



Article

# Sustainable Urban Green Infrastructure Development and Management System in Rapidly Urbanized Cities of Ethiopia

Eshetu Gelan \* and Yared Girma

Department of Architecture, School of Civil Engineering and Architecture, Adama Science and Technology University (ASTU), Adama 1888, Ethiopia; ygirma84@yahoo.com

\* Correspondence: eshetu.tgelan@gmail.com

**Abstract:** Lack of sustainable strategic approaches has led to non-functional, unsafe, inaccessible, and fragmented urban green infrastructure within cities. In sub-Saharan African cities, the development and management of urban green infrastructure are not realized in many instances due to a lack of priorities and resources. The objective of the study is to develop strategic approaches that help to overcome the challenges of urban green infrastructure and promote a sustainable development and management system in Ethiopia with special references to the emerging towns of Oromia special zone that surrounds Finfinne. To design sustainable strategic approaches for an urban green infrastructure development and management system, the study collected data using key informant interviews, focus group discussion and document reviews. Findings identify seven potential strategic approaches that are needed to create a sustainable urban green infrastructure development and management system. Hence, improving the quantitative, qualitative, and accessibility standards on the provision of urban green infrastructure is needed for sustained development. Moreover, advanced development in budget allocation, capacity building, legal and institutional framework, awareness creation, and stakeholder's involvement are also needed to promote a sustainable development and management system of urban green infrastructure in the urban centers of Ethiopia in general and emerging towns in particular.

**Keywords:** green infrastructure; suitability; awareness; participation; standards



**Citation:** Gelan, E.; Girma, Y. Sustainable Urban Green Infrastructure Development and Management System in Rapidly Urbanized Cities of Ethiopia.

*Technologies* **2021**, *9*, 66.  
<https://doi.org/10.3390/technologies9030066>

Academic Editor: Manoj Gupta

Received: 23 August 2021  
Accepted: 8 September 2021  
Published: 14 September 2021

**Publisher's Note:** MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



**Copyright:** © 2021 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

## 1. Introduction

Throughout the world, urban areas have increased in size over recent decades [1,2]. The United Nations report indicates that currently, more people of the world (55%) are residing in urban centers, a proportion that is expected to increase to 68% by 2050 [3]. This rapid population growth and urban expansion across the globe is followed by degradation of local environments through air pollution, intensification of the heat island, depletion of urban green spaces, biodiversity and ecosystem services [4–8]. Overall, population growth and urban expansion place pressure on natural resources and threats to compromise the quality of life within the urban environment [9,10].

Currently, urban green infrastructure (UGI) is acclaimed as an alternative nature-based and cost-effective remedy to these negative consequences [11–15], and it is increasingly recognized as playing a crucial role in strengthening the resilience of urban environments and transforming urban centers [16]. UGI commonly refers to the strategically planned interconnected network of high quality natural and semi-natural areas with other environmental features, which is developed and managed to provide multifunctional benefits and protect biodiversity in both urban and rural areas [11,12,17–19]. Therefore, UGI in the context of this study, is a part of an urban area with a mix of street trees, parks, garden, green corridors, and sport fields established outside urban plans, proposed in urban plans, and established as a result of the implementation of urban plans.

Several studies have demonstrated that UGI elements can provide crucial ecosystem services for ecologically degraded urban environments by regulating climate [20], min-

imizing air pollution [21,22], aiding water purification [23], and providing habitats for wildlife [24,25]. In addition, it offers benefits relating to individuals' wellbeing and health such as recreational opportunities [26,27], relaxation [28], and a connection to nature [29].

Studies show that successful strategic approaches that promote sustainable development and management system of UGI have been emphasized on principles of multifunctionality, grey and green integration, connectivity, and social inclusion [12,30–32]. Moreover, Pauleit et al. [32] stated that strategic planning, interdisciplinary and transdisciplinary partnerships, and multiscale planning are also important additional principles to be considered. Therefore, the adoption of these principles can help to maintain and enhance the quality of life in unplanned and intensified cities [33].

Previous studies also show that process of UGI development and management are based on long-term spatial visions supplemented by actions that are usually led by the public sectors, which also includes NGOs, community groups, individuals and various sectors. The process also aims at enhancing linkages between disciplines, science, policy and practice through integrating knowledge and demands from different disciplines such as landscape design, landscape ecology and urban planning [34]. Therefore, developing governance arrangements that enable the process will be a key for strategic UGI development and management system all over the world [32].

The development and management system of UGI has been receiving more attention and it is considered as essential urban infrastructure in Europe, North America, and Asia countries [33]. In contrast, developing countries have remained with a huge assignment regarding the development and management of UGI components. UGI components in developing countries have excessively been destroyed [35–37]. For instance, studies in different sub-Saharan African cities [36,38–41] found massive depletion of UGI components with the resultant effect being low coverage of green spaces in the landmass of many African cities. Consequently, UGI components resulted in many deficiencies both in demand and in supply [42] and they are not properly utilized by the urban dwellers [43].

Numerous studies have mentioned that rapid urbanization, unplanned urban growth, limited institutional capacity, lack of political will, corruption, lack of financial resources and lack of skilled expertise are the main factors that lead to poor development and management of UGI components in African cities [44–47]. Additionally, limited awareness and understanding of the benefits provided by UGI components among the communities and decision makers are also factors for inadequate provision of high-quality UGI components [48–50].

Similar problems were also observed in Ethiopia, which is one of the most rapidly urbanizing countries in sub-Saharan Africa [51,52]. In Ethiopia, most of the urban centers are unable to meet the minimum standard of green space per capita proposed the World Health Organization (WHO) [53]. For instance, Adama, Shashemene, Dese, Jijiga, Dire Dawa and Bahir Dar had 2.1, 1., 3.1, 3.8, 5.6, and 8.2 m<sup>2</sup> UGI components per person, respectively [53]. Even these existing UGI components are poorly accessible and not safe [54]. Moreover, they are not well developed and lack basic facilities discouraged urban dwellers to utilize it [55]. Poor enforcement of planning regulations, inadequate legal framework, unqualified professional, lack of financial support, limited participation and poor collaboration among institutions were commonly mentioned as a driving factors that led to poor development and management of UGI components in the urban center of Ethiopia [54–57].

Recently, several studies have been conducted in Ethiopia relating to UGI components. The studies are mainly focused on: the effects of urban development on green space [58–60], adaptation to climate change [61], developing functional green infrastructure [56], ecosystem service [62], planning aspect [57], green spaces depletion [63], green spaces accessibility [64] and utilization pattern [55,65]. Nevertheless, the results of previous studies did not fully cover what strategies and approaches should be used to solve the problems regarding the development and management of UGI elements. Therefore, this study is intended to contribute to bridging this gap by proposing strategic approaches that

overcome challenges and promote sustainable development and management system of UGI in the urban center of Ethiopia by taking the emerging towns of Oromia special zone surrounding Finfinne as a case.

The study is novel in its field for two reasons. The first is that no study has been undertaken in developing countries to provide strategies for overcoming challenges of urban green infrastructure and promoting a sustainable development and management system of UGI in the urban centers of developing countries, in general, and Ethiopia in particular. Second, the study used mixed research approaches to identify strategic approaches, integrating key informant interviews, focus group discussions, and a review of relevant works, which is uncommon in most studies on developing countries. Therefore, using a mixed research technique in this study can also make the research methodologically novel.

The findings of this paper provide variety of strategic approaches offering a wider range of measures that can be utilized to successfully develop and manage UGI components such as parks, playing ground, sport field, green corridors, etc. Such strategies provide a broader range of ideas that can be incorporated into development agendas and different planning strategies to support sustainable development and management of UGI for the emerging and other towns. Moreover, the study provides scientific knowledge by filling literature gaps for developing an effective UGI development and management strategy for small towns of Ethiopia. Furthermore, it helps as a pertinent literature and input for policy makers in formulating policies and strategies along with the issue. Besides, the study may use as baseline information for further investigation to enrich the research findings in this area.

The remainder of this paper is structured as follows. The following main section presents the literature review where theories and concepts related to urban green infrastructure, definition, typologies and significance is presented. In addition, urban green infrastructure development and management issues have been presented. Section 3 then presents methodologies employed to identify different alternatives and strategies. Section 4 presents the results of the seven identified strategies. Section 5 presents opportunities that the emerging towns have to implement the identified strategic approaches. Finally, the article concludes in Section 6 by summarizing the main findings, providing reflections, and states' limitations and suggests opportunities for further research.

## 2. Related Work

In the 1990s, the term “green infrastructure” first appeared [31]. It is, however, not a new concept, having its roots in the planning and conservation of green spaces that began 150 years ago [66]. Its theory and application have grown significantly in the last decade [31]. However, the term's origins are unknown [67,68], and there are numerous interpretations of its meaning [69,70]. It has been defined as a controversial phrase [71], with many definitions ranging from large-scale green space network planning to ecosystem-based storm water management. Green infrastructure, for example, is defined by Benedict and McMahon [66] as an interconnected network of green space that conserves natural ecosystem values and functions while also providing advantages to human populations. Green infrastructure, as defined by Davis et al. [72], is characterized as areas of an urban region that include a combination of street trees, parks, cultivated land, wetlands, lakes, and streams. As a result, green infrastructure in urban areas includes a wide range of green space elements such as parks, open spaces, playing fields, pocket spaces, small incidental green space, and community gardens, all of which are connected by tree-lined streets and waterways that run across and between urban areas [57].

Studies have shown that a well-developed and managed urban green infrastructure contributes significantly to urban sustainability by providing significant benefits in the areas of social, economic, and environmental concerns [20,73,74]. In both developed and developing countries, urban green infrastructure can provide passive and active recreation and help to meet a community's leisure needs by providing places for playing, sport, recreation, special events, and other leisure activities [75,76]. The existence of urban green infrastructure may stimulate beneficial social interactions that improve health and well-

being through cultivating social cohesion [77]. In the United Kingdom, Finland, and Mexico, Haq [78] discovered that urban green infrastructure is a significant resource for leisure activities. According to studies, urban green infrastructure components such as parks and urban forests contain considerable amounts of biodiversity and play a critical role in habitat conservation, ecological value, and biodiversity [79,80]. It also has the ability to contribute positively to the stabilization of microclimates and the mitigating of urban climate extremes [81]. Urban green infrastructure may also serve to regulate storm water run-off in cities by moderating the flow of surface run-off, which can cause erosion [82].

Despite the benefits mentioned above, the development and management of urban green infrastructure face a number of challenges [83,84]. According to researchers in the area, community and institutional barriers have a significant constraint in the development and management system of urban green infrastructure in many parts of urban centers [41,84,85]. The characteristics and values of a community have a significant impact on a community's acceptance of green infrastructure and may be critical barriers to its implementation [86]. These barriers, according to Kimme et al. [86] and Mensah [41], include public knowledge and perception, landowner preferences, development plans, resistance to change, and a lack of political commitment and leadership. Financial incentives, both direct and indirect, are likely to be other influential factors impeding the development and management of urban green infrastructure [83]. Kimme et al. [86] found that the availability of financial resources to plan, design, implement, and maintain green infrastructure is a major challenge for communities, cities, and regions in both developed and developing countries. Legal frameworks play a significant role in the adoption of urban green infrastructure because they mandate the inclusion of green infrastructure in urban planning and design [83]. As Kimme et al. [86] indicated, rules and regulations at all levels of government can obstruct the development and maintenance of sustainable urban green infrastructures.

