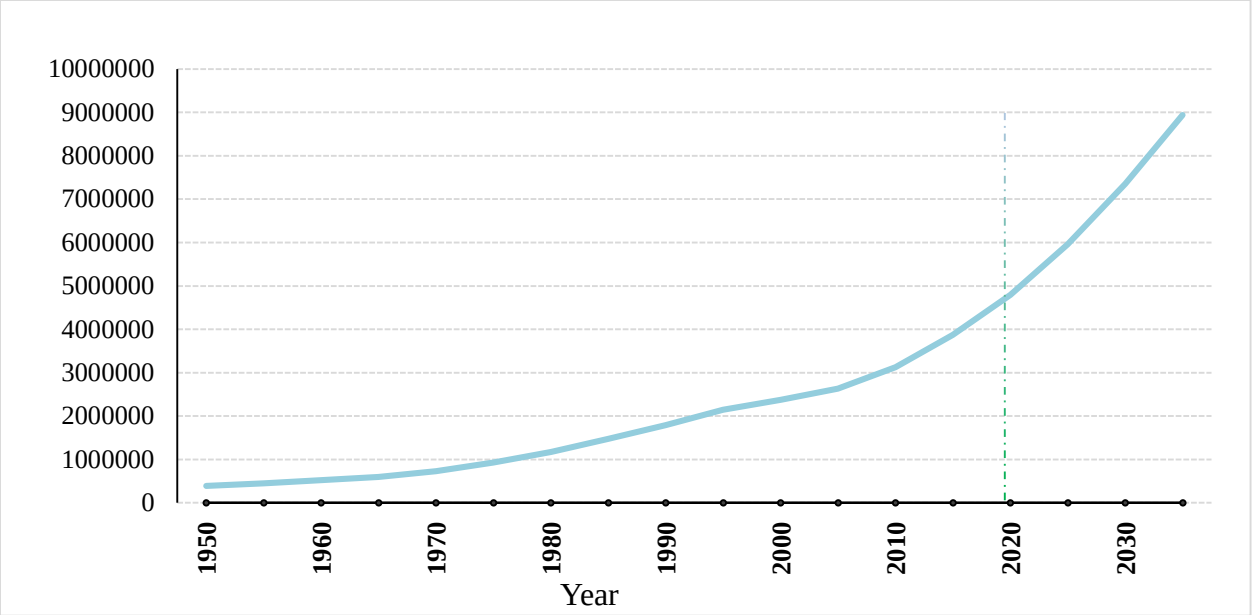
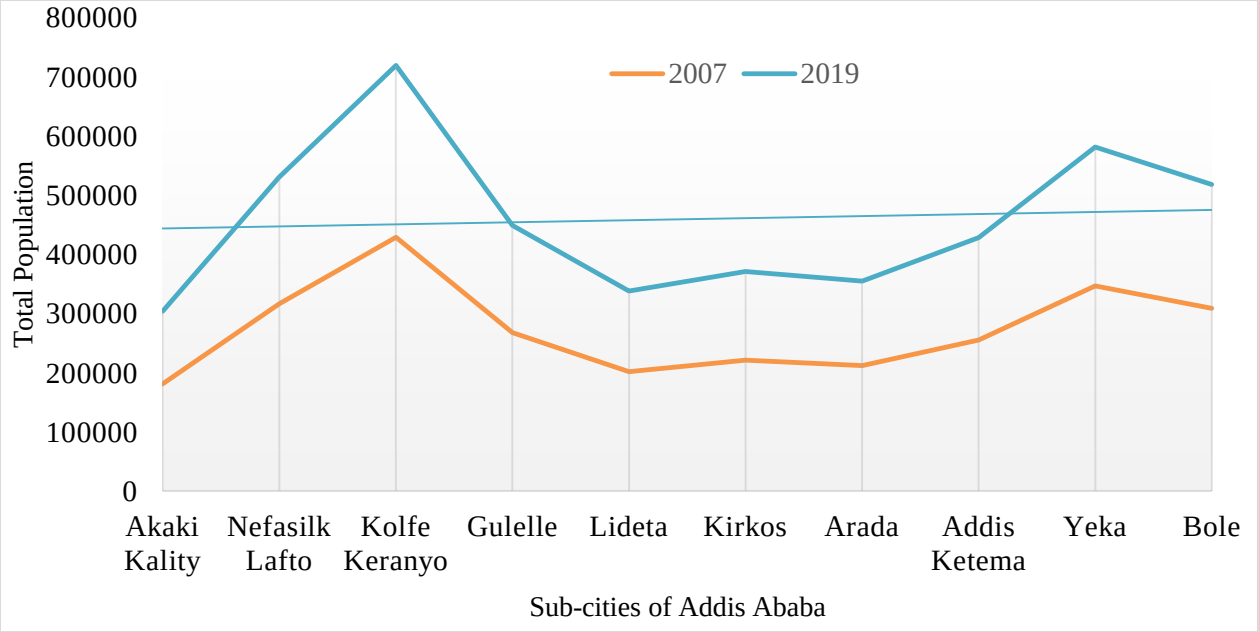


Fig 3.2 Population growth trend of Addis Ababa city

Addis Ababa is also the largest city in terms of population in the country, with a total population of 2,739,551 according to the 2007 census data (CSA, 2007). However, this data was criticized by professionals, because it was inaccurate when recorded and underestimated the population of the city. The CSA report shows that 47% of the city's population were males and the rest 53% was females. About 14.6% of the population were under 18 years of age and about 7.7% of the population were 65 years old and above (CSA, 2007). The city has through recent years seen a robust annual population growth rate. Within the last 12 years' (2007-2019) the city population increased by 40%.

When we look at the population distribution in the sub-cities of Addis Ababa, Kolefe Keranyo and Yeka have a higher population than other sub-cities (Fig 3.3). The population density of the city also decreases from the inner sub-cities to peripheral areas. Addis Ketema was the densest sub-city with 49550 persons per Km^2, followed by Arada (36840 person per km^2), Lideta (36840 person per km^2) and Kirkos (25320 person per km^2) sub-cities (CSA, 2019).



Source: Central Statistics Agency

Fig 3.3 Population of Addis Ababa sub-cities

3.1.2. Topography and climate

The physical landscape or topography of Addis Ababa city is characterized by rugged topography in the north and central part, while the southern part of the city is predominantly flat. The city is bounded by Entoto Mountain to the North, Wechecha Mountain to the North West and Yerer Mountain to the East. The altitude of the city lies between 2015 m to 3140 m above sea level. The lowest and the highest point of the city are located in the southern lower part of Akaki plains and the highest peak of the Entoto Mountain respectively.

Addis Ababa city has a humid sub-tropical highland climate (Ethiopian Meteorological Agency, 2020). The mean annual temperature recorded for the last 30 years (from 1983 to 2014) ranges from 15^0C to 18^0C (Fig 3.4). The mean maximum temperature varies from 25°C in May to 21°C in August and the mean minimum temperature varies from 11°C in May & April to 7°C in December & November (Ethiopian Meteorological Agency, 2020).

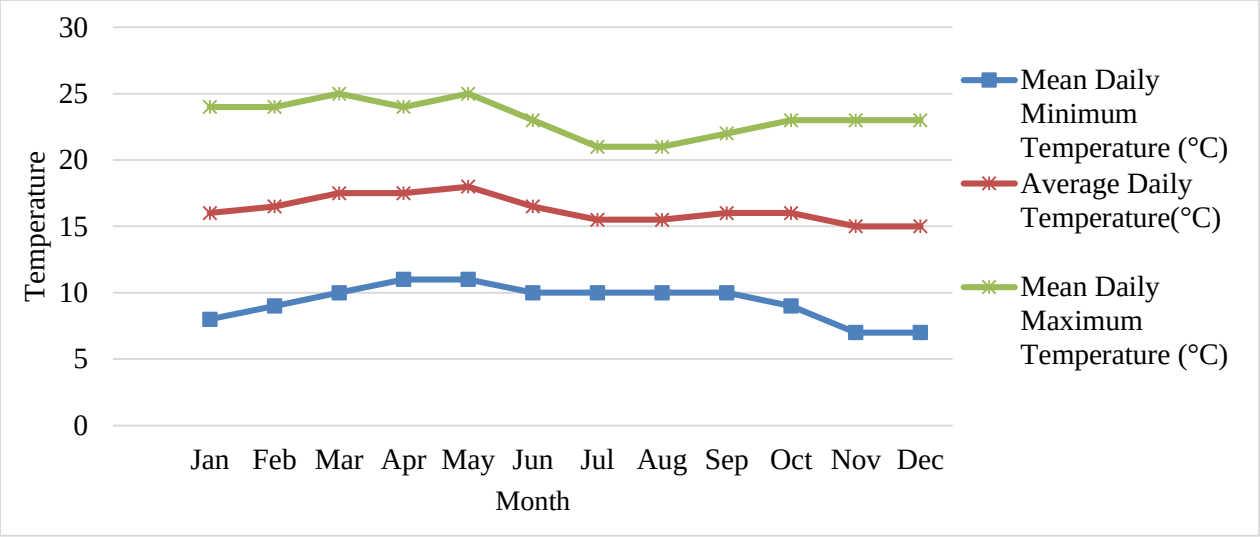


Fig 3.4 Mean average daily temperature (°C) of Addis Ababa city

In general, due to the influence of altitude, the city experiences lower temperature than might be expected in tropical Africa. However, a review of climate records for over one hundred years shows, there is an increase in minimum and maximum air temperatures in the city.

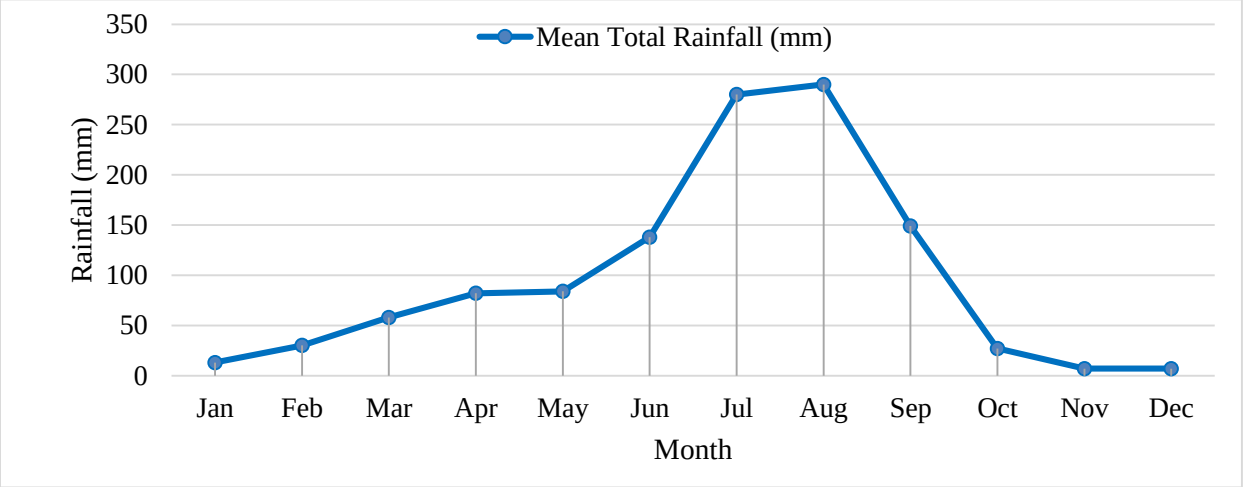


Fig 3.5 The distribution of mean total rainfall

In addition, the climatic data of the city indicated that the mean annual rainfall between 1983 and 2014 was 1,165mm, whereas the total rainfall has shown a declining trend of 36.45 mm per decade (Ethiopian Meteorological Agency, 2020). As indicated in Fig 3.5, there is no even distribution of

rainfall during the course of the year. The highest mean rainfall was recorded in August (290mm) and the lowest mean rainfall was recorded in December (7mm) and November (7mm).

3.1.3. Natural vegetation and green spaces

Addis Ababa city is endowed with different green space, including plantation, natural forests, rivers and streams, parks, and urban agriculture. Historically, Addis Ababa city was covered with natural indigenous vegetation which belonging to Afro-Montane forest and woodland (Kahsay, 2016). The natural forest had been dominated by indigenous trees such as *Juniperus procera, Olea europaea, Hygnia abyssinica, Hypericum revolutum, Podocarpus falcatus, Acacia abyssinica* and others (Kahsay, 2016). However, after the foundation of the city (1886), a number of eucalyptus trees have been introduced in the city by emperor Menilik II and became dominant tree species in the city (Fetene & Worku, 2013; Kahsay, 2016). The main purpose of the introduction of eucalyptus tree was for satisfying the growing demand of wood for fuel and construction, and to reduce the pressure on the remnant natural forest in the city.

At the turn of the mid-20th century, with the city development and population expansion nearly all the woody vegetation within and around the city were distracted (Fetene & Worku, 2013). The situation was aggravated by agricultural expansion surrounding the city, and the increase in the demand of wood for fuel and construction purpose (Eyob, 2010; Fetene & Worku, 2013). A continued urban sprawl further demanded its toll on urban forest and green spaces for many years and until now. Recently, only few patches of natural indigenous vegetation remained in the upper catchment of the city, around historical churches, palaces, compounds of old embassies, old schools, and recreational parks, while the entire Entoto mountain range and river valleys has been mainly covered with Eucalyptus plantation (Eyob, 2010; Fetene & Worku, 2013; Kahsay, 2016).

It should also be important to mention that the Entoto Mountain has been a sanctuary habitat for many wildlife.

3.2. Methodological framework of the research

The methodological framework of the study shown in Fig 3.6 forms the basis of the research structure. It illustrates the various steps of the study i.e. from initial preparation of the study to the contribution to the field of the study/UGI. The framework links the problem statement with the literature review, data collection techniques, and data analysis & synthesis stage.

The initial stage of the study was establishing the problem statement and research objectives. At the second stage of the study, related literature was reviewed. At this stage the existing body of knowledge (theories, methodological techniques, research findings and discussions) related to UGI was critically reviewed to identify the gaps in the field, which forms the conceptual framework of the study. The methodological framework also illustrated the third stage of the study, which shows the methods and materials employed, the tools used in data collection, and the relevant procedures. The study used mixed research approach. Both quantitative and qualitative data collection and analysis technique were utilized. A variety of socio-spatial data were collected from different sources and analyzed by using various quantitative and qualitative analytical techniques. At the 4th stage of the study, the analysis and synthesis of the finding of each objective were undertaken. At this stage, the first three objectives of the study were analyzed and discussed consecutively, and then based on the analysis of these objectives the constraints of UGI identified and discussed. Lastly, based on the finding of the research, strategies were developed for successfully plan and manage UGI in the city.

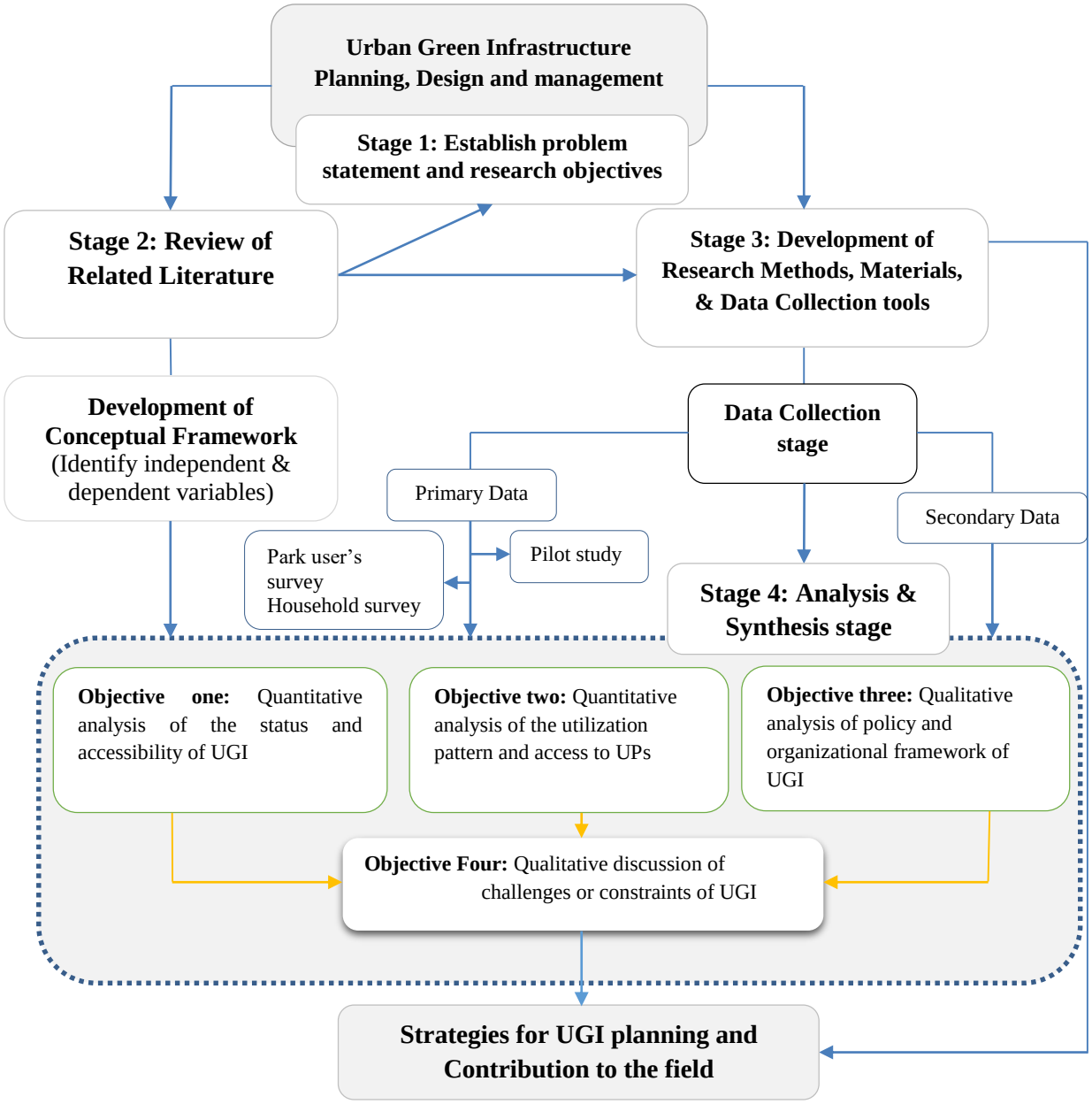


Fig 3.6 The methodological framework of the research

3.3. Assessment of the status of green infrastructure

In order to assess the status of UGI in Addis Ababa city this study examined the land use of UGI for the last 13 years from 2003 to 2016. The years were selected because they coincide with the revision period of structural plan of the city. The commonly used technique for assessing the status

of green space is the Normalized Difference Vegetation Index (NDVI) using satellite imagery data (Lahoti et al. 2019). However, such methodology fails to consider different components of green spaces available in the city (Anguluri & Narayanan, 2017; Lahoti et al. 2019). Hence, this research used the land use map that was extracted from the structural plan of the city for quantifying different components of UGI in ArcGIS tool. Moreover, the structural plans data is more reliable and accurate than satellite images because it was collected directly through a field survey by using GPS and other tools. The structural plan shape file data of the year 2003 and 2016 was collected from Addis Ababa City Integrated Development Plan Project Office (AAIDPO). Here it should be noted that the land use land cover change analysis was conducted for both proposed and existing or already developed land uses of components of UGI for the mentioned years.

Furthermore, the city administration did not update the spatial data of existing UPs. Thus, a field survey was also conducted to identify the location of existing UPs by using GPS. After the field survey was undertaken, the collected GPS point data of UPs were imported into the GIS environment and overlaid on the existing land use plan of the city. Then, with same geographical projection and coordinate system, the accurate location of existing UPs was identified and the polygon of each UPs was extracted from the land use map. The details of Geo-referencing, mapping and accuracy assessment are further elaborated in detail in the previous work (Lahoti et al. 2019).

There is no universally accepted land use land cover classification since it is influenced by the specific users' objective and the geographical location of the land (Thompson 1996). Thus, for the purpose of this study, the study has chosen five land use class and extract from the structural plans of the city (Table 3.1). The land uses include the four UGI components (Urban forest, urban agriculture, river and riverside green, and UPs) and built up area. All built up land uses (residential,

commercial, industrial area, transportation network and other built infrastructure) were merged into one land use category to understand how much it affects UGI (Table 3.1).

Table 3.1 Land use land cover class (LULC)

LULC classes	Description of the LULC class
Built-Up Area	Include areas with all types of artificial surfaces, including residential, commercial, industrial area, transportation network and other built infrastructure.
Urban Agriculture	This includes cultivated lands, reserved land for agriculture, community lands along the river banks that are used for agricultural purpose.
Urban Forest	Include areas of dense vegetation cover, such as areas covered with both indigenous and exotic trees like Eucalyptus tree, grass and shrub areas, reserved land for forest, trees in the church and embassies, and along street.
River and Riverside Green	It includes rivers, streams, riverside or reserved buffer for greens and other water bodies.
Urban Parks	Urban parks refers to a specific piece of ground, excluding natural parks, within the city/town and set apart for recreational use by the public. It may be planted with trees, lawns and other shrubbery and include facilities for sport, entertainment, and recreation purpose.

There are different indicators that are used to assess the states of UGI. The size of UGI in terms of acreage or percentage is one indicator which is widely used (Kabisch & Haase 2013; Yao et al.

2014). GIS has provided a convenient technique to analyze the status and changes in the components of UGI based on the mentioned indicator. Thus, the land use of each UGI component and built up area for the year 2003 and 2016 was calculated in ArcGIS in terms of acreage or percentage. And then, the variation in each land use between the year 2003 and 2016 was analyzed. The percentage of change or variation in land use of each UGI component (urban forest area, urban agriculture, riverside green and UPs), and built up area of the city was calculated based on the equation described below i.e. equation 1-2 (Kabischa & Haasea 2013):

$$\mathrm{LULCj} = \frac{\mathrm{LULC(tj+1)} - \mathrm{LULC(tj)}}{\mathrm{tj+1} - \mathrm{tj}} \quad (1)$$

Where:LULCj are all land use land cover in the year tj with j = 1… 3 and

t1 = 2003, and t2 = 2016

$$\Delta\mathrm{PLULCj}(\%) = \mathrm{LULCj}\frac{1}{\mathrm{LULCtj}} \times 100 \quad (2)$$

Where: $\Delta\mathrm{PLULCj}(\%)$ is percentage of land use land cover change.

3.4. Assessing the spatial accessibility of urban parks

In this study the spatial accessibility analysis of UGI followed the definition by Coles and Grayson (2004), which define urban green space based on their access and function criteria. Thus, in this analysis only UGI covered by vegetation and used for recreational purpose that serve different needs of the urban community are considered. UGI type that serves for recreational purpose in Addis Ababa city is UPs. Hence, the main focus of this analysis was on UPs of the city. Although, urban forest, agricultural land and river and riverside green are equally important, they are not considered because they do not qualify the recreational function of UGI, and their current states are unsuitable for recreational service. As indicated by Addis Ababa City Beautification, Parks and Cemetery Development and Administration Agency (AABPCDAA) the available UPs in the

city is very small. Thus, the spatial accessibility analysis was conducted for all identified available UPs in all sub cities (10 sub-cities) of Addis Ababa city.

The spatial accessibility analysis of UPs requires a Geo-spatial database used in Arch GIS. Types of data used to develop the database include, administrative boundary shape file, the layer of the existing UPs and land use of the city. The population data (Fig 3.7A) and road network shape file (Fig 3.7B) of the city and each sub-city were also used for the analysis. All these data were collected from Addis Ababa city administration and existing UPs data were collected through field survey. The last census in Ethiopia was conducted in 2007 and this study used the 2019 projected population data by CSA.

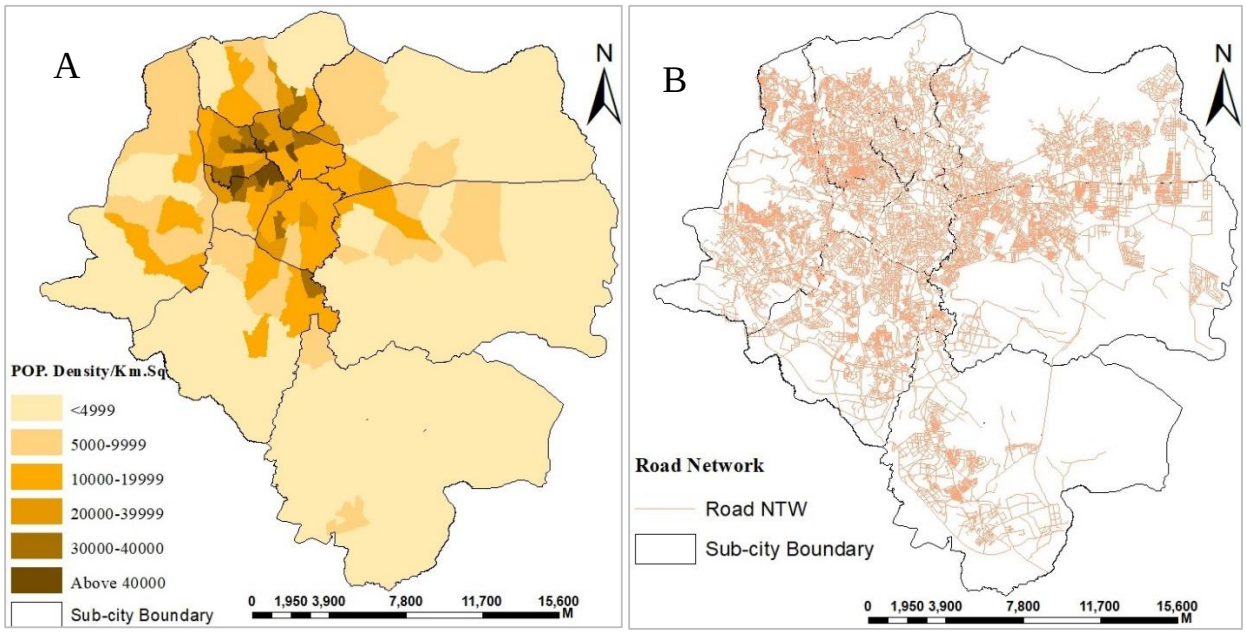


Fig 3.7 A) Population density map, **B)** Road network map of Addis Ababa city

As indicated by La Rosa (2014), accessibility is a broad term and is often "misused" and confused with terms like "mobility". Academicians and urban researchers also widely recognized accessibility as a complex multi-dimensional construct that is associated with both spatio-physical and socio-personal factors. In this analysis, UPs access is objectively measured UPs accessibility

(spatial accessibility) based on quantitative standards, i.e. proximity indicator, park area per capita (Lahoti et al. 2019; Barbosa et al. 2007) and park quality indicator. The detail methodology for analyzing data by each indicator explained below.

