

**Research article**

# **Wetlands Potential, Current Situation and Its Threats in Tana Sub-Basin, Ethiopia**

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## **Abstract**

In Amhara region, Tana Sub-basin has plenty of wetlands. These wetlands now days are decreasing at alarming rate. The study of wetlands potential, current situation and its threats in sub basin was conducted in 2014 for about ten months. Sampling sites (154 sampling sites) were identified and selected based on Agro-Climatic Zone and land use and land cover using Geographic Information System (GIS) and at the same time key informants (57 key informant) discussion were taken. Based on GIS result, the total area of wetlands in Tana Sub-basin is estimated that 340928.8 ha (permanent wetlands 17133.95ha, seasonal wetlands 7642.07ha, Lake Tana 311277.3 ha, ponds and dams 2057.128ha and rivers 2818.333 ha) which are directly or indirectly support millions of people by providing goods, functions and services to them particularly Negede Woy tribe. Now days, these things are decreasing at alarming rate. This is because of the existing land use system is unsustainable resulting in loss of wetlands. Wrong existing land use types of wetlands are drainage for agriculture, over grazing, upper catchment lands degradation, Eucalyptus encroachment or plantation, invasion of alien species or weeds, over harvesting of their resources, settlement and urban expansion, pollution and water diversion which threats of wetlands and are serious problems which need solutions. The reasons for lack of conservation and unsustainable use of wetlands are political shortcomings, the absence of policy and a strong legal framework for the conservation and sustainable use of wetlands, institutional shortcomings, socio-economic and environmental shortcomings such as poverty, lack of awareness, population pressure and climate change. **Copyright © WJAERD, all rights reserved.**

**Keywords:** Tana Sub-basin, wetlands, wetland threats, sustainable development

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## Introduction

Wetland has many definitions, from those, Davis (1994) defined as wetland are areas of marsh, fen, peat land 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.

Ethiopian wetlands consist of swamps/marshes, fresh and brackish lakes, riverine flood plains, swamp forests and human made wetlands which are distributed almost in all part of the country. In Amhara region the coverage of the wetland is about 288,744 ha of swamps and marshes and 316,609 ha of the water bodies (Dixon A.B. *et al*, 2001).

More than 60 seasonal and perennial rivers that are equipped with distinct riparian and wetland vegetation can be found in the Lake Tana region. But the vast majority of this vegetation type is concentrated in the flat plains of Lake Tana. One of the characteristic features of Lake Tana, the papyrus populations, has dramatically declined in its distribution due to overexploitation and habitat fragmentation and loss. Nowadays papyrus populations are mainly found in pocket habitats along the shorelines (Woldegabriel and Solomon, 2006).

Losses, alteration and fragmentation of natural habitat of wild animals and destruction of wetlands are because of inappropriate land use type (MEA, 2005). With the rapid increase in population and continuing expectations of growth in the standard of living, pressures on natural resources have become intense.

Wetlands have many economic, cultural, ecological functions and values. Birds use wetlands for migratory resting places, breeding or feeding grounds, or taking cover from predators. Wetlands also provided fish, drinking water, pasture land and transport and were part of the cultural history of early people. Wetlands have been described both as "the kidneys of the landscape", because of the functions they can perform in the hydrological and chemical cycles, and as "biological supermarkets" because of the extensive food webs and rich biodiversity they support (Barbier, E. *et al.*, 1996). Wetland systems directly support millions of people and provide goods and services to the world. People use wetland soils for agriculture, they catch wetland fish to eat, and they cut wetland trees for timber and fuel wood and wetland reeds to make mats and to thatch roofs. Direct use may also take the form of recreation, such as bird watching or sailing, or scientific study (Shumway and Caroly A, 1999).

