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Assessment of Urban Greenery Status in Major Cities of Oromia, Ethiopia

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ABSTRACT

This work aims at studying different green spaces' experiences in developed countries and extrapolates the experiences to Oromia cities in Ethiopia; in order to investigate and promote greenery infrastructure in selected cities. To do that greenery practice performance data were collected in four cities, which were classified into two groups as good and weak performers. As a result, Adama and Bishoftu cities were good urban greenery performers whereas Burayu and Sebeta were weak performers. The cities were also selected non-randomly to investigate the current urban greenery practice and different green areas in each city. Eight green areas were taken as samples for observation, where qualitative and quantitative data were collected from primary and secondary sources. The assessment of data confirmed that green areas along the roadside, recreational parks, open areas, and nursery sites existed in most cities. The urban plan of some cities does exclude most green area components. Greenery sites in Bishoftu and Adama are relatively better, while in Burayu and Sebeta urban greenery are highly abused for changing to another type of land use, e.g., residential and institutional areas. The technical skills of tree planting, care, protection, and management were also observed as a collective resource.

1. Introduction

Today more than 50 % of the world's population inhabits urban areas ^[1,2]. Current urbanization processes indicate that additional three billion person will live in cities by 2050, increasing the urban population proportion worldwide to two-thirds ^[3,4]. According to the report ^[5], human settlements are complex, involving social-ecological systems that are dependent on the health of natural environments for ongoing sustainability. Thus, planning for sustainable cities is a complex process

addressing all economic, environmental and social sustainability ^[6]. The greenery is consisted of vegetation in all urban parks, residential recreation areas and others any trees and shrubs are planted within demarked cities. Urban Green Infrastructure is an evolving concept to provide a biotic and cultural function with sustainability ^[7]. It emerges as an active term of reference in project development planning ^[8]. Hence, greenery has become an important policy initiative in many cities internationally, and has been used to address different environmental and social concerns today ^[2].

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Greenery is an emerging planning and design concept that is principally structured by a hybrid hydrological/drainage network. Complementing green areas and linking them with built infrastructure could provide ecological functions [9]. Currently, several studies confirmed urban green spaces as a resource in improving the environmental quality, promoting public health and providing valuable ecosystem services, urban tourism, active and passive recreations to urban dwellers [10,11]. Most importantly, it is reduced wind erosion and flooding which is the part of disaster abatement. Therefore, green areas should be an integrated concept in terms of single ideology, respecting ecology and mimicking nature [9]. Similarly, the current growth agenda may hopefully require the identification and targeting of land for new green infrastructures. To address, the importance of greenery to be incorporated in urban planning. However, along with discovering political and economic mechanisms for land acquisition in and around growing urban environments, sound ecological decisions will need to be made at a landscape scale [9].

One of the purposes of this review is to assess different green area experiences which are found in developed countries and to extrapolate those experiences to

developing countries, especially Ethiopia. Finally, this work attempts to bridge further source of information and endeavours to fill the existing research gaps about the green area issues. Green spaces could help urban areas adapt to the impact of climatic change regardless of whether they are parks, private gardens or street trees. However, the size, quality, and shape of a space, vegetation type and proportion of coverage all might influence the level of impact. The main problems of the study for Oromia cities are the challenges of land grab squatters, weak policy intervention, institutional capacity, less participation, political priority, etc. Only few studies have been conducted in urban areas in combating climate change and beautification value it has. The published information is extremely scarce on the root causes and constraints hindering the greenery development mainly in Oromia urban lands, no matter they are newly established or previously existed. The objective of this survey study is to assess status of urban greenery space development of Oromia cities. Based on existing greenery areas, to recommend the best option for further development for each cities according to their suitability of agroecology.

