Proceedings of the Second Awareness Creation Workshop on Wetlands in the Amhara Region

Organized by Ethio Wetlands and Natural Resources Association (EWNRA)
With financial support from Global Mechanism - Centre for Combating Desertification and Finland Embassy in A.A., Ethiopia

September 2005

Workshop participants in the conference room

Proceedings of the Second Awareness Creation Workshop on Wetlands in the Amhara Region

Organized by Ethio Wetlands and Natural Resources Association (EWNRA)
With financial support from Global Mechanism - Centre for Combating Desertification and Finland Embassy in A.A., Ethiopia

Ethio-Wetlands and Natural Resources Association
P.O.Box 1518 Code 1110, Addis Ababa, Ethiopia
Tel.251-011-552 -7791/091-163-5720
Email: ewrp@ethionet.et

September 2005

Contents Pages

Introduction

Ethio Wetlands and Natural Resources Association is a not-for-profit non-governmental organization established in the year 2000 as an extension of Ethiopian Wetlands Research Programme (EWRP), which was a three-year project implemented in Illubabor Zone of the Oromia Region. Since its establishment the organization is disseminating the findings of EWRP, involved in investigation and documentation of information on wetlands, capacity building and awareness raising on wetlands and implementing catchment-based wetland management projects. The organization has currently established linkage with various national and international institutions. It has implemented and is implementing different research, capacity building and development projects in Oromia, Amhara and Southern Ethiopian Nation, Nationalities and Peoples Regional States.

The organization conducted the first awareness creation workshop on wetlands in Amhara region in January 2001, which the participants identified key activities, which need to be pursued in the immediate future. Some of these are further awareness raising works at different level, conducting a wetland survey in the region, research work on wetlands to come up with recommendation for sustainable use, networking and capacity building through training and production and distribution of extension materials, policy review and development, institutional responsibility allocation, identification of sources of technical expertise and project development for wetland management.

In the past few years the Ethio Wetlands and Natural Resources Association has been working towards the achievement of the activities proposed at the first regional awareness creation workshop. With funding from the Finland Embassy and the Global Mechanism of the Convention to Combat Desertification (GM-CCD), the organization is implementing a pilot project for demonstrating and testing catchment and community based sustainable wetland management and rehabilitation in three weredas of Amhara region namely Dangla, Bahar Dar Zuria Fogera.

This project involves a series of inter-linked activity components, some of which are addressing activities proposed in the first regional awareness creation workshop. The five major activities components of the project are:

- Undertaking participatory studies on wetlands and wetland resources at selected sites,
- Undertaking awareness creation conferences to disseminate important information on wetlands to local government authorities and employees as well as farming communities,
- Dissemination of wetland information via the circulation of extension booklets and leaflets,
- Training of farmers, development agents and experts to build capacity within the public and government institutions for improved wetland management and
- Establishment and running of pilot demonstration sites in three catchments for demonstrating integrated catchment and community-based wetland management practices through community participation.

This workshop is organized in line with the above activity components to raise awareness on wetlands with local government authorities and employees. Twenty three people drawn from different offices of the three weredas (Fogera, Dangela and Bahar Dar Zuria), the Agriculture and Rural Development offices of south Gonder, Awi and West Gojjam zones and regional Bureau of Agriculture and Rural Development, the Rural Land Administration and Use and Environmental Protection Authority, Amhara Research Center and USAID are attended the workshop. Number of participants is lower than expected due to overlapping of the workshop with unexpected meetings of government officials, even though it was tried to change the date of the workshop several times to avoid such type of overlapping. This proceeding contains the papers presented at the workshop and discussions made by the workshop participants on wetland issues.

A Welcome Speech and Program Introduction

By Ato Afework Hailu,
Ethio Wetland and Natural Resource Association

Dear Ato Menberu Alebachew,
General Manager of Amhara Regional Government, Rural Land Administration and Use and Environmental Protection Authority.

Dear invited guests and workshop participants**,**
Ladies and gentlemen,

On behalf of Ethio Wetland and Natural Resource Association I would like to say welcome to this important but challenging workshop.

Wetlands are an ecosystem on which water is available above surface for short or long periods of time be it is naturally created or human made. This type of lands includes: marshes, swamps, riverbanks, shore of lakes, shallow lakes, etc. Wetlands have various socio-economic and ecological benefits, which we are going to discuss in this workshop. Even though wetlands have many benefits, they are undergoing serious damage due to lack of awareness at all levels.

Therefore, in order to minimize the damage to this natural resource, raising awareness of the public is very important and that is one of the objectives of this workshop.

Participants of the workshop are drawn from three weredas namely, Fogera, Bahar Dar Zuria and Dangela, as well as experts and decision makers drawn from concerned government institutions of Awi, West Gojjam and South Gonder Zones and Regional Bureaus.

It is believed that at the end of the workshop, participants will get some understanding and awareness about wetlands and in turn they will transfer the knowledge to other peoples and contribute their own share in the efforts made to reduce the damage to this natural resource.

In this workshop nine different study papers and papers based on field experience will be presented and discussed by researchers and natural resources management experts.

Finally I would like to thank the paper presenters who have devoted their time and are willing to share their knowledge and experience. I also thank Dr. Eshetu Dejen, Director of Fishery Research Center in Amhara Region Agricultural Research Institute and all staff of the Center for allowing us to use the workshop venue and all other facilities.

I thank Ato Menberu Alebachew, General Manager of Amhara Regional Government, Rural Land Administration and Use and Environmental Protection Authority for joining us by devoting his pernicious time. Further, I would like to thank all people contributing to the successful organization of the workshop.

Last not but least, this workshop is realized with the financial support obtained from Finland Embassy in Ethiopia and Global Mechanism of Centre for Combating Desertification.

With this, I invite Ato Menberu Alebachew to officially open the workshop
Thank You.

Opening speech

By Ato Menberu Alebachew,
Rural Land Administration and Use and Environmental Protection Authority,
Amhara Regional State

Dear workshop Participants!
Ladies and Gentlemen!

On behalf of the Amhara Regional Government, Rural Land Administration and Use and Environmental Protection Authority and myself, I would like to say Welcome to Bahir Dar town to attend the Second Regional Awareness Creation Workshop on Wetlands organized by Ethio Wetlands and Natural Resources Association.

Amhara Regional State is one of the largest regions in the country with total area of 170,000 sq. kms and estimated total population of 17 million. The region is also endowed with unique natural and cultural assets. Vast geographical area coverage, diversity in altitude, climate, landform and agro-ecology make the region rich in natural resources and biodiversity.

Despite these facts, the region is highly susceptible to easily perceivable degradation of the natural resources due to different natural, socio-economic and cultural reasons. The long history of human settlement, backward farming systems, rapid population growth and lack of suitable environmental policy, guidelines and strategies are directly or indirectly contributing to the rapid environmental degradation observed in the region. There is a general degradation of natural resources in the region but what initiated this workshop is the serious degradation of wetlands, which should be underlined. As all of us can understand that, apart from their direct contribution for environmental stability, wetlands have many more benefits for our community. Some of these are:

- Draining wetlands and cultivating them for food crop production,
- Source of drinking water,
- Livestock grazing,
- Transportation, and
- Tourism and other economic benefits.

High demands for the diverse benefits of wetlands plus other indirect causes make wetland ecosystems more vulnerable to degradation.

Ladies and Gentlemen!

Leaving alone other things, to make our agriculture sustainable, there should be proper management of natural resources. Wetlands are one of the natural resources where there is serious degradation and which seeks the attention of government, national and international NGOs. In my view, the problem of wetland degradation in our region is mainly due to the low level of awareness on the benefits of wetlands and sustainable management practices among decision makers, experts and the community at large. The majority of us recognize wetlands differently. Usually they are perceived as wastelands, sources of disease and dangerous places for human health.

The problems currently observed on wetlands are not only contradicting with the sustainable principle of natural resource utilization but also contradicting with the land use policy of the country and the international Ramsar Convention signed by many states.

Therefore due to their distinctive ecosystem and diverse benefits, establishing suitable policies, utilization guidelines and strategies is an urgent issue in order to ensure proper management and sustainable utilization of wetlands in our region. Beyond creating awareness, this workshop is has timely and it is good opportunity for all of us to discuss on wetland issues.

Dear workshop participants!
As the main objective of the workshop is awareness creation, it is my belief that at the end of the workshop every participant will have clear understanding of the issue and which enable us to contribute towards the efforts made to achieve sustainable utilization of wetlands resources.

Allow me to use this opportunity to thank Ethio Wetlands and Natural Resources Association for coming to us with this bright idea. Wishing you successful and fruitful discussion, I declare the workshop is open.

Thank you.

Ethiopian Wetlands Distribution, Benefits and Threats

By Afework Hailu,
Ethio Wetlands and Natural Resources Association
P.O. Box 1518 Code 1110
Addis Ababa
Telephone: 011 552 77 91
E-mail:ewrp@ethionet.et

Abstract

Ethiopia, like as many countries in the world, has immense wetland resources. The wetlands in Ethiopia include many forms such as lakes, swamps, marshy wetlands, peat wetlands, flood plains, high mountain lakes, natural and human made ponds. These wetlands have been contributing for the well-being of many Ethiopians for generations and still they are contributing and this will continue for years in the future. The many life supporting services that these wetlands provide includes water supply for humans and livestock, raw materials such as reeds, medicinal plants, fish resources, food through wetland agriculture and many other benefits. Further they have also immense ecological functions that include maintaining the hydrological cycle, flood and erosion control, refuge for the many endemic life forms and others. More than 40 wetlands are identified as important bird areas for the nation, and these sites support some of the endemic bird life and biodiversity of Ethiopia.

However, due to lack of awareness, information and research work on wetlands, excessive resource utilization, drainage, and damage, wetlands in the country are facing a serious thereat that might result in loss of these precious natural resources. Although there are efforts going on to address the problems and the threats that wetlands have encountered, it needs a paramount attention, efforts and commitments from all groups of actors that are concerned about wetlands at all levels from the grass roots to decision and policy makers in order to stop and reverse the threats and bring a sustainable solution to the problem.

Key words: Ethiopia, wetlands, socioeconomic benefits, ecological values, threats,

1. Introduction

Ethiopia is a mountainous country bounded by Sudan in the West, Eritrea in North, Djibouti in North East, Somali in East and Kenya in South. It has an area of 1.1 million square kilometres with an estimated population of 72 million and with a mean population density of 65.45 people per square kilometres. The mix of landforms of the country, which ranges from high mountains to rugged and flat lands, and the rainfall regime coupled with various geological factors have contributed to the formation of various forms of wetlands in the country. It is estimated that the total wetland area of the country is around 2%, a figure that corresponds with the estimated remaining forest area of the nation.

The value of these wetlands is immense to the country, in particular to the citizens those who are dependent on them for their livelihoods for decades. Wetlands in Ethiopia, as other wetlands in different parts of the planet, have been used by humans for generations. They have been supplying food for many people in the country after they are drained and cultivated. Successive drainage of these wetlands for food production has been undertaken for decades in the South-western part of the country, especially in Eastern and Western Wollega, Illubabor and Jimma Zones (Bognetteau et al 2003). Further the study undertaken by Ethiopian Wetlands Research Programme has revealed that there were many wetlands, which over years have been drained to grow hungry-season food crops (Wood, et al, 2000). In addition to draining for growing food crops, wetlands have many socio-economic benefits that include supply of water for humans and livestock, raw material supply for craft making and thatching purposes, fish supply and they are also sites for colleting medicinal plants. In addition to the socio-economic values, wetlands have many ecological functions and they are centres of biodiversity.

However, currently many wetlands in the country are at the edge of collapse due to continuous threats they are facing. Draining for growing food crops which involves double cropping, over harvesting of the resources, year round and over-grazing, the appearance of invasive plant species due to mismanagement of the resources, and the introduction of perennial crops into the wetland ecosystem are the major threats that are posing a dangers to the countries wetlands. On top of that, lack of clear awareness with the general public, decision and policy makers coupled with the absence of a clear policy and direction on wetlands issue are contributing to the problems mentioned before. Thus it is very important that the issue of wetlands is addressed in the country with great responsibility and concern. In this regard this paper tries to raise issues that are pertinent to wetland management in the country for further discussion with concerned groups.

2. Defining wetlands

Terms such as swamp, marsh, floodplains, swamp forest or peat swamps have been part of the vocabulary for many years now. In contrast the general term “wetland” only appeared recently when researchers, development officers and ecologists sought to regroup these different landscape units. It may seem strange that the term, which arose from the specific need to manage wetlands wisely, is in fact difficult to define, covering as it does a wide range of ecosystems.

Wetlands include both land ecosystems whose ecology is strongly influenced by water, and aquatic ecosystems with special characteristics due to their shallowness and the proximity of land. The key is the presence of **water for some significant period of time**, which changes the

soils, the *micro-organisms* and the *plant* and *animal communities*, such that the land functions in a different way form either aquatic or dry habitats.

As Memet (1986, cited by Rogerri 1995) emphasizes, wetlands are in fact transitional areas (eco-tones) and their limits are by definition difficult to delineate precisely. None of the 50 or so definitions currently in use is universally accepted, incontestable and applicable for every purpose (Duggan, 1990).

However, an internationally recognised, wetland definition has been developed by the Ramsar Bureau. The definitions proposed by the Ramsar Convention and the United States Fish and Wildlife Service are given in Box 1 for reference and comparison purpose.

Box 1. Wetland definition

Ramsar Convention

Wetlands are "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters" (Ramsar Convention, 1971).

Fish and Wildlife Service (US)

Wetlands are *"lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface of the land or the land is covered by shallow water"* (Cowardin et al., 1979).

In summary wetlands are areas where water is the primary factor controlling the environment and the associated plant and animal life. They occur where the water table is at or near the surface of the land, or where the land is covered by shallow water. Wetlands are one of the most productive ecosystems on the planet.

3. Socio-economic values, ecological functions and attributes of wetlands

Wetlands are among the most productive ecosystem on the planet. In the past wetlands have been served as the cradle of many civilizations in different parts of the world. Today wetlands continue to be of crucial significance for human beings. They play a role in numerous natural phenomena and processes, such as flood protection and groundwater recharge and as a result they have many functions. Their resources can be used extensively or intensively in order to obtain products (e.g. fish, fodder and reeds) or services (e.g. transport, recreational activities). Finally, they have attributes, such as biological diversity. These functions, attributes (or qualities) and resources are goods and services, which have a value for human beings. Table 3 gives an indication of the range of functions, resources and attributes of the main wetland types.

Table 1. Summary of Values and Functions of Wetlands

	Wetland Categories				
Resources	Flood plains	Marshes	Shallow Lakes	Peat swamps	Swamp forests
Agricultural resources	ν	●	●	●	○
Fishery resources	ν	ν	ν	○	●
Forest resources	ν	ν	○	○	○
Wildlife resources	ν	○	○	○	ν
Natural resources	ν	ν	●	●	●
Water supply	●	●	ν	●	●
Energy resources	●	ν	●	ν	●
Transport	●	○	●	○	○
Tourism	●	●	●	●	●
Research, education, monitoring	●	●	●	●	●
Attributes					
Biological diversity	ν	ν	ν	ν	ν
Uniqueness, naturalness, rarity, cultural heritage	●	●	●	●	●
Functions					
Nutrient retention	ν	ν	●	ν	ν
Nutrient export	ν	ν	●	○	ν
Ground water recharge	ν	ν	ν	●	●
Ground water discharge	●	ν	●	●	ν
Flood control	ν	ν	ν	●	ν
Sediment retention	ν	ν	ν	ν	ν
Erosion control	●	ν	○	○	●
Salinity control	ν	ν	●	○	●
Water treatment	ν	ν	●	ν	ν
Climate stabilization	●	●	●	ν	●
Role in life cycle of some fauna species	ν	ν	ν	●	ν
Ecosystem stability	ν	ν	ν	ν	ν

ν: Value is common and important λ: present ○: absent ● exist

Source: Duggan (1990), modified after James (1991) & others (cited by Roggeri 1995).

4. Wetlands distribution in Ethiopia and Amhara Region

4.1 Wetland distribution in Ethiopia

Wetlands are distributed throughout the world from the polar region to the tropics, from highlands to lowlands. Wetlands are found everywhere and they account nearly for 6.4% of our world (Wetten 1994). However, their distribution is not uniform from one country to another, even within a country it varies from region to region. As a case there are more wetlands in Ethiopian rift valley than in the eastern part of the country.

In Ethiopia there are quite large areas of wetlands in various parts of the country from lowland to highlands. According to the FAO land use map of the country made in 1984, two types of wetlands dominate in Ethiopia:

- **Swamps** – which are permanently flooded areas with herbaceous vegetation (usually greater than one meter in height) , and
- **Marshes** - which are also permanently flooded areas with herbaceous vegetation (usually less than one meter).

These two wetland types cover an estimated 1803 km^2 (0.16%) of the country's surface. In addition there are other important types of wetland areas throughout the country that were not addressed by the FAO land use, such as the floodplains of major rivers (e.g. the Baro-Akobo and the Awash), the Rift Valley lakes, human made lakes (e.g. Koka dam and others), and swamp forests. As a result, the total area of wetlands in Ethiopia may exceed 22500 km^2 (2%) a figure that corresponds with the estimated remaining forest area of the nation.

On the other hand Hillman (1993) listed 77 wetlands with a total area of 13,699 km^2 or 1.4% of the country's land surface. However, other estimates with additional evidences from various sources estimate the total wetland area of Ethiopia at 22500 km^2, some 2% of the country's land surface.

4.2 Wetland distribution in Amhara National Regional State

Amhara Regional state is one of the regions that is endowed with various types of wetlands. Lake Tana the largest fresh water lake in Ethiopia, Fogera and Dembia Flood Plains, Cheffa (Borkena), are some of the many wetlands that dominate the region's land surface. These wetlands make a significant contribution to the livelihood of many citizens in the region. The distribution and the size of the wetlands found within the region are summarized in Table 2.

