ADDIS ABABA UNIVERSITY

COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES

DEPARTMENT OF ZOOLOGY

THE ASSESSMENT OF THE BENEFITS AND CHALLENGES OF URBAN FOREST DEVELOPMENT AT KOLFE KERANIYO SUB - CITY OF ADDIS ABABA

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Thesis Approval Sheet

ADDIS ABABA UNIVERSITY COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES DEPARTMENT OF BIOLOGY

We, the undersigned, hereby declare that we have read the particulars included in the thesis, we recommend the department to accept the thesis paper prepared by Bizunesh Dibaba entitled The assessment of the benefits and challenges of urban forest development at kolfe keraniyo sub-city of Addis Ababa in partial fulfillment of the requirement for the Award of Master of Science in Biology.

Approved by Board of Examiners

External Examiner_____Signature _____ Date_____

Internal Examiner _____Signature _____ Date_____

Advisor _____ Signature _____Date_____

Declaration

I declare that this thesis paper entitled The assessment of the benefits and challenges of urban forest development at kolfe keraniyo sub-city of Addis Ababa is my own work, which has not been presented before for any degree or examination in any other university or college, and that all the sources I have used or quoted have been indicated and acknowledged by means of complete references.

Bizunesh Dibaba

Date _____

Signature _____

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Abstract

Urban forest has played important roles in social, cultural, economic and environmental protection. For example, landscape enhancement, provision of recreational and cultural facilities erosion control, water shade protection and supply of fruit and fuel woods are some of the multifunctional benefits of urban forestry. The study evaluates the benefit and challenges of urban forest development in Addis Ababa city, Kolfe Keraniyo sub city. The Simple random sampling technique was applied to select sample respondents from different woreda in kolfekeraniyo sub city. Accordingly, the study was conducted based on data gathered from 348 respondents. The SPSS statistical software was used to analyze the data. The result of the study identified the benefit from urban forest which includes urban forest is part of tourist appeal, make city more relaxing for visitors and for attraction of birds and other animals. The study also revealed society had awareness on benefit of urban forest for sustainable development, maintaining ecological health and means of habitat preservation. Despite these multiple benefits, there also the major challenges of increased human population, habitat loss and excessive site coverage by building from developing urban forest in kolfe keraniyo sub city. Altogether, from the present finding it is suggested that the government need to formulate the regulation and create awareness of the communities about benefits and challenges of developing urban forest. Moreover, to ensure sustainable development forest management strategies that encompass human social cultural and economic and environmental aspects may be adapted.

Keywords: urban forest, sustainable development, habitat loss

1. Background of the study

Urban forest encompasses the trees and shrubs in an urban area, including trees in yards, along streets and utility corridors, in protected areas, and in watersheds. This includes individual trees, street trees, green spaces with trees, and even the associated vegetation and the soil beneath the trees. In many regions, urban forests are the most extensive, functional, and visible form of green infrastructure in cities. Green infrastructure is the natural and semi-natural infrastructure within a city that provides ecosystem services like storm water management or air pollution abatement (Miller et al; 2015).

Urban green infrastructure refers to spaces that are located in the urban web which include urban forest, river buffer vegetation, recreational parks, urban agriculture, avenues of trees and other garden area. Green infrastructure is defined in different ways by different authors. Benedict and (Pandey et al., 2006) defined green infrastructure as an inter-connected network of water ways, wetlands, woodlands, wild life habitats and other natural areas: greenways, parks and other conservation lands, working farms, ranches and forests; and wilderness and other open spaces that support native species, maintain natural ecological processes, sustain air and water resources and contribute to the health and quality of life for communities and people. More recently (Davies et al., 2012) defined green infrastructure as parts of urban areas with a mix of street trees, parks, cultivated land, wetlands, lakes and streams. This definition is synonymous with the definition of urban forests. In which, urban forest is defined as trees, forests, green spaces, and related biotic, abiotic and cultural components in and around cities (Carter, 1995). Therefore, green infrastructure and urban forest are regarded as being similar land use types. Hence, in this paper, the terms green infrastructure, green areas and urban forest are used interchangeably.

1.1. Statement of the Problem

Today cities are facing enormous challenges, such as climate change demographic aging natural resource depletion. According to Marthe *et al* (2006) cities are particularly prone to the effect of climate change. Demuzer (2014) stated urban areas are facing increasing challenges from climate change such as, floods, droughts, heat waves and other threats to the human comfort and environmental injustice. In third world countries inner cities have old aged

infrastructure and infrastructure challenges especially in urban green infrastructures (Gossye, 2015).

Like other cities Addis Ababa faced challenges from flooding, threats to human comfort and environmental injustice (Dubbale *et al*, 2010) which could be mitigated by urban green infrastructure. It is one of the cities of Ethiopia that has experienced environmental deterioration and, in some cases the disappearance of its green areas particularly inner parts (Yewoineshet, 2007). However, Munir (2012) indicated some opportunities that inner Sub Cities of Addis Ababa cannot benefit from yet regarding urban green infrastructures due to management challenges like Master plan of Addis Ababa that was developed in 2002.

However, the green infrastructure of the 136 years old Addis Ababa is not developed, managed and protected very well to fulfill the environmental, social and economic benefits to the community. For example, the urban forest in Addis Ababa has transformed from once dense indigenous forest to degraded eucalyptus plantations (Horest, 2006). As it is known Addis Ababa is the capital city of Ethiopia and Africa, even it is the home of many international diplomats and a population of more than 3 million and site of many industries, but there are tremendous environmental, social and economic problems associated with lack of appropriate green infrastructure development, management and protection. Beyond this general statement, the status and overall challenges faced on the urban forest in the city is not clearly known. Thus, the researcher will assess the benefits and challenges of urban forest development, at Kolfe Keraniyo sub-city of Addis Ababa.

1.2. Objective of the study

1.2.1. General objective

The general objective of this study is to investigate the benefits and challenges of urban forestry development in Addis Ababa at kolfe keraniyo sub-city.

1.2.2. Specific objectives

The specific objectives of the study were to:

- To assess the benefits of urban forest development in Addis Ababa city kolfe keraniyo sub-city.

- To assess the challenges of urban forest development in Addis Ababa city kolfe keraniyo sub-city.
- To assess the awareness levels of the residents towards the values of urban forest development in the study area.

1.3. Research questions

The present study was addressing the following research questions:

- What are the benefits for urban forest development?
- What are the challenges of urban forest development in the study area?
- What are the levels of awareness of the residents towards the values of urban forest development in kolfe keraniyo sub-city?

1.4. Significance of the study

It is hoped that this research will lie in its potential to improve the quality of life to societies in the study area and offer a range of social, economic ecological and health advantages. The study also lists out the challenges to promote urban forest development and management in the study area and create awareness for the residents about the multifunctional values of green areas in the study sub-city. Moreover, the study will be helpful for researcher as a stepping stone to do further research on the issue at hand. Finally, the study will be important source of information for urban planners, policy makers, NGO practitioners and academics working on urban green infrastructure to develop strategies to promote the creation and conservation of valuable urban forestry .

2. Literature review

2.1. The concept of urban forest

Urban forest is ”the art, science and technology of managing trees and forest resources in and around urban community ecosystems for the physiological, sociological, economic and aesthetic benefits trees provide society"(Helms, 1998). This emphasis on benefits helps get us to the heart of the entire purpose of discussing planning for urban forest. Without a focus on anticipated benefits, a community simply has open space awaiting development or vacant lots that have gone fallow because of blight.

Although there has been a relatively development in green infrastructure research, there are still questions as to what green infrastructure is as a concept and as a landscape delivery mechanism. Both the term ‘green’ and ‘infrastructure’ have been discussed and presented elsewhere as offering a range of contrasting and sometimes contradictory meanings. As such, the concept is still fraught with contradictions. These contrasting definitions raise important questions, such as what constitutes green infrastructure and in which theoretical disciplines should it be located? The term ‘green’ can be used to reflect the environment, environmentalism, nature or recycling. Green has strong connotations with the environment, but professor Mark Shuck Smith questioned the green value or emphasis of green infrastructure. In answer to Shuck smith, the work of Williamson (2003) can be presented to support the use of the term ‘green’ in green infrastructure, emphasizing the ecological functions associated with the concept.

2.1.1. Components of urban forest development

Urban forest development is the network of natural environmental components and green and blue spaces that lies within cities, towns and villages which provides multiple social, Green economic and environmental benefits. Urban forest has its own physical components, including forest, parks, rivers, street trees and urban agriculture.

2.1.2. Urban Forest in Addis Ababa

According to FAO (2012) forest is defined as land spinning 0.5ha with trees higher than 5 meter and a canopy cover more than 10% or trees able to reach thresh holds in situ with the exception of agricultural and urban land uses. Based on this definition most of the forest

patches existing in Addis Ababa cannot be considered as a forest because the existing eucalyptus forest of Addis Ababa is either ex situ origin or it is in urban land use. However, arbitrarily the urban forest in Addis Ababa can be classified into peri urban forest and the plantation in recreation parks, road side, reverie vegetation and plantations in private and institutional gardens. It is quite clear that urban forest varies from natural forest in many ways. It is an urban green referring to a re-vegetation by planted trees, shrub or herbs with intended design to improve environmental quality, economic opportunity and aesthetic value. Large amount of forest is found in six sub cities of the city. Both the peri urban forests and down town forests supply fresh air to the city and they are considered as the breathing organ of the city. It also protects the city from hazards such as flood coming from the surrounding mountains. In general forest for the city is a base for economic welfare, water supply, improved air quality, stabilized soil, reduced sound pollution, home for wild life, serving as a carbon sink. The urban forest in Addis Ababa like any other cities is making life more comfortable to the residents. The existing master plan of the city designates about 22,000 ha of green area. The green area includes road side trees, recreational parks, and riverine and peri-urban forest. In the existing master plan of the city 12,342ha of land is allocated for forest and wood land, 4,197ha for river bank, 5129ha for urban agriculture, and 335ha for parks. At present total land covered by peri- urban forests is nearly 8,500ha is about 38.6% of the total green area.

