



## Research article

## Integrating river restoration goals with urban planning practices: the case of Kebena river, Addis Ababa

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## ABSTRACT

In the urban environment, rivers are most affected by development mismanagement to the extent that some of the essential services such as habitat for biodiversity conservation, recreation and domestic uses to communities are critically impaired. Consequently, river restoration is presented as practical solution to address urban river degradation issues and to revitalize urban rivers and river buffers. Goal setting along with clear and measurable goals in urban river restoration processes is one of the critical tools to guide restoration activities. This study aims to assess the qualitative effects of clearly defined river restoration goals and analyze their tangible effects on river restoration efforts in Kebena river watershed, Addis Ababa. Qualitative data from expert interviews, stakeholders' consultation, document review and institutional analysis are used to inform this research. The results show that the Environmental Protection Authority and Structural plan of the city have vaguely defined river restoration goal in the planning and implementation phases of river restoration projects. On the other hand, the goals of different institutions varied in context, while others were redundant and lacked synergy. As a result, urban rivers and river buffers accommodate various land uses that are negatively affecting the potential of rivers and river buffers in benefiting communities. Finally, the study forwarded critical methodological steps to guide the formulation of a well-defined goal and setting priorities for concrete actions to restore the river.

## 1. Introduction

Urbanization is the primary cause of alteration of the natural setting of urban rivers and their surrounding landscapes while limiting the various services they deliver to the society (Speed et al., 2016; Chan, 2012; Davies et al., 2011; Beechie et al., 2008; Findlay and Taylor, 2006; Groffman et al., 2003; Gergel et al., 2002; Paul and Meyer, 2001; Wang et al., 2000; Klein, 1979). Thus, river restoration is introduced as a mechanism to counter detrimental effects of urbanization on rivers (Groffman et al., 2003).

Restoration is the process of returning an ecosystem as close to its natural state as possible (Palmer et al., 2005). Successful restoration activities encompass reinstating ecological, social, and economic values of rivers (Elosegi and Sabater, 2013; Wohl et al., 2005). Despite positive effects of river restoration activities in urban areas, it is documented that river restoration activities create conflict of interest among various stakeholders. Conflicts of interest emerge from competing demands of social, economic, and political interests of various stakeholders. In order to reconcile the above-mentioned conflicting interests in the process of

revitalizing urban river ecosystems, goal setting is documented as a crucial step (Elosegi and Sabater, 2013; Beechie et al. 2008; Palmer et al., 2005; Kershner and Levin-Keitel, 1997).

Goals are ideas or core accomplishments to be attained (Slocombe, 1998; Barber and Taylor, 1990); while objectives are measurable targets that must be achieved to attain the goal. Formulating clear goal is vital to develop a set of objectives in an ordered action plan to guide implementation and monitor the effectiveness of projects (Jensen et al., 2015; Aulaskari, 2008; Tear et al., 2005; Ehrenfeld, 2000; Schiemer et al., 1999; Kershner and Levin-Keitel, 1997; Barber and Taylor, 1990). Urban river restoration projects, require clearly defined goals and objectives that take into account the entire ecosystem that interact with them (Zingraff Hamed et al., 2017; Cunningham, and Cunningham, 2010; Boon, 1998). Balancing of the conflicting interests of competing stakeholders without compromising the ecological integrity of rivers is one of the core reasons that make goal setting a critical component of urban river restoration.

Wohl et al. (2005) identified five themes that explain river restoration goals. These goals are introduced as restoration benchmarks (a) protecting clean water, (b) protecting food production, (c) maintaining

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aesthetical value, (d) protecting rare or valued biota, and (e) protecting fisheries. In most cases, restoration efforts are driven by declining eco-habitat such as shrinking of habitat areas and a decline in habitat quality (Pedersen et al., 2009; Kershner and Levin-Keitel, 1997; Nehlsen et al., 1991). Bernhardt et al. (2005) discussed the most commonly stated goals for small scale river restoration as being water quality enhancement, riparian zone management, in-stream habitat improvement, creation of fish passage and bank stabilization. In the contrary, broad-scale river restoration goals mainly focus on reconnecting flood plains, modifying flows, improving aesthetics and reconfiguring of river and stream channels. For this study, three underlying river restoration goals are adopted, these are, restoration of species (single or multiple), restoration of landscape systems, and restoration of ecosystem services (Beechie et al., 2008).

Restoration of species focuses on identifying and protecting endangered species and creating a conducive environment for better survival (Beechie et al., 2008; Ehrenfeld, 2000). The goal being, to restore the environment for reasonable accommodation of endangered species. The second goal revolves around restoration of river landscape systems. Landscape restoration focuses on replenishing degraded river landscapes as a result of uncontrolled urbanization activities (Beechie et al., 2008; Ehrenfeld, 2000). The third restoration theme focuses on capacitating degraded landscapes with the goal to revitalize ecosystem services that rivers cater to communities (Beechie et al., 2008; Ehrenfeld, 2000).

