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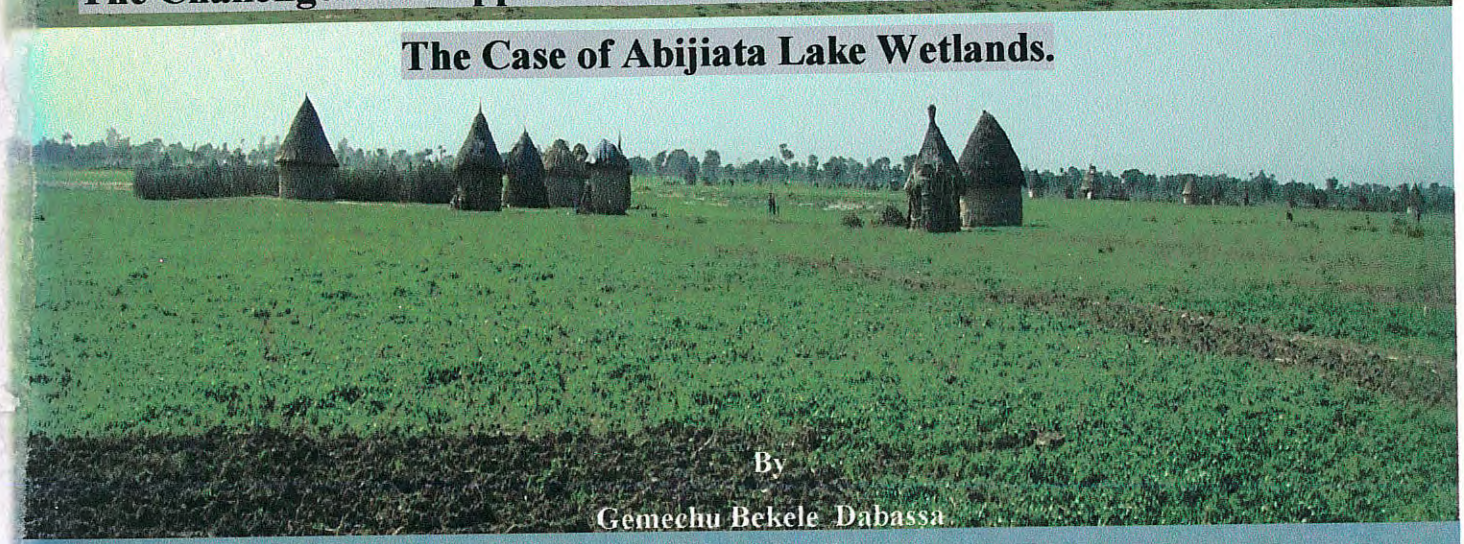
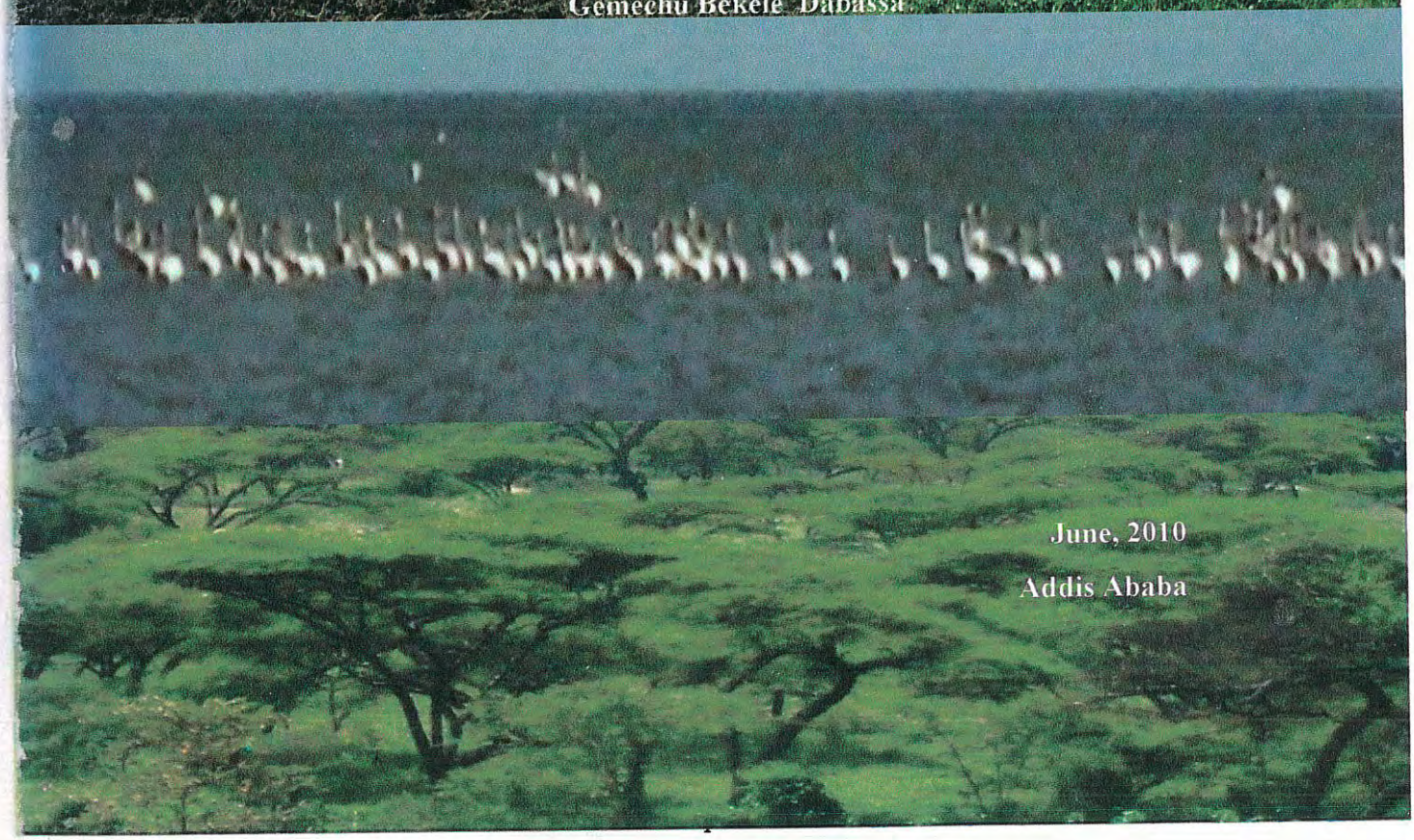
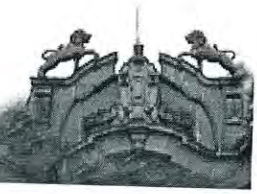
The Challenges and Opportunities of Wetlands Management in Ethiopia: The Case of Abijiata Lake Wetlands.



By
Gemechu Bekele Dabassa



June, 2010
Addis Ababa



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The Challenges and Opportunities of Wetlands Management in Ethiopia: The case of Abijiata Lake Wetlands

A thesis submitted to the college of Development studies of Addis Ababa University in partial fulfillment of the requirements for the degree of Master of Arts in Development studies, Environment and Development

By

Gemechu Bekele Dabassa

Advisor: Feyera Senbeta (PhD)

June, 2010

Addis Ababa

ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES

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DEVELOPMENT STUDIES

APPROVED BY THE BOARD OF EXAMINERS: SIGNATURE

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ACRONYMS AND ABBREVIATIONS

ASLNP: Abijiata-shala lakes National park
a.m.s.l: above mean sea level
AU : Adama university
CRV: Central Rift valley
CRVL: Central Rift valley
CSA: Central Statistical Authority
EWCO: Ethiopian wildlife conservation
EEA: European environmental Agency
`EMA: Ethiopian Map Agency
EPA: Ethiopian Environmental Authority
ETM : Enhanced Thematic Map per
EWRP: Ethiopian wetlands Research programme
EWNHS: Ethiopian Wildlife and Natural History Society
EWNRA: Ethiopia wetlands and Natural Resources Association
GIS: Geographic Information system
Ha: hectare
HH: Households
IMWI: International Water Management Institute
LU/LC: Land use and Land cover
Mcm: million cubic meters
MER: Main Ethiopian Rift
MoARD: Ministry of Agriculture and Rural Development
MoWR: Ministry of Water resource
MSS : Multi-Scanning System
NACIAD: Nazareth children center and Integrated Development
NWP: Uganda National Wetlands programme
PA: Peasant Association
CRVR: The central Rift valley Region
RVLB: Rift valley Lakes Basin
SNNPRS: Southern Nations Nationalities and peoples Regional states
TM: Thematic Mapper
WCED: World commission Environment and Development
WRMP: Water Resources management Policy.

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ABSTRACT

Abijiata Lake wetlands are situated in Abijiata-Shalla National Park (ASLNP)of Central Rift Valley of Ethiopia. This wetland has contributing significant roles in providing ecosystem functions and producing a number of products and services-that are socially and economically important to the local community. They also support a large population of migratory and residential waterfowl. The study was conducted to assess the challenges and opportunities of Lake Wetland's management;- and to recommendation future intervention measures for long term sustainable use. Different methods were used to collect primary and secondary data. The primary data were collected from 120 farm household; interviews and focus group discussions with different social groups, and key informants .The sample respondents were drawn from 3 kebeles adjacent to the lake wetlands. Moreover, land use/land cover change detection analysis was also made using satellite images (of 1973, 1986, 2000 and 2009) and ground truth. Lake Abijiata and its wetlands provide the necessary services for eco-tourism development and economic base for the local communities. The result indicate that more than 83% of people depend on the wetlands for different types of subsistence including fodder, fuel wood, mining and mineral salt extraction. In recent years, however, these wetlands are degrading progressively due to natural and human factors. Farmland expansion, sand mining, mineral salt extraction, over use of water for irrigation and other development intervention like soda Ash factory are among the major threats of wetland management. The land use/land cover change detection analysis of satellite images between 1973 and 2009 depicts that the wetland under the study is continually converted to other land uses: there is a continuous expansion; for human settlement from 3.20%in the year 1973 to 25.61%in 2009, and from 27.81% in the year 1973 to 44.54%in the year 2009 for croplands. Importantly, Acacia woodland and wetlands around the lake were also reduced from 37.98% in 1973 to 18.02% in 2009 and from 31.01% in 1973 to 11.83% in 2009 respectively. Despite, the high dependence of the local people on Abijiata wetland resources for their livelihood; however, these resources are under continuous threats. Managing the wetland on the basis of basin concepts and involving local people in alternative income generating activity has been suggested as a means of reducing pressure on land use and also reducing the threat to Abijiata lake wetlands .Furthermore, the focal policy working on wetlands promulgations of regulations to govern wetland uses, capacity building for monitoring and control of wetland use ,integrated planning for water ,land ,forest resources utilization as well as wetland change detection(the temporal and spatial variability of wetlands or LU/LC change analysis)/monitoring seasonal changes, are recommended if possible.