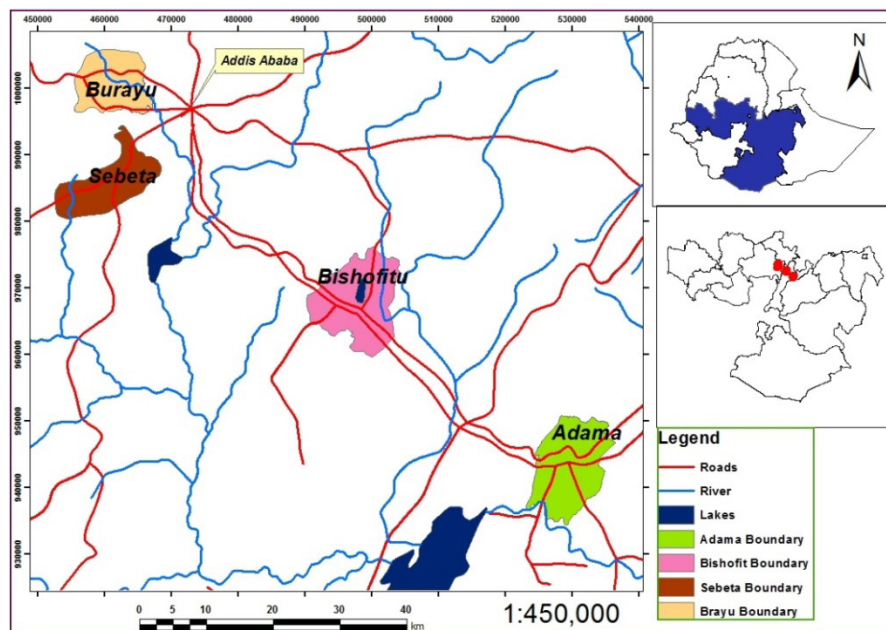


Figure 1. Location map of the studied cities

Table 1. Description summary of studied area

Cities	Altitude (m)	Latitude	Longitude	Temperature (°C)	Rainfall (mm)	Population
Adama	1620	8°32'24" N	39°16'12" E	21	838	150,228
Bishoftu	2135	8°43'26" N	38°56'24" E	20	1076	85265
Burayu	2600	9°02'30" N	38°03'30" E	14-22	1188	76,681
Sabata	2065	8°53'38" N	38°35'11" E	13-25	1605	97,554

2. Methodology

Adama, Bishoftu, Sebeka, and Burayu cities are selected for this study. Adama and Bishoftu are located in the East showa zone whereas the other two cities are located within the Finfinne Special Zone of Oromia Regional State, in central Ethiopia (Figure 1). The area and description of the study are presented in (Table 1).

2.1 Sample

A field survey was conducted on the general physiognomy of urban greenery in Oromia. Four cities namely Adama, Bishoftu, Sebeka and Burayu were selected as the sampled study areas for urban greenery performance and accessibility. A stratified sampling method was employed in assessing greenery practice performance. Four cities were classified into two groups as good and weak performers. Considering different standards, Adama and Bishoftu were selected as good urban greenery performer whereas Burayu and Sebeka were selected as weak greenery practice performing cities. A greenery site in the cities was also selected non-randomly to review the current urban greenery practice. Eight green areas in each city were taken as samples for observations. Respondents were also selected purposely according to the positions and duties in the corresponding departments. Eventually, questionnaire was given to the selected respondents from four cities.

2.2 Data Collection

Various types of qualitative and quantitative data were collected from primary and secondary sources. Secondary data were collected from the municipal administration department, urban greenery department and different stakeholders. Most data including agro-ecological, socio-economic and urban green infrastructure were collected through structured open and closed ended questionnaires, and personal perceptions. The comprehensive questionnaire was spread to the respondents from four cities to be filled with great care and attention. After filling the questionnaire from the individual's, the next part was having a discussion about the challenges and development of urban green space from the focus groups in each city which was comprised of staff members of urban greenery department. The number of participants in the focus group discussion was four in Adama, five in Burayu, six in Bishoftu and Sebeka cities in reference to the number of available staff members in each city. Both direct and indirect participant observations were made in all the cities at selected green space. During this survey, intensive observations were carried out on species compositions,

structure of urban greening and some physical challenges. Secondary data were collected from various researches, and reports. Urban greenery standards and practices in other Ethiopian cities were also reviewed as well as policies and legal frameworks of greenery space. Greenery strategic plan, urban greenery plan and reports of the studied cities were also collected and analyzed to review the current and future greenery practices of the cities.

2.3 Data Analysis

The representative biophysical data collected from the studied cities were subsequently analyzed using Microsoft excels. Arc GIS software was used to analyze greenery space areas in hectare. Qualitative data were also analyzed using descriptive and explanatory methods.