Hence, to develop and manage urban green infrastructure in a sustainable way, both in developed and developing countries, an integrated planning approach that involves open space, landscape and urban planning, nature conservation, the management of water resources, mobility, energy supply, real estate, and social institutions (i.e., interdisciplinary planning) is needed. This type of integrated planning necessitates the participation of a wide range of actors, not only government officials [87,88].

In order to develop and manage urban green infrastructure in a sustainable manner, diverse stakeholders need to be aware of each other and communicate effectively. In addition, institutions directly or indirectly responsible for developing and managing urban green infrastructure must work together. Promoting collaboration and knowledge sharing can be an efficient method to better interlink policies and handle restricted resources that typically restrict planning departments, according to case studies in 14 different cities across Europe [89].

Another important component in the development and management of urban green infrastructures is social inclusion [90]. Comprehensive participation can help to ensure the success of urban green infrastructure development and management by empowering local residents to contribute their own ideas to the planning process and fostering broader agreement on planning results. In Scotland, the city of Edinburgh's open space strategy is a superb example of citizen consultation in action [88].

This paper, therefore, builds on these theoretical perspectives and identifies and evaluates alternatives and strategies that enhance urban green infrastructure development and management system in the emerging towns of Oromia special zone surrounding Finfinne.

### 3. Materials and Methods

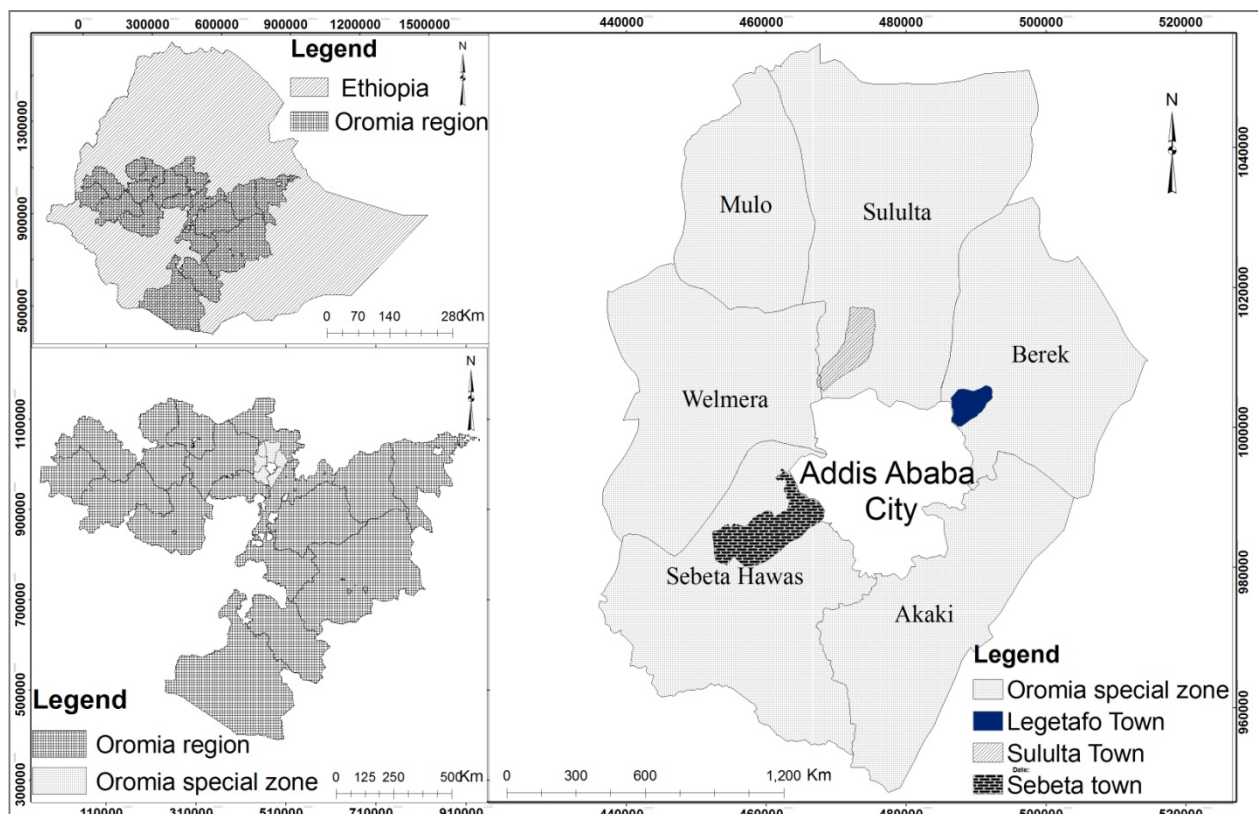
#### 3.1. Study Area

Oromia special zone surrounding Finfinne is one of the zones of the Oromia region in Ethiopia. The special zone comprises a surface area of 4300 Km<sup>2</sup>. This zone surrounds the capital of Ethiopia, Addis Ababa, which is called Finfinne in the regional language.

It is located between  $80^{\circ}34'25''$  and  $90^{\circ}34'41''$  N latitude and  $380^{\circ}25'50''$  and  $390^{\circ}7'53''$  E longitude. The zone consists of six woredas; namely, Akaki, Berek, Mulo, Sebeta Hawas, Sultulta and Welmera and eight major towns such as Sebeta, Gelan, Dukam, Legetafo, Burayu, Holeta, Sululta, and Sendafa [91]. Among the eight towns, Sebeta, Sululta, and Legetafo towns were selected purposively for this study (Figure 1 and Table 1). The towns were selected for two major reasons. First, they have the potential for being absorbed by the capital and for housing millions of people whose lives can be affected by their conditions. Second, they are fast growing compared to other special zone towns in terms of infrastructure, population, and physical size as a result of pressure from the capital [52]. In addition, the towns have similar characteristics with many emerging urban settlements in Ethiopia in terms of rapid urbanization, problems related to urban GI planning and management [41,44,57,63].

**Table 1.** Description of the study area.

Study Towns	Astronomical Location	Administrative Area	Distance from Addis Ababa	Sources
Sululta	$9^{\circ}30'00''$ to $9^{\circ}12'15''$ N latitude and $38^{\circ}42'0''$ to $38^{\circ}46'45''$ E longitude	44.71 sqkm	24 km	OUPI, 2006
Sebata	$8^{\circ}53'38''$ to $8^{\circ}59'58''$ N latitude and $38^{\circ}35'11''$ to $38^{\circ}39'33''$ E longitude	99 sqkm	24 km	OWWDSE, 2011
Legetafo	$9^{\circ}01'29''$ to $9^{\circ}06'$ N latitude and $38^{\circ}53'42''$ to $38^{\circ}55'30''$ E longitude	24.3 sqkm	21 km	OUPI, 2007



**Figure 1.** Map of the study area.

### 3.2. Key Informant Interview Analysis

To develop strategic approaches that promote a sustainable UGI development and management system, a key informant interview was also conducted with purposively selected 21 experts, researchers, policy makers, urban planners, and consultants from Ministry of Urban Development and Housing, Oromia Urban Planning Institute, the towns' administration, and kebeles administration of the study towns. The key informants were selected based on the following criteria:

- Those who have involved in different UGI component development and management practices;
- Those who have experiences and background on issues related to the development and management of UGI components;
- Those who have experiences in urban planning of the towns.

The level of education, area of expertise, and work experience of interviewed key informant (KII) is summarized in Table 2.

**Table 2.** Level of education, area of expertise, institutions and work experience of interviewed key informant.

No.	Institutions	Level of Education	Area of Expertise	Work Experience
KII 1	Ministry of Urban Development and Housing	BSc	Urban and Regional Planning, Urban Green Infrastructure Planning	Urban Planner
KII 2	Ministry of Urban Development and Housing	MSc	Environmental Science, GIS	Environmental Impact assessment officer
KII 3	Oromia Urban Planning Institute	PhD	Urban Planning, Urban management, spatial planning	Institute Director
KII 4	Oromia Urban Planning Institute	BSc	Surveying	Team Leader of Surveyor
KII 5	Sebeta Town Administration	BSc	Urban Planning	Process owner of Land Administration
KII 6	Sululta Town Administration	BSc	Agricultural Economics	Team leader of Greenery and Beautification Department
KII 7	Legetafo Town Administration	BSc	Urban Engineering	Head of the Department of Land Administration
KII 8	Kebele Administration	BSc	Environmental Science	Focal person of Greenery and Beautification Department
KII 9	Kebele Administration	MA	Urban Management	Kebele Manger
KII 10	Kebele Administration	BA	Geography	Focal person of Greenery and Beautification Department
KII 11	Kebele Administration	BSc	Surveyor	Focal person of Greenery and Beautification Department
KII 12	Kebele Administration	BSc	Natural Resource	Focal person of Greenery and Beautification Department
KII 13	Kebele Administration	BSc	Agricultural Economics	Focal person of Greenery and Beautification Department
KII 14	Kebele Administration	BA	Geography and Environmental Studies	Focal person of Greenery and Beautification Department
KII 15	Kebele Administration	BSc	Surveyor	Focal person of Greenery and Beautification Department
KII 16	Kebele Administration	MA	Urban Management	Kebele Manger

Table 2. Cont.

No.	Institutions	Level of Education	Area of Expertise	Work Experience
KII 17	ETG Designers and Consultants	BSc	Architect-planner	Design department Director
KII 18	Addis Ababa University	PhD	Urban Ecology	Associate Professor of urban ecology
KII 19	Addis Ababa University	PhD	Architect-planner, urban design	Assistant Professor in urban design
KII 20	ETG Designers and Consultants	MSc	Environmental Sciences and Natural conservation	Environment Department Director
KII 21	ETG Designers and Consultants	PhD	Environmental Planning	Senior environmental and system service expert