In addition to clearly stating goals and objectives for river restoration, their inclusion into legislation, proclamations, urban planning practices, and other working documents is crucial for the long-term success of river restoration operations. Urban plans are one of the decision-making mechanisms that seek to achieve economic, social, cultural, and environmental goals through the creation of spatial visions, policies, and plans as well as the implementation of a collection of a set of policy principles, tools, institutional and participatory processes, and regulatory procedures that govern the future development of cities (UN-Habitat, 2015). Following the establishment of river restoration goals, most countries are now developing green infrastructure planning schemes, which give them the ability to integrate urban planning activities with nature-based solutions (Hansen et al., 2017).

In the city of Addis Ababa, rapid and uncontrolled population growth and physical expansion resulted in the pollution of urban rivers and river ecosystems (Tsutsumi, and Bendewald, 2010). Addis Ababa being one of the fastest urbanizing cities in Africa (Addis Ababa City Planning Project Office AACPPPO, 2017; Zewdie et al., 2018), with a population growth rate of about 30%, the city's urban area has expanded from 8,000 ha to 34,100 ha within the last three decades (Zewdie et al., 2018). Kebena river is one of the three major rivers flowing through the city and heavily impacted by rapid urbanization (Beyene et al., 2009).

The lack of proper planning and growth regulations has exposed the city's rivers and their buffer zones to informal settlements (Asnake et al., 2021). Similar to the other rivers in Addis Ababa, Kebena river buffers have become *de facto* dumping sites for urban waste (Seyoum et al., 2017). At the same time, downstream dwellers utilize the river water for domestic and farming activities (Tsutsumi, and Bendewald, 2010). Such activities have posed serious health threats to the urban dwellers that use the river for livelihood activities (Gebre and Van Rooijen, 2009). Despite multifaceted nature of environmental challenges of the Kebena river and its surrounding buffer zones, pollution stands out as the primary concern. To alleviate issues of river pollution and other environmental problems, the government of the Federal Democratic Republic of Ethiopia (FDRE, 2005) introduced policies and structural plans along with rules and regulations while establishing various institutions to protect the city's environment. Moreover, various planning efforts were put in place to restore rivers and their surrounding areas from pollution, erosion, and deforestation. The Addis Ababa City Administration has also established a project office for river and riverside development. This office is responsible for conducting various studies around rivers and identifying the challenges with the aim of forwarding and implementing solutions.

Despite these efforts, most activities are conducted in fragmented manners with limited measurable success. The situation in and around the rivers of the city has instead deteriorated in the last few years.

This study intends to assess river restoration goals those currently focus on restoring and guiding planning practices of the Kebena river watershed in the city of Addis Ababa. The study also examines the significance of integrating river restoration goals with various planning practices of the city of Addis Ababa. Based on the findings, recommendations on a methodology that integrates urban river restoration goals and objectives with urban planning practices for successful river restoration measures are forwarded.

## 2. Materials and methods

### 2.1. Description of the study site

Addis Ababa is characterized by mountainous landscape and several streams that flow downwards to the south to form medium sized rivers in the central part of the city (ORAAMP, 2002). The study area, Kebena river is one of the main tributaries of the Great Akaki River that originates from the central northern part of Addis Ababa within a geographical location between 8° 9' 50"N - 9° 6' 60"N latitude, and 38° 45' 30" - 38° 49' 30"E longitude (Figure 1). The total estimated area of Kebena Watershed is about 5,150 ha with an elevation range of 2000–3200 m.a.s.l.

At the source, Kebena River is found in the middle of a mountainous landscape mostly covered with *Eucalyptus globulus* and *Juniperus procera* forest, vast agriculture lands, and scattered settlements. The topography in the upper catchment exhibits high slope gradient. In the middle catchment, the river experiences physical developments of varying nature. Settlements around the river has grown fast in the past few years resulting in a large number of informal settlements developed very close to the river and in the surrounding areas (AACASPO, 2017). The lower catchment of Kebena River is predominantly built-up area, whereby some nearby residents use the polluted river water to irrigate urban vegetable farms (Asnake et al., 2021).

There are ten sub-cities within the city administration of Addis Ababa, under which 116 Woredas (the lowest official administrative units) are found. Kebena River, originating from Entoto mountain, as one of the major tributaries of Tiliku Akaki (Great Akaki River) passes through five sub-cities of the city namely Yeka, Gulele, Arada, Kirkos, and Bole.

There are two main reasons for the rationale to select Kebena River watershed for the study. First, Kebena river passes through the central parts of the city and unlike other rivers that pass through the city, this river serves a significant proportion of the city's inhabitants. Second, Kebena river has historical significance as a driver of the original settlement of the city's inhabitants. Because of this, over the years, Kebena river has been profoundly affected by urban developments that intersect with river's watershed.

### 2.2. Methods of data collection and analysis

The study employed both primary and secondary data collection methods that provide information on the relationship between river restoration efforts and river restoration goals and objectives that are integral parts of the currently implemented planning initiatives.

