



**SCHOOL OF GRADUATE STUDIES**

**An Assessment on Urban Green Infrastructure Development and Challenges:  
A case of Wolkite Town, Gurage Zone, Central Ethiopia**

**MA THESIS**

**BY  
FELEKECH TESFAYE**

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Assessment of Urban Green Infrastructure Development and Challenges:

A Case Study of Wolkite Town, Gurage Zone, Central Ethiopia

A THESIS SUBMITTED TO SCHOOL OF GRADUATE STUDIES, IN PARTIAL  
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BY

Felekech Tesfaye

Advisor: Zelalem Dendir (PhD)

Co-Advisor: Maereg Fikadu (MA)

April, 2024

Wolkite, Ethiopia

**WOLKITE UNIVERSITY**  
**SCHOOL OF GRADUATE STUDIES**

We here by certify that we have read and evaluated the Thesis entitled "Assessment of Urban Green Infrastructure Development and Challenges: A Case Study of Wolkite Town, Gurage Zone, Central Ethiopia" prepared under our guidance by Felekech Tesfaye. We recommend that the thesis shall be submitted as fulfilling the thesis requirement for the award of MA

Zelalem Dendir (PhD)

\_\_\_\_\_  
Name of major advisor

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

Maereg Fikadu

\_\_\_\_\_  
Name of Co advisor

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

As a member of the Board of Examiners of the MA Thesis Open Défense Examination, we certify that We have read and evaluated the Thesis prepared by Felekech Tesfaye and examined the candidate. We hereby certify that; the thesis be accepted as fulfilling the Thesis requirements for the award of degree of Master of art in Development Planning and Management.

1. \_\_\_\_\_

Name of external examiner

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

2. \_\_\_\_\_

Name of Internal examiner

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

3. \_\_\_\_\_

Name of chairman

\_\_\_\_\_  
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Name: Felekech Tesfaye

Signature: \_\_\_\_\_

Date: April 2024

Collage: Social sciences and humanity

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## ACRONYMS

CSA	Central Statistical Agency
EPA	Environmental Protection Authority
FAO	Food and Agricultural Organization
GI	Green Infrastructure
GIS	Geographic Information System
GZPO	Gurage zone plan office
HA	Hectares
IDA	International Development Agency
IHS	Institute for Housing and Urban Development
ISO	International Standard Organization
LDP	Local Development Plan
LG	Local Government
MUDHC	Ministry of Urban Development Housing and Construction
NGO	Non-Governmental Organizations;
PAA	Policy Arrangement Approach
SNNPRS	Southern Nations, Nationalities, and Peoples Regional State
UGI	Urban Green Infrastructure
WHO	World Health Organization

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## ABSTRACT

*The concept of urban green infrastructure is being implemented as part of future land use plans in cities around the world. This study was aimed to assessing current status and challenges of urban green infrastructure development in Wolkite town. To achieve the aforementioned research objective, a mixed research approach was used. Representative sample respondents and key informant were selected using random and purposive sampling methods, respectively. Questionnaire, key informant interview were used as tools of data collection. Data obtained via survey questionnaire were analyzed using descriptive statistics using Statistical Package for Social Sciences (SPSS version 26). Data collected by document review and key informant interviews were analyzed by description for method of triangulation. The findings of the study revealed that road side plantation was the common urban green infrastructure in the study area. However, the status of urban green infrastructure is very poor this lead to dissatisfaction among the dwellers. Increasing green areas coverage had encouraging effect on urban green infrastructure while lack of strategic plan to facilitate the development and management of urban green infrastructure and lack of reserved spaces was identified as the major problem in the town. Based on the findings of the study, it concludes that urban green infrastructure in the study are faces various challenges and as a result to improve the coverage and quantity of urban green infrastructure of Wolkite town used its maximum effort on it, Wolkite town administration and municipality administration should give consideration for plan, implantation and rules regarding urban green infrastructure in the study area*

*Keywords: Challenges, Urban, Green Infrastructure, Wolkite*

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background of the Study

Cities have become the hotspot of human activities. Next to growing in their size, they also have become more complex due to all aspirations, user demands and climatic challenges. The United Nations predicts that there will be around five billion urban inhabitants by 2030. As of today, 55% of the world population already lives in cities (United Nations, 2018).

Cities play a crucial role in the attempt to limit global warming to 1.5°C. Cities are identified as one of four “critical global systems” which can greatly improve the success of climate actions (IPCC, 2018). Thus, cities are a central part of sustainable development efforts. To emphasize the role of cities the United Nations phrased a sustainable development goal, which explicitly addresses the sustainability of cities. It is goal number eleven ‘Make cities and human settlements inclusive, safe, resilient and sustainable’ (United Nations, 2019).

The concept of Urban Green Infrastructure (UGI) is being implemented as part of future land use plans in cities around the world. Most of the cities where this type of infrastructure is developed, planned or implemented are the highly dense and compact cities of the globe (Jim & Chen, 2003). Well-planned and managed UGI needs to be considered as an integrative part of the city, since it is indispensable for the functioning of the city in a sustainable manner (Sandstrom, 2002).

UGI refers to a strategically planned and managed network of green spaces and other environmental features vital to the sustainability of any urban area. The current global consensus over the significance of UGIs recognizes the multiple environmental, social and economic benefits they provide to societies. A high-quality UGI in and around an urban center can significantly reduce costs for individuals, businesses and public bodies while enhancing the quality of life and health of residents, workers and visitors. Furthermore, well-developed GIs in urban centers are expected to provide for biodiversity conservation and mitigation of adverse impacts of climate change and environmental pollution. (MUDHC, 2016) Smart growth and development of urban centers demanded the collaboration of public, private and non-profit sectors on growth and development to achieve holistic advantages of the town (Zeleeke, 2008). The urban administrations, government and the people should give proper attention to environmental protection to avoid continuous suffocation and pollution followed with the expansion of cities.

It also emphasized for the delineation of UGI within the framework of the urban plan, at the town and kebele level and considering environmental protection issues in the overall urban development activities (EUDP, 2005).

Today natural land surfaces and urban vegetation has been replaced by surfaces and constructions that have the ability to absorb solar radiation. This has led to the generation of different microclimates in urban (Norton et al., 2015). The lack of GI led to substantial changes in the infiltration and retention capacity of the soil, altering the flow of ground water (Demuzere et al., 2014). These changes have led to a gradual increase of temperature in urban, w/c is reflected by an increase in forest fires events, landslides and the reduce disposal of urban water resources, that finally leads to an increased vulnerability for climate change at local level. In order to address and mitigate all the problems described above, cities are taking actions such as improvement of UGI (Connop et al., 2016). Due to this importance UGI need to be accessible to all people uniformly at the required quantity and quality. Globally cities are becoming gradually congested and polluted (Lee Maheswaran, 2011; Saniya and Faria, 2013). UGI identified as an alternative nature-based and cost-effective remedy to some of these negative consequences (Pakzad & Osmond, 2016).

In Ethiopia, the establishment and management of UGIs across the urban centers have not been uniform and there is a great deal of variation. Some of them have established some of the UGI components. Also, the development of UGIs across the urban centers in the country has not been standardized and the urban dwelling communities have not been receiving the goods and services that well-planned and well-developed UGIs are supposed to provide. (MUDHC, 2015) The integration and strategic planning and delivery of networks of connected green space described as GI has become a major discourse in urban greening and is increasingly accepted as a policy and planning approach (Davies et al., 2015).

UGI is recognized to deliver economic, social and environmental benefits to the urban population. Social and environmental benefits are provided via so-called eco-system services (Lafortezza *et al.*, 2013; Mattijssen *et al.*, 2017). Eco-system services are mind full development from the idea of ecosystem conservation. By acknowledging the services of ecosystems, the focus is placed on the functionality for flora, fauna and human well-being. The importance of GI for human health, recreation, response to climate change, as a means of protecting natural habitats and biodiversity is recognized worldwide. Due to this importance GI need to be accessible to all people uniformly at the required quantity.

## 1.2 Statement of the Problem

Cities are essential actors in stimulating green infrastructure. They occupy 2% of the world's landmass but are responsible for more than two-thirds of global energy use and greenhouse gas emissions (IEA, 2008). A majority of the world's population lives in cities; this majority is expected to reach two-thirds by 2050 (OECD, 2011).

Establishment of Green Infrastructure (GI) in urban and rural areas is mandatory. It is a reality that urban areas are at increasing trend. GI is researched mainly in urban areas (e.g. Gradinaru and Hersperger, 2019 and Hansen *et al.*, 2019), where it can connect green space (Davies and Laforteza, 2017), help mitigate climate change signs (De la Sota *et al.*, 2019) or even control urban sprawl (Gavrilidis *et al.*, 2019).

Recently, the value of GI in urban area is increasingly recognized by academia, health professionals, water managers, planners, policy makers and designers around the world. The rapid expansion of towns and cities contains the real risk of creating unlivable and unhealthy environments by reducing green spaces, parks, forests, increasing carbon emissions and wastes (Martin and Sheryn, 2012). This key to note that GI is also accepted as a relatively new research agenda (Mejia *et al.*, 2015).

The rapid urbanization creates great pressure from resource shortage and negative environment impacts (Dong *et al.*, 2018; Martos *et al.*, 2016). In the face of an increasing urban population, Ethiopia can learn from the experience of other developing countries. In some developing economies, too much growth in rapidly expanding capital cities has left them struggling with problems like population-related health conditions and forcing them to divert scarce resources to provide services such as basic housing, sanitation and UGI to a sprawling urban population. For the problem of rapid urbanization and its impact on the environment, different actors engaged from local on city level to global level, because environmental problems are local in their origin while global in their impact. Therefore, local actions should be taken to reduce the global impact (GGGI, 2015).

In Ethiopia, one of the most rapidly urbanizing countries in sub-Saharan Africa (Lamson-Hall, Angel, Martin, & Tafesse, 2018) where urbanization is largely taking the place through unplanned urban growth which aggravates environmental problems (MUDHC, 2015), the role of GI to address these challenges is still largely unknown. The pressure due to the rapidly increasing urban population and increased rate of urbanization across the country contribute to the increased emission of greenhouse gases leading to rise in atmospheric temperature.

This makes the development of UGIs more important. Development of GIs ensures the provision of a variety of services to the urban dwellers. The most notable benefits of UGIs in urban centers include mitigation of adverse effects of climate change expressed in the form the occurrence of extreme weather conditions such as rise in atmospheric temperature, droughts, flooding and environmental pollution. Besides, well developed UGIs also provide additional possibilities of food production, source of pleasure, improved health, reduced crimes, a rise in property values and better business opportunities (MUDHC, 2015).