Even though wetlands are critically important ecosystems that provide globally significant environmental, social and economic benefits, they are under serious threat. Miserably the degradation and loss of wetlands is more rapid than that of other ecosystems, for this agricultural land expansion, climate change and sedimentation are the major causes (MEA, 2005). Therefore, in addition to these, identification of other most important factors which enhance loss and extinction of wetlands is very urgent in order to conserve and optimize sustainable utilization of this natural resource in Tana sub- basin.

## Materials and Methods

### General Descriptions of the Study Area

Tana Sub-basin is found in the Amhara region. Geographically, the basin is located between North latitude 1210669m – 1411084m and East longitude 254549 - 416363m. Its elevation is ranging 1327 - 4109 meter above sea level. The basin has a total area of 1,589,654.98 hectares. The largest lake in Ethiopia, Lake Tana is found in this sub basin (Fig.1).

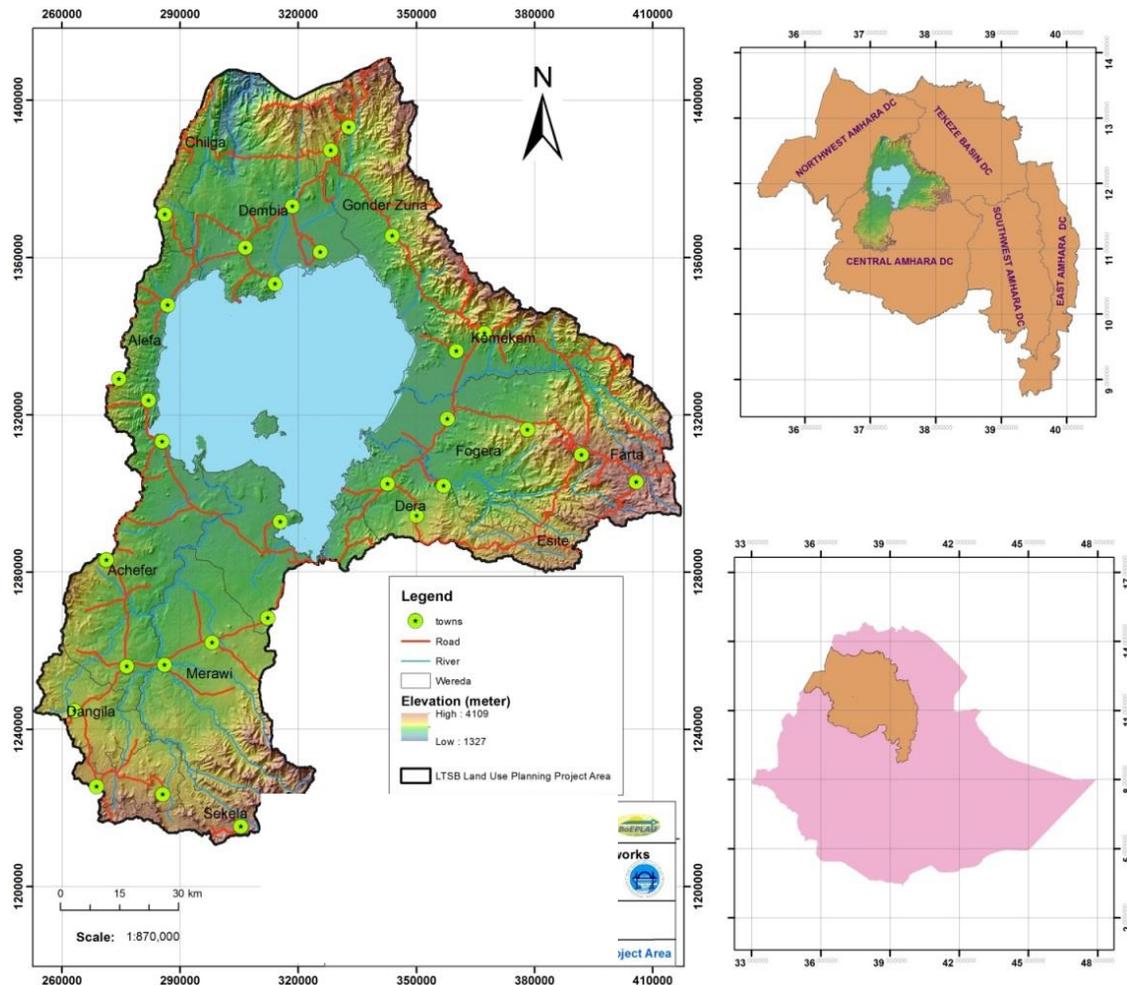


Fig. 1. Map of Tana Sub-basin

Human population in Tana Sub-basin is generally homogeneous linguistically and consists of the main ethnic families of Amhara. According to Central statics agency 2007 census and Woredas, the study area has a total population of 3103231 with male 1563276 and female 1539955 this is about 15.8 percent of the total regional population. The very big proportion or 75.8 percent of the population of the area is living in rural areas where as the remaining 24.2 percent are concentrated in urban and semi urban centers. The settlement pattern of the study area is 56% scattered and 44% clustered, and the average population density of the area is 292 persons per km square.

The sub basin is endowed with eight different agro-climatic zones namely, moist tepid, sub-humid tepid, moist cool, moist warm, moist cold, moist very cold, sub-humid cool and sub-humid cold. Most of the project area (79.4%) is found in moist tepid agro climatic zone followed by sub-humid tepid, moist cool and sub-humid cool which account for 12%, 5% and 3% respectively. The area is dominated by one main rainy season, from June to September and one dry season between October and May. The rainfall distribution of area is controlled by the northward and southward movement of the inter-tropical convergence zone (ITCZ) resulting in a single rainy season.