2.1.3. Recreation and Road Side Parks

At present there are 16 parks owned by the government with a total area of 122ha. These parks in addition to their economic and aesthetic importance they are playing significant role as urban forest component. Furthermore the city administration designates 342ha of the city's surface area for public recreational parks. Among the proposed 17 public parks in the master plan no one of them were realized in the given time period. The roadside parks are also play a significant role in urban greening and creating balanced ecosystem. They are important in improving urban environmental conditions and safeguarding biodiversity. Trees and other vegetation intercept particles and gaseous pollutants. They are important in reduction of noise pollution and dust particles. Moreover, they act as carbon sinks that help mitigate global warming.

2.1.4. Urban agriculture

Urban agriculture has been perceived and defined from different dimensions by different authors. According to Richtel et al (1995), it is not the location of urban agriculture which distinguishes it from rural agriculture but the fact that it is embedded in and interacting with urban ecosystem. Urban agriculture is the growing of plants especially tree fruits and the raising of animals for food and other uses with in cities and per urban areas. It also includes the production and delivery of inputs, and the processing and marketing of products. About half of the world population lives in urban areas. However, while urbanization brings a number of socio-economic benefits, the rapid increase in urban population ushers in a number of challenges. The continued expansion of urban areas in to the immediate hinterlands often leads to the conservation of potential agricultural lands in to non-agricultural land uses. Some cities have adopted urban agriculture as a strategy to address the increasing urban unemployment supports food security, and nutrition generates income for the urban poor in general and the disadvantaged groups such as women, the disabled. In Addis Ababa, urban agriculture is one component of these green frames covering an area of 7,309ha of land. It has a significant role in the city's daily economic activity. Wide varieties of plants including fruit trees are cultivated in the urban agriculture sector. In peri urban areas there are people engaged in agro-forestry practices. Thus, urban agriculture is sharing the burdens of urban forest by supplying biomass fuel and absorbing CO_2.An agro-forestry development as an extension package being implemented 15 both in urban and per urban areas of the city. The agro ecology of Addis Ababa could allow many cereals, vegetables and fruits. Significance of Urban Agriculture There is now growing consensus that urban agriculture is not a problem, as previously thought, but an important contributor to sustainable urban growth and development as well as to people's livelihoods. The sector contributes significantly to food supply, employment creation, income generation and environmental management. As indicated by Thomas (2013), one of the economic benefits of urban agriculture in Addis Ababa has been its capacity to generate income and create employment opportunities. On an average three vegetable growing co-operatives gained an annual income of 157,005.31birr, giving an average monthly income of 581.00 birr per each member of the co-operative. According to him in terms of employment, there were about 16,000 people engaged in producing vegetables in Addis Ababa. Social Benefits of Urban Agriculture To the above economic benefits, urban agriculture in Addis

Ababa was bringing about significant social contributions. It involved some vulnerable groups such as women and the elderly, thereby helping to reduce their dependency on other people. It also served to strengthen social integration of the farmers by organizing them in to cooperatives. Environmental benefits of urban agriculture due to the favorable climatic conditions of Addis Ababa, areas used for urban agriculture were green throughout the year. This contributed towards the creation of a microclimate in some parts of the city, as well as the to the city's aesthetic value. Evergreens also helped to clean the air by reducing dust and protecting the soil from erosion. Some urbanites believed that urban agriculture had protected their areas from being used as sites for the unhygienic dumping of wastes.

2.1.5. Urban forest and their environmental benefits

Green infrastructure is known to provide quantifiable or measurable environmental benefits. Trees for example, are an important cost effective solution to reducing pollution and improving air quality (Bell and Wheller, 2006).This is why Latin American cities: Mexico city and Sao Paolo integrated trees and other vegetation as part of urban environmental improvement programs, policies and measures (Escobedo *et al*; 2009).

2.1.5.1. Urban forest and heat amelioration

Towns and cities are usually a degree or too warmer than surrounding rural areas, as a result of the urban heat island effect (CABE, 2010).The urban heat island is caused by two main factors: the absorption of direct solar radiation by buildings and other man made surfaces and the lack of vegetation in urban areas. Green infrastructure in urban areas has an important role to play in ameliorating the warming effects of climate change and the urban heat island (UHI). Provision of green infrastructure can reduce higher urban temperatures through vapor transpiration, direct shading and conversion of solar radiation to latent heat. Some research proved that how green infrastructures can facilitate heat amelioration. Open spaces with higher number or larger area of trees have been found to have lower temperatures than those with few trees. Trees and shrubs provide protection from both heat and UV radiation by direct shading.

2.1.5.2. Urban forest improving air quality

The role of vegetation in mitigating the effects of air pollution has been highlighted as one of the potential benefits of urban green space (Tiwary *et al*; 2011).Trees in urban green space can

influence air quality in a number of ways; for example through direct absorption of gaseous pollutants and interception of particles on to leaf surfaces, by lowering air temperatures through transpiration which can reduce the formation of ozone, and through the direct production of oxygen during photosynthesis. The contribution of green infrastructure for air pollution reduction can be shown from different perspective. Tiwary *et al* (2011) showed that trees reduce pollution through the deposition of particulate matter on to leaf surfaces. The structure of large trees and their rough surfaces cause interception of particulate matter of less than 10 microns by disrupting the flow of air and trees provide a surface area for capture that can be between 2 and 12 times the area of land they cover. Nowak (1994) showed that trees in the Chicago area were estimated to remove 6190 tons of air pollution per year which equates to an average improvement in air quality of 5-10% can be gained from increased tree cover.

2.1.5.3. Urban forest and carbon dioxide

Forests help remove large amounts of carbon dioxide from the air. Studies suggest that forest stands in urban environments have the potential to sequester and store more carbon than rural stands of the same canopy species composition (Nowak; 1994). Green houses gases trap the heat of the sun, and as these gases build up, temperature rises. During photosynthesis, trees convert CO_2 in to oxygen; carbon is also stored in the body of the tree, in the soil surrounding its roots and in debris that falls to the ground. Thus, green infrastructure are very important in counteracting anthropogenic CO_2 emissions not only because they store and trap CO_2 in their biomass but also increase the soil surfaces of cities which otherwise would have been a non-permeable surface. The other way in which trees reduce atmospheric CO_2 emission is that by reducing building energy. In urban area were air conditioning is a must and where fossil fuel plants are used, urban trees reduce carbon production by energy conservation (Nowak, 1994). It is also known that well managed wood lots replace fossil fuels hence reducing emission.

2.1.5.4. Urban forest and biodiversity conservation

Urban forest can have influence on urban biodiversity. Green spaces can form a functioning ecosystem in its own right for many species, for example rare or protected or those that are invasive and require careful management. Just, importantly urban green space contributes to wider ecosystem function for species whose persistence is influenced larger scale process. Green infrastructure can influence biodiversity by increasing habitat area, increasing

populations of some protected species and increasing species movement. The positive impacts that urban green infrastructure can have on air, soil and water quality provide benefits for biodiversity.

2.1.5.5. Urban forest and social benefits

Community engagement during the creation of green infrastructure is vital at all stages in the process in order to ensure its success. The involvement of the local community brings social benefits such as community cohesion and inclusion to local people, and provides residents with a sense of ownership and from this a higher level of satisfaction and positive perception of quality. This helps the multifunctional use of the green space system. Green space offers possibilities in terms of increasing social activity, improving community cohesion, developing local attachment and lower in crime levels, particularly in deprived communities (Bell *et al*; 2008).The mere presence and local availability of green spaces and natural features have been shown to encourage people to use their outside spaces more and, once outside, these green spaces help to promote positive social interactions. Urban green spaces have personal and social significance. If these spaces are more widely available, physically improved and appropriate to practical as well as physiological need then more people could benefit from them. For example, green space could be aligned to fulfill aspects of daily routine, such as lunching, being a thoroughfare, or for conducting a range of social activities. Road side trees also reduce traffic accident. This is because the tree's view and heat reduction will calm drivers. Individual driving speeds were significantly reduced in the suburban settings. Faster drivers and slower drivers both drive slower with the presence of trees (Dixon and Wolf, 2007).