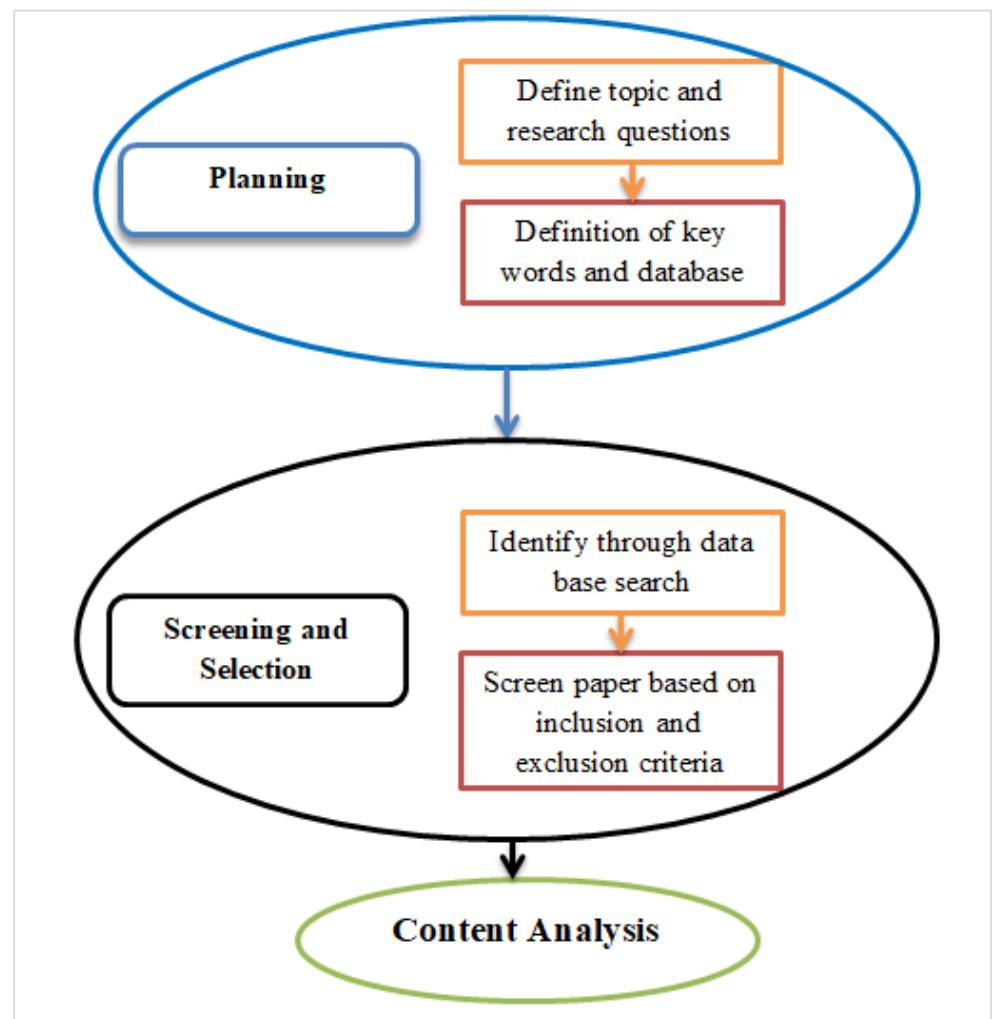
In this study, semi-structured interviews, which contained open-ended questions, was used as the main instrument to interview the key informants. The semi-structured interview handles the challenges hindering the sustainable development and management of UGI such as financial capacity, stakeholder involvement, coordination between institutions, institutional and legal framework and human capacities. The interviews were also focused on the issues related to the provision of UGI component. In addition, the key informants also asked about what type of strategic approaches should be developed to overcome the challenges and to promote sustainable development and management system of UGI components. Interviews with the key informants were conducted in February 2018 for approximately 20 min per individual respondent.

### 3.3. Focus Group Discussion

Six focus group discussions were undertaken with purposively selected local communities in the towns. The selection of respondent was made based on age (i.e., elderly preferred) and the number of years they lived in the area (i.e., 10 years and above). The rationale for preferring the elderly (age of 45 and above) was that they potentially have better information on the developments and management that have occurred on UGI components over a long period. The focus group discussion was organized on six different days with different groups (i.e., 23 February 2018 in Sululta 01, 24 February 2018 in Qaso Wasarbi, 25 February 2018 in Sebeta 01, 26 February 2018 in Furi, 27 February 2018 in Almegena and 28 February 2018 in Legetafo 01). The number of participants per focus group discussion was eight heads of the households. The discussions covered specific topics such as how to improve the availability of UGI such as parks, gardens, and playgrounds in their locality and how to improve the participation of the local community of the development and management of UGI components.

### 3.4. Related Work Review

There are several methods used for related work reviews that are helpful to address new or already known issues, and each provides different insights for knowledge creation, text development, and individuation [33]. To undertake the related work reviews on urban green infrastructure development and management systems, this research focuses on an integrative literature review approaches. As presented in Figure 2, to undertake an integrative literature review, the methodological approach relied on three main phases: planning of the research, screening and selection of the publications, and content analysis of the remaining documents.



**Figure 2.** Overview of the methodological approaches adapted from Monteiro et al. [33].

For the first phase, we identify and define the research topic, keywords and synonyms. Since the literature in this field of research is vast and complex, initially, we reviewed relevant journals and book chapters to obtain a closer look at the subject and to identify keywords, synonyms and search strings. In this way, combinations of two sets of terms were selected to ensure a high level of relevance of the resulting documents. First, the expression “green infrastructure” was included to ensure that the articles were consistent with the main topic, and then the terms “development”, “urban”, “management”, “challenges”, “Finfinne”, “Ethiopia”, “Sub-Saharan Africa”, “practices”, “strategies”, “planning”, “system”, “sustainable”, “park”, “playground”, “garden”, “green spaces”, and “approaches” were added using the operator “and” in between each in the search expression to incorporate terms related to green infrastructure development and management in urban areas.

After identification of the keywords and synonyms using Scopus, Web of Knowledge and Google Scholar databases, the screening and selection process was undertaken. This process consisted of the development of specific criteria to scrutinize the papers and thus select only the relevant ones. Regarding the records we identified in the preresearch, we only retained refereed journal articles and book chapters directly related to the overarching topics. We limited the results to articles written in English language. In a second round of research, again, we only considered refereed journal articles and book chapters directly related to the keywords and synonyms. The main topics on which we initially focused our review were the conceptualization of “urban green infrastructure” development and man-



agement as well as major current and future challenges in cities and different strategies or approaches implemented to overcome the challenges and promote sustainable deployment and management of urban green infrastructure; here, we considered literature covering the last ten years. Regarding urban planning and current trends and transitions of the GI concept, we also considered older literature that has had significance in shaping the direction of research. We added journal articles and book chapters published between 2002 and today referring to “green infrastructure” to the search to trace the transformation of the concept of GI over the past years.

After the screening and selecting documents, they were scrutinized using content analysis methods. Content analysis is a research method used to test theoretical issues to enhance understanding of the data in which it is possible to obtain a condensed number of concepts or categories describing a phenomenon, a theory or a research topic [92]. We analyzed the theoretical and empirical literature on concepts of urban green infrastructure, components of urban green infrastructure, benefits of UGI, challenges of UGI and knowledge gaps and development of possible future solutions to overcome the challenges. We finally present the review data in a summarized manner under the related work section.

### 3.5. Data Analysis Methods

A theoretical proposition strategy recommended by Yin [93] was used to analyze the data obtained from the key informant interviews and focus group discussion. Based on this strategy, the responses were categorized under themes such as improving standards, financial capacity, legal framework, stakeholders’ involvement, intuitional coordination, and capacity building. For further discussion, the data obtained from focus group discussion and key informant interviews were supported by personal observation and document review.

## 4. Results and Discussion

Limited access to urban GI components, low quality and quantity of the components, absences of social inclusiveness during the plan preparation period, limited connectivity between GI components and inadequate planning standards are the major challenges identified under the planning theme that affected the development of urban GI components in the study towns [57,64]. Moreover, violation of urban GI plans, less priority to urban GI components, financial constraint, inadequate staff, limited awareness, inadequate legal and institutional frameworks, lack of enforcement of laws, lack of coordination between institutions and limited community participation have also been identified as challenges hindering the development of urban GI components from implementation and management perspective [52,63]. Therefore, it is necessary to guide the urban green infrastructure development and management system through a variety of urban green infrastructure development and management approaches.

The research thus first tried to observe the major issues that could affect the urban green infrastructure development and management system in the emerging towns of Oromia special zone surrounding Finfinne. Then, alternative urban green infrastructure development and management approaches for the sustainability urban green infrastructure development and management of the study area were pursued.

### 4.1. Improving Provisioning Standards

The information obtained from field observation, key informant interviews and review of literature revealed that per capita of UGI components is 2.66 m<sup>2</sup> for Sululta, 0.9 m<sup>2</sup> for Sebeta and 2.17 m<sup>2</sup> for Legetafo towns [64]. This problem was found to be underpinned by the limited availability of many UGI components such as parks, playgrounds, sport fields, etc. in the total land mass of study towns. Surprisingly, the standards developed by Oromia urban planning institute in 2012 proposed 2 m<sup>2</sup> per capita green spaces for the first and second level urban center and 1 m<sup>2</sup> per capita for the third level urban center, which is far below the minimum green space requirement of WHO, which is 9 m<sup>2</sup> per capita. Moreover,

as the information obtained from focus group discussion and field observation shows, the existing green infrastructure components in the study towns are unattractive, mono-functional, fragmented and poorly accessible to the community. Therefore, improving the standards of quantity, quality and accessibility of UGI components such as parks, sport fields, and playground is one of a particular strategies that is proposed by this study.

To improve the standards, first, the planning authority should consider a minimum quantitative standard based on the population size during the planning of UGI components. Moreover, the planning authority has to ensure that the individual UGI component must be of size and equally distributed. Based on information obtained, such as literature, focus group discussion, and key informant interviews, and to provide sufficient UGI components in the study area, the planning authority should introduce indices such as the “biotope area factor”, “six acre standard” or “accessible natural green space standard”, based on the local context. Such indices will enable the towns to improve the quantity of the UGI components based on the population size of the towns. Moreover, to improve the quantity standard of UGI components, the planning authority and the town administration should focus on issues such as green space ratio, green space coverage and green space area per capita.

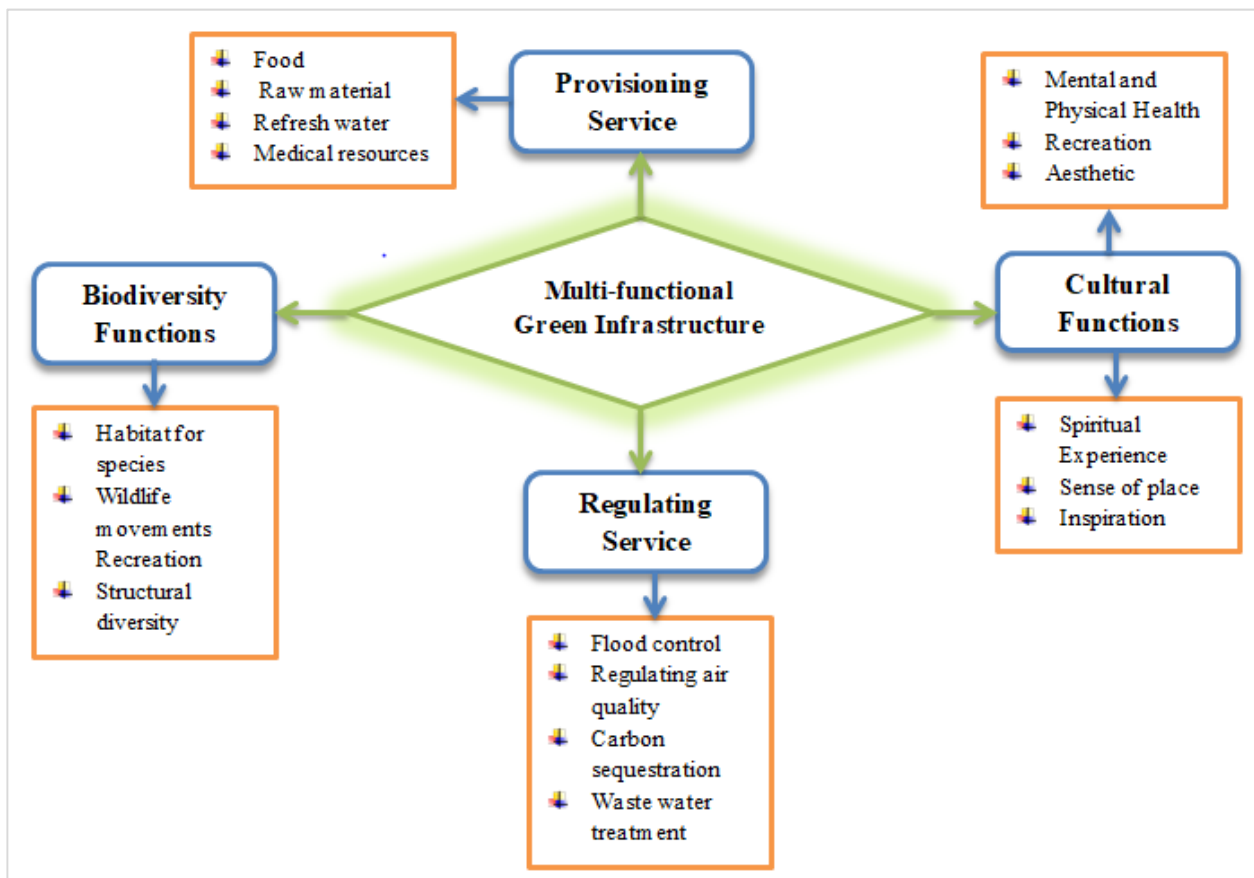
Second, besides improving the quantitative standards, UGI components quality standard improvement are often required in the study towns. The information obtained from key informant interviews and field observation show that the lack of connectivity, integration, facilities and multifunctional benefits of UGI component in the study towns have led to poor quality of the components. Therefore, the information obtained from key informant interviews, personal experience, and literature reviews shows that the quality standard should be focused on diversity and equity of UGI components, which results from the heterogeneity and spatial distribution of the green infrastructure components. Moreover, quality standard improvement should also be focused on connectivity. Therefore, UGI component should be planned and developed in the form of a coherent network. Connectivity can be of a spatial nature, for example in the form of riparian corridors (stream, lake, riverside), urban green corridors or road networks (cycling path, pedestrian zone/walkway, underpass, interchange, transport hubs).