River Megech, Rib, Gumara and Gilgel Abay are the main permanent water resources in the Basin, However, the Megech and Rib rivers sometimes dries-up at downstream during the dry seasons. Both rivers used to supply water for human and livestock consumption and also for crop irrigation. The others seasonal rivers originate from the upper in the mountainous range in the north and in hilly zones in the inter-riverine area of river Megech and Rib are also other sources of water. River Infranz, River Jema, River Awra Arda, River Derba, River Arno-Garno, River Shine, River Selamko, River Dengura are some of prominent seasonal rivers found in the study area.

The sub basin is one among the other agrarian areas of the nation, where by Agricultural field crop production is predominantly prevailing. With this respect, Agriculture production is the mainstay for the livelihood of people in the sub basin. Beyond the presence of huge arable land resource, the sub basin is adequately endowed with a wide variety of indigenous plants with a unique heritage of diverse germplasm of vegetables, fruits, oil crops, forages, tubers, cereals and pulses.

Forest resource offer the main energy supply is one of the most dynamic economic activity in sub basin; it also contribute to sustainable agricultural systems; and are a source for agro-biodiversity and a major storehouse for carbon and water. However, Forest resource in the sub basin is being depleted, biodiversity is declining, timber and non-timber forest products and services are weakened, and most of the important biological endemic species, that have a potential to sustain the livelihood in the basin, are now vulnerable.

The sub basin is rich in, birds, hippopotamus, fish and other animals. There are plenty of wetlands. Wetlands and fisheries resources also declining due to ever-increasing population in the study area coupled with inappropriate land use and wetlands management system and high fishing pressure with narrow mesh size.

## **Methodology**

Biophysical observation sites (about 154 sites) were identified and selected based on Agro-Climatic Zone and land use and land cover by using Geographic Information System (GIS) (Fig.2). In addition to this, some important sites such as irrigations Dams (Mitsili, Selamiko, Rib, Megech and Megech Serava) and dominant wetlands were observed based on the local source and GIS based ( Fig.1) and from these sites representative samples were taken randomly. Secondary data were also collected from woredas (21 woredas) (Agriculture office and Environmental protection and Land use Administration offices) and zonal sectors (North Gondar, Bahir Dar Liyu and South Gondar) department of Agriculture and EPLUA, by having developed formats in 2014 for about ten months.