2.1.5.6. Urban forest and economic benefits

The more our natural resources are compromised the more we become aware of their ecological and economic significance. In addition to social and environmental benefits green infrastructure can have an impact on the. The value of good quality accessible green infrastructure to the local economy can be quantified though; inward investment and job creation, land and property values, local economic regeneration. The more obvious economic benefits of urban forests are fuel wood, food, grazing for livestock, timber and poles, spices, fiber, medicines and other non-timber products (Carter, 1995). Other benefits (e.g.

beautification, privacy, wild life habitats, sense of place, and wellbeing) attributed to urban trees are difficult to price. But the fact that trees reduce buildings energy cost and those environmental services (e.g. reduced pollution and carbon stored) can be valued in money (McPherson *et al*; 2005). Reduced storm water runoff and decreased heating and cooling costs are the most notable cost savings (Wikipedia, the free encyclopedia). Trees also improve local business activity and increase property values. Shoppers are willing to make more frequent and longer shopping trips to tree-lined commercial districts. Consumers have also been shown to spend up to 12% more when shopping in these districts Generally, to estimate the economic values associated with existing and potential green infrastructure differ by geographical scale, from the individual site owner, to the community and broader.

2.2. Actors in urban forest development and management

Urban forest development and management required more integrated approaches and active involvement of public, private and non-governmental actors at individual, community, city and national level (Baycan-Levent and Nijkaml,2004:2-3 in Gebrye Kefelew; 2012).Urban forest development and management should therefore, involve those whose interests are affected by both green problems and management strategies and action plans; who control relevant instruments for implementing green management strategies, and those who possess relevant information and needed for dealing with a wide spectrum of green issues. For participation and partnership to become sustainable in the development and management of urban green infrastructure and open spaces, collaboration is very important. Regarding stakeholders identified the following influential actors which are directly or indirectly involved in the development and management of urban environment in general and urban green infrastructure in particular theses are environmental protection agencies whose staffs are responsible for setting environments regulations and standards for monitoring and enforcement, planning agencies whose staffs are responsible to conduct environmental analysis and used it as inputs for local development planning, concerned residents and community based organizations (CBO'S) whose members and leaders are acutely aware of the impacts of environmental problems at the household and neighborhood level, non-governmental organizations (NGO) that can be effective agents for building local awareness for mobilizing community action and for voicing local concerns, private and informal sector enterprise that generally are concerned

about the constraints placed on their business by environmental regulations and the costs such rule incur, particularly when enforcement is lack or inconsistent and the news media whose voice concern for the environment and reporting on those affected by environmental conditions. As the foregoing paragraph show state, use and challenges for the development and management of urban green infrastructure is determined by the interaction of various government offices, non-governmental organizations and community actors.

2.3. Empirical experience of urban forest development

2.3.1. Urban forest in Ethiopia

The consideration of urban forest in urban planning and other social and economic development endeavors of a country has paramount importance for sustainable development. In this regard the urban planning process of Ethiopia has been incorporating the issue of urban planning process exercise since the introduction of modern urban planning (Fetsum 2003:106 in Gebrye; 2012). He also indicated as this is reflected in the incorporation of green areas and parks in urban plans, considerations of the compatibility of various land use activities, incorporation of generalized environmental objectives and identification of hazardous areas. In order to respond these problems: the government of Ethiopia is forced to design various supporting guidelines, policies and proclamations. Concerning this, the Ethiopian constitution of 1995, the Ethiopian environmental policy of 1997, the Ethiopian urban development policy of 2006, and urban planning proclamations No 574/2008c can be mentioned. The Ethiopian constitution provides general principles that urge all people have the right to live in a clean and healthy environment. The concept of sustainable development and environmental rights are also enshrined in Article 43, 44 and 92 of the constitution of FDRE. As different interventions strategies and proclamations are designed in line with the constitution, Federal, regional and local governments can design and execute supporting proclamation and various intervention strategies and manage urban green infrastructure areas. Moreover, environmental policy of Ethiopia has recognized the importance of planning and creating green spaces with in urban areas. This is an opportunity for various stakeholders to develop and manage urban forests, street trees as elements of urban green areas. Besides, the urban development policy, Ethiopia has recognized cities as entities that strive to work towards minimizing serious causes and consequences that endanger the urban environment. The policy document also declared city

government to work towards: The development and protection of urban greens, designing and developing Environmental friendly development projects, planting and protecting Institutional, parks, residential green areas, street tree and informal green areas, ensuring that an exemplary and leading role as played by the government and ensuring the participation of the private sector in environmental protection selecting and adapting best practices, experiences and technologies sustainable for urban environmental Protection.

2.3.2. Urban forest experience in Addis Ababa

Development of urban green areas of Ethiopia was relating with the history of Addis Ababa, which was established in 1886 by Emperor Menelik II. Accordingly, in the early development of Addis Ababa the king divided the location of the residences of his noble men and gave land according to their respective positions. The chiefs in their turn redistribute their land to their immediate followers and create several clusters of residents known as "Sefer'' which means camp. In general, during the early development of Addis Ababa up to the development of the master plan of the city during the Italian occupation, these open public places served as a place for social gathering, rest, ceremonial gathering and even for recreational purposes. The development plan of Addis Ababa is being revised now had a proposal that enforces tree planting along the ring roads that are on all new and existing trees, and imposes one plot-one tree requirements. Moreover, initiatives and involvements of the private sectors have been observed in the past years, especially in the development of squares. This effort focuses mostly on beautifying and implemented through concession modality

3. Materials and methods

3.1. Study area

Kolfe Keraniyo sub-city is one of the eleven sub-cities of the capital Addis Ababa. It is located in the Western edge of the capital city of Ethiopia, Addis Ababa near Gefersa reservoir between 8°57'00"- 9° 05'24" N latitudes and 38°39'36" - 38°43'12" E longitudes. The total area of Kolfe Keraniyo sub-city is estimated to be 6400 ha or 61.25 Km^2 or 23.65 square mile. The total population of 2011 of the sub-city is 546,219. But as of 2023, the total population of the sub city has been changed to 70,672 under new structure Kolfe Keraniyo sub-city borders with the district of Gullele, Addis Ketema, Lideta and Nefas- silk Lafto. Geographically the area covers locations stretching from Dutch Embassy to General Winget high school area in the North, Mesalemia area in the East and Torr Hyloch area in the South border of Kolfe. There are ten Woredas in the sub-city. The numbers of households vary among these woreda (Table 1).

Table 1 The woreda and number of households in Kolfe Keraniyo sub-city

Woreda	**No of households**
Woreda 1	5107
Woreda 2	6935
Woreda 3	13480
Woreda 4	7985
Woreda 5	8952
Woreda 6	7262
Woreda 7	6973
Woreda 8	5169
Woreda 9	3685
Woreda 10	5124
Total	70672

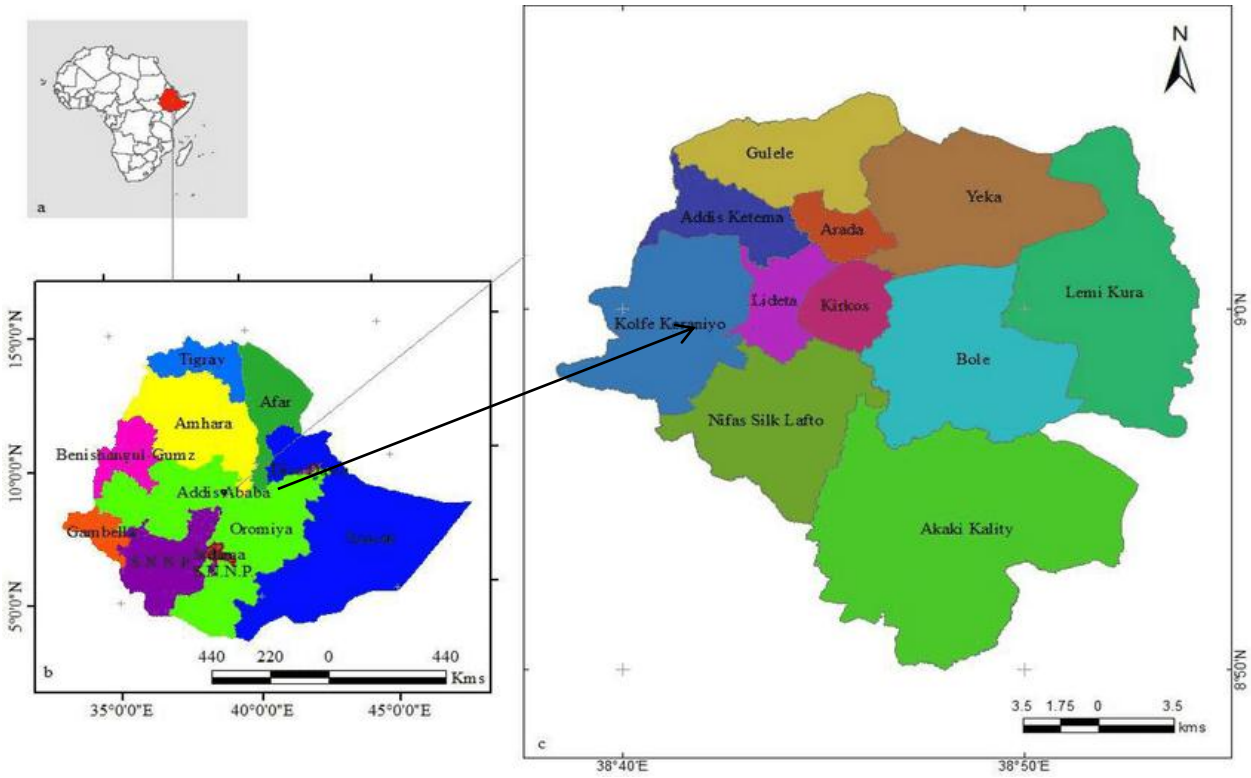


Figure.1.Map of the Kolfe Keraniyo sub city in relation to the map of the Addis Ababa Ethiopia.