Additionally, to improve the quality standard, the planning authority and the towns' administration should focus on integrating all green spaces with the grey structure in the towns. Different studies show the integration of green and grey infrastructure for storm water management and has gained considerable attention in the past two decades [94]. However, other fields of application include, for instance, bike paths and greenways along power line rights-of-way, green corridors for ventilation, or green roofs.

Furthermore, to improve the quality standard, the planning authority and the town administration should focus on enhancing multifunctionality (Figure 3). The town's administration has to be committed to increase multifunctional green infrastructure components and maximize their contribution to the quality of place and the benefits that they provide to local communities.

Third, the information obtained from focus group discussion and key informant interviews show that the majority of the UGI components (such as playground, parks, and sport field) are not accessible to urban dwellers. Therefore, based on information obtained from key informant interviews, reviews of related literature, field visits and personal experiences, the accessibility standard should be improved based on walking time and distance. A 10 to 12 min walk (400–600 m) is considered as reasonable by many countries. International research shows that having green space within a 5 min walk of home is a strong indicator for quality of life [76]. During improving the accessibility standard, the following issues should be considered:

- the site should be easily found and accessible by road, cycleway, footpaths and public transport including by those with disabilities;
- barriers that hinder access such as roads and rivers should be considered;
- the site must be with the appropriate size and inviting with a welcoming sign.



**Figure 3.** Different functions that should be considered in improving the quality standard.

#### 4.2. Solving Budget Shortages

The information obtained from the key informant interviews showed that a financial constraint is a big hindrance in the study towns for developing and managing UGI components. Therefore, different funding approaches should be used by the town administration to promote sustainable and high-quality UGI components. Based on reviews of relevant international best practice literature on the funding of UGI components and interviews with key informants, different funding approaches have been proposed in this study to overcome the budget shortage of UGI development and management system. The approaches developed in this study have either increased the financial resources or made better or more efficient use of existing financial resources (Figure 4).

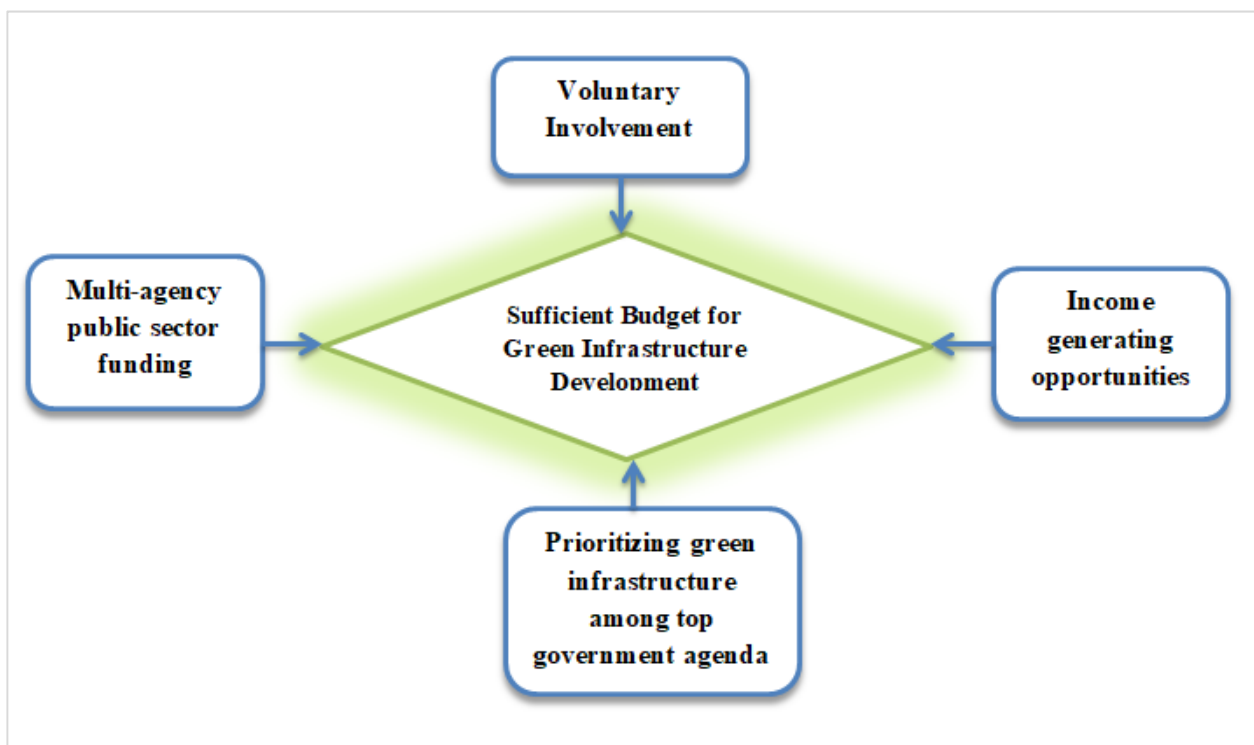
**Prioritizing green infrastructure components among top government agenda:** The information obtained from key informant interviews revealed that the attention of the towns' administration has been focused on the construction of roads, schools, health centers, housing and other social infrastructure resulting top priorities in the allocation of budget for social and economic infrastructure. As the budget report of the towns shows, matters on green infrastructure components have often relegated to the bottom or not given attention during the budget allocation. Therefore, the towns' administration should prioritize UGI components among its top agenda and allocate sufficient annual budget that can enable the greenery department to perform its activities efficiently.

**Multi-agency public sector funding:** The information obtained from key informant interviews revealed that the department of greenery is the only sector that allocated budget for development and management of UGI components. However, funding can be accessed from a range of departments and agencies for the delivery of projects that meet crosscutting targets. For instance, the office of health and office of youth and sport have targets for improving the public health, creating a conducive environment for youth, and protecting

youth from unnecessary activities. Well-developed and managed UGI components can provide opportunities for outdoor physical activities, social contacts, and relaxation, which is an important environmental determinant of the health of urban residents. Therefore, the abovementioned benefit can solve the burden of the offices of health and office of youth and sport. In view of that, the offices should allocate a budget to the greenery department for developing and managing the UGI components.

**Income-generating opportunities:** The greenery department should be granted the authority and mandate to generate its own income from various activities such as licensing and franchising, sponsorship, entry fees, and fines, on-site events and concessions fees such as for cafes or specialist recreational activities. Opportunities for generating income are ways in which funding from the private sector and users of UGI components can be sourced. The income-generating activities on Mile End Park in London offer a good example of this initiative [95].

**Voluntary involvement:** The central role that many UGI components play in people's lives can lead to a high degree of voluntary involvement. Non-profit organizations and voluntary community groups can contribute time and labor and raise funds for the development of UGI components [95]. Based on the experience of different countries, these are potentially the most viable option for creating self-sustaining UGI components in the future. Therefore, the towns' administration should promote the involvement of non-profit organization and voluntary community group in the development of UGI components.

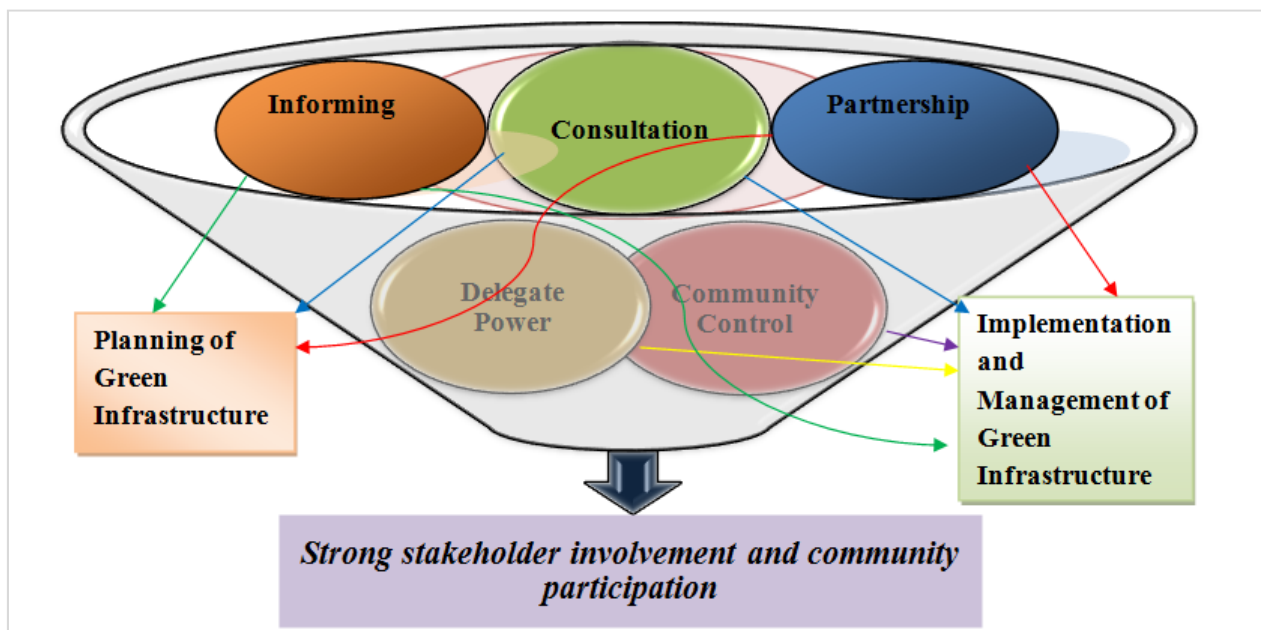


**Figure 4.** Different funding approaches to improve the development and management of green infrastructure components.

#### 4.3. Strengthening Stakeholder Involvement and Community Participation

The result of the focus group discussion and key informant interviews revealed that limited community participation and stakeholder involvement was the main problem for effective development and the overall management of UGI components in the study towns. Moreover, as the information shows, there was poor social inclusion in planning of the UGI components, resulting in limited awareness of green infrastructure component benefits, improper utilization, less sense of cohesion and UGI components that do not meet the needs and interests of all stakeholders. To overcome this challenge, the active involvement of the

stakeholders and the local community in all matters relating UGI components provide a major solution [96–100]. Therefore, the planning authority and the towns' administration should involve a wider range of stakeholders and the local community in the development and management of UGI components. To strengthen the involvement of different stakeholders and participation of the local communities' in the development and management of UGI components, this study has developed different approaches that can be used by the towns' administration and the planning authority. These approaches considered issues that were observed to undermine proper participation of the local community and stakeholders on UGI components development and management system in study areas such as lack of consultation with the local community, poor partnership, and limited empowerment (Figure 5).