Primary data were also collected from key informants (totally, 57 key informants were interviewed) in the same year.

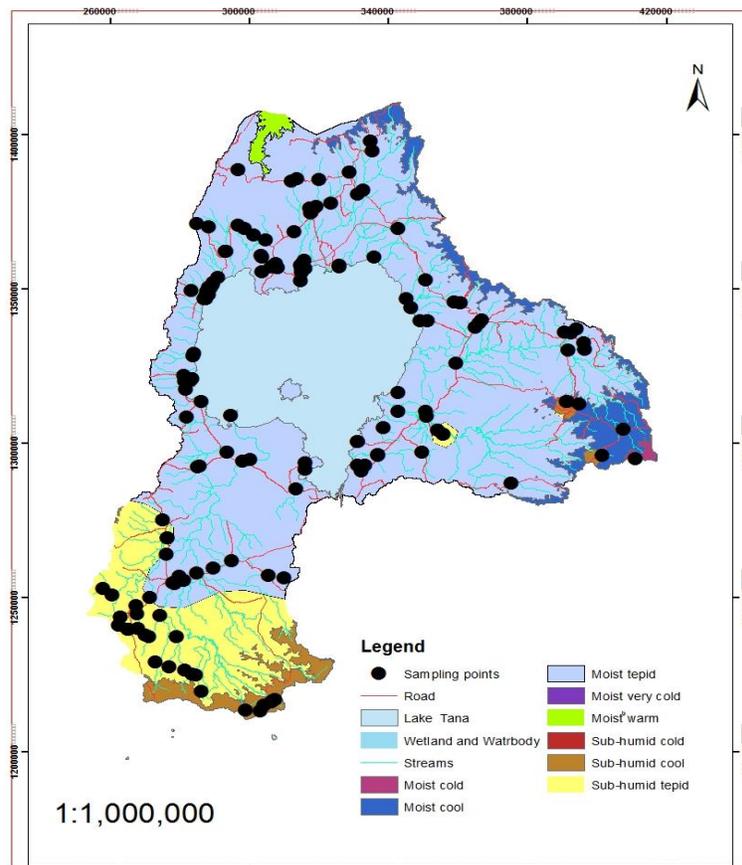


Fig.2. Map of observations and sampling sites of the study

## Data Analysis

Descriptive statistics were used. GIS was also used to show special distribution and allocation of wetlands.

## Results and Discussion

In Tana Sub-basin, there are plenty of wetlands almost in all sides of the Lake Tana, along the rivers and streams resulting from hydrological and land use changes. The Dembia plain to the North, the Fogera plain to the East and the Kunzila plain to the Southwest of Lake Tana areas bordering the lake, which are often flooded during the rainy seasons forming extensive wetlands in addition to permanent wetlands(Fig. 4).