Table 2. Wetland distribution in Amhara Region

ZONE	Total Area of the Zone	Area of Water in the Zone	Swamp Coverage	% Water	% Swamp	Total	
						In Area	In %
Awi	882,860	111	21,049	0%	2%	21160	3%
Mb/Gojam	1,305,820	19,038	42,378	1%	3%	61416	4%
Mk/Gojam	1,419,092	0	23,181	0%	2%	23181	2%
D/Gonder	1,467,112	939	4,364	0%	0%	5303	0%
S/Gonder	4,604,556	224,037	3,678	5%	0%	227715	5%
Oromiya	422,996	0	9,573	0%	2%	9573	2%
S/ Shewa	1,591,120	0	8,622	0%	1%	8622	1%
W/Hemra	863,048	0	0	0%	0%	0	0%
D/ Wollo	1,787,048	3,902	1,080	0%	0%	232697	0%
S/ Wollo	1,304,036	252	1,464	0%	0%	1716	0%
REGION	**15,647,688**	**248,279**	**115,389**	**2%**	**1%**	**363668**	**3%**

(Source: WBISPP 2002 Unpublished work)

5. Major wetland types and their distribution across the country

As stated above in this paper Ethiopia has various types of wetlands that vary in size type and location. The types of wetlands that are found and dominate in one area might be found rarely in other parts of the country. As an example valley bottom wetlands such as marsh and swampy wetlands, dominate the South-western Ethiopia, whilst lakes and lake associated wetlands are dominant within the Rift Valley. In some parts of the country, like the western lowlands, floodplain types of wetlands are dominant.

For convenience propose the major types of wetlands that are found within the country are summarised as follows based on information collated from different sources (Laykun 2000, Afework 1998, FAO 1984). The list provided here is not exhaustive by any means and numerous wetlands that exist all over the country are not mentioned. It is only the major types of wetlands that are tried to be listed here.

Lake Tana and Associated Wetlands

- Lake Tana
- Fogera Floodplain
- Dembia Floodplain
- Dangela and the surrounding Wetlands

The Ashenga and Hyake Lakes

Wetlands of the Bale Highlands

- Numerous alpine lakes including Gerba Gurecha
- Swamps and floodplains

Wetlands of the Western Highlands

- Keffa, Bench Maji and Sheka including Ghibe and Gojeb Floodplains
- Illubabor, Jimma and Wollega valley bottom wetlands, dominated by marsh and swamps

Lakes of Bisoftu

- Creater lakes – Hora, Bishoftu Guda and Zukala
- Grean, Babogaya, Bishoftu Lakes, etc.

Lakes and associated wetlands of the SW Rift Valley

- Lakes Ziway, Langano, Abjiyata, Shalla
- Lake Awassa and Chelekleka Wetland system
- Lakes Abaya, Chamo, Chew Bahar
- Lake Turkana

Lakes and Swamps of the Awash River System

- The Upper Awash Valley – Dillu Meda, Aba Samuel
- The Lake Beda sector
- The Gewane Lakes/Swamp Complex
- The Dubti, Afambo and Gemari Lakes/Swamp complex
- Lake Abe and delta

Lakes of the Afar Depression

- Lake Afera
- Lake Asale
- Dallol Depression

Western River Floodplains

- Alwero, Baro, Akobo, Gilo
- Chomen, Fincha Swamps
- Dabus Swamp
- Beles Floodplain

Lake Alemaya and Associated Wetlands and

Central Ethiopian Highland Wetland Complex.

From the above list one can conclude that Ethiopia have an immense wetland resources which need attention for their existence and sustainable use.

6. Ecological functions and socio-economic benefits of Ethiopian Wetlands

6.1 Ecological functions of Ethiopian Wetlands

The ecological function of wetlands in the country is poorly studied and recorded. However, Ethiopian wetlands, as with any wetlands around the globe, have also an immense ecological importance. Some of the ecological functions that the Ethiopian wetlands have, include:

- ✓ The Rift Valley lakes and wetlands support thousands of birds, serve as stop-over sites for migratory species including those worldwide endangered bird species. An example is the large number of lesser flamingos (230,000) reported between 1990 and 1994 in Lake Abijata (Siraj 2004).
- ✓ Overall more than 40 wetlands are identified as important bird areas within the country as a whole that support a variety of bird species including some endemic bird forms.
- ✓ Wetlands support a wide range of fauna and flora and they are centres of biodiversity,

- ✓ They also provide ground water recharge and discharge. In many parts of highland Illubabor many perennial and annual springs are associated with the existence of wetlands, etc

Wetlands are habitat for wild life. Large number of pelicans and other birds gathered on wetlands around Lake Tana

6.2 Summary of socio economic values of the country's wetlands

Further in Ethiopia wetlands have varied socio-economic values that include:

- ✓ Food supply: through draining and recession agriculture wetlands have been used for growing food crops in different parts of the country for decades,
- ✓ Wetlands are important sites for grazing: throughout the country wetlands are important sites of dry season grazing – e.g. Borkena, Fogera Flood plain, etc
- ✓ Raw material supply: reeds, papyrus,
- ✓ Water - for human use and livestock,
- ✓ Fish supply e.g. Lake Tana, Rift Valley Lakes, etc
- ✓ Medicinal plants: especially for livestock as well humans,
- ✓ Sites for tourist attraction – Rift Valley Lakes, Lake Tana, etc

7. Major wetland threats in Ethiopia and impacts

7.1 Major threats to the wetlands of Ethiopia

One cannot exhaustively list the of threats that Ethiopian wetlands are confronting at present, since the type of threats varies from one place to the other and due to the existence of a variety uses of wetlands within the country. However, an effort has made to compile many of the threats that the Ethiopian wetlands are currently encountering. For convenience of presentation the threats are grouped under different categories based on their nature and are briefly addressed here.

Lack of awareness, information and research work on wetlands

Lack of awareness within the general public, policy and decision makers within the country has impacted on the use and conservation of wetlands within the country. Little information is available for the general public due to limited research work on wetland resources. The information that exists from the limited research work is not sufficiently available for the general public, resource mangers, and decision and policy makers in order to advance wetland issues within the country. No co-ordinated effort has been made in the past to make the information available for the concerned authorities and the general public. Thus this has impacted on the use of the wetlands on sustainable manner and has contributed to the misuse of the resource base. Hence many of the wetlands are drying up and disappearing.

Draining wetlands for agriculture use

Draining of wetlands for agricultural purpose is a century-old practice in some parts of the country, mainly in Southwest Ethiopia. However, improper draining mechanisms, double cropping, growing of perennial crops such as sugarcane within wetlands ecosystem has become a major threat for the survival of wetlands. Long-term draining interferes with the ecological recovery of the wetland system and will speed up the drying up of the wetland.

Grazing in wetlands

Throughout Ethiopia wetlands have been, and still are, important sites for livestock grazing. Wetlands are the last destination for grazers during the dry months in the country from North to South and East to West. It might not be overestimating to say that the survival of the country's livestock is unthinkable without the existence of these precious resources. However, through time with the increase in the livestock population, shortages of fodder and the expansion of agricultural activities upslope have increased grazing pressure on wetlands. The pressure from grazing has resulted in a change in the characteristics of wetlands, some which have changed into rough grazing land. The threats from grazing can arise from overstocking in the wetland, year-round grazing which excludes ecological recovery and soil poaching by livestock due to grazing in wetlands during the wet season. Whilst compaction of the wetland by livestock has a significant impact on the infiltration capacity of the wetland soil and hence affects the hydrological system of the wetland itself. Loss of biodiversity is one of the impacts that over-grazing has on wetland resources.

Over exploitation of wetland resources

Wetlands have diverse resources that have immense values for the human resources. Many citizens are dependent on theses resources for their livelihoods. Out of the many resources that wetlands provide for humans the most important include fish, reeds, water, medicinal plants, papyrus, etc. However, the use of these resources is not often based on a studied assessment and their sustainability is under a serious threat. Over-exploitation of these resources is a major threat for their survival. In this regard a good example of over-exploitation could be the fishery resource from Lake Tana in Amhara Regional State. There are some reports that the catch size from the lake is declining over years. This is associated with indiscriminate harvesting of the

resources from the lake and the degradation of wetlands around the lake that have a significant role in the breeding of the fishery resources.

Excessive exploitation of the resources from wetlands can lead to a direct collapse of the resources within the wetland system, and in some cases the wetland itself. A good example of this scenario is the collapse of Lake Alemaya in Eastern Ethiopia due to combined actions of human use, especially excessive water withdrawal by the community within the vicinity (Brook 2004).

Deforestation, siltation, soil erosion and land degradation

Deforestation within a wetland catchment will be a starting point for an accumulation of silt within a wetland ecosystem. Loss of vegetation within the catchment will result in accelerated soil erosion and consequently lead to land degradation which in general is a major cause for an accumulation of silt within the wetland. The accumulation of silt within the wetland will lead to a complete change in the wetland ecosystem. It might result in a complete change in the biodiversity, affect the water holding capacity of the wetland and in the worst cases cause a collapse of the wetland itself.

In some parts of the country many wetlands have disappeared due to siltaion. Although the collapse of Lake Alemaya is mainly associated with excessive water extraction by the locals, siltation has also played its part in the loss of the lake itself.

Urbanization, settlement, pollution form urban centres and industrialization

Due to the attractive nature and abundance of natural resources in wetlands many urban centres around the globe, including Ethiopia, are located near or adjacent to wetlands. Good examples within Ethiopia are Bahar Dar, Awassa, Alemaya and Debreziet which are located near lakes, whilst Gimbi town is also located near an extensive swamp wetland. However, through time the presence of these urban centres or settlements has become a source of threats through pollution to the resources.

Other major threats include:

- ✓ Introduction of perennial crops into wetland ecosystem such as eucalyptus,
- ✓ Planting of high water demanding plants in the wetland ecosystem such as sugarcane,
- ✓ Appearance of invasive plants species within the wetland,
- ✓ Government policy that encourages draining wetlands to meet the country's food shortage, and
- ✓ Introduction of alien plant species into wetland ecosystems.

7.2 Overall impact of threats on wetlands

The overall impact from the aforementioned threats to the Ethiopian wetlands is immense and could result in the loss of many wetlands. The study undertaken by EWRP in Illubabor has revealed this reality and some of the wetlands that played a significant role in the lives of the local communities have disappeared due to mismanagement and unwise use. The loss of such wetlands will firstly and directly jeopardise the lives of many communities that are dependent on them for their livelihoods. Secondly it is a net loss to the country as well.

In summary the impacts from the current threats on wetland resources in general have the following negative outcomes:

- Decline and eventually total loss of food production,
- Loss of resources that will be collected from the wetlands,
- Lowering ground water table and drying up of water springs,
- Change in water quantity and quality,
- Change in the ecosystem as a whole,
- Loss of biodiversity, and
- Loss of dry season grazing site, etc.

8. Summary of efforts made to address wetland issues in Ethiopia

Wetlands have received little or no attention in Ethiopia by decision and policy makers and general public due to low level of awareness. Thus the attention paid to wetlands as a whole is very low and non-significant despite the fact that these areas contribute to the livelihood of millions of Ethiopians throughout the country.

However, independent efforts and works by different institutions have been undertaken over the years in different parts of the country. The studies and efforts made by different bodies provide a base for future work on the wetland areas in the country. Thus it worth mentioning the studies and the efforts made so far to address issues that are pertinent to wetlands within the country. The studies undertaken and the institutions involved in the studies are briefly mentioned as follow:

- Ethiopian Wildlife Conservation Organization has undertaken a study on wetland distribution, preliminary mapping and gathering of information for protected area management.
- Ethiopian Wildlife and Natural History Society through study on Important Bird Areas of Ethiopia has become involved in wetland study and management.
- The National Environmental Protection Authority has actively participated in advancing wetland issues since 2000 through coordinating various efforts that include, playing a coordinating role for the Wetland Core Team, undertaking an inventory of 41 major wetlands in Ethiopia, hosting national consultative workshop on the Ramsar Convention, collaborating with IUCN on wetland issues and hosting of various discussion forums on wetland issues.
- Various scholars from Universities and research institutions have undertaken a number of research works, especially in the Rift Valley Lakes/wetlands.
- Ethiopian Wetland Research Programme (EWRP) in Illubabor Zone undertook the most comprehensive study on wetlands over three years. The project was undertaken by Huddersfield University from UK in collaboration with Addis Ababa University with a backstopping role was undertaken by IUCN Eastern African Regional Office. The findings from the research work were disseminated in various levels from the grass root level to policy and decision makers. Further the work from this project has contributed to awareness raising on wetland issues within the country.
- Ethio Wetlands and Natural Research Association (EWNRA), was established at the termination of EWRP in order to take forward the works undertaken by the project. Since its establishment, EWNRA has continued to build on some of the works that was started by the previous project mainly in the area of information dissemination and awareness creation, capacity building, technical material preparation and dissemination, testing sustainable wetland management practices and others.

Summary of efforts undertaken to advance wetland issues by EWNRA includes:

- ✓ Awareness creation within the larger public,
- ✓ Capacity building within farming community, GOs and the general public,
- ✓ Field studies and further investigation using PRA tools, including IK,
- ✓ Community based wetland and watershed management implementation,
- ✓ Involvement in Amhara Region include:
  - o Undertaking the first awareness creation workshop in collaboration with Wetland Action and the Amhara National Regional State Bureau of Agriculture,
  - o a study on wetlands around Lake Tana Region and Borkena Wetland and
- ✓ current implementation of a catchment-based wetland resource management pilot project in Fogera, Dangela and Bahar Dar Woredas.

9. Conclusion

Wetlands are valuable natural resources and need attention to yield the maximum benefit for the present and future generations. In Ethiopia, due to limited information on wetlands and lack of commitment by the general public, little work has been done although thousands and millions citizens are benefiting from wetlands. The threats to these wetlands and their resources are escalating with pressures from land shortage for agriculture and increase of population. The threat from over-use and unwise management of these resources might cause significant damage to the wetland themselves and to the ecology of their environments and which might reach a larger area. Further the loss of wetlands and their resource will also directly affect those who are directly and indirectly dependent on them for their livelihood. In addition loss of many wild animals and birds will be evident including those that are endemic to the nation. If the current threats are to be addressed and sustainable use of wetlands encouraged efforts have to be made by all groups including the general public, researchers, resource mangers, decision and policy makers as a whole.

The philosophy that says "***conversion of useless, unhealthy wastelands into productive land***" is a dangerous when applied to wetland resources and should be stopped. This is causing great threats against this precious resource that the county owns.

EWNRA is happy to cooperate and work with others who have an interest in sustainable wetland and natural resource management issues.

References

Afework Hailu, 1998. An overview of wetland use in Illubabor Zone, South-western Ethiopia, EWRP, Metu.

Bognetteau E. et al., 2003. Wetlands and Food Security in South-west Ethiopia: An economic, ecological and institutional analysis for sustainability, Study Report, October 2003.

Brook Lemma, 2004. Human intervention in two lakes: Lessons from Lakes Alemaya and Hora-Kilole, Proceedings of the "National Consultative workshop on the Ramsar Convention and Ethiopia, March 18-19, 2004, Addis Ababa Ethiopia.

Cowardin, L.M., V. Carter, F.C. Golet & E.T. LaRoe, 1979. *Classification of Wetlands and Deepwater Habitatas of the United States*, FWS/OBS – 79/31. Washington D.C.: U.S. Fish and Wildlife Services, U.S. Department of the Interior. 131 pp.

Dugan, P.J. (ed)., 1990. Wetland conservation: A Review of Current Issues and Action Required. IUCN, Gland, Switzerland 94pp.

FAO, 1984. Assistance to Landuse, Ethiopia, *A land resources inventory for landuse planning*, AG: Dp/ETH/78/003, Technical Report 1. Rome.

Hillman, J.C. (ed)., 1993. *Ethiopia: Compendium of Wildlife Conservation Information*. NYZS – The Wildlife Conservation Society, International, New York Zoological Park, Bronx, NY and Ethiopian Wildlife Conservation Organisation, Addis Ababa, 2 Vol.s. 786pp.

James, R.F., 1991. *The valuation of Wetlands: Approaches, Methods and Issues*. PHPA/AWB Sumatra Wetland Paroject Report No. 29. Bogor: Asian Wetland Bureau-Indonesia (AWB-I) & Director General of Forest Protection and Nature Conservation (PHPA). 95.

Leykun Abunie, 2003. The distribution and status of Ethiopian Wetlands: an overview, proceeding of a seminar on the resources and status of Ethiopia's wetlands, IUCN.

Memet, L., 1986. Terres et eaux: approaches techniques pour conserve et metre en valeur les zones hunides. Paris: Centre d'Etudes des Systemes et des Technologies Avancees (CESTA). 224pp.

Ramsar Bureau, 1971. Proceedings of the international conference on conservation of wetlands and waterfowl, Ramsar, Iran, 30th January – 3rd February 1971, International Wildfowl Research Bureau, Slimbridge.

Roggeri, H., 1995. *Tropical Freshwater Wetlands: A Guide to Current Knowledge and Sustainable Management*. Developments in Hydrology 112 Kluwer Acadamic Publishers, Dordrecht 363pp.

Siraj Bekele, 2004, Wetlands of Oromia, Their conservation and contribution to food security and poverty reduction. Proceedings of the "National Consultative workshop on the Ramsar Convention and Ethiopia, March 18-19, 2004, Addis Ababa Ethiopia.

Wood A. P., 2001. The role and importance of wetlands in Ethiopia. Proceedings of the wetlands awareness creation workshop of the ANRS, January 2001, Bahar Dar.

Woody Biomass Inventory and Strategic Planning Project, 2002. A strategic plan for the sustainable development, conservation, and management of the woody biomass resources in Amhara Region, Unpublished document, Final Draft June 2002.

Wetlands of Fogera Wereda: Use, Management and Threats

By Kefie Minale,
Fogera Wereda Agriculture and Rural Development Office
P.O. Box 15
Wereta

Introduction

Fogera is one of the weredas found in southern Gonder Zone of Amhara region. The total area of Fogera wereda is 117.414 km^2 and total population of the wereda is estimated to be 233579. The wereda has suitable landforms for agricultural purposes. Out of the total area of the wereda 43.8% is used for annual crops, 23% is for grazing and bush lands whereas forestlands are estimated to cover 8.72% of the total area.