#### 2.2.1. Key informant interview

Twelve professionals from governmental and one non-governmental organization were selected purposively to participate in an in-depth semi-structured interview. Four planners, two of whom were involved in both 2002 and 2017 City Structural Planning processes in addition to different Local Development Plan (LDP) projects, with a planning experience of over 15 years. The other 2 planners were involved in various LDPs with minimum experience of three years in planning. In addition,

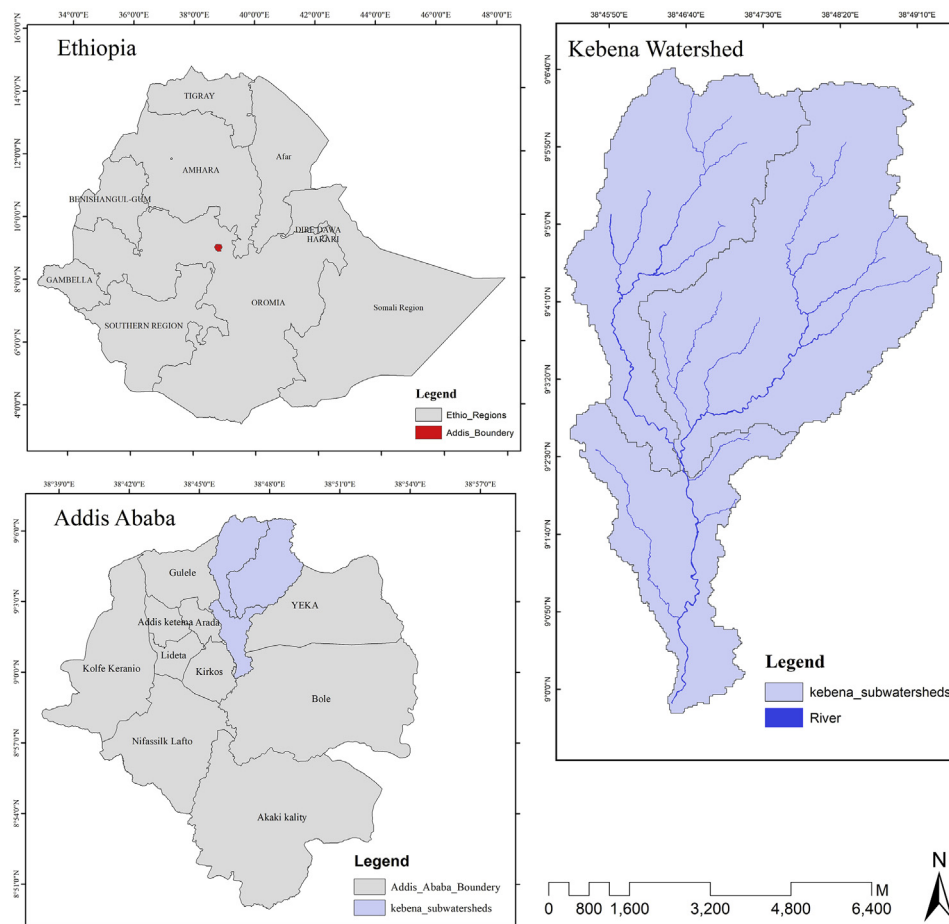


Figure 1. Kebena river watershed.

interview involved two environment experts from Addis Ababa Environmental Protection Authority (AAEPA), two from local non-governmental organization who have the experience of working on river restoration projects, two from the Addis Ababa City Government Beautification, Parks and Cemetery Development and Administration Agency (AACGBPCDA) and two from Addis Ababa Rivers and Riversides Development and Climate Change Adaptation Project Office (AARRDC-CAPO). Key informants were selected based on their knowledge and involvement in urban planning, river side planning and management expertise. Semi-structured interviews were conducted to collect information on riverside restoration efforts. Interviewees were asked questions pertaining to their respective institutional assignment and planning strategies related to river side restoration efforts. Moreover, interviewees were asked about goals and objectives as well as outcomes of river restoration efforts in the city of Addis Ababa.

### 2.2.2. Document review and analysis

The second data collection phase entailed examination of national documents such as urban plans and policies, and proclamations. Emphasis was given to documents that provide information on current river restoration practices. These documents were acquired from three agencies that actively engage in urban restoration projects (a) the Ministry of Urban Development and Construction, (b) Addis Ababa Environmental Protection Authority, and (c) Addis Ababa Rivers and Riversides Protection and Climate Change Adaptation Project Office and documents from various governmental institutions who are directly or indirectly working on riversides. In line with this, the following criteria were used for identification and selection of documents, (1) documents that convey information on preparation, execution and management of

river protection issues at both national, regional and local levels, and (2) document that are relevant to current river restoration efforts. The documents examined include Environmental Protection Organs Establishment proclamations, Environmental Pollution Control, Proclamation, Environmental Impact Assessment Proclamation, Local Development Plan (LDP) guides, City Structure Plans (of 2002 and 2017) and 23 selected LDPs that incorporate the watershed of the Kebena River. Thematic and content analysis were conducted to identify institutional practices that have implication to river restoration plans and practices. Moreover, the document analysis highlights similarities, disparities, and gaps with regards to clearly defined restoration goals and their integration in river side restoration efforts. Thematic content analysis was used to analyze the qualitative data gathered from the document review, and the conclusions on the integration of each institution's assignment and alignment towards addressing river restoration issues are summarized descriptively (Gardner et al., 2019).