1. Introduction

1.1 Background

Wetlands are complex habitats, which support highly adapted characteristic fauna and flora. Wetlands are so variable that their appearance and boundaries fluctuate over time. These dynamic changes are what make wetlands difficult to define (Abebe and Geheb, 2003).Many definitions for wetlands have been proposed and utilized over the years and thus, a definition for what is a wetland often depends on who is asking the question and what development or study is proposed for a particular wetland site. However, among the most widely accepted definitions is that of Cowardin et al.(1979),"*Land where an excessive of water is the dominant factor determining the nature of soil development and the types of animals and plant communities living at the soil surface. It spans a continuum of environments where terrestrial and aquatic systems intergrades*". Wetlands are a distinctive group of habitats between aquatic and terrestrial ecosystems (ponds, swamps, marshes, lakes, flood plains, river banks, deltas etc). These habitats are becoming increasingly recognized as among the most productive natural resources, because of their ability to fulfill a range of functions and produce a number of products that are socially and economically beneficial to the local community (Dugan, 1990; Silvius et al., 2000).

According to Finlayson and Moser (1991), wetlands occupy about 6 percent of the land surface of the world, or approximately 890 million ha but an estimate of 50% of world's wetlands may have been already altered or lost in the last 50 years (Dugan, 1993). However, wetlands conservation requires an overview on their distribution and status, but in most cases not all wetlands are easily accessible and many countries lack or have insufficient capacity to assess wetland resources (Dixon, 2000).

Ethiopia has diverse wetlands of various origins that distributed in many parts of the country. A large number of Ethiopians depend on wetland resources for their survival (Wood and Dixon ,2002).With the exception of coastal and marine related wetlands and extensive swamp forest complexes, all forms of wetlands are present in Ethiopia (Dixon and wood, 2003). Major rivers and lake systems, together with their associated wetlands, are fundamental parts of life interwoven into the structure and welfare of societies and natural ecosystems. According to FAO (1984) and EPA (2004), wetlands accounts for 2% of the total land mass of Ethiopia.

In Ethiopia, wetlands are distributed across different ecological ranges. The Rift valley ecosystem is one of these ecological systems and provide ecological functions which maintain and protect nature and human systems through services such as the maintenance of water quality, flow and storage, flood control, sand storm protection, nutrient retention and micro climatic stabilization, along with the production and consumption activities that they support (Lemlem, 2003).The whole Rift valley ecosystem, including its wetland drainage system and up lands, is regarded as a rich strategic site for a wide variety of resident and migratory avifauna population (Hillman,1993).

Wetlands have considerable socio-economic and ecological values. Wetlands support crop production, fishing and sources of medical plants among others. Ecologically, wetlands are instrumental in water storage, filtration and supply, flood control; perform sediment, nutrient and toxins retention functions and habitats for biodiversity of both flora and found (Abebe and Geheb, 2003).Despite all these functions and services, wetland ecosystems are presently faced serious ecological problems due to deleterious anthropogenic activities in the catchments. Clearing of forest, building of factories and use of fertilizers, herbicides and pesticides all contribute towards the damage of these indispensable but fragile wetland systems. Ethiopian wetlands are increasingly being lost or altered by unregulated over utilization, including water diversion for agricultural intensification, urbanization, dam construction, pollution and other anthropogenic interventions (Abebe and Geheb, 2003).

In promoting wetland management which is environmentally, economically and socially sustainable, there is therefore, a need to have sound planning system and that should engage all stakeholders in (management) discussion to facilitate effective co-operation, communication and participation of different interest groups. This is essential for helping to identify and raise awareness of cross-sect oral issues of wetland management. Thus, the endeavor of the study is to assess the challenges and opportunities of wetlands management in Ethiopia with particular emphasis to the Lake Abijiata Wetlands.

1.2 Problem Statement

It is globally understood that wetlands play important role in ecological, economic, social and cultural functions. Wetlands (mainly rivers and their associated flood plains) have been the heart of human civilization (Mateos, 2004).Thus, wetland systems have played key role throughout the development and survival of humanities.

Ethiopia possesses a great diversity of wetland ecosystems (shallow lakes, rivers and streams, swamps/marshes, flood plains, reservoirs and ponds, and high mountain lakes) as a result of the formation of diverse landscape; however, wetlands and their resources are not fully documented (Siraj, 2004). The Rift valley lakes wetlands systems have immense environmental, socio-economic services as well as sustenance of local community. But, these functions/opportunities of wetlands are under threats from a wide range of sources.

Wetlands are dynamic ecosystems which continually change naturally due to subsidence, drought, erosion and siltation. Natural change is normal and expected but the direct and indirect anthropogenic measures are the one considerably affecting the vital functions, values and attributes of wetlands. Wetland degradation could lose their ability to perform their valuables and functions. Loss of even small wetlands would have great environmental impacts and it is critical that the few remaining wetland resources of Ethiopia shall be protected and conserved. However, the impact of Environmental changes on wetland ecosystem (from both natural and human causes) is poorly understood due to our limited knowledge of wetland ecology.

The study area, the wetlands around Abijiata, is degrading progressively due to different natural and human factors; as a result there is a tremendous influence on the quantity and quality of the lake, biodiversity and the environment as a whole. The accelerated deterioration of the wetland resources and their functions, therefore, calls for an urgent measure, which can create harmony among wetland users and ecological functions and values of wetland.

In order to develop and use wetland resources wisely, full attention should be paid to understanding the dilemmas that they face and identifying ways to conserve/manage them. The problem is how to make this very applicable. Basically to alleviate all the problems associated with the wetland loss it has been found that first to know the actual causes, threats, rates and degrees of wetland land lose. In this regard, land use/land cover change have great role to assist and understand changes of wetlands. The past and present status of these resources must be carefully and regularly monitored, assessed and identified. Different studies have been conducted in the study area in the past. For instance, Debele (2007) and G/Michel (2008) studied the challenges of tourism resources conservation and management in Abijiata-Shala Lakes National Park (ASLNP), but the socio-economic importance of wetlands was underestimated. Hence this research is intended to fill the gap by doing research on opportunities and challenges of wetlands management in Ethiopia, with the emphasis of Abijiata lake wetlands.

1.3 Objectives and Research Questions

The main objective of the study is to assess the opportunities and challenges of Lake Abijiata wetlands management improvement.

The specific objectives of the study are;

- To assess the socio-economic importance of the lake wetlands under the study.
- To identify the major threats of wetland resources and analyzing its effect on wetland ecosystem
- To analyze the trends of Land use/Land cover changes in the study area at different time
- To make recommendation for future improvement

Research Questions

1) What are the socio-economic importances of Abijiata lake wetlands?
2) What are the serious challenges of wetlands resource management?
3) What is the trend of Land use/Land cover changes in the study area?
4) What are the possible solutions for the sustainable use/management of this wetland?

1.3 Significance of the study

The study will benefit the wetlands (lake) environment and development actors as well as policy makers at all levels of government in showing the wetlands management problems. It will contribute towards the effort of poverty reduction and will serve as input to attain ecological sustainable development in the area. This study will show the pattern of the problems related to wetlands management and also provides an initial view and supplementary information for researchers who would like to see the problem in the area differently.

1.5 Scope and limitation of the study

In this study, indicative challenges/opportunities of the wetlands resources in the lake Abijiata and its surrounding were assessed at one time interview. Wetlands resources challenges/opportunities at Lake Catchment's level surely require commitment of large resources and time to generate data on each of the key natural resources. In general, the spatial boundary of the study is limited to the Abijiata lake wetlands and its surrounding.

The availability and accuracy of data can affect to the study. For example, there were no record of amount of crops the farmers get in each year, livestock the farmers possess, the amount of income

generated from sand, mineral salt and charcoal(fire wood) selling for the lake wetlands that could be used to sample respondent from this population. The fact that primary data are based on respondent's memory may have effects on the study. There are many terms, which involved the respondents estimating quantities .These estimates should be treated as having high error terms. Moreover, the satellite image resolution employed in this study does not detect other aspects of the area, except land use classes/categories used for the purpose of the study.

1.6 Thesis organization

This thesis consists of five chapters. The first chapter is aimed at introducing the background information of the study; that covers background and justification, objectives, research problem, scope and limitation of the study. In the second chapter the definition of terms, conceptual frame works and review of related literature are outlined. In the third chapter research methodologies are included, which cover site description, sample procedure and sample size ,research design and data sources, materials/satellite images used and methods of data analysis. Moreover, the Physical and socio-economic attributes of the study area are presented here. Furthermore, discussing the results of the study begins in chapter four, which deals with the respondents' background characteristics, natural resources in the wetlands ecosystem and Livelihood systems, and challenges as well as opportunities of Abijiata lake wetland management. The overall conditions are summarized by way of conclusion and some points are recommended for the sustainable wetlands management in the area under chapter five.

2. REVIEW OF RELATED LITERATURE

2.1. Operational terms

An Ecosystem: is defined as a biotic community together with its physical environment (Bedru, 2006)

- It also defined as "a dynamic complex of plant, animal, fungal and micro organism communities and their associated non-living environment interacting as an ecological unit (Haslinger, 2004)

Ecosystem services: are the benefits people obtain from ecosystems. These include provisioning services, such as food and water regulating services; regulation of flood, drought, supporting services such as soil formation and nutrient cycling and cultural services such as recreational, spiritual, and religious and other non material benefit (http://www.isa.unu.edu/).

Ecosystem management: is defined as "management of natural resources using system wide concepts to ensure that all plants and animals in the ecosystem are maintained at viable levels in native habitats and that basic ecosystem process (e.g. nutrient cycling) are perpetuated indefinitely "(Burnside and Rasmussem, 1997).