Wetlands in the wereda are found on the western side of the main asphalt road connecting Bahir Dar and Gonder merging with Lake Tana. The area of wetlands in the wereda is estimated at 25.052 square kms out of this 2-3 sq. kms are flooded and wet all year round.

Benefits of wetlands in the wereda

Wetlands give several benefits for the community in the wereda. Some of these are:

- Cultivation for crop production,
- Livestock grazing,
- Habitat for birds,
- Raw material supply for hand crafts making,
- Traditional medicines,
- Fish,
- Water supply for human and livestock consumption and other benefits.

Major problems observed on wetlands in Fogera Wereda

The ever increasing of population, coupled with backward land use and farming system, catchment degradation and overgrazing has resulted in serious degradation of wetlands in the wereda. As a result wetlands are converted into permanent cultivation and grazing fields. Due to deforestation and degradation of the surrounding catchments, water flow into the wetlands through infiltration has decreased and wetlands hold insufficient water. There is high siltation on wetlands due to erosion in the catchments. Another problem observed is the expansion of plantation of unsuitable plants in wetlands, including eucalyptus.

Measures taken on the prevailing problems

The wereda is trying to raise the awareness of the community and implementing catchment-based soil and water conservation activities. Activities currently underway are:

- Construction of different physical conservation structures
- Raising and planting of different tree species and grasses to sustain the physical structures.
- Integrating with soil and water conservation practices with agro-forestry on the uplands
- Controlling use of wetlands for crop production, overgrazing and plantation of eucalyptus tree.

To conclude there are some practical works observed in the field, which could be considered as good starts that will improve the management of wetlands by raising the awareness of the community through continuous advice and example.

Wetlands of Dangela Wereda: Use, Management and Threats

By Alemayehu Guade
Dangela Wereda Agriculture and Rural Development Office
P.O. Box 133
Dangela

Background information of the wereda

Dangela wereda is found in Awi Zone, bordered by West Gojam in the northwest and northeast, Beni Shangule Gumuz regional state in northwest, Fagita Wereda in the south and southeast. The wereda has a mean annual rainfall of 1400mm and 16^0c mean annual temperature. The wereda has a total area of 419.2 square km with a total population of 198,117 (101,029 male and 97,088 female).

Distribution of wetlands in the wereda

Of the total area of the wereda, wetlands cover about 10% (4.192 sq. km) out of which about 0.419 sq. km is found in the Woyina Dega agro-ecological zone and the remaining 3.773 sq. km is found in Kola agro-ecological zone.

Benefits of wetlands in the wereda

Wetlands in the wereda are the main source of water. They are the source of many springs. They are also home (habitat) for many fauna and flora. Some of wetland dependant trees observed in the wereda are Phonex (*selen*), Sygijeun (*Dokima*), and *Ficus spp*. There are also grass species growing on the wetlands locally called tucha*, ketema, berbenza and others.* Different birds like *Sabissa, Gagano*,(Watled Ibis), *Yaibra*, Blue winged, *Jigra, Qock* also live in wetlands.

Most of the wetlands in the wereda are used as grazing land for livestock. The community also harvests wetland grass for thatching, making of rope, floor covering on ceremonial holy days and some people generate income from selling of wetland grass.

Damage caused on wetlands due to misuse and mismanagement

Most of wetlands at present are disappearing. Some of the problems currently observed contributing to the loss of wetlands and the out comes there off are over-grazing, conversion of wetland into agricultural field, siltation due to erosion from uplands, loss of fertility, expansion of eucalyptus plantations at spring heads and on wetlands, formation of deep gullies and land loss, disappearing of wetland fauna and flora, drying up of water springs and wetlands, and clearing up of vegetation cover on catchments.

Current wet land utilization and management practices in the wereda

Some community groups have a local committee, which manages wetlands used for harvesting of thatching grass. They protect it from illegal harvesting before it gets matured. Even some farmers fence wetlands used for grass harvesting and springs heads to prevent the entrance of livestock. They also plant trees, which they believe are good for the springs. Some peasants are trying to prevent gully expansion by planting fast growing trees like Sesbania.

Future Recommendations

- Reducing free grazing,
- Transferring people settled on steep slope to flat land,
- Ensuring food security, by efficiently exploiting land resources,
- Reforestation of steep uplands and area closure,
- Developing water springs,
- Gradual improvement of livestock breeds to reduce livestock numbers,
- Creating awareness in society on wetlands

Wetlands of Bahar Dar Zuria Wereda: Use, Management and Threats

By Getachew Nigatu,
Bahar Dar Zuria Wereda Agriculture and Rural Development Office
P.O. Box 119
Bahir Dar

Introduction

Bahar Dar Zuria Wereda is one of the weredas found in West Gojjam administrative zone. The wereda is located between altitude of 1500-1800m above sea level with mean annual rainfall of 800-1250mm and mean annual temperature of 28-32^{0}c. Total area of the wereda is estimated at 197.995 sq. km out of which 64.777 sq. km is water bodies, 47.751 sq. km is cultivation land, 21.823 sq. km is grazing land, 15. sq. km is bush and forest land and the remaining 17.368 sq. km is land used for different social infrastructures. Uncultivated lands due to various reasons are estimated to 31.271 sq. km. The wereda has 36 kebele administrations with total population of 230432 (133707 male and 96725 female).

The topography of the wereda is characterized by flat land as a result of which there are many wetlands in the wereda. Some of the kebeles, which have large areas of wetlands, are Wejeta, Lijome, Debanta, Lata, Chenta, Y/Mesenta, Zanzelima, Yibab and Weramit.

Even though there is a general understanding that wetlands are important natural resources, which seek proper management, there are no practical work is in place.

Benefits of wetlands in the wereda

Papyrus, one of important wetland resources is used as source of income for farming communities and some urban dwellers, including those in Bahar Dar. Papyrus is used as a raw material for making of different handicrafts, like sleeping mats and household utensils. The flowering part of the plant is sold in towns to be used for floor covering during occasional ceremonies. Wetlands are used for livestock grazing. Farmers use them as the main grazing field because they are the only places which look green all year round.

Other benefits are:

- thatching grass supply,
- fish supply,
- habitat and source food for different birds and other animals i.e. sources of biodiversity,
- cultivation field for different crop production including irrigation agriculture for sugar cane production.
- ecological benefits such as recharging groundwater and maintaining continuous flow of streams and for water supply scheme. (For instance source of water supply for Bahar Dar town is from a wetland at a place called Enfranze.) Wetlands are sources (origin) of many streams and lakes.

All the benefits of wetlands mentioned above attract the attention of everybody to take necessary managements.

Wetland use and management practices in the wereda

Wetland management practices in the wereda are not good. Clearing of the surrounding vegetation is a common practice. For instance in the 2003, due to the declining of the water level of Lake Tana, many farmers were involved in uprooting papyrus vegetation for fuel wood. In addition, papyrus vegetation in many places has been destroyed by deliberate fire outbreaks. More than 10 hectares of papyrus vegetation has been destroyed in Zanzelima kebele at a place called Debre Mariam. It is easily recognizable that fire outbreaks not only destroy the vegetation but also the fertile soil and animals of the wetlands. The wereda has tried to stop the damage by in collaboration with kebele administration and wereda police force. However, it is difficult to put out the fires, as the soil is rich in humus continue burning for extended days. The wereda agriculture and rural development office is communicating with kebele administration requesting them through letter to inform framers stop damaging activities. However follow-ups so far are minimum and not satisfactory.

Roles of local institution on wetland management

The understanding of the communities and their leaders on wetland is limited. The understanding is that those wetlands are free access resources and can be used except using it for cultivation i.e. no body is concerned about their management. Serious problems currently observed on wetlands are siltation and catchment degradation.

Measures that should be taken in the future

- Raising awareness of the local communities on the proper utilization of wetlands by understanding the ecological benefits of wetlands.
- Controlling soil erosion will reduce siltation on wetlands. Therefore it is important to implement soil and water conservation works.
- Improving water utilization system around wetlands.
- Control livestock grazing
- Wisely using papyrus vegetation in such away that may not harm sustainability.

Conclusion

To use wetland resources in the wereda in a sustainable manner, everybody should give due attention. The pilot demonstration project of Ethio Wetlands and Natural Resources Association in the wereda is very important in this regard. It is very important to work with the organization collaboratively. I would like to ensure that Bahir Dar Wereda environmental protection and land administration team is ready to give due attention to the sector.

Establishment of Department of Fisheries and Wetland Management in Bahar Dar University

By
Birehanu Teshale
Bahar Dar University Department of Biology
Tel: 058 220 59 44

Rationale

Fisheries and wetland management have acquired a prominent dimension worldwide over the past decade. This has been necessitated by the tremendous perturbation of fresh water ecosystem by man. Further, the high demand for food for the ever-increasing population requires to be supplemented through harvesting of aquatic resources. Although Ethiopia has huge water and aquatic resources, the contribution to the national economy is rather low. Beside, studies on fishery resources have not received much attention in Ethiopia. As a result, conservation of aquatic ecosystem in Ethiopia has been hampered by lack of knowledge on how these systems function. Aquatic resources in Ethiopia have not been fully utilized due to well-trained personnel in wetlands and fishery science. There is an urgent need for scientific and educational instaurations in the country to increase the number of trained professionals in this field. This is particularly urgent in view of water becoming a limiting resource in most places of Ethiopia, and this department endeavor to fill this gap that has been existed for a long time.

This department will be the first of its kind in the country. The courses to be taught in this program involve a variety of natural resources fields including fishery management, aquaculture, water quality management, wetlands and watershed management and law enforcement, and wildlife management. It will also address the interrelationships between the physical, chemical and biological aspects of aquatic systems, including land water interactions. Apart from producing an all rounded graduates in fisheries and wetland and wild life sciences, the program promotes interactions between teachers, students, consultants and policy makers through short-term courses, workshops and symposiums in wetlands and fishery sciences.

Objectives of the program

The proposed program aims at producing professionals capable of discharging duties in research, teaching and extension undertakings in aquatic systems and able to formulate and implement policies for better management of these ecosystems.

The specific objectives of the department of fisheries and wetland management are:

- To equip students with theoretical knowledge and practical skills to deal with problems of fishery, aquatic resources, and wetlands, and to enhance sustainable management of these resources;
- To promote awareness of and enhance knowledge in the value of aquatic and wetlands ecosystems;
- To train graduates who are able to interpret and implement policies related to fishery, wetlands and wild life resources conservation, utilization and management; and

- To prepare graduates for the societal and scientific challenges in aquatic sciences and for self-employment in aquaculture, consultancy etc.

Course Distribution

Year I

Code	***Course Title***	***Semester/credit hour***	
		I	II
FWM 101	General ecology	3	
FWM 103	Biology of aquatic vertebrate	3	
	Ethics	2	
	Civics	2	
	Report writing	2	
	Introduction to Statistics and Biometrics	4	
	Agro meteorology	2	
	Total	**18**	
FWM 121	Introduction to wetlands and watersheds		2
FWM 102	Biology of Vertebrate		3
FWM 112	Limnology		3
FWM 114	Ichthyology		3
FWM 116	Fisheries Biology		3
	Research methods in fisheries and wetland management		2
	Introduction to economics and agribusiness management		3
	Total		**19**

Year II

Code	***Course Title***	***Semester/credit hour***	
		I	II
FWM 211	Project planning and management	2	
FWM 201	Biology of planktons and macrophytes	2	
FWM 215	Aquatic toxicology	3	
	Fisheries management	3	
	Introduction to soils	3	
	Introduction to natural resources management	3	
	Communication skills	2	
	Total	**17**	
FWM 222	Wetland management I		3
FWM 212	Aquaculture I		3
FWM 304	Environmental chemistry		3
	Fishery technology		2
	Summer apprenticeship		4
	Entrepreneurship		2
FWM 224	Hydrology and wetlands		2
FWM 216	Aquatic biology seminar		1
	Total		**20**

Year III

Code	***Course Title***	***Semester/credit hour***	
		I	II
FWM 321	Wetland management II	3	
FWM 331	Wild life ecology and management	3	
FWM 301	Water quality management	2	
FWM 311	Aquatic resources economics	2	
FWM 313	Diseases of fishes and other aquatic organisms	2	
FWM 303	Senior research project	2	
	Farming system research and development	3	
	Total	**17**	
FWM 312	Aquaculture I		3
FWM 314	Aquatic animals nutrition		3
FWM 332	Fisheries and wildlife law, policies and administration		2
	Aquatic microbiology		3
FWM 302	Extension and rural sociology		3
	Environmental impact assessment		2
	Total		**17**

Soil Erosion and Sedimentation: The Case of Lake Alemaya

By
Fekadu Yohannes (PhD)
USAID/AMAREW Project,
P. O Box 61,
Bahir Dar
E-mail: fekaduyoh@yahoo.com

Abstract

Land degradation due to soil erosion is the major problem facing Ethiopia today. In Lake Alemaya catchment soil erosion is caused by the intense rainfall, steep topography, and poor vegetation cover coupled with cultivation of steep lands, and inadequate conservation practices. Sediment from the catchment has affected the storage capacity of Lake Alemaya. This study has integrated the Agricultural Non-point Source Pollution Model (AGNPS) and the technique of Geographic Information System (GIS) to quantify soil erosion in Lake Alemaya catchment. After application of the AGNPS, it appears that 66 % of the catchment has a soil erosion rate of 10 to more than 80 tons/ha/year. The annual soil loss is estimated at 31 tons/ha, which is more than the permissible value of 1-16 tons/ha for different agro-ecological zones of Ethiopia. The sediment yield of the catchment is about 10,148 tons with a delivery ratio of 6.82 %. An effective management plan is needed for the conservation and rehabilitation of the catchment and maintaining the storage capacity of Lake Alemaya.

Key words*: Soil erosion, Sediment yield, Lake Alemaya catchment, AGNPS model*

1. Introduction

The rates of soil erosion and land degradation in Ethiopia are frighteningly high. Worst affected are the Ethiopian highlands (>1500 m a.s.l), which cover 44% of the country's total land area and account for more than 90% of the agricultural activity and production systems in the country. According to the Ethiopian Highlands Reclamation Study EHRS (1984), 50% (27 million ha) of the Ethiopian highlands is severely eroded and will unlikely be able to sustain economic crop production in the future. Land degradation is seriously threatening the economic and social development of the country as a whole.

Current rates of soil erosion documented in Ethiopia range 16-300 t $ha^{-1}yr^{-1}$ (Hurni, 1988). The Ethiopian Highlands Reclamation Study (EHRS, 1984)) estimated the average annual soil erosion rate of 100 t $ha^{-1}yr^{-1}$ for the Ethiopian Highlands. The steep and rugged topography and intense rainfalls have caused severe soil erosion damage. The indiscriminate forest clearing, complete removal of crop residue, overgrazing, and poor soil management and land use practices further aggravate the situation. The consequences are depletion of water resources, declining soil fertility, shortage of cultivable land, non-or under employment of the rural population and food insecurity. An increasing number of the population is becoming vulnerable to the effects of drought due to land degradation.

The problem of land degradation or soil erosion and sediment deposition can be better perceived at a watershed scale. A watershed is a hydrologic unit and operates as a definable system. There is a dynamic relation and interaction of all components of the watershed: Soil, water, and vegetation. If one portion of the watershed is degraded, the stability of other interrelated watershed elements become disrupted.

The effects of soil erosion are grouped as on-site effects and off-site effects, but all occurring within called watershed. The on-site effect of soil erosion is generally reflected in a reduction of soil productivity through the loss of chemical, physical and biological fertility. Soil eroded from one part of the watershed results in off-site effects usually occurring on lower parts of the watershed. Gully cutting, sedimentation of irrigation and drainage canals, lakes and rivers, and eutrophication of water bodies, are some of the off-site effects of erosion.

1.1 Classification of watersheds

The Ethiopian highlands are the center of economic activity of the country and are characterized by enormous ecological, environmental, agricultural and cultural diversities. An understanding of the nature of a watershed helps in assessing the spatial and temporal variation land degradation caused by the mismanagement of natural resources and for simulation of erosion and sedimentation processes as well as planning interventions to mitigate the problem. The intensity of planning interventions by and large depends on the scale of the watersheds. Watersheds can be classified according to different criteria. Based on spatial scale, watersheds are classified into small watersheds (<100 sq. km.), medium-size watersheds (100-1000 sq.km), and large watersheds (>1000 sq.km). Such a classification is arbitrary. A watershed is rarely homogenous in its characteristics. Hence a large or heterogeneous watershed can further be divided into, on an average sense, homogenous planning units called sub-watersheds.

Again, the watershed can be classified based on land use as agricultural, urban, forest, rangeland, wetland, and mixed watershed. Most of the watersheds of the Ethiopian highlands are agricultural, while some are mixed consisting of urban and agricultural lands. Most lakes in Ethiopia are found in close association with towns and cities in the same watershed making it a mixed watershed. Bahar Dar, Debre Zeit, Zeway, Arba Minch, Haik, Alemaya towns are good examples to this. This classification helps to identify sources of pollution of lakes and rivers and target interventions to control the damage caused by soil erosion and sedimentation.

1.2 Sedimentation and storage capacity of lakes and wetlands

Lakes in Ethiopia are rich in aquatic life (fish, birds, and vegetation). They are important for fishing, recreation, irrigation and domestic water supply, transport, etc. Lakes with an average depth of less than 6m and surface area from 1ha to 100 sq km can be referred to as wetlands. The term wetlands can include shallow lakes and adjacent swampy or marshy lands. Swamps are rich in aquatic life; they also serve as sediment filters and as ground water recharging areas.