### 2.2.3. Stakeholder workshop

The third data collection activity was conducted in the form of stakeholder workshop that involved twenty participants. Participants were selected from relevant governmental and non-governmental offices, and academia involving researchers and graduate students. At the workshop, group discussions covered issues about the main challenges of the Kebena river and its buffer zones. Participants reflected on core aspects of river restoration practices from the point of view of their respective professional expertise. Information was collected at the stakeholder workshop and analyzed using content analysis technique. Qualitative descriptions, tables, and figures are produced and presented to groups and categorize perspectives on river restoration strategy, goals

and issues. Moreover, the perceptions of professionals towards developing clear river restoration goals are presented through narration.

### 3. Results and discussion

#### 3.1. Integration of clearly defined river restoration goals in legal and institutional provisions

Broadly speaking, review of policy and legal documents, revealed that the Addis Ababa city administration recognizes the value of river protection and river buffer zone development. This observation was confirmed at interviews conducted with officials from Addis Ababa Environmental Protection Authority and Addis Ababa City Government Beautification, Parks and Cemetery Development and Administration Agency. The officials reported that the city government recognizes the value of protecting and restoring waterways, and has adopted various environmental regulatory frame works such as policies, proclamations, structural and local plans to address the issue. These documents demonstrate governmental institutions' efforts to promote preservation of rivers and the larger eco-systems. Summarized below are two groups of documents that address river restoration efforts at different points in time:

- a. Ethiopia's Environmental Policy, which was developed in 2005, aimed at ensuring the protection of vital ecological processes and life support systems, the preservation of biological diversity in cities, while using sustainable natural resources to maintain their regenerative and productive capabilities.
- b. Various Proclamations are forwarded at different periods to support establishment of different institutions that operate to protect urban rivers, such as:
  - (Federal Negari Gazeta, 2002) No. 295/2002, Environmental Protection Organs Establishment Proclamation, Page 1939;
  - (Negari Gazeta, 2002) No. 299/2002 Environmental Impact Assessment Proclamation Page 1951;
  - (Addis Negari Gazeta, 2004) No.17/2004 Addis Ababa City Structural Plan Preparation, Issuance and Implementation, Page 293.
  - (Addis Negari Gazeta, 2015) REGULATION No.75/2015 a regulation to provide for establishment of the Addis Ababa city government rivers and river sides development and climate change adaptation project office, Page 1.

The reviewed documents demonstrate efforts of the city administration to restore urban rivers with the understanding that urban river restoration requires concerted and coordinated effort between policy making, planning, and implementing bodies. According to the proclamations, the Environmental Protection Authority and the Beautification of Parks Cemeteries Development Administration Agency were considered the major stakeholders of rivers and riversides management. These agencies are authorized to develop and manage river sides by obtaining a permit from the Addis Ababa City Administration Land Development and Management Authority (AACALDMA) through Article 38/11 and Article 46/1 of Proclamation No. 295/2002. That being said, interview with officials from these two institutions reveals overlap of mandates that raised conflict of interest during river restoration projects leading to the total abandonment rivers and river sides.

Consequently, with the aim of distinguishing the institutions' responsibilities in 2011, the City Administration issued a new Article 11/11 on Proclamation No. 35/2011. This mandate gave the Addis Ababa Environmental Protection Authority the autonomy to monitor and control riverbanks for public users as well as to promote and advise on restoration techniques. Article 56/11 on the other hand gave the

mandate to Addis Ababa City Government Beautification, Parks and Cemetery Development and Administration Agency (AABPCDAA) to develop and manage riverbanks. Although efforts were unsatisfactory, interview revealed that AABPCDAA has since been able to implement few public park projects along the rivers of Addis Ababa under AAEPAs' supervision.

As a result of the conflict of interests that emerged between the two institutions, in 2015, the bulk of Addis Ababa rivers and river protection functions were shifted to the newly established Addis Ababa Rivers and Riversides Protection and Climate Change Adaptation Project Office (AARRDCCAPO). Since then, AARRDCCAPO is responsible for the preparation and execution of river restoration efforts at various locations along Addis Ababa City's riverbanks. AARRDCCAPO implements its restoration efforts in compliance with the new regulation; Regulation No. 75/2015. Despite the fact that the newly established office is expected to work in collaboration with key stakeholders such as AAEPAs and AABPCDAA, the organization had other emerging conflicting roles that are still overlapping with AABPCDAA when it comes to parks that are located within river buffer zones. Ten of stakeholders' meeting participants agreed that the newly declared regulation lacked sufficient effort to identify gaps and address the challenges of rivers and riverside buffer zones restoration. While twelve of them confirmed that lack of consensus among institutions coupled with conflicting roles has hindered development of the common goals which is resulting in poor implementation of river restoration projects.

Interviews with officials from the Addis Ababa EPA and the BPCDAA, as well as the stakeholder meeting, revealed that, in addition to the main stakeholder institutions, other government and non-government organizations are engaged in river restoration activities without the knowledge of the main stakeholders (Table 1). These institutions, in addition to their main development goals, are involved in creating jobs and organizing as well as and engaging communities in urban agriculture activities in Kebena river watershed. However, the collaboration and coordination between these institutions and the main stakeholders in river restoration issues is lacking. During the stakeholders' meeting, representatives from these groups suggest that rivers and riversides are regarded as "no man's land", thus, were considered as potential areas to implement other institutions' goals. In general, results from the interviews and stakeholders meeting show there is poor coordination and dysfunctional relationship among institutions which resulted in the land-use change of vegetated river buffers to religious centers while others were 'temporarily' changed to serve as quarry sites, settlement areas and open defecation sites.