Per capita green indicator: - For calculating the park per capita, the aggregate of UPs acreage available for the city and each sub-city is calculated using "calculate geometry" tool in ArcGIS 10. Then per capita park index was calculated based on city and each sub-city population. Equation 3 was used for calculating per capita green index (Anguluri & Narayanan 2017).

$$APi = \sum_{i=0}^{n} \frac{GAi}{SPi} \tag{3}$$

Where; GAi- refer to the park area and SPi-is a population which enjoys services within the boundaries of the sub-city i, APi- per-capita park index indicated the amount of parks available in a sub-city for every inhabitant of the sub-city.

The per capita indicator was also used to carry out the comparison of available UPs with the benchmarks provided by Ethiopian UGIS and WHO standard so as to indicate the service area gap or deficit of UPs at city and sub-city scale. To calculate the service area gap/deficit of UPs in the city equation 4 was used (Anguluri & Narayanan 2017).

$$GAg = (Np - Api) \times P \tag{4}$$

Where; GAg-shows a shortage area of the park, P- Population number of the region, Np-denotes the international standard and Api-per-capita park index indicated the amount of parks available in a sub-city for every inhabitant of the sub-city.

Proximity indicator: - in addition to the per capita green indicator, this study used proximity indicator to examine level of UPs access to the city population. It is the widely used indicator to

assess the proportion of the population having access and without access to UPs that was modelled in ArcGIS using Euclidean or network distance (Nicholls, 2001).

As a minimum standard, planners have been able to establish some general principles about the willingness and ability of residents to walk to their nearest neighborhood park (Nicholls, 2001; Van Herzele & Wiedemann, 2003; Boone et al. 2009). Even though there is a lack of such standards for measuring the accessibility of UPs in Ethiopian context, it is necessary to establish some standards against which the citywide park access can be evaluated. Several walking distance standards were employed in the literature to calculate the effective service areas of UPs, such as 250, 300, 400, 800 and 1000m (Nicholls, 2001; Tan & Samsudin, 2017). Since this study has focused on daily services of UPs within walking distance, two distances were applied, a 400m (5-min walking distance) and 800m (10-min walking distance). The former is a comfortable distance while the latter is a little bit long, but still acceptable for most adult people.

Different proximity measurement techniques are used in ArcGIS in determining neighborhoods with good park accessibility (Nicholls, 2001; La Rosa, 2014). In this study GIS based Network distance rather than Euclidian distance was used to calculate the service area of UPs, since it has been shown that the former is more accurate (Nicholls, 2001; La Rosa, 2014). Many studies also choose GIS based network analysis method, because it has an advantage over Euclidian distance as it reflects the actual travel and consider all the barriers that make routes inaccessible by park users (La Rosa, 2014). For comparison and visualizing the difference, the study produced the maps of park service area by using both techniques (Fig 4.3 & Fig 4.4).

The accessibility or proximity analysis begins with an evaluation of the general park service coverage on a citywide and sub-city level using GIS. Then, the study estimated the population with potential urban park access at the city and sub-city levels. As mentioned above, ArcGIS based

Network Analyst‘s Service Area Analysis tool was used to create a 400m and 800m walking distance service area (polygon) that defines the spatial extent of each park access. An additional setting under the “multiple facilities option” was also used to make each polygon discrete, not allowing the polygons to coincide. These separate non-overlapping polygons are used to represent the service area for each park. Then, the created service areas of parks and point data of the city population were overlaid on top of each other to calculate park service area, and total number of population lying inside and outside each service area. Thus, individuals located within a service area were assumed to have better access and easily use that particular park daily than people a bit farther away from a park (Sister et al. 2007). A high service population ratio means that inhabitants of residential areas could benefit more, and a high service area ratio means greater accessibility of UPs for inhabitants in residential areas.

The accessibility was calculated based on the following equations: first the ratio of the service area of UPs within 400m and 800m walking distance was determined by equation 5. As this ratio applied the population of neighborhood parks, the ‘total impact area population’ was calculated by equation 6.

$$SAR = \frac{PSA}{TA - PA} \times 100\% \quad (5)$$

Where; SAR is a service area ratio, PSA is a service area of parks, TA-is the total area of the city and PA is parks area.

$$AI = \frac{NA}{NT} \times 100\% \quad (6)$$

Where; AI is accessibility indicator, which measures the proportion of the urban population that lives within the service area of UPs. NA is the number of urban inhabitants who live within the

400m or 800m walking distance to an urban park. NT is the total number of urban inhabitants within the city.

Park facility audit: One of the parameter used to assess park quality is the availability of facilities in the parks. Thus, the amount of available facilities in the parks were investigated through park audit. The Park audit was conducted in 15 parks, which were selected purposefully from each sub-city. Some parks were under maintenance, some were closed and some parks were very small to consider in the assessment. Thus, the study exclude such kind of parks during park facility audit. Active parks which were serving the city population and above 2 hectare were included in the assessment. The distribution of the sampled parks were indicated in table 3.2.

Table 3.2 List of urban parks selected for facility audit

Name of the park	**Sub city of the park location**	**Total Area in meter square**
Hamle 19 Park	Gullelle	67,968
Yekorea zemachoch/memorial park	Gullelle	30,209
Sheger Park	Gullelle	54,000
Anbesa Gibi Park	Arada	12,000
Ferencay Park	Yeka	48,575
Yeka Park	Yeka	22,000
Golla Mikael Park	Lideta	9,625
Ethio-Cuba Friendship Park	Lideta	29,803
Teklehaymanot Park	Lideta	4,371
Ambasader Park	Arada	9,393
Africa Park	Kirkos	45,702
Akaki Park	AkakiKaliti	62,518
Bihere-tsigie Park	Nifas Silk Lafto	140,000
Kolfe menafesha	KolfeKeraniyo	20,000
Maekelawi (peacock)Park	Bole	43,769

The availability of 15 facilities were investigated in each selected parks. The facilities include physical exercise facilities for adults or youth (fitness center/gym, valley ball, sport field.. etc.), playing facilities for children, walking ways, parking area, bicycling ways, diversity of green plants, seats, sheds, toilet, sign spots, lights in the park, garbage bin, small cafeteria, small retail shops, and water feature (swimming pool, pond, stream or fountains). These facilities were adapted from the review of literature and other international surveys on recreational spaces (Nielsen & Hansen, 2007; Akpinar, 2016). The data was collected by three trained field workers and they rated the 'presence' or 'absence' of the aforementioned park features.

3.5. Level of urban park utilization and access in the city

Apart from looking at the spatial perspectives of UGI in general and UPs access in particular, this study also addressed the social perspectives of UPs access in the study area. Studies indicated that investigating the community perception of UPs access through surveys revealed a wide range of influencing factors, including the quality of UPs (Zhang et al. 2015), adequacy of facilities in the parks (Sugiyama & Ward Thompson, 2008), proximate of UPs (Cohen et al. 2007), safety concerns (Jansson et al. 2013), and maintenance and management(Tzoulas & James, 2010). Moreover, community surveys showed that demographic factors (Sanesi & Chiarello, 2006; Wende et al., 2012) and the socioeconomic backgrounds of users (Jim & Shan, 2013; Schipperijn et al. 2010) had a strong influence on the access to UPs. An in-depth understanding of all these variables that encourage or discourage urban dwellers to access UGI through social survey is crucial for planning and managing green spaces. Thus, this study also conducted a social survey (household and park users' survey) in purposively selected UPs of the city to address how much UPs of the city is accessible and properly serving the city residents.

3.5.1. Sample surveyed parks

To have better understanding of the existing condition of UPs in terms of their access, the case study approach was adopted (Rowley, 2002; Hancock & Algozzine, 2006). The case study approach was used to produce more reliable and robust research by collecting more data from multiple cases (Yin, 2003; Hancock & Algozzine, 2006; Zaidah, 2007; Adjei, 2014).

According to the field survey, the city has 29 small to large parks, which cover an area of 1,210,852m^2 (Fig 3.8). From these parks the case study was conducted in purposefully selected three parks (Fig 3.8). These were (a) Central Park, (b) Hamle 19 Park, and (c) Biher-tsige Park (Fig 3.9).

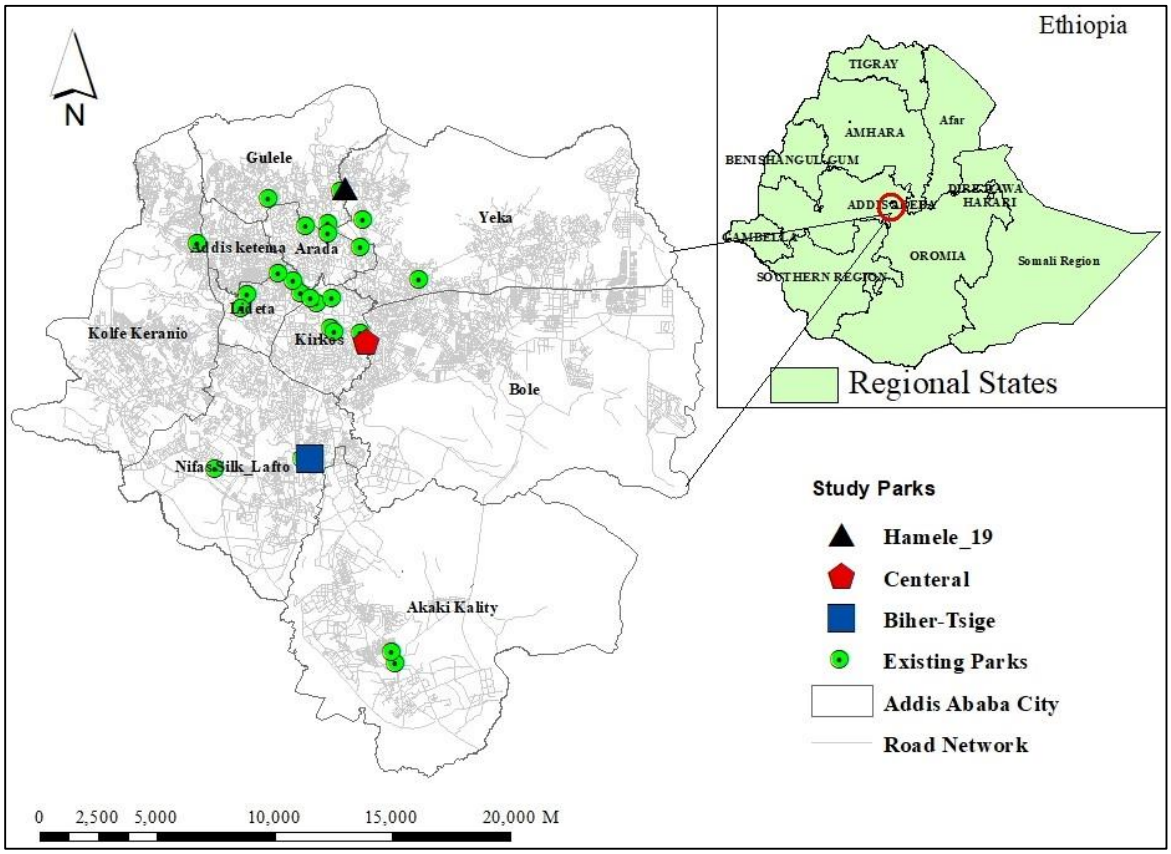
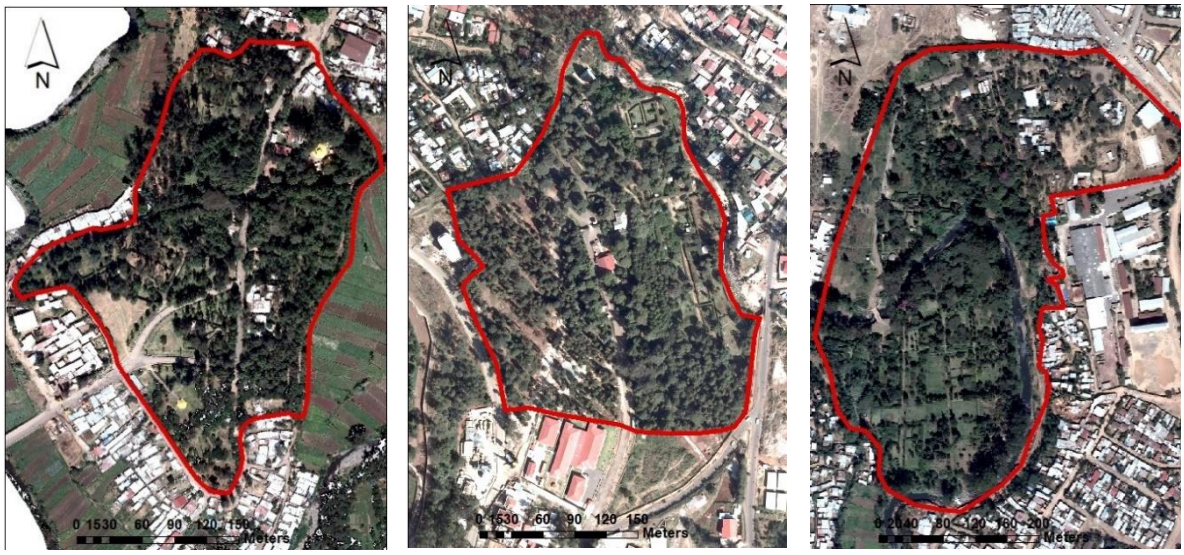


Fig 3.8 Map of study parks

The selection of these parks was made through the discussion with managers and officials of AABPCDAA and based on different criterion. The criteria used to select the parks, include park

size, location, type of accessibility through the road network, availability of neighborhood surrounding the parks, and available facilities in the parks. Bihere-Tsige Park is located in Nifas Silek sub-city on the way to Bishoftu town, opposite to St. Joseph church around Red Cross office. The area of the park is around 140,000m^2 and it is the largest park in the city. Hamle 19 Park is located in Gulele sub-city on the way to Entoto Mountain behind the USA Embassy. It covers an area of 67,968m^2. Central park is also called Peacock Park. It is located in Bole sub-city in front of Bole printing press, one kilometer away to the left side of the main road. Its area is 43,769m^2. All the three parks have an entry fee, and they remain open all day from morning to sunset.



a) Central park b) Hamle 19 park c) Biher-tsige park

Fig 3.9 Aerial photographs of sample parks

3.5.2. Urban park users' survey

On-site respondent completed surveys are one of the most appropriate and commonly used methods for studying the situation of UPs (Veal, 2011). This method can provide data about the community perception regarding recreational facilities, and amenities of parks (Veal, 2011). The current study used this method to collect data about park users and park use pattern. The survey

was conducted between 20th of January and 30th of February, 2019. These months are selected because they are the peak months of the year in which a large number of visitors visit UPs compared to other months of the year.

Due to the non-availability of visitor record, it was not possible to apply a statistical sampling technique to draw a true probability sample for the study. However, based on a simple random sample, one out of every three visitors over 16 years old age were selected as sample respondents on the main entrance of the park. Trained investigators approached and asked if the selected respondents were willing to participate in a brief questionnaire on park use. After the introduction of the purpose of survey and obtaining respondents' consent, participants were provided with a self-completion questionnaire. It took fifteen to twenty minutes for the visitors to answer the questionnaire. The overall target was approximately 200 respondents across the three parks and the survey was conducted until the desired number of respondents was reached. Although this target is not derived from a statistical estimate of sample size, it was found that the responses did not vary appreciably after this point. This gave us confidence that the responses we received were representative of the majority of the visitors to the park. Other studies have used a similar or lesser number of respondents to investigate park user's perceptions and have drawn inferences from them (Tucker et al. 2007).

The survey was conducted on both weekdays and weekends in the mornings between 9:30 a.m. to 11a.m. and in the evenings from 3p.m. to 5p.m. to understand the views of morning and evening users. To conduct the survey, eight visits were made to Central and Hamle 19 Parks each and ten visits to Bihere-Tsige Park. The questionnaires were prepared in two languages, namely English (academic and international language) and Amharic (widely used local language) languages. However, the survey was conducted in Amharic by two-trained investigators. In total, 200

questionnaires were distributed to the respondents: Central Park (n =65), Hamle 19 Park (n=65) and Bihere-Tsige Park (n=70). Out of the 200 respondents 94.5% (189) completed in full and returned the questionnaire. Eleven invalid questionnaires were excluded from the final analysis, as they were incomplete or invalid to be considered.

3.5.3. Household survey

In addition to park users' survey, household survey was also conducted to gain information about personal constraints of UPs usage. The households is defined as people who do not access or use the parks nearer to their residents. Thus, the survey was conducted in the neighborhoods located within the 400m service area of the sampled parks mentioned in section 3.5.1. The 400m distance was used, because people of all age can easily walk to and access recreational areas nearer to their home (Nicholls, 2001; Tan & Samsudin, 2017). The 400m service area boundary of the parks was first delineated in ArcGIS based on the Arial photograph and Google map. Based on this information, the number of the neighborhood that falls within the service area was identified on the ground, and then, the household survey was performed.

During the survey, the households who were identified as park users were excluded from the study. In total 210 households were identified as non-users from 316 visited households within the 400m radius of the parks. The distribution of non-park users surrounding the three parks were: Central Park (n =38), Hamle 19 Park (n=70) and Bihere-Tsige Park (n=102). The variation in household size surrounding the three parks were due to the size of the park, the availability of natural feature (like river, unsuitable land for settlement), and institutions surrounding the park. The household survey was conducted at the same period with park user's survey (between 20th of January and 30th of February, 2019) by three-trained investigators. Each household survey lasted between ten to twenty five minutes. The surveys were standardized and the collected data was socioeconomic

and demographics characteristics, sub-city of the residents, whether they visit urban park or not, and reason for not visiting the park. Data on the 'reason for not visiting the park near to their home' was tallied for each parks and amassed as a whole.

3.5.4. Survey questionnaire and measurement

The survey questions were adapted from the review of literature on recreational spaces (Nielsen & Hansen, 2007; Akpinar, 2016). The questionnaire was initially tested with a small group of park visitors prior to administering it to the survey participants. This helped us in further refining the questionnaire so that it ensured that the participants understood the questions uniformly and they were able to provide appropriate information. The survey questionnaire consisted four sections (Appendix 1). The first section of the survey was about socio-demographic characteristics of the respondents such as gender, age, income, occupation, education and marital status. The age classification was based on the age thresholds used in census by the Ethiopian central statistical agency. The second section was about the frequency of park visits, awareness about available UPs (Table 3.3), and participants' motivations for and personal constraints to park visitation (Appendix 1). The third section was about the physical factors such as distance, time travelled from home to parks and mode of travel used by the respondents (Table 3.3 & Appendix 1).

The fourth section of the questioner was about park quality and related challenges (Appendix 1). Studies revealed that there are four major factors most commonly used in assessing the quality of recreational parks; including number of available facilities & amenities, level of maintenance, cleanness, and perceived safety (Taylor et al. 2011; Dobbs et al. 2014). This study used these parameters to measure the quality of available UPs. Data on the number of available facilities & amenities was collected through park audit (Section 3.4). Whereas, data on the level of maintenance, cleanness, and perceived safety of the parks was collected from park users (Appendix

1). Thus, in this sections, respondents asked to rate the condition of park facilities such as its maintenance, cleanness and safety based on likert-scaled questions. The park maintenance, cleanliness and safety/security of the parks were rated as 1= Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree and 5=Strongly Agree. Park maintenance was defined as the general state and functionality of the park facilities and amenities.

Table 3.3 Survey questions and their attribute

Variables	**Survey questions**	**Type of response**
Frequency of park visit	How often have you visited urban parks in a month?	Open and categorical (more days per week/ weekly/ monthly/occasionally)
Distance	How far is this park from your home?	<400m/401m-800m/8001-1km/ 1km-4km/>4km
Traveled Time	How much minutes/hr. does it takes to walk from your home to this park?	Open
Mode of transport	What mode of transport you use to travel to this park from your home?	Walking/ bicycle/ Public transport/ Private car
Awareness about available parks	How do you rate your level of awareness about the available parks and their programs?	5 point Likert scale-Very good/ Good/Average/Poor/ No awareness

The final question was open-ended question which was about the opinion and feedback of park users either on the subjects covered by the questionnaire or on other possible issues related to the provision of facilities, planning and design, and management of UPs.

3.5.5. Method of data analysis

The study employed descriptive statistics, cross-tabulation, chi-square test, and multiple linear regression using IBM SPSS 20. Descriptive statistics such as frequencies and percentages were used to summarize the socioeconomic and demographic characteristics of the park users, motivations to and personal constraints for park visit. Cross-tabulation and Chi-square test (X^2) were applied to assess the association of socioeconomic and demographic characteristics, physical and park quality factors (park maintenance, safety, and cleanliness) with frequency of visit to the parks. The results were then tested for significance at less than 5% (0.05) level (95 percent confidence level). The results were quantitatively displayed by using tables and graphs.

The multiple linear regression analyses were performed to examine the influence of socio-demographic characteristics and other independent variables on the frequency of park visit. This method was used because it examines the relationship between a single outcome measure and several predictors or independent variables. It uses a number of predictors to look at their level of influence on a dependent variable. Number of park visit per month was treated as an outcome (dependent) variable while different park visit variables' were treated as independent variables. Before performing multivariate linear regression analyses, presence of multi-co-linearity issues between explanatory variables was checked. First, the data were plotted to check for a linear relationship and any outliers. Then, the variance inflation factor checked to detect the multi-co-linearity issues, and the result showed that there were no multi-co-linearity issues between the independent variables.

The implicit form of the regression equation is-

$$\hat{Y}i = \hat{\beta}0 + \hat{\beta}1X1 + \hat{\beta}2X2 + \hat{\beta}3X3 + \hat{\beta}4X4 + \hat{\beta}5X5 + \hat{\beta}6X6 + ... + \hat{\beta}9X10 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 7$$

Where: $\hat{Y}i$ = Number of park visit per month, $\hat{\beta}i$ = Parameter, X1=Age of respondent, X2=Education of the respondent, X3=Gender of the respondent, X4=Monthly income, X5=Marital status, X6=Occupation, X7=Knowledge of existing parks, X8=Distance to the Park, X9=Time to the park, X10=Mode of transport

3.6. Analyzing constraints or challenges behind the current state of urban green infrastructure

The challenges or constraints of UGI in general and UPs in particular are analyzed based on the data collected through different techniques. The constraints are initially derived from the result of the spatial and perceived accessibility analysis and then, supported by the review of policy and organizational framework, analyses of other secondary materials, personal observations, and interviews with different key government officials.

Key informant Interviews: Key informant interview was conducted with government officials and experts responsible for UGI planning and management. Ten key informants were selected from four governmental institutions of the city such as Addis Ababa City Environmental Protection and Green Development (AAEPGDC), Addis Ababa City Beautification, Parks and Cemetery Development and Administration Agency (AABPCDAA), Addis Ababa City Urban Planning Institute, and Addis Ababa City Farmers and Urban Agriculture Development Commission (AAFUADC). These government institutions were selected because they are responsible for planning and managing components of UGI. For instance, AAEPGDC is responsible for riverside green and urban forest development, AABPCDAA mange UPs and other recreational areas, Urban

Planning Institute is responsible for planning and land use development of the city and ...etc. The ten informants were also selected from these institutions based on their educational background and expertise about UGI practice in the city.

The interviews were open ended and conducted on a face to face basis and through phone calls. A total of 10 interviews was conducted with each interviewee (Appendix 2). The interview questions were prepared and conducted in Amharic language and then translated to English language. The interviews lasted between 30 minutes to one and half hour. Key informants were asked for general information on the availability of UGI policies or legislation and their level of enforcement, actors involved in UGI planning and management such as government organization and the community, constraints of UGI, and strategic solutions (Appendix 2). These interviews were conducted to gain in-depth information from the experts who have knowledge about UGI practice in the city.

Field observation: On-site personal observation was also conducted for two purpose. The first purpose was to see the current states of UGI in the city (river and riverside green and UPs), and the second reason was to crosscheck the proposed UGI in the structural plan of 2003 and the implementation of those proposed UGI on the ground. Digital photographs were also taken during the field observation sessions as exhibits to give the exact condition of UGI in the study area.