**Figure 5.** Approaches that strengthen the stakeholders' involvement and community participation.

**Informing**—under this approach, the stakeholder and local communities should be informed about the planning process related to UGI components and there should be a clear flow of information from planning authorities and the town administration to the local community and stakeholders on green infrastructure planning decisions. Under this circumstance before the local community can participate, they must be aware of what activities are occurring.

**Consultation**—the towns' administration and planning authority should consult the local community and stakeholder in order to seek their views and concerns, and then factor such issues into planning decisions to meet the needs of the communities and other stakeholders. This approach can be prepared by inviting people to attend (e.g., public meetings, focus groups discussion and consensus conferences). During the consultation process, the town administration or the planning authority should focus on building consensus reflecting the common decisions agreed by all stakeholders, including the local people who are often neglected in decision-making processes. This will ensure that activities on UGI components are transparent and open to all stakeholders and the local community.

**Partnership**—under partnership approach, there should be shared roles and responsibilities during planning and management of UGI components between the town administration, non-governmental organizations, academic institutions, and private sector. For instance, the towns' administration should develop partnerships within private businesses companies for developing UGI components by sharing risks and right to use the values of those components for business purposes and profits. Moreover, the town administration

can develop a partnership with academic institutions during the planning and design of UGI components.

Delegation of power—under this approach, the towns' administration should provide limited power to private developers and the local community to undertake UGI components near to their household. For instances, after the towns' administration develop the UGI components, it can give the right of maintenances and management to the local community. This condition creates the active participation of the local people and to an extent, makes their involvement in the planning and management of UGI components good.

Community control—concerning the final approach, the local community should self-facilitate the development and management of UGI components by themselves in their areas to improve their wellbeing. Under this approach, the government can give all the rights or powers to control, develop, maintain and manage the UGI components to the local community and stakeholders.

#### *4.4. Awareness Creation*

Limited awareness of the benefits of UGI has made the local community view UGI development and management as the sole responsibility of government. Due to lack of awareness and understanding, the local authorities and decision makers view UGI as a luxury, which allots less budget and resources, and prioritizes the land for other basic services. As a result, awareness needs to be raised among communities, stakeholders and decision-makers on the significance and notions of UGI components and its vital role in establishing sustainability within urban environments. In addition, planners need to be made aware of the concept and the need to think creatively in implementing the UGI planning principles. The awareness creation can be accomplished through workshop, seminars and by using the mass media (Figure 6). Awareness creation materials such as posters, leaflets, and brochures indicating the benefits of UGI components, the consequences of the actions of all on the urban environment and the need for sustainable development of urban areas can be developed. This attempt will sensitize the public to place effort into preserving the UGI components. Moreover, it will help in changing the behavior of the public on the development and management of UGI. Besides raising awareness as part of the educational campaign, the government should introduce courses focused on UGI into the educational curriculum at the basic level. This will help to inculcate into schoolchildren the spirit of environmental stewardship and help them grow up to develop a love for the preservation of UGI components.

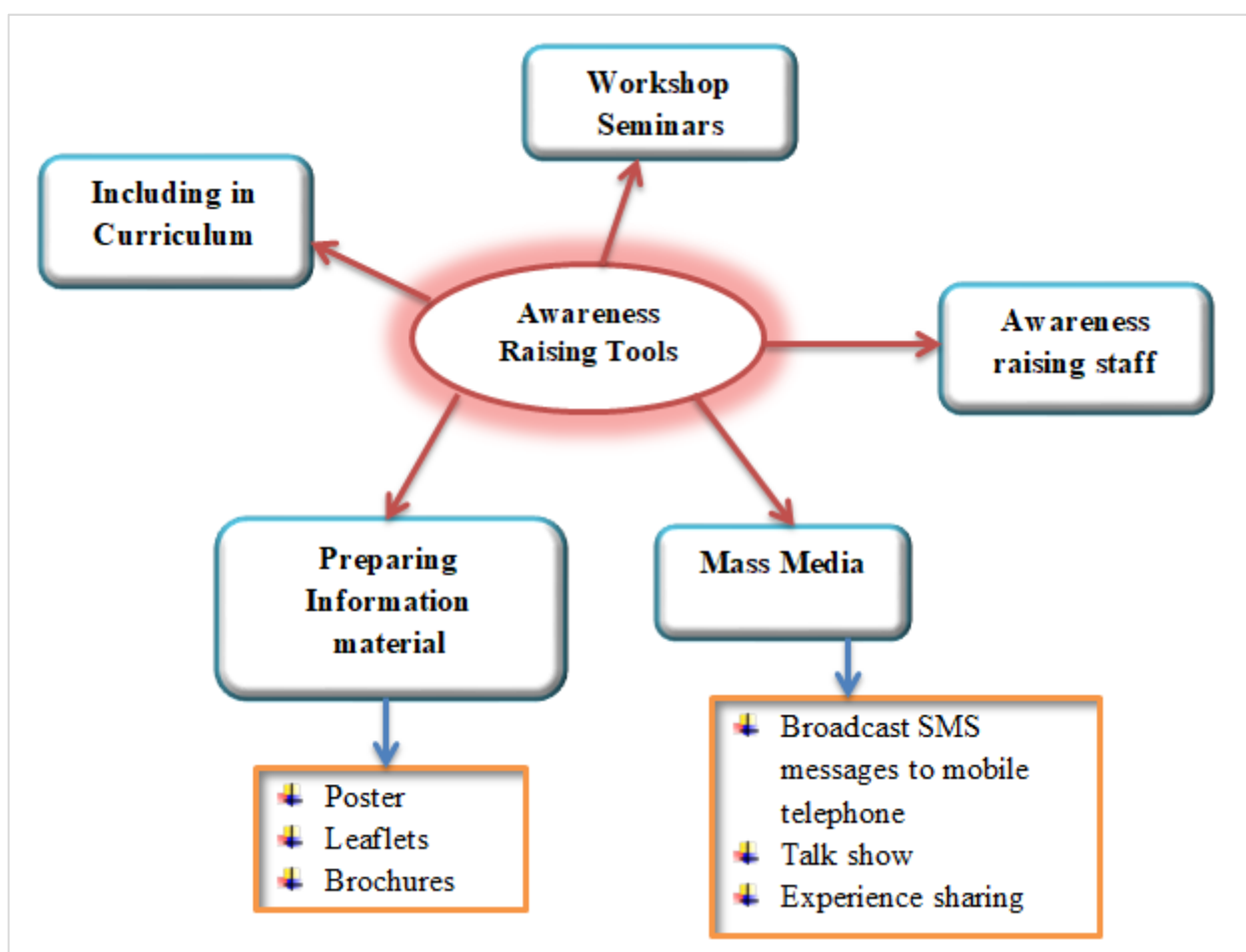


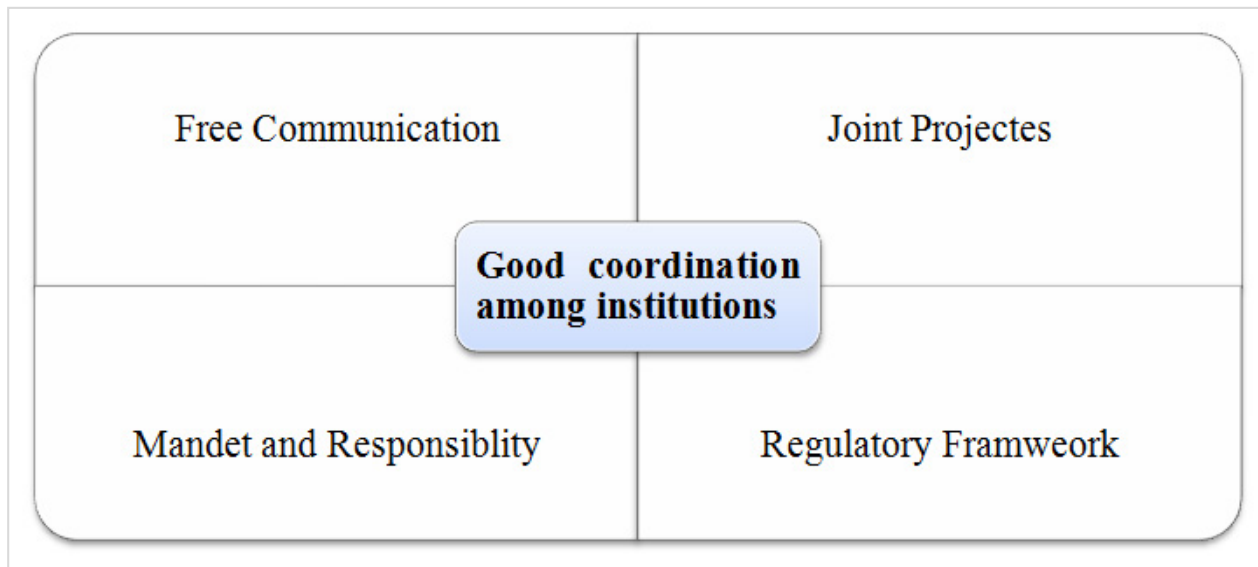
Figure 6. Tools for awareness raising.

#### 4.5. Improving the Coordination among Institutions

Limited coordination among institutions in charge of UGI development and management, such as the department of greenery, environmental protection office, land administration department, department of finances and urban planning department are identified as one of the major problems behind poor development and management system of UGI in the towns. However, sustainable UGI development and management system requires strong coordination between these departments [41]. Therefore, based on a review of different forms of literature, personal experiences and key informant interviews, this study has proposed different alternatives that can be used by the towns' administration to promote good coordination among the departments. These alternatives took into consideration issues that were observed to undermine proper coordination among allied departments on UGI components in study areas such as lack of recognition of certain parts of the department such as important stakeholders, incoherent responsibilities and poor communications (Figure 7).

Based on the proposed alternatives to strengthen the coordination among departments, first, the towns' administration should clearly define the mandate and responsibilities of the department of greenery, land administration department, environmental protection office and the focal person at kebele level on issues related to UGI components development and management to avoid conflicting responsibilities. In addition to this, the different connection between various departments can be well defined and structured. This condition will create a strong institutional network and interdependencies to effectively develop and manage UGI components. Second, to strengthen the coordination, the associated department on the development and management of UGI components should

communicate freely, which is important to easily share information, ideas, and produce fast responses or feedback on vital information. Third, the towns' administration should promote a joint project that performs together with the departments on the development and management of UGI components. The other alternative is establishing regulatory frameworks that improve and enhance coordination among institutions and encourage working together.