Over the last century, the quality and storage capacity of lakes in the country has declined drastically. The lake ecosystem and water resources are in danger due to deforestation of upland watersheds, erosion, sedimentation, and competitive water use and increased pollution. Fertilizers used on adjacent agricultural fields and in the catchment are easily transported by runoff into the lakes causing nutrient loading. Nutrient loading has changed many lakes from clear water and rich in aquatic life to turbid and non-vegetated lakes. This phenomenon is called lake eutrophication. With increased nutrient loading the biomass of aquatic macrophytes (large plants) increases. Submerged plants largely disappear when turbidity increases. Prolonged eutrophication of vegetated lakes can lead to a gradual increase of phytoplankton biomass (small plants) that covers the plants and cause shading effect that ultimately leads to a collapse of the vegetation due to light limitation. Fish and birds that are associated with vegetation or feed on them or find refugee against predators disappear. Then restoration of non-vegetated turbid lakes to the clear vegetated state becomes very difficult.

The storage capacity of many lakes in Ethiopia is also notoriously affected by sediment deposition. The source of sediment is soil erosion mainly in the upper unprotected watershed. With increased sedimentation, the depth of the lake decreases leading to a reduction of the storage capacity and seasonal increase of the lake water surface area. A larger surface area is associated with increased evaporation loss impacting negatively on the water balance of the lake. Furthermore, the heat storage capacity of the lake reduces for the incoming solar energy with a further decrease in depth of the lake water. This means, unlike deep lakes, the lake water temperature quickly rises for more evaporation loss. It can thus be concluded that as a result of the above phenomenon the life of lakes becomes very much shorter and more quickly disappear towards the latter life of the lake as the depth drastically decreases. This situation is now observed in many lakes of Ethiopia and could lead to severe socio-economic problems unless the Government and communities take urgent and integrated and sustainable measures.

1.3 Assessment of soil erosion and sedimentation

The Soil Conservation Research Project (SCRP) of the Ministry of Agriculture has since 1982 tried to monitor runoff and soil erosion on few selected catchments of the Ethiopian highlands using runoff plots and installing gauging stations. However, such experimental methods are rather expensive and often unaffordable. Many erosion models have been developed ranging from

empirical ones like the USLE (Universal Soil Loss Equation) (Wischmeier and Smith, 1978), which can provide long-term average annual soil loss estimates at field level, to process-based models such as AGNPS (Agricultural Non-Point Source) pollution model for predicting soil erosion and its spatial and temporal variations at the watershed level (Singh, 1995).

2. The Case of Lake Alemaya

2.1 Introduction

Lake Alemaya Catchment, located in Eastern Hararghe, is a typical example of the on-site and off-site effects soil erosion. The storage capacity of Lake Alemaya has rapidly decreased due to sedimentation of the eroded material from the catchment. The water supply of surrounding towns that depend on the lake is severely affected. A detailed assessment of soil erosion was thus urgently needed to identify critical areas and reduce or control the on-site and off-site erosion damage through planning of a proper conservation and rehabilitation program of the catchment.

The objective of this study was to use the AGNPS model to estimate soil loss and sediment yield of Lake Alemaya catchment, and the life of the lake to provide a uniform method for evaluating potential sediment problems on other lake watersheds in Ethiopia. The model was integrated with the geographic information system (GIS) technique for input and output of spatial data.

2.2 Materials and methods

2.2.1 The AGNPS model

The AGNPS was developed by the U.S. Department of Agriculture's Agricultural Research Service in cooperation with the Minnesota Pollution Control Agency and the Soil Conservation Service (Young et al., 1989). AGNPS is event-based model. It can be used to analyze and provide estimates of runoff, and sediment transport for watersheds ranging in size from a few hectares to up to 20,000 ha. All watershed characteristics and inputs are expressed at cell level with resolutions of 0.4 to 16 ha. Runoff and transport of sediment and nutrients are simulated for each cell and routed to the outlet.

The AGNPS model was for the first time in Ethiopia tested by Negussie and Fekadu (2003) on Augucho catchment, Western Hararghe and showed good performance in predicting runoff, soil erosion and sediment yield. Sediment yield estimation from the model compared favorably with the measured value with model efficiency of 0.66. Similarly, Hassen, et al. (2003) validated the AGNPS model on Kori (Maybar) watershed, South Wollo, and found that the model resulted in a correlation coefficient of 0.94 and 0.98, and model efficiency 0.86 and 0.88 between observed and predicted values of runoff and sediment yield, respectively.

2.2.2 Description of the study area

Lake Alemaya Catchment lies 9°22'03''-9°27'12'' N and 41°58'14''– 42°05'26'' E in Alemaya District, Eastern Ethiopia. The total area of the catchment is about 50 km^2 of which 2.28 km^2 was occupied by Lake Alemaya. The catchment is 2018 m a.s.l. At lake level and maximum 2422 m a.s.l. In Gara-Damota sub-catchment. Undulating and rolling topography characterize about 71% of the catchment. The climate is sub-humid with an average annual rainfall of 801 mm. The daily

temperature ranges from about 10°C to 25°C. The major portions of the agricultural soils are very shallow. The five major soil types in the catchment are Lithosols, Regosols, Cambisols, Fluvisols, and Vertisols (Tamire, 1981).
The majority of the population in the catchment is small scale farmers engaged in mixed farming, i.e. cropping and livestock production. Sorghum is the major food crop in the area. The land is intensively cultivated with horticultural crops and a perennial plant locally known as "Chat" (*Catha edulis*) using irrigation water from Lake Alemaya. All marginal and grazing lands are brought under cultivation.

Based on the drainage network, Lake Alemaya catchment was divided into nine sub-catchments (Figure 1).

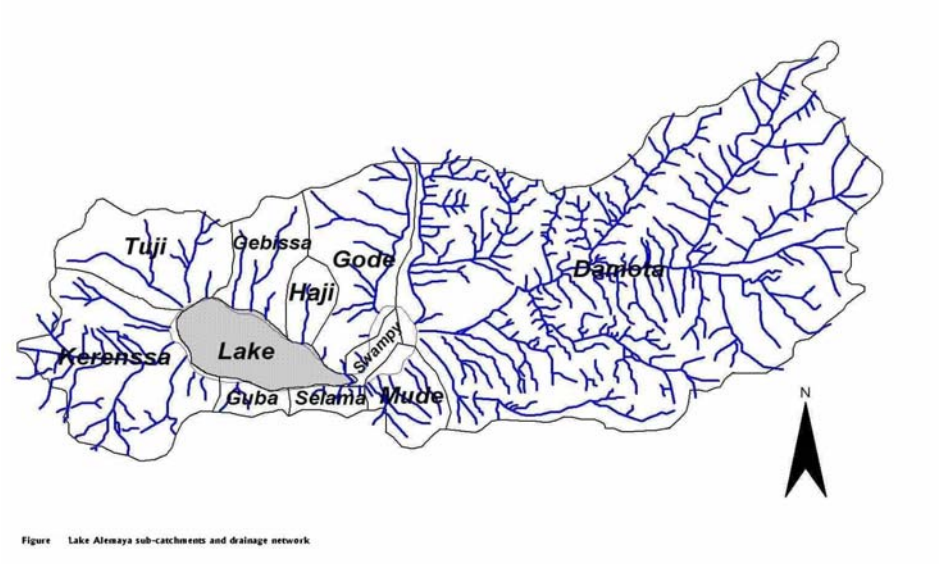


Figure Lake Alemaya sub-catchments and drainage network

The Damato sub-catchment is the largest of all and drains more than half of the catchment (2935 ha). The remaining eight sub-catchments: Keressa, Tuji, Gebissa, Haji, Gode, Mude, Guba, and Selama cover 1821 ha (38.3%).

2.2.3 Data collection and analysis

The catchment boundary was delineated using both aerial photo and topographic map of the sub-region at 1:50,000 scale, and refined in an extensive field survey using global positioning system (GPS). The delineated topographic map of the catchment was then scanned, and digitized using the ILWIS GIS software.

The catchment area was sub-divided into 365 cells, each cell covering 16 hectares (400m x 400m). The physiography of the catchment was developed by establishing the digital elevation model (DEM) and the contour map. From the DEM and contour map, the grid-based raster map of slope, slope shape, length and flow direction for a cell, were produced using ILWIS GIS software. A comprehensive survey, assisted by aerial photo of the catchment, was made for inventory of the land use/cover, flow channels and the drainage network. The map was then scanned and digitized and processed by the ILWIS software.

Soil erodibility was determined using the Revised Universal Soil Loss Equation (RUSLE). The input parameters such as soil texture, bulk density, and permeability were analyzed from soil samples taken from each soil unit with standard laboratory methods.

The rainfall erosivity factor was determined by the regression equation of Wischmeier and Smith (1978). A total of 29 erosive storms greater than 10 mm were identified in year 1999 for the assessment of soil loss and sediment yield using the AGNPS model.

2.2.4 Results and discussion

Soil erosion and sediment yield

The annual runoff volume from all the sub-catchments estimated with AGNPS model was 6,731,614 m^3. The highest contribution of runoff (75%) and soil loss rate (38.4 tons/ha) was from Damota sub-catchment (Table 1). The total annual soil loss from the entire catchment was 31.3 tons/ha. Hurni (1986) estimated the soil loss tolerance limit for the different agro-ecological zones of Ethiopia to be in the range 1-16 tons/ha. The model output showed an appreciable spatial variation of soil loss in the catchment. Cell erosion ranged 0-354 ton/ha. The Damota sub-catchment represented 79% of the total high to extreme soil hazard zone. Gross erosion from the catchment was about 148,848 tons. The maximum contribution (75.8%) was from Damota sub-catchment.

The annual sediment yield from Lake Alemaya catchment was 7,928 m^3 as predicted by AGNPS model. The sediment delivery ratio, estimated by relating sediment yield to gross erosion, was about 6.8 % on average (Table 1). The largest proportion (71%) of the sediment yield was from Damota sub-catchment (7182 tons). The unchecked sedimentation is still advancing at an estimated rate of 10,148 tons per year.

Table 1. Runoff, soil loss, gross erosion and sediment yield of Lake Alemaya sub-catchments

No	Sub-catchment	Runoff volume 10^3 * m3	Soil loss (ton/ha)	Area (ha)	Gross erosion (tons/yr)	Sediment yield (ton)	Delivery ratio (%)
1	Damota	5,025	38.4	2,935	112,775	7,182	6.4
2	Keressa	580	25.7	569	14,619	513	3.5
3	Gode	545	22.4	385	8,625	728	8.4
4	Tuji	90	15.3	336	5,147	407	7.9
5	Gebissa	85	10.7	195	2,089	273	13.1
6	Mude	110	19.8	147	2,915	312	10.7
7	Haji	54	14.1	85	1,195	123	10.3
8	Guba	60	25.5	53	1,351	488	36.1
9	Selama	188	2.5	51	129	123	95.2
	Total	6737		4,755	148,845	10,149	6.8

Surface area storage capacity and life of Lake Alemaya

In order to predict the possible changes of the Lake Alemaya, the water balance of the lake was employed which consisted of surface inflow, abstractions and storage components. The subsurface water inflow was assumed to be equal to seepage loss. The water balance is expressed by the general equation:

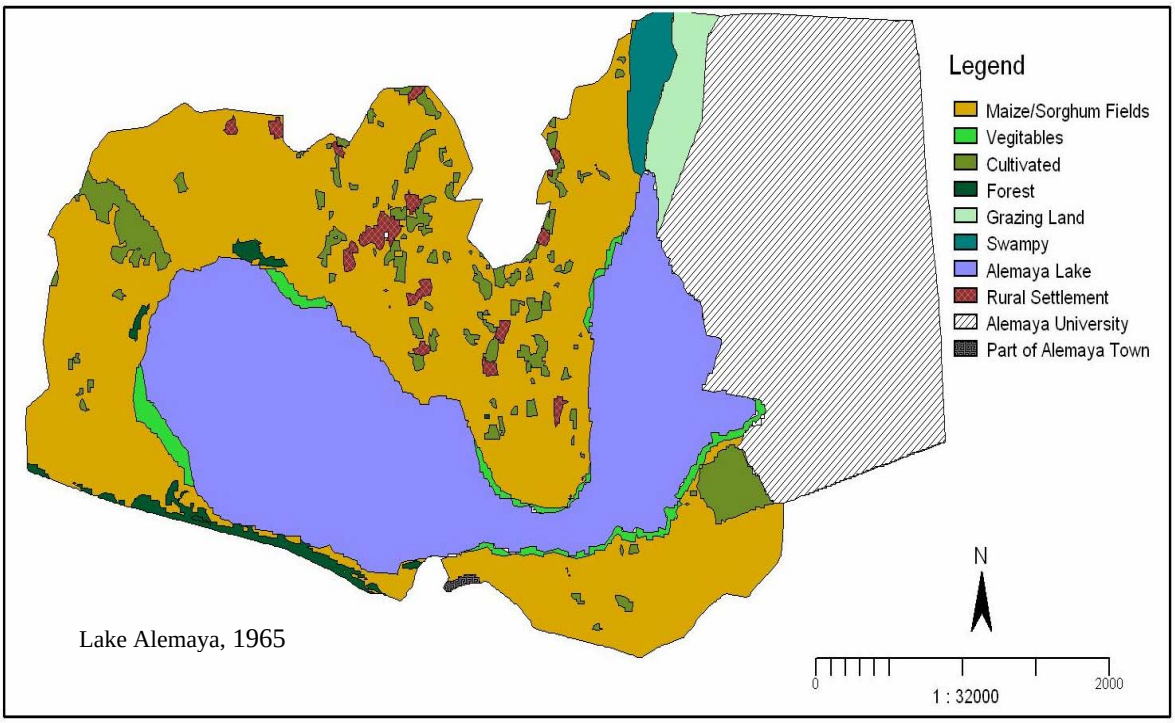
Change in storage = Inflow - Outflow

The inflow, which is surface runoff from the nine sub-catchments, was estimated to be 6,731614 m^3. Outflow included evaporation and abstraction for irrigation and domestic water supply. Considering a daily evaporation rate of 3.1 mm from the lake's water surface, the annual evaporation loss 2,630515m^3. The annual abstraction for domestic water supply for the towns Harar, Alemaya, and Awoday at a rate of 4800m^3 at 22 hr of pumping was 1,752,000m^3. The annual abstraction of Alemaya University for various purposes was 150,830m^3. The estimated abstraction for irrigation by the local farmers was 751,680m^3 and for miscellaneous purposes 604,878m^3. The total consumption or abstraction amounts to 6,862, 275m^3. Hence, based on these estimated values the water balance of the lake showed annual deficit of 130,660m^3, which was compensated from the lake. This indicated that due to over abstraction of water, the lake storage constantly reduced.

Table 2. Variation of lake surface area (base year 1965)

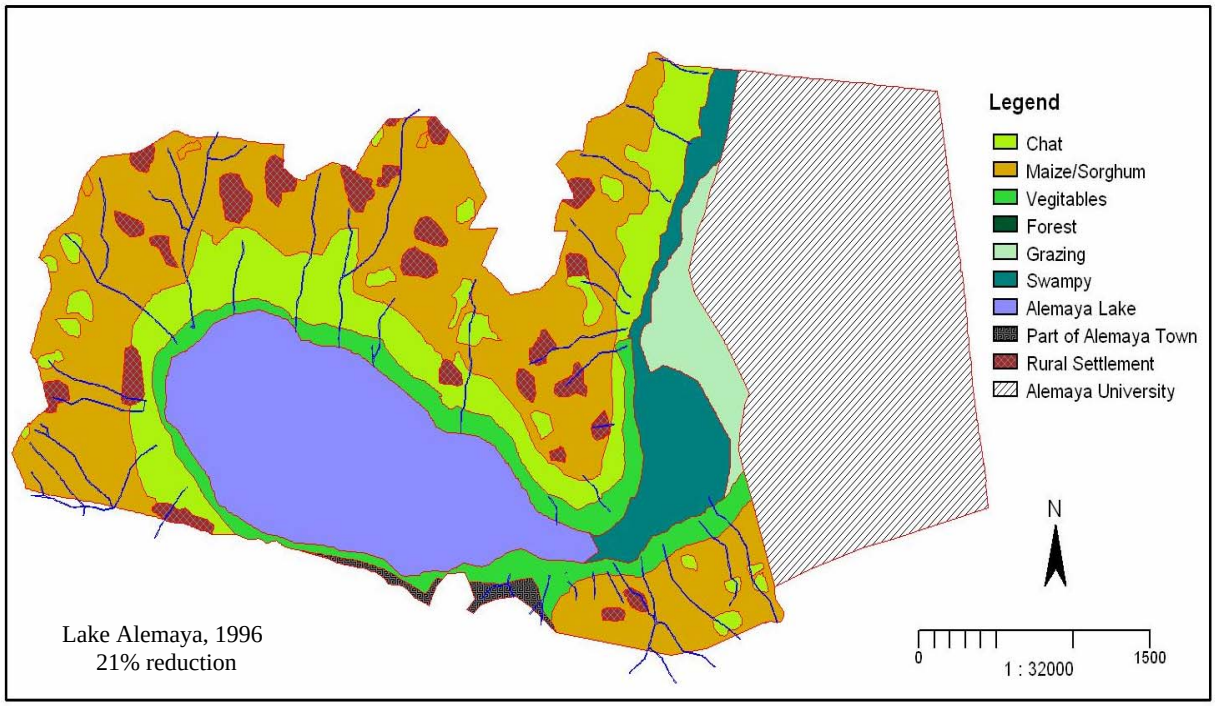
Year	**Area (km^2)**	**Reduction of surface area (%)**
1965	3.88	-
1996	3.06	21
2001	2.28	41
2005*		100

*4 years after this study was completed.