Research Findings of Eshetu and Yared identify seven potential strategic approaches that are needed to create a sustainable UGI development and management system. Hence, improving the quantitative, qualitative, and accessibility standards on the provision of UGI is needed for sustained development. Moreover, advanced development in budget allocation, capacity building, legal and institutional framework, awareness creation, and stakeholder's involvement are also needed to promote a sustainable development and management system of UGI in the urban centers of Ethiopia in general and emerging towns in particular. (Eshetu and Yared, 2021) Also, in different previous research examining the challenges associated with the implementation of GI in cities around the world that identified five challenges which are design standards; regulatory pathways; socio-economic challenges; finance ability and innovation (Staddon *et al.*, 2017).

The urban centers of Ethiopia have not fostered the development of UGIs in general and GI around residential areas in particular. At the moment, UGIs are not in good condition and are not providing the services they are expected to. Thus, should offer something for everyone, be robust and give people a sense of place. That is why UGI needs the attention of cities like Wolkite, which are on the verge of development. The increasingly fragmented nature of Wolkite city as a result of land use intensification, demands the integration of UGI into different sectors of development. Furthermore, UGI should be planned, as much as possible, in such a way that they improve the quality of life around residential areas by providing clean and attractive GI for informal recreation of people in the neighborhood's, contribute to the development of climate resilient green economy (CRGE), address the issues of food insecurity in urban centers and reduce poverty through job creation (MUDHC, 2015).

However, the results of **other studies** did not fully address the development challenges of UGI in Wolkite town. Therefore, this study is intended to contribute to bridging this gap by assessing the status of UGI development and identify the main constraints in the town.

### **1.3. Objectives of the Study**

#### **1.3.1 General Objective**

- To explore current status and challenges of urban green infrastructure development in Wolkite town.

#### **1.3.2 Specific Objectives**

- To examine the current status of urban green infrastructure development in Wolkite town.
- To assess the main socio-economic benefits of urban green infrastructure in Wolkite town.
- To assess the main socio-economic opportunities of urban green infrastructure in Wolkite town.
- To identify the main challenges of urban green infrastructure development in Wolkite town

### **1.4 Basic Research Questions**

To this end, the current study has aimed at answering the following three questions;

1. What are the current practices of urban green infrastructure development in Wolkite town?
2. What benefits were gained from UGI in Wolkite town?
3. What opportunities were gained from UGI in Wolkite town?
4. What are the main challenges towards implementation of UGI in Wolkite town?

### **1.5 Significance of the Research**

The outcome of the study will have a great significance in terms of ameliorating urban green infrastructure in Wolkite through a robust status urban green infrastructure development that would abate green infrastructure depletion so that they can sustainably render their economic, social and environmental services. The research will also improve our understanding of local communities residing in green infrastructure. It also serve as a bridge to a knowledge gap that currently existed on factors hindering the sustainable management of urban green infrastructure in the study area. It will also serve as the base line information source document and as a stepping stone for researchers interested to conduct related study in the town.

## **1.6. Scope of the Study**

The study mainly focuses in the urban green infrastructure development, the current status and overview the practices of urban green infrastructure in Wolkite town. And the development challenges and constraints behind the current status and set sustainable strategies to address problems affecting the development. The geographic scope of the study was delimited in Wolkite town in the Gurage Zone. The time scope the study was conducted from September 2022 to June 2023.

## **1.7. Limitation of the Study**

The researcher faced problems of time as the research was being undertaken in a short period with limited time for doing a wider research. The researcher also faced a challenge in acquiring secondary data from the documented source in municipality and town administration since some of these municipalities did not release several aspects important data to the study in the research time. Therefore, researcher tried to overcame the limitation of the study by using primary data source in advance. Also, in towns resident always asked to adopt, develop and manage GI like other else in the country but the concerning bodies of this regard failed to response our questions rather they made only couple of stone here and there.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1. Definition of Green Infrastructures**

The definitions of green infrastructures are defined in different scholars with regard to their backgrounds and disciplines. Originally, “green” infrastructure was identified with parkland, forests, wetlands, greenbelts, or floodways in and around cities that provided improved quality of life or “ecosystem services” such as water filtration and flood control. Now, green infrastructure is more often related to environmental or sustainability goals that cities are trying to achieve through a mix of natural approaches (Josh *et al.*, 2011).

According to Anna (2016), green infrastructure refers both to a set of storm water best practices that provide multiple benefits, and more broadly to interconnected networks of green spaces that provide multiple benefits for wildlife, human recreation, and water quality (Matthews, *et al.* 2015), or “natural, semi-natural, and artificial networks of multifunctional ecological systems within, around and between urban Areas” (Tzoulas *et al.*, 2007).

As mentioned in Joshua *et al* (2012), Benedict & McMahon (2002) define UGI as it is the networks of wild lands, woodlands, waterways, and wetlands that, when combined with green roofs, permeable paving, vegetative swales, parks, and green streets, support ecological processes and contribute to human health and quality of life. Based on Maryatia (2015), Green infrastructure (GI) is defined as a set of techniques, technologies, management approaches, and practices that can be used to eliminate or reduce amount of storm water and nonpoint source runoff including water and pollutants that run into combined sewer overflow system. Green Infrastructure can be broadly defined as a strategically planned network of high quality natural and semi-natural Areas with other environmental features, which is designed and managed to deliver a wide range of ecosystem services and protect biodiversity in both rural and urban settings. More specifically GI, being a spatial structure providing benefits from nature to people, aims to enhance nature’s ability to deliver multiple valuable ecosystem goods and services, such as clean air or water (European Commission, 2013).

#### **2.2. Urban Green Infrastructure**

Urban green infrastructure can be interpreted as a hybrid infrastructure of green spaces and built systems, e.g. forests, wetlands, parks, green roofs, and walls that together can contribute to ecosystem resilience and human benefits through ecosystem services (Marthe *et al.*, 2016).



Rapid urbanization in East Africa (Ethiopia) poses several serious challenges for planning, city development, living conditions and a great challenge for urban ecosystem sustainability. To sustain their life a number of peoples try to solve their housing needs by getting land informally at the urban fringe. This result has become a problematic repercussion for proper land use and planned urban development (Bjørn, 2007).

In Africa the rapid rate of urbanization has engendered several challenges and problems similar to situations in other parts of the world and most of the city are characterized by substandard and inadequate housing, slums, and lack of infrastructure, transportation problems, low productivity, poverty, crime and juvenile delinquency (Mabogunje, 2002).

Urban development problems in Africa could be viewed from both socio-economic and environmental perspectives. Thus, the cities are especially vulnerable to frequent flooding, erosion and storm damage (Lawanson, 2006, and Young, 2009). In addition to that, most urban people in Africa have very limited experience with green infrastructure development and underestimated in land use decisions, so they do not understand its significance or the potential it can bring to their city and towns (Young, 2009). Hence, the cumulative effect of the above mentioned urban problems has its own contribution to development of environmental sustainability and quality and quantity of GI. Usually, urban environmental problems are mostly due to developmental processes and are of local, regional and global effects (Adedeji et al, 2010). Thus, the integration of the Green Infrastructure approach can be smart and strategic and offer potential ways of effectively integrating biodiversity into spatial planning and sectoral considerations (SDC, 2010).

However, with inadequate planning, the green infrastructure resource of African cities is being rapidly depleted and the communities has also miss the opportunity to maximize the benefits which is obtained from the existing green infrastructure resource (CLUVA, 2013). Consequently, planning should avoid harm before the need of mitigation measures. At a policy level, planning and the planning system needs to incorporate green infrastructure and an ecosystem approach to ensure that benefits are optimized in the long term, especially in relation to climate change adaptation and biodiversity loss (CIWEM, 2010).

### **2.3. Elements of Green Infrastructures**

Elements of green infrastructure include open Areas such as urban forests, large public parks, gardens, playing fields, rights-of-way along streams and roads, and constructed features such as green roofs, permeable vegetated surfaces, swales, rain gardens, and “green streets”

(Mellet *et al.*, 2013 ; Matthews *et al.*, 2015) (Anna *et al.* , 2016). “Green” infrastructure and technological practices include green, blue, and white roofs; hard and soft permeable surfaces; green alleys and streets; urban forestry; green open spaces such as parks and wetlands; and adapting buildings to better cope with floods and coastal storm surges (Josh *et al.*, 2011).



Figure 2 Urban Green Infrastructures type

Source; Tayouga, S, and S. Gagne 2016

### 2.3.1 Urban Green Spaces

Urban Green Areas include any natural elements in towns and cities that provide an ecological or ecosystem service function (Losarcos, 2010). This includes urban elements such as green parks, green walls, and green roofs that host biodiversity and allow ecosystems to function and deliver their services by connecting urban, peri- urban and rural Areas. Under the Habitats complexes category of the EUNIS habitat classification, green urban Areas include the following habitats:

- Large parks: large, varied green spaces within towns and cities, usually >5 ha. These include small woods, mown lawns, water bodies (semi-natural or artificial), flower beds and shrubberies and semi-natural grassland or woodland enclaves.
- Small city-center non-domestic gardens: usually<0.5 ha often partitioned by walls located inside city blocks and completely or almost completely surrounded by

architectural structures. They may contain mown lawns, flower beds and native or ornamental trees. For the purposes of this project, it will also be understood to include green roofs.

- Large non-domestic gardens: typically 0.5-5 ha, more restricted in diversity than large parks, usually similar composition and aspect to small city center non-domestic gardens.
- Domestic gardens of cities and town centers: usually <0.5 ha with very mixed species-rich flora and fauna.
- Domestic gardens of villages and urban peripheries: usually <0.5 ha, with very mixed species-rich flora and fauna, in close proximity to human dwellings, agricultural land, natural or semi-natural habitats.

## **2.4. Socio-Economic Benefit of Urban Green Infrastructure**

### 2.4.1. Social Benefits

Various literatures confirmed that there are many potential social benefits that good quality, accessible green space and infrastructure can provide, but the most significant of these can be grouped into three broad categories: Improvements in levels of physical activity and health, promotion of psychological health and mental well-being and facilitation of social interaction, inclusion and community cohesion (Forest Research, 2010).