**Figure 7.** Alternatives for promoting good coordination among institutions.

#### 4.6. Professional Capacity Building

To enhance the development and management of a UGI system in a sustainable way, skilled professionals equipped with different disciplines such as urban and regional planning, landscape architecture and landscape ecology are crucial for the institutions responsible in undertaking projects related to UGI [32]. However, the information obtained from key informant interviews revealed that a department of greenery is occupied by few skilled professionals and the majority of the officers are from unrelated disciplines. As the information shows, the majority of employees were recruited to this department when the government fired them from higher positions such as mayor and cabinet member positions. Therefore, the availability of a sufficient number of skilled professionals is a prerequisite for advanced UGI development and management systems in the towns. Based on the information obtained from key informant interviews and review of the elated literature, to increase the number of qualified professionals in the department, the government should stop the practice of recruiting demoted officials to the department of greenery. In addition, UGI planning, implementation, and management related short- and long-term on-the-job training should be facilitated for unskilled staff. Furthermore, memorandum of agreements should be signed between the government and universities to design curriculum and to launch training that is related to UGI planning implementation and management. The memorandum will help to upgrade the skills of the staff and to solve the problem of unqualified professional, which was eminent among the department of greenery.

#### 4.7. Improving the Policy and Legal Framework

An effective UGI development and management system requires an effective policy and legal framework that supports the process. As information obtained from document reviews and key informant interviews, the current policy and legal framework for UGI development and management system in the study area was inadequate, and it is powerless in taking action against those who violate the UGI component plans. Therefore, the following issues must be considered to overcome the policy and legal framework challenges.



First, UGI planning principles such as multifunctionality, connectivity, integration, and social inclusiveness should be incorporated into national urban planning policies and strategies. For instance, the establishment of multifunctional and interconnected UGI component such as park and playgrounds around urban areas should be proclaimed as an urban policy objective.

Second, in the legal frameworks, the issue of overlaps and gaps of laws must be especially considered since UGI planning is multi-sectoral. In most cases, laws at the local level are more appropriate for handling the specific needs and conditions of individual towns. In many cases, simply integrating UGI planning into existing town institutions can be the easiest way to start a program. However, legislation needs to clearly define the responsibilities of the different authorities directly or indirectly responsible for UGI development and management.

Furthermore, the legal framework should also address the existing interrelations of UGI planning with other sectors and areas, such as agriculture, environmental management, urban planning, and budgetary department. UGI cannot be developed and managed in isolation from other sectors and disciplines. The linkages between UGI planning and other sectors require comprehensive strategies.

Finally, there should be strict legal frameworks that enforce planning laws to prevent the encroachment of UGI components. The legal framework should include how the civil remedies, criminal remedies, and administrative remedies have been taken on those who violate the land use plan and on those who allow building on areas proposed for UGI components. Moreover, a judicial support system is needed to restrain the disregard of the local community not to abuse UGI components. The policy and regulations should integrate the legal framework of which all forms of illegal and inappropriate actions of all types of actors can be effectively treated.

## 5. Opportunities to Implement the Strategic Approaches in the Emerging Towns

Despite the limitations mentioned previously, the emerging towns have certain advantages and opportunities for implementing the strategic approaches mentioned to promote sustainable UGI development and management system. First, the municipalities of the emerging towns have strong revenue that is collected from different taxes. Thus, the strong financial capacity of the municipalities makes it possible to allocate adequate budget for the development and management of UGI. Second, citizens have the right to partake in the government's decision making regarding environmental issues, including UGI components, from project conception to planning and implementation to monitoring and evaluation [101]. Thus, residents' ideas for developing and managing UGI components can easily reach towns administration and decision makers. Third, the different infrastructure projects such as road and bridge have been undertaken cooperatively with the department of infrastructure, land administration and finances office. Therefore, developing a joint project that is undertaken together with these institutions can make possible the implementation of the project easily and timely because there is strong coordination between the institutions that are developed previously for other purposes. Fourth, Kotebe Metropolitan University has been signed a memorandum of agreement with Addis Abba city administration to educate the professionals that the city administration needs in the field of urban environmental management and urban land administration. Thus, this experience can provide good opportunities for the emerging towns to upgrade the skills of the professionals found in the department of greenery by signing a memorandum with the Kotebe Metropolitan University and others. Lastly, public land ownership status backed up by regulatory instruments is more advantageous for providing adequate UGI components than that of the private land ownership status relying on market-based instruments [102]. Therefore, since the government is the owner of the land in Ethiopia, it is possible to provide accessible and suability UGI components for the community in the study area.

## 6. Conclusions

Previous studies have overlooked different challenges that hindered the sustainable development and management system of UGI components in Ethiopia. However, the strategic approaches that overcome the challenges are still missed. Therefore, this study developed strategic approaches that promote sustainable development and management systems of UGI by assessing the major challenges in the emerging towns of the Oromia special zone surrounding Finfinne.

Based on the result of the study, per capita of UGI components is 2.66 m<sup>2</sup> for Sululta, 0.9 m<sup>2</sup> for Sebeta and 2.17 m<sup>2</sup> for Legetafo towns. The result of the study revealed that financial constraint is a big hindrance in the study towns for developing and managing UGI components. The result of the study also revealed that limited community participation and stakeholder involvement was the main problem for effective development and the overall management of UGI components in the study towns. Based on the result of the study, limited awareness on the benefits of UGI has made the local community view UGI development and management as the sole responsibility of government. Furthermore, the result of the study shows that limited coordination among institutions in charge of UGI development and management, such as the department of greenery, environmental protection office, land administration department, department of finances and urban planning department are also one of the major problems behind poor development and management system of UGI in the towns.

To overcome the challenges and promote a sustainable UGI development and management system, the study identifies seven strategic approaches. Based on the results of the study, continued efforts are needed in raising awareness of the local community, urban planners, and decision makers on the concepts of UGI and the values of UGI components to promote a sustainable UGI development and management system. Equally, ranking UGI components among top government priorities and investment in courses related to the UGI development and management system in higher education are needed in order to enhance sustainable development of UGI. Additionally, there should be clear, appropriate and strong policy, legal and institutional framework for the development and management of green infrastructure components. Moreover, green infrastructure provisioning standards such as quantity, quality, and availability standard should be improved to prompt quality and sustainable green infrastructure components. Furthermore, stakeholder involvement and community participation are also needed in order to improve the development and management system of UGI in the emerging towns in particular, and in Ethiopia in general.

The variety of strategic approach proposed by this study offers a wider range of measures that can be utilized to successfully develop and manage UGI components. Such strategies provide a broader range of ideas that can be incorporated into development agendas and different planning strategies to support sustainable development and management of UGI for the emerging towns and other towns. However, the proposed approaches have limitations. Due to the large tasks that certain strategies must complete and the numerous problems that must be overcome, implementing all of these strategies at the same time will not be practicable in the short term. For example, a more powerful political will be required to prioritize UGI as a key government priority, as well as to alter certain regulations to make them more focused on UGI, particularly by establishing quantitative and qualitative requirements for UGI components. Since the concept of UGI planning principles such as multifunctionality, connectivity, integration, and social inclusiveness are new in developing countries, including Ethiopia, incorporating these principles into national urban planning policies and strategies and implementing on the ground will require enough time and professionals.

Finally, future research should focus on developing tools, which help to transfer the proposed strategic approaches into practice such as, information, decision supporting and technical tools. Furthermore, future research should be on challenges and opportunities of existing UGI program and strategic approaches. Such studies will significantly advance

our understanding of a sustainable UGI development and management system in Ethiopia in particular, and more widely in Sub-Saharan Africa.

**Author Contributions:** Conceptualization, E.G. and Y.G.; methodology, Y.G.; formal analysis, Y.G.; data curation, E.G. and Y.G.; writing—original draft preparation, E.G. and Y.G.; writing—review and editing, E.G. and Y.G.; visualization, E.G. and Y.G.; supervision, E.G. and Y.G. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Institutional Review Board Statement:** Not applicable.

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** All available data is contained within the paper.

**Acknowledgments:** We are indebted to Ministry of Urban and Housing Development, Oromia urban Planning Institutes and Sebeta, Sululta and Legetafo towns' administration for providing valuable information for this study.

**Conflicts of Interest:** The authors declare no conflict of interest.

## References

- Seto, K.C.; Güneralp, B.; Hutyra, L.R. Global forecasts of urban expansion to 2030 and direct impacts on bio-diversity and carbon pools. *Proc. Natl. Acad. Sci. USA* **2012**, *109*, 16083–16088. [CrossRef] [PubMed]
- Sun, L.; Chen, J.; Li, Q.; Huang, D. Dramatic uneven urbanization of large cities throughout the world in re-cent decades. *Nat. Commun.* **2020**, *11*, 1–9. [CrossRef] [PubMed]
- United Nation. *World Population Prospects: The 2017 Revision, Key Findings and Advance Tables*; Department of Economics and Social Affairs PD, Ed.; United Nations: New York, NY, USA, 2017.
- Capps, K.A.; Bentsen, C.N.; Ramírez, A. Poverty, urbanization, and environmental degradation: Urban streams in the developing world. *Freshw. Sci.* **2016**, *35*, 429–435. [CrossRef]
- United Nations Human Settlements Programme (UN-Habitat). *The State of Addis Ababa: The Addis Ababa We Want*; UN-Habitat: Nairobi, Kenya, 2017. Available online: <https://unhabitat.org/books/the-state-of-addisababa-2017-the-addis-ababa-we-want> (accessed on 30 August 2021).
- Güneralp, B.; Lwasa, S.; Masundire, H.; Parnell, S.; Seto, K.C. Urbanization in Africa: Challenges and opportunities for conservation. *Environ. Res. Lett.* **2017**, *13*, 015002. [CrossRef]
- Terfa, B.K.; Chen, N.; Liu, D.; Zhang, X.; Niyogi, D. Urban expansion in Ethiopia from 1987 to 2017: Characteristics, spatial patterns, and driving forces. *Sustainability* **2019**, *11*, 2973. [CrossRef]
- Wang, W.; Wu, T.; Li, Y.; Xie, S.; Han, B.; Yuanzheng, L.; Ouyang, Z. Urbanization Impacts on Natural Habitat and Ecosystem Services in the Guangdong-Hong Kong-Macao “Megacity”. *Sustainability* **2020**, *12*, 6675. [CrossRef]
- Wassie, S.B. Natural resource degradation tendencies in Ethiopia: A review. *Environ. Syst. Res.* **2020**, *9*, 1–29. [CrossRef]
- Yu, L.; Lyu, Y.; Chen, C.; Choguill, C.L. Environmental deterioration in rapid urbanisation: Evidence from assessment of ecosystem service value in Wujiang, Suzhou. *Environ. Dev. Sustain.* **2021**, *23*, 331–349. [CrossRef]
- Benedict, M.A.; McMahon, E.T. *Green Infrastructure: Linking Landscapes and Communities*; Island Press: Washington, DC, USA, 2006.
- Pauleit, S.; Liu, L.; Ahern, J.; Kaźmierczak, A. *Multifunctional Green Infrastructure Planning to Promote Ecological Services in the City*; Oxford University Press: New York, NY, USA, 2011; pp. 272–285.
- Pakzad, P.; Osmond, P. Developing a Sustainability Indicator Set for Measuring Green Infrastructure Performance. *Procedia Soc. Behav. Sci.* **2016**, *216*, 68–79. [CrossRef]
- Kabisch, N.; Korn, H.; Stadler, J.; Bonn, A. *Nature-Based Solutions to Climate Change Adaptation in Urban Areas—Linkages between Science, Policy and Practice*; Springer: Berlin/Heidelberg, Germany, 2017; pp. 1–11.
- Wijesinghe, A.; Thorn, J.P.R. Governance of Urban Green Infrastructure in Informal Settlements of Windhoek, Namibia. *Sustainability* **2021**, *13*, 8937. [CrossRef]
- Pitman, S.D.; Daniels, C.; Ely, M.E. Green infrastructure as life support: Urban nature and climate change. *Trans. R. Soc. S. Aust.* **2015**, *139*, 97–112. [CrossRef]
- Carter, J.G.; Handley, J.; Butlin, T.; Gill, S. Adapting cities to climate change—exploring the flood risk management role of green infrastructure landscapes. *J. Environ. Plan. Manag.* **2018**, *61*, 1535–1552. [CrossRef]
- Kato, S. Green Infrastructure Planning for Asian Cities: The Planning Strategies, Guidelines, and Recommendations. *Urban Biodivers. Ecol. Des. Sustain. Cities* **2021**, *353*, 353–371. [CrossRef]
- Ferreira, J.; Monteiro, R.; Silva, V. Planning a Green Infrastructure Network from Theory to Practice: The Case Study of Setúbal, Portugal. *Sustainability* **2021**, *13*, 8432. [CrossRef]