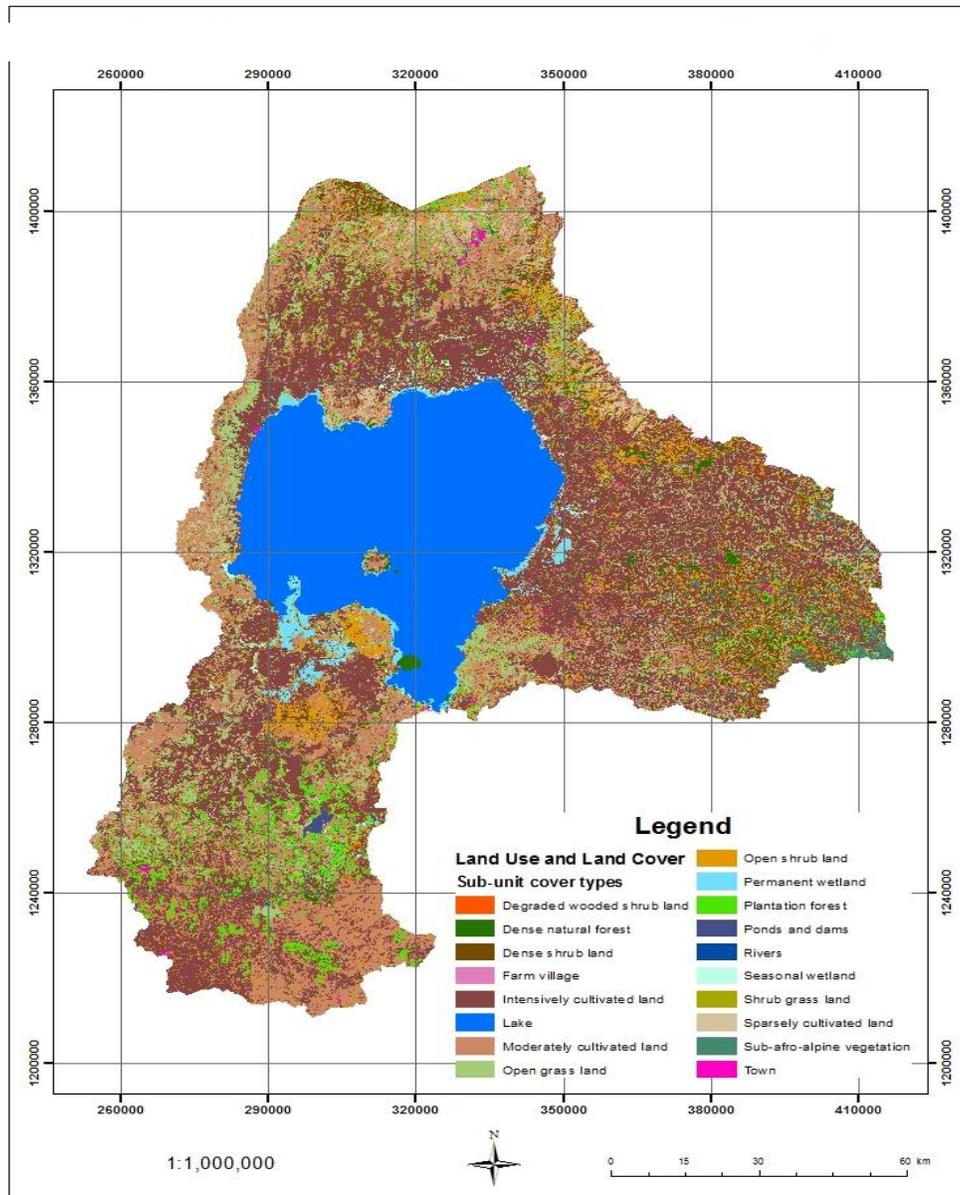


Fig. 3. Land use land cover of Tana sub- basin

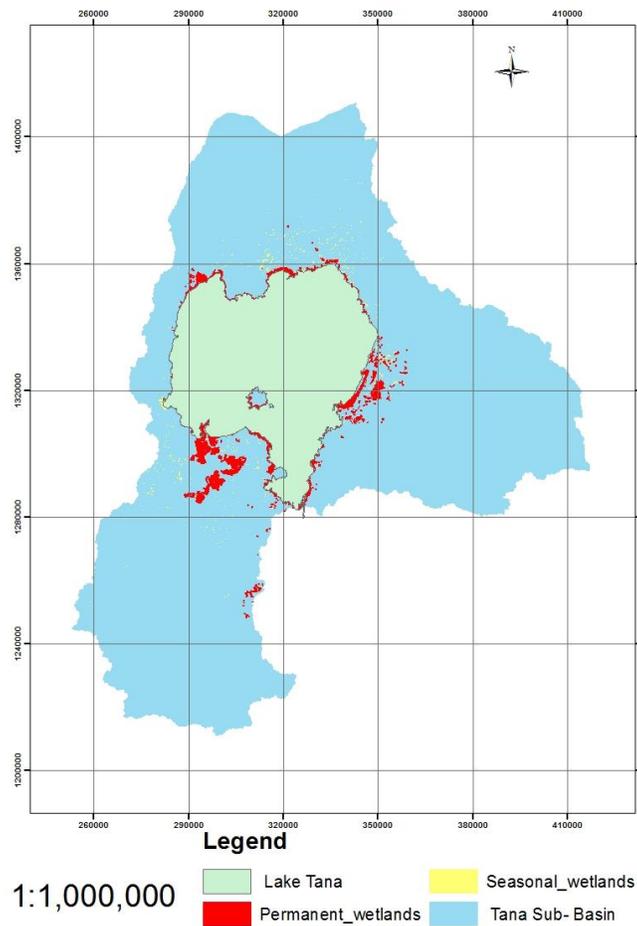


Fig. 4. Wetland distributions and allocations in Tana Sub-basin

According to Woldegabriel and Solomon (2006), in Tana sub- basin one can classify four major wetland ecosystems: (a) riverine freshwater wetlands, (b) lacustrine freshwater wetlands (c) palustrine freshwater wetlands and (d) agricultural flooded freshwater wetlands. Therefore, in this study based on GIS result, the total area is 340928.8 ha of wetlands (Table1), including Lake Tan and the rivers from the total land use/ land cover (Fig.3).

Table 1. Total area of existing wetlands in Tana sub-basin

No	Wetland type	Total area (ha)
<b>1</b>	Permanent Wetlands	17133.95
<b>2</b>	Seasonal Wetlands	7642.07
<b>3</b>	Lake Tana	311277.3
<b>4</b>	Ponds and Dams	2057.128
<b>5</b>	Rivers	2818.333

### Existing Situations of Wetlands

Because of poor understanding, wetlands ecosystem is basically assumed to be less important than any other priorities irrespective of the many services it provides and also regarded as free goods. Until recently, swamps and flood plains along the lake and the major rivers are often seen as wastelands that have no values and are best converted by drainage to allow agriculture (crop cultivation) or grazing but the reality is wetlands are the most productive ecosystem of all. So that, all wetlands in Tana sub- basin are used inappropriate manner, for this reason its coverage is highly changed example in Fogera plain in 21years from the three wetlands atotalof1733 ha is lost (Table2) From this, it is possible to extrapolate the change of the other wetlands.

Table 2. Change in Area of Key Wetlands, 1987 - 2008 (Source: Burnside and Tonkin & Taylor (2009))

Wetlands	Area(ha)		
	1987	2008	Loss in 21 years
Shesher	1557	136	1405
Welela	298	159	139
Daga-Takua	248	45	181
<b>Total</b>	2103	370	1733