Lake Alemaya, 1965

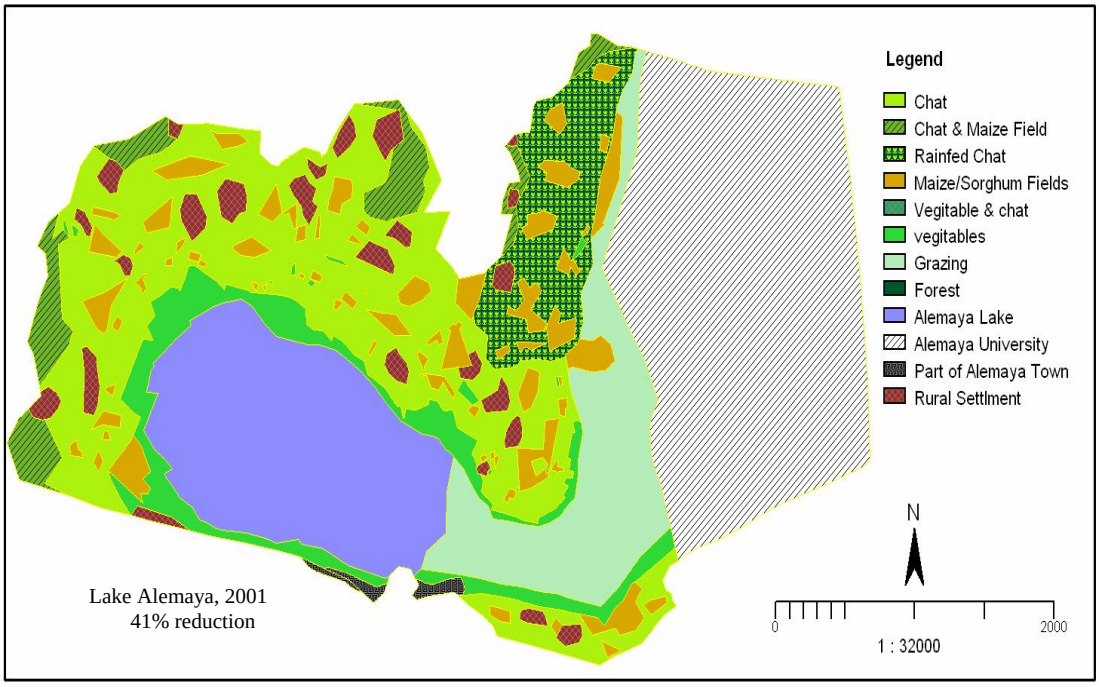
The surface area of the lake was also constantly decreasing as a result of siltation and abstraction. This was determined using aerial photos taken in 1965 and 1996 and a survey conducted in 2001 (Figure 2, 3 and 4). The surface area decreased by 21% and 41% in 1996 and 2001, respectively, taking 1965 as a base year (Table 2). Four years after this study in 2005, the surface area decreased 100%, meaning the lake disappeared completely



Lake Alemaya, 1996
21% reduction

Based on the current (2001) surface area of the lake and the bathymetric (depth) map and the predicted sediment deposition (7573m^3/year) and the compensation from the lake for the deficit in water balance mentioned above, the useful life of the lake was estimated to be 15 years from the year (2001) this study was conducted. However, already in 2005, it is reported that the lake has completely last its storage capacity and completely disappeared.

2.2.5 Conclusion



Lake Alemaya, 2001
41% reduction

The AGNPS model is a computer simulation model, event-based and provides spatial distribution of soil loss and sediment yield. The model is time saving and cost-effective compared to field plot research, which requires high investment.

The AGNPS model has produced reasonable estimates of soil loss and sediment yield in Lake Alemaya catchment. The estimated soil loss from the catchment is about 31.3 tons/ha, which is greater than the permissible value recommended for the different agro-ecological zones of Ethiopia, showing that appropriate soil and water conservation practices must be prescribed to control soil loss and sedimentation problems in Lake Alemaya. The high soil loss rate in the catchment can be attributed to the deforested lands, the poor land cover, the shallow soil depth, and high rainfall intensity.

The AGNPS model has also the capability of identifying areas within a watershed with high erosion and sediment yield. This helps to prioritize and formulate development and conservation plans in order to optimally use available economic resources. It is essential to develop a link between the model and GIS to process and analyze vast amount of input data so that the efficiency of the model can be improved.

3. Implications for watershed management in Ethiopia

The situation of Lake Alemaya is a clear indication of the alarming situation of land degradation and the fate of all other lakes and wetlands in Ethiopia, unless the Government and populations take urgent measures. The perception of the population on land degradation and its socio-economic consequences is far too low. This is for example evidenced when the study results on Lake Alemaya was presented in 2001 at different forum. The audience was very doubtful on the model prediction that the remaining life of the lake was only 15 years. Surprisingly, the lake disappeared in 4 years after the report (in 2005), i.e.10 years before the predicted life of the lake.

The whole issue lies on the long-term commitment of resources by the Government in considering our natural resources, namely land, water and vegetation, as the only source wealth of the country on which the survival of future generations depends. It has to be well recognized that the country as a state and the next generations can not continue under the current rates of natural resources degradation.

The Ethiopian Government has formulated a number of policies dealing with environmental protection and natural resources conservation. However, besides implementation problems, there are shortcomings observed in the approach adopted for natural resources management at all levels. Research and development are not focusing at the level of resolution needed to meaningfully address the challenges. More often, development organizations use the reductionist approach and focus on individual production sectors (e.g. crop, livestock, tree production, fishery). For example, the fate of a fisheries project may be determined not by the amount of funds invested and efforts made in that sector, but rather by how the use of adjacent forest, range and croplands influence the water and nutrient loading on which the project ultimately depends. Focusing on individual components may not provide a suitable insight into the broader system functions. Hence, there is the need for holistic approach.

We recommend that a watershed is the level of resolution for planning and implementation of agricultural, environmental and socio-economic development and research activities.

Observations in Ethiopia are that the concept of watershed approach is more said than done by governmental and non-governmental organizations.

A watershed-planning unit deals with critical economic interrelationships. If upland and lowland areas within a watershed are treated as independent planning units, a mismanaged upland system could trigger negative impacts on the lowland planning units. Integrated approach is needed to watershed planning involving upstream and downstream communities and government agencies.

There is also the need for social and political considerations in watershed management such as balancing sound natural resources management with agricultural and industrial development. A variety of social and political challenges must be dealt with before a watershed as a planning unit is viewed as socially acceptable and politically attractive.

Gilgel Abay, a big river that enter in to lake Tana transport large quantity of soil eroded from the wide area of the catchment which is potential threat for the survival of the lake

References

Ethiopian Highlands Reclamation Study (EHRS). 1984 Annual research report. (1983 - 1984). Ministry of Agriculture, Addis Ababa.

Hassen Mohammed, Fekadu Yohannes and Gete Zeleke.. Validation of Agricultural Non-point Source Pollution (AGNPS) Model in Kori Watershed, South Wollo Zone, Ethiopia. Journal of Applied Earth Observation and Geoinformation. Elsevier journal, In print.

Hurni, H. 1986. Degradation and conservation of the soil resource in the Ethiopian highlands. A paper presented at the first International Workshop on African Mountains and Highlands, Ethiopia, October 18-27, 1986. Agriculture. CADU publication No. 74.

Nigussie Haregeweyn and Fekadu Yohannes. 2003. Testing and Evaluation of Agricultural Non-point Source Pollution model (AGNPS) on Augucho catchment, Western Hararghe, Ethiopia. Agriculture, Ecosystems & Environment, Vol. 99, 201-212

SCRP, 1996. Soil Conservation Research Project database report 1982 – 1993. Ministry of Agriculture and University of Berne, series repot III. Hundelafto Research Unit

Singh, V.P. (ed). 1995. Computer Models of Watersheds Hydrology. Water Resources Publications, Colorado. U.S.A.

Tamirie Hawando. 1981. Soil, water and forest conditions in Hararghe highlands, Eastern Ethiopia. Alemaya University of Agriculture, Alemaya. 14pp.

Wischmeier, W.H., Smith, D.D., 1978. Predicting rainfall erosion losses. USDA Agriculkture Handbook 537. U.S. Department of Agriculture.

Young, R.A., Onstad, C.A., Bosch, D.D., and W.P. Anderson. 1989. AGNPS: A nonpoint-source pollution model for evaluating agricultural watersheds. Journal of Soil and Water Conservation, 44 (2): 168-172.

Biodiversity of Lake Tana and Threats for Sustainability

By Eshete Dejen (PhD)
Bahar Dar Fish & Other Aquatic Life Research Center,
Amhara Agricultural Research Institute,
Bahar Dar

E-mail: dejeneshete@yahoo.com
Tel. 058- 220-08-99

Abstract

Lake Tana is a turbid oligotrophic shallow lake (average depth 8 m., maximum 14 m.) covering a surface of ca. 3200 km^2 and the source of the Blue Nile river. The lake is located at a level of ca. 1800 meter and isolated from the lower Blue Nile basin by 40 m high falls, 30 km downstream from the Blue Nile outflow. Lake Tana harbors a diverse fish fauna, including the only remaining species flock of cyprinid fishes (15 species) left in the world. Lake Tana and its wetlands have a multipurpose value for the surrounding area. The lake ecosystem and the water resources as a whole are in danger due to deforestation, erosion, water level reduction, erratic rainfall and competition for water resources.

In this paper an overview will be presented on the biodiversity, potential, threats and possible management measures towards integrated water resource management of Lake Tana. It was recommended that the development of Lake Tana's resources could only be meaningful and sustainable when the following principles are met: ***precaution, prevention, integration and public participation.***

Keywords*: ecosystem, biodiversity, threats, sustainability, integrated water management.*

Introduction

Lake Tana and its characteristics

Lake Tana is located at an altitude of 1830 m, in the northwestern highlands of Ethiopia. The shallow lake (average depth 8 m, max. depth 14 m) covers an area of c. 3,050 km^2 and is Ethiopia's largest lake, containing half the country's freshwater supply. Several large rivers feed into the lake. Lake Tana is the source of the Blue Nile, which is the only river flowing out of the lake. High waterfalls (40 m) at *Tissisat* ('smoking waters'), 30 km downstream from the Blue Nile outflow, effectively isolate the lake's fish community from the lower Nile basin.

The water from Lake Tana is used to irrigate farmland and to generate electricity with the hydropower plant at *Tissisat*. The lake is dotted with island monasteries, which serve a religious purpose for hundreds of years. These historic monuments form a major tourist attraction. A daily ferry service transports people and goods over the lake. Most of the 25 fish are exclusively found in Lake Tana. The larger fish species are targeted by the traditional papyrus boat fishery and the recently developed commercial gillnet fishery.

Lake Tana: a unique ecosystem

In Ethiopia, 93 species of freshwater fish are reported (Getahun & Stiassny 1998), of which 44 species are cyprinids. In Lake Tana, the largest freshwater basin of Ethiopia (ca. 3150 km^2), an endemic flock of 15 large *Barbus* species has been found and studied (Nagelkerke et al. 1994, Nagelkerke & Sibbing 1997, 2000). Recently, also a new 'small barb' species has been described for Lake Tana (de Graaf et al. 2000a). Apart from the endemic subspecies *Oreochromis niloticus tana* (Seyoum & Kornfield 1992) (Cichlidae), also the cyprinid genus *Garra* may include some endemic species (Getahun 2000). The other fish species found in Lake Tana are widespread in the rivers and lakes of the Ethiopian highlands: *Clarias gariepinus* (Clariidae) and the cyprinid *Varicorhinus beso*.

Boulenger (1902) described three species of 'small barbs': *B. pleurogramma*, *B. humilis* and *B. trispilopleura*. The recently found fourth species *B. tanapelagius* (de Graaf et al. 2000a) is abundant in the surface layers of the deeper open water (4 -14 m), far from the shore. It differs from the other species by its small barbels, its large eye diameter, its prominent and hooked lower jaw contour, and by its slender silvery-white body. *B. pleurogramma* is distinct by its copper-brown colour, its small scales and its conspicuously serrated dorsal spine. It occurs mainly between shore vegetation and in floodplains shallower than 1 meter. *B. humilis* and *B. trispilopleura* are distinct from the previous two species. However, during sampling serious doubts developed about Boulenger's distinction between *B. humilis* and *B. trispilopleura*. Boulenger's (1902) descriptions are not adequate, most probably due to collection and preservation of his specimens by others, and due to the low number of specimens (3 for *B. trispilopleura*, 10 for *B. humilis*). The hypothesis that *B. humilis* and *B. trispilopleura* are not separate, but a single species is confirmed (Dejen, 2003).

Who is who in Lake Tana's fish community?

Nile Tilapia (35cm)

Nile Tilapia (*Oreochromis niloticus;* Cichlidae) is common throughout the lakes on the African continent. The most preferred fish for consumption is tilapia. Tilapia is the most likely to be served in any of the restaurants in Bahar Dar.

Tilapia feeds mainly on microscopic plants that float in the water column or lay on the bottom. Tilapia lives in the shallow areas of the lake adjacent to the floodplains. In Lake Tana, tilapia becomes mature around 20cm at an age of two years. Tilapia is the only mouthbrooder in Lake Tana. If danger arises, the small fry flee for protection into mothers' mouth. They reproduce throughout the year between the submerged plants in the floodplains.

African Catfish (125cm)

Similar to tilapia, African catfish (*Clarias gariepinus*; Clariidae) is common throughout Africa's lakes and rivers. Catfish live throughout the lake near the bottom, feeding on whatever they can find. Usually the larger animals are found in deeper waters. African catfish have a special organ, which enables them to obtain oxygen from the air. It is the only species in Lake Tana that can survive for long periods outside water or live in aquatic environments with low oxygen content. Although the meat of catfish is highly valued in Africa, Asia and Europe, surprisingly in Ethiopia you will hardly find it on the menu.

Cyprinid Fishes

Lake Tana harbours the only remaining intact species flock of cyprinid fishes in the world. Lake Tana contains a great diversity of cyprinid fishes (23 species). There are four genera: (a) *Labeobarbus*, at least 15 large (max. 100cm), endemic species, (b) *Varicorhinus*, one species, (c) *Barbus*, three species, and (d) *Garra*, three species.

Labeobarbus species flock

Despite the overwhelming abundance of cyprinid fishes (>2000 species) throughout the world's fresh water systems, the *Labeobarbus* species of Lake Tana form the only remaining intact species flock of large barbs, since the one in Lake Lanao in the Philippines, has been destructed due to human activities.

The term 'species flock' refers to a concentration of closely related species of common ancestry that have diversified in a limited geographic area (e.g. Lake Tana). The evolution of these 15 unique *Labeobarbus* species in Lake Tana from a single ancestral riverine barb similar to *L. intermedius* probably happened very rapid, in less than 25,000 years.

Labeobarbus (25-100cm) species flock

L. acutirostris (ac)
L. brevicephalus (br)
L. crassibarbis (cr)
L. dainellii (da)
L. gorgorensis (go)
L. gorguari (gu)
L. longissimus (lo)
L. macrophtalmus (ma)
L. megastoma (me)
L. nedgia (ne)
L. platydorsus (pl)
L. surkis (su)
L. truttiformis (tr)
L. tsanensis (ts)
L. intermedius "shore-complex" (in)

Where do they swim?
During their evolution the large barbs adapted to all available habitats and food sources in the lake. The body colouration and shape of the head and mouth can tell a lot about their biology. For example the silvery coloured species (AC, BR, CR, MA, ME, PL, TS, TR live predominantly in the deeper waters while the dark or green species (DA, GU, GO, LO, NE, SU, IN) live mainly in the shallow areas of the lake, often between the rocks or weeds.

What do they eat?
The fish-eating or piscivorous *Labeobarbus* species (AC, DA, GU, LO, MA, ME, PL, TR) have the largest mouths, largest heads and grow to the largest sizes (100cm). *Labeobarbus nedgia* uses its thick lips to suck insects from the crevices in rocks. The smallest species (25cm) *L. brevicephalus*, uses special gill structures to filter microscopic animals (<1 mm) from the water. The fat-bellied, green *L. surkis* grazes on plants like a cow. All cyprinids have two sets of jaws; one set without teeth in their mouth (oral jaws) and a second pair with teeth in the back of their throat (pharyngeal jaws). The pharyngeal jaws of *L. gorgorensis* are so powerful that they can crush clams and snails. The remaining three species (CR, IN, TS) feed on insect larvae (mosquitos), small snails and other small food items that they sort in their mouth from the mud.

Where and when do they mate?
The *Labeobarbus* species reproduce only once per year during a short breeding season (August-September) at the end of the rainy season. During this period most species form large spawning aggregations in the mouths of the inflowing rivers. When the time is right they migrate 40 km upstream the rivers and spawn in shallow gravel beds with clear fast-flowing water. The *Labeobarbus* are long-lived and do not mature until 3 to 5 years old.

Fishery and the future

The spawning aggregations are vulnerable to over-exploitation in the river mouths (using gillnets) and on the upstream spawning areas (using traps, scoopnets, and poison). The harvest of ripe fish before they have had a chance to mate and produce offspring is currently seriously threatening the existence of the unique species flock.

***Varicorhinus beso* (40cm)**
Varicorhinus beso lives over rocky bottoms near the shore. In comparison with *Labeobarbus*, *V. beso* has very small barbels and thick horny lips which it uses to scrape algae from the rocks. During the breeding season, the mature males develop a conspicuous white spawning rash on their heads. *V. beso* only forms a small part (<1%) of the commercially harvested fish in Lake Tana.

Barbus (10cm)
Barbus pleurogramma lives among the submerged vegetation in the floodplains. *Barbus humilis* is abundant in the shallow areas of the lake over rocky and sandy bottoms. The endemic *Barbus tanapelagius* occurs only near the surface in the deep, offshore areas, feeding strictly on zooplankton. The last two species by their number have a large biomass and are important prey items for the large piscivorous *Labeobarbus* species. At present these small *Barbus* species are not being fished. Their potential as a cheap source of protein is under investigation.

***Garra* (15cm)**
The cigar-shaped *Garra* species (Cyprinidae) are true bottom-dwellers. They live in the shore areas over rocks (*G. dembecha*) or sandy bottoms (*G. microstoma*) and over sandy bottoms in the deep, offshore waters (*G. tana*). Only on Dek Island are these small fish caught and eaten by the local people.