### 2.4.2. Health and Well-Being

Socially, benefits from urban greenery can accrue to urban communities through access to urban green spaces, healthy living and education. Many public green areas provide the local community and visitors with opportunities for physical recreation and relaxation, as well as for social interaction (Wodarczyk, 2007). According to Forest Research, there is a strong body of evidence which demonstrates the restorative value of green space showing that more passive forms of usage, or even just access to views of green space, can have a beneficial impact on mental well-being and cognitive function (Forest Research, 2010 and RICS, 2011). Studies found that, quality green spaces have positive benefits for people living in deprived urban communities (SDC, 2010). Similarly, access to green space is an important predictor of increased physical activity (“active living”) and reduced risk of obesity (John, 2011). This was already found by Bayram *et al.*, (2012), people who were exposed to natural environment, the level of stress decreased rapidly as compared to people who were exposed

to non-environment. Sustainable responses to climate change and economic difficulties can also help to solve social problems, such as fuel poverty and traffic congestion (SDC, 2010).

Various research evidences, shows that they can have a beneficial impact on mental well-being and cognitive function. At their best, green spaces can also help facilitate social interaction, integration and the development of community cohesion (Forest Research, 2010). On the other hand, different case studies showed that reduced access to the natural environment can result in social isolation, obesity and chronic stress (Institute of Public Health, 2006). Clean waters are essential to the vibrancy and success of local businesses that depend on beachgoers and other recreational water users. However, a study conducted by USEPA found the contamination and loss of aquatic species and habitats from polluted storm water runoff costs the commercial fish and shellfish industry up to \$30 million every year (Water keeper Alliance, 2008). Reducing polluted runoff that flows into rivers, streams, and coastal waters is a cost-effective strategy to ensure that these waters are safe for swimming, boating, and fishing (Banking on Green, 2012).

Green spaces also act as a filter to improve air quality, in this case vegetation has a great contribution to improve air quality through removing gas and dust related pollutants (Bolund *et al.*, 1999). Certainly, improvements in air quality due to vegetation have a positive impact on physical health with such obvious benefits as decrease in respiratory illnesses (Bayram *et al.*, 2012 and NICE, 2008). Various medical studies indicated that, peoples just being in, or viewing, green space for a few minutes reduces stress which is has been demonstrated with hospital patients and the general public (John, 2011). Thus, the connection between people and nature is significance and strong for everyday enjoyment, work productivity and general mental health (Haq, 2011).

Similarly, a review of literature linking health and green infrastructure, observed that there were a number of epidemiological studies linking proximity of green space and levels of physical activity (Humpel *et al.*, 2004; Pikora *et al.*, 2003 cited in Forest Research, 2010). Human contact with nature is recognized as valuable for our mental health (SDC, 2010). The positive effects increased with the length of stay and with the level of physical activity undertaken (Sun *et al.*, 2003).

At present, several studies have pointed to urban green spaces as a resource in promoting public health and providing valuable ecosystem services to urban dwellers (Martin *et al.*, 2013). Greater reductions in blood pressure were observed in subjects who had recently taken

part in tasks demanding attention, when they were in a room with a view of trees compared with those in a room with no view (RICS, 2011). Lohr *et al.* (2007), has also demonstrated that plants in the workplace reduce stress levels. The health benefits of regular walking have been widely reported, for instance, Jones *et al.*, (2009), confirmed that the benefits walking can contribute to reducing coronary heart disease and type diabetes. Similarly, blood pressure reductions, as well as reductions in anger and greater attention, were also found in those walking in a nature reserve compared with those walking in an urban setting (Hartig *et al.*, 2003). Green infrastructure can also be used to encourage active travel, with integrated walking and cycling networks which promote cardiovascular health (Forest Research, 2010). People who have better perceived access to green spaces have been reported to have greater physical activity (Coombes *et al.*, 2010). The potential for green infrastructure to positively influence health needs to be balanced with other important factors, such as both the real and perceived personal safety of accessing and being in such areas (Jones *et al.*, 2009; Pretty *et al.*, 2005). However, the links between green space and physical activity are not clear and different studies have found contradictory results (Jones *et al.*, 2009). One studies demonstrated the concern that is sometimes raised about public open spaces is their potential to attract criminal activities such as drug dealers and other undesirable elements from outside the immediate community. This is because the public green spaces are often deserted at night, thus providing secluded and convenient venues for crime (Thomas, 2013). Nevertheless, a study of public housing complexes in an inner city, found a correlation between lower crime rates and nearby vegetation (Kuo, 2001).

## **2.5. Recreational Value of Green Infrastructure**

Green Infrastructure provides a high quality environmental setting attracting new businesses and which directly serve the tourism, recreation, leisure and health sectors (SDC, 2010). People satisfy most of their recreational needs within the locality where they live. Urban green spaces serve as a near resource for relaxation; provide emotional warmth (Bayram *et al.*, 2012). Studies conducted on UK found that, green corridors reaching into town centers from the surrounding countryside provide infrastructure for non-motorized transport and access to healthier environments (EFTEC, 2005). Similarly, studies in Mexico City, the centrally located Chapultepec Park draws up to three million visitors a week who enjoy a wide variety of activities (Haq, 2011). According to EFTEC, 2005) and John (2011), greening city centers also attracts new visitors, in turn supporting urban retail and tourism

sectors and provide ideal surfaces for a variety of recreational and sports activity and high use activities including parks and playgrounds. Many literatures illustrated the positive impacts on quality of life in urban areas from improved aesthetics, increased recreational space, and a connection to the natural environment (MMSD, 2012). One study found that office workers who can see nature from their desks report greater job satisfaction and lower rates of sickness than those who cannot see nature from their work areas (Niemelä, 2009).

A study looking at the effect of nature on those living in poverty found that poor inner-city environments generate chronic mental fatigue through crowding, noise, together with the stresses of poverty and single parenting (SDC, 2010). Improved aesthetics values of cities have been shown to decrease stress and, when combined with transportation improvements that increase walking and biking, significant health benefits are realized (MMSD, 2012). According to “CDC recommendations for improving health through transportation policy,” several green infrastructure strategies, such as porous pavement and bio-retention, can be placed along roadways and help form complete streets roadways that are planned, designed, and operated to enable safe, attractive, and efficient access and travel for all users (CDC, 2010). Urban housing developments that are adjacent to natural amenities such as woodland, parks, waterways and the coastline are more attractive to buyers and this is often reflected in market prices (UCD, 2008). Similarly, some other benefits like providing recreational opportunities, rendering aesthetic enjoyments, enhancing social ties and playing a role in developing a community identity have been attributed to green spaces (Yang *et al.*, 2005). Many public green areas provide the local community and visitors with opportunities for physical recreation and relaxation, as well as for social interaction (Wodarczyk, 2007).

## **2.6 Educational Value of Green Infrastructure**

Green infrastructure has also been used as a valuable education resource, and has the potential to improve educational achievement, eventually helping to create a better qualified and more highly skilled workforce, and to bring higher salaries and more valuable business investment into the region (GLA, 2003). It also offers learning and employment opportunities through events, educational outreach and jobs as rangers and green space managers (Richard *et al.*, 2013). Various case studies illustrated that, the educational value of green infrastructure can be achieved through both formal education, e.g. field trips with school, and informal education, e.g. through visits with friends and family (Okunlola, 2013). But, in order to derive the maximum benefits from outdoor learning and play, the green space should offer

a variety of vegetation types and topographies, as well as the ability to interact with the environment (Niemelä *et al.*, 2009).

Lifelong learning skills can also be enhanced by engagement with green infrastructure. The fostering of greater respect of green infrastructure among adults can also assist in reducing management costs through reduction in litter, fly tipping and other inappropriate uses (Okunlola, 2013). Studies in UK found that, the importance of outdoor learning is recognized in the UK National Curriculum where the need for fieldwork and data-recording skills, as well as the ability to discover information about the local environment, are required from as early as primary education (The Countryside Agency, 2005; Natural England, 2010). Therefore, green infrastructure is an instrument which can be used to demonstrate and know peoples especially youngsters about their entire environment.

## **2.7. Economic Benefits of Green Infrastructure**

Investment in Green Infrastructure can encourage and attract high value industry, entrepreneurs and skilled workers to a region through the creation of high quality, environmentally friendly living and working environments, value adding to local economies (ECOTEC, 2008). Green Infrastructure investment provides for the generation of new recreation and leisure opportunities and also stimulating economic activity within agriculture, forestry, and public services (EFTEC, 2005). In order to given that, good quality green infrastructure can have positive impacts on environment and society, it follows that it can also positively contribute to economic performance (RICS, 2011). A studies conducted by Michigan State University found that, as components of green infrastructure, natural and environmental resources provide a wide array of amenity services benefits to society (LPI, 2008). In order to assess local or regional economy, studies showed on the value of green infrastructure in offering local economic opportunities, this becomes particularly relevant to communities and regions in transition from “old” to “new” economies and also determine population and income growth (Deller, *et al.*, 2001; LPI, 2008). Nelson *et al.* (2003) also found that and generate direct and indirect economic impacts through visitor spending in the local economy. Thus, local economic regeneration is strongly related to increased quality of place, recreation and leisure, and tourism (Martin *et al.*, 2013). According to forest research studies economic regeneration involves increasing employment, encouraging business growth and investment, and tackling economic disadvantage (Forest Research, 2010). Countries when developing the green economy there is also related opportunities; they can create new

jobs, limit the environmental impact of towns and cities, and reduce the costs of running them (SDC, 2010). Similarly, in poor urban areas, where food purchasing makes up a large part of a household's income, they produce from urban agriculture can be used for home consumption and as an effective way of supplementing income, thus contributing towards poverty reduction (Thomas, 2013). On the other hand, green infrastructure can provide less expensive, and more cost-effective, approaches to managing runoff municipalities may benefit from lower capital costs (Banking on Green, 2012).

Studies conducted on North West America showed that, green infrastructure technologies can reduce flood water surface elevations, which means that property values, due to reduced flooding, could increase by as much as 5% and avoided costs in downstream culvert replacement and upgrades could equal over \$3 million and decrease flood losses by amounts ranging between \$9,000 per acre of floodplain for the 100-year event to \$21,000 for the 2-year event (Johnston et al, 2006; Medina *et al.*, 2011).

Various literatures illustrates that this type of flood control is cost-effective for small flood events, and also provide measurable flood control benefits for larger, less frequent events (Banking on Green, 2012). Still, indicators are very strong that green spaces and landscaping increase property values and financial re-turns for land developers, of between 5% and 15% depending on the type of Project (Haq, 2011). This can assist in urban regeneration and renewal; improve the attractiveness of locations for business investments; create community enterprises; and generate new employment opportunities (Wodarczyk, 2007).