Document review: A review of policy and organizational framework of the city was undertaken to identify challenges and constraints of UGI. Related policy documents available at national and municipal level were investigated and examined. This includes policy documents, regulations, guidelines, city development strategies, different period's master plans of the city including the 2003 and 2016 structural plans, local development plans, reports, and archival records. Other secondary materials that were drawn from a wide range of academic publications, and international

policy documents of UGI and recreational parks were also used. Academic publications include journal articles and other written materials available in the internet.

3.7. Developing the planning and management strategies

To address the final objective of the study, which is to develop the planning and management strategies for UGI in Addis Ababa city, the study used different data source. The developed strategies were based on the result of the study and constraints identified through the analysis of the study. Moreover, the key informant interview (expert interview) mentioned in section 3.6 and expert advice from professionals of UGI were also employed. For instance, as indicated in appendix 2 experts were asked open ended questions about their opinions on "How the city administration should solve the constraints of UGI in the city? They also asked to mention the solutions from policy, planning, and management perspectives. Moreover, different countries experiences (e.g. the experience of Hannover city, Germany), policies and strategies were examined and included in the strategy. The strategies also came out through the analysis of national and municipal policy documents, regulations, guidelines, strategies, structural plans, and urban planning evaluation reports. Moreover, the strategies also developed on the basis of consultation with key stakeholders such as residents of the city and park users. The consultation with the key stakeholders was conducted during park users and household survey.

3.8. Conclusion

This chapter of the research presents methods and materials used for gathering and analyzing data in order to achieve the research objectives of the study. The chapter began with the description of the study area followed by the illustration of the research framework. The other sections of the chapter give a detailed account of what was done during the study, how the population was chosen,

sampling methods that were used, the manner in which data was gathered and managed up, and the analytical techniques used to address each research objective.

In general, the study used a mixed research approach in data collection and analysis. Both quantitative and qualitative approaches were utilized. A variety of socio-spatial data were collected from different sources and analyzed by using various quantitative and qualitative analytical techniques. First, the study mapped and calculated the status of UGI from 2003 to 2016 based on the land use data of the city in ArcGIS. Then, the study analyzed the spatial accessibility of UGI such as recreational parks based on proximity, per capita green indicators and park quality parameters by using the land use maps, road network, gridded population data, and park audit data. The study also addressed the social perspectives of urban parks (UPs) access based on park users and household survey. The study employed structured questionnaire to collect data from 399 sample park visitors (189) and households (210) surrounding the parks. Besides, the descriptive statistics, cross-tabulation, chi-square test and multivariate regression were used to analyze the association between the variables. Finally, the study used a qualitative analysis technique to examine the constraints behind the current states of UGI. Qualitative technique was also used to examine the policy and organizational framework of UGI, and to identify the gaps.

4. Status of Urban Green Infrastructure in Addis Ababa

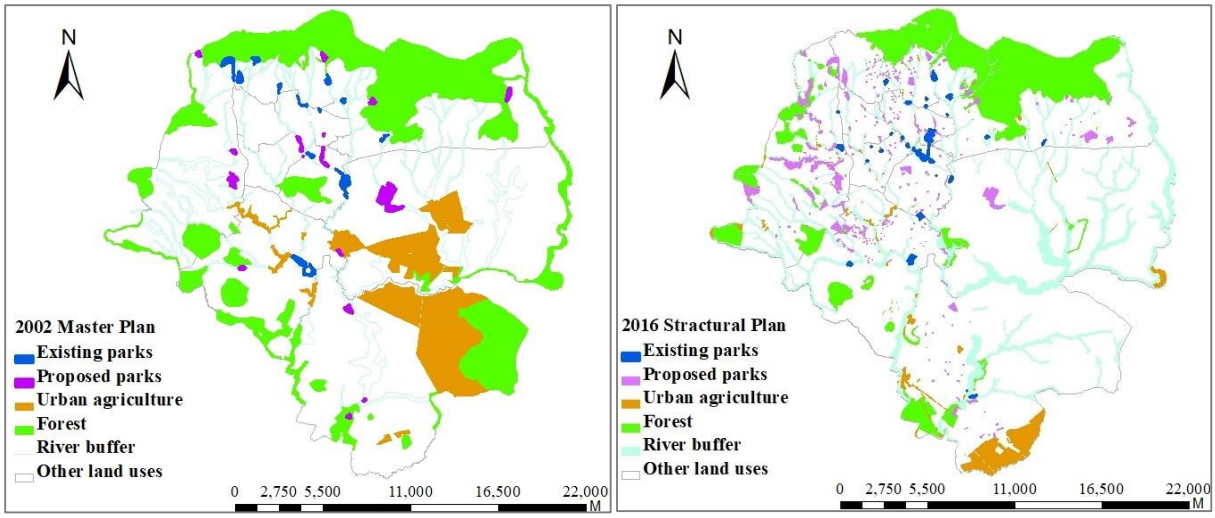
As indicated in the methodology part, UGI in Addis Ababa city context is classified into four major categories including urban forest, river and riverside green, urban agriculture and UPs. To have a general overview and understanding about the status of these components, this part of the study presented the result of the land use land cover and land use change of UGI components between the year 2003 and 2016. In addition, this part of the study also presented the status of available UPs in the study area from the spatial accessibility point of view by using park per capita and proximity indicators as well as park quality parameter such as the availability of park facilities. Level of deficit in urban park service area also present in this section. The final section of the chapter presented the discussions of each findings.

4.1. Results

4.1.1. Status and trend of urban green infrastructure in Addis Ababa

4.1.1.1. Land use land cover of urban green infrastructure in 2003 & 2016

The analyzed land use land cover change of UGI components between the year 2003 and 2016 was presented in Fig 4.1 & Table 4.1. Accordingly, in 2003, the land use of UGI covered 20,956ha (40.3%) of the city area. This has, however reduced to 16262.8ha in 2016 representing 31.1% of the total land uses of the city. When we look at the land use share of each component of UGI, in 2003 urban forest (23.4%) has the highest coverage and followed by urban agriculture (13.8%). However, UPs that serve for recreational function have the least coverage than other components of UGI. Again in 2016, the land use of urban forest has the highest coverage and followed by river buffer land use. Even though good emphasis was given for UPs during the 2016 structural plan, still the land use of UPs in relation to other components of UGI is very small (1.8%).



Source: Produced by the author from the structural plan of 2002 and 2016 and field survey

Fig 4.1 Land uses maps of UGI of Addis Ababa city in the year 2003 and 2016

When we look at the land use of urban forest, it was 12168ha which covers 23.4% of the city area in the year 2003 (Table 4.1). It has, however decreased to 10301.5ha in the year 2016 and this covers 19.7% of the city area (Table 4.1). This coverage includes the forest covered and proposed forest area. Currently, forest covered area in Addis Ababa is mostly found in the north and northeast part of the city. Some forest patches are also found in the northwest and southwest part of the city. However, other forest land of the city converted to built-up area and other land uses. For instance, the reserved land for woodland forest in Akaki Kality and forest patches in Nifasilik sub cities were converted to built-up area (Fig 4.1).

The situation of urban agriculture in the city is quite alarming. In 2003 agricultural land use of the city covers 7176ha and this represents 13.8% of the city area (Table 4.1). The major agriculture sites during this period were Koye, Wedesso, Idoro, Fetche, Akaki, Beseka, Abebora, Dongora, Harbu, Jemo, Bulbula, Bole weregenu, Dire-migra, mekanissa and Lafto. However, the amount of agricultural land use was very much decreased (996.1ha) in the year 2016. Most of the

aforementioned agricultural sites were converted to other land uses such as condominium and real state housing sites, and industrial development area.

Table 4.1 Land use land cover of urban green infrastructure in 2003 and 2016

Urban green infrastructure & built-up area	**2003**		**2016**		**Percentage of change**
	Area/ha	LUP (%)	Area/ha	LUP (%)	
Green Infrastructure					
Urban forest	12168	23.4	10,301.5	19.7	-15.3
River and river buffer	1144	2.2	4026.5	7.7	+251
Urban agricultural	7176	13.8	996.1	1.9	-86.1
Urban parks	469.4	0.9	938.7	1.8	+100.6
Total	**20956**	**40.3**	**16262.8**	**31.1**	**-22.4**
Built Up Area	31044	59.7	36029.2	68.9	+16
Total Area	**52000**	**100**	**52292**	**100**	

Source: Author own calculation based on ORAMP, Note: LUP-land use percentage

Regarding river and riverside green, the city has 7 major and 6 medium rivers which are fed by 75 small streams (Fig 4.2). These rivers and streams are mostly seasonal and start from north, northwest and northeast, and flow towards the southern part of the city and ended at Lake Aba Samuel. The major rivers of the city are Kebena, Ketchene, Little Akake, Kurtame, Bantiyketu, West Akaki and East Akaki (Fig 4.2). In 2003, the proposed area of river and riverside green was about 1144ha (2.2% of the city area) and this was increased to 4026.5ha (7.7 %) in 2016 proposal (Table 4.1). However, based on field observation and interview with experts the proposed riverside green development during 2003 was not implemented. Most of the proposed riverside buffer strips are highly abused and occupied by squatters and informal settlers (Fig 4.3).

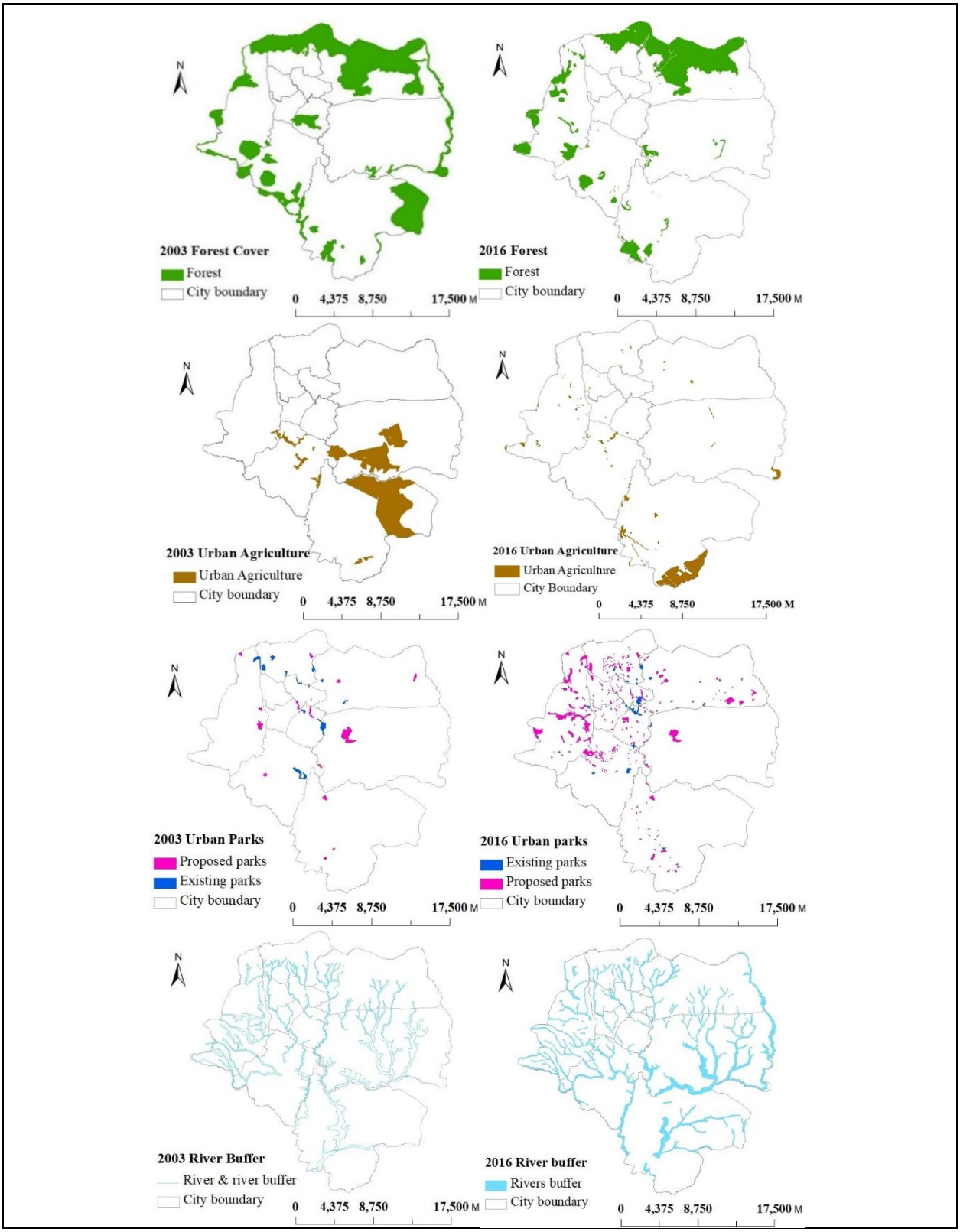


Fig 4.2 Distribution of the land use of UGI components for the year 2003 and 2016

Moreover, the observed rivers and streams are increasingly choking with uncollected garbage and solid waste from households, and industrial waste in the form of liquid effluence, agro-chemicals, petrochemicals and metals (Fig 4.3).

Informal settlements along the rivers of the city

Contaminated rivers and disposed solid wastes in the rivers

Fig 4.3 Contaminated rivers and informal settlement along the City Rivers

In addition, in 2003 the city had 469.4ha of UPs land use. From this 190.2ha was existing UPs and 279.2ha was proposed UPs (Table 4.2). However, almost all proposed UPs during 2003 have not been realized and implemented. In 2016 the city was again allocated 825ha of additional land for UPs development (Table 4.2). Nefas Silk, Gullele and Kolfe Keraniyo sub-cities have allocated

the highest number of plots of land for UPs respectively and Bole sub-city allocated small number of plots of land.

Table 4.2 Proposed and existing urban parks in 2003 and 2016

Sub-city	Existing UPs in 2003	Proposed UPs in 2003	Implemented UPs in 2012	Proposed UPs in 2016	Existing UPs in 2020
Akaki Kality	-	3(22.9)	1(5.5)	35(45)	2(5.9)
Nefas Silk Lafto	1(46.4)	1(8.4)	-	163(79)	3(26.4)
Kolfe Keraniyo	1(31.1)	3(50.7)	1(0.7)	66(361)	2(7.4)
Gulelle	4(45.1)	1(10.6)	-	105(65)	4(18.2)
Lideta	2(1.4)	2(10.8)	-	17(19)	6(6.5)
Kirkos	1(6)	2(14.5)	-	31(68)	4(27.8)
Arada	2(5.3)	1(0.8)	-	31(24)	3(30.6)
Addis Ketema	-	-	-	15(24)	-
Yeka	2(10.2)	2(26.9)	-	30(98)	4(9.4)
Bole	1(44.7)	1(133.6)	-	4(43)	1(36.4)
City Total	**14(190.2)**	**16(279.2)**	**2(6.2)**	**504(825)**	**29(168.7)**

Note: 12 (188.8)-12 indicate the number of UPs, and 188.8 indicate the size of UPs in hectare.

Until this research is undertaken, the city has 29 existing UPs with a total area of 168.7ha (Table 4.2). Even though, the number of additional UPs are developed recently, the total area of existing UPs is decreased by 20.1ha from 2003 total area of existing UPs. This is due to the conversion of parts of some parks to other land uses. Out of ten sub-cities, Addis ketema has no existing UPs and Lideta sub-city has better number of UPs than other sub-cities (Fig 4.2).

When the distribution of the land use of parks in terms of park typology or hierarchy was evaluated, among 29 existing parks the dominant type is sub-city parks (62.5%) followed by neighborhood parks (16.7%), woreda parks (12.5%) and city parks (8.3%). From the 2016 proposed parks, neighborhood park typology is the dominant one (59.2%) followed by woreda parks (22.5%), sub-city parks (14.3%), and the city parks. This indicate that all types of parks were not evenly distributed within the city of Addis Ababa (Fig 4.4).

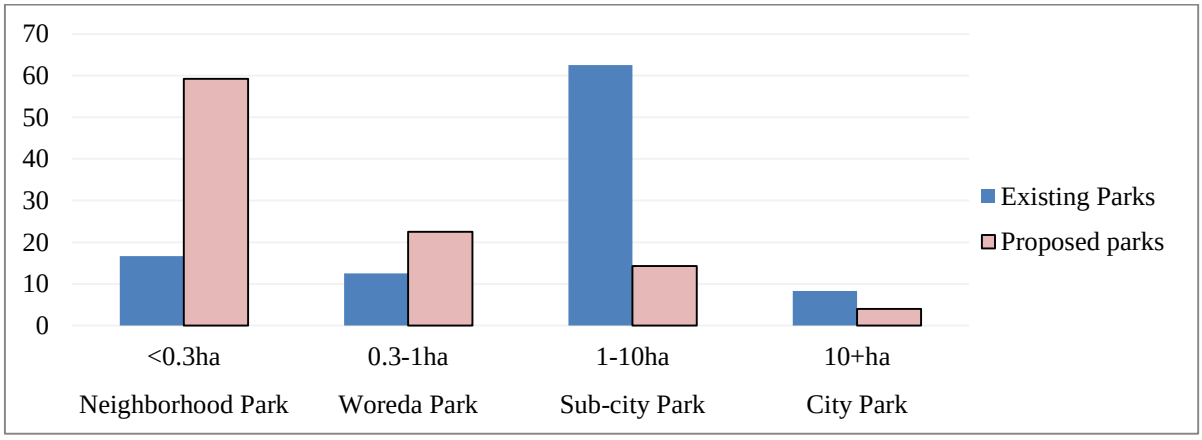


Fig 4.4 The distribution of existing and proposed park typology

4.1.1.2. Land use land cover change of urban green infrastructure between 2003 & 2016

When we look at the change in land use of UGI components between the year 2003 and 2016, about 4,693.2ha (22.4%) of UGI had been decreased or converted to other land uses. On the other hand, the proportion of built-up area has increased by 4985.2ha (16%). The land use of urban agriculture is very much decreased (by 86.1%) and followed by urban forest which was decreased by 15.3% (Table 4.1). Many of the converted urban forest land use were undeveloped or proposed lands. However, the land use of UPs and proposed river buffer green were increased by 100.6% and 252% respectively. This is because the city was allocated more additional lands for UPs and river buffer green during the revision of 2016 structural plan of the city. Fig 4.2 is also clearly indicates the variation in land use of UGI components between the year 2003 and 2016.

4.1.2. Spatial accessibility of urban parks

4.1.2.1. Per capita of existing urban parks

When the per-capita of existing UPs is evaluated, the overall city average is 0.37m^2 and it ranges from 0 to 0.86m^2 at sub-city level (Table 4.3). Among the sub-cities, Arada and Kirikos have relatively the highest ratio, while the other sub-cities have the lowest park per person ratio.

Table 4.3 Currently existing urban parks coverage and per-capita in Addis Ababa

Sub-city	Area of Sub city (m^2)	Total Population	Population density/km^2	Area of UPs (m^2)	UPs LU (%)	UPs Per-capita (m^2)
Akaki Kality	123455172	303842	2461	58845	0.05	0.2
Nefas Silk Lafto	62078558	530150	8540	264438	0.4	0.5
Kolfe Keraniyo	63492540	718908	11323	74297	0.12	0.10
Gulelle	31193194	448588	14381	182297	0.6	0.41
Lideta	9177843	338109	36840	65252	0.7	0.19
Kirkos	14645876	370830	25320	278315	1.9	0.75
Arada	9499376	354515	37320	306405	3.2	0.86
Addis Ketema	8638853	428051	49550	-	-	-
Yeka	86130129	581074	6746	93942	0.1	0.16
Bole	118472112	517933	4372	364000	0.3	0.7
Total	526783653	4592000	8717	1687791	0.32	0.37

Note: LU- land use

The densest sub-cities such as Lideta (36840 individuals per km^2) and Addis ketema (49550 individuals per km^2) have a very small park per-capita in relation to other sub-cities. The

percentage of UPs to the total area of the city was 0.32% and ranges from 3.2% to 0.05% in sub-cities (Table 4.3).

4.1.2.2. Proximate of urban parks to the city population

The proximate or the service area maps of the parks that were produced by road network and simple buffer analysis technique are indicated in fig 4.5 and fig 4.6. As we can see from the two figures the two maps are different in terms of their service area coverage.

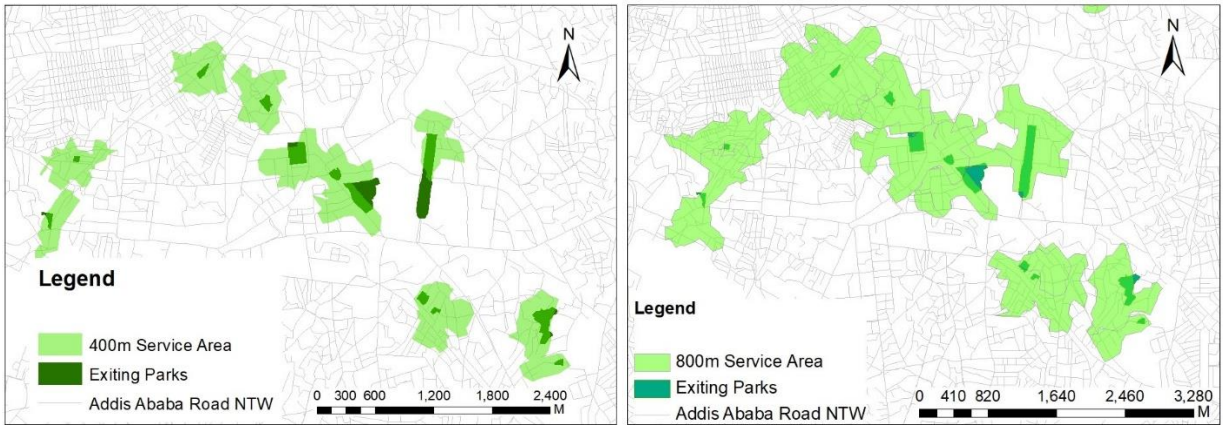


Fig 4.5 Service area of urban parks by road network analysis

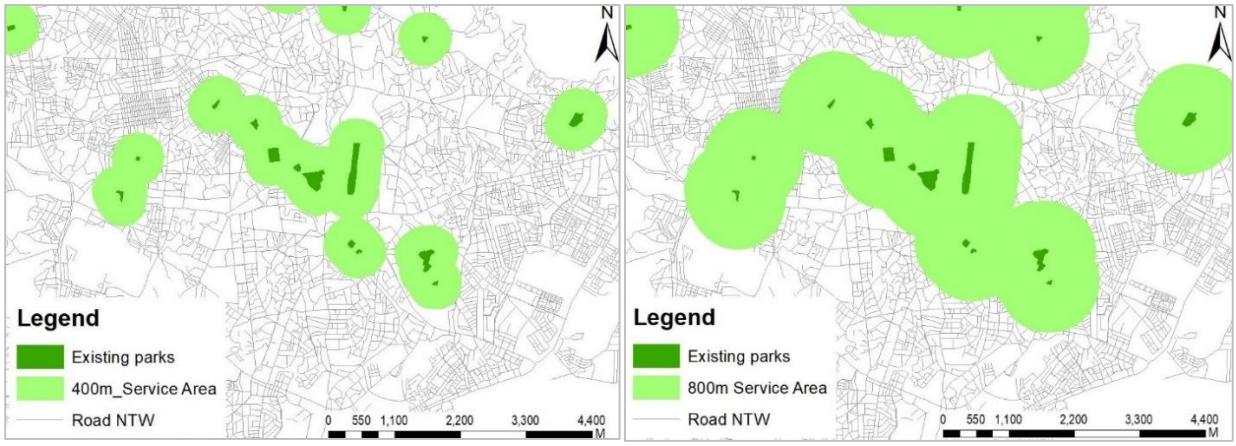


Fig 4.6 Service areas of urban parks by simple buffer

Table 4.4 shows the result of road network based total park service area and the number of city residences that can access parks within the service area. The results showed that the service area

within 400m covered 3234458m^2 (0.6%), while the service area within 800m covers 15881803m^2 (3.0%) of the residential area of Addis Ababa city. In addition, more than 126383 and 520957 population of the city resident are live within 3234458m^2 and 15881803m^2 service area of UPs respectively. This mean 2.8% of the city dwellers has access to UPs within 400m walking distance and 11.3% of the city dwellers can access UPs within 800m walking distance. This indicated the mismatch in available UPs service area with the city population and the improper spatial distribution of the parks with respect to built-up land use.

When the percentage of park service coverage for each sub-city is evaluated, only 3 sub-cities (Lideta, Kirkos, and Arada), which represent 6.4% of the city area have more than 3% of their area fall within the 400m distance and more than 16% of their area fall within 800m walking distance. Lideta has relatively the highest park service area in both distance thresholds followed by Arada sub-city (Table 4.4). The three outlying large sub-cities such as Bole, Akaki Kality, and Nefas Silk Lafto have the lowest park service area and the highest demand of UPs respectively.

When the number of each sub-city population within park service areas is analyzed, Lideta (20.4%) and Kirkos (4.6%) have relatively the highest served population, whereas the three big sub-cities Akaki Kality (0.4%), Nifas Silek (0.4%), Addis Ketema (0.4%) and Bole (0.2%) have the smallest number of served population within the 400m distance. Again, Lideta (66.5%), Kirikos (19.3%) and Arada (15.9%) sub-cities have relatively the highest number of population that have access to UPs within 800m walking distance. Other sub-cities have the small number of population that fall within the service area of 800m walking distance. Overall, the proximity of UPs to the city residents within the walking distances of 400m and 800m is inadequate and the majority of the city residents are forced to walk more distances to use UPs.