Studies address those environmental policies and regulatory guidelines constitute the basis for effective activities in river conservation relating to specific environmental problems (Perini, and Sabbion, 2017). For example, Chan (2012) identifies lack of systematic water or river legislation as a barrier that hinders effective river management efforts in Malaysia. The absence of transparent, substantive water legislation in the Kebena river basin, therefore, has resulted on counterproductive conflict between the different stakeholders. These conflicts undermined the institutions' primary task of protecting and improving waterways and rivers. According to (Levin-Keitel, 2014; Erdogan, 2013; Chan, 2012), communication among key implementation institutions and integration of goals and objectives is vital to harmonize objectives with main river restoration goal while synergizing institutional goals.

#### 3.2. River restoration issues and the current urban planning practice

Urban plans play a prominent role in guiding city development (Carter, 2007). The Addis Ababa structure plan provides general development guidance, while Local Development Plans on the other hand provide detailed plans that align with visions set by the structural plan. This study, thus, evaluated if and how river restoration efforts were integrated into present urban planning practices. Results from the



**Table 1.** Institutions working on rivers and riverside development activities and their main development goal.

Institutions	Year of establishment	Institutions' Main Development Goal Related to Rivers
*Office for the Revision of Addis Ababa Master Plan (ORAAMP)	1998–2002	Protect rivers through the provision of a 15m green buffer zone.
* Addis Ababa City Revised Structure Plan Executive Summary	2014	Protecting rivers through the provision of a green buffer zone with a maximum width of 50m and develop them to provide various ecosystem services.
*Addis Ababa Urban Planning Institution	2004	Preparing urban plans to guide the development of the city.
*Addis Ababa Sub City Planning Offices	2004	Developing detail of the Structural Plan for implementation.
*Addis Ababa City Land Administration Authority	2002	Providing title deed ( <i>certificate of land possession</i> ) for riversides.
Ministry of Environment, Forest & Climate Change, Ethiopia - MEFCC	2016	Coordinate and ensure the forestry objectives and the basic forestry principles indicated in the forestry policy of Ethiopia.
*Addis Ababa Environment Protection Authority	2009	<i>To administer forest areas and riversides according to development proposals of the masterplan of the city.</i>
*Addis Ababa City Administration Beautification and Cemetery Development Agency	2009	<i>To develop, administer and control, under the ownership of the City Government riverbanks identified following the city's plan</i>
*Addis Ababa Rivers and Riversides Development and Climate Change Adaptation Project Office	2015	to harmonize the city development with the management and development of the rivers and river buffers in the city.
Addis Ababa City Administration Trade Bureau Urban Agriculture Sector	2016	To create a better community through better household income and food security and leading the city to sustainability and ecosystem resilience.
Addis Ababa City Administration Urban Job Creation and Food Security Agency	2016	secure sustainable food supply and create job opportunity
Tenna Kebena Ginfilen Enatsda Charity Organization	2007	Cleaning riversides and develop them for different ecosystem services.
Addis Ababa City Administration Cleansing Management Agency	2003	to make Addis Ababa a clean and African model city.

Institutions that are marked with \* are those whose main development goals are highly relevant to river restoration activities.

document review demonstrate the absence of clearly defined river restoration goals and objectives woven through local development plans and the city's structural plan. The reviewed documents entail:

- The Addis Ababa City Structural Plan Preparation, Issuance and Implementation Proclamation No. 171/2004, aimed at providing the overall planning objective of the Addis Ababa Structure Plan as, "*indicating general development directions, laying out of infrastructure, land use, and organization that enables to direct the future development of the City.*" The declaration also provides general guidance on how Local Development Plans (LDPs) can implement and strengthen the vision of the structure plan.
- The Local Development Plan Preparation Manual formulated in 2006 (FDRE, 2006). This document aims to guide planners towards enhancing the vision of the city development plan.
- The Revised Master Plan of Addis Ababa (ORAAMP, 2002), and the Addis Ababa City Administration Structure Plan Project Office (AACASPPPO, 2017) have the aim of protecting urban rivers through buffer zone provision.
- Local Development Plans, seek to provide detailed planning framework to be used in projects based on goals of the strategic plan, LDP Manual of (FDRE, 2006).
- The Norms and Standards of the Addis Ababa Structure Plan Components, formulated in, 2002, aimed to providing standards and guidelines for the structural plan components.
- The Rivers and River Buffer Green Infrastructure Design Standard Implementation Manual, 17/2016 (Ministry of Urban Development and Construction, 2016).