Economic benefit increased city tax revenue from the development has resulted in an estimated increase of ecological, recreational, and aesthetic resource site value (MMSD, 2012). Studies showed that, in Michigan skiers and snowboarders spent \$146 million on trips to ski areas through 2.2 million skier visits, generating \$63.7 million in ski revenue; \$41.3 million in visit expenditures; and \$41.4 million in tourism related spending. This created \$54 million in direct personal income and 3,900 jobs (Sun et al., 2001). Similarly, Pictured Rocks National Lakeshore in Michigan hosted 421,000 recreational visits in 2001, spending \$14.8 million. The total estimated economic impact of visitor spending was \$12 million in sales, \$4.6 million in personal income, \$7.4 million in direct value-added and 426 jobs (Nelson et al., 2003). Although several plans were evaluated, ultimately the green infrastructure based solution was chosen because it saved \$1 million, a 45% reduction compared to the conventional storm water management option (Banking on Green, 2012).

Parks has also makes substantial contributions to the community's economy for example Golf is growing in popularity, and appealing to a broad range of people (Okunlola, 2013). Urban public park can help in increasing the property value the real estate market consistently demonstrate that many people are willing to pay a higher amount for a property located close to parks or open space areas than for homes that does not offer this facility (Love,et.al,1999 cited in Okunlola, 2013). A park basically becomes one of a city's landmarks and attraction making it a prime marketing tool to attract tourists, conventions and business. (Okunlola, 2013 and MMSD, 2012) Although direct economic evidence about the provision of these benefits is limited, what little exists suggests that green infrastructure provision and green space initiatives are a cost-effective method of achieving them. The improvement of existing and creation of new green infrastructure should be prioritized, especially in areas of greatest need (Forest Research, 2010).

## **2.8. Green Infrastructure for Energy**

Saving Energy is the base of today's economy; communities around the world are seeking ways to reduce energy consumption and spending (Banking on Green, 2012). Vegetation has a great contribution in order to reduce the energy costs of cooling buildings has been increasingly recognized as a cost effective reason for increasing green space and tree planting in temperate climate cities (Bayram *et al.*, 2012). Studies show that, green roofs, street trees, and increased urban green spaces have the effect of making individual buildings more energy efficient by reducing heating and cooling demands (Banking on Green, 2012). Heisler (1986) analyzed the amount of costs of which is reduced by green infrastructure show that, cooling cost reductions of 20-50%, and heating cost reductions of 10-15% for residential allotments with trees. Some studies confirmed that, an 11,000 square foot green roof surface would save roughly \$400 per year in heating costs and \$250 per year in cooling costs for a total of \$650 in savings per year (Obendorfer, *et.al*, 2007). One recent study showed that, savings of \$650 in annual heating and cooling costs associated with a typical, commercial-sized green roof (Foster *et al.*, 2012). The green roof at O'Hare covers nearly 175,000 square feet, captures close to two million gallons of storm water annually, and will save the company an estimated \$35,000 in energy costs per year (Obendorfer *et al.*, 2007). Plants improve air circulation, provide shade, this cooling effect contribute to lower air temperatures, for example; a study conducted on Turkey indicated that, a park of 1.2 km by 1.0 km can produce an air temperature between the park and the surrounding city that is detectable up to 4 km away

(Bayram *et al.*, 2012). Correspondingly, property value areas of the city with enough greenery are aesthetically pleasing and attractive to both residents and investors. This variability combined with inconsistent energy costs makes it difficult to calculate global energy benefits of green infrastructure. However local and regional examples indicate that considerable savings are possible through green infrastructure development (Banking on Green, 2012).

## **2.9. Green Job Opportunities**

A green oriented infrastructure has an economic stimulus options that would have an immediate impact on job creation. For instance, the Apollo Alliance estimates that every \$1 million invested in the US in energy efficiency projects creates 21.5 new jobs, as compared to only 11.5 jobs for new natural gas generation (DB advisors, 2008). On the other hand, green infrastructure has a potential to restoration, maintenance habitats, balance ecosystem services, and also create jobs and fuel the economy at different level. Investments in green infrastructure provide jobs as well as business opportunities and help to build partnerships (SURF, 2011). Studies on Milwaukee Metropolitan Sewerage District (MMSD) show that, on average, there will be 160 new construction jobs per year for constructing and maintaining new facilities. According to the Cambridge shire report there is expected to accommodate a significant amount of strategic growth over the next twenty years, equating to at least 73,000 new homes, 50,000 new jobs and over £ 4 billion worth of new infrastructure in the period to 2021 (Cambridge Horizons, 2010).

## **2.10. Green Infrastructure Response to Environment**

### **2.10.1. Biodiversity/Ecological Response**

Ecologically, green spaces are significant for nature conservation as they provide habitats for a wide range of flora and fauna (Thomas, 2013). Urban green spaces provide to cities with ecosystem benefits ranging from maintenance of biodiversity to the regulation of urban climate (Bayram *et al.*, 2012). This may include both the preservation and protection of rare and vulnerable species, and the provision of a valuable educational resource (Sinnott, 2006). A studies conducted on Turkey indicate that, green spaces do many functions as protection center for reproduction of species and conservation of plants, soil and water quality (Bayramet *al.*, 2012). In the study of Haq (2011), in green spaces that feature has good connectivity and act as wildlife corridors or function as urban forests, can maintain viable populations of species that would otherwise disappear from built environments. Ecological

benefits of urban green infrastructure are largely related to the provision of habitat (Forest Research, 2010).

Studies showed that, the very presence of plants in a city improves the visual appearance of the urban environment, contributes towards climate change prevention, creates lower densities of development and reduces levels of activity in an area (Thomas, 2013). There is big variation comparing with rural areas, in solar input, rainfall pattern and temperature is usual in urban areas, hence solar radiation, air temperature, wind speed and relative humidity vary significantly due to the built environment in cities (Bayram *et al.*, 2012).

Studies carried out on London illustrated that, green infrastructure/spaces are increasingly being recognized for their ecological significance (Harrison *et al.*, 2002). On the other hand, green Infrastructure has good opportunities to reconnects habitats which had been separated by development creating physical space for natural processes to take place (SDC, 2010). This helps to supply the linkage of the urban and rural areas. They provide visual relief, seasonal change and link with natural world (Bayram *et al.*, 2012). Whereas, a functional network of green spaces is important for the maintenance of ecological aspects of sustainable urban landscape, with greenways and use of plant species adapted to the local condition with low maintenance cost, self-sufficient and sustainable (Haq, 2011).

#### 2.10.2. Carbon Reduction and Sequestration

Green roofs, bio-retention/rain gardens, and trees provide carbon reduction benefits by sequestering CO<sub>2</sub> from the air as they grow (MMSD, 2013). Similarly, vegetation intercepts airborne particulate matter (PM<sub>10</sub>), reducing concentrations in air, thereby improving air quality. This reduces the amount of PM<sub>10</sub> exposure to humans and, in turn, reduces the incidence of respiratory illness (Forest Research, 2010). Recent researches show that, GI/spaces purify and trap more than 12 million tons of dust, soil and other particulate matter. This is particularly important in urban areas due to the high incidence of asthma and other breathing disorders (John, 2011). Various studies explored the links between urban tree cover and air quality (Escobedo *et al.*, 2009). On the other hand, the results of the 3-year Chicago Urban Forest Climate Project estimated that the trees removed 6145 tons of air pollutants (valued at \$9.2 million), and sequestered 155 000 tons of carbon per year, in addition to providing energy savings for residential heating and cooling that, in turn, reduce carbon emissions from power stations (Martin, 2013 and MMSD, 2013). Through both carbon sequestration and avoided emissions, widespread green infrastructure will reduce CO<sub>2</sub> by a

total of 73,000 tons per year (MMSD, 2013). This mass is equivalent to removing the emissions of 14,000 vehicles, based on annual vehicle emission rates from USEPA (USEIA, 2010a). Other environmental services provided by trees, which can be given a monetary market value, include carbon sequestration and air pollution mitigation (Martin, 2013). The natural functions of urban trees are known to remove atmospheric pollutants, oxygenate the air, and absorb carbon dioxide through photosynthesis (Nowak *et al.*, 2006). The net present value of carbon storage of woodlands has been estimated in different part of UK; this varies from £601 million in the North West to £2,684 million in the South East, £114 million in the East Midlands to £492 million in the South West, (ECOTEC, 2008). The projected net present value of investment in planting and care of trees in Chicago indicates that the long-term benefits of trees are more than twice their costs (Nowak, 1995).

### 2.10.3. Improving Urban Air Quality

Green infrastructure can have a positive impact on air quality. Vegetation is capable of removing ammonia (NH<sub>3</sub>), carbon dioxide (CO<sub>2</sub>), oxides of nitrogen (NO<sub>x</sub>), ozone (O<sub>3</sub>), particulate matter (PM; dust) and sulphur dioxide (SO<sub>2</sub>) from the air (Nowak *et al.*, 2006 and Powe *et al.*, 2004). The ability of trees to intercept pollution varies between species, throughout the age of the tree, and with the planting design (Martin, 2013). A case study carried out in West Midlands on urban forest reported that some species of tree have a greater potential to improve air quality (O<sub>3</sub>, NO<sub>2</sub>, HNO<sub>3</sub>, NO and PAN) while others could have a detrimental impact (Nowak *et al.*, 2006). Urban areas contain the most particulate matter, due to an abundance of motorized vehicles. Thus, well maintained turf grass shields the soil and traps the particles which prevent harmful pollutants such as sulfur dioxide, ozone, hydrogen fluoride, and peroxyacetyl nitrate from being carried into the atmosphere (Almeida, 2006). Nowak (1995), analyzed the environmental impact of air pollution, according to him air pollution is a major environmental problem in most cities across the world. Major pollutants in urban areas are carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), ozone (O<sub>3</sub>), volatile organic compounds (VOCs), sulphur dioxides (SO<sub>2</sub>) and particulate matter (Nowak, 2006). While, a recognized ecosystem service which is provided by urban trees and vegetation is mainly improve air quality in cities and towns (Martin, 2013). This can have positive impacts in terms of climate change mitigation (CO<sub>2</sub>) and human health (PM, SO<sub>2</sub> and O<sub>3</sub>) (RICS, 2011).

Increasing green space through green infrastructure practices like green roofs can improve air quality, particularly in urban areas, because the trees and plants that are critical components of these technologies are able to remove common air pollutants like nitrogen dioxide, ozone, sulfur dioxide, and some particulate matter (Obendorfer *et al.*, 2007).