20. Palliwoda, J.; Banzhaf, E.; Priess, J. How do the green components of urban green infrastructure influence the use of ecosystem services? Examples from Leipzig, Germany. *Landsc. Ecol.* **2020**, *35*, 1127–1142. [[CrossRef](#)]
21. Song, X.P.; Tan, P.Y.; Edwards, P.; Richards, D. The economic benefits and costs of trees in urban forest stewardship: A systematic review. *Urban For. Urban Green.* **2018**, *29*, 162–170. [[CrossRef](#)]
22. Barwise, Y.; Kumar, P. Designing vegetation barriers for urban air pollution abatement: A practical review for appropriate plant species selection. *NPJ Clim. Atmos. Sci.* **2020**, *3*, 1–19. [[CrossRef](#)]
23. Gillefalk, M.; Tetzlaff, D.; Hinkelmann, R.; Kuhlmann, L.-M.; Smith, A.; Meier, F.; Maneta, M.P.; Soulsby, C. Quantifying the effects of urban green space on water partitioning and ages using an isotope-based ecohydrological model. *Hydrol. Earth Syst. Sci.* **2021**, *25*, 3635–3652. [[CrossRef](#)]
24. Dallimer, M.; Davies, Z.G.; Irvine, K.N.; Maltby, L.; Warren, P.H.; Gaston, K.J.; Armsworth, P.R. What Personal and Environmental Factors Determine Frequency of Urban Greenspace Use? *Int. J. Environ. Res. Public Health* **2014**, *11*, 7977–7992. [[CrossRef](#)]
25. Li, F.; Zhang, F.; Li, X.; Wang, P.; Liang, J.; Mei, Y.; Cheng, W.; Qian, Y. Spatiotemporal Patterns of the Use of Urban Green Spaces and External Factors Contributing to Their Use in Central Beijing. *Int. J. Environ. Res. Public Health* **2017**, *14*, 237. [[CrossRef](#)]
26. Koohsari, M.J.; Mavoja, S.; Villanueva, K.; Sugiyama, T.; Badland, H.; Kaczynski, A.T.; Owen, N.; Giles-Corti, B. Public open space, physical activity, urban design and public health: Concepts, methods and research agenda. *Heal. Place* **2015**, *33*, 75–82. [[CrossRef](#)] [[PubMed](#)]
27. Adhikari, B.; Mishra, S.R.; Dirks, K.N. Green space, health, and wellbeing: Considerations for South Asia. *Lancet Planet. Health* **2020**, *4*, e135–e136. [[CrossRef](#)]
28. Hedblom, M.; Gunnarsson, B.; Irvani, B.; Knez, I.; Schaefer, M.; Thorsson, P.; Lundström, J. Reduction of physiological stress by urban green space in a multisensory virtual experiment. *Sci. Rep.* **2019**, *9*, 1–11. [[CrossRef](#)]
29. Wood, E.; Harsant, A.; Dallimer, M.; De Chavez, A.C.; McEachan, R.; Hassall, C. Not All Green Space Is Created Equal: Biodiversity Predicts Psychological Restorative Benefits from Urban Green Space. *Front. Psychol.* **2018**, *9*, 2320. [[CrossRef](#)]
30. Artmann, M.; Bastian, O.; Grunewald, K. Using the Concepts of Green Infrastructure and Ecosystem Services to Specify Leibilder for Compact and Green Cities—The Example of the Landscape Plan of Dresden (Germany). *Sustainability* **2017**, *9*, 198. [[CrossRef](#)]
31. Pauleit, S.; Hansen, R.; Rall, E.L.; Zölch, T.; Andersson, E.; Luz, A.C.; Szaraz, L.; Tosics, I.; Vierikko, K. Urban Landscapes and Green Infrastructure. In *Oxford Research Encyclopedia of Environmental Science*; Oxford University Press (OUP): New York, NY, USA, 2017.
32. Vaňo, S.; Olafsson, A.S.; Mederly, P. Advancing urban green infrastructure through participatory integrated planning: A case from Slovakia. *Urban For. Urban Green.* **2021**, *58*, 126957. [[CrossRef](#)]
33. Monteiro, R.; Ferreira, J.C.; Antunes, P. Green infrastructure planning principles: An integrated literature re-view. *Land* **2020**, *9*, 525. [[CrossRef](#)]
34. Mell, I.; Clement, S. Progressing Green Infrastructure planning: Understanding its scalar, temporal, geo-spatial and disciplinary evolution. *Impact Assess. Proj. Apprais.* **2020**, *38*, 449–463. [[CrossRef](#)]
35. Mpofo, T.P. Environmental challenges of urbanization: A case study for open green space management. *Res. J. Agric. Environ. Manag.* **2013**, *2*, 105–110.
36. Douglas, I. The challenge of urban poverty for the use of green infrastructure on floodplains and wetlands to reduce flood impacts in intertropical Africa. *Landsc. Urban Plan.* **2018**, *180*, 262–272. [[CrossRef](#)]
37. Colding, J.; Gren, Å.; Barthel, S. The Incremental Demise of Urban Green Spaces. *Land* **2020**, *9*, 162. [[CrossRef](#)]
38. Cobbinah, P.B.; Nyame, V. A city on the edge: The political ecology of urban green space. *Environ. Urban.* **2021**, 09562478211019836. [[CrossRef](#)]
39. Mwangi, M.W. An Assessment to The Challenges Facing Urban Green Spaces a Case of City Park in Nairobi. *Int. J. Sci. Res. Publ.* **2019**, *9*, 121. [[CrossRef](#)]
40. Oduwaye, L. Globalization and Urban Land Use Planning: The Case of Lagos, Nigeria. Real Corp. Planning Times. 2013. Available online: [http://www.corp.at/archive/CORP2013\\_7.pdf](http://www.corp.at/archive/CORP2013_7.pdf) (accessed on 18 February 2019).
41. Mensah, C.A. Urban green spaces in Africa: Nature and challenges. *Int. J. Ecosyst.* **2014**, *4*, 1–11.
42. Pedrosa, E.; Okyere, S.; Frimpong, L.; Diko, S.; Commodore, T.; Kita, M. Planning for Informal Urban Green Spaces in African Cities: Children’s Perception and Use in Peri-Urban Areas of Luanda, Angola. *Urban Sci.* **2021**, *5*, 50. [[CrossRef](#)]
43. Chishaleshale, M. Governance and Management of Urban Trees and Green Spaces in South Africa: Ensuring Benefits to Local People and the Environment. Ph.D. Thesis, Rhodes University, Grahamstown, South Africa, 2012.
44. Okeke, D.C. African Approaches to Spatial and Green Planning. *Agric. For. Fish.* **2015**, *4*, 6.
45. Bobbins, K.; Culwick, C. Green growth transitions through a green infrastructure approach at the local government level: A Case study for the Gauteng city region. *J. Public Adm.* **2015**, *50*, 32–49.
46. Chishaleshale, M.; Shackleton, C.; Gambiza, J.; Gumbo, D. The prevalence of planning and management frameworks for trees and green spaces in urban areas of South Africa. *Urban For. Urban Green.* **2015**, *14*, 817–825. [[CrossRef](#)]
47. Udoh, J.P. Sustainable nondestructive mangrove-friendly aquaculture in Nigeria I: Ecological and environmental perspectives. *AAFL Bioflux* **2016**, *9*, 50–70.
48. Gwedla, N.; Shackleton, C.M. The development visions and attitudes towards urban forestry of officials responsible for greening in South African towns. *Land Use Policy* **2015**, *42*, 17–26. [[CrossRef](#)]