Table 4.4 The proximity of urban parks in Addis Ababa

Sub-City	400m Distance			800m Distance		
	Service Area (m^2)	Served Pop.	SA per Pop.(m^2)	Service Area (m^2)	Served Pop.	SA per Pop.(m^2)
Akaki Kality	204569(0.2)	1098(0.4)	186.3	886737(0.8)	4643(1.5)	190.9
Nefas Silk	181614(0.3)	2023(0.4)	89.8	1353737(1.9)	13627(2.6)	99.3
Kolfe Keraniyo	222503(0.4)	6819(0.9)	32.6	891915(1.5)	25126(3.5)	35.5
Gulelle	242988(0.8)	6007(1.3)	40.4	1387861(4.6)	36291(8.1)	38.2
Lideta	851670(9.3)	68965(20.4)	12.3	3110300(33.8)	224717(66.5)	13.8
Kirkos	685111(4.7)	17064(4.6)	40.1	3025964(20.6)	71538(19.3)	42.3
Arada	291999(3.0)	10781(3.0)	27.1	1605533(16.2)	56536(15.9)	28.4
Addis Ketema	54293(0.7)	1802(0.4)	30.1	725624(9.8)	22734(5.3)	31.9
Yeka	456339(0.5)	10820(1.9)	42.2	2691543(3.1)	60234(10.4)	44.7
Bole	39986(0.03)	1004(0.2)	39.8	220054(0.2)	5513(1.1)	39.9
Total	3234458(0.6)	126383(2.8)	25.6	15881803(3.0)	520957(11.3)	30.5

Note: *(0.2) indicates percentage, Pop- refers to population*

The study also evaluated the level of park pressure in each sub-cities based on mean park service area per served population to know the congestion level at each sub-city (Table 4.4). Considerable differences in park pressure was found within a 400m walking distance, ranging from 186.3m^2 per person in Akaki Kality and 12.3m^2 per person in Lideta, which is the highest park congestion. In general, Lideta, Arada and Addis Ketma have more park pressure than other sub-cities.

4.1.2.3. Level of deficit in urban park service area

When the UPs per capita (0.37m^2) of the city and each sub-cities of Addis Ababa were computed against the Ethiopian UGIS, WHO, and African green index; the city lacks high amount of parks service area. As illustrated in Fig 4.7, the park deficit of the city was very high based on suggested standards by the Ethiopian UGIS, WHO, and average African per capita.

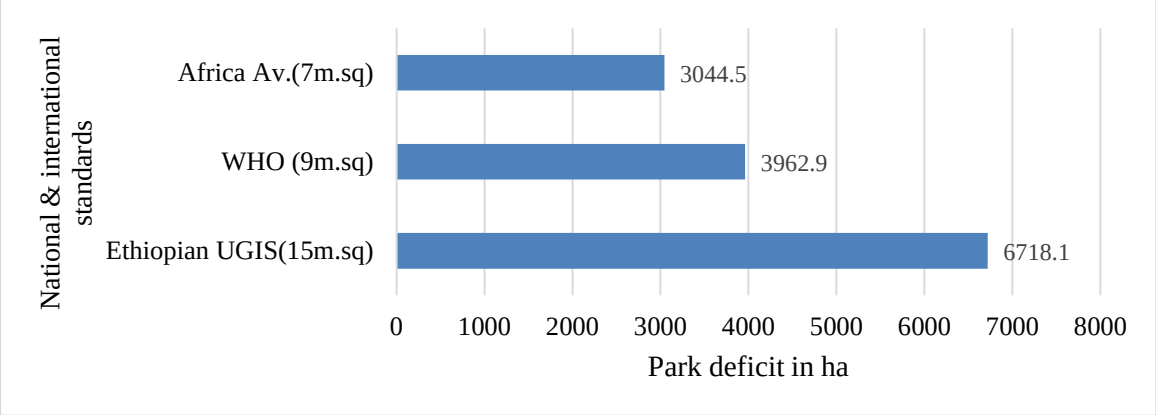


Fig 4.7 Service area gap at municipal level

Thus, the Addis Ababa city municipality has to increase the amount of urban park area by 6718.1ha, 3962.9ha, and 3044.5ha to reach the minimum standards stated by Ethiopian UGIS, WHO and average per capita green index of Africa. This reveals that Addis Ababa city has a considerable deficit in UPs service and the city needs more additional recreational parks to satisfy the current demand. Furthermore, by using the same standards and analytical technique, park service area gap at the sub-city level was analyzed (Fig 4.8). Based on the national UGIS of Ethiopia Kolfe Keraniyo (1071.2ha) needs more park area followed by Yeka (862.3ha), and Nefas Silk-Lafto (768.7ha). Whereas, Akaki Kality (449.7ha) and Arada (501.3ha) sub-cities relatively need the smallest UPs acreage amongst other sub-cities.

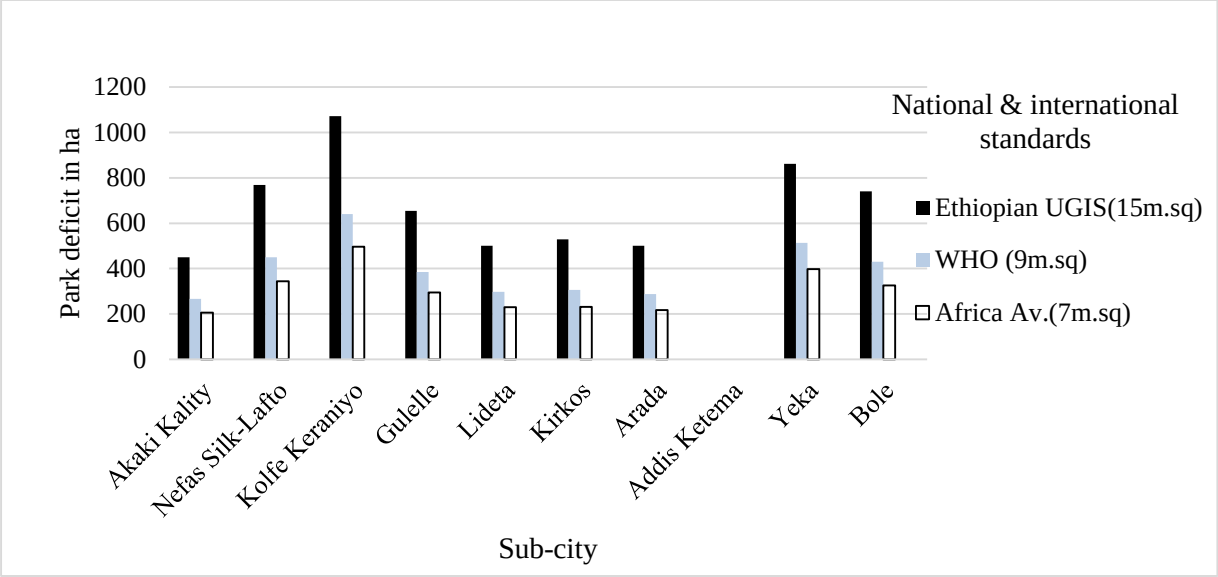


Fig 4.8 Service area gap in sub-cities level

4.1.2.4. The availability of park facilities

The availability of 15 facilities were investigated in each selected parks of the city and presented in Table 4.5. The result of park audit indicated that almost all investigated UPs have no bicycle paths, parking area (86.7%), water feature (Swimming pool or ponds, fountain) (93.3%) and physical exercise infrastructure (93.3%) such as playground, sport area, valley ball court, table tense, gym and ...etc. Walking paths are available almost in all parks (93.3%) and very few parks (40%) have a plying facilities for children. In terms of amenities, there are sheds in 11, seat in 13, toilets in 13, small retail shops in 0, small cafeteria in 8, garbage bins in 4, lights in 5, and sign spots in 5 parks. Even though some amenities such as sheds, seats, and toilets were available in most UPs of the city, they were not adequately provided in all the investigated parks.

Moreover, most investigated parks (66.7%) have diversified green plants. However, this data can not exactly shows the actual available plant species and tree diversity in the investigated parks. Thus, more inventory works are needed in the future on the amount of available tree species and

plant diversity. In addition, information has to be provided for types of tree and other plant species in the parks.

Table 4.5 Actual available facilities in the urban parks of the city

Park Facilities	**Frequency**		**Percent**	
	Existent	Absent	Existent	Absent
Physical exercise facilities for adults or youth (Gym, valley ball)	1	14	6.7	93.3
Playing facilities for children	6	9	40	60
Walking ways	14	1	93.3	6.7
Parking area	2	13	13.3	86.7
Bicycling ways	0	15	0	100
Diversity green plants	10	5	66.7	33.3
Seats	13	2	86.7	13.3
Sheds	11	4	73.3	26.7
Toilet	13	2	86.7	13.3
Sign spots	5	10	33.3	66.7
Lights in the park	4	11	26.7	73.3
Water feature (Lake, Ponds, streams, fountain)	1	14	6.7	93.3
Garbage bin	4	11	26.7	73.3
Small cafeteria	8	7	53.3	46.7
Small retail shops	0	15	0	100

4.2. Discussions

UGI provides enormous environmental, economic, and social benefits that contribute to the quality of life in the cities (Kaczynski & Henderson, 2008; Tabassum & Sharmin, 2013; Wolch et al. 2014; Jennings et al. 2016). Sufficient amount of UGI is very essential for a sustainable urban environment and better quality of life. This study also investigated the status of UGI in rapidly urbanizing city Addis Ababa. The result on the citywide analysis of the status of UGI for the last two structural plan periods (2003-2016) shows a complex picture. This finding clearly depicted that there had been a rapid decrease in the land use of UGI and at the same time increase in built up area in the city. Similar findings were reported by previous studies conducted in Addis Ababa city. For instance, Abebe and Megento (2016) found the shrinking of urban green spaces, particularly urban forest and the increasing of built-up land use during the past three decades (1986-2015).

The study also revealed a dramatic decline of urban agriculture and forest land uses in the city during the last thirteen years. This finding is consistent to the study conducted by Teferi and Abraha (2017) that pointed out built-up areas expanded dramatically in Addis Ababa, whereas UGI components such as forest and urban agriculture declined. The result of this study is also consistent with research undertaken in the United States, specifically in Los Angeles, Long Beach, and Santa Ana, where the percentage of urban green spaces decreased from 20.29 percent in 2005 to 18.20 percent in 2015 (Huang et al. 2017). However, in contrary to this findings the studies conducted in 202 European cities identified an overall increase of 0.54% of urban green spaces annually between 2000 and 2006 (Kabisch & Haase, 2013). This pattern may reflect the fact that most cities of developed countries are increasingly paying attention to develop and preserve UGI.

This was partly in agreement with observations made by Richards et al. (2017) who found that developed countries city had more urban green spaces than developing countries.

As mentioned in different part of this dissertation, UGI provides multiple benefits for urban environment (Jennings et al. 2016; Wolch et al. 2014). Provision of social service is one particular benefits of recreational parks. It offers opportunities for physical activity, social cohesion and engagement, and contribute to the community's well-being and health (Kaczynski & Henderson, 2008; Tabassum & Sharmin, 2013). In order to enjoy these opportunities, city residents or users must have reasonable access to these services. A starting point for inquiries about utilization of UGI is an assessment of their geographical or spatial accessibility (Khan & Shafqat, 2014). This study also investigated the status of existing UPs in the city from the spatial accessibility point of view by using park per capita and proximity indicators.

The result of park per capita analysis indicated that the city has no sufficient amount of accessible recreational parks that serve the city residents. As per the existing land use analysis of the city, currently areas under existing UPs is around 168.7ha for a population of more than 4.5 million, making the per capita availability of parks of the city about 0.37m^2 (Table 4.4). This is insufficient and very small as per the standard set by Ethiopian UGIS (15m^2), WHO (9m^2) and the African green index (7m^2). It is far behind the per capita of other emerging cities of Ethiopia, such as Adama (2.1m^2), Shashemene (1.9m^2), Dire Dawa (5.6m^2) and Bahir Dar (8.2m^2) cities (MoUD, 2015).

In addition, the proximity analysis also revealed that the available UPs are not easily accessible for the city residents within the minimum walking distance. The majority of the city residents are disadvantaged and forced to walk more than 400m (97.2%) and 800m (88.7%) distance to use UPs. Various studies also investigated similar findings. For instance, the study conducted by Khalil

(2014) found out that more than 70% of the population in Jeddah walk a distance of more than 500m to use UPs. Van Herzele & Wiedemann (2003) also indicated, individuals do not have the same access within the walking distance and its distribution is not even. Moreover, the proximity analysis of the study also revealed that the population in the outlying big sub-cities of Addis Ababa, such as Akaki Kality, Nifas Silek and Bole are the most disadvantaged in access to UPs. This is due to the fact that these sub-cities have very few parks that serve the community, and their population density is also lower than other sub-cities. Even though, the central sub-cities such as Lideta, Kirkos and Arada have better access to UPs, park congestion was more observed in these parts of the city. This is because these sub-cities are the most densely populated part of the city (Table 4.4).

UPs play a critical role in improving the physical, mental, and spiritual health of the urban community and creating opportunities for social cohesion across all age groups and gender (Page & Connell, 2010). However, to realize these benefits, different facilities ought to be in place. Among these seats, toilet, and physical exercise facilities are very crucial (Dunnett et al. 2002). However, the availability of such facilities is the major problem in the investigated UPs of Addis Ababa. The park audit result of this study indicated that there is a lack of physical exercise facilities (sport area for all age groups, gym, ball game...etc), parking lots in the parks, and bicycling ways. This indicates, the available parks facilities are not in accordance with the basic park facility criteria mentioned in different literature (Cohen et al. 2006; Kaczynski et al. 2008) and the national UGIS of Ethiopia (MoUDH, 2015). Some of the available facilities such as seats, shades and toilets are inadequate, and this was equally a big problem in the UPs of the city. Studies in Nairobi (Makworo & Mireri 2011) and Kisumu (Rabare et al. 2009) reported similar results, which indicated the lack of seats found as a common problem of many UPs. Luck of such facilities can

also undermines the level of comfort in the UPs of the city. Studies indicated that the presence of sufficient amount of facilities and amenities in the parks such as sports fields (Floyd et al. 2008); green plants, trails, walking paths, and sidewalks (Shores & West, 2008; Kaczynski et al. 2008); running tracks, swimming areas, lighting, shade, and fountains promote park usage (Cohen et al. 2006) and the absence in such facilities can result in discouraging park use.

Moreover, absence of water features such as artificial lake, pond or stream is another problem of UPs in the city. Apart from other physical facilities and plant diversity, the value of recreational parks increases with the presence of water feature such as ponds or streams. The demand of the community for UPs will also increase if the blue infrastructure is available in the parks and lack of such facilities had also an effect on access to UPs. In general, better understanding of the available park facilities has important implications for park planners and urban designers in creating attractive park environment (Kaczynski et al. 2008).

4.3. Conclusion

To sum up, the finding presented in this chapter of the study demonstrated that there had been a rapid conversion and destruction of UGI in Addis Ababa city between the year 2003 and 2016. The study disclosed that the land use of UGI from 2003 to 2016 is decreased by 22.4% and the built up area increases with the same rate. The land use of urban agriculture decreased significantly (by 86.1%) followed by urban forest (by 15.3%). The spatial accessibility of UGI such as recreational parks is also insufficient and inaccessible to the majority of city residents. The city's park per capita was very small ($0.37m^2$) compared to Ethiopian UGI ($15m^2$), and WHO ($9m^2$) standards. The large portion of the city's population (above 90%) has no access to existing parks within the minimum walking distance thresholds. The results indicated that there is high demand

of recreational UGI in the city. To satisfy the current demand the city administration should provide 6718.1ha of recreational parks.

Moreover, the city parks are poor in terms of park quality parameters such as the availability of facility. The supply of various facilities in the parks was inadequate. The park audit result of the study indicated that there is a lack of physical exercise facilities (sport area for all age groups, gym, ball game...etc.), parking lots in the parks, and bicycling ways. The absence of water features such as artificial lake, pond or stream is another problem of UPs in the city. In general, the study investigated the rapid decrease in components of UGI and the inaccessibility of available UGI such as parks.

5. Utilization Pattern and Factors Affecting Urban Parks Use in Addis Ababa City

Apart from looking at the spatial perspectives of UGI in general and UPs access in particular, this study also addressed the utilization pattern and factors affecting UPs use from social perspectives by taking some parks as a case study. The use pattern of UPs were examined from socioeconomic background, demographic characteristics, personal condition of park users, park quality (level of maintenance, cleanness and safety), and other physical condition of the park. Thus, this part of the study present the result and discussion of UPs access and use pattern based on aforementioned variables that may affect park access and usage in the study area. First, the findings of each issues were presented and then, the discussions were follow.

5.1. Results

5.1.1. Socioeconomic and demographic characteristics of park users

The characteristic of the respondents was denoted by five socioeconomic and demographic variables (Table 5.1). The descriptive analysis of the respondents showed a great difference between male and female park participants. The age group from 16-25 outnumbered other groups, followed by the age group 25-55. The representation of the senior/old age group >55years was very small in comparison with other groups. The majority of the respondents hold university degree & above (52.4%), followed by secondary & TVET, and then primary and below primary education. Single group (64.6%) was the dominant park users among the marital status category and divorced was the least park users. In terms of income, the highest-income group (>4,000 ET Birr) was the main park participant and the low-income group (<600ET Birr) was the least park

visitors. Among the five occupation categories, the highest park visitors were government employees and the smallest were merchant and followed by private company workers.

Table 5.1 Overall socio-demographic characteristics of park users

Socio- demographic characteristics		**N/Percent**
Gender	Male	121(64.0)
	Female	68(36.0)
Age	16-25 (young)	96(50.8)
	25-55 (Adult)	69(36.5)
	Above 55 (Senior/Old)	24(12.7)
Educational status	Primary education & less	20(10.6)
	Secondary education & TVET	70(37.0)
	University degree & above	99(52.4)
Marital status	Married	58(30.7)
	Single	122(64.6)
	Divorced	9(4.8)
Occupation	Government	59(31.2)
	NGO/private	34(18.0)
	Merchant	10(5.3)
	Self-employed	35(18.5)
	Student	51(27.0)
Monthly income	Below 600 Eth. Birr	35(18.5)
	601-2000 Eth. Birr	42(22.2)
	2,001-4,000 Eth. Birr	50(26.5)
	Above 4,001 Eth. Birr	62(32.8)
Frequency of visit	More days per week	44(23.3)
	Weekly	41(21.7)
	Monthly	47(24.8)
	Occasionally	57(30.2)
Awareness about available parks location & use	Very good	13(6.9)
	Good	46(24.3)
	Average	95(50.3)
	Poor	32(16.9)
	No awareness	3(1.6)

Note: N refers to number of respondents.

The study also provided information about the frequency of residents in urban park visit (Table 5.1). The result revealed that almost one third of the respondents were occasional visitors (30.2%), followed by

monthly (24.8%) and more days per week visitors (23.3%). The remaining 21.6% of the respondents visited only once per week. Moreover, regarding the awareness of park location, only 6.9% of the respondents have very good awareness and 50.3% of the respondents have average awareness about available UPs and their programs in the city.

5.1.2. Socio-demographic variables and frequency of urban park visit

The result of the analysis in this section was to illustrate the extent to which the frequency of urban park use could be associated with respondents' socio-demographic characteristics, including age, gender, education, occupation, marital status and income (Table 5.2). The cross-tabulation result showed that there is a significant gender difference ($P<0.05$) in the utilization of UPs in the study area. A greater proportion of male respondents visited the parks more days per week (83.3%) and on a weekly basis (81.3%) than the females. The frequency of park visits was also varied across all age categories and it has significant association ($P<0.05$) with the frequency of park visit. The finding indicated, income, educational background and occupation of the respondents have a statistically significant association ($P<0.05$) with the frequency of park visit. The low-income group and those who had primary and below primary education were infrequent park users in the study area.

Regarding marital status, the highest percentage of park users in the study area were single group (64.6%). However, marital status did not have a statistically significant association with frequency of park visit ($P>0.05$). The study also revealed that there is a strong association between awareness about available parks location and frequency of park visit ($P<0.05$). In the city, the frequent park users were those who have good awareness about the available parks and its program.

Table 5.2 The association between socio-demographic group and frequency of park visit

Socio-demographic group		Frequency of visit				Chi-square	Df	Sig.
		More days/week (%)	Weekly (%)	Monthly (%)	Occasionally (%)			
Age	16-25 (Young)	40.9	70.7	43.5	50.0			
	25-55 (Adult)	31.8	29.3	52.2	32.8	24.751	6	**.000***
	Above 55 (Senior)	27.3	0.0	4.3	17.2			
Gender	Male	81.8	80.5	63.0	39.7			
	Female	18.2	19.5	37.0	60.3	25.845	3	**.000***
Educational status	Primary & less	0.0	12.2	17.4	12.1			
	Secondary & TVET	81.8	48.8	17.4	10.3	67.897	6	**.000***
	University degree & above	18.2	39.0	65.2	77.6			
Marital status	Married	47.7	19.5	30.4	25.9			
	Single	47.7	75.6	63.0	70.7	9.848	6	.131
	Divorced	4.5	4.9	6.5	3.4			
Monthly income	<600 Eth. B	0.0	41.5	23.9	12.1			
	601-2000 Eth. B	61.4	19.5	4.3	8.6			
	2,001-4,000 Et. B	15.9	22.0	34.8	31.0	76.501	9	**.000***
	>4,001 Eth. B	22.7	17.1	37.0	48.3			
Occupation	Government	31.8	34.1	21.7	36.2			
	NGO/private	6.8	7.3	34.8	20.7			
	Merchant	0.0	12.2	4.3	5.2	36.430	12	**.000***
	Self-employed	31.8	9.8	26.1	8.6			
	Students	29.5	36.6	13.0	29.3			
Awareness about available parks	Very good	11.4	4.9	13.0	0.0			
	Good	54.5	43.9	8.7	0.0			
	Average	22.7	43.9	71.7	58.6	87.227	12	**.000***
	Poor	11.4	7.3	6.5	36.2			
	No awareness	0.0	0.0	0.0	5.2			

**The Chi-square statistic is significant at the .05 level. Note: Eth. B-Ethiopian Birr*

5.1.3. Distance, traveled time, mode of transport to parks verses frequency of visit

Physical factors of UPs access were also analyzed to understand their level of association with park utilization (Table 5.3). Distance analysis indicated that 62.4% of the visitors travelled more than 1km from their place of residence to visit the surveyed parks. This indicates the number of visitors to the surveyed park tends to increase with the distance of their place of residence.

Table 5.3 Association between distance, travel time, mode of transport and frequency of park visit

Physical factors		**Frequency of visit**				**Chi-square**	**Df**	**Sig.**
		More Days/week (%)	Weekly (%)	Monthly (%)	Occasionally (%)			
Distance to the park	<400m (7.9%)	27.3	7.3	0.0	0.0	85.873	12	**.000***
	401m-800m/13.8%)	6.8	24.4	10.9	13.8			
	801m-1km (15.9%)	36.4	12.2	10.9	6.9			
	1km-4km (39.7%)	25.0	34.1	67.4	32.8			
	>4km (22.7%)	4.5	22.0	10.9	46.6			
Time traveled to the park	10 Minutes (20.6%)	15.9	39.0	17.4	13.8	108.04	12	**.000***
	15 Minutes (15.9%)	52.3	0.0	4.3	8.6			
	20 Minutes (31.2%)	22.7	36.6	54.3	15.5			
	1 hour (20.6%)	4.5	19.5	23.9	31.0			
	> 1hour (11.7%)	4.5	4.9	0.0	31.0			
Mode of transport	Walking (52.9%)	75.0	75.6	52.2	20.7	48.094	6	**.000***
	By bicycle (0%)	0.0	0.0	0.0	0.0			
	Public transport (42.9%)	25.0	24.4	37.0	74.1			
	Private car (4.2%)	0.0	0.0	10.9	5.2			

**The Chi-square statistic is significant at the .05 level. Note <400m (7.9%)-(7.9%) indicates percentage of visitors*

The majority of park visitors traveled more than 20minute to reach the surveyed parks. Moreover, more than half of the park visitors walk to UPs and the visitors did not mention cycling as a mode of transport to UPs. Distance from home to the surveyed park and frequency of visit by park users also analyzed in order to see their association. The finding indicated that the frequency of park visit tends to decrease as the distance to the park increases (Table 5.3, Fig 5.1). It also had a significant association with the frequency of park visits (P <0.05).