Ecology of wetland: is defined as the sum of the wetlands functions, products, and attributes that are derived from the individual biological, chemical, and physical components of ecosystem and their interaction (Finlayson, 1996 a)

Household size: is defined as the number of people sharing the same kitchen. It is in a way the number of people under the responsibility of a household head.

Inter-linkage: is a strategic approach to managing sustainable development that seeks to promote greater connectivity between ecosystems and societal actions. In practice this means translating this natural connectivity in to a greater degree of cohesiveness among institutional, environmental issue based and development focused responses, as well as the range of international, national and regional mechanisms that share this challenge (http://www.ias.unu.edu)

Livelihood-refers to means of living and comprises the capabilities, assets and activities required for living (Chambers,1997)

Wetland services: are the benefits that humans drive from the wetland functions. Services are based on the functions but depend more on the use of these functions by humans. These services include, provisioning, regulating, cultural and supporting (ecological and social economic) service (EWNRA, 2008)

Wetland function: is the capacity of the wetland to provide goods and services. Functions are related strongly and directly to the components and process of the wetland. For instance, a number of functions performed by wetlands are hydrological /hydraulic functions, climatic functions, biodiversity functions, habitat functions, and water quality function (EWNRA, 2008)

Wise use of wetlands: is the sustainable utilization for the benefit of human kind in a way compatible with the maintenance of the natural properties of the ecosystem (Ramsar COP_3,1987).

Definitions of Wetlands

The Ramsar Convention on Wetlands

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.

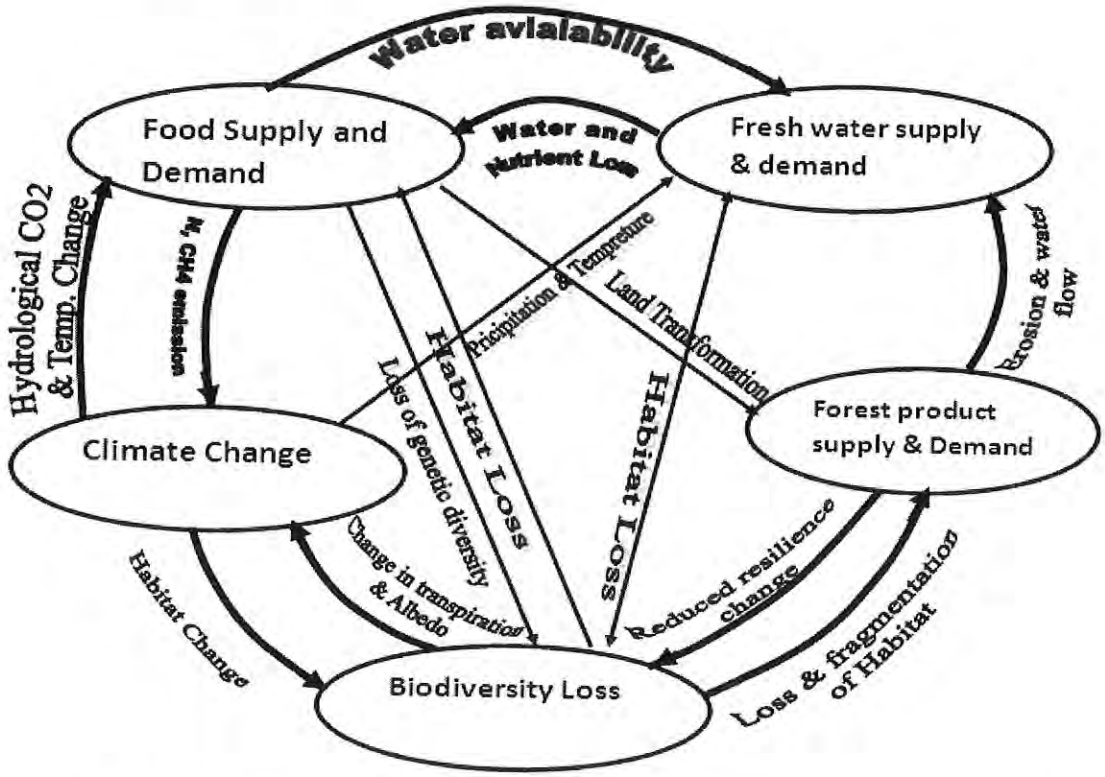
Table 1. Descriptions of land use/land cover categories or classes for which changes were detected for the period between1973-2009

No	Land use/land cover class	General Description
1	Lake	Indicates water body surrounded by land mass; particularly it refers to Abijita.
2	Settlement	Areas composed of small villages and/or scattered hamlets.
3	Crop land	Areas allotted to rain fed crop production, mostly of cereals in subsistence farming.
4	Acacia woodland and wetlands	It is a dominant woody vegetation type in the area, they are found throughout the land area of the wetland under the study in association with some broad leaved trees, and wetlands are an area which is primarily occupied by water Abijiata(lake) and now converted to other land uses

2.2. Ecological Inter-Linkages in the wetland Ecosystem

Wetland ecosystems are complex and there are a number of feedback loops between different ecological sectors such as between climatic change and biodiversity. These interconnections and inter-linkages at the ecological level underpin the rationale for developing inter- linkages.

Figure 1.Inter-linkages and Natural interdependence of Ecological factors (source: Millennium ecosystem Assessment, 2005)



Wetlands are among the most biologically diverse ecosystems on the planet, providing crucial habitats for many native and migratory species of birds, fish and other wild life (http://www.ias.unu.edu/).Wetlands support different species that are endangered. Wetlands therefore; have a key role to play in the conservation of biological diversity.

Maintenance of wetlands in their current states and thus the goods and services they provide and species they support is crucially linked to averting serious changes in land use and climate change. Changes in climate affect the boundaries, composition and functioning of ecological systems, and changes in the structure of vegetation, particularly of carbon and nitrogen (http://www.ias.unu.edu/).Thus, attention to one ecological aspects of wetlands cannot be considered without taking in to account the impacts of changes in other ecological sectors, and vis versa.

2.3 Wetland ecosystems of Ethiopia: Distribution and Classification

Wetlands are ubiquitous, that is, they are found on every ecosystem from alpine (high mountains) to desert ecosystem in the low-lying regions and across all traditional climatic zones (Wood, 2001).Wetlands are widely distributed in all climatic regions of Ethiopia. There are several important Swamp areas in the country. Riverine wetlands are also common throughout the country. Such wetlands are particularly extensive in the flood plains of Aawsh, Abay, Baro, Gibe, Wabe-Shebelle and Dawa Rivers (Getachew, 2004).

Wetlands are complex systems that can be described and classified by a large number of characteristics (Getachew, 2004). At the macro level, wetlands may be classified according to biomes. At the local and more specific level, wetlands may be grouped according to their habitats type, physical and biological characteristics (Dugan, 1990).Ethiopian wetlands can be grouped in to four major categories based on ecological zones, hydrological functions, geomorphologic formations and climatic conditions. These categories interlink to form four major biomes, which also describe climatic conditions in Ethiopia. These biomes are the Afro-tropical highlands, the Somali-masai, the Sudan-Guinea and the sahelian transition zone groups (Tilahun et. al, 1996; Leykun, 2003). The Afro-Tropical wetland systems are composed of the central, western, and eastern highlands of Ethiopia that serve as the prime water catchments and sources of its major rivers. The Somali-Masai wetland system exists, in large measure, due to the formation of the Great Rift Valley. Its wetland includes the southern group of the Great Rift Valley lakes and northern group of the Awash Basin together with their associated swamps and marshlands. The sudano-Guinean wetland system is found in the western low lands of Ethiopia and the Sahelian transitional wetland system is that found in the extreme northeast part of Ethiopia (Tilahun et.al, 1996).

Based on habitat type and basic physical and biological characteristics, wetlands may be grouped in to 30 categories and nine man made ones (Dugan, 1990). Using the Directory of African wetlands as a basis, Ethiopian wetlands are classified in to the following major groups; lakes being included (Hughs and Hughs, 1992;EPA,2004), namely lake Tana and associated wetlands; the Ashenge and Hayk lakes, wetlands of Bale mountain; wetlands of the western high lands; lakes of Bishoftu; lakes and the associated wetlands of the south western Rift Valley; lakes and Swamps of the Awash River system; lakes of the Afar Depression; western river flood plains and Artificial impoundments and micro Dams. This classification is based mainly on river and lake drainage systems. The

classification is not complete and will need revision. Because they are numerous, not all Ethiopian wetlands are listed. The classification scheme is, however able to show the diversity of wetland types in the country. It is not able to cope with the many different forms of wetland e.g. Alkaline, fresh or seasonal.

Characteristics of wetland ecosystem

Wetland ecosystem can be distinguished from the surrounding environment by the following features (Getachew, 2004):

- the presence of water (either at the surface or within the root zone)
- the presence of vegetation adapted to wet conditions (hydrophytes), and
- the presence of unique soil conditions that differ from adjacent uplands.

For classification purposes look for characteristics of ecosystems that can easily be recognized or measured (EPA, 2004. The national wetland ecosystem classification is made in such a way that the results will best serve conservation and sustainable utilization as well as proper implementation of environmental policies.

2.4 Use and Status of Wetlands in Ethiopia

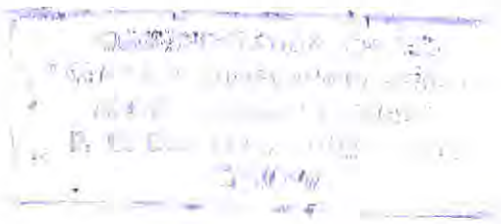
Ethiopia is endowed with rich wetland resources that include lakes, marshes/swamps, rivers, flood plains, reservoirs, manmade ponds and dams. These wetlands can naturally be best accounted for their rich resources endowment including endemic species of plants, animals and microorganisms. The plant biological resources vary from riverine forest and semi-arid area woodland to swampy shoreline vegetation and salt-tolerant grasses. In addition, substantial numbers of micro-organisms-that have economical and ecological importance-have been reported (Zinabu,1998). Biodiversity richness in inter and intra-wetlands varies due to variations of their respective ecosystem.