Kolfe Keraniyo sub-city is divided into ten woreda and a number of neighborhoods called villages and the residents identify the small physical units by different names. the most famous ones are Jemo 2, Mickle and condominium site, Repi upper, Asko area, Atenna tera, Ayer-tena, Gebre kirstose bete kirstian, Kolfe keraniyo, Koshim, Kurtume stream, Lekwuanda, Lideta Gebriel bete kirstian, Nifro Neighborhood, Sost kutir mazoria. It Coordinates: 9°0′49.75″N 38°42′21.49″E

3.2. Study approach

The study was employing both qualitative and quantitative research methods. Thus, the study was used mixed research method. The reason for using this method is to compare the results from two different perspectives as relying on quantitative methods alone can hide important facts obtained from qualitative methods.

3.3. Study design

Research design is a plan for gaining a sample from population of the study. According to C.R. Kothari (2002), research design mentions to the techniques and processes that the researcher should agree in selecting the samples from the studied population. This study employed descriptive and explanatory research design. This kind of design aims at generating information after the incident has occurred. The research design looked at the reasons why the situation behaves the way it does and also what the weakness and the strength are. This design was explanatory.

3.4. Sources of data and data collection methods

3.4.1. Sources of data

For this study both primary and secondary data sources were collected from various sources. The primary data obtained from beautification, park and cemetery development and management officer of the sub city and experienced individuals, government officials, residents, NGO practitioner, stakeholders and business communities. Secondary data obtained from existing maps, published and unpublished materials, internet web sites and photos.

3.4. 2. Method of data collection

The data was collected by conducting observational study, using structured questionnaire, and the interview that was held at household level. More over observational study was conducted to assess the benefits and the challenges of urban forest development. The questionnaire was developed by referring previously published literatures on the benefits and challenges of urban green infrastructure in inner sub- cities and modified according to the objective of the study. First, the questionnaire was developed in English and translated into Amharic and then back to English for data entry and analysis. The questionnaire was containing four parts. Part one respondents' personal information and data, part two respondents' awareness on the benefits of urban forest, part three respondents' awareness on the challenges faced on the development of urban forest and part four respondents' levels of awareness on the perception of communities on the benefits of urban forest. The final version of the questioner was distributed to randomly selected households in order to get data on their levels of awareness and challenges faced urban forest in the study area.

In addition, the interview was conducted to key informants to get data on the values of recreational parks and street trees, budget allocation and challenges for the development and management.

3.5. Sampling size and sampling techniques

3.5.1. Study population

For this study, information was obtained from sample households of five selected woredas who were selected by stratified simple random sampling technique. The total population for the target study area was 26,341 and it's a combination of different demographic groups.

3.5.2 Sample size

The multistage sampling system was applied for the study based on purposeful sampling technique for selecting sample woreda, Cochran's formula (1977) and simple random sampling methods for selecting households. Accordingly, firstly, five sample woreda were selected purposefully base on the presence and absence of urban forest. Secondly, Cochran formula was applied to determine sample size.

Cochran formula for sample size calculation is;

$$n_\circ = \frac{Z^2 pq}{(e)^2}$$ (For the known population size)

Where $n_\circ$ - sample size

Z - Score =1.96 at confidence level 95%

p -estimated proportion of population = 0.5

e - Acceptable margin of error = 0.05

q = 1-p = 1-0.5 = 0.5

Pq- is the estimate of variance

$$n_\circ = \frac{(1.96)^2 (0.5)(0.5)}{(0.05)^2}$$

$$= \frac{(3.8416)(0.25)}{}$$

$$= \frac{0.9604}{0.0025} = 384.16 \sim 385 \text{ (sample size)}$$

3.5.3 Sampling techniques

The numbers of households which were sampled from each woreda were indicated in Table 2. After determining the sample size, stratified simple random sampling technique was used to select sample population from each selected woreda.

3.5.4 Inclusion and exclusion

Those woreda that have urban forestry were included in the study woreda 4, 5, 6, 7 and 8)

While other woreda that have no urban forestry were excluded from the study. (Woreda 1, 2,3,9 and 10.)

Table 2**.**The number of sample households was selected from each five woreda.

Name of selected woredas	Total number of population	Number of sample population
Woreda 4	7985	85
Woreda 5	8952	94
Woreda 6	7262	77
Woreda 7	6973	74
Woreda 8	5169	55
Total	26341	385

3.6. Methods of data analysis

The descriptive statistics (e.g. Mean, frequencies, and percentages) was used to summarize the data proportions and Pearson correlation to evaluate the differences in perceptions of the respondents demographic characteristics related to the conservation of urban forestry and to determine whether any significance relationship exists on the variable. Statistical software (SPSS version 26) was utilized for data analysis. Finally, the relevant discussion, conclusion and recommendation made to the results obtained from the study.

3.7. Ethical Consideration

Efforts were made to make the research process professional and ethical. To this end, researchers tried to clearly inform to the respondents about the purpose of the study.

As the researchers introduce its purpose in the introduction part of the questionnaire and interview guide to the respondents, authors of the study was confirm to subjects, confidentiality was protect. The participants make to understand what has explained and be given the opportunity to ask questions and have them answered by the researchers.

Since ethical consideration is common in a study, the researcher respected rights, needs, values and desires of the participants. The researcher showed the written permission from the concerned bodies to the participants to carry out the study. And also told them about the objective of the study and how the data would be used.

Moreover, informed them about all the data collection devices and the activities. The researcher ensured the confidentiality of the data that no other person would access it and no harm they would face in relation to the data they gave to the researcher on the issue under study.

4. Results and discussion

In this chapter the researcher used to discuss the last results of the data that were collected through analytical questionnaires. Background of the information of the respondents were going to interpreted basically by applying descriptive statistics using SPSS version 26.

4.1. Background information of respondents

The demographic characteristics of the respondents contain sex, age and level of education. This particular data analysis presents about the analysis of personal data on the respondents of the questionnaires. The tables below show the description of characteristics of the respondents and their percentage

Table 3. Sex of respondents in the study area.

Sex	Frequency	Percent	Valid Percent	Cumulative Percent
Male	162	46.6	46.6	46.6
Female	186	53.4	53.4	100
Total	348	100.0	100.0	

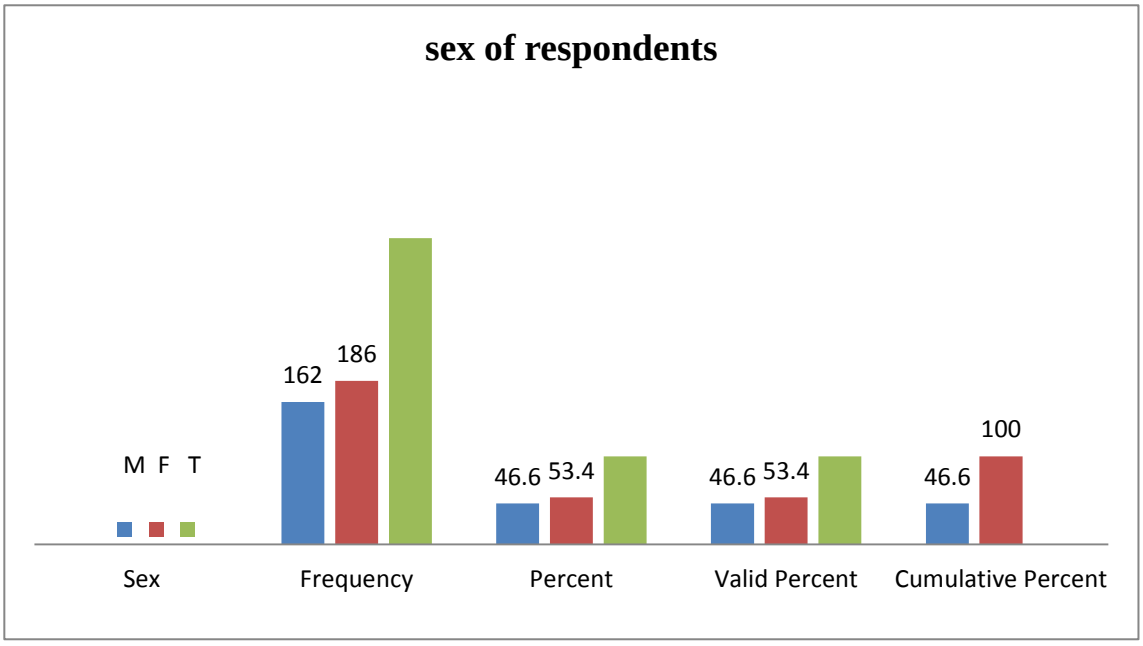
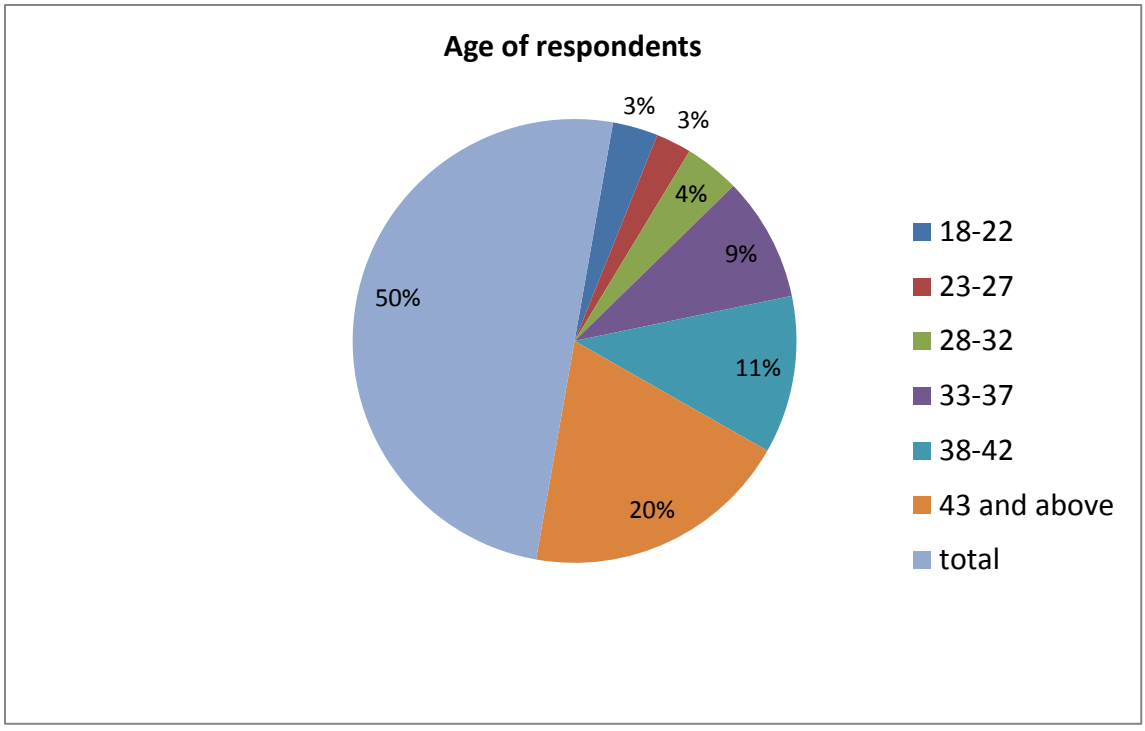