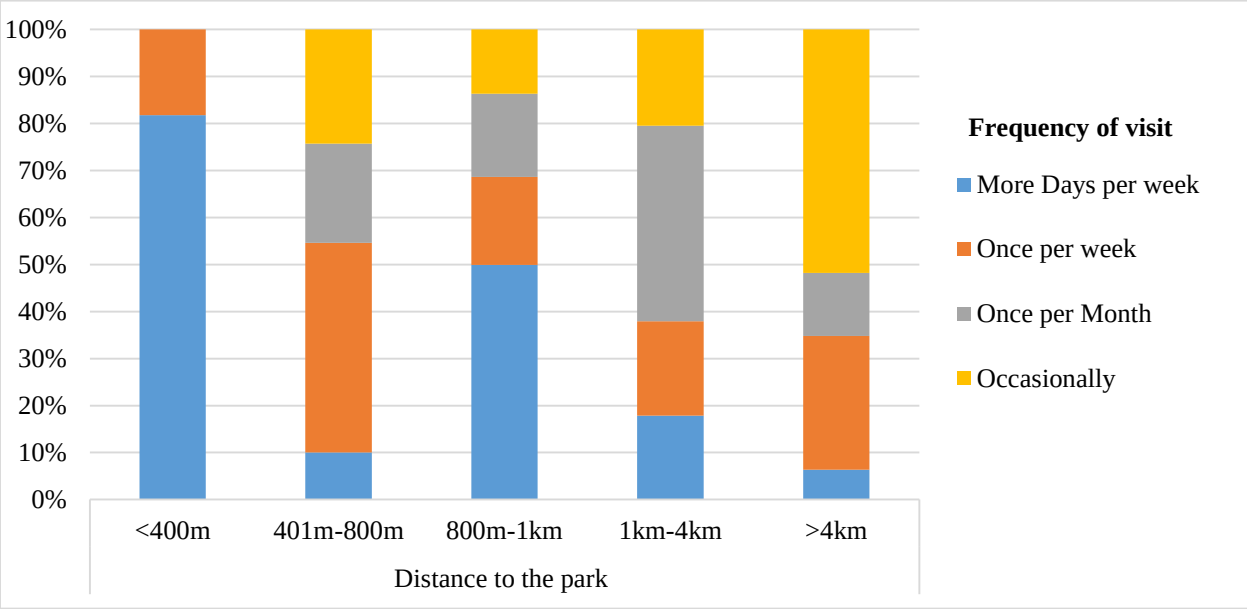


Fig 5.1 Relation between the frequency of park visits and distance to the surveyed park

Similarly, traveled time and mode of transportation to the park had significant association (P <0.05) with frequency of park visit. Those who traveled to the park for 10-15minutes were frequent park users than 1hour and more hour's travelers. Moreover, respondents who walk to UPs are more likely to visit the parks more days a week than those who arrive by other means of transportation. Those who arrive by private car visit the parks less frequently than those who arrive by public transport.

5.1.4. The effect of independent variables on the frequency of park utilization

Multiple linear regression was used to test the influence of socio-demographic characteristics of the users and physical factors on the frequency of park utilization (Table 5.4). The analysis showed that four predictors had a negative correlation coefficient. These include monthly income, awareness about the available parks, distance to the park and mode of transport.

Table 5.4 Test of individual parameters/coefficients

Model	**Unstandardized Coefficients**		t	Sig.	**Collinearity Statistics**	
	B	Std. Error			Tolerance	VIF
(Constant)	12.278	2.015	6.092	.000		
Age	1.174	.424	2.764	.006*	.536	1.864
Gender	-.727	.498	-1.459	.146	.829	1.207
Marital status	-.244	.223	-1.091	. 277	.777	1.287
Educational status	-.462	.408	-1.133	.259	.626	1.597
Occupation	.314	.159	1.974	.050*	.695	1.439
Monthly income	-.975	.531	-1. 834	.068	.583	1.714
Awareness about available parks	-1.370	.299	-4.578	.000*	.736	1.359
Distance to the park	-1.036	.352	-2.946	.004*	.263	3.797
Time traveled to the park	.793	.319	2.486	.014*	.284	3.525
Mode of transport	-.726	.295	-2.462	.015*	.483	2.069

*Dependent Variable: Frequency of UPs visit in a month; *Denotes level of significance at 0.05*

The prediction model was statistically significant, since the p value (0.000), which is less than the critical α value (0.05) and accounted for approximately 2.99% of the variance of monthly visiting of UPs (R^2 =0.393, Adjusted R^2 = 0.359). This indicated that 39.3% of the response variables is explained by the explanatory variables. The Goodness of fit of the model explained by 35.9%. The analysis shows that seven of the ten independent variables (predictors) have a statistically significant association with a monthly visit of UPs at a significance level of $p < 0.05$. These include age (p-value =0.000), monthly income (p-value = 0.06), occupation (0.05), awareness about available parks (0.000), distance to park (p-value = 0.004), time traveled to the park (0.014) and mode of transport (0.015). The others independent variables (predictors) did not have a statistically significant effect on a monthly visit of UPs since their corresponding P values are greater than 0.05. When evaluating the standardized beta values, the greatest influences upon the dependent variable were in the following order: park awareness (beta=-1.370), distance to park (beta = -1.036), age (beta=1.174), time traveled to the park (beta =.793), mode of transport (beta = -.726), occupation (beta=.314) and monthly income (beta=-.975).

5.1.5. Motivations for and personal constraints to park visitation

Survey data were collected on motivations for park visitation, in the study area (Table 5.5). The most frequently reported reasons for park visit were meeting with families or friends followed by enjoying nature, relaxation/rest and reading books. Other motivations such as attending community events, eating/drinking and physical exercise were the least mentioned activities by the park visitors.

Moreover, survey answers were collected on personal constraints to park visitation from two hundred ten (210) households surrounding the study parks (Table 5.5). Of the surveyed household, the majority (33.3%) indicated time limitation as the major constraint of park visitation. Lack of

interest (22.9%) and household duties (14.3%) were the second and the third constraints reported by respondents. On the other hand, constraints like transport problem, recreational cost, fear of crime, health problem and others were among the least reported personal barriers to park visitation.

Table 5.5 Motivation for and personal constraints of urban parks

Motivations	**No (Percent)**	**Personal constraints**	**No (Percent)**
Relaxation & rest	26(13.8)	Time limitation	77(36.7)
Physical exercise (Walking, jogging, ball game, tennis, etc.)	2(1.1)	Health problem	11(5.2)
Eating/drinking	3(1.6)	Recreation cost	18(8.6)
Reading book	26(13.8)	Lack of interest	48(22.9)
Playing with children	8(4.2)	Transportation problem	15(7.1)
Enjoying nature	34(17.9)	Fear	11(5.2)
Meeting with family/ friends	75(39.7)	Household duties	30(14.3)
Attending community events	10(5.3)	Others	0
Other	5(2.6)	**Total**	**210(100)**
Total	**189(100)**		

5.1.6. Park quality and level of park access

As indicated in the methodology part, the quality of UPs in terms of level of maintenance, cleanness, and safety of the parks were investigated through survey questioner from the park users. However, the amount of available facilities were investigated through park audit (section 4.1.2.4). Thus, the respondents' level of agreement with specific statements relating to maintenance, cleanness, and safety of the parks was presented in table 5.6. Accordingly, about 46.1% of the respondents agreed or strongly agreed with the statement that 'park is well maintained'. Almost

equal proportion of respondents (49.2%) did not support this statement and 3.7% chose to remain neutral. When we look at the association between level park maintenance and frequency of park visit, they have significant correlation (P<0.05). The highest number of occasional visitors disagree (56.1%) with the statement 'park is well maintained".

Table 5.6 The association of urban parks quality and frequency park visit/access

Park quality indicators		**Frequency of Visit**				**Chi-square**	**Df**	**Sig.**
		More Days/ week	Weekly (%)	Monthly (%)	Occasionally (%)			
Clean and attractive	Strongly disagree (7.9%)	4.5	0.0	8.5	15.8			
	Disagree (37%)	15.9	29.3	46.8	50.9			
	Neutral (2.6%)	2.3	7.3	2.1	0.0	42.655	12	**.000***
	Agree (46.6%)	72.7	48.8	42.6	28.1			
	Strongly agree (5.8%)	4.5	14.6	0.0	5.3			
Well maintained	Strongly disagree (4.8%)	0.0	7.3	6.4	5.3			
	Disagree (44.4%)	18.2	51.2	48.9	56.1			
	Neutral (3.7%)	11.4	2.4	2.1	0.0	28.905	12	**.004***
	Agree (39.2%)	56.8	31.7	36.2	33.3			
	Strongly agree (7.9%)	13.6	7.3	6.4	5.3			
Safe and secured places	Strongly disagree (6.9%)	6.8	4.9	8.5	7			
	Disagree (50.3%)	45.5	61	51.1	45.6			
	Neutral (4.8%)	0.0	4.9	8.5	5.3	8.568	12	.739
	Agree (36.5%)	45.5	29.3	29.8	40.4			
	Strongly agree (1.6%)	2.3	0.0	2.1	1.8			

**The Chi-square statistic is significant at the .05 level*

Regarding the cleanness of UPs, almost 52.4% of the respondents agreed that the parks are clean, 2.6% neutral and 44.9% are not satisfied with the cleanness of the parks. More days per week and once per week park users agreed that parks are clean, while the majority of occasional park users are disagreed with the cleanness of UPs. The chi-square test of the association between the park cleanness and frequency of park visit was also showed strong relationship ($P<0.05$) between the variables. Moreover, about 37.1% of the respondents agreed that the parks are safe place, about 4.8% remain neutral; while more than 50.3% of the respondents revealed that they do not feel safe at all. This indicates that more than half of the respondents do not feel secured in the parks even if the extent differs. However, the chi-square analysis indicate that park safety does not have a statistical association with frequency of park visit ($P>0.05$).

5.2. Discussions

In addition to spatial accessibility of UPs, the study examined perceived park access or utilization by the city residents. Surveys of urban park users shown a wide range of park accessibility factors, including the quality of parks, accessibility of green spaces in terms of distance and transport, adequacy of facilities, safety concerns, and maintenance and management of UPs (Cohen et al. 2007; Sugiyama & Ward Thompson 2008; Tzoulas & James, 2010; Jansson et al. 2013; Zhang et al. 2015). Surveys also showed that demographic factors (Sanesi & Chiarello, 2006; Wende et al. 2012), the socioeconomic backgrounds and personal characteristics of users (Jim & Shan, 2013; Schipperijn et al. 2010) had a strong influence on the use of UPs. A thorough understanding of these key factors is important for properly plan, design and manage accessible parks in the city. Thus, based on the findings of the study the park use pattern and factors affecting park use and access in the city are discussed here below:

The socioeconomic and demographic determinants of urban park access: researches that were conducted in developed countries have identified a number of socio-demographic factors that influence both the need for recreational services and the ability of people to access and utilize these services (Jim & Shan, 2013; Byrne & Wolch, 2009). However, the effect of these factors is not well known in rapidly urbanizing countries context. The regression analysis revealed that socio-demographic factors such as age, income and occupation have significantly affected the frequency of urban park use in the study area. This finding is in line with the studies that indicated socioeconomic and socio-demographic characteristics of park users have an effect on park usage (Jim & Shan, 2013; Sanesi & Chiarello, 2006; Schipperijn et al. 2010). However, it is inconsistent with the study carried out in one of the developed countries, which found that socio-demographic characteristics of the park participants had no significant effect on the frequency of green space use (Dallimer et al. 2014). This is because most cities of developed countries consider the need of different groups of the community in their recreational areas planning and development.

One of the socio-demographic factors that had a significant influence on the urban park access in the study area was age. The age group from 16-25 was the largest park user whereas above 55 years was the lowest park user. The study found that the rate of participation in park utilization decreases with an increase of age. This finding is similar to the study that indicated young people tend to spend more time in outdoor recreational areas than the other group (Sallis et al. 2000). Ghimire et al. (2014) also indicated that older people are less likely to involve in outdoor activities than other groups. In other words, the elderly experience more obstacles to outdoor recreation (Sanesi & Chiarello, 2006) or they are more restricted by various factors to engage in outdoor recreational activities than other communities. For instance, constraints such as age, immobility, distance and small income are the major factors that deter park usage by old age group in the study

area. Moreover, the participation of a small number of old age group in the park use may be due to the limited number of observations made and thus, detail research with more samples would be needed to understand the park use pattern of old age group.

As far as gender is concerned, the finding of this study indicated that the number of female park users was very small compared to males, which is supported by the previous researches undertaken in different countries (Shores & West, 2010; Delfien et al. 2013). For example, the study conducted in Turkey showed similar findings that men visit urban green space more often than women do, but the study found no gender-related disparities in park preferences (Akpinar, 2016). The reason for such gender difference in park use in Addis Ababa is similar to the study conducted in Nigeria, which found that African females have culturally spent more time at home, especially during the motherhood period (Anaza & McDowell, 2013). Moreover, in Addis Ababa, females bear more domestic responsibilities and they have less time for leisure activities, while males have fewer domestic responsibilities and more mobility. Little (2002) also found that sociocultural factors, such as gender role expectation, played a significant role in hindering females from engaging in recreational activities. Safety is also mentioned as another important psychological factor that hindered women from participating in recreational activities (Sanesi & Chiarello, 2006; Miles, 2008; Anaza & McDowell, 2013). Even though, the chi-square analysis of the study indicated the association of gender and frequency of park utilization, the regression analysis did not indicate the association of gender and park access. This indicate gender has no any significant influence on park access.

In studies conducted in developed countries, public space users were proven more likely to be higher-income group than the populations of lower-income level (Schipperijn et al. 2010; Koohsari et al. 2013). Similarly, this study revealed that the higher-income group uses UPs more frequently

than the low-income group. Similar findings indicated that respondents, who earn lower income per year have lower access or visits to recreational areas (Jonathan et al. 2015). In addition, low-income people have less access to green space, parks, or recreational areas than those who are more affluent (Jennifer et al. 2014). Moreover, the scarcity of UPs in most part of low-income residential areas of Addis Ababa city may also be the main factor for underutilization of UPs by this group. The other socio-demographic factor that affects park utilization in the study area was occupation. Merchants (5.3%) and NGO/private company workers (18%) were the least and infrequent park users than other categories of occupation. This may be because of the nature of their work which does not allow them to participate in different recreational activities. The marital status of the respondents did not explain the variation in the frequency of participation in park visit and had insignificant influence on the park users in the study area. Even though, educational background of the respondent has a correlation with frequency of park utilization, it had no effect on the park access.

In general, the aforementioned discussion indicated that the available UPs in the city do not fulfill the need of different socio-demographic groups' especial the need of all age, income and occupation groups. The finding also indicate that although promoting social equity in green space is exist in most resilience initiatives, in practice it is a different story in the study area. Instead, in many cities, it is common to find that the minorities and low-income neighborhoods have less vegetation and access to green space than wealthy neighborhoods (Hoang & Fenner, 2016; Willemse, 2015). This disproportional access to recreational areas results in an environmental justice issue (Smiley et al. 2016).Thus, this study indicate the importance of designing parks in a way that considers equal access for all people- people with and without disabilities, people of all age groups, and people of all socioeconomic and demographic statuses (MoUDH, 2015).

Distance, travel time, mode of transport and urban park access: most studies have revealed that, distance is an important physical factor that affects access to UPs (Cohen et al. 2006; Corburn, 2017) which is similar with the findings of this study. The park participants come from different part of the city including outside Addis Ababa city. The majority of the park visitors come from a distance of more than one kilometer and only few park visitors (7.9%) come from less than 400m distance. This confirms that the distance to UPs for most residents of the city is very long compared to other countries, where the distance to green spaces is relatively short for most visitors (Barbosa et al. 2007; Schipperijn et al. 2010).

An increase in distant park participants may attributed to multiple factors. Most residents of Addis Ababa city, including those surrounding the study parks are lack knowledge about the health benefits and values of UPs. These might be the main factors that hindered their involvement in park use. Studies have also indicated that lack of awareness about the importance of UPs could affect park use (Ayeghi & Ujang, 2014; Jonathan et al. 2015). Income is also mentioned as a major factor that plays a significant role in affecting the involvement of people in recreational activities (Shores et al. 2007). Other factors include an uneven distribution and a lack of parks in the neighborhoods of remote park visitors. The available parks of Addis Ababa are concentrated in old parts of the city, and large and peripheral sub-cities have no accessible recreational parks (Fig 3.7). Studies also indicated that most residents of Addis Ababa city do not have adequate and evenly distributed parks (Abeje, 2007; Mpofu, 2013). As a result, the city residents are forced to travel long distances to use the ones in other neighborhoods or sub-cities (Giles-Corti et al. 2005). Apart from the lack of parks in the vicinity of distant park visitors, the size and attractiveness of the park may be the other factors for distant park visitors to travel a long distance (Giles-Corti et

al. 2005). For example, Beher-Tsige Park is the city's largest park and relatively has better facilities than other parks and it can attracts park visitors from all over the city.

As indicated by Schipperijn et al. (2010), the frequency of green space use declined with increasing distance and this study investigated similar findings in Addis Ababa city. In the study area, the number of frequent visitors tends to decrease with increase in distance to the park, which has been verified by studies in developed countries such as Denmark (Schipperijn et al. 2010) and Belgium (Roovers et al. 2002). At the same time, a large proportion of monthly and occasional visitors travel long distance to visit the surveyed parks. This result indicated the distant visitors use public transport/car, and this incurs additional transportation cost and at the same time, it deters the frequency of park visit of the distance visitors. Road congestion was the other barrier for distant visitors that affect the frequency of park visit in the study area. In Addis Ababa, road congestion is the major challenge that affects the transportation system of the city, and indirectly this has an effect on the perception of visitors to utilize UPs more frequently. However, the finding this study is contrary to the results from a study conducted in developed country, which showed that only few (3%) respondents considered distance to be a constraint on the frequent use of parks (Nielsen and Hansen, 2007).

Another important factor that had been a significant effect on access to UPs in the study area was mode of transport. The study revealed that respondents who walk to UPs visit the parks more frequently than those who arrive by private car or by public transportation. This finding is consistent with the study that indicated as the distance between home and UPs increase, the travel mode gradually changes from walking to driving by car and public transportation (Koohsari et al. 2013). Although these modes of transport were conducive and fastest to visit parks by distant residents, they had a negative impact on the city residents to access parks. The possible reason

why the mode of transport affected frequency of park use by distant visitors may be related to the inconvenience of the transportation system and increase in transportation cost. The high travel cost might also reduce the threshold at which residents desire to visit parks. Moreover, shortage of public transport, road congestion and lack of access to private transport are the major problem of rapidly urbanizing cities of developing countries and hence, the major constraints that hinder park access (Dony et al. 2015; Lee & Hong, 2013). Other studies also indicated accessibility of green spaces in fast growing cities of developing countries is often limited by problem of public transport development or lack of access to private transport (Schetkea et al. 2016). Even though, other studies investigated cycling as a common mode of travel to UPs in many cities around world (Veitch et al. 2012a), in this study cycling was not mentioned due to the lack of bicycle paths and the culture of the community to use bicycle.

Motivations for and personal constraints on the park access: People choose to visit UPs for many reasons, including for their own personal and environmental motivations (Irvine et al. 2013). The investigation of such park visitors' motive is very important for urban planners to design UPs that are more attractive in order to promote their access and improve community health. To address this issue, this study investigated the motives of park users. The finding revealed that meeting with families or friends was the most common purpose of visiting UPs by the residents of the city, followed by enjoying nature, relaxation as well as reading books. Similar to our finding the study conducted in Amsterdam, identified 'meeting friends' as the most important motivation, followed by 'to be in nature' (Chiesura, 2004). The reason why most park users meet families or friends and enjoy nature in the study area is partly due to the fact that, these activities do not require more facilities and services in the park. These activities may also indicate the inadequacy of various

facilities in the park, which provide residents with opportunities to meet their different recreational needs.

In the study area, physical exercise, playing with children and community events were the least mentioned reasons to visit parks. This might have different reasons. Absence of diversified programs and community events held in the parks and lack of facilities can be indicated as the main reasons. The investigated parks were not allowed for any physical exercise and sport except "Martial art" for youths in Bihere-Tsige Park. Studies also indicated that the absence of such physical exercise and organized community events in the park could affect access to the park (Cohen et al. 2010; Wright Wendel et al. 2012). Thus, public open spaces such as parks should provide a variety of services, user interests, and social infrastructure that act as the catalysts to foster social activities and cohesion (Stauskis & Eckardt, 2011). However, opposing to this finding, a study carried out in special towns surrounding Finefine/Addis Ababa, Ethiopia, indicated that physical exercise and relaxation are the most common motive of park visitation (Girma, Terefe, & Pauleit, 2019).

Moreover, personal constraints such as time limitation, lack of interest and awareness about the location and importance of UPs are the three most important constraints that affect residents' participation in park use in the study area. Time constraint could be due to people being too busy with their day-to-day activities to visit parks and participate in different leisure activities. Similar findings also indicated that constraints related to park visitation often include lack of time and information (Jaclyn et al. 2019). The result of this study was also consistent with the study by Stodolska et al. (2019) who found similar categories of constraints in their qualitative study (e.g., cost, lack of knowledge about parks and opportunities, access such as transportation, time such as being too busy, programs and facilities, safety concerns, issues related to race and culture).

Previous studies have also documented the influence of individual awareness about park location and its programs on the park access (Scott & Jackson, 1996). Studies conducted in Ethiopia (Girma, Terefe, & Pauleit, 2019), Canada (Alberta Community Development, 2000), and Texas (Scott & Kim, 1998), also reported the same result. The result of this study is also consistent with the aforementioned findings, where a number of surveyed park users had less awareness about the location of UPs and what the UPs had to offer. It was also the strongest predictor of park access in the city. The reason for lack of awareness is due to absence of promotion and publicizing the existing parks and available programs in the parks. The low publicity makes the public and visitors to have little information about the UPs, which negatively affect access to such places. The interview made with officers of the city also indicated that even though there was some activities in promoting about the existing parks enough work was not done.

Urban parks quality versus access to urban parks: studies indicated, quality of UPs was found to be a significant predictor of access to recreation activities (Abdul Malek et al, 2015). The same studies also reported the significant relationship between qualities of UPs, use patterns as well as the satisfaction of park users (Abdul Malek et al. 2015). This suggests that every park needs to be designed and maintained a high quality standard to increase its accessibility to the city residents. The current study also investigated the quality of UPs in the study area based on different park quality indicators such as the availability of facilities, maintenance, cleanness of the parks, and safety/security in the parks.

Maintenance of facilities and cleanness of the parks are the other indictors of park quality. Poorly maintained facilities in the parks can serve as a barrier to use these spaces. People often seek UPs and recreational areas for aesthetic motives, and a failure to meet these expectations such as insufficient maintenance and neglect may prevent users from accessing these spaces. The findings

of this study revealed that the highest number of park users (49.2%) feel that the parks are not well maintained. Moreover, maintenance of UPs was also associated with frequency of park usage (P<0.5%). Personal observations of the parks also confirmed the widespread of broken down facilities (chairs, sign spots, sheds and etc...) in several parks of the city that demand urgent maintenance works (Fig 5.2).

Source: Field survey

Fig 5.2 The condition of park facilities in Hamele 19 & Beher Tsige parks

This resulted in the decline of use or complete avoidance of park access (Boone-Heinonen et al. 2010). Similarly, studies indicated maintenance are often identified as an issue affecting the use of UPs for physical activities (McCormack et al. 2010). Other studies also mentioned that people

interpret well-maintained lawns in green space as a sign of care that make areas look safer (LaGrange et al. 1992; Brown & Bentley, 1993). Without proper maintenance of facilities, UPs do not attract people for creative play and social settings that might act as gathering places (Gobster, 2002; Rishbeth, 2001).

Aside from the poor maintenance of facilities, lack of cleanness was another problem of the parks of Addis Ababa city. The chi-square result indicated, cleanness as another factor that associated with park access ($P<0.5\%$). Moreover, personal observations of the parks confirmed the seriousness of uncleanness and the unpleasant odor in some recreational parks of the city. The respondents also expressed about the presence of many used plastic bottles and bags, and solid waste in the parks. For instance, some part of Behertsige Park was turned into liquid waste dumping site from the neighborhoods of the park. This observation supports the findings of Fuwape & Onyekwelu (2011) who mentioned that in some parks and botanical gardens in African cities such as Ibadan, Lagos, Kano and Kaduna (Nigeria), Accra (Ghana) and Freetown (Sierra Leone) where some portions of the parks were converted into refuse dumps. Therefore, park managers of the city should understand that park users are not interested in visiting UPs which are not cleaned and visually unattractive (McCormack et al. 2010).

The other quality indicator that was examined in this study is safety or security of UPs. According to many studies, people's perceptions of safety and security can affect access to UPs. For instance, residents would be less likely to utilize UPs, if viewed as unsafe or as a setting, where illegal activities take place such as drug use and gang related behavior (Kaczynski & Henderson, 2008; Durant et al. 2009; Cohen et al. 2010). The findings of this study also support these views, and the majority of surveyed park users (57.2%) cited safety as a barrier, demonstrating that safety is a critical issue in keeping the city residents out of UPs use. Personal interview with park users

indicated that issues related with safety, such as assaulting females, and chat & other drug users were the major fears that indicated by park users. Studies also indicated, concerns about various factors related to safety may inhibit the use of green spaces, which may lead potential users to avoid green spaces or seek other recreational services (Weiss et al. 2010). Abusing females especially during night time identified as the main security problem mentioned by park users in Beher-tsige and central parks. It would appear that residents are avoiding using UPs, at least due to safety or security concerns. However, the chi-square result of the study does not indicated the association between safety and frequency of the park visit (P>0.5%). This means park safety has no significant effect on the frequency of park access.

5.3. Conclusion

Apart from the spatial analysis, the social survey analysis of the study has also revealed important findings about access and use pattern of UPs. The survey analysis demonstrated, to what extent park access and utilization pattern associated with socio-demographic characteristics, physical factors and park quality indicators. It also analyzed the determinants of UPs access and utilization in the study area. In general, age, income and occupation of the respondents had an effect on the frequency of park access and utilization. For instance, old age and very low-income groups were identified as the least and infrequent park users in the study area. Awareness about the available parks had also an effect on the park access. Moreover, physical factors such as distance, travel time to the park and mode of transport had strong association and significant effect on the park access.

The study also investigated the quality of UPs based on different parameters. The overall assessment indicated, the city parks have poor quality. In terms of cleanses, there were a poor refuse collection, lack of dustbins, and inadequate and unclean toilets. In general the city parks

were not well maintained, cleaned and managed. The majority of surveyed park users (58%) also cited safety as a barrier, demonstrating that safety is another critical issue in keeping the city residents out of UPs use.