The Socio-economic values of the wetlands are extremely high. They provide economic and socio-cultural products. Economically, most of the wetland resources are used for fish harvesting, forest resource extraction, roof tacking and dry season grazing. Some of them are used for industrial and irrigation water sources and for domestic water supply. Crocodile farming is also yielding economic benefits in two wetlands – Abaya and Chamo Lakes (Leykun, 2003). Wetlands and the associated wildlife have also the economic value attracting tourists. The fact that some of the wetlands are resting and nesting areas for inter-Africa and Europe migratory birds add to their significance in the tourism industry (Lemlem, 2003).

Some wetlands in the Oromia and SNNPRS have also cultural as traditional holiday sites. Some Ethino-medicines are also extracted from the wetland biotas. Game and controlled wildlife hunting are also carried out in wetland areas like Chew Behir. Sport and recreation like swimming and boating are also increasingly exercised in most of the wetlands' water bodies. In addition, these wetlands have anthropogenic value of balancing hydrological cycling and are significant as a trap for flood and sediment (EPA, 2004). They play a role in ground water discharge and recharge. Their flood controlling and sediment trapping abilities protect associated water bodies from pathogenic substances and benefit the biota living in the water bodies, and the rest of the wetlands by purifying the water (Tenalem, 2002). Thus, these functions are indispensable for the productivity of the wetland ecosystems.

The wetlands resources always attract the attention of nearby societies to extract resources beyond the rejuvenating capacity of the wetlands (Lemlem, 2003). Such over use of the resources affects not only the resource base in use but also associated resources. In addition, the fact that most of the major wetlands are in vicinities of towns, municipal and industrial waste discharges always negatively affect them(Zerihun,2003). This has been ever growing problem of Chamo, Abbaya, Awassa, Ziway, Abiyata-Shalla, Tana- Fogera, Haik and wetlands in the Awash River basin (Tenalem, 2009). Most of these wetlands are currently receiving volumes of domestic and industrial sewage containing wide varieties of inorganic and organic chemicals that enhance eutrophication on water bodies and toxicity to fish and other organisms in the wetlands. For example, a brief assessment in the Ziway wetland showed that the concentration of sodium (8.14-10.24 meq/100gm soil in crop plots and 16.82-18.88 meq/100m soil in marshy areas) is alarmingly high. The second highest chemical content in the soil is calcium (21.80-24.72 meq/100gm soil in cultivated area and 28.93-30.30 meq/100gm soil in marshy areas) despite its advantage in count balancing the high sodium content. The electrical conductivity (EC), Fluoride, Sodium (Na), and in some samples, sulphate (S_2O_4) and Nitrate contents are above the standard for drinking water. The Salinity level of the water has also reached upper limit for irrigation purpose when cited in conjunction with the high electrical conductivity of the water and high sodium levels. Although the water of Lake Ziway is marginally acceptable for irrigation in its current state, the ionic concentration in the water is severely increasing when compared against the May (1961) findings, in which the total cations and anions were 4.47 and 5.03 meq/L, respectively.

According to EPA (2004) report, most of the wetlands' ecosystems are severely degraded and most of the floristic and faunistic species are endangered mainly for two reasons. Firstly, land use which



does not take wetlands conservation into account while they are under pressure by the farming population which is in disperse need of land for pasture and crop farming. The situation is aggravated by the fact that wetlands are considered as either state property or a property belonging to no one. The second reason is that people in the wetland vicinities (in lowland areas) devegetate herbaceous vegetation to avoid the harboring of mosquito flies and snakes. Because of these and related actions, most of the wetlands are seriously denuded, except those situated in remote areas.

Currently, some wetlands are at the edge of extinction. The situation of Lake Haramaya in the east wetland exhibits this reality. The resources and the lake disappeared for reason they cannot comprehend. Neither are facts available. Many lakes are also similarly endangered. The dangers would refer to Ziway, and Abijiata wetlands where currently human actions related to resources extraction are being maximized beyond the resources rejuvenating capacity.

2.5 Challenges Related to the Wetlands: Ethiopian Context

It is globally understood that wetlands play important role in ecological, economic, social, and cultural functions. They are rich in faunal and floral resources as well as important sources of water for agricultural, industrial and domestic uses, in addition to their importance for fishing, flood regulation and waste purification (Abebe and Geheb, 2003)

Efforts in wetlands management in Ethiopia are being challenged due to poor legal supports resulting from insufficient political will that failed to incorporate sufficiently the sustainable management of wetlands in the land use policy (Mengistu, 2003). Currently, wetland resources are used beyond their rejuvenating capacity (EPA, 2004). Such overuse of the resources often affects not only the resource base in use but also associated resources, adversely affecting the integrity of the whole resources relation leading to the disruption of the ecosystem at large. According to Bezabih (2008), factors that adversely affecting the wetland functions, values and services are grouped into natural, economic, institutional, policy and strategic factors.

Natural factors include geographical, landscape rainfall, flood, storm, etc.that determine soil and water degradation. In most cases, these factors are risk factors beyond the control of human beings. Human acts mitigate the impacts of these factors if properly planned and appropriate strategies are put in practice. It is important, however, to note that human activities aggravate natural resources degradations (Bezabih, 2008). Wetland areas of the rift valley are often rain fall deficit and prone to drought experiencing semi-arid climate with evapo-transpiration exceeding precipitation. The intr-annual variation in rain fall and water inputs is also significant and exerts pronounced impacts on

the wetlands (EPA, 2004). Freshwater and/or seasonal runoff discharged to wetlands is progressively decreasing while the evaporation rate around the wetlands is increasing promoting chemical concentration of the water.

The pressures on wetlands will come from different directions as climate change intensifies (Wood and Dixon, 2008):

1. Less rainfall will mean that wetlands decline in size, and become drier, assuming no other changes occur;
2. The expansion of wetland agriculture may lead to increased extraction of water from wetlands and growing desiccation of these areas;
3. Increased erosion from degraded uplands / catchments, as a result of more intensive rainfall, will lead to increased sediment deposition in the wetlands burying the fertile soil.

Together these developments will reduce the utility of wetlands for cropping and domestic water supply, and so undermine one of the key adaptive strategies of rural communities in the face of climate change. Wider implications of wetland damage are the loss of the environmental functions of wetlands such as the reduction in flood peaks, the recharge of aquifers, and the storage of carbon - mostly in permanent wetlands. Wetland loss will also have biodiversity implications as the ecological gradations around wetlands are vital for the survival of many wild plants, birds and animals. Another threat to development goals due to wetland use may come from the way communities respond to the situation of increasingly scarce resources. Access to wetlands will be increasingly valuable as farmers want to supplement their declining rain-fed harvests, either by growing crops for domestic use in a subsistence manner or by growing ones for sale. This is likely to see increased "privatization" of formerly "open access" resources by a rural elite and increased differentiation in rural society (Wood and Dixon, 2002)

In economic factors, poverty plays a great role in threaten wetlands. In an attempt to use wetland resources to make their livelihood, people over exploit these resources. Trees are cut to generate income, fisheries resources are over exploited, water resources are used for irrigation, etc. (Bezabih, 2008).Vegetation resources in almost all wetlands have been alarmingly denuded that siltation of water bodies is becoming major problem and birds and other wild animals are leaving wetland areas because of nesting and resting shelters distraction. This is due to the fact that trees have been cut down and grasses have been overgrazed (EPA, 2004). Water abstraction for agricultural crop irrigation and industrial use is also severely threatening some lakes including lake Tana, Ziway,

Abijiata, shalla,Abaya and chamo(Abebe and Geheb,2003).Therefore, the economic factors are aggravated by poverty and population pressure. As population pressure increases, the newly formed farm house holds i.e. the youth has limited access to farmland. These farmers encroach in to wetlands and forest areas for conversion. Moreover, poor households sell firewood and charcoal to cope with food insecurity (G/Michael, 2008).

Grazing by domestic stock has also identified as threat to wetlands in addition to the above factors. When grazing follow continuous cultivation; wetlands easily become degraded, and lose their natural characteristics. Livestock trample the soil and compact it and destroys natural vegetation. They erode drainage channels leading to gullies and increase water outflow (Afework, 2003). These effects often result in the complete degradation of wetlands by reducing the water table and by changing the original vegetation. As such, wetlands produce an ecological equilibrium in the environmentally maintaining the integrity of life support systems for sustainable socio-economic development. Yet, many wetland ecosystems particularly flood plains and swamps are regarded as wastelands and continue to be depleted at an alarming rate throughout Ethiopia (Abebe, 2003).

Institutional capacity is also one of the factors in affecting the sustainable wetland management. Institutions have responsible for land administration, and other natural resources management. However, there is little or no awareness of current status, threats or values of wetlands, lack of capacity to implement the government policies (EPA, 2004) or even the need for their conservation and sustainable utilization. Although there are various organizations/institutions with some sort of wetland expertise and awareness, no coordination exists between these institutions for the conservation, management and wise use of wetlands in Ethiopia (Abebe and Geheb, 2003).

As wetlands are source of water, biodiversity and related resources, they attract a number of stakeholders that deal directly or indirectly. There is a need for coordination efforts that harmonizes the relationship among the stakeholders and sets better management options of wetlands. As a result, wise use of wetlands has not yet given proper attention and priority (Dessalegn, 2003). Different users' viewed wetlands from their own perspectives and institutional objectives. For instance, agriculturalists see moist fertile soil with vast potential for growing grain; fishery managers find a support base for producing fish; hydrologists calculate capacities to provide water for industry, agriculture, and domestic use; public health specialists may see them as regulators of water quality or in contrary as transmitters of diseases such as malaria; and so on(EWNRA,2008).

Decision makers also do not give warranty to protect wetlands unless they appreciate some definite and critical values in economic terms. As a result, whether they are protected or not, wetlands have become common properties which are overused and as a result degraded (Abebe and Geheb, 2003).Yet, investment in wetland management is rarely integrated. Instead, wetlands are invariably viewed by each user as single-product systems, precluding other values, while single-purpose returns fall far short of expectations.

Lack of a comprehensive wetlands policy and implementing law coupled with the absence of an institution duly empowered to issue and implement wetland laws and coordinate management activities is the underlying cause for the deterioration of the wetlands of Ethiopia.

Wetland management in Ethiopia also suffers from capacity limitations due to lack of skilled manpower, finance and technology. Wetland focused training programmes are very scarce in higher learning institutions of the country. There is also awareness problem from grassroots up to decision maker level (EWNRA, 2003).The scarcity of wetland focused institutions and weak relation of the country to wetland affiliated global institutions such as the Ramsar Secretariat has hampered its capacity building opportunities.