Inappropriate land use type is creating many challenges for the ecosystem like sedimentation, Lake Tana water quality and quantity, shelter problems of birds, hippopotamus, fish, other vertebrates and invertebrates which are wetland dependants and other ecological functions, service and importance of wetlands. If things are continued in such a way not only wetlands, aquatic animals and wetland dependants but also the lake itself will disappear or extinct in short periods of time.

In general, almost all wetlands that are located in this sub- basin are exposed to active anthropogenic effects and several threats. These active human dangers activities are:-

#### Drainage for agriculture

Wetlands are aggressively used for agriculture activities (Fig.5). This is very serious problems for most wetlands. Lake Tana has great siltation problem this silts are interesting for cropping. In the dry season, when the lake shrinks

the farmer follows and growing crops, this can alter not only the physical properties of water but also the chemical characteristics of the water as a whole the ecosystem.



Fig.5. Agriculture activities on wetlands the left in Gondar Zuria and rests are in Dembia woredas

### **Over grazing**

All wetlands especially during the dry season, the water retreats and the flooded area is used for free grazing or over grazing (Fig. 6). Instead of cut and carry feeding system, huge numbers of animals are allowed to graze all together as mentioned especially in the dry season. This system has problems not only foot effect on wetland animals, plants, accelerates rate of evaporation and others but also animal diseases transmitting from one to the other even for themselves. This is because of poor animal feed production system in the sub- basin; animals are exposed for shortage of feed, particularly during dry season. So in this time, farmers allow all animals to graze on wetlands. During this time, there is distraction of wetland dependant animals (including other vertebrates and invertebrates) and hydrophytes and enhances evaporation of water, water losses. Intern there will be ecological distraction in all system.