Figure.2. Sex distribution of respondents in the study area.

As it is shown in the above the table, from a total of 348 respondents participated in questionaires162 individuals were male that possess 46.6% whereas 186 of the respondents are females that covers 53.4% of the total respondent.

Table 4 Age of the respondents in the study area

		Frequency	%	Valid %	Cumulative %
Age	18-22	23	6.6	6.6	6.6
	23-27	18	5.2	5.2	11.8
	28-32	28	8.0	8.0	19.8
	33-37	63	18.1	18.1	37.9
	38-42	80	23.0	23.0	60.9
	43 & above	136	39.1	39.1	100.0
	Total	348	100.0	100.0	



Figer.3. Age distribution of respondents the study area

Focusing the age group of the respondents, the largest number of respondents were in range of 43 and above years were 136 that represent 39.1% that is followed by the age category of 38-42 years were 80 respondents that accounts 23% the next respondents fall in the category of 33-37years were contain 63 respondents that possess 18.1 % which is followed by the group of

28-32 years that accounts 8% .the lowest number of respondents were in the ranges of 23-27 years only contains 18 individuals that accounts 5.2%.

Table 5 Education status of the respondents in the study area.

Education status	Frequency	Percent	Valid Percent	Cumulative Percent
Cannot read and write	29	8.3	8.3	8.3
Can read and write	77	22.1	22.1	30.5
Elementary school	97	28	27.9	58.3
Secondary school	83	23.9	23.9	82.2
College and University	62	17.8	17.8	100.0
Total	348	100.0	100.0	

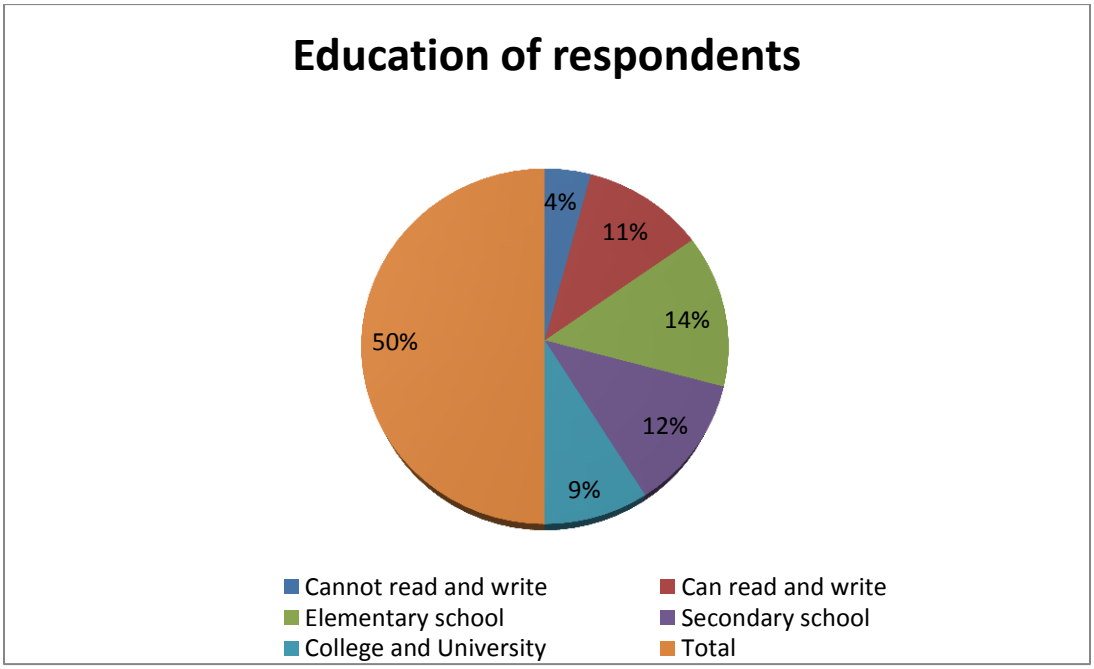


Figure. 4. The Educational status of respondents

By taking the educational level in to consideration the largest respondents were those who attend Elementary school are 97 that represent 27.9% followed by respondents who attend Secondary school 83 individuals (23.9%). Respondents who can read and write accounts 77 by

percantage22.1%.The lowest respondents were fall in those who cannot read and write only contains 29 individuals that account only 8.3%.

Table 6 Response scale about benefit of urban forest development

Responsiveness	Strongly disagree(1)		Disagree(2)		Neutral		Agree(4)		Strongly agree (5)		Mean	Mode	S.Deviation
	F	%	F	%	F	%	F	%	F	%			
Urban forest make the city more relaxing for visitors	27	7.8	21	6	20	5.7	167	48	11.3	32.5	3.93	4	1.15
Urban forest in kolfe keraniyo sub city make it better place to visit	31	8.9	95	27.3	49	14.1	128	37	45	12.9	3.17	4	1.23
I believe that urban forest are part of tourist appeal of Addis Ababa	22	6.3	45	12.9	25	7.2	161	46.3	95	27.3	3.75	4	1.17
Urban forest is place in the city where peoples do recreational activities	15	4.3	53	15.2	30	8.6	174	50	76	21.8	3.69	4	1.12
I am satisfied with the appearance of urban forest in the city	48	13.8	117	34	57	16.4	83	23.9	43	12.4	2.87	2	1.27
I believe that urban forest in kolfe keraniyo gives the	45	12.9	116	33.3	42	12.1	107	31	38	12.9	2.93	2	1.26
Urban forest attracts birds and other animals	31	8.9	52	14.9	17	4.9	148	42.5	10	28.7	3.67	4	1.27
Urban forest does not give interesting scent and colors	92	26.4	127	36.5	37	10.6	64	18.4	28.8	8	2.45	2	1.27
Urban forest hinders tourists mobility	81	23.3	146	42	51	14.7	45	12.9	25	7.2	2.38	2	1.18
Urban forest does not tell us seasonal change	77	22.1	135	38.8	50	14.4	65	18.7	21	6	2.47	2	1.19

As it is shown in the above table the respondents have put the following result about benefits of urban forest development. Among items asked about benefits of urban forest respondent's show strong disagreement on urban forest does not give interesting scent and colors by 26.4%, urban forest hinders tourist mobility by 23.3% and urban forest does not tell us about seasonal change by 22.1%. On the other hand respondents strongly agree on items such as urban forest make the city more relaxing for visitors by 32.5%, urban forest attract birds and other animals by 28.7% and urban forest is parts of tourist appeal in Addis Ababa by 27.3%

Table 7 Response scale about challenges faced to the development of urban forest

Responsiveness	Severe challenge		Moderate challenge		Not challenge at all		mean	Mode	S.deviation
	Freq.	%	Freq.	%	Freq.	%			
Change in climate	128	36.8	167	48	53	15.2	1.78	2	0.68
Pests and plant disease	160	46	126	36.2	62	17.8	1.71	1	0.75
Fertilizer use	92	26.4	163	46.8	93	26.7	2.00	2	0.73
Pesticide and herbicide use	96	27.6	169	48.6	83	23.9	1.96	2	0.71
Nonnative plants	98	28.2	153	44	97	27.9	1.99	2	0.75
Increasing human population	240	69	64	18.4	43	12.4	1.49	1	0.34
Lack of public involvement in management	181	52	135	38.8	32	9.2	1.57	1	0.66
Lack of funds for development	198	56.9	104	29.9	45	12.9	1.61	1	1.26
Lack of public understanding about urban forest	185	53.2	117	33.6	46	13.2	1.60	1	0.71
Lack of public support about urban forest management	154	44.3	143	41.4	51	14.7	1.70	1	0.71
Misleading information about urban forest	144	41.4	139	39.9	65	18.7	1.77	1	0.74
No enough scientists or experts involved	174	50	138	39.7	36	10.3	1.60	1	0.67
Habitat loss	219	63	91	26.1	38	10.9	1.48	1	0.69
Excessive site coverage by building	210	60.3	94	27	44	12.6	1.52	1	0.71
Heavy air pollution	202	58.1	94	27	52	14.9	1.60	1	0.74

Regarding challenges of developments of urban forest 348 respondents were participated in questionnaires and put their results. According to the results collected from respondent's items that considered as severe challenges are increasing human population by 69%, habitat loss by62.9%, excessive site coverage by building by 60.3% and heavy air pollution by 58%.