The document review revealed that one of the objectives of the structure plan is to create ... "*a city that will ensure a safe and clean environment for a healthy and productive society...*". In line with this, the ORAAMP (2002) recommends a 15m wide green buffer zone around rivers with the intention of protecting rivers and stream banks. However, most of the interview participants from the planning offices contended that the structure plan does not provide clear river restoration goal and sufficient development guideline for the river buffer zones, further

contributing to the degradation of rivers and their surrounding areas. For example, the Revised Structure Plan of the city (AACASPPPO, 2017), forwards principles such as keeping a maximum of 50m buffer zones around rivers through planting trees with the aim of lessening the degradation of rivers and riversides. However, the document still falls short of providing clear river restoration goal that guides future river restoration efforts. An interviewee, a planner, who participated in the revision of the two Structure Plans (of 2002 and 2017) explained that:

*"... For the last twenty years, the municipal structure plan regarded rivers only as elements requiring buffer zones; thus, it never integrated rivers as part of the urban development process. Furthermore, the interviewee confirmed that the Structural Plan did not provide adequate instructions as to what each organization should or should not do regarding rivers."* (Key informant interview: 2017)

Within the Ethiopian planning system, according to the LDP Manual of Ministry of Urban Development and Construction (2006), and Addis Negari Gazeta (2004) Proclamation No. (171/2004), LDPs are the final provisions in the urban planning framework that are required to combine urban planning with design proposals and regulations. This document facilitates implementation of projects on the ground, in this study twenty-three LDPs were analyzed to assess levels of consideration given to rivers and riversides' restoration during the local development planning process. The assessment focused on availability of clear river restoration goals and their compatibility with the proposed plans based on the connectedness of sites with rivers. Thus, LDP sites that are bounded on both sides by rivers are considered as highly connected, whereas sites with no link to a river or stream are considered to have zero connection to rivers.

Fifteen of the twenty-three Local Development Plans (Table 2) intersecting with the Kebena watershed were chosen based on their connectivity levels to rivers and streams. Consequently, two of the LDP sites are bordered on both sides by rivers and are intersected by a smaller current. Another two LDPs are moderately connected to rivers on one side and are crossed in the middle by a river. The majority of the LDPs, i.e. eleven out of the twenty-three LDPs, have a link to rivers as they are either crossed or bordered on one side.

**Table 2.** Local Development Plan (LDP) sites in connection with rivers and streams and the level of concern given to the rivers in LDP proposals.

	Size LDP area in ha	Study area Connection with Rivers (measure from highly connected to not connected)	The relevance of Main Development Goal to River Restoration	The relevance of Objectives to River Restoration
LDP Site 1	8.1	5	2	1
LDP Site 2	13.5	3	1	1
LDP Site 3	21.37	3	2	2
LDP Site 4	78.8	3	2	1
LDP Site 5	10.5	2	1	3
LDP Site 6	24.8	4	4	4
LDP Site 7	33.2	5	2	3
LDP Site 8	33	3	2	3
LDP Site 9	23.04	3	2	
LDP Site 10	27.04	1	1	1
LDP Site 11	18.4	3	2	2
LDP Site 12	33	3	1	1
LDP Site 13	24.5	3	1	1
LDP Site 14	27.7	3	1	2
LDP Site 15	22.5	2	2	3
LDP Site 16	23.8	3	2	4
LDP Site 17	23.1	4	2	3
LDP Site 18	21.5	3	4	2
LDP Site 19	23	2	2	1
LDP Site 20	66	2	1	1
LDP Site 21	58	2	1	1
LDP Site22	27.8	1	2	2
LDP Site 23	19	2	2	2

Relevance of Main Local Development Plan (LDP) Goal to River Restoration: Highly relevant -5; Medium Relevant - 4; Relevant -3; Less Relevant -2; Not Relevant - 1. Relevance of Objectives to River Restoration Highly relevant -5 Medium Relevant - 4 Relevant -3 Less Relevant -2 Not Relevant – 1.

Main goals of the selected LDPs (Table 2) were examined based on the level of linkage of the LDP sites to rivers. LDPs' main development goals were examined for the fifteen LDP sites as these were the sites with high to medium level connectedness to rivers. The analysis indicated that eleven out of the fifteen LDPs directly forwarded the structural plan's proposal related to river restoration issues without an explicit assessment of the rivers and their surrounding areas, while two of the LDPs' main development goals suggested river protection as a crucial issue in their documents. The two LDP proposals designated some specific activities such as, urban agriculture, poultry, and parks to be incorporated within the buffer zone around the rivers. However, even these two LDPs did not explicitly discuss protective measures and risks that rivers are facing. Interview with planners also confirmed similar sentiment where government officials lack concern over issues of river side restoration. Below is the perception of many planners as contended by one of the interview participants:

*"We don't know what to do with regards to river planning. We offer a 15-meter buffer on both sides of rivers, which is inadequately designed. The only reason we, the planners, preserve this 15m buffer is to adhere to the city's structure plan; we have no idea why this guideline was established."* (Key informant interview: 2017)

Furthermore, the stakeholders' meeting revealed poor representation of professionals such as environmentalists, and hydrologists during the planning processes of Structural and Local Development Plans. The absence of consultation with pertinent stakeholders such as AAEP, and AABPCDAA experts results in poor planning decisions towards river restoration. Stakeholders meeting also reveals that water experts and other relevant stakeholders consider themselves constrained by a lack of support and appropriate working platform to engage in river restoration issues during the planning process.