Fig.6. Overgrazing of wetlands in Takusa (left) and the middle is in Mecha and the right is in Dembia woredas

### **Upper catchment lands degradation**

Wetlands are not isolated entities in the environment. They exist in close interaction with all other ecosystem components in the landscape. Thus, they are part of ecosystem process and share problems that occur in a watershed in their surroundings. Poor watershed management in the uplands (Fig.7) is one of the leading forces that affect / shift wetlands to the other system.



Fig.7. Upper catchments degradation in Takusa (left) and the rest two are in Alefa woredas

### **Eucalyptus encroachment or plantation**

The other most challenges of wetlands are plantation of Eucalyptus tree (Fig.8). This plant has great impact on the ecology disturbance of wetlands and other ecosystems.



Fig. 8. Eucalyptus encroachment at Alefa (left) and the right at North Achefer woredas

### **Invasion of alien species or weeds**

Alien species introduced into water bodies have adverse impact on native populations and changing the ecology of water bodies and wetlands. Water hyacinth (*Eichornia crassipes*) has spread to northern parts of Lake Tana and associated wetlands, which is blocking water channels, altering hydrological regimes and leaving surrounding areas prone to increased flooding. Even though there was controlling of Water hyacinth in the last years, it was not possible to control all, there is existent of this weed. This is because there is gap and no total removal or controlling of it, as local formers indicated. Because of these, nowadays Water hyacinth is reinvading the Lake Shore of Lake Tana especially in Dembia and Gondar Zuria woredas and it increase its expansion to the next areas every year. So as to, control it totally this weed, there should be continuous assessment and follow up from governmental and non- governmental organizations, particularly the regional government.

There is also invading of alien species (locally known as Chigign) in Dembia Woreda near to Megech River mouth. As local people source and key informants, this species appeared here about six years ago; it is not native species in this area like Water hyacinth. Like Water Hyacinth it is invading wetlands and grazing lands (Fig.9).



Fig.9. Alien species in Dembia Woreda Water hyacinth (left) and the right one locally called Chigign

#### **Over harvesting of their resources**

It is known that wetlands are means of livelihoods for many people, particularly for this sub basin peoples who are living around it and also for traders. Because of this there is high human pressure on these wetlands. Therefore, any resources from wetlands are over harvested.

#### **Settlement and urban expansion**

Settlements in this sub basin are mostly scattered and are settled in relation to natural resources bases, among these resource water bodies and wetlands are highly required. As result of this wetlands are exposed for inappropriate settlements. Examples, of settlements in southern parts of Bahir Dar (Fig.10) eastern, northern and western parts of the lake, all parts of the lake and on other wetlands.

Urbanization is worldwide problem which affect agricultural lands and in this sub basin also true on wetlands. This is most in southern parts of the lake, at Bahir Dar many buildings can be mentioned as an example, almost all buildings along the lake shore.



Fig. 10. Settlements very closet Lake Tana and wetlands in Bahir Dar city

#### **Pollution and water diversion**

The effluents from domestic use and industrial plants are emerging threats to wetlands adjacent to the major urban and industrial centers (from point and non- point sources). This is the most common to Southern part of Lake Tana. Many wastes including dangerous plastics (Fig.11) are too treating of wetlands.

Small scale agriculture activities are taking place around Lake Tana. This agricultural activities lead to introduction of agricultural inputs, such as fertilizers, pesticides and herbicides in to the lake which are serious problems. Although the amount of the use these inputs by farmers is small quantities so far but the unregulated manner in which they are used is a threat to the health of the water.