Biodiversity conservation and sustainable fisheries

Traditionally, Lake Tana fisheries consisted only of an artisan, predominantly subsistence reed boat fishery. This type of fishery is limited to the shore areas and targets mainly the tasty tilapia. The total number of reed boat fishermen in Lake Tana is estimated to be ca. 450. Fishing has never been an important activity historically. Ethiopians are meat eaters (10 kg/year). Fish is not highly valued as a source of cheap protein and mainly eaten during religious fasting periods. On average an Ethiopian only eats 0.1 kg of fish per year. To fulfil the increasing demand for fish from the capital city Addis Ababa (1kg/year), motorised boats and modern, more efficient, nylon gillnets were introduced in Lake Tana in 1986.

This new commercial gillnet fishery developed rapidly, total catches increased from 39,000 kg in 1987 to 360,000 kg in 1997. The annual catch roughly consisted of one-third *Labeobarbus* species, one third tilapia and one third catfish. However, the commercial gillnet fishery on *Labeobarbus* is highly seasonal and mainly targets the spawning aggregations, as more than 50% of the annual catch is obtained in the river mouths during August and September. These characteristics of Lake Tana's gillnet fishery raises great concern about the sustainability of the fishery on the *Labeobarbus* stocks. Throughout this century, the vulnerability of Africa's large cyprinids for unregulated modern gillnet fisheries targeting these spawning aggregations has been proven time and again with the collapse of several *Labeobarbus* and *Labeo* fisheries throughout the continent. Gillnets were set near river mouths, effectively blocking them off from the lake, preventing mature individuals from reaching the upstream spawning areas.

During the 1990s the abundance of *Labeobarbus* species in Lake Tana decreased dramatically with ca. 75%. Regulations limiting the gillnet fishery in the spawning season and/or area shall prevent a total collapse of the *Barbus* stocks as has happened to other cyprinids in African lakes. Such measures will be implemented in the near future to guarantee the conservation of Lake Tana's unique, largely endemic biodiversity and to maintain a sustainable source of cheap protein. The Amhara Regional State approved regional fisheries legislation, which is the first positive development for the proper utilisation of the fish resource in the country. Continuous monitoring of the commercial catches, and the regular carrying out of independent experimental sampling programs, are of utmost importance to determine the condition of the stocks and to evaluate the consequences of implemented regulations.

Lake Tana as a resource base and challenges

It gives the surrounding community heterogeneity of the following services and products:

- Fisheries
- Water supply
- Transportation
- Hydro-electric power supply
- Irrigation
- Heritage/religious practice

- Diversity of flora and fauna
- Tourism
- Quality of life for Bahar Dar residents
- Livelihood for marginalized and other poor people (e.g. the *Weyto*)
- Waste processing
- Soil preservation by vegetation
- Mining (sand) and others

Since the lake has a multipurpose function, the following issues are of general importance:

- Awareness creation. The lake ecosystem and the water resources as whole are in danger due to deforestation, erosion, sedimentation, water level reduction, erratic and reducing rainfall, competing uses of water resources (hydropower, navigation, fishery, tourism). The lake suffers from increased use of fertilizers, pollution and pressure of the growing population. What is to be done?
- The water resource has to meet the national objective in enhancing food security either by irrigation or fishery etc.
- Integrated resources management is required to optimize priorities in resource use aiming at sustainability for future use.
- A holistic multidisciplinary approach is required to deal with the water resources issue at the sub-basin /basin level taking the hydrologic boundary of the catchment area as a unit of planning.
- Water law and water rights. Lake Tana is not only ours; it is an international lake and trans-boundary. This applies also to its biological and cultural treasures.

Major challenges to meet:

- Securing the food supply
- Meeting basic needs in high-quality water supply and sanitation; equitable allocation of water, treatment plant of waste water
- Protecting the ecosystems and their biodiversity
- Managing risks, e.g. floods, drought, pollution and water related hazards.
- Valuing water: manage water in such a way that it reflects its economic, social, environmental and cultural values; pricing and equity issues
- A sustainable river basin management (boundary and trans-boundary water resources): sharing water resources, promote peaceful cooperation
- A balanced development of tourism (protecting monasteries, bird life, Blue Nile falls)
- Governing water supply, to ensure good governance, including all stakeholders.

It was stressed that the development of the lake's resources can only be meaningful and sustainable when the following principles are met: *precaution, prevention, integration and public participation.*

Fish biology, ecology and fishery

Composition of the fish fauna:

- An endemic species flock 15 'large' *Labeobarbus* species (length up to 100 cm)
- 3 'small' *Barbus* species (< 10 cm)
- 4 *Garra* species
- *Varicorhinus beso* (Beso)
- *Oreochromis niloticus* (Nile tilapia)

- *Clarias gariepinus* (African catfish)
- Probably other small, not well-known species in flood plains and papyrus beds

The diet, reproduction, distribution, ecological segregation, and other biological aspects of these fish were investigated and presented during the workshop. Such information is a prerequisite to reconstruct the ecosystem, its food web, its dynamics and constraints, which is basic knowledge enabling us to formulate management recommendations for Lake Tana.

Scientific value: Lake Tana, due to its species flock and its isolated position, is an excellent model for studying evolutionary processes and mechanisms, which have worked in the past. These mechanisms also work in the future and provide insight in the responses to be expected from the system to natural and human impact. Such studies clarify the stability and resilience of the system, and the biological constraints on fisheries and its other uses.

Exploitation and fisheries management

Major findings

- 'Large barb' *(Labeobarbus)* stocks are highly vulnerable to increased fishing pressure, especially during aggregation of the ripe fish in the spawning season in the river mouths.
- Fisheries regulations restriction fishing near river mouths and upstream on spawning ground during the breeding period (July-October) are urgently required to prevent extinction of the unique large barbs.
- There is a potential of 4,000 tons small barbs to be exploited. The effects of such fishery on the large barbs, feeding on these small prey-fish, needs to be investigated and monitored. However, prior to starting utilizing this small sardine-like fish information is required how to catch, dry and use them. Also the social, economical and ecological aspects must be investigated in detail.
- African catfish and Tilapia are not in danger because they have a healthy recruitment.
- Knowledge on growth, recruitment of the stocks, and the preferential habitats of larvae and juveniles of fish is still largely lacking.

Major threats:

- Over-exploitation, minimizing gene pools, and thereby the stability and resilience of the system, and endangering sustainability of the resources
- Introduction of exotics, upsetting the system balance
- Pollution, worsening general conditions of life and affecting the survival of the ecosystem
- Environmental degradation, for example by continuing deforestation and by river regulation through dam-construction (e.g. in the outflow of the Blue Nile from Lake Tana), increasing silt-load and turbidity and by increased flooding of wetlands also lake-bound diseases (bilharzia, malaria)
- **Unawareness to the above threats**

Gaps to be filled:

Society-level

- Public awareness on Lake Tana and the vulnerability of its resources due to human and natural impact; extension
- Regulation and control

- Socio-economic investigations
- Establishing a fisheries section at Bahar Dar-University

Research

- Wetland areas / papyrus based community
- Where are the nurseries for juvenile barbs? Growth and recruitment.
- Northern lake area (hardly explored)
- Impact of droughts on the system (rainfall is some years very little)
- Geological and climatological history of Lake Tana

Lake Tana Fisheries Research Center

- Long-term monitoring programs (abiotic and biotic)
- Training – capacity building
- Replacement old research boat
- Creating facilities for further research, from ecology to molecular biology for national and international scientists.

D) Priorities for future research and gaps in knowledge

- Which areas have been investigated in the past decade?
  - Ecology, Evolution and Fishery of the commercial important fish stocks
  - Taxonomy, Ecology and potential for fishery of the small barbs
  - Zooplankton species composition & abundance
  - Some environmental parameters (oxygen, temperature, transparency)

- Which areas need to be investigated?
  - Wetland resource management: energy flow in the ecosystem
  - Energy flows through lower trophic levels (phytoplankton dynamics, detritus, bacterioplankton, etc.) should be investigated
  - The effect of sediment load on the abiotic and biotic factors, its rate and possible measures to combat this problem
  - Community dynamics, e.g. multi-species interactions, predator-prey interactions, parasite-host relations
  - Significance of biodiversity for resilience (adaptability) and productivity of the ecosystem, including molecular and genetic approaches
  - Population genetics of fish stocks
  - Compare structure and functioning of Lake Tana with other Ethiopian Lakes
  - The fisheries centre should evolve into a broad limnology lab with good facilities for researchers and students

Actions to be taken:

- Create awareness and concern on multipurpose use of water resources
- Continuous (monthly) data collection and monitoring on the development of fish stocks and fisheries efforts (catch-effort data recording).
- Continuous data recording on environmental parameters (e.g. siltation, turbidity, nutrients)
- Species-specific detailed investigation when needed.
- How and when to fish the small barbs
- Survey of the riverine fishery potential

- Energy flow through the wetland/floodplain system
- Provide feedback to the policy makers on the status of the resource
- Investigations on biological, social and economic aspect for the small pelagic fishery
- Fish processing, harvesting and fishing gear experiment.
- Watershed management approach rather than focusing only on the Lake.
- Training and development of human resources (e.g. especially MSc-training programmes for students)
- Acquisition of funding and cooperation for the above research programmes
- Improve research facilities at the center.
- Improve the roads to and from the centre.

Aquaculture research, extensive fish-culture

- Survey the potential of different water bodies for introduction of native fish.
- Develop fish larvae culture capacity at Bahar Dar
- Mass production of appropriate fingerlings for stocking in different water bodies
- Provide advisory service for possible aquaculture for the regional government
- Train farmers how to farm fish in their own or community pond

Cooperation in the future

- Locally with the Bahar Dar University, especially utilizing graduate students
- Nationally with all stakeholders, research institutes, higher learning institutions etc.
- To maintain and improve the interactions with Wageningen University, and start and improve other cooperation. Moreover recent
- Advanced and detailed basic research like molecular biology, evolution, energy flows etc. Hatchery and fish larvae management are production techniques that we need to learn and implement it.
- Develop a discussion forum once a year for all research groups to get common understanding and integrate their efforts.

Recommendations

The general attitude in utilizing Lake Tana's resources should be: **'BETTER SAFE THAN SORRY'**

Lake Tana is multipurpose lake so that Integrated Water Resource Management (IWRM, interdisciplinary) has to be practiced, and a regulatory body has to be established comprising the main stakeholders. Such a Lake Tana Resource Management Council will advise the regional government on the utilization and management of the lake resource. A strategic plan has to be designed, suggestions are already made.

In utilizing the lake waters, operation rules have to be set out considering all beneficiary sectors utilizing the ecosystem.

The strategy of resource utilization has to be optimized assuring the well being of the ecosystems, and sustainability for future use.

Water resources planning for Tana should be a subset of the sub-basin lake Tana and the Blue Nile (and of course the Nile) as a whole.

The fish and the fishery biology, the fishery studies and utilization should consider the sub-basin as their platform of study.

Comprehensive study regarding water quality, hydrology, pollution, eutrophic status and resources potential has to be studied and recommendations have to be forwarded.

Enforcement measures should be taken to prevent pollution from both point and non- point sources to prevent eutrophication and contamination of the water quality. The waste discharges from urban centers should be minimized and treated in a waste water plant prior to return into the lake. It is time to introduce the famous enforcement measure “Polluter Pays” principle.

The proclamation of the regional fisheries legislation by the Amhara Regional Government Council is required as soon as possible.

The establishment of fish and aquatic resource professional society at the national level

Lack of awareness by the users of Lake Tana created the misconception that “it is an infinite resource”. As much as possible awareness creation until the grass root level must be designed. It should be stressed that community based (participating local community) natural resource management must be the priority. Of course the fishery legislation is needed to enforce it with the community participation.

In conclusion, it must be underscored that Lake Tana’s resources can be sustainably utilized in adhering to the following principles: **precaution, prevention, integration and public participation.**

References:

Boulenger, G.A. 1902. Descriptions of new fishes from the collection made by Mr. E. Degen in Abyssinia. The Annals and Magazine of Natural History, 7th Series 10: 421 –437.

de Graaf M., E. Dejen, F.A. Sibbing & J.W.M. Osse. 2000a. *Barbus tanapelagius*, a new species from Lake Tana (Ethiopia): its morphology and ecology. Env. Biol. Fish. 59: 1-9.

Dejen, E., 2003. Ecology and potential for fishery of the small Barbs (Cyprinidae, Teleostei) of Lake Tana, Ethiopia. PhD thesis, Wageningen Institute of Animal Sciences, Wageningen University, The Netherlands.

Getahun, A. 2000. Systematic studies of the African species of the genus *Garra* (Pisces: Cyprinidae). Ph.D. Thesis, City University of New York, New York. 478 pp.

Getahun, A. & M.L.J. Stiassny. 1998. The freshwater biodiversity crisis: the case of the Ethiopian fish fauna. SINET Ethiop. J. Sci. 21: 207-230.

Nagelkerke L.A.J., F.A. Sibbing, J.G.M. vanden Boogaart, E.H.R.R. Lammens & J.W.M. Osse. 1994. The barbs (*Barbus* spp.) of Lake Tana: a forgotten species flock? Env. Biol. Fish. 39: 1-22.

Nagelkerke, L.A.J. & F.A. Sibbing. 1997. A revision of the large barbs (*Barbus* spp., Cyprinidae, Teleostei) of Lake Tana, Ethiopia, with a description of seven new species. pp. 105–170. *In*: The Barbs of Lake Tana, Ethiopia: Morphological Diversity and Its Implications for Taxonomy, Trophic Resource Partioning, and Fisheries, Ph.D. Thesis, Wageningen Agricultural University, Wageningen.

Nagelkerke, L.A.J. & F.A. Sibbing. 2000. The large barbs (*Barbus* spp., Cyprinidae, Teleostei) of Lake Tana, Ethiopia, with a description of a new species, *B. osseensis*. Neth. J. Zool. 50: 179-214.

Seyoum, S. & I. Kornfield. 1992. Taxonomic notes on the *Oreochromis niloticus* subspecies-complex (Pisces: Cichlidae), with a description of a new subspecies. Can. J. Zool. 70: 2161-2165.

Inventory and characterization of potentials and current management of wetlands in selected weredas of Amhara Region.

Enyew Adgo* (PhD)
Amhara Regional Agricultural Research Institute
Bahar Dar

Abstract

Wetlands are useful natural resources. Their proper management is crucial for ecosystem balance and livelihood improvements of the rural community. Agricultural activities such as irrigation, residual cropping, and fishery are often linked with wetlands. Despite of their economic and environmental benefits, they are neglected and mis-managed. There is as yet no documented information about the extent, distribution, or management practices and threats to wetlands in our region. This study is initiated with the aim of bridging these gaps. Formal and informal surveys have been conducted in 26 selected weredas of the region; 11 weredas from North Shewa Zone, 9 from Gonder and Gojjam areas and 6 weredas from Wollo.

In all these weredas, more than 60,000 hectares of wetlands have been identified and surveyed. They are more concentrated in the highlands than in the lowlands. Those wetlands found in the lowlands are usually formed due to imbalance of the water inlet and outlet situations. As a result the bottomland is temporarily or permanently covered by water. Those wetlands found in the highlands are usually small but numerous. The survey confirmed that wetlands are sources of biodiversity. Different fauna and flora were identified. The composition of species of wetlands found in the drier eastern part of the region differs from that of the western and North Shewa highlands.

The majorities of wetlands are under communal ownership and utilized as grazing lands. Moreover, they are cultivated either in the small rainy season (Belg), or at the end of the main rainy season for residual moisture crops or for irrigated agriculture. Grasses from wetlands are utilized as thatching, and as income generating activities by selling products made of grasses and 'cheffe' to town and city dwellers.

Due to land degradation, drought, and lack of bylaws and social rules to protect wetland, these areas are highly endangered. More research on their management options and policy support for wetlands is required to protect them from extinction.

* *Others contributors:*

1. *Gete Zeleke,World Food Program, Ethiopia, Addis Ababa*
2. *Gizaw Desta Debre Berhan Agricultural Research Center, Debre Berhan*
3. *Tewodros Assefa, Sirinka Agricultural Research Center, Sirinka and*
4. *Tadele Amare, Adet Agricultural Research Center, Adet*

Introduction

Whenever somebody travels through out the country in general and in the Amhara region in particular, one can simply notice that there are a number of wetlands in different landscapes, soil types and climatic conditions. Wetlands are one of the important natural resources for the rural poor communities on the one hand and it is also one of the neglected and miss-managed resources on the other hand. They are usually the basis for the survival of many people.
According to the Ramsar Convention 1971, wetlands are defined as follows: "Areas of marsh, fen, peat lands or water whether natural or artificial, permanent or temporary with static or flowing, fresh, brackish or salt, concluding areas of marine water the depth of which at low tide does not exceed six meters" (Stuip et al. 2002). This definition is obviously very broad and includes even lakes and rivers. In our survey, rivers and lakes have not been included in the study.

The coverage of wetlands in Ethiopia and Amhara region is not yet precisely determined. However, the share of wetlands in Ethiopia is estimated to be 1.14% of the landmass (Leykun 2003), while their share in Amhara region is assumed to be 3.7% (Abye 2001). The above estimations are based on topographic maps and very little has been done to verify it on the ground. Moreover, the figure includes water bodies so that it is difficult to relate it with the data of this study.

The people of the Amhara region have been depending on wetlands as a source of water, food pasture etc. Due to population pressure and land degradation, wetlands are often highly threatened. This has and will have environmental consequences and negatively affect the livelihood of the people depending on them.

There is not yet a comprehensive study about the extent, distribution, utilization, management conditions and threats of wetlands in the region. Therefore, this study has been initiated to inventorize and characterize the extent and distribution of wetlands in selected weredas to assess their potentials and threats.

However, it should be noted here that the conclusions drawn from this survey are not statistically analyzed but simply made through comparisons of the raw data (information) collected. Therefore, it should be seen as crude information about the status and conditions of wetlands.