3. Results and Discussion

The greenery areas on the urban plan in Bishoftu, Burayu, and Sebeka are 3,903.67 ha, 2,982.7 ha and 2,234.19 ha respectively. The lands developed for green space is 1,172.38 ha in Adama, and 612.96 ha in Bishoftu whereas no lands have been developed in Burayu and Sebeka. Hence, the per-capita urban greenery coverage per Metric Square for Adama and Bishoftu are 0.0038 m² and 0.0033 m² respectively which are unable to meet the minimum standard proposed by the World Health Organization (WHO) ^[12]. One of the study in other cities of the country showed that, Shashemene, Dese, Jijiga, Dire Dewa, and Bahir Dar cities are 1.9 m², 3.1 m², 3.8 m², 5.6 m², and 8.2 m² of urban green spaces per person respectively in 2013 ^[13,14] are greater than the study cities. Only a few green infrastructure components were established in Oromia cities. As confirmed by the assessment, green areas along the roadside, recreational parks, open areas, and nursery sites existed in most cities. The cities plan does include most of the green space components. Greenery sites in Bishoftu and Adama are relatively better. However, the greenery sites in Burayu and Sebeka are highly abused and changed to residential and institutional area. No concrete data were supplied by the city administration during this work. All the data were collected from personal observations and secondary sources from Oromia Urban Plan Institute.

3.1 Challenges of Urban Green Space

Problems related to the technical skills of tree planting, care, protection, and tree management were observed in this work. The survey confirmed that the forestry practices in Oromia cities suffered from the following: arboriculture challenges, canopy space challenges, poor

soil quality, deficiency or excess of water and light, pollution, mechanical and chemical damage to trees. Tree management challenges include maintaining a tree and planting site inventory, quantifying and maximizing the benefits of trees, minimizing costs, obtaining and maintaining public support, funding and establishing laws and policies for trees on public and private lands. In Adama and Bishoftu, destruction from domestic animals, illegal cutting of trees, waste disposal on the green space and illegal land use changes were observed as the main constraining factors. There was no provision for a site plan for green infrastructure components in all cities. Compared to the international greenery standards of 20 m²/person^[15], the greenery spaces in the studied cities 0.0035 m²/person are less than Dire Dawa 5.6 m², and Bahir Dar 8.2 m² per person as confirmed by the study of^[14,16].

Some of the challenges of urban green space that were observed in the cities include: harsh growing conditions of the plants, poor tree selection, poor nursery stock, failure of post-planting care, small genetic diversity and lack of professional manpower^[17]. In order to tackle these challenges, strategic efforts will be required to coordinate relationships among cities and regions. The political attention should be sought so as to fill the gap of unavailable greenery growing space in the city centres.

3.2 Observed Species in the Cities

3.2.1 Adama

Various trees, shrubs, grass, and flowers were planted in Adama city in different green spaces. Current planted tree species included *Acacia S.*, *Acacia A.*, *Acacia D.*, *Acacia T.*, *Alternata*, *Araucaria A.*, *Azadrachta I.*, *Balanites A.*, *Borassus A.*, *Bougainvillea S.*, *Boxus Sp.* (*hedgerow plant*), *Callestimon C.*, *Carica P.*, *Casimir (fruit trees)*, *Cassia S.*, *Cassuarina E.*, *Coffee A.*, *Cordia A.*, *Croton M.*, *Cupressus A.*, *Cupressus P.*, *Cymbopogon M. (tessar)*, *Dahlia Sp.*, *Delonix R.* and *Dovyalis A.*. The dominant species observed in most parts of the city are *Acacia A.*, *Borassus A.*, *Araucaria A.*, *Callistemon C.*, *Casuarina E.*, *Delonix R.*, *Grevillea R.*, *Hibiscus R.*, *Jacaranda E.*, *Mangifera I.*, *Melia A.*, *Moringa S.*, *Nerium O.*, *Pennisetum C. (Kikuyu grass)*, *Persea A. (Avocado)*, *Phoenix R.*, *Schinus M.* and *Spathodea N.* It was observed that in Adama city, different types of urban greenery space were not initially considered in the urban plan. Therefore, the city council needs to revise the urban plan and assign some spaces to greenery components.