A study on City of Portland, on green roofs showed that each square foot of green roof removed 0.04 pounds of dust and particulate matter out of the air. Their analysis found that one 40,000 square foot green roof would remove 1,600 pounds of particulate matter from the air every year and would yield \$3,024 annually in avoided healthcare costs (Gill *et al.*, 2007). Studies on urban Ecosystem Analysis of Washington, DC confirmed that tree cover in the city not only saved \$4.7 billion in avoided storm water storage costs, but also created \$49.8 million in annual air quality savings by removing 20 million pounds of pollutants from the air every year (Urban Ecosystem Analysis for the Washington, DC Metropolitan Region, 2002). Therefore, the use of urban green space offers significant potential in moderating the increase in summer temperatures expected with climate change (Gill *et al.*, 2007).

#### 2.10.4. Climate Change and Adaptation Response

Green infrastructure can also play an important role in reducing some of the impacts of climate change in our urban environments (RICS, 2011). It supporting the adaptation of people who live in towns and cities to a changing climate, depending on location, type and extent, green infrastructure provides shade, cooling and wind interception and an insulation role in the winter (Forest Research, 2010). Trees, in particular, have been identified as a key element of urban climate change adaptation strategies (Greater London Authority, 2008), without which the cities of the future are likely to become very inhospitable places (Trees and Design Action Group, 2008). The scientific evidence showing that the earth's climate is changing is well established, as is the fact that much of this is due to man-made greenhouse gas emissions (IPCC, 2007). Green Infrastructure alleviates the impacts of climate change, such as flooding and the heat-island effect and provides effective ecosystem services that are expensive and difficult to replace with man-made solutions (SDC, 2010). Urban areas have warmer air and surface temperatures compared with non-urban areas. Buildings, roads and paved surfaces store heat during the day which is then released in the evening and night resulting in increased temperatures (RICS, 2011). Green spaces around homes can reduce air conditioning costs, potentially saving \$6.3 billion (USGA, 2007). Modeling studies indicate that, despite the projected effects of climate change, addition of 10% green space in high

density urban areas will allow cities to maintain current summer temperature levels for the next 70 years (John, 2011).

Green infrastructure can help communities become more resilient to the likely impacts of climate change (Milly *et al.*, 2012). A study in Greater Manchester showed that increasing urban green cover, in high-density areas could decrease expected maximum surface temperature in the 2080s by approximately 2.5° C (Gill *et al.*, 2007). The use of urban green space offers significant potential in moderating the increase in summer temperatures expected with climate change (John, 2011). Particularly in urban areas, where evaporative cooling and shading provided by green infrastructure can ensure that towns and cities continue to be attractive and comfortable places to live, work, visit and invest (SURF, 2011).

### **2.11. The Challenges Faced By Urban Parks**

In large cities, park expenditures have been flat or declining despite the encouragement of taxpayers to increase spending (Association, 2011). There has been inadequate investment in landscaping, play scapes, ball fields, walking and biking trails, recreation centers, and other community facilities, which are not replaced when they come to the end of their useful lives. According to LeVario (2011), crime is one of the challenges face urban parks ,some of the crimes that are happened regularly in the park are Murder, Arson, Rape, Theft, Assault, Robbery, Vehicle, Theft, and Burglary. Undertaking the revitalization or creation of a new urban park or recreation Area, agencies face challenges to the mission and programs of public parks as well as other issues that impact the viability of successful park and recreation programming including:

- Catering to a variety of constituencies that have different expectations and goals;
- Diminished funding and resources limit the ability of park and recreation agencies to respond to community needs;
- Public perception that access to urban parks and recreation programs should be free;
- Park and recreation departments are losing the competition for general fund dollars; and
- Deferred maintenance totals over \$1 billion in many large cities.

### **2.12. Street Sides and Medians Trees**

Street trees are planted trees on pedestrian roads, in road medians and road corridor and they are part of the overall green infrastructure component of cities (Kumelachew, 2015). Street trees are the most important organizing element of the streetscape environment. Appropriate

tree species selection and location and design of the planting site will ensure the healthy growth and longevity of trees, enhance streetscape character, and maximize the City's investment. It has been demonstrated that street trees enhance property values in residential neighborhoods and commercial Areas (Christopher *et al.*, 2011).

### **2.13. Challenges of Street Trees**

Planting a diverse urban forest with the right tree in the right place can enhance a city streetscape and reduce the long-term cost of tree replacement and maintenance (Farley, 2013). Although essential in an urban forest, street trees create numerous challenges for municipalities as well as private owners. Lack of species diversity is usually pronounced. In addition, inappropriate species are commonly planted along streets. Numerous variables such as proximity to buildings or vehicular traffic, soil Area, exposure, and road salt usage should also be considered when planting any tree.

# CHAPTER THREE

## RESEARCH METHODOLOGY

### 3.1. Introduction

This chapter gives an outline of the research methodology that was used in the study. Therefore, it contains description of study area, research approach, target population, sampling procedure and sample size design, types and source of data, a description of the method of data collection techniques, method of data analysis

### 3.2 Descriptions of the Study Area

Wolkite (also transliterated Wolkite) is a town in south-western Ethiopia. The town is the administrative center of the Gurage zone. The town has a latitude and longitude of 8°17'N 37°47'E and an elevation between 1910 and 1935 meters above sea level. It is surrounded by Kebena Woreda, Abeshige Woreda and Cheha Woreda and also and it was part of former Goro Woreda.

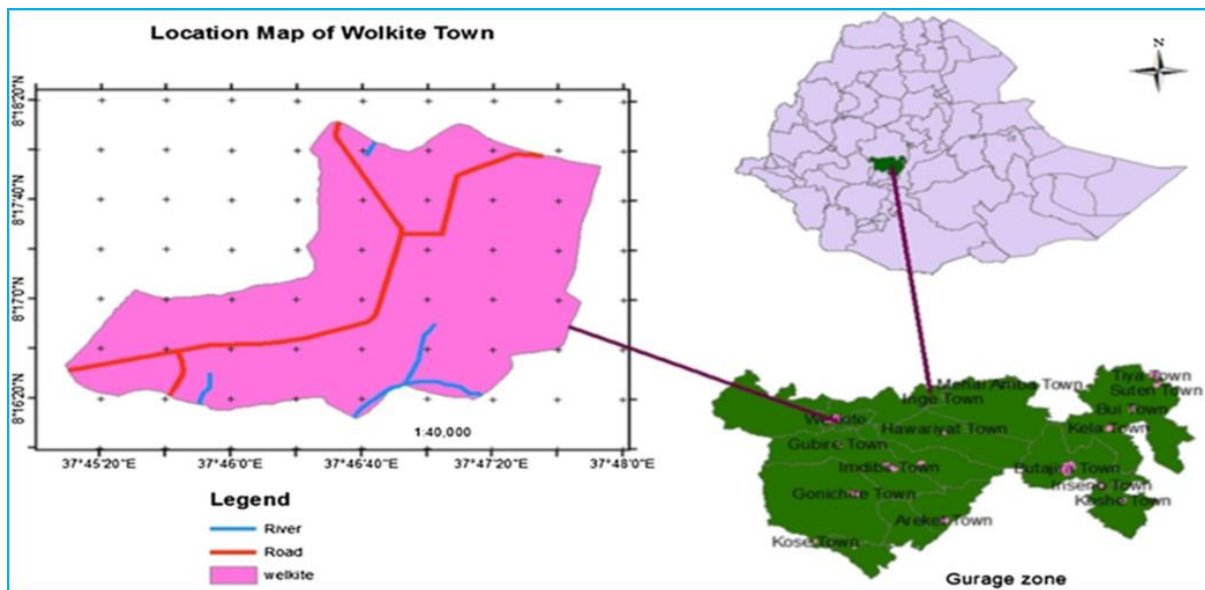


Figure 3: Location Map of the Study Area

Source: (Ethio GIS, 2004, Adapted from Adane, 2018).

The town is situated in the south-west plateau about 80km to the west of the main Ethiopia Rift Valley on a water divide of “Rebu”, “Megecha” and “Wabe” rivers. The City stretches some 12 km towards south west direction of Gubre sub city which is recently being part of Wolkite town and the place of Wolkite University. Total population of the Wolkite town in 2023 was 116,957, with an annual growth rate of 3.69%. (GZPO, 2023) At present the city divided in to three sub city namely, Bekur sub city, Addis sub city and Gubre sub city.

Wolkite town has been selected as a study area since it is one particular town that represents almost all the common challenges facing many cities in Ethiopia such as rapid urbanization, problems with town planning, urban sprawl and loss of urban biodiversity including GI.

### **3.3. Research Approach**

For this research, a mixed methods research design is used b/c a procedure for collecting, analyzing, and “mixing” both quantitative and qualitative methods in a single study or a series of studies to understand a research problem. The research used a mixed research approach i.e. a mix of qualitative and quantitative approaches. Quantitative approach was used for numerical data while, qualitative approach was employed to understand and often answers like “why”, “how”, “in what way” and “to what extent”. Due to the nature of the study, both research approaches was used. So that more reliable findings has been reached from the analysis of both quantitative and qualitative data. Most of the data for this study were obtained through questionnaires, interview and observations in which case results were generated in quantitative and qualitative.

### **3.4. Study Population**

Population is the universe of events from which the sample is drawn. . The study population for the research is the household of Wolkite town. According to the data from Wolkite town finance and economic development office (2015) investigate the town population is 116,957. Hence the sample frame was draw from the total. Also Gurage zone urban development employee, officials (technical staff), officials of municipality were used.

For relevant, expected and necessary data the sample units the researcher used in this thesis were sample units of households units, town municipality, zonal and town officials and technical staff and related institutions are also sample units.

### **3.5. Sampling Techniques and Sample Size Determination**

In this study, use both probability (systematic random) and non-probability sampling techniques were used in the study. Systematic random sampling is a method used in research whereby any person in the population has a specified randomly of being included in the sample. This may help the respondents to get equal chances to be selected from the population. In the case of non-probability sampling, purposive sampling utilized. Purposive sampling enabled researcher to secure data through purposeful selection of particular units from the sample who had better know how about the issues. Whereas, to select key

respondents from Zonal and city technical staff, municipality and land management and community representative were selected purposively.

To determine the sample size for the research, Kothari (2004) sample size determination formula was used. This research supposed the standard normal deviation at a required level of confidence 93% and Z Value for Confidence Level is 1.81, the proportion in the target population estimate to have characteristics being measured 50% and the level of statistical significance set 0.07%. The predictable total population of the Wolkite town in 2023 was 116,957. (GZPO, 2023) Therefore, sample was determined using the formula proposed by (Kothari, 2004). Accordingly, the formula for sample size determination is by:

$$n = Z^2 * p * \frac{q}{d^2} = 260$$

### **3.6. Data Type and Source**

In order to achieve the objectives of the study and also to provide sufficient answers to the study's research questions, both primary and secondary data source were utilized. Such as questionnaire and interviewing the resource person was used as a source of primary data for the study. In addition, Secondary data was collected from various sources such as books, scientific articles and papers both published and unpublished, reports, strategic planning, policy, regulation, standards, guide lines, proclamations, Terms of Reference, publications, brochures and other related documents from different governmental offices and institutions and also Several, grey literatures, policy documents, reviewed of the organization reports and other records for getting additional information on urban green infrastructure development and management. The study was conducted by employing both data gathering instruments.