Materials and Methods

The three research centers of ARARI; Adet, Sirinka and Debre Berhan have conducted the survey in their respective mandate areas. The surveyed Wereda were selected based on their representativeness of the mandate area. A total of twenty-six weredas were included in the survey; six weredas from Wollo and Oromia Administrative Zones, eleven from North Shewa Administrative Zone and nine weredas from Gojjam/Gonder areas.

Preliminary informal and formal surveys have been conducted. Focus group discussions and interviews with semi-structured questioners were also done, including transect walks. Detailed secondary data have been collected and reviewed which were available from different institutions. In some cases topographic map at a scale of 1:50,000 have been used to delineate and estimate the area of the respective wetlands. After delineation and estimation, the size of the wetlands has been identifies through detailed ground survey. Otherwise, the area of each of the

wetlands was simply estimated. It should be noted here that since the definition of wetlands is very broad, which includes even rivers and lakes as far as their depth is less than 6 meters. Therefore, in our study we tried to restrict the concept of the wetlands only to permanent or temporary marshy areas, which have usually a water table at or near the earth surface or these lands covered temporarily by shallow water often not more than one meter.

Results and Discussion

More than 14,575 hectares of wetlands have been identified and assessed in the surveyed six Weredas of Wollo. Among them Chefa, in Dawa Chefa woreda, Gerado in Dessie Zurea Wereda and Borkena in Kalu Wereda, with an area 12,000, 1500 and 875 hectares of wetlands respectively. All these wetlands have inlets and an outlet. During the rainy season, the amount of water discharged in the bottomland from the surrounding catchments is much higher than the amount of water discharged out through a single outlet and hence the surrounding area is roofed temporarily or permanently by water.

From the survey, eleven weredas in North Shewa zone 1938 hectares of wetlands have been identified. The survey has been conducted in Angolela Tera, Antsokia Gemza, Basona Worana, Efrata Gaidim, Ensaro Wayu, Gera, Kewet, Hagere Mariam, Lalomama and Tarmaber. Most of the surveyed Weredas are found in the highlands and the wetlands identifies are often very small in size but numerous in number. For example in Ensaro Wayu Wereda alone, fifteen different wetlands have been identified. These wetlands are however very small in size and the largest wetland identified was about only four hectares in size.

Table 1: Surveyed wetlands and their areas

Wereda name	Wetland name	Area (ha)
Wollo Zone		
Dawa Chefa and Artuma	Chefa	12,000
Kalu	Borkena	875
Dessie Zuria	Gerado Boru Meda	1500
	Boru Meda	*
Kutaber	Alensha Meda	*
Tehulederie	Margins of Hardibo and Lugo lakes	*
North Shewa Zone		
Angolela Tera	Asa Bahar, Boren, Chefanen etc	641
Antsokia Gemza	Atko, Fiecho etc	1020
Basona Worana	Abamotie, Alobert, Debele etc	180
Efrata Gidim	Alala, Hora etc	82
Ensaro Wayu, Gera, Kewet, etc	Agemso, Mesel Mariam, Alo Bahar etc	15
Gojjam/Gonder areas		
Fagita	Zimbiri, Chigulally, Sharta, etc	4498
Mecha	Brakat, Inundation, Inashenefalen, etc	7863
Dangla	Chara, Zelesa giorgis, etc	6641
Burea	Kwant plain. foket plain, achawata, etc	5409
Kola Deba	*	1892
Achefer	Debil, etc	4293
Banja	*	8219
Ankesha	*	2675
Fogera	Fogera	2805
Sub Total		**60,608**

* ***Not identified***

In Gonder and Gojjam areas eleven Weredas were included in the survey. Fagita, Mecha, Dangla, Burea, Kola Deba, Achefer, Banja, Ankesha and Fogera were among others surveyed. Most of these Weredas are found in the highlands greater than 1500 m.a.s.l. In all these Weredas more than 43,303 hectares of wetlands were identified and surveyed closely. In the surveyed twenty weredas a total of about 60,608 hectares of wetlands were identified and assessed.

Wetlands are sources of biodiversity (Table 2 and 3) and so they are very important components of natural resources. The life of many plant and animal species is directly linked with their existence. Interestingly, the plant and animal species found in the western part of the region including in the North Shewa areas shows differences in their diversity. Hence in table 2 and 3 plant and animal species are described in two broad categories; those found in the eastern and drier part of the region and those found in western part of the region with sufficient moisture. The biodiversity and current land use types of the different wetlands in a category are more or less similar and hence it is fair to treat them together. Among the animal species found in the eastern wetlands; *kakisa*, Wattled Ibis, *dakiye*, fox, fish, *sabisa*, *Yebahar Doro* are the most important ones. As to the opinions of the local community, some species like frogs, *Yewuhaenat*, *Shurubit*, *Agazen*, *Buhor*, *Kerkero* and *Gureza* (Columbus Monkey) have been disappeared from the wetlands.

Biodiversity of animal species in wetlands of Amhara

- ***Animal species found in wetland of Wollo areas***

Kakisa	Sabisa
Tatie (Wattled Ibis)	Ye Bahar Doro
Dakiye	Aliquada (long legs and bikes)
Fox	Wutala
Fish	

- ***Some species have been extinct in some wetlands***

Yewuhaenat	Buhor
Frogs	Kerkero
Shurubit	Ape
Agazen	Gureza

- ***Animal species found in wetland of Western Amhara and North Shewa areas***

Fish (Ambaza)	Gagane
Sabisa	Baleenkirt
Yibra	Shimela
Jibo	Dirchit
Alekt	Frog
Buhor	Tifer Metimit
Gulagunt	Mekur
Machido	

In the wetlands of North Shewa, Gojjam and Gonder areas, the following animal species were identified; *Tifer Metimit*, *Gulagunch*, *Alekt*, Frog, *Shimela*, *Direchit*, *Yibra*, Fish, *Sabisa*. Obviously, animals such as *Sabisa* and Fish were identified both in the eastern and western

wetlands. Frogs and *Buhor* are tending to extinct in the eastern wetlands while they still exist in the wetlands of Gojjam and Gonder areas.

A diversity of plant species has been also observed in wetlands of different areas. Among the species identified in the eastern wetlands are *Senbelete, Filla, Cheffe, Ketema, Wonz Admik, Gicha, Yegesa Sar, Mashergie, Mush, Gudegn* etc. Similarly, of the wetlands found in the western part of the region, *Godir, Berenbeza, Ketema, Asendabo, Chefe, Sebeze, Kechkecho, Yaheya Shoch, Yambaza Sar* etc are the main ones identified. Moreover, *Sesa, Keha, Dokma* and *Girar* are among the tree species found in the western wetlands.

Biodiversity of plant species in wetlands of Amhara

- ***Plant species found in wetlands of Wollo areas***

Grasses

- Filla
- Senbelete
- Cheffe (Cyprus latifolius)
- Ketema- Mush
- Wonzadmik (Salix subserrata)
- Gicha
- Qewie
- Yegesa sar
- Mashengie
- Gudegn
- Delecho (Ketema)
- Kebero ageda

Tree

- Eucalyptus

- ***Plant species found in wetlands of Western Amhara and North Shewa areas***

Grasses

- Godir
- Berenbeza
- Ketema
- Asendado
- Chefe (Cyprus latifolius)
- Sebez
- Yambaza sar
- Gaja
- Yaheyashoch
- Kechkecho
- Yekebt berer

Trees

- *Acacia spp*
- Sesa
- Dokma
- Keha

This all shows that wetlands are sources of biodiversity and hence basic elements of natural resources, which should be protected and managed properly. Grasses are used not only for animal feeds but also for thatching roofs, making hay and building huts. Selling of *Cheffe* (*Cyprus latifolius*) is often means of subsistence for many youths living in towns and cities. *Gessa, Dibora,* and *Gadeta* are made of grasses and used for different purposes. They also bring additional incomes to the communities living in the surrounding of the wetlands.

Wetland use I Amhara region

Wetlands are currently used as communal grazing lands, cultivated land and for traditional fishing purposes. Rice cultivation is expanding in wetlands of Fogera and Chefa. In the eastern part of the region, wetlands are also cultivated during the short raining period (*Belg*) because during the main rainy season (*Meher*) the land remains under water cover. The majority of residual crops are grown in areas tending to wetlands.

During the dry season, farmers practiced irrigated agriculture in wetlands especially in shorelines, beaches and mangroves, which is traditionally called "*Baharsheshi meret*" meaning 'land that was under water during the big rainy season'. This shows the economic value of wetlands in the life of the community. Preserving and protecting wetlands means improving the livelihoods of the rural communities living around the wetlands and beyond. For example, nomads from Afar region brings their cattle and builds huts in Chefa and Borkena wetlands during the dry seasons and goes back when the rainy season begins. Generally, wetlands support lives of millions of people in the region.

Wetlands act as water reservoirs, arrest floods, recharge ground water, improve water qualities. They play a vital role in the hydraulic and hydrologic cycle. Many rivers dissect wetlands and as a result increase their volumes. Wetlands are also sources of rivers and streams. For example, *Keitiema* and *Meher Shegne* rivers in North Shewa originate from wetlands. There are also rivers like *Chimas* and *Fichet Kola* in Kera Keya Woreda of North Shewa that die or end up in a wetland called *Alo Bahar*.

Despite of the huge importance of wetlands they are currently very endangered and subjected to extinction unless immediate action is taken to protect them. The biggest threats are sedimentation, encroachments of farmlands, overgrazing and low perception of communities.

As a result of deforestation and cultivation of steep slopes, almost all wetlands are loaded with sediments. As a result, many wetlands disappeared and are disappearing. Often they are used as cultivated lands, which is also associated with drying out of streams and rivers. Some wetlands like *Chefa* are highly affected with weeds called "*Mogne Fakir*", which have overtaken thousands of hectares of grazing lands. Communities sometimes consider wetlands as wastelands as well as mosquitoes breeding sites. As a result, they have developed negative perceptions, and consequently the willingness to protect them is low.

The recurrent drought has affected wetlands negatively. Most wetlands are diminishing in size from time to time, which leads to their disappearance. The community also sees plantation of trees like eucalyptus as a solution to wetlands. The higher water demand of the tree lowers the water table and affects wetlands.

Conclusion and recommendations

The region has a number of wetlands covering hundreds and thousands of hectares. With this study, it was not possible to quantify the whole wetlands of the region, their biodiversity status and extent of utilization and distribution. We were focused only on selected wetlands of the twenty-six sample *weredas* but it is possible to draw some conclusions about their economic

benefits and their threats and measures to be taken to save them from extinction. Generally, more than 60,000 hectares of wetlands in twenty-six *weredas* were identified and closely surveyed. The existence of many plant and animal species are directly linked with wetlands, especially during the dry periods where millions of cattle and other animals are directly depend on wetlands for feeds.

Wetlands are source of streams and rivers and used to recharge ground water. Paddy rice production and their expansion in the future are directly linked with wetlands. This highlights that wetlands are means of subsistence for millions of people in the region. Hence, protection, improvement and proper utilization of wetlands will help to improve livelihoods of rural communities and so it has implication for food security.

In spite of such important roles of wetlands they are highly endangered. Some are already extinct and others are being reduced in size continuously. Therefore, the protection of wetlands must be prioritized. This requires the existences of constructive policy environments supported by community bylaws and social rules and regulations on how to protect improve and utilize wetlands. Due attention should be also given to ownership issues. Whenever communities are agreed to distribute wetlands into the hands of the individual households their management issues should be in line with certain agreed guidelines. Otherwise, their deterioration as a result of mismanagement will have negative consequences not only for its owners but also the whole communities living in its surrounding and also beyond. As such, research on wetlands should be focused on developing management options and producing management guidelines to be used by the community. In such efforts, priority should be given to the biggest and most important wetlands. To plan future research and development activities on wetlands, there is a need to identify, characterize and map all wetlands available in the region. Soil and water management efforts on crop and grazing lands are also very important activities in the protection of wetlands and should be further encouraged in the future.

References

Abye Kindie (2001): Wetlands Distribution in Amhara Region, their importance and current threats. Proceedings of the wetland awareness creation and activity identification workshop in Amhara National Regional State.

Leykun Abunie (2003): The distribution and status of Ethiopian wetlands. Proceedings of the seminar on the resources and status of Ethiopian wetlands, Yilma D. Abebe and Kim Geheb, IUCN .

Stuip, M.A.M., Baker, C.J. and Oosterberg, W. (2002): The Socio-economics of Wetlands, Wetlands International and RIZA, The Netherlands.

Findings of Participatory Field Studies in Fogera, Bahar Dar Zuria and Dangela wereda for Community and Catchment Based Pilot Demonstration Project.

By Legesse Taffa
Ethio Wetlands and Natural Resources Association
P.O. Box 1518 Code 1110
Addis Ababa
Telephone: 011 552 77 91

Abstract

Wetlands in Amhara region in general and Fogera, Bahar Dar Zuria and Dangela weredas in particular, occupy a significant proportion of the total land mass. They also have many economic and ecological benefits that support the livelihood base of rural and urban populations. However, recent trends show that wetlands in the region are degrading at an accelerating rate. Increasing pressure from human and livestock populations on one hand and the minimal attention given to the sustainable management of this resource on the other hand mainly accelerated degradation of wetlands. Degradation of wetlands has strong linkages with the over all degradation of watersheds.

The protective vegetation cover on the upslope hills is cleared for expanding cultivation, which accelerate soil erosion and increases siltation in wetlands. Again land shortage and low productivity of farmland on up slopes increases pressure on wetland either for cultivation or for livestock grazing. Most of the grazing wetlands in the studied areas are open access communal resources for which no one takes care of.

The overall environmental problems observed in wetlands and the catchments in Amhara Region are:

- *over grazing,*
- *extensive use of wetlands for agriculture,*
- *catchment degradation and erosion resulted in increasing siltation in the wetlands,*
- *over-harvesting of the natural wetlands vegetation, such as papyrus,*
- *expansion of invasive weeds and eucalyptus plantation on wetlands. As a result of the productive wetland ecosystems are changed in to dry lands.*

The aforementioned problems are alarming and require major efforts in order to ensure food and water security in the area. An attempt made by Ethio Wetlands and Natural Resource Association in demonstrating community and catchment based sustainable wetland management practices can be successful only through continuous effort by raising awareness on wetlands and empowering and building the capacity of the local community.

Key words: participatory rural assessment, wetlands, catchment, degradation, wetland management.

Introduction

With funding from the Finland Embassy and Global Mechanism of the Convention to Combat Desertification (GM-CCD), Ethio Wetlands and Natural Resources Association is implementing a pilot project for demonstrating and testing catchment and community-based sustainable wetland management and rehabilitation in Dangla, and Bahar Dar Zuria and Fogera Weredas. The project involves a series of inter-linked components. Prior to the implementation of the pilot project, an initial in-depth participatory study at selected weredas and sites was undertaken.

Three demonstration sites were selected (one from each wereda) for the study and implementation of the demonstration project. This was done in consultation with the concerned Wereda Agriculture and Rural Development Offices. The basic criteria used to select the demonstration sites were a catchment that has wetlands at the bottom, of manageable size for demonstration purpose (not larger than 300 hectares) and willingness of the community to participate in the initial in-depth study as well as catchment rehabilitation activities.

Description of sites selected for the study

Name of the Site	Wereda	Characteristics
Yitedit (Amolikenga)	B/Dar Zuria	The wetland is seriously degraded due to unwise grazing system. As a result invaded by thorny weeds. The catchment is susceptible to soil erosion
Papyrus wetland	B/Dar Zuria	The wetland is located along a riverbank and is covered by papyrus vegetation. There is over-harvesting of papyrus by the local and external communities.
Gangita Sillase	Dangela	The wetland is entirely used for communal activities. It is also used for fodder and thatching grass production. There is serious degradation of the wetland due to unwise grazing system as a result it is invaded by thorny weeds. The surrounding catchment's cultivation land is exposed to soil erosion.
Kilti valley bottom wetland	Dangela	The wetland is stretching along Kilti River. It is used for communal grazing and harvesting of thatching grass
Kuharba	Fogera	It is part of the extensive Fogera flood plain, which is used for cultivation (rice and other crop production) as well as grazing. The surrounding catchment is highly susceptible to soil erosion and siltation is one of the problems in the wetland.

Objectives of the study

The main objectives of the study are:

- to understand the degree of environmental degradation in the wetlands and associated catchments, and
- to understand wetlands management practices of the community in selected sites.

The study seeks to identify the underlying causes of wetland degradation and alternative measures, which need to be taken to minimize the problems.

Methodology of the study

Data collection for the study has been made using Participatory Rural Appraisal (PRA) techniques and tools. It involved participatory resources mapping, ranking and scoring, trend analysis, focus group discussion, individual interviews and observations recorded through transect walks.

Photos of field study methodology

Participatory resource mapping, Amolikenga community, B/Dar wereda

Ranking and scoring exercise with Gangita Sillase community, Dangela wereda

Focus group discussion during case study at Kilti valley

As a supplement to the PRA study secondary data on population, land use, crop production and livestock resources at wereda and kebele level were collected and compiled, and regional Land Administration and Land Use policy documents also reviewed.

The PRA study in the three demonstration sites took seven sessions plus two sessions of case studies at the unique wetland sites in Dangela and Bahar Dar Zuria weredas. Fieldwork design and site selection was undertaken from 20th to 30 October, while the field study was conducted from November 2004 to March 2005. Technical staff of EWNRA assisted by staff of Wereda Agriculture and Rural Development Coordination Office facilitated the study.

The presentation of the finding reflects the view of the community members who participated in the study. The role technical staff was in facilitating discussions and then organizing findings and forwarding concluding remarks.

Discussion of the findings

The study tried to explore all the socio-economic and ecological benefits of wetlands for the local community in the studied sites. Accordingly farmers identified a number of benefits they are getting from the wetlands in their localities. The major benefits of wetlands identified can be categorized into two as presented below:

1. **Socio Economic Benefits**
   - grazing fields
   - crop production such as rice, pulses, vegetables and others, e.g. on the Fogera Flood Plain,
   - water for livestock and human consumption,
   - medicinal plants,
   - thatching grass,
   - papyrus used for construction and raw materials for handicrafts,
   - common resources such as papyrus, ceremonial and thatching grass harvested for sale/income generation, particularly for resource poor households,
   - grass for making hay, either for own use or for revenue generation,
   - nursery sites for rising of seedlings, and
   - clay soil for pottery making.