Respondents also put their results on items that cause moderate challenges on developments of urban forest. According to the result pesticide and herbicide use by 48% of respondents ,change in climate by 48% of respondents and fertilizers use by 46.8% of respondents are considered as moderate challenges to forest.27% of the respondents also put their results as non-native plants were not challenge at all for development of urban forest.

Table 8 Respondent scale about awareness level of community on the values of urban forest development.

Responsiveness	Most important		Moderately important		Least important		Mean	Mode	S.deviation
	Freq.	%	Freq	%	Freq.	%			
For sustainability	291	83.6	42	12.1	15	4.3	1.21	1	0.50
Ecological health and habitat preservation	279	80.2	54	15.5	15	4.3	1.24	1	0.52
Mitigate or lessen changes in climate	259	74.2	77	22.1	12	3.4	1.23	1	0.53
Improve sense of community	227	65.2	86	24.7	35	10.1	1.45	1	0.67
For aesthetic or beauty	284	81.6	51	14.7	13	3.7	1.22	1	0.50
Increase property values	269	77.3	61	17.5	15	4.3	1.26	1	0.53
For more trees	237	68.1	77	22.1	34	9.8	1.41	1	0.66

According to the above table about awareness of community on benefits of urban forest 291 respondents which accounts 83.6% put their result as urban forest is used for sustainability, 284 of respondents or 81.6% put their idea as urban forest is most important for aesthetic and

beauty of the city and 279 respondents or 80.2% put their results as ecological health and habitat preservation are the most important aspects of urban forest. On the other hand 34 individuals which accounts 9.8% put their result as to get more trees is the least important awareness held by community on urban forest.

As obtained from the result of chi square test, there is a significant association between elderly age of the population and their awareness levels about the high property value of urban forest development X^2 (10)=39.848,P=0.000 and need of more trees from urban forest development.X^2(10)=20.105,P=0.028

This means that as the age of a population increases, having good awareness regarding the property value of urban forest development and the need of more trees from urban development become high.

4.2. Responses obtained from interviewer in selected woreda

During the interview with the representative from Woreda 4, several key points were highlighted regarding urban forest development and management. Firstly, the benefits derived from such initiatives encompassed the protection against global climate change, enhancement of the city's aesthetic appeal, and overall environmental preservation. Stakeholders identified for the development and management of urban forests primarily included the government, with a crucial emphasis on community involvement. Challenges facing the conservation and management efforts within Kolfe Keraniyo Sub city predominantly revolved around deforestation and illegal land usage. Regarding societal awareness, it was stressed that fostering a positive attitude within communities towards the benefits of urban forests is imperative. Furthermore, the extent of community participation was noted to be high in such endeavors. Responsibilities were delineated among federal and regional governments, as well as urban forest developers, emphasizing control, protection, and designated usage of forested areas. Lastly, the economic, social, and environmental benefits of developing and managing urban forests were underscored, including the provision of fresh air, contribution to tourism, and mitigating global climate change.

During the interview with respondents from Woreda 5, insights were gathered regarding urban forest development and management. The benefits of such initiatives were highlighted, emphasizing the reduction of carbon dioxide emissions and the enhancement of city green

infrastructure. Stakeholders identified for the development and management of urban forests included both government entities and the broader community. Challenges facing conservation efforts within Kolfe Keraniyo Sub city centered on the lack of protected forest areas and limited societal awareness about urban forests. It was stressed that society must cultivate awareness to prevent forest degradation. The importance of community participation in urban forest development and management was underscored as very significant. Responsibilities were outlined for the federal and regional governments, as well as urban forest developers, including budget allocation, protection of forested areas, and community awareness campaigns. Economic benefits, such as income generation and furniture production, social benefits like providing fresh air, and environmental benefits such as preventing soil erosion, were cited as outcomes of developing and managing urban forests.

During the interview with the representative from Woreda 6, insights were provided regarding urban forest development and management. The benefits highlighted included environmental protection and climate control measures derived from such initiatives. Stakeholders identified for the development and management of urban forests encompassed both communities and governmental bodies. Challenges facing conservation efforts within Kolfe Keraniyo Sub-city primarily revolved around illegal land controls. Concerns were raised about the limited awareness among society regarding the benefits of urban forests. Emphasis was placed on the crucial role of community participation in urban forest development, with communities being attributed the highest responsibilities in this regard. Responsibilities for the federal and regional governments, as well as urban forest developers, included preventing illegal practices related to forests, tree planting, and conservation efforts. Economic benefits, such as income generation, social benefits for recreational purposes, and environmental benefits, including air pollution prevention and carbon dioxide balance, were cited as outcomes of developing and managing urban forests.

In the interview conducted with representatives from Woreda 7, insights were gathered regarding urban forest development and management. Benefits derived from such initiatives were primarily focused on creating favorable air conditions within urban areas. Stakeholders identified for the development and management of urban forests included communities, governmental bodies, and the forest development sector. Challenges facing conservation efforts within Kolfe Keraniyo Sub city were highlighted as soil erosion and illegal land

controls. Regarding society's awareness of the benefits of urban forests, it was noted that communities possess some awareness, although socioeconomic factors may influence the depth of this understanding. Community participation in urban forest development was deemed crucial and should be of high importance. Responsibilities were delineated for the federal and regional governments, including tree planting and raising awareness about urban forests. Economic benefits cited encompassed tourist attraction, while social benefits included recreational services and the provision of clean air for society. From an environmental standpoint, the development and management of urban forests were emphasized as crucial for providing fresh air to urban populations.

In the interview conducted with the representative from Woreda 8, key insights were provided regarding urban forest development and management. The benefits highlighted included the provision of fresh air and the mitigation of global warming through effective management practices. Stakeholders identified for the development and management of urban forests comprised government bodies at all levels as well as local communities. The conservation efforts in Kolfe Keraniyo Sub city face notable challenges, particularly the absence of adequate protection for forested areas and the limited awareness among society regarding urban forests. The importance of community awareness and involvement in protecting urban forests was underscored, with a call for communities to actively participate in conservation efforts. Responsibilities were outlined for both federal and regional governments to collaborate on urban forest development initiatives. Economic benefits, such as income generation, social benefits for recreational purposes, and environmental benefits, including air pollution prevention and carbon dioxide balance, were cited as outcomes of developing and managing urban forests.

The main finding of the interview is that stalk holders from each woreda consistently have identified social, ecological, economic, health and cultural benefits of urban forest development and common challenges faced on urban forest development and management.

In general the findings of the above result described as, The principal objective of this study was dealing with The assessment of benefits and challenges of urban forest development in Addis Ababa at kolfe keraniyo sub - city. The study was descriptive study focused on benefit and challenges of urban forest development in selected woreda of kolfe keraniyo sub city. Simple

random sampling was adopted to select 348 respondents from kolfe keraniyo sub city. Questionnaires were used as principal tools for data collection. Structured interviews were also used to collect data from respondents. The data collected from respondents was analyzed using basic statistical tools such as frequency, mean mode, standard deviation, table and percentage. Most of the questions were in the form of closed ended manner. The SPSS version 20 window software was used in analyzing the data.

4.3. Discussion

The result of back ground of information of respondents show that from the whole participants male respondents were 162 that possess 46.6% whereas 186 of the respondents are female that covers 53.4% of total respondents.

Based on the age group of the respondents, the largest number of respondents were in range of 43 and above years were 136 that represent 39.1% that is followed by the age category of 38-42 years were 80 respondents that accounts 23% the next respondents fall in the category of 33-37years were contain 63 respondents that possess 18.1 % which is followed by the group of 28-32 years that accounts 8% .the lowest number of respondents were in the ranges of 23-27 years only contains 18 individuals that accounts 5.2%

The last demographic characteristics are educational level of the respondents. By taking the educational level in to consideration the largest respondents were those who attend Elementary school are 97 that represent 27.9% followed by respondents who attend Secondary school 83 individuals (23.9%). Respondents who can read and write accounts 77 by percantage22.1%.The lowest respondents were fall in those who cannot read and write only contains 29 individuals that account only 8.3%.