Policies and strategies have their own impact on wetland management. Poor policies and lack of appropriate legislation are the primer challenges to successful wetland management in Ethiopia. Even though, various policies such as Environmental, land ,and water resources management policies have been issued to address the different aspects of the Environmental problems, there is no specific comprehensive national policy that deals with wetland issue (Bezabih,2008);in other words, Ethiopia lacks a specific policy on wetlands that enshrines wetlands of the land from deleterious actions that affect their contribution to the national development (EPA, 2004.At another scale ,the mandate of stake holder institutions to address wetland issues are not clearly defined.. As a result, there is no entry point for one to initiate any effective wetland undertaking at the moment (Abebe and Geheb, 2003).

Strategy documents that favor irrigation agriculture at the expense of wetland ecosystems. These documents encourage draining and conversion of wetlands into other forms of land use particularly for improving agricultural yield. Wetland issues are also inadequately mentioned in the Water Resource Management Policy (WRMP) (EWNRA, 2008). The main aim of WRMP is the provision of water for socio-economic development. It does not show the significance of wetlands such as swamps and floodplains in the development of water resources. The Environmental Policy in its

general aim of protecting the environment highlights only the importance of wetlands for water resources management.

When used in sustainable manner wetlands provide numerous services to humans in different forms. Wise use normally diversifies and maximizes benefits that emanate from wetlands. But in contrary to this in most parts of Ethiopia adequate attention is not given to wetland management and wise use. People use recklessly only with the objective of obtaining immediate benefits such as draining for agriculture, overgrazing, excessive resource exploitation, growing destructive plants such as eucalyptus and so on. This is mainly related to rapid population growth, shortage of agricultural land and growing demand for water for different activities. Conditions that enhance wise use such as community management plans, stakeholder participation mechanisms and awareness or training undertakings in wetland management are not institutionalized and as a result not materialized.

2.6. Rift Valley Lakes Wetlands

The Rift valley lakes are isolated water bodies, which have been isolated geographically for thousands or millions of years allowing them to develop specialized habitats and consequently unique diversity of flora and fauna species. Some species of plants and animals have been reported to have substantial levels of endemism or near endemic entities. The greater and lesser flamingos are some of the fauna species that depend wholly on the rift valley lakes for their existence, and any threats on the ecology of these habitats threaten the survival of these species (Siraj, 2004).

Lake ecosystems in the Rift Valley can be described as areas of high biological diversity that are prone to external influences. The lake levels often fluctuate in response to combined anthropogenic and climatic impacts (Tenalem, 2009). The lakes are resilient systems that are important for environmental and economic services as well as sustenance of local community livelihoods (EPA, 2004).

Yilma (2004) stated that, the whole Rift Valley ecosystem including the wetland drainage system and the uplands is regarded as the richest and strategic site for a wide variety of resident and migratory avifauna populations. In contrast, the overall ecosystem is a region of rainfall deficit, with evapo-transpiration higher than the mean annual rainfall that could make the area susceptible to drought and ecological degradation. Biodiversity of the Rift Valley lakes has immense

environmental, functional, anthropogenic values with trans-boundary, regional and global implications.

Many people depend on the Rift Valley lakes and their rich biodiversity for sustenance. The socio-cultural and socio-economic activities carried out by the local communities, and others include: livestock grazing, extraction of other natural products, tourism, mining, agricultural production, water supply for domestic and other uses, such as cultural ceremonial sites(Siraj,2004).

The biodiversity of the Rift Valley Lakes faces threats from a wide range of sources. Some of the threats can be linked to natural causes but the majority can be attributed to human activities within the lake basins and their catchments areas. The primary impact of human activities is to enhance the impacts of natural threats, introduce new threats and increase the rate of biodiversity loss (Lemlem, 2003). The severity and diversity of threats are strongly linked to the spatial distribution of human settlements, population density concentration of resources, level of socio-economic development and the intensity of land use (EPA, 2004).

2.7 Sustainable wetlands management

Sustainable wetland management should ensure peoples continued access to the resources in ways, which maintain both their livelihoods, and the resources on which they depend. In other words, the use of the resources for agriculture must be limited so that other benefits are not destroyed or seriously reduced (Wood, 2003). In this way wetlands conservation can be undertaken so that it enhance the benefits that local populations derive from the natural ecosystems while maintaining them. Sustainable wetlands management requires the active participation of the relevant stakeholders in the planning and implementing process (Siraj, 2004)

Wetlands have become the "new agricultural frontier" in many African countries over the last few decades. Wetland farming has expanded as population growth and land degradation have increased the pressure upon "upland" areas. Wetlands now play an increasingly important role in food security, sometime as the last resort for domestic production by poor people, but in other cases they have been appropriated by rural elites for market oriented production (Wood, 2001). Hence, there is a need to accommodate some level of wetland conversion while at the same time maintaining or even expanding their environmental and hydrological services. This is only possible through sustainable management of wetlands.

Sustainable wetlands management can be viewed as a process of intervention between two extremes. One extreme is complete protection of wetlands in their pristine condition and the other is

complete conversion for agriculture or other uses. Between these two are a range of combinations of conversion and conservation. Sustainable management involves a balance between the biological concerns favoring protection and the socio-economic and equity needs of people which seek conversion of these areas. The aim is to achieve the long-term production of benefits from wetlands and the maintenance of the ecological functioning of these areas through designing and realizing appropriate policy measures.

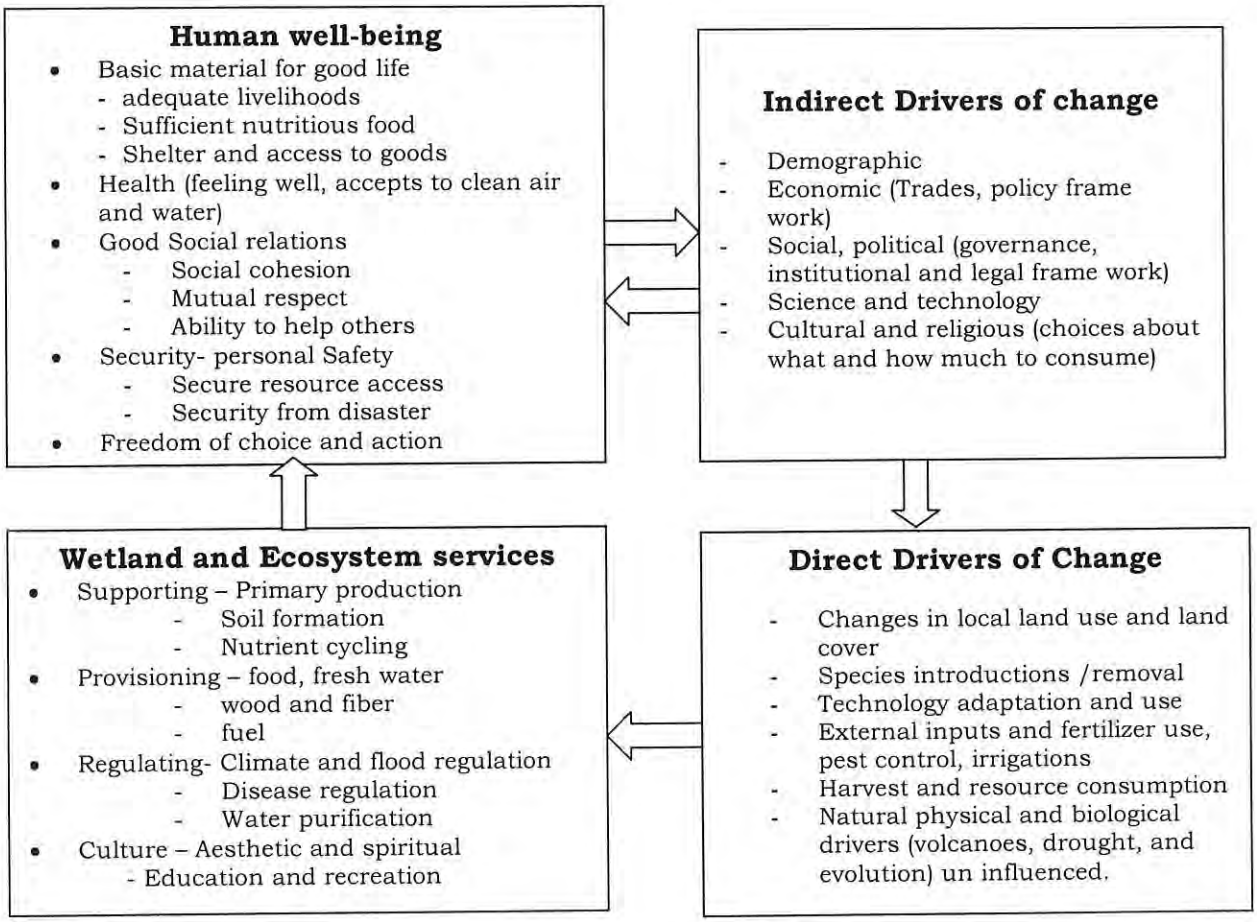
Several policies and legislative frameworks concerning natural resources ownership, use and management have been enacted by the Ethiopian government. These include: The constitution of the Federal Democratic Republic of Ethiopia which provides the basic legal framework and principles according to which the conservation and utilization of natural resources and the environment shall be directed and regulated, the land use policy, biodiversity policy, conservation strategy of Ethiopia, environment policy, investment policy, Environmental impact assessment proclamation, forest law, wildlife laws, fishery policy and wetlands management policy.

At the national level wetlands are not on specific policy agenda and hence, there is a policy vacuum when it comes to the consideration of wetlands in their own right (Beabih,2008).Besides, Ethiopia is not signatory to the Ramsar convention and so there is no related legislation.

2.8 Conceptual Framework

The major benefits obtained from wetlands i.e. social-economic and Ecological benefits are highly influenced by human being and other natural calamities. Here, the conceptual framework places human well being as the central focus, while recognizing that biodiversity and wetland ecosystems also have intrinsic value and the people take decisions concerning ecosystems based on considerations of well being. The assumption is that, there is a dynamic interaction exists between people and other parts of wetland resources, with the changing of human condition serving to both directly and indirectly drive change in ecosystems and with changes in ecosystem causing changes in human well-being. At the same time, many other factors independent of the environment change the human condition, and many natural forces are influencing the wetland ecosystems (see Figure 1).

