



An Assessment of Watershed Management Practices in Gullele Botanical Garden, Addis Ababa, Ethiopia

Gudeta Chalchisa^{1*} and Birhanu Kebede, PhD

¹Botanist at Gullele Botanical Garden, Addis Ababa, Ethiopia

²Ambo University, Centre for Environmental Science, Ethiopia



Abstract

The study will explore the prospects and approaches of watershed management practices of past and presents at Gullele Botanical Garden, Addis Ababa city administration, by assessing and evaluating the existing complex set of biophysical condition, conservation practices and identifying the key watershed problems as well as the root causes.

The information of the study will be gathered from official documents, direct observation, interview the office technician and experts. Then, the gather data will be analyzed both qualitative and quantitative as well as checked, arranged, processed and analyzed in R software and word sheet. Others GIS data models will be analyzed by using Arc mag 10.3.

It will indicate, the DAM A and around reserved forest site watersheds, watershed management focuses only on soil and water conservation. Emphasis will be place on choice of technology for soil and water conservation measures. By use a combination of purposive and random sampling techniques and will obtain data from Gullele Botanical Garden office data, Books, study reports, student theses as well as published and unpublished documents of other organizations.

Introduction

The watershed is the land and water area, which pitch in runoff to a common point. It's considered a biological, economic, physical, and social system. Watershed management has emerged as a new paradigm for planning, development, and management of land, water, and biomass resources with a focus on social and environmental aspects with a participatory approach.

The economic and resource development of developing countries depends on the performance of the agricultural sector; the contribution of this sector depends on how the natural resources are managed and conserved. Unfortunately, in the majority of developing nations, the quality and quantity of natural resources are decreasing resulting in more severe droughts and floods [1].

In most developing countries, the major factor for land degradation is improper and unsustainable land use and management due to population pressure and small farm sizes, land tenure insecurity, and land redistribution, limited access to credit and education [2].

Ethiopia is one of the developing countries in which land resources are becoming increasing scarcity and the quality of resources such as soil, water, plants, and animals are decreasing as a result of improper use and management. Land degradation in the form of soil erosion, sedimentation, depletion of nutrients, deforestation, and overgrazing is one

of the basic problems facing farmers in Ethiopia and this limits their ability to increase agricultural production and reduce poverty and food insecurity [3].

To address the land degradation and loss of soils, extensive watershed management practices were launched in Ethiopia, particularly after the famines of the 1970s. Since then, huge areas have been covered with terraces, bunds and millions of trees have been planted [4,5]. Even though a number of watershed management techniques were introduced to combat land degradation, the adoption of these practices remains below expectations.

Watershed management is a landscape-based strategy that aims to implement improved natural resources management systems for improving livelihoods and promoting beneficial conservation, sustainable use, and management of natural resources [6].

Gullele Botanical Garden is part of the Entoto mountain

***Corresponding author:** Gudeta Chalchisa, Botanist at Gullele Botanical Garden, Addis Ababa, Ethiopia

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chain which has been predominantly covered by Eucalyptus globules since the early 19th century. Mount Entoto largely has an undulating topography with steep slopes highly prone to severe runoff, causing soil erosion. From the early days of the garden soil and water conservation measures have been implemented using two methods: biological and physical [7].

Therefore; this study will help to assess watershed management practices and to generate recommendations that would assist in the further development and management of watersheds.

Statement of Problems

Degradation of vegetation cover and soil degradation are mainly caused by a lack of effective watershed management practices and inappropriate use and management of natural resources. For instance, over the last two decades, the governments of Ethiopia and its donor have spent significant sums on micro-watershed and macro-watershed rehabilitation and development. Most of these projects were not successful due to effective community participation, limited sense of responsibility over assets created; inefficient implementation of technologies, inadequate policies lack of integration among stakeholders, unmanageable planning units, and evaluation techniques for their feedback [8]. Poor watershed management practices seem to be responsible for land degradation.

Therefore; in Gullele Botanical Garden, watersheds like DAM A and around reserved forest site are among the watersheds that are severely affected by land degradation which includes soil erosion, nutrient depletion, and plantation cover. Gullele Botanical Garden has the landscape of watershed management and a source of ground water access for Addis Ababa city administration. So, empirical assessment of watershed management practices to be undertaken to identify the key watersheds problems and the root causes.