Analysis of respondents about benefits of urban forest indicates that 26.4% of respondents show their strong disagreement in items urban forest does not give interesting scent and colors. This disagrees with the result of Nowak et al.,(2013) .23.3% of respondents disagree on urban forest hinders tourist mobility This disagrees with the result of Voigt et al.,(2014) and 22.1% strongly disagree on urban forest does not show about seasonal change. This disagrees with the study result of Berland and Hopton (2014) and (de Groot et al., 2002). On the other hand respondents strongly agree on items such as urban forest makes the city more relaxing for visitors by 32.5. This result strongly agrees with the study result of Voigt et al (2014). Urban

forest attracts birds and other animals by 28.7% this agrees with the result of (c.f., de Groot et. al 2002) and urban forest is parts of tourist appeal in Addis Ababa by 27.3%. Regarding challenges of developments of urban forest 348 respondents were participated in questionnaires and put their results. According to the results collected from respondent's items that considered as severe challenges are increasing human population by 69% This result agrees with the results of (UN,2006) ,habitat loss by 62.9% this agrees with the results of (painter ,DurhamWH,eds,1995). Excessive site coverage by building by 60.3% and heavy air pollution by 58%.This agree with the results of West P et al, 2006)

Respondents also put their results on items that cause moderate challenges on developments of urban forest. According to the result pesticide and herbicide use by 48% of respondents ,change in climate by 48% of respondents and fertilizers use by 46.8% of respondents are considered as moderate challenges to urban forest.27% of the respondents also put their results as non-native plants were not challenge at all for development of urban forest.

Based on awareness of community on benefits of urban forest 291 respondents which accounts 83.6% put their result as urban forest is used for sustainability this agrees with the results of (zerner C, ed 2000), 284 of respondents or 81.6% put their idea as urban forest is most important for aesthetic and beauty of the city this agrees with the results of (Voigt et al.2014) and 279 respondents or 80.2% put their results as ecological health and habitat preservation are the most important aspects of urban forest which agrees with the results of (Zarin DJ et al.2004). On the other hand 34 individuals which accounts 9.8% put their result as to get more trees is the least important awareness held by community on urban forest this agrees with the results of (Wyckoff-Baired B, 2005)

The study provided further evidences on benefit of urban forest for cities and its community.as it revealed from the result urban forest provided important benefit for cities and their population especially in relation to tourist attraction, make the city more relaxing, it also reduces risk connected to climate change such as floods and drought.

The study also assess about challenges faced development of urban forest. Most challenges such as increased human population, habitat loss and the coverage of excessive land by building were identified during the study.

Lastly the study also assessed about awareness of community on benefit of urban forest.so community mostly aware on items such as urban forest for sustainability, for beauty and aesthetic value and for habitat preservation.

5. Conclusions and recommendations

This chapter is mainly concerned with the conclusion and recommendation of the researcher. Conclusion of the paper express about the ideas that the researcher finalizes the main points of the study and recommendation is the suggestion that the researcher forwards his/her ideas based on his/her findings of the study.

5.1. Conclusion

Based on the data obtained from respondents, the following conclusions can be drawn:

Communities are aware of the benefits of urban forests and their development: The study suggests that the communities surveyed have knowledge and understanding of the advantages associated with urban forests. This awareness indicates a positive attitude towards urban forest development.

Urban forests provide various benefits to cities: The research confirms that urban forests offer a range of benefits to cities. These benefits include environmental advantages, such as improving air quality and preserving biodiversity. Social benefits include promoting community cohesion, fostering a sense of inclusion among local residents, and generating a feeling of ownership, leading to higher satisfaction levels and a positive perception of quality. Additionally, economic benefits can be derived from urban forests in the form of wood, food, grazing for livestock, timber and poles, spices, fiber, medicines, and other non-timber products.

Development of urban forests faces multiple challenges: The study identifies several challenges encountered in the development of urban forests. These challenges include changing climatic conditions, the impact of increasing human population on available space, loss of habitat for flora and fauna, insufficient public involvement in forest management, and excessive land coverage by buildings. These challenges highlight the complexities and obstacles associated with creating and maintaining urban forests.

The implications of these findings underscore the importance of promoting and supporting the development of urban forests. Policy-makers, urban planners, and community stakeholders should consider the numerous benefits associated with urban forests and address the challenges that hinder their establishment and sustainability. Strategies such as climate-resilient design, public engagement initiatives, and integrated land-use planning can help overcome these

challenges and maximize the potential benefits of urban forests for communities and cities as a whole.

5.2. Recommendation

Based on the benefits and challenges of urban forest development in Kolfe Keraniyo sub-city, the following recommendations are proposed:

- Enhance Awareness Programs: Implement educational programs to raise community awareness about the benefits of urban forests, focusing on sustainability, aesthetics, ecological health, and habitat preservation.
- Strengthen Community Involvement: Encourage active community participation in planning, management, and maintenance through citizen committees, volunteer programs, and other engagement platforms.
- Address Population Growth: Integrate urban forest development into urban planning strategies to allocate sufficient green spaces and incorporate forests in new development projects, considering the challenges posed by population growth.
- Preserve Habitat and Biodiversity: Protect and restore habitats within urban forests, implement conservation practices, and promote the inclusion of native plant species to enhance biodiversity and ecological health.
- Manage Land Use: Implement appropriate land use planning and regulations to address the challenge of excessive site coverage by buildings, ensuring a balance between urban development and the preservation of green spaces.
- Mitigate Climate Change Impacts: Develop strategies to mitigate the effects of climate change on urban forests, including selecting resilient tree species, promoting sustainable practices, and adapting to changing climatic conditions.
- Collaborate and Seek Partnerships: Foster collaboration between government agencies, NGOs, community groups, academic institutions, research organizations, and industry experts to leverage resources, expertise, and funding for urban forest development.

These recommendations provide guidance to policymakers, conservationists, and scientists involved in urban forest management and highlight key actions to promote sustainable and thriving urban forests in Kolfe Keraniyo sub-city.

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Appendix I questionnaire

Questionnaire filled by respondents

This questionnaire is used during field work of data gathering. The study is conducted for research purpose under the title challenges and benefits of urban forest development in Addis Ababa at kolfe keraniyo sub- city.

Dear respondents

This questionnaire has only research purpose thus the outcome from this research will help to address challenges and benefit of urban forest in the case of kolfe keraniyo sub-city. Therefore I kindly request the respondent to fill this questionnaire. I assure you that all your responses will be held confidentially.

Part I For statistical purpose only

Please put the right sign (√) in the box where it is appropriate.

1. Gender: male ☐ female ☐

2. Age of respondent: 18-22 ☐ 23-27 ☐ 28-32 ☐ 33-37 ☐ 38-42 ☐

43 & above ☐

3. Educational level:- cannot read & write ☐ can read & write ☐

Elementary completed ☐ high school Completed ☐ College & university completed ☐

Part II Response scale about benefits of urban forest

Direction; **please tick under your correct responses based on benefits of urban forest**

Statement	**Strongly disagree**	**disagree**	**neutral**	**agree**	**Strongly agree**
Urban forest make the city more relaxing for visitors					
Urban forest in Kolfe Keraniyo make it better place to visit					
I believe that urban forest are part of tourist appeal of Addis Ababa					
Urban forest is place in the city where peoples do recreational activities					
I am satisfied with the appearance of urban forest in the city					
I believe that urban forest in kolfe keraniyo give the city urban appearance					
Urban forest attract birds and other animals					
Urban forest does not give interesting scent and colors					
Urban forest hinder tourists mobility					
Urban forest do not tell us seasonal change					

Part III; Respondent scale about challenges faced on development of urban forest

Direction; please indicate how much challenges you believe on forest development in and around your sub city from the scales indicated from severe challenges to not challenge at all

Challenges on urban forest development.	**Severe challenge**	**Moderate challenge**	**No challenge at all**
Change in climate.			
Pests and plant diseases.			
Not using fertilizer			
Pesticide and herbicide use.			
Non - native plants.			
Increasing human population.			
Lack of public involvement in management.			
Lack of funds for development.			
Lack of public understanding about urban forest.			
Lack of public support about urban forest management.			
Misleading information about urban forest			
No enough scientists or experts involved			
Habitat loss			
Excessive site coverage by building			
Heavy air pollution			

Part IV: Respondent scale about awareness of community on the values of urban forest development

Direction; please indicate your awareness on benefit of urban forest by tick under most important, moderately important or least important

Values of developing urban forest	**Most important**	**Moderately important**	**Least important**
For sustainability			
Ecological health and habitat preservation			
Mitigate or lessen changes in climate			
Improve sense of community			
For aesthetic or beauty			
Increases property values			
For more trees			

አባሪ II የአማርኛ መጠይቅ

ይህ ጥናት በአዲስ አበባ ከተማ በኮልፌ ቀራኒዮ ክፍለ ከተማ የከተማ ደን ልማት ፋይዳዎች እና ተግዳሮቶች በሚል ርዕስ ለምርምር ዓላማ የሚካሄድ ነው።

ውድ ምላሽ ሰጪዎች የዚህ መጠይቅ ዋና ዓላማ በአዲስ አበባ ከተማ ኮልፌቀራኒዮ ክፍለከተማያለውን የከተማ ደን ፋይዳዎች እና ተግዳሮቶች ላይ ተገቢ መረጃ ለመሰብሰብ የሚውል ነው። የጥናቱም ውጤት በክፍለ ከተማው ያለውን የከተማ ደን ልማት ተግዳሮቶች ለመፍታት እና የማህበረሰቡን ግንዛቤ ለማስፋት ይረዳል።ስለዚህ ይህንን መጠይቅ በአግባቡ እንዲሞሉ በትህትና እጠይቃለሁ።ሁሉም ምላሾችዎ በሚስጥር እንደሚያዙ አረጋግጣለሁ።

ክፍል አንድ፡- ስለ መላሾች አጠቃላይ መረጃ እና ጭብጥ።

እባክዎን በተገቢው ሳጥን ውስጥ የ(√) ምልክት በማድረግ ምላሽዎን ይስጡ ።

1 ጾታ፡ ወንድ ☐ ሴት ☐

2. የመላሽዕድሜ፡ 18-22 ☐ 23-27☐ 28-32☐ 33-37☐ 38-42 ☐ 43 እናከዚያበላይ ☐

3. የትምህርትደረጃ.