6. Policy and Organizational Framework of Urban Green Infrastructure

The success of UGI in general and UPs in particular needs a good policy or legal and organizational frameworks. Thus, this part of the study provides insight into the main actors and organizations that involved in UGI development and management, and highlights their responsibility and interaction/coordination in providing UGI components. It also briefly examined the available policies or legal frameworks that directly or indirectly affect the planning and management of UGI. It includes the evaluation of existing policies, regulations, laws, planning norms and standards that are available at both national and municipal levels.

6.1. Result

6.1.1. Organizational framework of urban green infrastructure management

The development of UGI in general and UPs in particular needs the involvements of an extensive actors and stakeholders. This section provides insight into the main actors or government institutions that involved in UGI development and management, and highlights their responsibility and interaction/coordination in providing UGI components. Accordingly, the study identified four major government agencies directly involved in UGI development in the study area (Table 6.1). These include; Addis Ababa City Environmental Protection and Green Development Commission (AAEPGDC)-which is responsible for forest development in the upper catchment areas of the city and along the river banks; Beautification, Park and Cemetery Development and Administration Agency (BPCAA)-which is engaged in park development, street plantation and cemetery development; the third one is Addis Ababa City Farmers and Urban Agriculture Development Commission (AACFUADC), which is responsible for urban agriculture development; and the fourth is Riverside Park Development Project Office (RPDPO) also called Beautifying Sheger project. RPDPO has been recently established organization, responsible for riverside park

development, cleaning rivers and overall beautifying the city. Moreover, some of the aforementioned organizations are hierarchically structured from the city level to woreda or district level. For instance, BPCAA has a hierarchical structure from city level to woreda/district level.

Table 6.1 Responsibilities and level of coordination of relevant government organizations

Municipal organizations	**Responsibilities**	**Level of coordination**
Addis Ababa city Environmental Protection & Green Development Commission **(AAEPGDC)**	Forest development in the upper catchment areas of the city and along the river banks	weak
Beautification, Park and Cemetery Development and Administration Agency **(BPCAA)**	Park development, street park plantation and cemetery development	weak
Addis Ababa City Farmers and Urban Agriculture Development Commission **(AACFUADC)**	Urban agriculture development	weak
Rivers and Riverside Development Project Office **(RRDPO)**	Riverside park development, cleaning rivers and overall beautifying the city	-

When we look at the interaction and the level of coordination among the aforementioned government organizations, the majority of the key informants were indicating that there is no/weak coordination and interaction (Table 6.1). A key informant from BPCAA mentioned that the activities of each sector are addressed independently. Moreover, there is no coordinated action among the institution and a legal lead agency which creates such integration of activities among

the agencies. The key informants were also raised a lack of vertical coordination and integration of activities within the same agency. Moreover, it was also raised that, in the implementing institutions the technical skills of workers are not timely upgraded due to the lack of budget. There is also a lack of experience sharing, exchange of information and good practices among the implementing institutions. There is still a capacity problem, especially in the field of landscape planning and design profession in BPCAA and it created a gap in implementing green development activities.

6.1.2. Policies and regulations of urban green infrastructure

The present study also briefly highlighted some of the available policies and legislations at a national and municipal level in order to see its influence on the accessibility of UGI. In this regards, the study identified various policies, proclamation and guidelines that support the development of urban green space in the urban centers of the country. The major identified national policies include; the Ethiopian Constitution of 1995, the Ethiopian Environmental Policy of 1997, the Ethiopian Urban Development Policy of 2006, Urban Planning Strategy of 2013, and Urban Planning Proclamation no. 574/2008c.

The Ethiopian Constitution of 1995 article 92 stated, the general principles that give all citizens the right to live in a clean and healthy environment. The constitution also mentioned the concepts of environmental rights and sustainable development issue in Article 43, 44 and 92. The Ethiopian Urban Development Policy of 2006 mentioned the importance of incorporating green areas in urban development and demarcating these spaces within the framework of the urban plan, at all levels of the urban centers (at city, town or kebele levels). The Ethiopian Environmental Policy of 1997 has also recognized the importance of planning and creating green spaces within the urban areas. This creates an opportunity for various stakeholders to develop and manage urban forests,

parks, street trees ...etc. in their localities. Moreover, the Urban Planning Proclamation No. 574/2008c makes urban administrations responsible institutions in protecting urban environment. The proclamation also forbids any kind of urban development projects that cannot consider its impacts on the urban environment. In general, all the policies and proclamations mentioned above are very important advances in urban green space planning and management in the country and Addis Ababa city as well.

However, except the aforementioned policies, the study investigated that there is no any specific UGI or green space policy at national and municipal level that support the planning and development of UGI. Besides, the key informants from different government offices have also confirmed that the city does not have an approved rule and regulation related to UGI. They also indicated, no implementation guidelines, and technical manuals at the city level. Moreover, there is no controlling mechanism of the encroachment of green components by formal and informal housing expansion. According to the interviewee made with AAEPGDC officials, there are some regulations adopted by EPA, but they are generally not strictly followed by the concerned government agency. Law enforcement is loose, particularly at the lower administrative or woreda levels. The relevant policy or guidelines that available at municipal level are the Growth and Transformation Plan (GTP II) of 2016 (2016-2021), the Master Plan or Structural Plan of the city, and the manual of Local Development Plan (LDP).

The five years (2016-2021) Growth and Transformation Plan (GTP II) of Addis Ababa city, which was formulated by the initiation of the National Planning Commission (NPC) of the Federal Democratic Republic of Ethiopia mentioned the importance of increasing the coverage of UGI and recreational areas for sustainable city development. The LDP manual indicated, urban green areas as an essential element of urban services and forwards some norms to incorporate green space in

the neighborhoods of the city. Moreover, the urban planning process of Addis Ababa city has been incorporating the issue of urban green areas in the overall planning exercise since 1936 or the Italian invention.

According to the document review and key informants, the first master plan of the city was prepared during the Italian invention (1936-1941) by Italian Architects. This master plan was simply a guideline sketch type proposal prepared only by observing the city from the air. In this sketch plan, public open spaces and green areas were well considered. And this was a major step in the planning history of the city and the introduction of green space as part of the urban plan. Since this period, the city prepared around 10(ten) master plans. However, more consideration of urban green space in the city's master plan was observed in the 1986 master plan. This master plan was proposed different green spaces and public open areas at three city scales. These include local green network at the neighborhood level, woreda or district green network, and city wide green areas which included functional green areas reserved for recreational activities like festivals, Zoos, horse race tracks, golf field and wood lands or forests etc. However, these proposed green components were not implemented.

Again in 2003, the office for the Revision of Addis Ababa City Master Plan (ORAAMP) revised the ninth structural plan of the city. This master plan was focused on the reorganization of the 1986 master plan with detailed studies. In this structural plan, urban green spaces are proposed to be located in the city centers. Public parks, zoological parks, and open areas were proposed at different scales of the city. But the plan lacks norms or standards and strategies for implementing the proposed green space. Moreover, due to lack of proper implementation of the plan, most of these proposed areas were converted into other functions or land uses.

The tenth (10^{th}) and the recent structural plan of the city was revised in 2016 by the Addis Ababa city Development Plan Project Office (AADPPO). It was planned for the period of 10 years (2016-2026) and it is the main guiding tool of the city's development. It contains planning standards and norms for local development planning as well as other subsidiary rules and target to facilitate and improve the land use planning process. However, the review of this structural plan indicated that it did not define and clearly map out components of UGI and how it will operate as an interconnected system. In the structural plan, all the green components were included under the environmental issues. Although objectives, directives and strategic actions of each component of UGI were laid out, they were neither clearly defined as a structured, interconnected and continuous system, nor were their relationship with the urban fabric considered.

6.1.3. Planning norms and standards

In addition to policies and regulation, it is important to highlight some of the relevant planning norms and standards that influence the ways in which recreational UPs are planned in Addis Ababa city. In this regards, this study investigated different norms and standards that have been developed for UPs planning and design at a national and municipal level. The planning norms and standards available at national level is the 2015 National Urban Green Infrastructure Standard (UGIS). This standard stipulates that 30% of the land should be allocated for components of UGI, 40% for building construction, and 30% for road infrastructure. The 2006 Urban Development Policy of Ethiopia also recommends the same standards. The national UGIS also indicated that cities should ensure a minimum of $15m^2$ UPs per capita within the city boundaries and every resident should live within 500 meter buffer from a public park of a size of at least 0.3 hectares. However, this standard is generic and not considers the already congested big cities like Addis Ababa. The document also indicated UPs quality parameters. For instance, the manual mentioned, the

provision of playground for children, adventure play areas, formal sport facilities (e.g. basketball and volleyball court, football field, and table tennis), seating and tables, litter bins, and adequate lighting in the sub-city parks. It also indicates the provision of storage facilities, bank or ATM machine, swimming pool and service buildings in the sub-city parks. However, this document didn't mentioned about the provision of artificial blue infrastructure such as rivers, lakes, ponds, fountains, swimming pool or streams.

As discussed in section 6.1.2, the only currently available guiding tool of UGI at municipal level of Addis Ababa is the 2016 structural plan. It contains planning standards and norms for local development planning as well as target to facilitate and improve the land use planning process. This structural plan of the city adopted similar quantitative standards mentioned in the national UGIS for park provision. For instance, the plan allocates 40%, 30% and 30% land use of the city for mixed use buildings, green spaces and road infrastructure respectively. Moreover, the plan recommended 15m^2 park per capita in the city. Although this structural plan of the city is a good guiding document than the previous master plans, the park quality parameters indicated in the plan are generic, and lacks a detailed specification to be applied for each park typology or park hierarchy such as city, sub-city, woreda/district and neighborhood parks. The structural plan also lacks the provision of artificial blue infrastructure such as rivers, lakes, ponds, fountains, swimming pool or streams. The city has also standard procedures for river bank protection, street park development and catchment protection.

6.2. Discussions

Studies mentioned that the availability or absence in policies, legislations, and guidelines have an important role in influencing the provision and management of UGI. For instance, the study conducted in the cities of African countries found out, the inadequacy, ad hoc provision and poor

management of components of UGI as a result of weak policy, legal and regulatory framework (Zakka et al. 2017). Similarly, the provision of components of UGI in Addis Ababa city has been taking place in the absence of UGI policy or adequate regulations (Abeje, 2007, Desta & Yeshitila, 2011; Girema, 2019). The only policies available in the country or at the municipal level are the 1995 Constitution of the Federal Democratic Republic of Ethiopia (FDRE, 1995), Environmental Protection Policy of 1997 (FDRE, 1997), Urban Planning Proclamation no. 574/2008c (FDRE, 2008), and Urban Development Policy of 2006 (Ministry of Federal Affairs, 2006). These policies contain only the general information on the importance of green spaces provision in urban centers of the country and the right of the citizens to have access to these spaces. From this, the study concludes that the absence in policy and the inadequacy of the legal formwork of UGI in the country is one of the limiting factors of UGI provision. In contrary to this finding, the studies undertaken by Chen et al. (2016) mentioned, the availability of a number of specific policies and guidelines that oversee UGI planning and management in western countries.

Various countries around the world incorporated the concept of UGI in their urban development policy and exercising in the urban landscape to realize its multi-functionality (Girma et al. 2019). However, in our country, there is no such kind of exercise and the concept of UGI is also not clearly defined and understood (Girma et al. 2019). The aforementioned policies of the country have not addressed the issue of UGI in terms of multi-functionality including its connectivity or networking. Moreover, the 2016 structural plan of Addis Ababa city did not define and clearly map out components of UGI and how it will operate as an interconnected system in the city. Although objectives, directives and strategic actions of each component of UGI were laid out, they were neither clearly defined as a structured, connected and continuous system, nor were their relationship with the urban fabric considered.

Moreover, the application of UPs standards has been argued as one of the approaches to ensure sufficient and accessible UPs in the cities (Byrneet et al. 2010). Planning standards are formulated to act as a general benchmark for quality, quantity and accessibility of a given recreation area in the urban centers. The available norms and standards in the municipality of Addis Ababa and the country were recently developed. For instance, the National UGIS of Ethiopia is developed in 2015 and stated several UGI provision standards. For instance, the recommended quantitative standard of recreational parks provision in urban centers of the country is $15m^2$ per person. The 2016 structural plan of Addis Ababa city also adopted similar standard for providing UPs. However, achieving this standard or the WHO ($9m^2$) standard in the current situation of Addis Ababa city is very difficult to the city administration. This is because the city has already exceeded its limits in constructing buildings before the standards was launched in 2015. Currently, the city is congested with the built up environment and there is no enough space to achieve accessible UPs based on the mentioned standards. Besides, pure quantitative standards without consideration of quality of UPs are not meaningful, especially when applied at the city scale (Ståhle, 2008).

Although the norms and standards of the 2016 structural plan of the city are a good guiding tools than the previous plans, the park quality parameters are generic and it lacks a detailed specification to be applied for each park typology or park hierarchy such as city, sub-city, woreda/district and neighborhood parks. This has also an effect on the future recreational park development in the city. The value of recreation parks increases with the presence of water feature such as ponds, artificial lakes, streams or rivers apart from other physical facilities and plant diversity. However, these UGI facilities are not included in the structural plan.

6.3. Conclusion

To summarize, this chapter of the study briefly examined the available policies or legal and organizational frameworks that directly or indirectly affect the planning and management of UGI in general and recreational parks in particular. The qualitative analysis of the organizational setup indicated, weak coordination among different concerned government institutions that involved in UGI development. Both horizontal and vertical coordination of the organizations are weak. Moreover, the city lacks UGI policy and different regulations that support the development of UGI. Although the norms and standards of UPs are developed at national and municipal level, they are generic and lacks a detailed specification to be applied for each park typology or park hierarchy such as city, sub-city, woreda/district and neighborhood parks. The structural plan of the city is not properly addressed the issues of UGI.

7. Constraints, Prospects, and Planning and Management Strategies of UGI

7.1. Introduction

As indicated in the previous chapters (chapter 4 & 5), there had been a rapid decrease of UGI land use in Addis Ababa city between the year 2003 and 2016. The available UGI such as recreational parks are also insufficient and inaccessible to the majority of city residents and different groups of the community in terms of proximity, time, transportation, and overall quality of UPs. There are a number of constraints that contributed to the degradation and inaccessibility of UGI in general and UPs in particular in the city. Based on the analysis of the previous three chapters, document review, expert interview and field observations this study identified the constraints behind the current states of UGI and discussed them in this part of the study.

Moreover, this chapter also addressed the final objective of the study, which is to develop the planning and management strategies for UGI in Addis Ababa city. More specifically, the planning and management strategies discussed in this chapter aims to provide useful information that can support urban planners, decision makers and the municipality of Addis Ababa city and beyond, so as to enhance and maintain accessible UGI within the city.

7.2. Constraints behind the Current State of Urban Green Infrastructure

7.2.1. The spatial constraints of urban green infrastructure

7.2.1.1.Expansion of built up area

Expansion of built up area is one of the driving factor for the depletion of UGI in the city. The analyses of the study indicated that there has been an increase in the percentage of built up land use from 2003 to 2016. This can be attributed to the rapid urbanization that takes place in Addis Ababa city over the past years. The city population was 1,423,111 in 1984, 2,738,248 in 2007 and

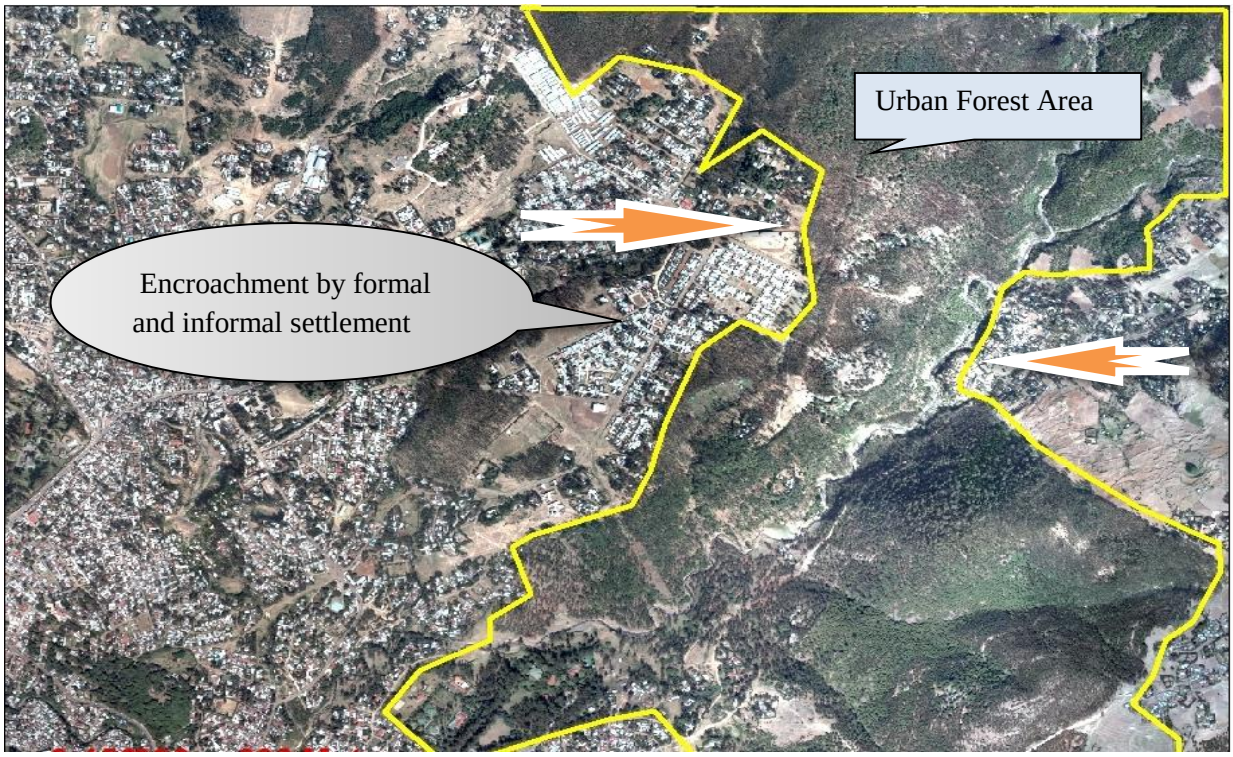
increased to 4,592,000 in 2019 (CSA 2019), and this confirming the high growth rate of urbanization. This high urbanization necessitates the provision of housing and different physical infrastructure to meet the needs of the increasing population in the city. Accordingly, the city administration has been constructing a 'social housing project' or 'condominium houses' by clearing green spaces and urban agricultural lands in the peripheral part of the city since 2004 (Fig 7.1).

Tulu Dimitu Site Koye Fech Site

Fig 7.1 Converted agricultural land to condominium apartments

The study conducted in the city indicated similar findings that more urban green spaces have been destroyed due to physical expansion of built-up areas (Dubbale et al. 2010). The findings of Mundia and Aniya (2005) in Nairobi, Kenya also indicated in per-urban area, forests were cleared for urban settlements. This result also supports the findings of many studies conducted in developed countries. For instance, the studies conducted in 274 metropolitan areas in the USA found the expansion of settlements to be the major factor that affected the availability of many green spaces (McDonald et al. 2010). Moreover, in addition to the expansion of formal settlement, informal settlement through land squatting has been contributing to the depletion of components

of UGI in Addis Ababa city. For instance, as illustrated in Fig 7.2, the land reserved for UPs and forest area was encroached by many informal settlements or urban sprawl.



Source: Google map

Fig 7.2 The encroachment of upper catchment forest of Addis Ababa by urban expansion

As mentioned above, the cause of built up area expansion in Addis Ababa city is rapid urbanization. This study conclude that rapid urbanization is the indirect driving factor for the depletion of UGI in the city. This rapid urbanization was partly attributed to the natural population growth and more of due to high migration from other parts of the country. As aforementioned, Addis Ababa is the capital of Ethiopia and this makes the city a nodal point to attract many settlers from all parts of the country and other countries as well. In support of this Tibbetts (2002) stated, developing countries have experienced high levels of movement of people from the countryside to cities and settlements of all sizes, but the most dramatic increase in populations is occurring in

'giant' cities, particularly in Africa and Asia. Thus, the Addis Ababa city administrations should do more work to manage this rapid urbanization.

7.2.1.2.Residential and population density

Residential and population density are also another driving factor for the depletion and inaccessibility of UGI in the study area. This study revealed that the densest part of the city, especially the inner sub-cities of Addis Ababa, such as Lideta and Addis Ketama have a small amount of UGI. There is also high population pressure on the existing UPs of these sub-cities. This indicated population density is another driving factor that affected the availability of different components of UGI in Addis Ababa city. Similar studies also frequently cited population density as a driver of decreasing in urban green spaces (Yuan et al. 2005; Tan & Samsudin, 2017).

Other studies reported urban growth with a high density of residential development has been recognized as a major factor that shaping the biosphere in the built up environment (Yuan et al. 2005; Teferi & Abraha, 2017). Bernstein's (1994) also found that unplanned urban densification has often destroyed green spaces and natural landscapes found in the cities of developing countries. However, such findings are not universal because some studies indicated that the dense inner city experienced higher green space. For instance, the study conducted in developed countries indicated increased housing density and streets have a positive influence on urban green spaces due to the presence of green lawns and trees in housing areas and along the streets (Dobbs et al. 2014).

7.2.2. Management challenges of urban green infrastructure development

7.2.2.1. Lack of proper planning and enforcement of planning regulations

Development controls, regulations or master plans are tools or mechanisms used in urban planning to guide the growth of cities and improve the quality of life of the residents (Makworo & Mireri, 2011). Thus, the proper planning of the green components such as UPs is very crucial to achieve

their accessibility. UPs to be accessible to all and effective as an adaptive measure, surface land area and/or surface built areas should be allocated in systematically planned and standardized way (Halik, 2003). However, this study investigated that lack of proper planning was the main challenges of UGI access in the city of Addis Ababa. The interview conducted with experts indicate that in Addis Ababa city, UPs and other green space development was an ad-hoc rather than strategic. The interview indicated that only left over space and hillsides are allocated for recreational parks without following formalized methodologies.

Moreover, having development plans, policy or regulation is not enough by itself; unless there is implementation or enforcement of these development controls. This study investigated that lack of implementation of UGI proposals were the main challenges of UGI access in the city. Almost all of the proposed UPs (273hr) in 2003 structural plan of the city were almost not implemented (Table 4.2). For instance, Adawa Park which was proposed in 2003 is not implemented yet (Fig 7.3). Through cross examination of the structural plan of the study area and the actual physical development that have taken place shows that areas demarcated on the structural plan as UPs were either non-existent or were converted into different land-uses. Similar studies conducted in Ghana, Kisumu also indicated that public parks and green spaces were found only in the city plan document, but not implemented on the ground (Collins, 2014). Thomas (2013), who conducted a study in Addis Ababa mentioned, lack of political will to implement the proposed parks as the main reason for the undersupply of UPs in the city. Expert interview also indicated, almost none of the master plans prepared at different periods have been effective, nor have they been ever been fully implemented.

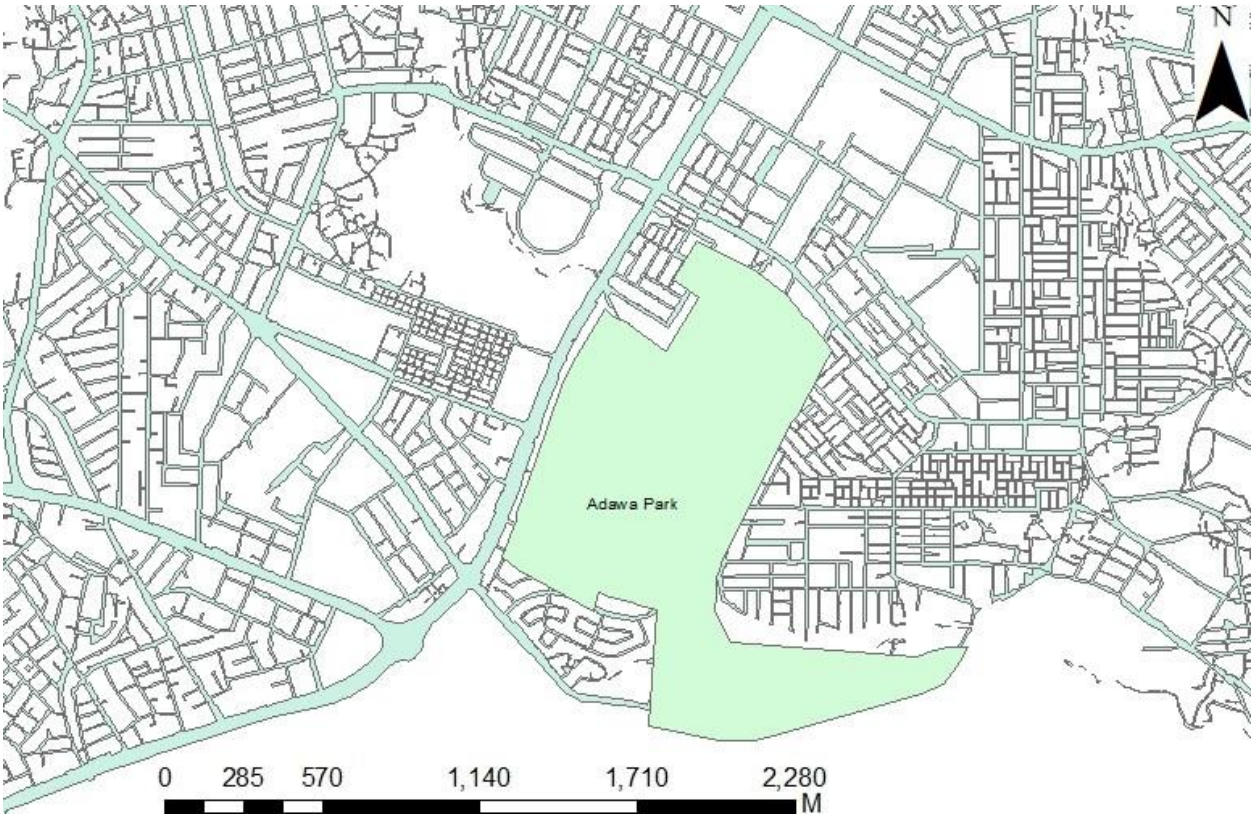


Fig 7.3 Adawa Park - proposed park in 2003 and not developed yet

The consequence of the weak enforcement of plans and regulations leads to the encroachment of most proposed river buffer strips by squatter and informal settlers. The same is true for other UGI components like urban parks, forests and urban agricultural lands. In support of this finding, studies indicated that a lack of political desire to enforce regulations (Lara-Valencia & García-Pérez, 2015); poor administration of planning processes at the local level; and a reluctance to make good planning decisions (Pincetl & Gearin, 2005) can all affect the provision and implementation of UGI. Officials of the AABPCDA conceded that enforcement of development controls by their outfits has been very weak due to challenges like political interferences, lack of manpower and financial constraints.