3.2.2 Bishoftu

Gravillia R., *Casuarina E.*, *Melia AZ.*, *Olea A.*, *Delonix*

R., *Jacaranda M.*, *Spathodia N.*, *Schinus M.*, *Phoennex R.*, *Cordia A.*, *Acacia S.*, *Acacia M.*, *Eucalyptus Sp.* and *Golden Flower* tree species and turf development are found in the city greenery areas. These tree species are planted in the spaces illustrated on the city structural plan. Similar to Adama city, Bishoftu has left a green space on its urban plan. However, the scientific approach was not applied during the tree plantation process. In brief, different lands are allocated for the riverside, roadside, forest, open areas, mixed residential, plant's area, park, urban agriculture and lake greenery components. Forest has the biggest green space that was considered by Bishoftu city municipality. The least prioritized green infrastructure components in the city were roadside. Other greenery components like cemetery area, religious area, institutional and organizational area, river buffer zone, greenbelt plaza, and public area are not considered in Bishoftu city's structural plan. Though Bishoftu city prepared spaces for many greenery components, only roadside, park, and lake components are developed now.

3.2.3 Sebeta

Only a few of the greenery site components are developed in Sebeta roadside open areas, mixed residential and urban agriculture are highlighted on the city structural plan. There is no adequate information available on the types of trees and details of green infrastructures in Sebeta city. The city administration has no adequate greenery practices. According to the city structural plan, 128.9, 1810.9, 7302 and 294.39 hectares are allocated for roadside, open areas, mixed residential and urban agriculture green infrastructure components, respectively. However, there is no greenery practice that was taken on the ground development.

3.2.4 Burayu

The greenery site components are not clearly observed on the urban plan. Similar to the situation in Sebeta, there were no adequate information presented on the types of trees and details of green spaces in Burayu and not adequate greenery practices.

3.3 General Gaps and Strength of Urban Greenery Components

The greenery components like median strips, squares/plaza, drainage areas, roadsides, institutional area, home gardens, nursery sites, communal housing area, rivers, river buffer zones, green belts, parks, sports field, cemeteries, and urban agricultural sites were assessed in this study. Majority of these components in the various

cities have not been actualized ^[18]. As a consequence of lacking knowledge and awareness, shortage of finances, less political commitment and poor legal framework, the greenery coverage is decreasing in most cities. The designed greenery space is changed to other land use or practically undeveloped. The situation of greenery sites in studied cities showed similar trends that have been observed in other cities of the country ^[17]. The practices in Adama and Bishoftu are relatively better compared to the other two cities in Oromia. The development of the median strips in the cities is quite appreciable as compared to the other types of green space. Most of the greenery components are indicated on their structural plan and lands are allocated accordingly. It also created job opportunities for small and micro enterprise associations and became an income source for many young individuals. In Adama, there are 14 associations with a total of 188 members who are working on greeneries and the majority of them are 21 to 35 years old. The median strips in Adama and Bishoftu were well managed by the associations and supervised by urban greenery and beautification team. The nursery was established for raising different seedlings which can adapt to the hot climate of the city. The city nursery site was well designed, fulfilling the established criteria. In Adama's nursery sites, 750,000 seedlings of 30 different species have been raised annually. But no information on the greenery practices was available as for Burayu and Sebeta cities although the green spaces have been indicated in their structural plan.

3.4 Purposes of Managing Green Area

Urban greenery resources in and around densely populated places are well-known by providing different local values and playing an important role in improving living conditions. As explained in different kinds of literature ^[14], and observed in Oromia cities, the greenery

resources were providing different goods and services, creating job opportunities, moderating harsh urban climates, conserving biodiversity and contributing to better public health in the cities. In spite of its various scientific purposes and benefits, the development of greenery spaces has not been understood well in most cities ^[18]. This assessment confirmed that the purpose of developing different greenery components in studied cities was not well understood. According to data observed from the Adama and Bishoftu cities, the types of plants and ground covers used for those green areas were not scientifically approved. Some of the observations in all the cities were; unsuitable agro-ecological zone of the tree species, inappropriate type of trees, and tree planting without purpose (Table 2).