Figure 2.The inter-linkage between wetland ecosystem and human well being.



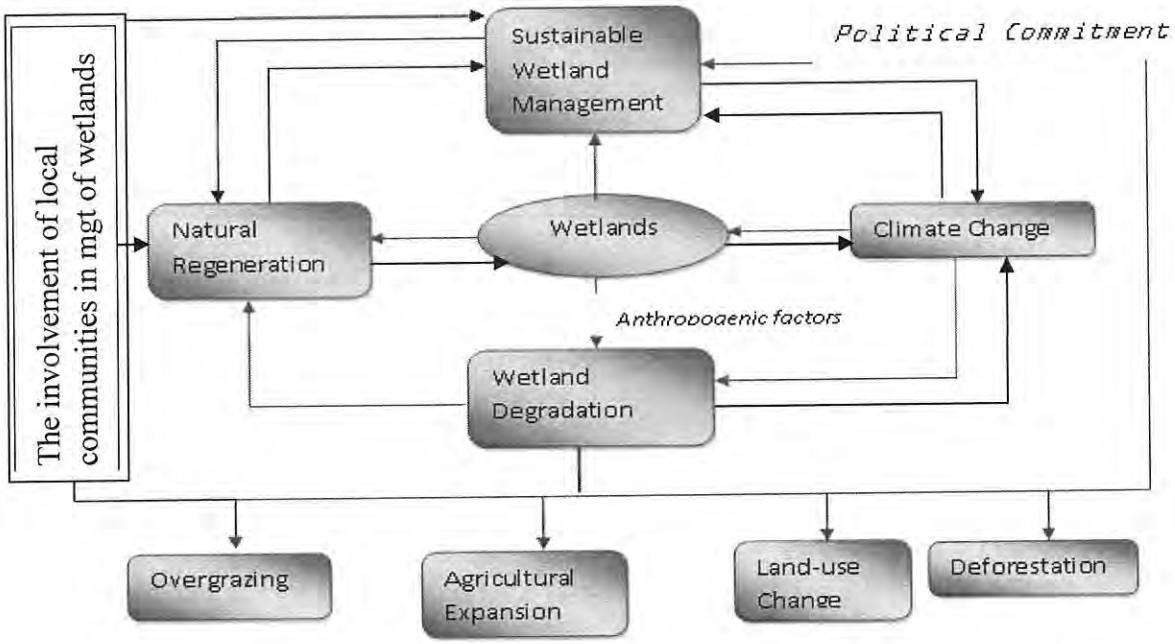
(Source: *Millennium Ecosystem assessment*, 2005)

This figure depicts the strength of linkages between categories of wetland ecosystem services and a component of human well-being that are commonly encountered and includes indications of the extent to which it is possible for socio-economic factors to mediate the linkage. Changes in factors that indirectly affect wetland ecosystems, such as population, technology and life style, can lead to changes in factors directly affecting ecosystems, such as the application of fertilizers to increase food production. The resulting changes in the ecosystem cause the ecosystem services to change and there by affect human well-being(http://www.ias.unu.edu).

In light of the ecological inter- linkages in wetland ecosystem, an integrated and holistic approach at the National, regional and local level is needed to provide an effective frame work for sustainable management of the Abijiata and similar wetlands. For instance, when examining sustainable wetland management, the impacts on environment need to be taken in to account as do the potential

impact on climate change. In other words, sustainable wetland management has a direct positive impact on the environment through stabilization of micro climate and in the same way nature plays a great role in wetlands regeneration if human actions/ interferences are controlled or at minimum level or almost none. However, climate change of a given area determine the sustainability of wetland management through erosion (flooding), drought, siltation and etc-resulted in wetland degradation. In the same manner, wetlands degradation occurs due to anthropological factors in performing the socio-economic activities to lead their livelihoods. Agricultural expansion, deforestation, overgrazing and land use change (Conversion of a given land in to other land use) among the major ones are responsible for wetland degradation. Therefore, to bring sustainable wetlands management; good policy (political commitment /political will) and the involvement of local communities in the management system of wetlands are crucial issues. Thus, the development of wetland management should take in to account the harmonization of human activities with that of sustainable wetland utilization.

Figure 3. Inter-linkages approach for wetland management



To sum up, the potential for the integrated sustainable management of the Abijiata wetland is at critical stage. On the one hand, these wetlands are facing un precedential threats for economic development attraction of its forest land, water may pose great environmental threats to the wetlands through changes in the action may lead to the frying up of some wetlands, fundamentally altering their ecology, interconnected nature of different aspects of its ecology, what has been referred to as ecological inter linkages.

3. Research methodology

3.1 Methodology

3.1.1 Sample site description

The central Rift valley (CRV) of Ethiopia consists of a chain of lakes, streams and wetlands with unique hydrological and ecological characteristics. At the same time the CRV is one of the environmentally very vulnerable areas in the central rift valley lakes, Abijiata with the surrounding woodland and grassland form the wetlands. Abijiata lake wetlands, is found 200km south of Addis Ababa (Figure 4).

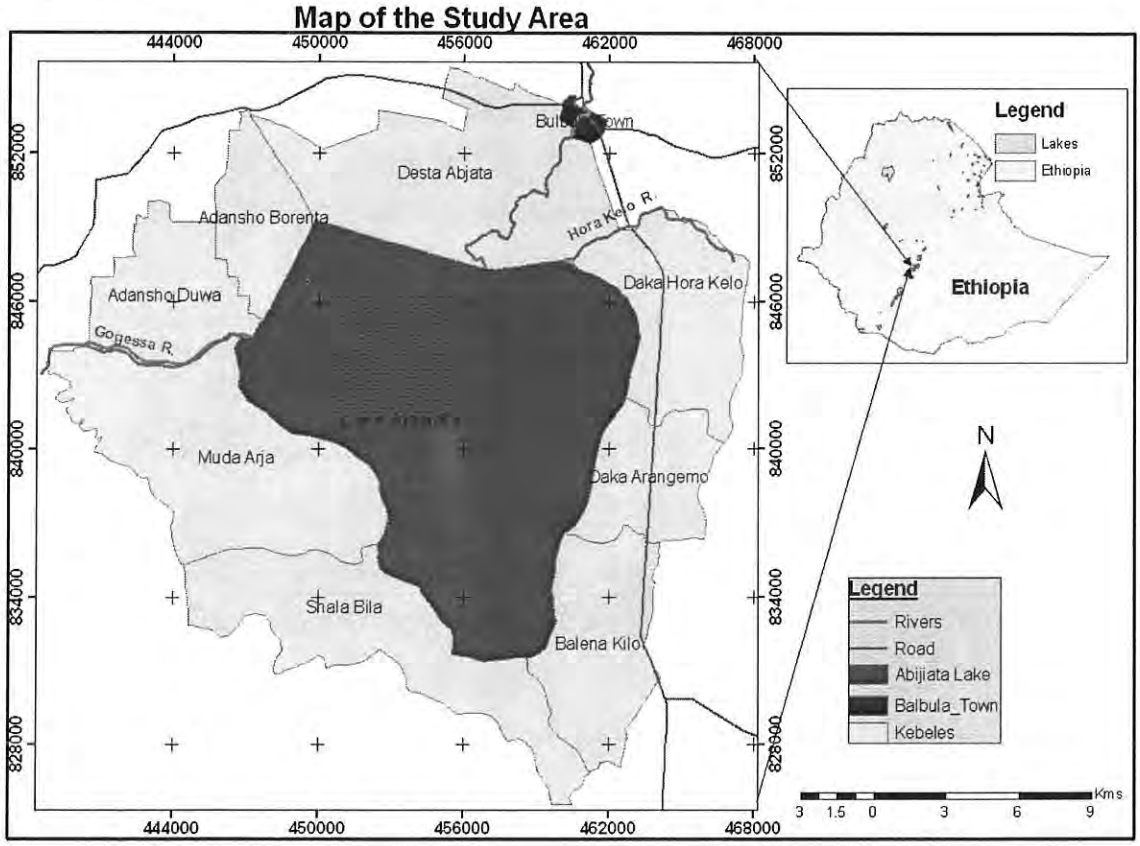


Figure 4.Map of the study area (**source: CSA, 2007**)

3.1.2 Sampling procedure and sample size

Majority of Abijiata lake wetland is found in between two zones of Oromia National Regional state, namely west Arsi and East shoa. From these two zones I selected Arsi Negele and Adami Tulu Jidokombolcha woredas for this study purposively. Hence the Arsi Negelle and Adami Tullu Judo kombolcha are selected from which the sample households were drawn. Preliminary survey, discussions with various focal persons as well as other concerned woreda officials, and literature review helped the author in identifying the sample kebeles. The two woredas were selected because of the reasons that: the largest portion of the lake and its wetland is found here, it is the most

accessible for data administration and area of high community interaction/impact on the lake wetland resources.

From the two woredas, 8 kebeles were selected on the basis of their direct interactions (adjacent to) with Abijiata Lake and its wetlands. Multistage sampling procedure was applied to select the households. Firstly, the two woredas were purposefully selected by involving key informants and knowledgeable persons from the office of Agricultural and rural Development of the two zones. The selection of woredas considered diversity, accessibility and representativeness. Secondly, three kebeles were selected purposefully with in selected woredas in such a way that samples were drawn from kebeles adjacent to Lake Abijiata. Thirdly, sample respondents were randomly selected from the households registered as residents of the selected kebeles, since they are homogenous in their ethnicity, socio-economic characteristics, educational backgrounds and etc. Accordingly, 10% of household sample size from each selected three kebeles was drawn and a total of 120 heads of farm households were randomly selected.

Table 2. Distribution of Respondents by their woredas and kebeles.

No	Nameof kebelePA	Nameof woreda in which kebele PA is found	Household size(HH)	Sample size (10% of HH)
1	Algae Dilbato	Arsi Negele	435	
2	Dakadalu Harangama	Arsi Negele	140	
3	DakaHora Qallo	Arsi Negele	288	**29**
4	Dasta Abijiata	AdamiTulu Jido Kombolcha	495	**50**
5	Hadh Boso	Arsi Negele	264	
6	Gale and Qallo	Arsi Negele	405	**41**
7	Mudhi Arjo	Arsi Negele	822	
8	Shala Bila	Arsi Negele	598	
Total				**120**

Source: Woreda Agricultural and Rural Development office of Arsi Negele and Adami TuluJjido kombolcha 2006/07

3.1.3. Research design and data sources

In order to achieve the objectives of the study, different research approaches were used to collect data from primary and secondary sources. The primary data were collected using household survey, focus group discussions, and key informant interview with different social groups, institutions. Moreover, observations were made. Secondary data were used to supplement the survey data.