Questions

- What is the problem of watershed management in Gullele Botanical Garden?
- What are the root causes of watershed practices?
- How to the conservation activities in Gullele Botanical Garden going on?
- Is there a Systematic process of watershed management planning at Gullele Botanical Garden?
- What are the watershed characteristics physical and biological in Gullele Botanical Garden?

Objectives

General objective

The general objective of this study will to assess watershed management practices and conservation activities at Gullele Botanical Garden, Addis Ababa.

Specific objectives

- ✓ To identify the major factors affecting the watershed

an Gullele Botanical Garden.

- ✓ To evaluate conservation activities as response of ever expanding land Degradation through watershed management practice.
- ✓ To generate a recommendation that would assist in the further development and management of the watershed.

Literature Review

Watershed management practices in Ethiopia

Watershed management practices implemented in rainfed regions are oriented largely toward rehabilitating degraded lands; protecting soil, water, and other natural resources to produced, forage, fiber, and other products; enhancing the flows of high-quality water from upland watersheds to downstream places of use [9]. While many land uses can occur on watersheds, natural resources production and environmental protection are equally important managerial objectives.

The Ethiopian government has for long time recognized the serious implication of continuing soil erosion to mitigate environmental degradation and as a result large national programs were implemented in the 1970s and 1980s. However the efforts of these initiatives were seen to be inadequate in managing the rapid rate of demographic growth within the country, widespread and increasing land degradation, and high risk of low rainfall and drought. Since 1980, the government has supported rural land rehabilitation, these aimed to implemented natural resources conservation and development programs in Ethiopia through watershed development [10].

The institutional strengthening watershed project in Ethiopia was implemented by FAO, and was principally aimed at capacity building of Ministry of Natural Resource's technicians and experts and development agents in the highlands regions of the country. The projects used the sub-watershed as the planning unit and sought the views of local technicians and members of the farming community to prepare of land use and capability plans for soil and water conservation. This approach was tested at the pilot stage through FAO technical assistance under MOA during 1988-1991 [10].

Community participation in Watershed management

Participatory watershed development planning and management will be employed to improve the livelihoods of community/household/ in rural areas and optimizes the use of existing natural resources [11].

Environmental deterioration can best be reversed through involving local people directly with state, transforming the common experience of conflict into co-operation [12,13]. Government and NGOs have recognized that protection of watershed cannot be achieved without the willing participation of local people [14]. Therefore for successful and sustainable

watershed management, people's participation is essential. This is one of the lessons learned from the failures of centrally planned watershed development projects through which local people have been either forced to construct terracing, bunding, rehabilitating gullies and other technical measures that experts believed would cure watershed degradation [15-17].

Farmer's participation is essential not only for implementation of soil and water conservation activities like terracing, bunding by food for work but also during planning of sustainable management of land and water resources. Farmers are closer to the real problems, and therefore they are aware of issues that experts may miss, and their objectives are more practical for economic development [18]. Furthermore, farmers participation in recommendation technology [19].

In most of the centrally planned projects, like Ethiopia, soil and water conservation programs are promoted with standard technical solutions such as terracing, contour bunding etc. on the assumption that soil conservation measures are universally applicable and local farmers are unaware of soil erosion and ignorant of its causes and consequences [10,20]. However, these measures, which were often forced on the people, may cause more erosion than their own indigenous practices, either because the new conservation works are not maintained or are technically less well adapted than existing practices [16].

The large majority of watershed development projects

are based on rigid and convectional approaches considering only physical planning without attention to socio-economic or ecological conditions, for instance in Ethiopia in the 1980s the large Borkena Dam in south Wollo was constructed without considering ecological conditions of the area resulting in filling with silt and coarse material [10].

Material and Methods

Site descriptions

The Gullele Botanic Garden (GBG) is located in the north western part of the capital city Addis Ababa 4.3 km away from the centre. The geographical co-ordinate of the garden lies between latitude 8° 55' N and 9° 05' N and longitudes 38°05' E and 39°05' E (Figure 1). The Garden is mainly bordered with Oromia Regional state to the North and Addis Ababa, Gullele and kolfe Keranyo sub City to the South part. It belongs to the central plateau and dry evergreen agro-climatic zones of Ethiopia. Gullele botanic garden has two topographic landscape units or physiographic features. The northern half is a plain land while the southern half is mountainous, with a maximum elevation of 3000m above mean sea level. Two perennial watercourses originate from this mountainous area and flow southwards to the city centre. The garden is known by holding a number of Ethiopian endemic and indigenous plant species facing extinction and required protection. It is home to riverine vegetation's and remnants of indigenous trees of the city of Addis Ababa.