7.2.2.2. Lack of priority and attention

Lack of priority and attention that is given to UGI indicated as the other factor for the degradation and insufficient provision of accessible UGI in the cities (Collins, 2014). The study conducted in Nairobi city also mentioned that green spaces for recreation and environmental protection are given less priority in the development and spatial planning of the city (Makworo & Mireri, 2011). Similarly, in urban centers of Ethiopia especially in Addis Ababa, authorities did not give much attention and commit the needed funds for the development of components of UGI (Abeja, 2007; Thomas, 2013).

The main reason for lack of priority for UGI especially UPs development in the city may related to matters of poverty reduction. Addis Ababa city has gone through largely organic changes that have lacked a clearly defined urban patter and form. The city also characterized by lack of housing, poor social services and physical infrastructure such as road. Thus, the priority of the city authority is more on fulfilling these social services and gray infrastructure of the city than UGI development. Studies also indicated that matters of poverty reduction and provision of social amenities such as housing, roads, schools, hospitals, and pipe water constitute the top priorities of many African countries (Bolnick et al. 2006). Bolnick et al. (2006) also mentioned, in Africa more attention is given to the brown agenda than green agenda. However, this result is different from the study conducted in developed countries (Norway, Sweden, Denmark) that found the city authorities given more attention to green space development (Randrup & Persson's, 2009). This is because developed countries already satisfied their need of gray infrastructure and they equally value the importance of UGI with the gray infrastructure.

The other reason for lack of priority for UGI development may be related with lack of awareness about the importance of UGI for the city resident. Personal interview with experts indicated that

UGI is not considered as an important resource by the city authorities. This is also manifested by change in zoning of various categories of UGI that have already proposed on the structural plan of the city. Most sub-cities of Addis Ababa have changed some of the proposed park area or other UGI to various land uses like residential and mixed land uses by requesting a zoning change from the municipality. Moreover, during the revision of structural plan, plots unsuitable for building or other land use because of their shape or access have been left for UGI or UPs. This also shows how much the city authority ignores the importance of UPs or other UGI components for the city.

7.2.2.3. Lack of organizational coordination and integration

The role of organizational set up is important in ensuring UGI access and success. Studies indicated, the lack of organizational integration was an obstacle to coherent and efficient implementation of UGI at different levels of the city (Wiens et al. 2002). Similarly, weak coordination among different concerned government institutions is the other constraint of UGI development in Addis Ababa. The study investigated weak horizontal and vertical coordination among sectors of UGI. The interview with official confirmed that under the current structure of the city, the planning and implementation activities of UGI are undertaken in a fragmented way. Studies conducted in the city also revealed the same result. For instance, Kahsay (2016) indicated that concerned institutions have put duplicative efforts in managing the green spaces in Addis Ababa city. The same study also mentioned, conflicts of interests and overlapping of responsibilities was risen among the concerned organization of Addis Ababa city. The failure is resulted in weak coordination, mobilization of communities and resources in managing the green components. Similarly, the study conducted in Malaysia, Klang Valley showed that there is quite a number of municipal departments involving in green space development, such as Administrative Divisions, Park Divisions, City Cleansing and Control Divisions, and Agriculture and Horticulture

Divisions (Konijnendijk, 2003). The study indicated their responsibilities are also fragmented. However, the case studies conducted in Hanover (Germany), Curitiba (Brazil) and Zurich (Switzerland) cities produced results that were entirely different from the situation in Addis Ababa. The studies found strong and healthy coordination among the concerned organizations on green spaces with the resultant effect being comprehensive development of green spaces (Camorna et al. 2004).

In addition, lack of professional staffs due to a high staff turnover was also the other challenge of the concerned organization of Addis Ababa city especially in BPCDA. This affected the institutional capacity of the agency to cover the whole city and achieve all its responsibilities. Moreover, the institutional problem was more aggravated by the poor financial allocation for the concerned government institutions. Studies also indicated, the city authorities did not give much attention and commit the needed funds for the development of components of UGI in Addis Ababa (Abeja, 2007; Thomas, 2013).

7.2.2.4. Lack of community and different stakeholder involvement

Involving community and different stakeholders in UGI planning and management become an important way of enhancing UGI in the cities (Dunnett et al. 2002; Mell, 2013). More ideas and perspectives can be generated if a wide range of community and stakeholders become involved, while they can also generate alternative funding opportunities for the enhancement of urban greening efforts (Dunnett et al. 2002). Moreover, community involvement is becoming a mainstream activity in many developed countries. However, in cities of developing countries like Ethiopia, the involvement of different stakeholders in UGI planning, provision and management is very weak. It is also another organizational challenge of UGI in Addis Ababa city as well. Expert interview and the reviewed literature confirmed, the weak involvement of different stakeholders

such as the community, private sectors and NGOs in the urban greening process. For instance, Desta & Yeshitila (2011) in their evaluation of the implementation of 2003-2010 development plan of the city mentioned, the lack of community involvement in UGI development. Thomas (2013) also indicated, the lack of community participation has contributed to the weak progress in recreation parks and other green space development in the Addis Ababa city.

Many factors can be raised for the lack of community involvement in UGI development. Lack of dedication by the city authority to involve the community and other stakeholders in the decision making process was one of the limiting factors. Studies also indicated, the city residents considered as passive participants by the city authorities. For instance, Selman's (2004) mentioned that local communities are treated as passive participants in landscape management of many developing countries, and many decisions are made without the involvement of the community. However, the study conducted in Scandinavian cities indicated, community involvement in the planning and management of green spaces had enhanced the quality of green spaces (Beer & Jorgensen, 2003). The second reason was uncooperative attitudes of the general public towards the development and management of these spaces. The key informants mentioned that the level of commitment of the community in developing or preserving green space was very poor, and causing serious threats to the available green components. The community thinks that, it is the responsibilities of the city authority to preserve and develop UGI components. This resulted in the destruction of upper forest and green space by the community for fuel, informal housing and commercial purpose. Hammond (2011) also indicated, the uncooperative attitudes of the general public towards the development and protection of green spaces.

7.2.3. The influence of policy and legal framework

As already mentioned in the previous chapter section 6.2, the availability or absence in policies, legislations, and guidelines have an important role in influencing the provision and management of UGI. This study also identified the absence in policy and the inadequacy of the legal formwork of UGI in the country as well as in the municipality of Addis Ababa. Although the norms and standards of UPs are recently developed at national and municipal level, they are generic and lacks a detailed specification to be applied for each park typology or park hierarchy such as city, sub-city, woreda/district and neighborhood parks. In general, UGI in the city is not properly planned and addressed due to absence of planning tool and standards for several years. These policy related problems are also the major constraints behind the current state of UGI in the city of Addis Ababa.

7.3. Planning and Management Strategies

Four key broad planning and management strategies were developed to address the constraints and problems of UGI in general and UPs in particular in Addis Ababa city and beyond. These include; address the spatial problems of UGI, consider the socioeconomic context, revisit the policy and planning regulation, and improve UGI management system. These strategies offer a variety of suggestions that can be used to enhance the availability, accessibility and quality of UGI in the study area and beyond. Moreover, it also provides a good lesson for other emerging cities and towns of Ethiopia.

7.3.1. Address the spatial problems of urban green infrastructure

UGI in Addis Ababa city is currently in precarious condition. It is degraded and fragmented. The available recreational UGI is insufficient and inaccessible for the majority of the city dwellers. The assessment of UPs access indicated that the availability, proximity, and quality (facilities,

attractiveness, cleanness and safety) of UPs are very poor. To address these problems, the following strategies have been devised:

7.3.1.1. Protect encroachment on the existing components of UGI

Components of UGI in Addis Ababa city are destroyed at an alarming rate. The result of this study indicated the land use of UGI from 2003 to 2016 is decreased by 22.4%. Encroachment of UGI by built up areas such as formal/informal housing development, and infrastructure expansion as well as building density were the major constraints. Thus, to minimize the encroachment and enhance UGI in the city this study proposed two major strategies.

Application of the concept of green infrastructure networking*:* As indicated in previous sections, the structural plan of Addis Ababa city categorized UGI into four major components such as; urban forest, riverside green, UPs, and agriculture lands. Again UPs further subdivided into four; (i) city Park, (ii) sub-city parks, (ii) woreda/district parks, and (iv) neighborhood parks. These components of UGI were not interconnected and evenly distributed in the city. They are fragmented and planned without consideration of their connectivity (Fig 4.1). Studies indicated that green space connectivity is increasingly considered as a suitable approach to improve the ecological value of urban green components and urban environment, and reduce the distraction and fragmentation of green spaces (Conine et al. 2004; Hepcan et al. 2009).

Besides, interconnecting components of UGI in the entire landscape of the city would enable to generate substantial ecosystem service such as shade, regulation of air temperature and air pollution, and improve aesthetic values for the urban communities. Thus, the connectivity of components of UGI across the entire landscape of the city is recommended as one strategy to reduce the destruction of UGI and maintain a sustainable urban environment (Davies et al. 2006). Expert interview also reported that a broader network of green space in the city is required for both

ecological and social benefits. The interconnectedness will be ensured through creating spatial integration of urban green corridors or road network and riverside greens or riparian corridors (stream, lake, rivers) with other components of UGI such as urban forest, urban agriculture, UPs and other green areas in the built up environment.

Enforcing the development controls and regulations: Lack of the enforcement of policies, and existing urban planning regulation and laws was the main problems that resulted in the encroachment of UGI in the city. For instance, many of the proposed UPs (273ha) and forest land uses in the structural plan of 2003 were not implemented. These proposed areas were encroached by informal or formal settlements, and other infrastructure developments. Thus, the city administration can control this problem by properly enforcing the exiting urban planning regulations and laws of the city (For instance, implementing building code & apply 70/30 policy). This strategy was highly recommended by the officials and experts of UGI planning and management of the city. The implementation of proposed UGI will also help in reducing the encroachment.

7.3.1.2. Improve the accessibility of recreational parks

In Addis Ababa, the available UGI such as recreational parks are insufficient and not accessible to the majority of city residents. The per capita UPs of the city found to be 0.37m^2, which is far below the minimum standard set by Ethiopia UGIS (15m^2), WHO (9m^2) and African green index (7m^2). Moreover, the majority of the city population has no access to existing parks within the minimum walking distance that individuals are willing to walk. Lack of maintenance and the uncleanness of UPs are other problems. These problems were found to be underpinned by unavailability and uneven distribution of UPs due to inadequate provision of these recreational facilities during the past decades. The city needs more additional recreational park acreage (6718.1ha) to fulfill the

current need of the city residents (Fig 4.7). Thus, the particular strategy that could be implemented to improve park access in the city is providing small to large size UPs at different scales of the city. Studies also indicated that the accessibility of green space can be expanded in the city by building more accessible small-to-medium sized green space (Jim, 2004; Tabassum & Sharmin, 2013). This strategy corroborated by the professional experts from AABPCDAA, AAIDPO, and AAEPGDC. The city administration should also enhance the quality of UPs, and improve transportation service and infrastructure so as to improve park accessibility. These strategies are elaborated in detail as follows.

A) Increase the availability of urban parks

Implementing the planned UPs: Lack of implementation of proposed UGI of the last three revised structural plans (1986, 2003 & 2016 plans) was the main challenge of UGI access in the city. For instance, many of the proposed UPs (273ha) and forest land in the structural plan of 2003 were not implemented. The 2016 structural plan of the city allocated 825ha of land for UPs development, but yet they remain undeveloped on the ground (Table 4.2). As mentioned in pervious section, a typical example of such reserved space is Adawa Park (112.3ha) in Bole sub-city which was proposed in 2003 and not developed yet (Fig 7.3). Thus, one of the options that can help to enhance the availability of UPs in Addis Ababa city is developing UPs on these lands that have already been proposed for UPs developments.

Developing pocket or small parks in the densest part of the city: This study disclosed that the densest and the oldest sub cities (Lideta, Kirkos, and Arada) of Addis Ababa have less amounts of UGI and recreational parks. In these sub-cities the provision of large parks might be difficult because of the scarcity of land. Thus, in such parts of the city pocket/small parks are one option for enhancing park access. Although pocket parks might be too small for physical activities, they

can meet a variety of social needs and functions, including small event space, children's playground, and spaces for relaxation. Spaces like vacant building lots, small and irregular pieces of land, unused areas, and abandoned spaces are appropriate for converting into small parks. Providing small to medium size parks in the renewal parts of these sub-cities can also be another solution to minimize the high demand of recreational parks.

Establishing parks in the expansion areas of the city: Developing UPs in housing expansion areas such as condominium housing and real estate development sites of the city is another alternative to enhance access to recreational parks. Addis Ababa city is expanding and rapidly urbanizing in the last three decades. This high growth rate of urbanization necessitates the provision of housing to meet the need of the increasing population in the city. Accordingly, the city administration has been constructing a vast social housing projects or condominium houses in different parts of the city since 2004. Until recently, the city constructed more than 200,000 condominium houses and transferred to beneficiaries (AIHDP, 2019). Even though, the provision of small parks or green areas recommend in the integrated housing development policy document almost all condominium sites have no well-established green space and parks. Thus, the city administration should take these areas into consideration for establishing small parks, playgrounds, and other greenery.

Promoting UPs and green areas in residential and commercial premises of real estate development sites is another option for increasing UPs accessibility. It is a recognized fact that the real estate development sector is highly contributing in alleviating the housing need in Addis Ababa city. Most of these real estate companies are carrying out their development projects in vast parts of the city. And it is a good opportunity that these housing companies have kept some provisions for green areas like small parks in the residential areas, and commercial premises. In this context, the city administration can also enforce some regulations for the housing and real-estate development

companies that every company must have to allocate some amount of land for small parks and green areas.

Encourage other greening options (Rooftop gardens and vertical greening): As indicated in different part of this study, land is the scarce resource in Addis Ababa city. Specially, the value of land in the inner and oldest sub-cities is very high. In these sub-cities the provision of park is very hard because of the absence of space due to building density. Currently, multistory building structures are increasing in this part and other areas of the city. With the booming of these multistory buildings, the application of rooftop and vertical greening technology could have a major impact on the city's environment. Therefore, the residents or owners of the multistoried buildings can take a simple and easy initiative to make all roof tops green by planting different trees such as fruit, trees, vegetables, ...etc. Studies also indicated that when space is scarce to provide UPs or green spaces in the city, other greening strategies such as rooftop gardens and vertical green infrastructure are put forward as an option for greening the urban environment (Jim, 2013; Tan et al. 2013).

Rooftop gardens are man-made green spaces on the topmost of industrial, commercial, and residential building structures. Rooftop gardens (Fig 7.4) and vertical greening (Fig 7.5) can add another dimension of green space to urban landscape without taking up an extensive area of land in densely populated places. Developing the gardens on the rooftops of buildings can fulfill different functions such as cooling the air, food production like fresh fruit and vegetable, amenity, and biodiversity conservation (Ishimatsu & Ito, 2013; Tan et al., 2013). Moreover, it will create a nice environment in the area that would give residents much pleasure and also improve living quality and contribute to a city’s greening (Tan et al. 2013).

Fig 7.4 Rooftop gardens

Fig 7.5 Vertical green infrastructure

These greening technologies are new to our country and Addis Ababa city as well. Thus, the city authority should take initiatives by arising the awareness of the community to develop rooftop gardening and vertical greening. Some regulations are also needed to enforce rooftop garden and vertical greening. For instance, in Switzerland and some European countries, bylaws have been approved that new buildings must be designed to relocate the green space covered by the building to their roofs.

Replicating the ongoing river buffer park development project along other rivers: As indicated in the finding section, Addis Ababa city has 7 major and 6 medium rivers which are fed by 75 small streams (Fig 4.2). The city allocated 1144ha (2.2%) and 4026.5ha (7.7 %) of land along these riverside for green or park development in the structural plan of 2003 & 2016 respectively (Table 4.1). However, these proposed riverside greens were not implemented. All riverside buffer strips are highly abused and occupied by squatters and informal settlers. They are increasingly choking with uncollected garbage, solid waste from households, and industrial waste in the form of liquid effluence, agro-chemicals, petrochemicals and metals.

Recently (in 2019), with the initiation of his Excellency P.M. Abiy Ahmed, Addis Ababa city administration started Riverside Park Development Project also called Beautifying Sheger project (Fig 6.3). According to the project office, the project covers 54km along waterway/stream from Entoto to Akaki waste water treatment plant. The construction of this project is underway by the Chinese company and recently the project completed two parks (Sheger Park and Entoto Park) and opened for services (Fig 6.3). If this grand project is finalized, it will increase the recreational park coverage of the city by some amount. Thus, replicating such kind of projects to other rivers of the city is very crucial to increase recreational parks in the city. Moreover, expanding recreational parks along riversides of the city will achieve several additional goals. It will prevent water and air pollution, illegal urban expansion and reduce slums along the river buffers. It will also reduce flooding, which have been threatening the illegal slum dwellers and homeless families along these rivers for decades. Moreover, the development of these riverside greens will increase the connectivity of components of UGI of the inner city with the peripheral part of Addis Ababa.

Fig 7.6 Addis Ababa city riverside park development project

B) Enhance the quality of urban parks

UPs need to be designed and maintained high quality standards to increase the accessibility of the residents to the recreational opportunities (Baycant-Levent & Nijkamp, 2009). From this point of view, this study investigated the quality of UPs of Addis Ababa city based on different parameters. The overall assessment indicated the city parks have poor quality. The supply of various facilities in the parks was inadequate. The parks lack very important facilities such as playgrounds, sport facilities for all ages, lighting, sufficient parking lots and cycling paths. This was observed in

almost all the parks of the city and thus, this study suggested the installation of the aforementioned facilities and other amenities such as cafeteria, children play equipment, more sitting places, sign spots, and shelters or shades in all parks of the city. The incorporation of these diversified facilities and amenities can raise the quality of UPs and make them more attractive and accessible. Efforts must also be made to ensure attractive UPs through the introduction of different programs, festivals and activities.

Apart from park facilities, the value of recreation parks increases with the presence of blue infrastructure such as artificial lake, pond, fountain, and rivers or streams. Most green areas in cities of developed countries such as European cities have such kind of blue infrastructure. For instance, Fig 8.4 illustrated the artificial lakes and rivers in the garden of Hannover city, Germany, which were captured by the author during his short term research visit in Leibniz University, Hannover. Such kind of water or blue structures are essential for cities in many ways and they are key elements in shaping the urban landscape. Thus, the Addis Ababa city authority should take a lesson from Hannover City's experience and develop artificial blue infrastructure which may not be very costly wherever practicable to increase the attractiveness of the city.

Moreover, regular maintenance of park facilities and service has been recommended by many scholars to enhance the accessibility of UPs (Dunnett et al. 2002; Baycant-Levent & Nijkamp, 2009). Such maintenance works range from fixing damaged facilities to replacing the new facilities to augment the existing ones. This study investigated the widespread of broken down facilities (chairs, sign spots, sheds and etc...) on several parks of the city that demand urgent maintenance works (Fig 5.1). In terms of cleanses, there were a poor refuse collection, lack of dustbins, and inadequate and unclean toilets. In general the city parks were not well maintained, cleaned and managed. Thus, to realize accessible UPs in the city, a number of interventions are required. At

the most operational level, park administrators should deal with all types of facility maintenance in the parks. Aside to maintenance, park administrators should engage in routine cleaning of wastes, and installation of dustbins and waste disposal equipment in all UPs of the city.

Artificial lakes in Hannover city

Artificial Rivers in Hannover (left) and Amsterdam city (right)

Source: *captured by the author during his short term research visit in Hannover, Germany*

Fig 7.7 Artificial lakes and rivers in the garden of Hannover city, Germany, & Amsterdam, Holland

C) Improve the transportation service and infrastructure

This study investigated that lack of transportation service and infrastructure can be a barrier to access UPs in Addis Ababa city. The study identified as the distance between home and UPs increase, the travel mode of users gradually changes from walking to driving and public transportation, and the frequency of park utilization also decrease with a change in mode of transport. This is due to the inconvenience of the transportation system and the cost of public and private transportation. Therefore, good public transportation system and enough parking lots in the park could attract more park users from distant part of the city. In addition, a convenient walking and cycling road network that connecting UPs with neighboring residential areas are essential to enable city residents use UPs more often. Introducing or encouraging cycling for transportation to recreational areas and elsewhere has also many benefits for the city residents.

7.3.2. Consider the socioeconomic and demographic context

7.3.2.1. Increase public awareness and understanding

The result of this study indicated that a number of surveyed park users had less awareness of the location of UPs in the city and what the UPs had to offer. Moreover, many people who resided around and near the surveyed parks were not visiting the park due to lack of information about the benefit of visiting the parks. This indicates knowledge dissemination was the major challenges of UPs access in Addis Ababa city. There is a lack of promotion and publicizing the existing parks, available programs and health benefits of the parks in the city. This makes the public and visitors to have little information about UPs, which negatively affect access to such places. Thus, awareness creation about the benefit, location, and available programs in the parks is very essential to enhance park utilization. A study conducted in Cleveland, Ohio also confirmed that improved park promotion encourages park use (Scott & Jackson, 1996).

The available UPs and their location in the city of Addis Ababa will continue to be promoted extensively. More services, programs and activities that will attract different groups of the community must be provided and communicated (Cohen et al., 2010). There is also a need to continue to spread public awareness about UPs and other green spaces benefits. This should include explaining the potential contribution of UPs in improving health and the well-being of the city and wider community. This can be achieved through workshops, seminars, the city website, information signs at each UPs, a monthly newsletter, the provision of free site leaflets and social media. Personal interview also confirmed the necessity of media campaigns and improved signage to increase awareness and attract more visitors to UPs. As an example, a recent inauguration and advert on TVs, local newspapers, and different social media about the newly opened parks such as Unity Park/Anedent Park/ in the national palace, Sheger Park and Enetoto Park are attracting a number of visitors from the city and around the country.

7.3.2.2.Considering the need of different socioeconomic groups

Park provision strategies mentioned in previous sections, by themselves may not increase access to UPs in the city of Addis Ababa. This study disclosed the variation in frequency of park access among socio-demographic groups such as age, income and occupation. Females, old/senior age, uneducated and very low-income groups were the least and infrequent park users in the study area. The need of the community to utilize UPs varies across these socioeconomic and demographic background and caused variation in the frequency of park access. Studies have also shown that access to and use of green spaces differ among socioeconomic, cultural and demographic groups (Barbosa et al. 2007; Kabisch & Haase, 2013). This disproportional access to green space results in an environmental justice issue (Smiley et al. 2016). Therefore, the study recommends a more site-specific approach that builds on a thorough analysis of a neighborhood type, its population,

and the need of different socio-demographic group, before deciding on a viable strategy to increase UPs. In other word, a more active use of population demographics, living conditions and background of the residents of the city could be helpful when planning, designing and providing recreational spaces. Lack of socially inclusive design and provision may result in an UPs that does not meet the desires of different sectors of the urban community well, thus increasing social equalities is very crucial. All parks should be designed and provided inclusively in a way that considers equal access for all people-people with and without disabilities, people of all age groups, and people of all socioeconomic backgrounds (MoUDH 2015; McGee 2017).

7.3.2.3.Improve park security

Security is a major determinant factor that can affect access to parks and the satisfaction of visitors. In order to encourage the city dwellers to access and make full use of the parks, parks should ensure the safety and security of their visitors. Concerns about various factors related to safety may inhibit the use of UPs, which may lead potential users to avoid green spaces altogether or seek other green spaces (Weiss et al., 2010). A number of users and the residents surrounding the study parks were concerned about visiting these spaces alone, or with young children. Thus, improving security and encouraging a guard presence in the UPs of the city was suggested in order to promote more use. Brighter lighting, increasing guards, effective vegetation management to increase sight lines, and promoting activity in sparsely used areas are some important ways that personal safety in the park settings can be increased (Schroeder & Anderson, 1984). Moreover, the UPs should be equipped with monitoring systems, such as security guards and if possible CCTVs, to give physical and psychological comfort to the users.