- ማንበብ እና መፃፍ የማይችል/ትችል/ ። ☐
- ማንበብ እና መፃፍ የሚችል /የምትችል /። ☐
- የመጀመሪያ ደረጃ ያጠናቀቀ/ች/ ☐
- የሁለተኛ ደረጃ ትምህርት ያጠናቀቀ /ች/። ☐
- ዩኒቨርሲቲ ያጠናቀቀ/ች/ ☐

ክፍል ሁለት፡-ስለ ከተማደን ፋይዳዎች የመላሾች ልኬት ።

አቅጣጫ፡-እባክዎን እያንዳንዱ ሀሳብ ምን ያህል የከተማ ደን ፋይዳዎችን እንደሚገልጽ የ (√)ምልክት በማድረግ ትክክለኛ ምላሽዎን ይስጡ።

መግለጫ	እጅግ በጣም አልስማማም	አልስማማም	ገለልተኛ	እስማማለሁ	እጅግ በጣም እስማማለሁ
የከተማ ደን ከተማዋን ለነብኚዎች የበለጠ ዘና እንድትል ያደርጋል ።					
በ ኮልፌ ቀራንዮ ክፍለ ከተማ የሚገኘው የከተማ ደን ቦታውን ለጉብኝት የተሻለ ተመራጭ ያደርገዋል ።					
የከተማ ደን የአዲስ አበባ የቱሪስት መስህብ አካል ነው ብዬ አምናለሁ።					
የከተማ ደን በከተማ ውስጥ ለሚኖር ሕዝብ የመዝናኛ እንቅስቃሴዎችን የሚያደርግ በት ቦታ ነው ።					

በከተማው ውስጥ ባለው የከተማ ደንገጽታረከቻለሁ።					
በኮልፌ ቀራንዮ የሚገኘው የከተማ ደን የከተማዋን ገጽታ ያሳያል ብዬ አምናለሁ።					
የከተማ ደን አዕዋፍ እና ሌሎች እንስሳትን ይስባል።					
የከተማ ደን አስደሳች መዓዛ እና ማራኪቀለማትአይሰጥም ።					
የከተማ ደንበቱሪስቶችእንቅስቃሴላይእን ቅፋትይፈጥራል					
የከተማ ደን ወቅታዊ የአየር ጠባይ ለውጥን አይገልጽም					

ክፍል ሶስት፡- የከተማ ደን ልማት ተግዳሮቶች ላይ የመላሾች ልኬት

አቅጣጫ፡- እባክዎን በክፍለ ከተማዎ ውስጥና ዙሪያ የከተማ ደን ልማት ያጋጥመዋል ተብለው ከተዘረዘሩት ተግዳሮቶች ውስጥ እርስዎ አለ ብለው በሚያምኑበት ተግዳሮት ስር የ(√) ምልክት በማድረግ ምላሽዎን ያመልክቱ ።

የከተማ ደን ልማትተግዳሮቶች	ከባድተግዳሮት	መጠነኛ ተግዳሮት	በፍፁም ተግዳሮት የለበትም
የአየር ንብረት ለውጥ			
ተባዮች እና የተክሎች በሽታዎች			
የማዳበሪያ አጠቃቀም			
ፀረ-ተባይእናፀረ-አረም መጠቀም			
አገር በቀል ያልሆኑ ተክሎች			
የህዝብ ቁጥር መጨመር			
በጥበቃና እና አያያዝ ላይ የህዝብ ተሳትፎ እጥረት			
ለልማት የሚሆን የገንዘብ እጥረት			
በከተማ ደን ዙሪያ የህዝብ ግንዛቤ ማነስ			
ስለ ከተማ ደን አስተዳደር የህዝብ ድጋፍ እጦት			
ስለ ከተማ ደን የተሳሳተ መረጃ መኖር			
የተመራማሪዎች ወይም የባለሙያዎች በበቂ ሁኔታ አለመሳተፍ			
የአካባቢ መራቆት			
የበታዎች ከመጠን በላይ በግንባታ መሸፈን			
ከፍተኛ የአየር ብክለት			

ክፍል አራት፡- በከተማ ደን ተጠቃሚነት ላይ ማህበረሰቡ ስላለው ግንዛቤ የምላሽ ሰጪዎች ልኬት ።

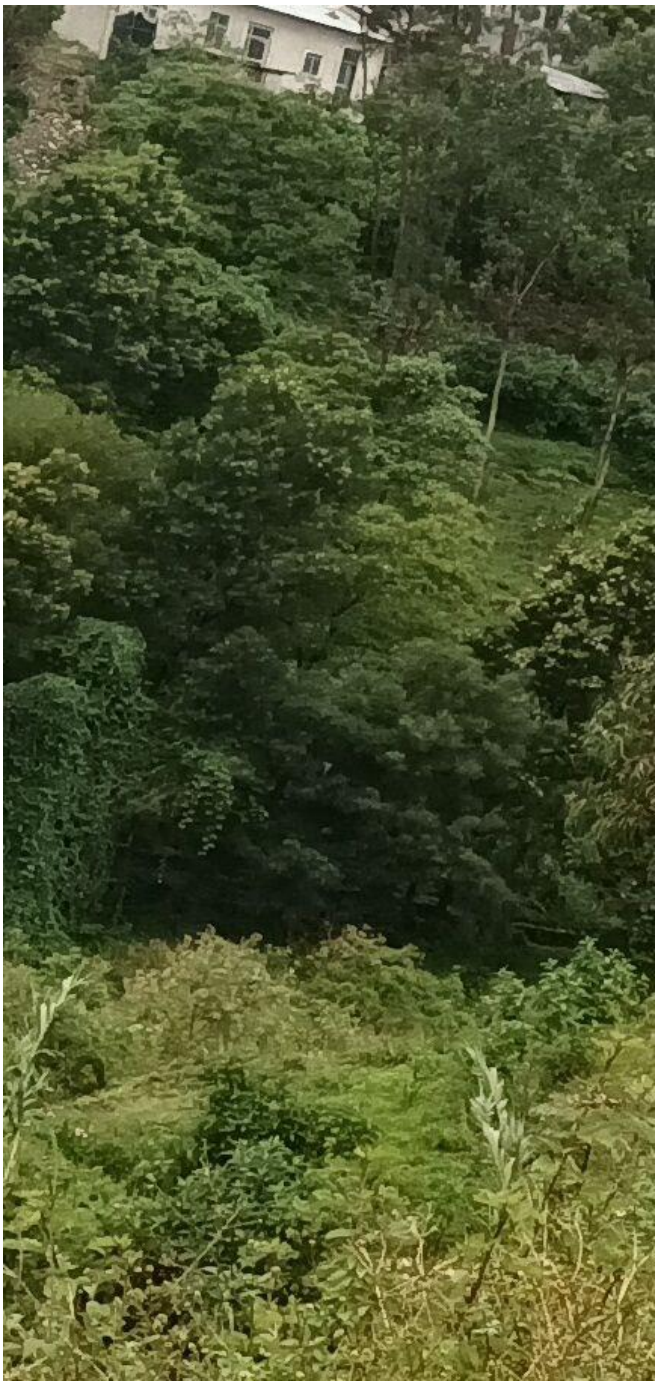
አቅጣጫ፡-እባክዎን በከተማደን ፋይዳዎች ላይ ማህበረሰቡ አለው ብለው በሚያምኑ ትግንዛቤ ዙሪያ በጣም አስፈላጊ፣ በመጠኑ አስፈላጊ ወይም በጣም በጥቂቱ አስፈላጊ በሚሉ አማራጮች ስር የ(√)ምልክት በማድረግ ምላሽዎን ያመልክቱ ።

የከተማ ደን ልማት ፋይዳዎች	በጣም አስፈላጊ	በመጠኑ አስፈላጊ	በጣም በጥቂቱ አስፈላጊ
ለዘላቂነት ጥቅም			
ለስነ-ምህዳር ጤና እና ለአካባቢጥበቃ ።			
የአየር ንብረት ለውጦችን ለማሻሻል ወይም ለመቀነስ ።			
የማህበረሰቡን ስሜት ለማሻሻል			
ለአካባቢ ስነ -ውበት ወይም ማራኪነት			
የደን ሀብት እሴትን ለመጨመር			
ለበርካታ ዛፎች ምንጭነት			

Appendix III

List of Urban Forest photo taken from different woreds at Kolfe keraniyo Sub-city

Figure.5. Bururu forest.



Figuer.6. FM Mariam forest.

Figure.7. Michael forest

Figure. 8. Gebrejawo forest.