Primary data is collected by employing questionnaire survey, Focused Group Discussion, Observations and key information interviews. In addition land use/land cover change analysis was made using different time references.

Survey questionnaire: The selected households were interviewed using structured and semi structured questionnaire (Annex 1). This was aimed to investigate the different uses of resources by local communities. This household survey is being conducted on 120 sample households permanently living in the area. The major issues addressed in the questionnaire include socio-economic features of the households, means of livelihood and income generation ,land sources and its utilization, wetlands crop and livestock production and output losses attributed to natural and human made factors.

Focused Group discussion: This was arranged to support the data obtained from household survey and from interview of various stake holders. In all the three kebeles surveyed, discussions were made with a group of farmers composed of different social groups. The elders were important source of information sharing their observations and experiences on the change in the natural resource bases and their values. A total of 25 people participated in the group discussions. Checklists (Annex 2) were prepared to lead the discussions. The major focuses of the discussions were to generate information at community level that can complement the survey data in the value (importance) and threats of wetlands. As far as possible, the discussions were also supplemented with personal observation of the facts on the ground. The discussion was also held with different kebele administrations and other social institutions selected through purposive sampling; based on their responsibilities linked to natural resource administration.

Table 3 .Distribution of participants of the focus group discussions

No	Kebele PA	Participants		
		Male	Female	Total
1	Dasta Abijiata	9	1	10
2	DakaHora Qallo	5	1	6
3	Gale and Qallo	7	2	9
	Total			25

Source: Field survey ;(January, 2010)

Additionally, in depth interview was employed with 10 officials (as key informants) that is selected through purposive sampling method, in relation to their responsibilities .This helped to know the opinion, importance, interest, shortcoming, the interaction, willingness/ awareness and commitment to cooperate with others in the use and management of the resource.

3.1.4 Materials used in Land use/Land cover change Analysis

Table 4: Materials and soft wares used in the current study.

No	Type	Description	Source
1	Maps	Topographic maps(1:50,000)	EMA
		Country,Region,District(Woreda)and kebele shapefiles	CSA
2	Softwares	ArcGIS9.3,ERDAS9.1,WinRAR,MSExceel and MSword	AU,GIS lab.
3	Instruments	GPS(GARMIN),Digital camera	

To analysis land use/land cover changes in the study area topographic map, different soft wares and instruments were used. First, Topographic maps (1:500,000) scanned, digitized and georeferanced by the help of Arc GIS 9.3, ERDAS 9.1 and other soft wares to extract woreda and kebele shapefiles. Then woredas and kebeles shapefiles (maps) extracted from country and region shapefiles, from these shapefiles the map of the study area also developed. Finally to supplement the topographic map in formations, GPS is used to collect coordinate/ reference points during field observation and also Digital cameras used to take the photos from the study area.

Table 5: Summary of satellite images used in land use/land cover change detection

S/N	Image Types	Path/Row	Acquisition Date	Spatial Resolution (m)
1	Landsat MSS	181/055	January 31, 1973	80.0 x 80.0
2	Landsat TM	168/055	January 21, 1986	28.50 x 28.50
3	Landsat ETM+	168/055	November03,2009 &February 05,2000	28.50 x 28.50

To analysis LU/LC changes in the area satellite images were also used. The land use and land cover status was identified through the classification of land sat imagery acquired in January 1973,1986,

February 2000 and November 2009 in Arc GIS 9.3 and ERDAS 9.1softwares.Landsate images acquired on January,1973 was selected as the historical image and used for change detection against 1986,2000 and 2009 images. Spatial resolution differences between land sat MSS,TM and ETM sensors were standardized through pixel resizing algorism using the above soft wares. Their pixel sizes were standardized in to 1986 image (i.e 28.5m) prior to change detection analysis.

In terms of **secondary data** review of pertinent documents from published and unpublished materials; books, journals, reports, maps and photographic and from relevant offices were made.

3.1.5. Data analysis

Data analysis is carried out using qualitative descriptions. The data collected through different instruments (non-quantifiable information from open ended questions, key informant interviews, observation and focus group discussions) tallied, tabulated, the analysis and interpretation is conducted by qualitative descriptions. This helps the researcher to draw some inference or to make some generalization from the collected data. Indeed, frequency tabulation is used for some quantitative descriptions. Since wetland ecosystems are very complex and difficult to interpret only by qualitative descriptive, satellite images were used to supplement ground truth data collection through field work, this is helpful to interpret changes detected on different land use/land classes for the comparison on the actual ground.

3.2. Physical and social attribute of the study area.

3.2.1. Location and Topography

Ethiopian Rift valley runs the whole length of the country from neighboring Eritrea in the north east to Lake Turkana in the southwest, bordering Kenya. The Ethiopian Rift valley lakes Basin(RVLB)is one of the twelve Ethiopian river basin ecosystems which share a common geological structure, history and similar biological resources (Lemlem,2003).The RVLB covers some 52,000km^2 extending from the Awash watershed in the north to the Kenyan border in the south.

The Central Rift valley (CRV) in Ethiopia is situated between, approximately, 38^{0}5'E and 39^{0}25'E and 7^{0}10's to 8^{0}30's at 150 km south of Addis Ababa. The area is situated in the administration regions of Oromia and the southern Nations Nationalities and peoples Regions (SNNPR),(Alterra-rapport,2007).The area encompasses large lakes, Ziway,Langano , Abijiata and Shala.

The study area is situated in the Abijiata-Shalla National Park (ASLNP), located in between 07^0 37'N;38^0 35'E with in the Central Rift Valley. Abijiata lake is fed by rivers originating from other lakes. The main in flow (discharge) is from the bulbula and Hora Kelo Rivers, which are the out flows of lakes ziway and langano, respectively.

3.2.2 Climate

The study area characterized by warm, wet summer (with most of rain fall occurring from July to September) and dry, cold and windy winters. The CRV is characterized by its semi-arid climate with a long summer season bringing heavy rains from the Indian and Atlantic oceans. According to Ethiopian climatic classification, the area is characterized with hot semi-arid and warm temperature of tropical climate. The annual range of rain fall is between 500 to 700mm with the temperature can be high, reaching 45^{0c} at maximum in the warmest month and at minimum in the coldest months (December and January) with an annual average of 27^{0}c.for the area the rainy season is from March to April and June to September. This area is classified within the climate zone of upper-kola or semi desert based on the Ethiopian climate zoning system (Ayenew, 2004).

3.2.3 Biodiversity and eco-tourism of the lake wetlands

The water of the lake supports different species of phytoplankton, zooplankton and fish (Mohammed,1993). It is specially known for the large number of lesser Flamingo, as a major

3.2.5. Socio-economic characteristic of the area

The economic base of the community in the area to the wetland is agriculture (crop production and animal husbandry).They also use the sand, mineral salts and charcoals as a means of generating additional income. However, agricultural sector seemed to dominate all other livelihood activities. Tourism development is inadequate even although the natural tourism resources of Abijiat wetlands are abundant and diverse, and could probably rank among the best touristically rich area in Ethiopia, and has a great potential and significant contribution to tourism development of the country or the national economy as a whole and this can create an opportunity/benefit the local community.

3.2.6 Soil and vegetation

Soil types in the Rift valley are closely related to soil parent materials. According to FAO digital map FAO (1996) and Bediru (2006), there are up to 24, 12 and 7 different soil units in the central and southern Rift, the Ziway-Awassa basin, and the national park including its environs respectively. While Eurtic vertisol is dominating the former two categories, vitric Andosol covers more than 1/3 of the park and its 10km radius .The same is true for Abijiata lake wetlands since its whole area is situated in the ASLN and the soil of this particular area especially along the shore of lake is Basic in character.

The vegetation is Acacia woodlands with small areas of reverine forest and open shrub on the rocky slopes. Abijiata lake shores have short grasslands comprising of cynodom and sporobolus that are important for stabilizing the fragile soils (G/Michael, 2008).

Different studies have indicated that the rift valley floor basin has been largely dominated by woodland and wooded-grass lands .The most common tree species along the rift floor belong to the deciduous Acacia while the cooler escarpments on both sides support wide diversity of both broad leaves and conifer (G/Michael, 2008).

4. Results and Discussion

4.1. Sample household Characteristics

As indicated under chapter one, the total sample size used in this study is 120 permanent households settling adjacent to Lake Abijjata. These households were drawn from three kebele PA, two of which are found in Arsi Negele and one is in Adami Tulu Jido Kombolcha woreda. Accordingly, each target kebele peasant association has contributed to the sample relative to its house hold size. Therefore, the sample composition of this survey consists of 10% of each respective kebeles; and 29, 41 and 50 households were drown from DakeHora Qalo, Gale and Qalo, and Dasta Abijiata respectively.

4.2. Age, Household size, education and religion

Age: Characteristics in term of age are displayed in table 7. About 98 percent of the household's respondents are within the age group of 20-65 year, this depicts that more than 90 percent of the total sample size have high chance of fertility, and to have many children as a consequence in the long run unless corrective measures will be taken, contribute to high population growth.

Table 6. Respondents' age distribution

Age	Frequency	Percent
20-30	38	32
31-40	40	41
41-55	20	17
56-65	10	8
65+	3	2
Total	120	100

Source: Author field survey, (January, 2010)

Household size: they could be family members, relatives or other people living with in the household for an extended period of time. The survey result shows that the household size ranges from 1 to 17 with an average of 8 persons (Table 5)

Table 7. HH size of sample population

Household size	Frequency	Percent
1-6	58	48
7-10	49	41
11-17	13	11
Total	120	100

Source: Own survey (January, 2010)

Education: Illiteracy is one of the features of the rural area in Ethiopia. The education level of the sample households reflects this situation or reality; where more than 80 percent of them had no formal education (Table 8). About 13 percent of the respondents attended primary education and the number of farmers who completed secondary education is low.