As key informants' discussion particularly fishers, local farmers add crushed seeds of Birbira with little Malathion in to the rivers for fishing. These will let to the lake, with a gradual accumulation would have impact on the lake system, and in turn would affect the well being of life within the lake, the ecosystem as a whole.

In addition, wastes from the different sections of Bahir Dar town (e. g .Hotels, Hospitals, Residents, etc) are, in most cases, discharged in to Lake Tana directly. The setting of appropriate sewerage system could solve or mitigate the danger of the pollution of the lake water.



Fig. 11. Pollution of Wetlands by plastics (left) at Takusa, the middle at South Achefer Woreda and the right at Bahir Dar

### **The Root Causes of Wetlands Degradation**

Poor understanding and awareness of both policy makers and communities about the ecological, economical and social benefits of wetlands exposed these crucial resources to be extinct. The reasons for lack of conservation and sustainable use of wetlands are (a) political shortcomings, i.e. giving high priority to short term economic benefits rather than to sustainability issues, (b) the absence of policy and a strong legal framework for the conservation and sustainable use of wetlands (e.g. change in grazing system towards year-round grazing due to land ownership as communal grazing land), (c) institutional shortcomings (by the absence of legally structured institution or within existing institutions), (d) socio-economic and environmental shortcomings such as poverty, lack of awareness, population pressure and climate change.

Agricultural expansion on wetlands is linked to the intensification of cultivation, for example the introduction of rice and double-cropping. One reason for the conversion of wetlands is that despite their benefits, wetlands are seen as wastelands and are connoted with mosquitoes, diseases and floods so that prevailing policies usually encourages wetland draining.

## **Conclusion and Recommendation**

### **Conclusion**

From these results, the following conclusions were reached:

- When the flooding recedes, many people use the shores of Lake Tana for recession agriculture. The soil is fertile and there is enough moisture for growth of crops. Settlements are being consolidated. Encroachment on the Wetlands increases every year. There are also privately run small-scale irrigation projects that use the lake's water. The depletion of emergent macrophyte through harvesting and burning as well as expansion of the submerged stand is serious concerns for the wetlands existence. Problems in the watershed of the rivers and wetlands that feed the lake have also become serious problems. Unless the riparian vegetation is maintained it would be very difficult to protect soil erosion and lake sedimentation. Even if dams are constructed and reservoirs are formed, they could easily be filled with sediments if the watershed is not properly managed. Deforestation for energy use and overgrazing caused by high density livestock are major threats of Lake Tana that need urgent solution by all concerned bodies.
- Almost all wild-animals are endangered example fish species, birds and hippopotamus because of its habitat degradation and loss
- In Ethiopia, wetlands did not attract much attention from policy makers and less is done for the conservation of these resources. For instance environmental policy of Ethiopia was issued in 1997
- There is extraction of water for irrigation purpose from water bodies which can result ecological disturbance (example fishes are dying in the Gumara, Rib, Megech and other rivers) because of excessive water removal

### **Recommendations**

From the above conclusion the followings are strongly recommend:

- As soon as possible, existing land use type of wetlands must be stopped and Water hyacinth also should be removed or cleared in the Lake and wetlands; otherwise these wetlands including the lake will be disappeared with in short period of time
- Avoid and minimize wetlands impacts and finally encourage wetland restoration
- Ethiopia should be signatory to Ramsar Convention on wetlands so as to bring its sustainable development
- As wetlands are not useless, their conversion into arable land has to be evaluated against the loss in social, economical and ecological benefits
- The role of wetlands in climate regulation, adaptation and mitigation and the impacts of climate change on wetlands have to be recognized
- Do not accept the promise of compensatory mitigation as justification for the destruction of wetlands. If mitigation is proposed, be sure to consult with regional and federal wetland permit staff to verify that avoidance standards have been met
- Reduce impacts of adjacent developments by establishing required development standards, such as wetland setbacks, vegetated buffers and criteria to avoid altering the quality and flow of water into or out of wetlands

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