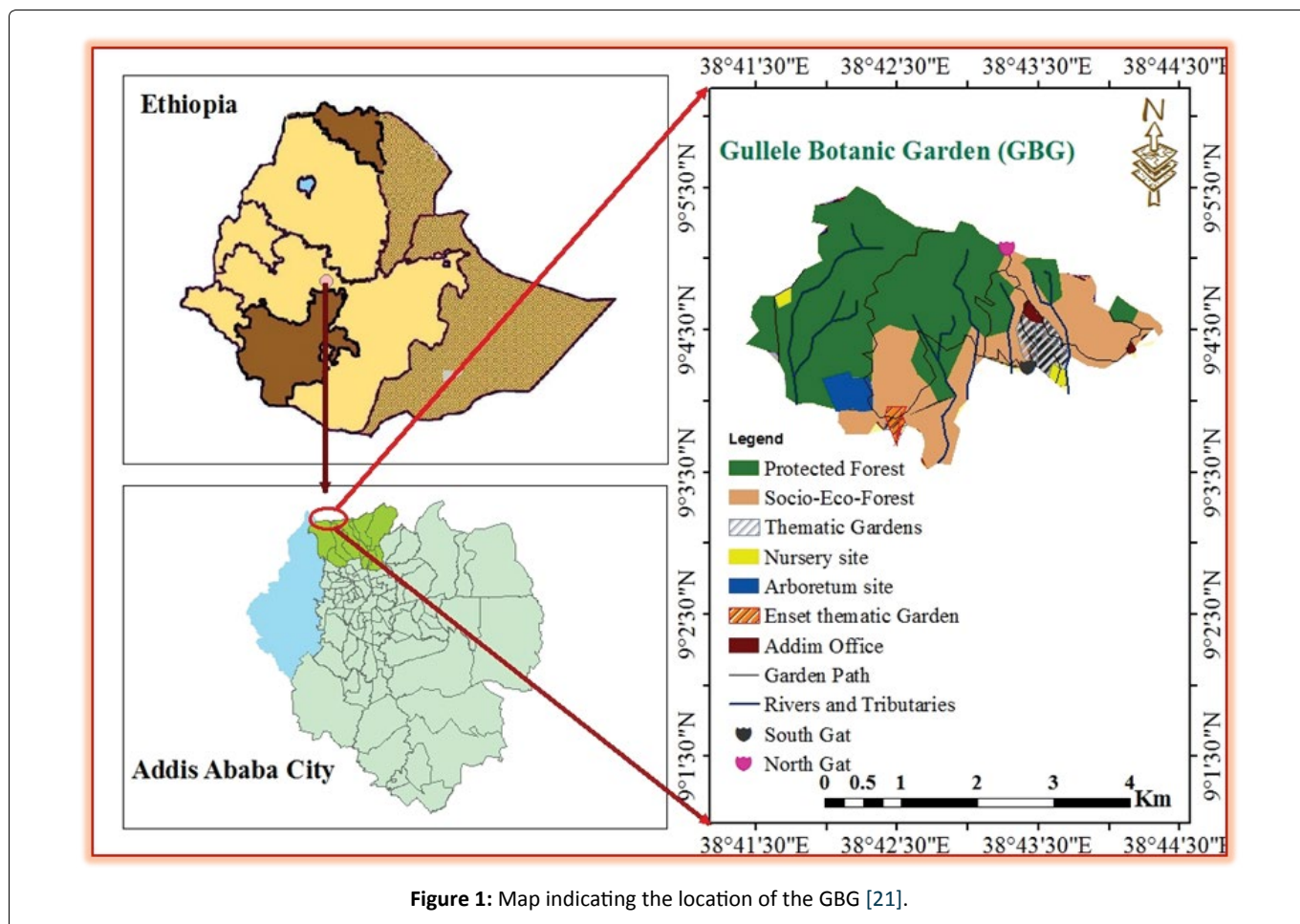


Figure 1: Map indicating the location of the GBG [21].