An important finding from both document review and stakeholder interviews reveal that planners' approach towards rivers and riversides

development lacks strong knowledge-based and informed reasoning. As a result, planners often perform river and riverside evaluations without specifically using the assessment results to determine the conservation measures needed to restore and/or preserve rivers and riversides. The LDP practitioners' misinterpretation of planning documents, which resulted in poor planning decisions, has caused river and riverbank depletion.

In many countries, river restoration issues are not in the priority list of the planning programs as there are other pressing factors, such as political, social, economic issues (Chan, 2012; Carter, 2007; White and Howe, 2003). Recently, in some countries, elements of river restoration issues have been incorporated with urban plans. For instance, in Germany, 100 years flooding history of rivers is studied, and the results were incorporated with urban plans, thus providing, large open green spaces allocated only for temporary activities, (Pahl-Weber and Henckel, 2008).

In addition, various literature on the issue of planning urban waterways discusses the significance of subordinate planning documents, such as regional plans, Catchment Action Plans, Local Environment Plans, coupled with riparian mapping to provide higher levels of technical guidance for land-use planning affecting urban waterways (Davies et al., 2011). In Addis Ababa, though, LDPs are fundamental transitions between a structure plan decisions and future projects in the process of urban plans implementation (Ministry of Urban Development and Construction, 2006), the result of the assessment, revealed that most of the LDPs do not indicate development possibilities customized to the specific sites. In most cases, LDP decisions are the direct copy of the structure plan proposals with an inadequate in-depth assessment of the existing situations such as biology and riparian habitat, hydrology and hydraulics, water quality, continuity and removal of barriers, pollution sources and other issues.

Despite all the constraints, the structure plan of the city indicates that Kebera river along with other rivers is anticipated to provide various ecosystem benefits (AACASPP, 2017), which according to Ehrenfeld

(2000), Beechie and Bolton (1999), and Parker (1997) is considered as a potential theme to clearly define river's restoration goal. This theme if suitably applied to develop clear river restoration goal it is possible to restore Kebena river to bring about the economic benefits to the local community while increasing the environmental value of the restored landscapes. Therefore, the critical challenge of restoring Kebena river lies in prioritizing river restoration objectives under a well-defined restoration goal.

### 3.3. Barriers preventing the adoption of river restoration planning and implementation efforts

Though many of the assessed regional as well as the local documents refer to the significance of restoring rivers, they lack synergy and common goal to guide fragmented river restoration efforts conducted along Kebena river. Current river restoration practices in the city of Addis Ababa reveal that there is often changing proclamations, altering and overlapping mandates among institutions. Proclamations are often amended without sufficient assessments with the aim of identifying and amending gaps. Hasty decisions without involvement of professionals, planners, scientists and the public have resulted in poor planning and implementation of river restoration proposals for long time. Partial mandates given to a number of institutions to control and guide river restoration activities have led to failure to protect and restore rivers and riversides. Therefore, the result of the document review, interview of professionals and stakeholders' meeting indicated the three major issues that are hindering the current river restoration practices of Kebena River from achieving the intended aims are:

- poor legal and institutional provisions for river restoration issues and integration of river restoration goals with current urban planning practices at various scales such as the structural and local development plans;
- lack of clearly defined goal followed by measurable, simple and attainable objectives; and,
- poor communication platforms among stakeholders about the current situation of rivers and the different activities that are taking place.

## 4. Methodology for developing and integrating river restoration goals with planning practice

### 4.1. Build institutional and legal provision of river restoration issues

The effectiveness of river restoration activities is dependent on institutional and legal requirements (Beechie et al., 2009). In the process of establishing a specific river restoration objective, these provisions help to align and coordinate the efforts of those agencies working to preserve and/or protect urban rivers and river sides. For instance, in the case of Addis Ababa, the assessment results show that most of the institutions including the Addis Ababa Plan Commission, Sub City Planning offices, the AARRDCCAPO and other stakeholders involved in river restoration activities directly or indirectly aim to maximize benefits that society acquires from rivers and their surrounding landscapes. In line with this, the general goal advanced by the City's Structural Plan focused on providing various public benefits, such as urban agriculture, leisure activities, and job development, as some of the main ecosystem services that urban rivers are expected to provide in the future through extensive study (AACASPPPO, 2017). Though, these institutions seem to have similar intention towards river restoration, they lack synergized and well-defined restoration goal which helps them align their activities accordingly. Therefore, all responsible stakeholders and institutions should develop a systemic river legislation for effective river restoration and management efforts. Furthermore, clear and substantive water legislation in the Kebena river basin would address the detrimental dispute between the various stakeholders. Creating simple

communication channels is also critical for a smooth and sustainable workflow.

In Addis Ababa, particularly in Kebena river and the surrounding areas, delineation of the river buffer protects the river and its surrounding landscape from further pollution through enforcement of laws and regulations, referring to a set of water quality standards to be met within a specified period of time; applying flood protection methods, and mitigation of watershed soil erosion, and restoration of degraded riversides through planting, and cleaning is vital.