### **3.7. Data Collection Instruments**

#### **3.7.1. Primary Data Sources**

The primary data was collected through questionnaire and interview from the concerning bodies.

##### **3.8.1.1 Questionnaire**

A questionnaire with both open-ended and close-ended question items used to known over all perspective of residents by self-administered. Creating questionnaire items was based on knowledge and theory gathered from review of literature. It was created in English language and translated into Amharic language (working language of Ethiopia) in order to make the questions clear, avoiding ambiguity as well as make it easily understood by the respondents. The data collection process was managed by the researcher. Prior to the commencement of

the actual data collection process, the questionnaire was pre tested and the necessary modification was made.

#### 3.8.1.2 Interview

Both structured and unstructured manner of face to face interview was conducted to obtain accurate information from urban green infrastructure management concerned offices, namely the Municipal Manager, Municipal Beautification and Greenery Cemetery Development, City Environment protection authority & Forest office, Urban agriculture office, Municipal infrastructure Development and Zone city plan preparation & Implementation.

#### 3.7.2 Secondary Data Sources

Secondary data from review of all necessary documents and related literature were also be used as a supplementary.

### **3.8. Data Analysis**

In this study, theoretical proposition strategy was used as a means of data analysis. There are also other data analysis methods which were used in this research. Relevant records from interview and questionnaire is translated, transcribed into English and grouped into categories for further analyses.

After data collection, questionnaire was checked for completeness and code was given during data coding. Relevant records from interview and questionnaire were translated, transcribed into English and grouped into categories for further analyses. Descriptive statistics using the latest version of Statistical Package for Social Sciences (SPSS version 26) was used to analysis collected data. In addition, information from the KIIs and *document review* were integrated with quantitative data to picture-out responses. Therefore, the researcher was used the combined methods and to make the research complete and enhance the validity of the findings.

## CHAPTER FOUR

### RESULT AND DISCUSSION

#### Introduction

This part provides with the discussion of the final results and the process through which the results were obtained. This includes background information of respondents, descriptive analysis about current status of urban green infrastructure, challenge, benefit and opportunities of urban green infrastructure.

#### 4.1 Response rate of respondents

It was defines the response rate as the extent to which the final set of data includes all sample members and it is calculated as from the number of people with whom interviews are completed divided by the total number of people in the entire sample, including those who refused to participate and those who were unavailable (Brians, 2011).

Based on sample size questionnaires were prepared and distributed to the participants its result was analyzed below the table.

Table 1: Response rate

No.	Respondents	Distributed	Returned	Unreturned	Response rate%
1	Residences of the town	180	180	0	100
2	Employee of the selected sectors	60	60	0	100
3	Managers	20	20	0	100
		260	260	0	100

(Source: Own survey, 2024)

## 4.2. Socio-Demographic Characteristics of the Respondents

In this study, the numbers of men respondents were much higher than the number of women. The table below shows that out of 260 total respondents 206 (79%) of them are men and the remaining 54 (21%) of respondents were women. Diverse age group (from very young to old aged) was participated in the research. About 68% of the respondent were young adults and followed by older people which account 31%. Green infrastructure creates conducive environment for all age groups.

It was observed that the local people had greatest interest in improving and managing green infrastructure in each level of age. But, according to KIIs, there are not enough green infrastructures to satisfy the interest of each age group at the study area. Particularly, the young and adult people spend most of the time in none valuable place and their lesser time spend on chewing chat and drinking alcohol.

In the study, majority of the respondents were married (61.9%) followed by single which account 24.2% of the respondents and the remaining 13.9% were widow and divorced. About 27.6 % of respondents had certificate and diploma, followed by degree holders (24.1%), secondary and preparatory (20.7%), can read and write (13.8%), complete primary school education (10.3%) and the remaining 3.45% have no any education level. This shows that most of the participants had formal education and this helps them understand the benefit, opportunities of green infrastructure and they need little information to manage green infrastructure in the study area.

Table 2: Socio-demographic characteristics of the respondents

Demographic characteristics	Sex	Frequency	percent	Mean	sd
Sex	Female	54	20.8%		
	Male	206	79.2%		
Age	18-30	45	17.3%	2.27	0.91
	31-44	134	51.5%		
	45-60	45	17.3%		
	61-75	36	13.8%		
Marital	Single	63	24.2%	1.93	0.69

Demographic characteristics	Sex	Frequency	percent	Mean	sd
status	Married	161	61.9%		
	Widow	27	10.4%		
	Divorced	9	3.5%		
Educational status	Illiterate	9	3.5%	4.27	1.46
	Read and write	36	13.8%		
	Primary	27	10.4%		
	Secondary and preparatory	54	20.8%		
	Certificate and diploma	72	27.7%		
	Degree and above	62	23.8%		

(Source: Own survey, 2024)

### 4.3. Current Status of Green Infrastructure Development and Management

The respondents were asked about the existence GI and in this regard about 135 (52%) of the respondents recognize that there is green infrastructure like road side plant and plant at the median of the road. Besides this, few respondents also support this idea by saying there are few GI at private recreational areas, government offices, around fence of few local individuals as well as at the road side but compared to the town coverage much more remain to do it. On the other hand, comparable number of the town's residents (48%) replied on contrary to the above ones.

Out of the total respondents, around 44.6% of the respondents mentioned that the current GI practice and management Perception in the area is very poor followed by medium (31.2%), poor (17.3%) and very few of them replied well which account only (7%) of the respondents. This shows that the current practice and management of GI in the town is still in the early stage of its development, Based on your respondent's perception. In current study, most

respondent forwarded their idea by saying that the town administration had weak practices in this regard and they spent a lot on forestation around the river sides and barren areas. This also shows, urban green infrastructure is far from their mind and few those planted in summer time missed them and lack follow up on the side of town administration.

The response of the respondents showed that, majority of the local people unsatisfied by existing GI which account about 98(37.69%) followed by moderately satisfied 81(31.15%), highly unsatisfied 18(6.92) and very few number of respondents highly satisfied.

From this response, it resembled to unsatisfied (44%) that means (highly unsatisfied plus unsatisfied) while those replied satisfied were replied based on their place and living village point of views.

According to the respondent, majority of green spaces that convenient in wolkite town was street plantation which is cited by nearly by have of the respondents (107 or 41.15% of the respondents) followed by forest plantation in barren land and space between in plants of scares forest which is cited by 72(27.69%) respondents, riverside vegetation mostly around wabe river and rabu river side which is reported by 54(20.77%), Institutional (mixed) reported by 18(6.92%).

On the other hand, the least reported green space around the study area was vegetable farm around the home and the fence which is cited by few respondents. In some extent it was similar with the study conducted in Addis Ababa by Kumelachew (2015). He categorized the green spaces in Addis Ababa into field crop, vegetable farm, public recreational parks, riparian vegetation, plantation forest, institutional forest (mixed forest), street plantation, and grassland. In his summary, field crops took the highest hectares of green space (9834.7) followed by plantation forest (3372.8 hectares), institutional mixed (1549.1 hectares), riverside vegetation (1535.8 hectares), grass land (823.1 hectares) and the least were vegetable covers (344.1 hectares).

In current study, the highest space was occupied by street plantation followed by plantation forest so that the study is more or less similar in this way while vary in the other way such as there is no field crop as urban green space in the study area.

Table 3: current status and practices of green infrastructure development and management

Current status	Response	Frequency	percent
Is there a green area in	Yes	135	52%

Current status	Response	Frequency	percent
your Village? (260)	No	125	48%
How do you evaluate current practices of the town administration for developing and managing of green infrastructure? (260)	Very good	0	0%
	Good	18	6.9%
	Medium	81	31.2%
	Poor	45	17.3%
	Very poor	116	44.6%
You are satisfied with the currently existing green areas/infrastructure in your city (260)	Very satisfied	9	3.46%
	Satisfied	54	20.8%
	Moderately satisfied	81	31.1%
	Un satisfied	98	37.7%
	Highly unsatisfied	18	6.92%
What is the principal type of green spaces that convenient in Wolkite city? (260)	Field crop	0	0%
	Vegetable farm	9	3.46%
	Public recreational parks	0	0%
	Riverside vegetation	54	20.8%
	Plantation forest	72	27.7%
	Institutional (mixed)	18	6.92%
	Grassland	0	0%
	Stet plantation	107	41.15%
Type Green space that found at Wolkite (260)	Roundabout	9	3.46%
	Road side trees	179	68.8%
	Cemeteries	18	6.92%
	Other type	54	20.8%
How do you evaluate the capacity of the town	Very good	0	0%
	good	36	13.85%

Current status	Response	Frequency	percent
administration in maintaining and managing green infrastructure? (260)	Neutral	54	20.77%
	Poor	125	48.07%
	Very poor	45	17.31%
green infrastructure situation of the town indicate growth advancement	Yes	108	41.54%
	No	152	58.46%
What is the real current management exercise to improve poor management performance in municipality and urban land administration office?	Teamwork between stakeholders	9	3.5%
	Allocation of adequate budget	9	3.5%
	Awareness creation	45	17%
	Tree planting	197	75.9%
Do you think that green spaces are properties of the community? (260)	Yes	195	75%
	No	65	25%
Have you ever seen green spaces reserved by the town development plan around your village? (260)	Yes	125	48%
	No	135	52%

(Source: Own survey, 2024)

### Responsible Bodies for Development and Management of the Town Green Spaces

The involvement of private developers to urban green infrastructures particularly to urban recreational parks a, Street sides and medians trees for the sake of them indirectly enhance the development and quality of the UGIs. Increment of professionals aided with Increment of public need of quality open spaces, pure air, and other recreational parks day to day could be an opportunities to green infrastructures management and development.

Out of the total respondents, 126(48.3%) of the respondent replied that the responsible organ for development and management of the town green infrastructure were the governments followed by the community themselves 72(27.59%), private 36(13.79%) and NGOs 27(10.34%). They mentioned different NGOs particularly the NGOs on greenery and drainage in and around Wolkite town were one wash organization and projects. The community has endless responsibility in development and management of the town green infrastructure. While the government and government bodies has great responsibility in follow up and facilitate everything related the issues.