GBG is aiming to collect living plants from the whole country to rescue threatened flora from extinction through enhancing biodiversity conservation, research, education and aesthetic values. Furthermore, the garden is intended to develop as a national and international standard representative of Ethiopian endemic and indigenous plants and offering scientists an array of rich plant collections to carrying out research on diverse species interaction, ecological dynamics and create an inspirational place for enjoyment and learning. Accordingly, the garden will supposed to intensifying indigenous knowledge for biodiversity conservation, climate change mitigation and urban greening option.

In Gullele Botanic Garden 1200 collected plant species were found. Out of this 166 are found to be medicinal plants. 65 species were found to be endemic to Ethiopia and Eritrea based on the flora of Ethiopia and Eritrea. Sixteen of them belong to herb, 37 shrubs, 22 trees, 4 shrub/tree, 1 herb/shrub and 1 climber. There are also 11 large mammals and 95 bird species were recorded from the garden, out of which one species of animals and one species of birds where endemic to Ethiopia [21].

Sampling methods

In this study area researchers will use a combination of purposive and random sampling techniques. The first steps will purposive selections of watershed areas namely DAM A and reserved forest sites.

The second stages will be the simple random sampling of area from the GBG. To facilitate this final stage, the list of names of specific area in each selecting area will select by researcher and the field extension officers of Gullele Botanical Garden.

Methods of data collection

Primary data will collect through structured interviews. Structured questionnaires will be used to collect primary data from soil conservation experts in the watershed. Additional information will also obtained from focus group discussion and key informant interviews with soil and water conservation

leader. DEM data will be accessing from Google earth /landsat satellite image, using DEMs and raster data operations the watersheds and topographic features such as slopes, stream networks at Gullele Botanical Garden will be analyzed.

In field observation the physical resources and status of conservation measures within watershed will observe. Some physical soil and water conservation measures (stone bunds and cut-off drain) will practice in the watershed will observing and comparing with standard applicability parameters.

Secondary data will obtained from Gullele Botanical Garden office data, Books, study reports, student theses as well as published and unpublished documents of other organizations.

Data Analysis

For this particular study the researchers will used both quantitative and qualitative data analyzing methods. In this case of quantitative data analyzing methods, the primary data collected from household survey will present in figures, tables and percentages. In the case of qualitative data analyzing, the collected primary data will checked, arranged, processed and analyzed in R software and word spread sheet. Others GIS data models will be analyzed by using Arc mag 10.3 (Table 1 and Table 2).

Appendix

Questionnaires for water and soil conservation specialists

1. History of environment in general and the situation of watershed problems and their causes in particular.
2. The situation how individual or the experts are actively responding to these watershed problems.
3. The major constraints of the experts to implement watershed management activities in the area.
4. What are current watershed management practices in the area?, such as area closure, soil and water conservation practices, composting, tree planting and other land management activities.

Table 1: Work Plan.

No	Activity	YEAR (2023)											
		Jan	Feb	mar	April	may	June	July	Aug	Sep	Oct	Nov	Dec
1	Selection of topic												
2	Selection of site												
3	Proposal writing												
4	Questionnaire development												
5	Formal survey												
6	Data collecting												
7	Data coding and analysis												
8	Writing the first draft report												
9	Writing the final report												
10	Submission of report												
11	Presentation of the report												

Table 2: Budget Plan.

No	Description of materials	Unit	Unit cost (birr)	Total (birr)	
1	Stationary	2 pack	400	400*2	800
2	Paper	1 pack	200	200*2	400
3	Pen	1 pack	200	200*2	5000
4	Pencil	1 pack	200	200*2	400
5	Writing and Printing	Number	500	500*2	1000
6	Binding expenses		500	500*5	2500
7	Reserve budget		5000	5000*5	250000
		Total budget			=35100birr

5. What are the impacts that you think when these watershed techniques applied and how it caused?
6. About protection and maintenance activities after watershed management techniques (soil and water conservation activities) have been conducted.
7. The extent of participatory in palnning, designing, implementing monitoring, evaluating, and executing in the land magement decision in thus works?

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