The major bottlenecks that hinder further development of this sector were technical limitations, awareness, and participation of public and stakeholders, attitudes, limited resources, weak institutional setup, policy and legal framework and lack of political commitment. On the other hand, there is a limited amount of funds allocated for greenery in the municipal sector. The political leader's paid little attention to the development of greenery landscapes hence leading too few of annual budgets allocated as compared to the situation of the workload. Besides, the land is not well protected under the demarcation. The allocated greenery site can be suddenly changed to another land use system sometimes. Moreover, there is no policy and legal framework that can protect and keep the urban greenery in Oromia cities. Nevertheless, there are policies, urban greenery strategies, proclamations, and standards that can enhance greenery development at the federal level.

3.5 Tree Nursery Site

Nursery site was well-known in providing opportunities

Table 2. Major various species observed in the study area

No.	Trees	Shrubs	Grass
1	<i>Acacia saligna</i>	<i>Carissa edulis</i>	<i>Cymbopogon martini</i>
2	<i>Acacia tortolis</i>	<i>Dovyalis abyssinica</i>	<i>Dahlia sp.</i>
3	<i>Azadrachta indica</i>	<i>Phoenix reclinata</i>	<i>Pennisetum clandestinum</i>
4	<i>Cordia africana</i>	<i>Dovyalis abyssinica</i>	<i>Arundo donax</i>
5	<i>Croton macrostachyus</i>	<i>Psidium guajava</i>	<i>Gazania thermalis</i>
6	<i>Cupressus pyramidalis</i>	<i>Punica granatum</i>	<i>Aloe vera</i>
7	<i>Spathodea niloittica</i>	<i>Rosa abyssinica</i>	<i>Mussa ensata</i>
8	<i>Delonix regia</i>	<i>Hibiscus rosasinesis</i>	<i>Gazania thermalis</i>
9	<i>Ficus vasta</i>	<i>Lantana montevidensis</i>	
10	<i>Mangifera indica</i>	<i>Coffee Arabica</i>	
11	<i>Persea americana</i>		

for potential sources of seedlings and cultivating the locally adaptable tree species^[17]. Bishoftu and Adama have standard nursery sites even though dominantly exotic species have been grown in it, whereas the nursery site was not well developed in Burayu and Sebeta. There were sample nursery sites under standard conditions in Burayu and Sebeta but does not fulfil the following conditions as presented in a nursery catalogue: human labour, working conditions, personal protective equipment, accessibility, infrastructure, species selection, and management system. The organizational structure of greenery sector in Oromia cities is one of the bottlenecks for implementation of different greenery components according to the required standards. There is no adequate trained human labour allocated for greenery sector in all cities. The institutional structure contains two or three persons, supervised by town municipalities to undertake urban greenery and beautification process. However, the staff members allocated for greenery jobs are unqualified persons without knowledge and skills of greenery in the field.

In Adama and Bishoftu cities, there are some micro and small enterprises that can bring job opportunities for the urban dwellers even though they are not enough to address the depth of greenery works in the cities. However, these enterprises are not found in Sebeta and Burayu cities. Bidding for development of the green area by municipality focuses only on the least cost approach thus compromising on the quality.

4. Conclusions

The investigations and analysis on this survey have come to these conclusions. The current urban greenery coverage in Oromia cities is smaller than the given quality and size an international standard value of UN-HABITAT and Ethiopian Federal Democratic Republic urban greenery standard value^[12,16]. The per-capita international urban greenery standards of the globe and Ethiopia are 20 and 9 m² per person, respectively. However, the average per-capita urban greenery share of Oromia is 0.0035 m² per person and also poorly managed. The green space in cities of the region is also decreasing gradually. The structural plan of most cities has indicated the space for greenery without highlighting the names of different green area components clearly. The current practice of greenery in most cities is insignificant. In some cities, greenery spaces have been changed to other purposes while in other cities the development of greenery spaces has not been started yet. Some of the bottlenecks that have contributed to the substandard urban greenery in Oromia cities are: weak institutional setups, lack of training, flimsy policy and legal frameworks, sleazy political commitment,

reluctant of public and stakeholder's awareness and participation. The authors are strongly recommended to the responses cities municipality to manage and protect the existing greenery areas and allocate sufficient greenery areas for further development.

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