7.3.3. Revisit policies and planning regulations

7.3.3.1.Formulate a sound green infrastructure policy

The policy of urban greening has greater impact on the UGI availability and accessibility. Without policy and its enforcement, UGI development can hardly be achieved. The study also identified the absence of UGI policy and adequate regulation at national and municipal level. The absence in UGI policy contributed to the current states of UGI in the city of Addis Ababa. Thus, for the effectiveness of efforts to provide and manage UGI in cites of the country a sound policy and additional legislative required at national level. Moreover, UGI planning policies need to be developed at municipal level in order to satisfy the local needs and contribute to the achievement of broader sustainability objectives. It is through sound policy that sustainable and environmentally conducive city can be achieved.

Moreover, various countries around the world incorporated the concept of UGI in their urban policy and exercising in the urban landscape to realize its multi-functionality (Lafortezza et al. 2013; Pauleit et al. 2017; Girema, 2019). However, in our country, there is no such kind of exercise and the concept of UGI is also not clearly defined and understood. Various urban and environmental policies of the country have not addressed the issue of UGI in terms of multi-functionality including its connectivity or networking. Moreover, the 2016 structural plan of the city did not define and clearly map out components of UGI and how it will operate as an interconnected system. Although objectives, directives and strategic actions of each component of UGI were laid out, they were neither clearly defined as a structured, connected and continuous system, nor were their relationship with the urban fabric considered. Thus, as a policy statement the emphasis should be given to the multi-functionality of UGI. For instance, the establishment of interconnected components of UGI in urban areas should be decreed as one of the policy

objectives. The policy should include departments/agencies that should be involved in decision making regarding UGI development and management and the roles, codes and regulations that need to be updated to incorporate UGI. UGI objectives, directives and strategic actions should be laid out, and it should be clearly defined as a structured, connected and continuous system within the urban fabric.

7.3.3.2. Revise the planning and design standards

The application of UPs standards has been argued as one of the approaches to ensure sufficient and accessible UPs in the cities (Byrne & Sipe, 2010). Planning standards are formulated to act as a general benchmark for quality, quantity and accessibility of a given recreation area in the urban centers. The 2015 National UGI standard of Ethiopia stated several UGI provision standards. For instance, the recommended quantitative standard of recreational parks provision in urban centers of the country is $15m^2$ per person. Addis Ababa city also adopted similar standard for providing UPs. However, achieving this standard or the WHO ($9m^2$) standard in the current situation of Addis Ababa city is very difficult to the city administration. This is because the city has already exceeds its limits in constructing buildings before the standards was launched in 2015. Currently, the city is congested with the built up environment and there is no enough space to achieve accessible UPs based on the mentioned standards. Thus, the city administration should improve this quantitative standard based on the density and existing situation of the city. This study suggests the WHO average park per capita standard ($7m^2$ per person) that recommended for African cities. Moreover, recommendations for standards of UPs and other green space are already available in different countries, for example, in the U.K. (Natural England, 2010) that could be used as a model.

Besides the quantitative standards, devising quality standard is also needed. Pure quantitative standards without consideration of access and quality of UPs are not meaningful, especially when

applied at the city scale (Ståhle, 2008). As the analysis of this study shows, lack of different facilities in the UPs of Addis Ababa city has led to poor quality and less accessibility. The park quality parameters are also not clearly included in the 2016 structural plan and other urban policies of the city. Therefore, the quality standards such as the type of facilities and amenities for each hierarchy of UPs (from neighborhood to city parks) should be formulated. The quality standard should also consider the fitness of the facilities for the intended purpose, the hierarchy/typology of the parks, the appropriateness of the designs, the flexibility to the users, and the overall long-term sustainable use of the parks.

Moreover, it is desirable that the planning authorities of the city should develop specific local standards for parks or green areas in housing expansion areas such as condominium and real estate development sites, and non-housing developments sites, such as industrial and commercial development areas. For instance, the planning authority can mandate condominium or real estate projects to allocate 7% of their total area for parks and the minimum street width of 30 feet to include street landscape.

7.3.4. Improve the management system

Absence of participatory planning approach and lack of integration, weak involvement of different stakeholders, lack of follow up and monitoring activities, absence of priority and ignorance of the importance of UGI and lack of human and financial resources were the other management challenges of UGI in the city of Addis Ababa. Thus, the following strategies are recommended to solve these challenges.

7.3.4.1.Cross-sectorial planning approaches and integration of activities

In order to create a better green environment and multi-functional UGI in Addis Ababa city, increased cross-sectorial integration is needed. Studies indicated, the lack of integration was an

obstacle for coherent and efficient implementation of UGI at different levels of a city (Wiens et al., 2002). Similarly, there is a lack of integration and coordination among sectors of UGI in Addis Ababa city. Under the current structure of the city, the planning and management activities of UGI are fragmented. There is also duplication of activities among the sectors.

As studies indicate, conserving and providing UGI requires a multi-sector and cross-sector approach (Wiens et al., 2002). UGI development concerns the whole, each level of the organization and their interrelations, and the actions at one level affects the other. Thus, the challenge of UGI can only be successfully tackled, if the institutional fragmentation of UGI planning and provision is overcome in the city of Addis Ababa. This can be achieved through cross-sectorial panning approach and integration of activities. The cross-sectorial integration should undertake among the major concerned sectors of the city such as AAEPGDC, AAFUAC, BPCDAA, and RGDP. The sectorial integration approach should also incorporate the most relevant institutions like Land Administration Agency (LAA), Road and Transport Authority, and Urban Planning Agency of the city. Moreover, top-down (Municipality to woreda/district level) integration approach is also very crucial to share responsibilities. Conducive policy framework for integrating the sectors is very essential as well.

7.3.4.2. Enhance monitoring and follow up activities

The absence of regular follow-ups and protective measures to maintain UGI in the city of Addis Ababa were the major challenges. The study recommends that the city administration should regularly follow and monitor UPs to know whether they are giving the intended services or not, whether they are damaged or not, and …etc. The same is true for other components of UGI such as urban forest, urban agriculture and riverside green. Urban forest and other components should be monitored regularly to control the encroachment by commercial and formal or informal

housing. It is highly recommended that government should follow up and take measures on informal housing developers that encroach the upper forest of the city.

Moreover, with the initiation of his Excellency P.M. Dr. Abiy Ahemed many trees and green plants were planted within the urban centers and across the country since 2019. Different government, NGOs, and private institutions as well as the wider communities were involved in tree planting. Similarly, in Addis Ababa city, in millions of trees were planted along the road corridors, pocket lands and peripheral parts of the city. This initiative will have a great impact on the accessibility of green space and overall ecosystem service in the city of Addis Ababa. However, learning from the experience of the past programs, it is worth pointing out that tree planting is just the beginning, not the end of the urban greening process. There has to be monitoring and follow up mechanism that cares the planted trees. As I have observed, these planted trees are not properly managed and it's destroying. The management system was also not in place. Thus, this study strongly recommend that the government should prepare a management plan. In addition, it would be good to bring the residents of the city into the monitoring and management role of the current greening program. One promising way to do this is to give responsibility of planting and managing trees for each neighborhoods in the urban areas or each Kebles in the rural areas. Moreover, providing incentives for the neighborhoods or Kebles is also another management option.

7.3.4.3.Create collaboration with community and other stakeholders

Collaboration is becoming an important way of UGI planning and management. More ideas and perspectives can be generated if a wide range of actors and stakeholders become involved, while they can also generate alternative funding opportunities for the enhancement of urban greening efforts. Community involvement is becoming a mainstream activity in many developed countries (Healey, 2006). However, in Addis Ababa and other cities of Ethiopia the involvement of different

stakeholders in UGI planning, provision and management is very weak. Expert interview also confirmed the weak involvement of different stakeholders such as the community, private sectors and NGOs in the urban greening process. Thus, the collaboration of the city authorities with these parties as emphasized by the concept of collaborative governance (Healey, 2006) can help the realization of accessible UGI in the city.

Moreover, engaging in dialogue and sharing information with different stakeholders about UGI planning and recreational areas provides public authorities with access to experience, knowledge, opinions, and expertise within the community. It is also an opportunity to educate the public about issues, priorities and constraints of urban greening. This effort will help in changing the behavior of the local community towards the development and protection of UGI components. Efficient, well-informed planning and management can help to improve recreational areas and meet users' needs. Moreover, the interviewed authorities in this study indicated a lack of financial resources as a major problem for urban greening. Thus, collaboration with the community and other stakeholders can also solve this financial limitation faced by the city administration.

7.3.4.4. Create awareness among policy makers

As already mentioned, lack of attention and poor management of UGI were the major causes for poor maintenance and deterioration of green components in Addis Ababa city. Most decision makers of the city are politically appointed and they had no 'know-how' about the importance of UGI and recreational areas for sustainable city development. Urban development for such kind of decision makers mean only fulfilling the social services (housing, schools, health centers and …etc.) and gray infrastructure of the city by ignoring green infrastructure. This was the biggest challenge of UGI development in the city for the last decades. Thus, awareness needs to be raised among policy makers (top-managers and employees) about the benefits of UGI and its vital role

in creating sustainable urban environment. They need to be trained to think creatively in introducing new methods of urban greening. Continuous advice and training must be provided for all decision makers on how to improve greening projects, policies, action plans, implementation, management, maintenance and monitoring of UGI.

8. Conclusions and Future Studies

The previous chapters (chapter 4, 5, 6 & 7) presented various findings and discussions on the status of UGI, the spatial and perceived accessibility of UGI, several constraints that contributed to the current states of UGI as well as the planning and management strategies of UGI. This chapter continues with a brief summary or conclusions of the main points of the dissertation in line with the research questions raised in chapter one. Finally, the chapter ends with the contribution of the study and a brief list of future research.

8.1. Conclusions

Ethiopia, like most developing countries all over the world has becoming increasingly urbanizing. UGI are important settings for improving the quality of urban life. However, with the continuation of urbanization, providing UGI in the major cities of the country became difficult. Development of UGI remains a major challenge of the capital city Addis Ababa as well. Many studies have been conducted on the constraints underpinning the undersupply and inaccessibility of UGI in cities of developed countries. Contrary to this, similar studies in rapidly urbanizing cities of Africa like Addis Ababa are scant. The aim of this study is to fill this gap, by examining the status, accessibility and various constraints of UGI in general UPs in particular in Addis Ababa city, Ethiopia. Moreover, by intensively explore all possible constraints of UGI, the study evolve possible policy direction and strategies that help to improve and maintain UGI in the cities. Overall, this study provided important findings that show the status, accessibility and different constraints behind the current state of UGI, which have seldom been assessed before in Addis Ababa city. Thus, this study yielded the following important findings;

First, the study assessed the status and trend of UGI components in Addis Ababa city by examining the land use condition of the city from 2003 to 2016 based on the structural plans of the city. The

result on the citywide analysis during these periods shows a complex picture. The finding clearly depicted that there had been a rapid decrease in the land use of UGI and at the same time increase in built up area in the city. In 2003, the land use of UGI covered 20956ha (40.3%) of the city area. This has, however reduced to 16262.8ha in 2016 representing 31.1% of the total land use of the city. When we look at the change in land use of UGI, about 4693.2ha (22.4%) had been decreased or converted to other land uses. From components of UGI, the land use of urban agriculture decreased significantly (by 86.1%) followed by urban forest (by 15.3%).

Second, the spatial accessibility analysis of this study revealed that the city residents have no sufficient recreational UGI access based on per capita green index, proximity indicator and park quality parameters. The city's park per capita was very small ($0.37m^2$) compared with Ethiopian UGIS ($15m^2$), WHO ($9m^2$) or African Green index ($7m^2$). In addition, the proximity analysis also showed, the majority of the city population has no access to existing parks within the minimum walking distance that individuals are willing to walk. Most of the city residents are disadvantaged and forced to walk more than 400m (97.2%) and 800m (88.7%) distance to use UPs. Moreover, the proximity analysis revealed that the population in the outlying big sub-cities of Addis Ababa, such as Akaki Kality, Nifas Silek and Bole are the most disadvantaged in access to UPs. Even though, the central sub-cities such as Lideta, Kirkos and Arada have better access to UPs, park congestion was more observed in these parts of the city. These results indicate, there is high demand of recreational UGI in the city. Thus, to fulfill this demand the city administration should provide 6718.1ha of UPs based on the national UGI standard.

Third, apart from looking at the spatial perspectives of UGI accessibility, this study also addressed access to and utilization pattern of available UPs from park user's perspectives so as to identify factors that determine their level of utilization. Overall, the study provided important findings

about the use pattern of UPs by different groups of the city residents; and how socioeconomic, demographic and personal characteristics of park users, physical factors and park quality influence park accessibility in the study area. This finding indicated that socioeconomic and demographic characteristics of park users such as age, income, and occupation were important predictors (significant at P<0.5%), and limiting factors for accessing UPs in the study area. The available UPs are not accessible to females, old/senior groups, less educated, low-income groups and private or NGO employees. This showed the available UPs are not inclusive and equitable for different groups of the community. The descriptive statistics indicated limited activities/program in the park, and personal constraints such as lack of time and interest have an effect on the perception of the community to access the parks. Lack of information about the available parks, their location and programs in the park of the city is also the major factor that determine UPs access. Moreover, physical factors such as distance, time to reach UPs, and mode of transport were important predicators and limiting factors of access to UPs in the study area.

Fourth, this research also examined the accessibility of available UPs of the city in terms of their quality. The quality parameters used in the study were the availability of facilities, maintenance, cleanness, and safety/security. The overall assessment indicated that the city parks have poor quality. The results of park audits showed, the supply of various facilities in the parks of Addis Ababa was inadequate. There were few facilities in all parks such as sitting places, signs, walking path, toilets, and shelters. On other hand, the available parks lack very important facilities such as play grounds and sport facilities for all age group, water features (artificial lake, ponds or streams), lighting, parking lots and cycling paths. The general sanitation with poor refuse collection, and inadequacy in maintenance and management of the parks. This was prevalent in almost all the

parks of the city. This result suggests that quality of UPs (i.e. maintenance and cleanliness) was associated with frequency of park access and is important limiting factor for the city population. Fifth, as indicated above, there had been a rapid conversion and destruction of the land use of UGI in Addis Ababa city between the year 2003 and 2016. The available UGI such as recreational parks are also insufficient and inaccessible for the majority of city residents and different groups of the community in terms of size, proximity, time, transportation, and overall quality of recreational parks. There are a number of factors that contributed to the aforementioned problems of UGI in the city. Some of the major constraints behind the current state of UGI include; the expansion of built up area (by formal and informal housing, road network and other infrastructure), population and housing density, lack of policy and regulations at national and municipal level, lack of proper planning, insufficient operation of existing urban planning regulations or laws, lack of priority and attention for UGI development, and organizational or management problems.

Therefore, the overall results of this study suggested that UGI provision is thus, confirmed as a crucial problem to be addressed in order to enhance the worsening built environment of the city. Besides, the study suggested different strategies to maintain UGI and enhance its accessibility in Addis Ababa city. The strict adherence to the development plans and regulations as well as planning for UGI networking could reduce the encroachment and improve the fragmentation of UGI of the city. The city administration should also improve UPs accessibility by; increasing the availability of small to median size parks; enhancing the quality of UPs; and improving the transportation service and road infrastructure of the city. Provision of a good public transportation system, parking lots in the parks and a convenient walking and cycling road network are important in order to enhance access to parks and recreational areas.

Moreover, the policy of urban greening has greater impact on the UGI availability and accessibility. Without policy and its enforcement, UGI development can hardly be achieved. This study also identified the absence of UGI policy at national and municipal level. Thus, formulating a sound green infrastructure policy at national and municipal level is very crucial. Revising the existing quantitative standard of UPs based on current situation (such as density) of the city has also a paramount importance to achieve the current demand of UPs in the city. In addition to improving park quantity, quality or accessibility, considering the need of different socio-demographic groups during park planning is very crucial in order to meet the demand of different groups of the community. Moreover, the city administration should improve the management of UGI by: creating cross-sectorial planning approaches and integration of activities (horizontal & vertical integration), enhancing monitoring and follow up activities, forming collaboration with stakeholders, and create the awareness of policy makers about the importance of UGI.

8.2. Contribution of the study

This research has a lot of contributions for the field of the current study. **From practical point of view**, this study can serve as the benchmark for planners and decision makers in identifying the priority areas/locations for developing additional UGI in Addis Ababa city. The spatial accessibility and deficit analysis of UPs can also support the planners and decision makers in providing the clear picture of the recreational parks acreage currently needed in the city. The other practical contribution of this study is that it provides a good basis for understanding the use pattern of UPs by different socio-demographic groups of Addis Ababa city residents. Such information is very crucial for park management, to enhance park accessibility and usage based on the need of various group of the community. Moreover, the variety of planning and management strategies developed by the study offer a wide range of measures that can be utilized to enhance UGI that

plays a major role in augmenting the quality of public life in the city. The strategies also provide the municipality of Addis Ababa and other cities, much information that can be incorporated into the city plan and development agendas related with sustainable development initiatives.

From theoretical perspective, the findings of this study contributed to understand and develop the theories concerning social interactions and the features of successful UGI. This study has also expanded the existing knowledge on the status and accessibility of UGI in Africa where there is limited literature. It provides in-depth discussion on the nature and constraints of UGI from African countries context, which offers a good reference material for subsequent studies on UGI in the continent. As far as I aware, this is the first empirical study that addressed the accessibility of UGI and its constraints in Addis Ababa city. Thus, it provides a good starting point for future research and more in-depth evaluation of UGI in the city and beyond. Moreover, two peer-reviewed papers have already been published in reputable journals (by Elsevier and Springer publisher) out of this study and one paper is under review to augment the existing literature on UGI from African countries context.

Methodologically, this study used a variety of approaches to assess the status of UGI in the city. These approaches broadly categorized as objective and subjective approaches. The objective/spatial assessment technique based on size, percentage, per capita green index and proximity indicator in GIS analysis and the subjective technique such as perceived accessibility indicators together can facilitate a better understanding of how UGI can be effectively developed or maintained; perceived and used; how human-green space interaction can be investigated; and what planning methodology or tool can be used to address UGI development. Utilizing such diverse assessment techniques can enable professionals and non-professionals to clearly identify the gap and provide better solution to enhance UGI in the city.

8.3. Future studies

There are several issues that need further research in the study area. Frist, nowadays, sustainable urban development focuses on the development of "UGI" as the main strategic tool (Conghong et al. 2017). Thus, more research is needed on how to create "Networked UGI" that can achieve multiple socioeconomic and environmental objectives in Addis Ababa city. Second, the identification of successful policies, legislation and practices that helps to reduce the degradation and maintain UGI in rapidly urbanizing cities is needed. Third, research on how to develop highly functional UGI in densest part of the city is required. Fourth, very little is known about the mechanisms that can explain why urban green can have a positive effect on our health from Ethiopia context. This information is important to help urban planners, managers and decision makers to develop healthier cities and promote better public health. Such studies can raise awareness among authorities and professionals on the importance of UGI for public health. Fifth, further research also needs to be conducted on what institutional or organizational frameworks are needed in order to realize UGI in Addis Ababa. Finally, the study recommends that the future research should focus on the frameworks and tools that enable successful community and different stakeholder's participation in developing UGI.

All the aforementioned suggested studies would significantly advance our understanding of UGI development and management system in rapidly urbanizing countries of Sub-Saharan Africa and beyond.

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Appendix 1: Questionnaire Developed for Data Collection from Park visitors

Name of the park……..Date ……. Time……

A. Address of the Respondents

Sub-city…….....Woreda .....….....Kebele .....……..

B. Socioeconomic and Demographic Characteristics of the Respondents

1. Age of the respondent ……..
2. Sex of the respondent: 1). Male 2). Female Birth place ……...
3. Marital status: 1) Married 2) Single 3) Divorced
4. Your educational status: 1) Primary education & less 2) Secondary & TVT education 3) University Degree & above
5. Occupational status: 1) Government employee 2) NGOs or private sector employee 3) Merchant 4) Self-employed 5) Students
6. How would you describe your monthly income? 1) Below 600 Eth. Birr 2) 601-2000 Eth. Birr 3) 2,001-4,000 Eth. Birr 4) Above 4,001 Eth. Birr
7. How many years you have lived in this residence/Kebele? ……..

C. Regarding Urban Park Uses/Visitation

8. How do you describe your habit of park visit? 1) very high 2) high 3) Medium 4) Low
9. How often have you visited urban parks? 1) More days per week 2) Weekly 3) Monthly 4) Occasionally
10. If your answer for question No. 9 is "occasionally" what is your reason? 1) Too busy/No time 2) Health problem 3) lack of interest 4) Recreational cost 5) Fear and safety problem 6) Transport problem 7) Household duties

8) If other …….

11. How do you rate your level of awareness about the available parks and their programs?

1) Very good 2) Good 3) Average 4) Poor 5) No awareness at all

12. Usually on which days of the week do you visit the park?

1) Weekdays 2) Weekends

13. On those days you visit the park, at what time of the day do you visit?

1) Morning 2) Afternoon 3) Evening

14. For how many hours you stay in this park? 1) 15 minutes 2) 16 minutes to 30 minutes

3) 30minutes to 1hr 4) More than 1hr 5) for long duration

15. How many people accompany you to visit this park? 1) 1 person 2) 2 to 3 person

3) More than 3 person 4) Alone

16. What are your main activity/motivation for using this park?

1) Attending community events
2) Reading book
3) Playing with or watching children
4) Meeting with family or friends
5) Physical Exercise (Walking, jogging, ball game, tennis)
6) Enjoying nature
7) Eating/drinking
8) Relaxation and rest
9) other (please describe) ……..

D. Mode of Transport and Proximity to Urban Parks

17. Are you living near to this recreational park? 1) Yes 2) No

18. How far is this urban park from your home? 1) less than 400m 2) 400m-800m

3) 800m-1km 4) From 1km-4km 5) More than 4km

19. How much minutes/hour does it takes to walk from your home to this park? ……

20. What mode of transport you use to travel to this park from your home? 1) Walk

2) Cycle 3) Public transport 4) Private car

21. How would you describe the size of this park? 1) Very small spaces 2) Small spaces 3) Large spaces 4). Very large spaces 5) I don't know

E. Park Quality and Related Challenges

22. How much do you satisfied with the overall quality of this park? 1) Very much satisfied 2) Very satisfied 3) I have no answer 4) Not satisfied 5) Not very much satisfied

23. The following statements are related with park quality in Addis Ababa. Do you "agree" or "disagree" with the following statements? Please circle your response for each statement.

	Strongly Disagree	Disagree	Nether Agree or Disagree	Agree	Strongly Agree
Visiting this park is not affordable.	1	2	3	4	5
This park is neat and clean.	1	2	3	4	5
This park is well maintained.	1	2	3	4	5
This park is accessible for people with disabilities.	1	2	3	4	5
This park is safe or secured place for recreation.	1	2	3	4	5

24. What are the main problems perceived by you in the park?

1) Security and safety problem
2) Maintenance
3) Area problems (insufficient small areas)
4) Expensive entrance fees
5) Site design problems
6) Lack of trees and greenery
7) Lack of essential services
8) Lack of shaded areas

9) Space shape problems

10) Lack of seats and site furniture

11) Not well fenced

12) Youth drug addiction and smoking

13) Unclean

14) please describe if any.....

25. How should the park administrators solve the perceived problems and constraints of UGI? Can you suggest some park management solutions please? 1) …….. 2)…….. 3) …….. 4) …….. 5) ……..... 6) …… 7) …….. …..8) ……..

26. If you have any comments about the overall situation and related challenges of urban parks in the city please write here.

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Appendix 2: List of Questions for Interview with Officers and top Managers

Major themes	Interview questions and investigated issues
Government organization	• What are the responsibilities and role of your organization? • How your organizations are structured (at sub-city and woreda level, number of staff (if exist) ...etc.)? How much strong the linkage of your organization with sub-city and woreda level offices? (1. Good, 2. Medium or 3. weak) • Are there any other government institutions, that are involved in UGI planning and management? Name these organizations. How do you rate the extent of coordination of your organization with these government organization? (1- Good, 2- Medium or 3- Weak).
Community or Stakeholders involvement	• Are the following groups involved in green space planning and management: 1) NGOs; 2) Private sectors; 3) the community/the public and 4) other? • Which instruments/procedures are used for involving stakeholders? if any; e.g., sponsoring schemes, surveys, consultation procedures (for businesses)?
Policy & legislation	• Is there any policies and regulation related with UGI at national or municipal level? Please provide me the list of these policies and regulations? • If regulations exist how much they are implemented to protect and enhance UGI? • Is there any manual that indicates tools and standards that support the planning of UGI or UPs during master plan revision?
Constraints & management solutions	• What are the most important constraints of UGI planning and management in Addis Ababa city? • How should the city administration solve these constraints of UGI? Can you mention them from policy, planning, and management perspectives?

Appendix 3: Published and Ongoing Articles

1. Azagew S. and Worku H. (2020) Accessibility of urban green infrastructure in Addis-Ababa city, Ethiopia: current status and future challenge. *Environmental System Research Journal,* 9:26. https://doi.org/10.1186/s40068-020-00187-0.
2. Azagew S. and Worku H. (2020) Socio-demographic and physical factors influencing access to urban parks in rapidly urbanizing cities of Ethiopia: The case of Addis Ababa. *Journal of Outdoor Recreation and Tourism,* 31:100322. https://doi.org/10.1016/j.jort.2020.100322.
3. Azagew S. and Worku H. (2021) Strategies for accessible urban green infrastructure planning and management in Addis Ababa, Ethiopia. *Journal of Urban Management*, (Under review).
4. Azagew S. and Worku H. (2021) Quality, park feature and access to urban parks in rapidly urbanizing cities: The case of Addis Ababa City, Ethiopia. (Ongoing manuscript).