2. Ecological benefits of wetlands recognized by farmers

- Wetlands are reservoirs of water for dry seasons use,
- Wetlands trap sediments,
- Wetlands are the home for different wild animals.

Trends in Wetland Degradation in the studied area

Although the diverse benefits of wetlands in the studied areas are well recognized, efforts made to sustain the benefits are minimal. As a result, wetland changes/degradation is accelerating in the areas. Degradation of wetlands is due to human activities on the wetlands and the surrounding catchments.

The out comes of wetland degradation are:

- Diverse benefits obtained from wetlands decrease, such as pasture, water, thatching grass and craft materials.

- Unique wetland vegetation, like papyrus, decrease and totally disappeared in some places.
- Grazing wetlands are invaded by thorny weeds.
- Water resource of wetlands decline; the discharge of streams and springs decreases, duration of flooding is shortened and scarcity of water during dry season becomes one of the serious problems in some places.
- Wetland areas shrink due to drying up of the peripheries.

The major causes for the changes currently observed in wetlands, as recognized by farmers, are as follows:

- Increasing human and livestock populations as a result of which the demand for wetland use increases,
- Change in the grazing system on wetlands; over-stocking and year-round grazing,
- Expansion of eucalyptus plantation on wetlands particularly since 1979 E.C and villagization,
- Intensification of cultivation; introduction of rice and double cropping practices for instance on Fogera Flood Plain,
- Catchment degradation, erosion and siltation on wetlands.

Impacts of the changes on the livelihoods of local communities

- Degradation of grazing in wetland reduces the livestock production,
- Clearing of natural vegetation on the catchment results in shortage of wood supply, drying up of springs, increasing of soil erosion, decrease in productivity and change in micro-climate,
- Shortage of thatching grass and raw materials for handicrafts,
- Erosion on uplands, siltation and formation of gullies on wetlands takes some land out of use.
- Siltation along the shore of the lake and riverbanks make rivers flood wide areas and causes increased damage.
- Drying up of permanent swamps and seasonal wetlands disturbs the breeding places of fishes and causes scarcity of water supply, particularly during dry seasons.

Adaptation strategies of the community

The community has developed adaptation strategies to overcome problems faced due to the degradation of the wetlands and surrounding catchments. For instance, to overcome scarcity of water, in some places farmers try to dig water wells for dry season use. Individuals are trying to allocate a plot of land for growing thatching grass and keeping crop by-products for livestock feed to overcome shortage of pasture on wetlands. One of the studied communities has established a wetland management committee to prevent unwise use of wetland resources. Loss of natural forest on the catchments has been compensated for by the plantation of eucalyptus. Individual farmers are also trying to practice soil and water conservation works on the uplands to reduce soil loss. Even though they have not been realized yet, farmers have recognized the importance of reducing livestock numbers to reduce degradation of the wetlands due to overgrazing.

Wetland management practices

To see the institutional set up and policy statement, the existing policy document of Regional Land Use and Environmental Protection Authority was evaluated. In the policy document

wetlands are generally considered as communal resources, except cultivated ones, which are considered as individual farm plots. According to the policy document there are three types of wetlands ownership observed as stated under Article 2 –No. 12 - 14. These are:

1. Individual holdings - cultivated wetlands,
2. Communal grazing wetlands: free access resources and the *kebele* administration is responsible for their management, and
3. State holding -large swamps and lakes.

Practically there are different customary rights under which different management practices are operating. Some of these are stated as follows:

1. Wetlands managed by local institutions, like papyrus wetland in Yibab Chencher kebele Bahar Dar Zuria wereda, where local community has established a management committee responsible for protecting the papyrus and surrounding forest against illegal harvesters.
2. Communal grazing wetland with some management inputs like the Kilti valley bottom wetland, Dangela wereda Girarge Warkit kebele where a community group is using the wetland and practice limited management with partial draining of stagnant water and removing thorny weeds by arranging campaign work.
3. Relatively well-managed wetlands used for cultivation - like Fogera Flood Plain and small pockets of wetland plots used for growing thatching and fodder grass under ownership of individuals, group and public institutions, like school and churches.
4. Poorly managed communal grazing wetlands, which are used for free-access grazing in many places and conventionally managed by kebele administration. There is no management input to improve or maintain these communal wetlands. Every dweller of the area, including the neighboring communities, have free access rights. These types of the wetland are extensively grazed all year round, severely degraded and invaded by thorny weeds.

Conflict

Conflicts frequently arise among wetland users are:

- among neighboring communities on communal grazing lands, when one group living close to the resource is interested to exclude other communities due to the scarcity of resource and degradation of the wetland caused by overgrazing,
- between upstream and down stream users on water resources, when the upstream users block water for irrigation purposes as a result of which downstream users suffer from shortages of water for human and livestock use during the dry season,
- on water use where the wetlands are used for irrigation agriculture during dry season like Fogera,
- with individuals interested to expand their territory toward the communal wetlands, including for eucalyptus plantations, and
- with road Construction Company that damage wetlands by construction or detouring vehicles across wetlands, blocking river crossing on the wetland to use the water for construction purposes and dumping gravel on the wetlands.

Local elders resolve minor conflicts, like conflicts arising between individual farmers, through negotiation. Serious cases that are not settled by the local elders are brought to the *Kebele* social court, which passes decisions and penalties based on evidence. *Kebele* administration is

responsible for enforcing the decisions of the social court. *Kebele* and wereda administrative bodies resolve conflicts between neighboring communities. In some places conflicts with individuals expanding their territory toward communal wetlands and claiming land certification are reported to the wereda Rural Land Administration.

Problems currently observed on wetlands and surrounding catchments

Discussions were made with farmers, senior experts and development agents to help identify the major problems currently observed on wetlands and the surrounding catchments. The findings are summarized as follows:

1. **Problems observed on wetland**
   - drying up of water springs and scarcity of water during dry season,
   - erosion and siltation on water sources and wetlands,
   - disappearance of the indigenous grass species and wetlands are invaded by thorny weeds,
   - degradation of the wetlands changes the characteristics of wetland vegetation, forms gullies and leads to drying-out and cracking,
   - shortening of the flooding seasons and shrinking of wetlands territories,
   - expansion of eucalyptus plantations on to wetland ecosystems, and
   - disappearance of unique wetland vegetations like papyrus and wild lives due to the drying up of the swamps and siltation.

2. Problems observed on surrounding catchments

- decreasing productivity of the lands,
- disappearance of the vegetation cover,
- accelerating of soil erosion,
- shortage of farm land and interruption of fallowing,
- scarcity of water, and
- desertification.

Conclusion and Recommendations

Wetlands in the studied area play a significant role in the livelihoods of the community. Even so, wetlands in the area are seriously degrading due to mismanagement and unwise utilization of the resources. A number of human activities are resulting in irreversible damage to the wetlands. Currently the attention given for sustainable management and wise use of wetlands is very low or minimal.

Increasing of human and livestock population, expanded cultivation on the up-slopes and accelerated deforestation are some of the underlining causes mentioned that are significantly contributing to the degradation and loss of wetlands. High erosion from upslope has resulted in the accumulation of silt on wetlands. Siltation reduces water-holding capacity of wetlands as a result of which fish and other water dependant creatures have disappeared.

Overgrazing is another severe problem currently observed on wetlands, which decreases the quality and quantity of pasture and water availability and has accelerated the spread of invasive thorny weeds thereby changing the characteristics of the wetlands. One of the immediate outcomes of wetland degradation is scarcity of water, which has wider implication. The problem is appearing in many communities particularly during the dry season. Other outcomes are

decrease in crop and livestock production, loss of biodiversity, and impacts on particular groups of the community who depend on wetland resources for survival.

Thus it is important to address the problems and minimize the current threat to wetlands. Implementing a catchment-based wetland management and rehabilitation project is very important for addressing the prevailing problems. Awareness creation on the sustainable management of wetlands within the farming community, concerned government staff and local decision makers is also very important. Building the capacity of community and government staff through interactive training and supporting wetland rehabilitation activities by running demonstration sites like the one planed by EWNRA is very important. Revising the land use policy with due attention to wetlands is also an important issue.

Some of catchment based conservation activities undertaken by Ethio wetlands and Natural Resource Association in collaboration with wereda agriculture and rural development offices at pilot demonstration sites in Fogera and Dangela wereda

Stone band constructed on farmlands Fogera wereda to stop soil erosion hence to decrease siltaion in the wetlands

Soil band constructed on farmlands Dangela wereda for the same purpose

Vetiver grass planted to reinforce soil bands, Dangela wereda for similar purpose as above

Plenary Discussion

After presentation of all the papers the floor was opened for plenary discussion. The following are the questions asked and clarifications given on the papers presented and related issues. There are also elaborations given by paper presenters and other participants of the workshop.

Question: Is it a problem using wetlands for agriculture? Are agricultural practices on the Fogera Flood Plain such as rice cultivation, appropriate?

Response: Of course it is the best option if wetlands are protected as a natural ecosystem if there are no factors forcing people to use wetlands for agricultural purpose. However, cultivation of wetlands is not a problem by itself but the problem is if the cultivation system is not practised in a sustainable manner. In general, if wetlands are used for cultivation, they have to be rested (left uncultivated) for a certain period of time particularly during the rainy season for ecological recovery. They should be protected from other uses like livestock grazing and planting with perennial and water loving plants – sugarcane and eucalyptus, avoided. Measures should also be taken immediately when the wetlands show signs of degradation. In this regard, the cultivation system on the Fogera Flood Plain seems not sustainable because it is subject to double cropping, while livestock grazing is allowed on cultivated wetlands and eucalyptus is widely planted on the Flood Plain. Currently some symptoms of degradation are appearing in the flood plain, such as complete drying up of parts of the flood plain and appearing of invasive weed species. Rice cultivation is also not a serious problem if it is harmonious with the flooding.

Question: The awareness of decision makers on wetland issues is minimal. On the other hand the existing policy and guidelines encourage maximum utilization of lands, including wetlands, to boost production and ensure food security. How is it possible to achieve a compromise between maximum and sustainable utilization?

Response: Maximum utilization of resources to ensure food security is definitely important but we have to think about long-term food security without depleting our natural resource base. It is a matter of choice between ensuring food security for the short-term without ignoring conservation of the resource base and ensuring food security in a sustainable way with due consideration for conservation of the natural resources. Therefore, it is the responsibility of policy makers and implementing institutions to designs balanced strategies.

Question: There are some initiatives in the region like using vertisols for agriculture, these soils are mostly found in waterlogged areas. What is the view of Ethio Wetlands and Natural Resources Association in this regard? What will be the possible impacts of these initiatives on wetlands?

Response: Ethio Wetlands and Natural Resource Association has no experience and idea on vertisols but catchment management can have positive impacts on wetlands and that is why the organization is implementing a pilot demonstration catchment-based wetland management project in selected sites.

Question: Which government sector / institution is mainly responsible for wetland issues and how is it possible to achieve inter-sectoral integration?

Response: Wetlands are cross-sectoral resources with which different sectors are concerned. Different countries have different scenarios but in our case as far as we know the Environmental Protection Authority is the legally mandated institution to deal with wetlands. Drafting appropriate policies for wetland management is a mandate of this institution but it has no institutional setup to co-ordinate sectors and follow-up the proper implementation of policies at lower levels.

The participant from EPLAUA added that all institutions dealing with natural resources at a lower level are under Agriculture and Rural Development. This is potentially good for cross-sectoral coordination.

Question: Wetlands are considered as sources of mosquitoes, which cause malaria. Does conservation of wetlands contradict malaria eradication?

Response: Basically the spreading of malaria is associated with increasing of human interference in wetlands. Draining of wetlands is not the only solution to eradicate malaria. If we do so we will loss diverse benefits of wetlands. Therefore before deciding to avoid wetlands we have to balance the advantages and the disadvantages to do so.

After the discussion session within workshop hall was over, participants were taken for field observations on Lake Tana and to have a discussion among themselves on the trends of changes recognized on the lake and in surrounding wetlands. Some of the participants who were born and brought in the area explained the deteriorating changes they have observed particularly on the hydrology, flora and fauna of the lake and the surrounding areas.

Upon conclusion of the workshop, participants promised to contribute their best share for the sustainable use of wetlands. They also promised to disseminate awareness gained to other staff and farming communities and put pressure on policy and decision makers toward revising of the land use policy so that it gives due attention to wetlands.

Appendices

Appendix 1 Workshop program

Second awareness creation workshop on wetlands in Amhara region March 2005
Venue: Fishery Research center, Bahar Dar

Time	Activities/ Topics To be addressed	Presenter	Chair Person
8:00-8:30	Arrival At Workshop venue	All Participants	
8.:30-8:45	Registration	All Participants	
8.:45-9:00	Welcome speech and program introduction	Afework Hailu, EWNRA	
9:00-9:40	Opening speech	Menberu Alebachew, General Manager EPLAUA	
9:40-0:00	Wetland definition, benefits and distribution in Ethiopia	Afework Hailu	Dr. Fekadu Yohannes, Research Advisor USAID AMAREW project
10:05-10:30	Coffee and tea break	All Participants	
10:05-10:30	Wetland of Fogera wereda: Use, Management and Threats	Ato Kefie Minale, Fogera wereda Agriculture and Rural development office	Dr. Fekadu Yohannes
10:30-10:50	Wetland of Dangela wereda: Use, Management and Threats	Ato Alemayehu Guade, Dangela wereda Agriculture and Rural development office	Dr. Enyew Adgo, Director for Natural Resources Research, ARARI
10:50-11:10	Wetland of Bahar Dar Zuria wereda: Use, Management and Threats	Ato Getachew Nigatu, Fogera wereda Agriculture and Rural development office	Dr. Enyew Adgo
11:10-11:30	Establishment of fishery and wetland management department in Bahar Dar University	Ato Birehanu Teshale, Head of Chemistry department, Bahar Dar University	Dr. Enyew Adgo
11:30-11:50	Soil erosion and sedimentation on the Case of Lake Alemaya	Dr. Fekadu Yohannes, Research Advisor USAID AMAREW project	Dr. Enyew Adgo
11:50-12:10	Biodiversity of Lake Tana and threats for sustainability	Dr. Eshete Dejen, Researcher & Manager, Fish & Other Aquatic Life Research Center, ARARI	Dr. Enyew Adgo
12:10-12:30	Discussion	All	Dr. Enyew Adgo,
12:30-2:00	Lunch break	All	
2:00-2:20	Inventory and characterization of potentials and current management of wetlands in Amhara region	Dr. Enyewu Adgo	Dr. Eshete Dejen
2:00-2:20	Findings of Participatory Field Studies in Fogera, Bahar Dar Zuria and Dangela wereda for Community and Catchment Based Pilot Demonstration Project.	Ato Legesse Taffa	Dr. Eshete Dejen
2:20-2:40	Amhara Region Wetland Management and threats	Wolegbreal G/ Kidan, Ecologist EPLAUA	Dr. Eshete Dejen
3:30-4:00	Coffee and tea break	All Participants	
4:00-5:30	Discussion and Field Observation	All Participants	Dr. Eshete Dejen
5:30-6:00	Video show (depends on time available)	All Participants	
6:00	Closing	Dr. Eshete Dejen	

Appendix 2: List of Workshop Participants

No.	Name of the Participants	Organization	Job title
1	Getachew Nigatu	Agriculture and rural development office, Bahar Dar Zuria wereda	Team leader
2	Getachew Delele	Agriculture and rural development office, Bahar Dar	Soil and water conservation expert
3	Alemayehu Guade	Agriculture and rural development office, Dangela wereda	Soil and water conservation expert
4	Wale Dessie	Agriculture and rural development office, Fogera wereda	Soil and water conservation expert
5	Birehanu Teshale	Bahar Dar University	Lecturer
6	Teklu Damtie	Environmental Protection Land Administration and Use Authority	Ecologist
7	Goraw Gashu	Amhara Region Agricultural Research Institute, Fishery Research centre	Assistant Researcher
8	Araya Silasie Alemu	Education Department Fogera Wereda	Education Department
9	Tesfaye H/Silasie	Agriculture and rural development office, Fogera wereda	Land use Expert
10	Keffie Minale	Agriculture and rural development office, Fogera wereda	Agro forestry Expert
11	Mengiste Yihune	Agriculture and rural development office	Rural land Administration desk
12	Hailu Tekalign	Dangela wereda Education Department	Head of wereda Education Department
13	Sewunet Eshetu	Bureau of Agriculture and Rural Development	Water shade expert
14	Biresaw Mahatot	Bureau of Agriculture and Rural Development	Forestry expert
15	Abeye Mereawy	Agriculture and rural development office, Dangela wereda	Head of EPLAUA team
16	Tesfaye Simeneh	Dangela Wereda Education Department	Expert
17	Workineh Alemayehu	Agriculture and rural development office, Awi Zone	Team leader
18	Belay Gashu	Agriculture and rural development office, West Gojjam Zone	Environmental expert
19	Enyew Adgdo (Dr)	Amhara Region Agricultural Research Institute	Director NRM
20	Eshete Dejen (Dr)	Amhara Region Agricultural Research Institute, Fishery Research center	Center manager
21	Fekadu Yohannis (Dr)	USAID/AMAREW project	Researcher
22	Memberu Alebachew	Environmental Protection Land Administration and Use Authority	General manager
23	Etenesh Yohanes	Agriculture and rural development office, South Gonder Zone	Agronomist
24	Tsige Girma	Agriculture and rural development office, Bahar Dar Zuria wereda	Extension team leader
25	Zelalem Wasse	Amhara region mass media Agency	Camera man
26	Mezimur Hawaz	"	Reporter
27	Ayenew Berihun	"	Reporter
28	Getachew Aseman	"	Reporter
29	Alemayehu Moges	"	Reporter

Workshop participants on field observation at wetlands around Lake Tana