Almost all respondents replied that, the communities have great willingness to participate in green area developments and managements. While in some instances, the local people dissatisfied on the sides of the government in various ways such in proper compensation, lack of plan and lack of proper follow up and supports.

The responsibility of the local people or the residents has responsibilities in different aspects such financial aspect, in kinds, in discussion and other many aspects. In this regard the community highly participates in discussion and actively participated development and management of urban green infrastructure which account about (58.1%) of the respondents followed by in kinds supports (15.5%), financial supports (6.9%) and other such as hand weeding, additional planting and remove fall off and unwanted thing around the UGIs (26.4%).

Table 4: responsible bodies for managing urban green infrastructure

Question	Responsible individual	Frequency	percent
Who is responsible for development and management of the town green spaces? (260)	Government organizations	126	48.28%
	The community	72	27.59%
	Private organization	36	13.79%
	NGOS	27	10.34%
Willing to participate in green area development and management?	Yes	258	99.2%
	No	2	0.77%
What is your responsibility in	Financial support	68	26.4%
	In kind support	40	15.5%

Question	Responsible individual	Frequency	percent
management of green areas? (258)	Participating in community discussion	150	58.1%
your estimation about the community participation on developing and managing of private and public gardens in the town?(260)	Very good	9	3.45%
	Good	90	34.5%
	Poor	126	48.3%
	Very poor	36	13.8%
	I don't know	9	3.45%
How do you participate in the growing of seedlings at town level during planting and managing? (260)	I am participating in very good level	9	3.46%
	Participate in a good level	90	34.6%
	Poorly participate	120	46.2%
	Almost no participation	41	15.8%
Low priorities have been given to green areas in the town of Wolkite(260)	Strongly agree	120	46.2%
	Agree	41	15.8%
	Neutral	15	5.77%
	Disagree	9	3.46%
	Strongly disagree	84	32.3%
Are there any local rules and regulations designed by inhabitants of the town? (260)	Yes	40	15.4%
	No	220	84.6%

(Source: Own survey, 2024)

#### 4.4. Benefits and Opportunities of Urban Green Spaces

Green infrastructure brings a lot of benefits such as environmental, economic, and social benefits to urban dwellers and resident around the UGI. In the study area, UGI has recent history and it is in infant stage. Its benefit remains unknown in well manner as compared to its diverse benefits. Understanding the benefits of green infrastructure assets helps local

governments, professional and community to decide where, when, and to what extent green infrastructure practices should become part of future planning.

In this study, environmental benefits are one of the major benefits among the different types of benefits. Among the environmental benefits, beautification and recreation, combating climate change, Combat air pollution, Ecological balance and Biodiversity conservation were mentioned in this study. Beautification and recreation were the major benefits of UGI and the respondents were asked whether or not beautification was one of the major benefits of UGI. In this regard about 170(65%) of the respondents strongly agreed followed by agreed 45(17%), neutral 18(6.9%), strongly disagreed 18(6.9%) and the remaining 9(3.5%) of the respondents replied disagreed on the stated issue. This also support by the officials and said that we adopted the UGI mainly for the seek beautification and recreation purposes.

The other environmental benefits of UGI were combating climate change. It was also raised to the respondents and they said that “UGI had unpredictable benefits, among that combating climate change the important benefits”. Among the respondents, 134(52%) strongly agreed followed by agreed 72(28%), disagreed 27(10.4%), strongly disagreed 18(6.5%). on the other hand, very few respondents neither agreed nor disagreed on the stated issues.

In the study combating air pollution were mention as environmental benefits and the highest number of respondents strongly agreed (45%) followed by agreed (42%), Disagreed (10.4%) and 6.9% of them strongly disagreed respectively. the official also confirm the same thing as ordinary respondents. Similarly, keeping ecological balance and biodiversity conservation have equal consideration as aforementioned benefits.

The second main benefits were social and economic benefits of UGIs. In this regard, different socio-economic benefits of UGIs were mentioned such as Carrying out different ceremony, Aesthetic value, and Education and Create job opportunity. So that, the respondents were asked their agreement whether or not UGIs benefits on Carrying out different ceremonies and 48% of respondents agreed followed by strongly agreed (28%), neither agreed nor disagreed (14%) while the remain were strongly disagreed and disagreed with 6.9% and 3.5% respectively. Aesthetic value, education and Create job opportunity were also included in socio economic values or benefits of UGIs. In all these case, maximum number of respondents agreed and strongly agreed up on the three aforementioned benefits. This shows that, the number socioeconomic advantage were gained as results of UGIs. On the other hand, little number of respondents disagrees and strongly disagreed on these stated benefits in table

below. In one way or another urban green infrastructure had uncountable benefits and opportunities for the study areas and elsewhere in the world. This is consistent with the finding of Alemaw (2017) that, UGI provide green space in residential areas, institutions, Religious Compounds Green Infrastructure Thus it increases the availability of urban green infrastructures in inner sub cities. It increases the green coverage in inner cities as well as increase connectivity of them. It mitigates climate change, provide food and other many.

Table 4: Benefits and opportunities of urban green areas

Benefit category	Benefits of green areas	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
Environmental benefit	For beautification and recreation	18(6.9%)	9(3.5%)	18(6.9%)	45(17%)	170(65%)
	Combating climate change	18(6.9%)	27(10.4%)	9(3.5%)	72(28%)	134(52%)
	Combat air pollution	18(6.9%)	27(10.4%)	0	99(38%)	117(45%)
	Ecological balance	27(10.4%)	18(6.9%)	0	108(42%)	108(42%)
	Biodiversity conservation	18(6.9%)	27(10.4%)	9(3.5%)	90(35%)	90(35%)
Social benefit and economic	Carrying out different ceremony	18(6.9%)	9(3.5%)	36(14%)	125(48%)	72(28%)
	Aesthetic value	18(6.9%)	9(3.5%)	45(17%)	108(42%)	30.76923
	Education	27(10.4%)	0	9(3.5%)	152(58%)	72(28%)
	Create job opportunity	27(10.4%)	9(3.5%)	18(6.9%)	152(58%)	54(21%)

(Source: Own survey, 2024)

#### 4.5. Challenges in Managing Green Infrastructure in Wolkite Town

More than half of the respondents replied that there is challenge to implement, development and management of green space in the study area. 80 % of the respondent agreed on the existence of challenges while other 52(20%) of the respondents replied on the otherwise.

This shows that, the developments and managements in the study area were affected by various factors as indicated in the (table 6) below. In the current study respondents mentioned

different challenges that prohibit UGI development and management in the town such as difficulty from structural plan, lack of responsiveness and awareness, skilled man power and financial related challenges. It was found that difficulty from structural plan as informed by 100(48.08%) followed by financial constraint cited by 45(21.63%) respondents, lack of responsiveness and lack of awareness were another major challenge in the study area and cited by 32(15.38%) and 31(14.9%) of respondents respectively. It was supported by the study conducted by Mensah (2014), budgets are perennially inadequate, and recreation land acquisition probably could not feasibly support all user demands or perceived “needs.” He indicates due to lack of political will - beautification projects halted in Addis Ababa institutional inefficiencies (financial constraints, low staff strength, lack of logistics, bureaucracies, corruption, political interference, and embezzlement of funds) are other challenges mentioned. `

Lack of structural highly influence urban green infrastructure. In similar way, Christopher *et al.* (2011) appropriate tree species selection, location and design of the planting site will ensure the healthy growth and longevity of trees, enhance streetscape character, and maximize the City’s investment. It also enhances property values in residential neighborhoods and commercial areas. It was consistent with other research works elsewhere in the world and the researchers mentioned such as competing demands for the use of land, uneven distribution of costs and benefits resulting from the development, and the environmental impacts arising from land use changes (Short *et al.*, 2013). From this finding the challenges are categorized as community & institutional, budgeting & financing, policy & governance and technical & information barriers.

It was shown that the majority of respondents (58.5%) answered that the area coverage of urban green infrastructure elements has decreased, 63(24.2%) answered increased the quantity while the remaining 45(17.3%) replied that that the quantity of urban green space remains the same from the previous years. The decreased in the quantity of urban green infrastructure components of the town is due to different reasons. The respondents mentioned in effective land use, miss use of green space, lack of structural plan implementation, lack of integration between communities and the government bodies (stake holders).

The reason for decreasing urban green infrastructure were absence of covered compensation preparation, shortage of urban land, unwillingness of affected people to leave from roads, No need of strategic plan in the town. In this regard shortage of urban land took the first stage in

protecting the proper implantation urban green infrastructure which is cited by 62(40.8%) of the respondents followed by absence of covered compensation preparation 45(29.6%), unwillingness of the affected people 25(16.4%) and the remaining 20(13.2%) of the respondents answered there is no clear strategic plan in the town. In addition to these aforementioned obstacles, the local people assume the following as decline reason as well as factors affecting urban green infrastructure are lack of effective land use, miss use of green space, lack of structural plan implementation, lack of integration between communities and the government bodies. It was consistent with many studies such as Kimmel et al. (2013) and Mensah (2014) state; there are barriers include public knowledge and perception, landowner preferences, development plans, resistance to change and a lack of political commitment and leadership. Moreover, according to Alliance (2011), community barriers can involve private properties, public outreach, public perception, the education of builders and developers, equitable distribution, equitable representation, and neighborhood issues while institutional barriers included lack of interagency coordination, resistance to change, diffuse jurisdictional power, shared commitment and lack of political leadership. On the other hand, Plan implementation problem is one of the major factors for improper development and management of GI components such as parks, playgrounds and sport fields in urban centers of Ethiopia. Even though a sound plan is prepared, ground interpretation of the plan is not seen through the coordinated effort of the concerned stakeholders (Wondimu, (2007). Furthermore, Derese (2008) demonstrates, there is no adequate budget for planning and managing GI components such as parks and gardens in urban centers of Ethiopia such as Addis Ababa. In times of fiscal constraints, as Forsyth (2003) argues budgets for GI components are often one of the first to be cut in Ethiopia. Therefore, shortage of budget for development and maintenance of urban GI components is a key factor in urban centers of Ethiopia in spite of their multifunctional benefits for the urban environment in particular and their contribution to divert the current problems related to global warming in general.