49. Kaoma, H.; Shackleton, C.M. The direct-use value of urban tree non-timber forest products to household income in poorer suburbs in South African towns. *For. Policy Econ.* **2015**, *61*, 104–112. [[CrossRef](#)]
50. Ward, E.; Winter, K. Missing the link: Urban stormwater quality and resident behaviour. *Water SA* **2016**, *42*, 571. [[CrossRef](#)]
51. Lamson-Hall, P.; Angel, S.; DeGroot, D.; Martin, R.; Tafesse, T. A new plan for African cities: The Ethiopia Urban Expansion Initiative. *Urban Stud.* **2018**, *56*, 1234–1249. [[CrossRef](#)]
52. Girma, Y.; Terefe, H.; Pauleit, S. Urban green spaces use and management in rapidly urbanizing countries: The case of emerging towns of Oromia special zone surrounding Finfinnee, Ethiopia. *Urban For. Urban Green.* **2019**, *43*, 126357. [[CrossRef](#)]
53. Ministry of Urban Development and Housing. *Ethiopian National Urban Green Infrastructure Standards*; Ministry of Urban Development and Housing: Addis Ababa, Ethiopia, 2015.
54. Azagew, S.; Worku, H. Accessibility of urban green infrastructure in Addis-Ababa city, Ethiopia: Current status and future challenge. *Environ. Syst. Res.* **2020**, *9*, 1–20. [[CrossRef](#)]
55. Hailegiorgis, Y.G. Recreational Parks: Practices and Challenges in Hawassa City. *J. Tour. Hosp.* **2017**, *6*, 1–7. [[CrossRef](#)]
56. Herslund, L.; Backhaus, A.; Fryd, O.; Jørgensen, G.; Jensen, M.B.; Limbumba, T.M.; Liu, L.; Mguni, P.; Mkupasi, M.; Workalemahu, L.; et al. Conditions and opportunities for green infrastructure—Aiming for green, water-resilient cities in Addis Ababa and Dar es Salaam. *Landsc. Urban Plan.* **2018**, *180*, 319–327. [[CrossRef](#)]
57. Girma, Y.; Terefe, H.; Pauleit, S.; Kindu, M. Urban green infrastructure planning in Ethiopia: The case of emerging towns of Oromia special zone surrounding Finfinnee. *J. Urban Manag.* **2019**, *8*, 75–88. [[CrossRef](#)]
58. Abebe, M.T.; Megento, T.L. The city of Addis Ababa from ‘Forest city’ to ‘Urban Heat Island’ Assessment of Urban Green Space Dynamics. *J. Urban Environ. Eng.* **2016**, *10*, 254–262. [[CrossRef](#)]
59. Gashu, K.; Gebre-Egziabher, T. Spatiotemporal trends of urban land use/land cover and green infrastructure change in two Ethiopian cities: Bahir Dar and Hawassa. *Environ. Syst. Res.* **2018**, *7*, 8. [[CrossRef](#)]
60. Abo-El-Wafa, H.; Yeshitela, K.; Pauleit, S. The use of urban spatial scenario design model as a strategic planning tool for Addis Ababa. *Landsc. Urban Plan.* **2018**, *180*, 308–318. [[CrossRef](#)]
61. Lindley, S.J.; Gill, S.E.; Cavan, G.; Yeshitela, K.; Nebebe, A.; Woldegerima, T.; Abo-El Wafa, H. Green infrastructure for climate adaptation in African cities. In *Urban Vulnerability and Climate Change in AFRICA*; Pauleit, S., Coly, A., Fohlmeister, S., Gasparini, P., Jørgensen, G., Kabisch, S., Kombe, W.J., Lindley, S., Simonis, I., Yeshitela, K., Eds.; A Multidisciplinary Approach. Future City 4; Springer International Publishing: Basel, Switzerland, 2015. Available online: [http://link.springer.com/chapter/10.1007%2F978-3-319-03982-4\\_4](http://link.springer.com/chapter/10.1007%2F978-3-319-03982-4_4) (accessed on 17 November 2018).
62. Woldegerima, T.; Yeshitela, K.; Lindley, S. Characterizing the urban environment through urban morphology types (UMTs) mapping and land surface cover analysis: The case of Addis Ababa, Ethiopia. *Urban Ecosyst.* **2017**, *20*, 245–263. [[CrossRef](#)]
63. Girma, Y.; Terefe, H.; Pauleit, S.; Kindu, M. Urban green spaces supply in rapidly urbanizing countries: The case of Sebeta Town, Ethiopia. *Remote Sens. Appl. Soc. Environ.* **2019**, *13*, 138–149. [[CrossRef](#)]
64. Gelan, E.; Girma, Y. Urban green infrastructure accessibility for the achievement of SDG 11 in rapidly urbanizing cities of Ethiopia. *GeoJournal* **2021**, 1–20. [[CrossRef](#)]
65. Molla, M.B.; Ikorukpo, C.O.; Olatubara, C.O. Socio-economic characteristics and utilization of urban green infrastructure in Southern Ethiopia. *Int. J. Dev. Res.* **2017**, *7*, 18010–18020.
66. Benedict, M.A.; McMahon, E.T. Green Infrastructure: Smart Conservation for the 21st Century. *Renew. Resour. J.* **2002**, *20*, 12–17.
67. Allen, W.L. Environmental Reviews and Case Studies: Advancing Green Infrastructure at All Scales: From Landscape to Site. *Environ. Pract.* **2012**, *14*, 17–25. [[CrossRef](#)]
68. Roe, M.; Mell, I. Negotiating value and priorities: Evaluating the demands of green infrastructure development. *J. Environ. Plan. Manag.* **2013**, *56*, 650–673. [[CrossRef](#)]
69. Caspersen, O.H.; Olafsson, A.S. Recreational Mapping and Planning for Enlargement of the Green Infra-structure in Greater Copenhagen. *Urban For. Urban Green.* **2010**, *9*, 101–112. [[CrossRef](#)]
70. Ellis, J. Sustainable surface water management and green infrastructure in UK urban catchment planning. *J. Environ. Plan. Manag.* **2013**, *56*, 24–41. [[CrossRef](#)]
71. Matsler, A.M.; Meerow, S.; Mell, I.C.; Pavao-Zuckerman, M.A. A ‘green’ chameleon: Exploring the many disciplinary definitions, goals, and forms of “green infrastructure”. *Landsc. Urban Plan.* **2021**, *214*, 104145. [[CrossRef](#)]
72. Davis, A.Y.; Belaire, J.A.; Farfan, M.A.; Milz, D.; Sweeney, E.R.; Loss, S.R.; Minor, E. Green infrastructure and bird diversity across an urban socioeconomic gradient. *Ecosphere* **2012**, *3*, 1–8. [[CrossRef](#)]
73. Muzdalifah, A.U.; Maryono, M. Preliminary Identification of Urban Park Infrastructure Resilience in Sema-rang Central Java. In Proceedings of the 2nd International Conference on Energy, Environmental and Information System (ICENIS 2017), Semarang, Indonesia, 15–16 August 2017; EDP Sciences: Les Ulis, France, 2018.
74. Woldesemayat, E.M.; Genovese, P.V. Urban Green Space Composition and Configuration in Functional Land Use Areas in Addis Ababa, Ethiopia, and Their Relationship with Urban Form. *Land* **2021**, *10*, 85. [[CrossRef](#)]
75. Holt, E.W.; Lombard, Q.K.; Best, N.; Smiley-Smith, S.; Quinn, J.E. Active and Passive Use of Green Space, Health, and Well-Being amongst University Students. *Int. J. Environ. Res. Public Health* **2019**, *16*, 424. [[CrossRef](#)]
76. Lee, A.; Jordan, H.; Horsley, J. Value of urban green spaces in promoting healthy living and wellbeing: Prospects for planning. *Heal. Policy Politi Sante* **2015**, *8*, 131–137. [[CrossRef](#)]

77. Jennings, V.; Bamkole, O. The Relationship between Social Cohesion and Urban Green Space: An Avenue for Health Promotion. *Int. J. Environ. Res. Public Health* **2019**, *16*, 452. [CrossRef]
78. Haq, S.M.A. Urban Green Spaces and an Integrative Approach to Sustainable Environment. *J. Environ. Prot.* **2011**, *02*, 601–608. [CrossRef]
79. Qiu, L. *Linking Biodiversity and Recreational Merits of Urban Green Spaces*; Swedish University of Agricultural Sciences: Alnarp, Sweden, 2014; Volume 2014.
80. Lepczyk, C.A.; Aronson, M.F.J.; Evans, K.L.; Goddard, M.; Lerman, S.B.; MacIvor, J.S. Biodiversity in the City: Fundamental Questions for Understanding the Ecology of Urban Green Spaces for Biodiversity Conservation. *BioScience* **2017**, *67*, 799–807. [CrossRef]
81. Sturiale, L.; Scuderi, A. The Role of Green Infrastructures in Urban Planning for Climate Change Adaptation. *Climate* **2019**, *7*, 119. [CrossRef]
82. Sitzenfrei, R.; Kleidorfer, M.; Bach, P.M.; Bacchin, T.K. Green Infrastructures for Urban Water System: Balance between Cities and Nature. *Water* **2020**, *12*, 1456. [CrossRef]
83. Tayouga, S.J.; Gagné, S.A. The Socio-Ecological Factors that Influence the Adoption of Green Infrastructure. *Sustainability* **2016**, *8*, 1277. [CrossRef]
84. Thorne, C.; Lawson, E.; Ozawa, C.; Hamlin, S.; Smith, L. Overcoming uncertainty and barriers to adoption of Blue-Green Infrastructure for urban flood risk management. *J. Flood Risk Manag.* **2018**, *11*, S960–S972. [CrossRef]
85. Biernacka, M.; Kronenberg, J. Classification of institutional barriers affecting the availability, accessibility and attractiveness of urban green spaces. *Urban For. Urban Green.* **2018**, *36*, 22–33. [CrossRef]
86. Kimmel, C.; Robertson, D.; Hull, R.B.; Mortimer, M.; Wernstedt, K. *Greening the Grey: An Institutional Analysis of Green Infrastructure for Sustainable Development in the US*; Center for Leadership in Global Sustainability, Virginia Tech: Blacksburg, VA, USA, 2013; p. 6.
87. Buijs, A.; Hansen, R.; Van der Jagt, S.; Ambrose-Oji, B.; Elands, B.; Rall, E.L.; Mattijssen, T.; Pauleit, S.; Runhaar, H.; Olafsson, A.S.; et al. Mosaic governance for urban green infrastructure: Upscaling active citizenship from a local government perspective. *Urban For. Urban Green.* **2019**, *40*, 53–62. [CrossRef]
88. Pauleit, S.; Hansen, R.; Rall, E.L.; Rolf, W. Urban green infrastructure: Strategic planning of urban green and blue for multiple benefits. In *The Routledge Handbook of Urban Ecology*, 2nd ed.; Douglas, I., Anderson, P.M.L., Goode, D., Houck, M.C., Maddox, D., Nagendra, H., Puay Yok, T., Eds.; Routledge: London, UK, 2020; pp. 931–941.
89. Hansen, R.; Werner, R.; Santos, A.; Luz, A.; Száraz, L.; Tosics, I.; Pauleit, S. Advanced Urban Green Infra-Structure Planning and Implementation-Innovative Approaches and Strategies from European Cities: Deliverable 5. Technical Report of the Green Surge Project. 2016. Available online: <https://greensurge.eu/workingpackages/wp5> (accessed on 20 June 2018).
90. Davies, C.; Hansen, R.; Rall, E.; Pauleit, S.; Lafortezza, R.; De Bellis, Y.; Tosics, I. The Status of European Green Space Planning and Implementation Based on an Analysis of Selected European City-Regions. EU FP7 Project GREEN SURGE, Deliverable D, 5. 2015. Available online: <https://ign.ku.dk/english/green-surge/> (accessed on 30 August 2021).
91. Oromia Water Works Design and Supervision Enterprise (OWWDSE). *Report on Socio economic survey and Analysis of Oromia Special Zone Surrounding Finfinne*; Oromia Water Works Design and Supervision Enterprise: Finfinne, Ethiopia, 2011.
92. Titz, A.; Chiotha, S.S. Pathways for Sustainable and Inclusive Cities in Southern and Eastern Africa through Urban Green Infrastructure? *Sustainability* **2019**, *11*, 2729. [CrossRef]
93. Yin, R.K. *Case Study Research: Design and Methods*, 5th ed.; Sage: Thousand Oaks, CA, USA, 2014.
94. Fletcher, T.D.; Shuster, W.; Hunt, W.F.; Ashley, R.; Butler, D.; Arthur, S.; Trowsdale, S.; Barraud, S.; Semadeni-Davies, A.; Bertrand-Krajewski, J.-L.; et al. SUDS, LID, BMPs, WSUD and more—The evolution and application of terminology surrounding urban drainage. *Urban Water* **2014**, *12*, 1–18. [CrossRef]
95. Morsi, A. Profitable urban public spaces significant role in building safer and more sustainable societies Cairo as a promising Case. *J. Archit. Arts Humanit.* **2021**. [CrossRef]
96. Shuib, K.B.; Hashim, H.; Nasir, N.A.M. Community Participation Strategies in Planning for Urban Parks. *Procedia Soc. Behav. Sci.* **2015**, *168*, 311–320. [CrossRef]
97. Haaland, C.; van den Bosch, C.K. Challenges and strategies for urban green-space planning in cities undergoing densification: A review. *Urban For. Urban Green.* **2015**, *14*, 760–771. [CrossRef]
98. Dennis, M.; James, P. User participation in urban green commons: Exploring the links between access, voluntarism, biodiversity and well being. *Urban For. Urban Green.* **2016**, *15*, 22–31. [CrossRef]
99. Malik, A.A.M. The Role of Stakeholders Related to the Management of Ecological Function of Urban Green Open Space. Case Study: City of Depok, Indonesia. *IOP Conf. Ser. Earth Environ. Sci.* **2017**, *99*, 012001. [CrossRef]
100. Kanniah, K.D. Quantifying green cover change for sustainable urban planning: A case of Kuala Lumpur, Malaysia. *Urban For. Urban Green.* **2017**, *27*, 287–304. [CrossRef]
101. FDRE. *Environmental Policy of Ethiopia*; FDRE: Addis Ababa, Ethiopia, 1997.
102. Wang, A.; Chan, E. Institutional factors affecting urban green space provision—from a local government revenue perspective. *J. Environ. Plan. Manag.* **2019**, *62*, 2313–2329. [CrossRef]