### 4.2. Develop common river restoration goal and prioritize objectives

Continuous discussion among the relevant stakeholders is vital to formulate common river restoration goal that reasonably addresses the often-conflicting stakeholders' interests (Deason et al., 2010; Gregory and Brierley, 2010). Representatives from the community and concerned bodies, decision makers, planners, scientists, potential funders, and investors should take part in the implementation of restoration efforts. Moreover, objectives should be developed based on an in-depth study of current status of rivers in focus.

In the case of Kebena river, provision of various benefits from the river can be recognized as the guiding theme to clearly define its restoration goal (Ehrenfeld, 2000; Beechie and Bolton, 1999; Parker, 1997). This theme guides the river's restoration efforts to deliver economic benefits to local community while increasing the environmental value of the restored landscapes. Furthermore, river restoration goals should include three important components, according to Beechie et al. (2008): (1) the biological goal (river water quality, habitat conservation, species protection, and so on), (2) addressing the underlying causes of ecosystem degradation (deforestation, land use change, pollution, and so on), and (3) understanding social fabric, economic, and land use constraints within which the restoration process is taking place. However, currently, Kebena river is not in a position to provide many of the benefits required by the community or planners as it is very much polluted and the surrounding landscape is degraded. Therefore, the main concern becomes the issue of prioritizing objectives under a well-defined restoration goal.

In line with this, understanding the manner in which the river network has been degraded through time, followed by the consequential alteration of the river ecosystem are vital steps to be taken (Gilvear, 2013). Delineating river buffer zones around Kebena river is the next step where the various institutions such as the Structural Plan revision office, environment experts and LDP experts from sub-cities together with experts from AARRDCCAPO should collaboratively work together. Consequent to delineation of rivers and river buffers, gradual and hierarchical development will take place to acquire the intended benefits. The intention is not producing all-inclusive plan with every single prospect proven by facts and figures, but develop an integrative planning approach, considering uncertain conditions at present and an unpredictable future (Levin-Keitel, 2014).

### 4.3. Integrate river restoration goal with the current urban planning practice

Integrating the developed river restoration goal with structure plan and further with local development plans makes the practice of river restoration projects practical, and sustainable. In addition, planners and other relevant professionals involved in the process should have clear and vital role in the process of river restoration. Plans should support recommended river restoration goals through allocation of functions in a landscape. The potential of plans to bring as many stakeholders to one platform as possible, thus, will guide the perception of relevant stakeholders and the public towards common river restoration goal. In addition, restoring the urban environment in general, and rivers in particular, should be viewed as a critical component of the city's development plan,

necessitating equal financial, technological, and political contributions similar to other public needs.

If river restoration issues such as river buffer delineation, buffer development, and other related issues, are proactively designed, developed, and preserved, they have the potential to direct the city's development by providing a framework for economic growth and nature conservation of cities (Tzoulas et al., 2007). As a result, it is critical to employ green infrastructure development as a tool to guide Addis Ababa River restoration concerns, which are incorporated in the city's development plan's Environment section, provided adequate river restoration goals are defined.

#### 4.4. Professional capacity building

The engagement of skilled staff in river restoration projects is a critical component of effective urban river restoration preparation, execution and monitoring processes. This can be accomplished in three ways: first, skilled professionals with adequate river expertise should be involved in the planning and implementation processes. Second, practitioners involved in LDP restoration preparation and execution should receive short- and long-term river restoration skill training (Arnold and Gibbons, 1996). Third, an interdisciplinary team of experts, community members, and various stakeholders should be involved in the preparation of plans, especially for sites with high access to rivers and streams. Furthermore, allocating adequate time for preparation is critical because the study of rivers and their surrounding areas necessitates a detailed evaluation and study before drawing conclusions and making planning decisions.

## 5. Conclusion

This study assessed integration of clearly defined goals and analyzed their significance in urban river restoration activities of the Kebena River in Addis Ababa. Although the city government recognizes the value of protecting and restoring waterways, and has adopted various policies, proclamations, structural and local plans; very little attempt has been vested to develop clear river restoration goal to guide successful restoration of the rivers and the environment around them. Current practices demonstrate that there is clearly defined river restoration goal in the planning and implementation phases of river restoration projects. Most recently planning efforts focus on protection of rivers, which is a vague term that does not communicate the right concept. The Kebena river watershed is one example where the lack of a clearly defined goal for restoring the river has led to poor planning and implementation of proposals. This research also showed that the problems of urban waterways are loosely integrated in the planning documents while being acknowledged in the proclamations, leading to inconsistent procedures in the restoration of waterways.

The study revealed lack of awareness, inadequate professional knowledge, lack of cooperation, and weak participation of the local community and stakeholders as major challenges resulting in fragmented river restoration efforts. It is recommended that addressing these issues for sustainable river restoration activities should be of urgent concern to the city administration. Findings of the study add new contextual knowledge that informs the river restoration literature about the importance of developing river restoration goal. Finally, the analysis informs policy makers on river restoration priorities for sustainable river management systems as well as for current planning practices in Ethiopia.

## Declarations

### Author contribution statement

Kalkidan Asnake: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Hailu Worku: Conceived and designed the experiments.

Mekuria Argaw: Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Data included in article/supplementary material/referenced in article.

### Declaration of interests statement

The authors declare no conflict of interest.

### Additional information

No additional information is available for this paper.

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