Table 6: Challenges in developing and managing green infrastructure in Wolkite town

Major Challenges	Response	Frequency	percent
There is any challenge on green spaces development and management in your town? (260)	Yes	208	80%
	No	52	20%
If the response for question #1 is	Difficulty from structural plan	100	48.1%

Major Challenges	Response	Frequency	percent
(yes), what are the key challenges of green infrastructure /spaces/ development and management in the town? (208)	Lack of responsiveness and awareness	32	15.4%
	Lack of Skilled man power	31	14.9%
	Financial constraint	45	21.6%
	Lack of political will		
	Others		
Does town has strategic plan to facilitate the situation for planting trees? (260)	Yes	200	76.9%
	No	60	23.1%
How do you evaluate green areas coverage to the rate of urbanization of the town? (260)	Increased	63	24.2
	Decreased	152	58.5
	The same	45	17.3
	I don't know		
What is/are the major decreasing green areas coverage and obstacle for the strategic plan not to implement and make conditions not suitable to develop and manage green spaces? (152)	Absence of covered compensation preparation.	45	29.6%
	Shortage of urban land	62	40.8%
	Unwillingness of affected people to leave from roads	25	16.4%
	No need of strategic plan in the town	20	13.2%
Is there any reserved green spaces land use changed by the town basic plan around your village? (260)	Yes	179	68.8%
	No	81	31.2%
If your answer for question # 6 is yes, for what purpose it is assigned now? (179)	Residential sites	100	55.9%
	Industrial zone	25	14%
	Playground	24	13.4%
	Public garden services	30	16.8%

(Source: Own survey, 2024)

## **CHAPTER FIVE**

### **CONCLUSION AND RECOMMENDATION**

#### **5.1. Conclusion**

Green infrastructures are very essential parts of urban life in order to satisfy the communities recreational wellbeing and to promote the livelihood of urban dweller by amendable the environment.

UGI increased when urbanization increased so that it is the main issue in many parts of the country in wide and it was the main issues in the study area. But increased urbanization and development have placed urban green infrastructures under extreme pressure, while unplanned urban growth has resulted in the loss of urban landscape and ecosystems.

In Wolkite Sub Cities, the urban green infrastructure coverage in the current time in not that much satisfactory. The study revealed that, current practices of urban green infrastructure is very poor compared to other areas near to study sites. This is due to low responsiveness of the concerning bodies on the stated issues as expected time interval. In this study common UGI were street plantation, forestation and riverside vegetation and among them street plantation the most abundant and the dominant type or space while the least was urban agriculture or urban vegetable farm in study area.

In this regard, the distribution of UGI varies from sub city to sub city and the available urban green spaces are concentrated at one Bekure and Addis sub city than Gubre sub city. As result the accessibility of UGI in these three sub city are not connected in expected manner and this makes the accessibility of the UGI very low. It was observed that, there is challenge to implement, development and management of green space in the study area.

The main challenges UGI development and management in the town was Difficulty from structural plan, Lack of responsiveness and awareness, skilled man power and financial related challenges. Lack of responsiveness and awareness was the major challenges in the study area. Generally, Wolkite city, urban green infrastructures faced different challenges including social, physical, economic, environmental, and institutional and management challenges. However; they have opportunities that enhance the management and development

of them which include: Different urban green infrastructures proclamations, standard, strategies, policies, and principles and so on.

## **5.2. Recommendation**

Based on the findings and conclusions of the study, to improve the existing situations of green infrastructure and management in Wolkite town the following recommendation was proposed.

- ④ To improve the coverage and quantity of urban green infrastructure of Wolkite town used its maximum effort on the stated issues and share experience in more advanced towns elsewhere the country. Beside this Wolkite town administration and municipality administration should give great attention for plan, implantation and rules regarding UGI in the study area
- ④ The concerning bodies, stake holders particularly town municipality and the communities should work together to enhance the existing status. Moreover, collaboration work should be essential especially those NGOs, practitioners, urban planner, business communities and local residents to increase, manage and protect UGI coverage at each sub cities.
- ④ Awareness rising work should be mandatory order to make the community aware of the benefits of green infrastructure and be motivated and inspired to participate and engage in the development and management of green infrastructure.
- ④ Furthermore, Success full urban green infrastructure provision and management program requires the active participation of stakeholders and the public in its planning and implementation.

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## APPENDIXES I

### Participants Survey Questionnaire

I am a graduate student at Wolkite University College of social science and humanity studies. Currently I am conducting a research for the completion of my master's in developmental planning and management. This study entitled on "Evaluation of Current Status and Development Challenges of Urban Green Infrastructure; the Case Wolkite town Gurage Zone of Ethiopia". This questionnaire is prepared for data gathering purpose for Research regarding Evaluation of Current Status and Development Challenges of Urban Green Infrastructure and I ask you politely to help me in filling the questionnaire.

Dear respondents, first of all I want to thank you in advance for your willingness to fill this questionnaire paper; In filling the questioner try to be very honest, free and open; because your responses to each and every question on the questionnaire paper will have high contribution for the validity and reality of the paper as a whole.

#### Part I: Back Ground of the Respondents

1. Sex:                   A) Male        B) Female
2. Age:                 A) 18-30        B) 31-64                C) 65 and above
3. Marital Status:    A) single        B) Married    C) Widowed    D) Divorced
4. Educational Status: A). illiterate   B) Read and write        C) Certificate        D) Diploma   E) Degree and above

#### Part II: Current Status and Practices of Green Infrastructure Development and Management.

1. Is there a green area in your Village?    A. Yes        B. No
2. How do you evaluate current practices of the town administration for developing and managing of green infrastructure?  
A. Very good    B. Good    C. Medium    D. Very poor   E. Poor
3. You are satisfied with the currently existing green areas/infrastructure in your locality  
A. Strongly agree   B. Agree    C. Moderate    C. Disagree    D. Strongly disagree
4. What is the principal type of green spaces that convenient in Wolkite town?  
A. Field crop    B. Vegetable farm        C. Public recreational parks  
D. Riverside (Riparian) vegetation        E. Plantation forest    F. Institutional (mixed) forest  
G. Grassland    H. Street plantation    I. Recreational Parks    J. Special function parks  
K. Private gardens    L. Street trees:
5. Green space type that found at Wolkite

- A. Squares B. Roadside trees C. Cemeteries D. Other type /indigenous and so on
6. How do you evaluate the capacity of the town administration in maintaining and managing green infrastructure?  
Very good B. good C. neutral D. poor E. very poor
7. Does the green infrastructure situation of the town indicate growth advancement?  
A. Yes B. No
8. What is the real current management exercise to improve poor management performance in municipality and urban land administration office?  
A. Teamwork between stakeholders B. Allocation of adequate budget C. Awareness creation D. Tree planting
9. Do you think that green spaces are properties of the community? A. Yes B. No
10. Have you ever seen green spaces reserved by the town development plan around your village? A. Yes B. No

Part III: Challenges in Managing Green Infrastructure

1. Do you think that, there is any challenge on green spaces development and management in your town? A. Yes B. No
2. If the response for question #1 is (yes), what are the key challenges of green infrastructure/spaces/ development and management in the town?

key challenges of green infrastructure/spaces/ development and management in the town	Yes		No	
	Frequency	Percent	Frequency	percent
Difficulty from structural plan				
Lack of responsiveness and awareness				
Lack of Skilled man power				
Financial related constraint				

3. Does town has strategic plan to facilitate the situation for planting trees?  
A. yes B. No
4. How do you evaluate green areas coverage to the rate of urbanization of the town?  
A. Increased B. Decreased C. The same

5. What is/are the major obstacle for the strategic plan not to implement and make conditions not suitable to develop and manage green spaces?

- A. Absence of covered compensation preparation.
- B. Shortage of urban land
- C. Unwillingness of affected people to leave from roads
- D. No need of strategic plan in the town

6. Is there any reserved green spaces land use changed by the town basic plan around your village? A. Yes B. No

7. If your answer for question # 6 is yes, for what purpose it is assigned now?

- A. Residential site
- B. Industrial zone
- C. Playground
- D. Public garden service

Part IV: Opportunities and Benefits of Urban Green Spaces

Table1: Benefits of urban green areas

No	Benefits of green areas	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
8.1	Environmental benefit					
	For beautification and recreation					
	Combating climate change					
	Combat air pollution					
	Ecological balance					
	Biodiversity conservation					
8.2	Social benefit and economic					
	Carrying out different ceremony					
	Aesthetic value					
	Education					
	Create job opportunity					

9. Who is responsible for development and management of the town green spaces?

- A. Government organizations
- B. The community
- C. Private organization
- D. NGOs
- E. Other

10. Are you willing to participate in green area development and management?

- A. Yes
- B. No, If your answer is no, why? -----

11. What is your responsibility in management of green areas?

A. Financial support

B. In kind support

C. Participating in community discussion

D. other specify

12. How is your estimation about the community participation on developing and managing of private and public gardens in the town?

A. Very good      B. Good      C. Poor      D. Very poor      E. I don't know

12. How do you participate in the growing of seedlings at town level during planting and managing?

A. I am participating in very good level

B. Participate in a good level

C. Poorly participate

D. Almost no participation

E. Other specify

13. Low priorities have been given to green areas in the town of Wolkite.

A. Agree

B. Strongly agrees

C. Neutral

D. Disagree

E. Strongly disagree,

14.If your answer is agreed, why? -----

15.If disagree, why? -----

16.Are there any local rules and regulations designed by inhabitants of the town?    A. Yes

      B. No

17.If your answer for question #16 is yes, specify them -----

## APPENDIX II

### Interview For officials

Prepared interview questionnaire were for officials or experts of Wolkite town municipality and urban development office which related with the evaluation of current status and development challenges of urban green infrastructure

1. How is the current situation of green infrastructure development and management in the town? -----
2. Which government organization(s) is/are responsible for planning and managing the green infrastructure of the town? -----
3. How the green space experts are structured regarding profession? -----
4. How many experts are there in the municipal office on urban greenery team work and how are their professions related to their position? -----
5. How often the green areas are conserved based on condition and duration of time? -----  
-----
6. How the budget allocation is looks like for green area development and Management?  
\_\_\_\_\_
7. How do these local regulations connect to national-level legislation for green infrastructure? -----
8. Is there any committee created to organize the practices of development and management of green infrastructure and greenery area in the town? -----  
-----
9. How do you measure the attitude of the residents regarding to urban greenery development and management?
10. How do you evaluate the current practices of the town on development and management of green spaces? \_\_\_\_\_
11. What are the most important Strengths, Weaknesses, Opportunities and threats of the town on development and management of green spaces? -----  
-----
12. What are the challenges your sector have been facing while developing and managing the existing green spaces in the town?
13. What kinds of strategies you suggest to overcome these problems and in order to improve the development and management practice for green infrastructure in the town?

14. Is sanitation and beautification department within municipality and others stakeholders play an expected leading role to achieve planned goal in the town green infrastructure development and management?
15. How do you explain urban greenery policy? -----
16. Does it practically implementing in your town?
17. Does it help to promote green area? Specify, how? -----  
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