Table 8. Educational status of sampled households

Education level	Frequency	Percent
No formal education	70	58
Adult education	30	25
Primary education	15	13
Secondary education	5	4
Certificate	-	-
Total	120	100

Source: Own survey (January, 2010)

Religion: The Rift Valley Lakes basin is home for people with different faiths and different religions co-exist together. However, the data on religion, in the study area depicts that 97 percent of the respondents are Muslim

4.3. Wetlands resources

4.3.1. Land use Trends/patterns

Data on land resource utilization or land use system was collected from the sampled farmers and participants of the focus group discussion in all of three sample kebeles. These types of information are useful to understand the value of the land resources in the wetlands. The major source of livelihood of the people in the Ethiopian in general and the study area in particular is crop production. Both annual crops and perennial crops are grown in the study area. Annual corps like maize, sorghum, and teff in small amount cultivated in the area. Maize is one of the staple food grain produced by majority of the farmers. The productivity of the maize is high due to use of chemical fertilizer and as compared to other crops; improved seeds have been available for maize. During the focus group discussions the participants indicated that crop production is becoming impossible without fertilizer due to high soil degradation. On the other hand the perennial crops have dual purposes. Production of fruits that can be consumed by the house hold or sold to generate income and ecological values since they help in maintaining the soil fertility, erosion control, and serve as shade trees.

The size of land per house hold declined during the last 10 years from 2.48 to 2.28 ha in the area (Table 9).The size of land allocated to crops, fodder production, private woodlots, and private holding adjacent to the marshy/wetland areas declined over time due to increasing population pressure. Land was distributed by parents to the landless young farmers, resulting in small and fragmented farmland.

Ethiopian wetlands support diverse crop that people dwelling with in or around the wetlands grow to food or cash. A number of cereals, pulses, vegetables, oil crops and bulbs that grow on the Ethiopian up lands also grow in the wetlands (Bezabih, 2008). Wetlands also provide pasture for riparian keeping livestock with in and around wetlands. Close to 1.5 to 4.4 people per hectare of agricultural land around lakes of Ziway, Langano, Shalla and Abijiata and an estimated 6 million people in the Abaya, Chamo, Awassa and Chew-Bahir catchments, with an average population density of more than 160 persons/km^2 (Lemlem, 2003).

Table 9: Area of land under different use system (ha per HH)

Land use type	1999	2009
Crop land	1.60	1.46
Pasture area	0.32	0.32
Forest and wood land	0.23	0.22
Marshy area/wetland	0.34	0.27
Total	2.48	2.28

Source: Own survey (January, 2009)

Traditionally, land is the most important asset that is transferred to heirs. The Ethiopia farmers land and give perennial crops and livestock as a gift to newly married sons, as a means of providing initial capital for the new household.

The respondents were asked how they obtained the land under their possession. About 33 percent of the sample respondents accessed farmland through inheritance of the parents while some 17 percent accessed land through government land distribution (Figure 5). Some 30 percent of the respondents participated in land transaction (share cropping, land renting and purchasing) to access land.

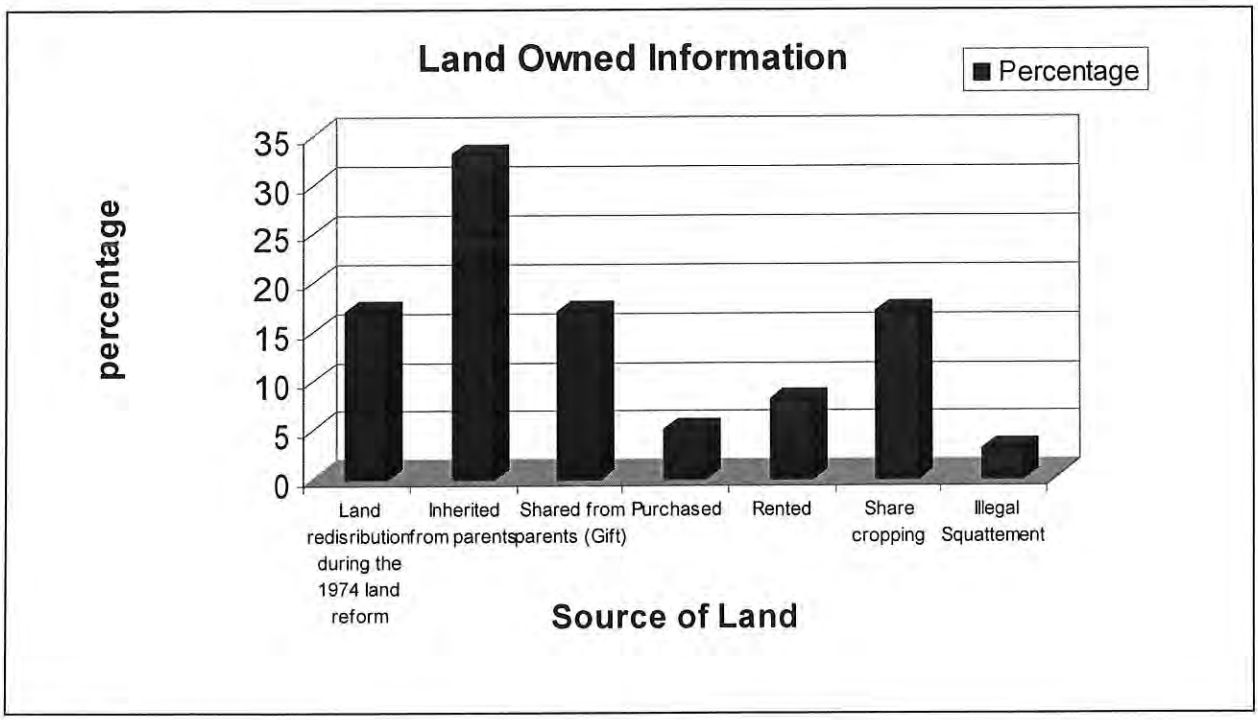


Figure 5. Proportion of respondents by source of land owned

4.3.2. Pasture land

Livestock production is an integral part of the farming system in the study area. Livestock feed is crucial factor affecting livestock production. Livestock feed is supplied from green pasture, tree leaves, crop residues and by products and supplementary feed from industrial products, which is rarely available to the rural area. The wetlands serve as the major source of livestock feed both during the dry and rainy season in the area.

Regarding the source of feed being used by their livestock, about 91 percent of the sample households explained that they are using common grazing land and wetlands around the Abijiata Lake. However, only 2 percent of them responded that they use their own grazing land (homestead) to feed their livestock (Figure 6)

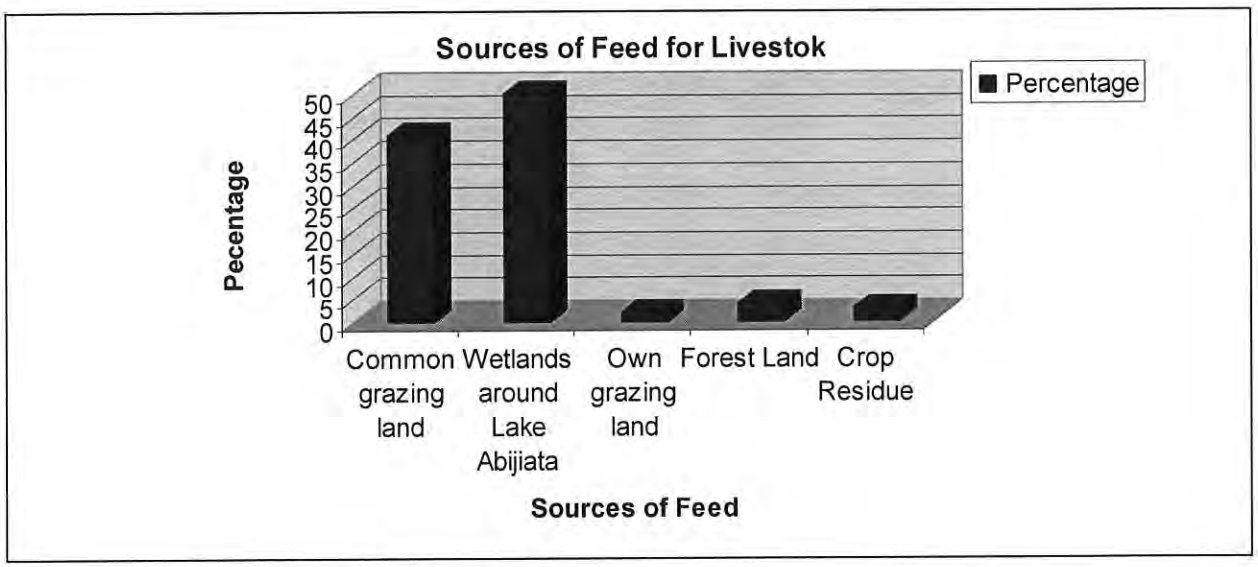


Figure 6.Responses of sample households on source of food for their livestock

The survey result indicated that more than 90 percent of the sample households used the wetlands resource as a source of food for their livestock. During focus group discussion the key informants replied that common grazing land around Abijiata Lake is the main source of food for their livestock especially during dry season since it is evergreen and moist throughout the year. Therefore, Lake Abijiata wetlands play a great role to over-come feed shortage for livestock of the local community. In a situation where the drought risk affects the area, this lake wetland helps farmers to mitigate the risk of livestock loss.

Figurer 7. Grazing, Farming and settlement land gained through shifting cultivation/clearing forest near ASLNP left and Abijiata lake wetlands serve as grazing land Right(photo: Author field survey, January; 2010)

4.3.3. Vegetation

The study area is covered by some natural forests particularly around the Abijiata-shalla Lakes national parks, largely dominated by wood land and wooded grass lands that are increasingly becoming more open.The most common tree species in the area belong to the deciduous acacia.According to my key informants, during 1970s and 1980s, Abijiata Lake was not easily seen/observed from a distance due to vegetation around the lake under the study. However, these vegetation cover is reduced due to many human and natural factors.

There are some plant species like cypress lactifolius (chaffee), brevifollius, Anagallis serpents and Fuirena stricta that are only available in the wetlands because of their special characteristics that tend to favor particular types of plants and soils (Wood, 2001). These plants provide diverse benefits: support people's livelihoods, conserve the environment, and used as shelter to wildlife. Deforestation due to population growth and the associated expansion of farming, increasing demand for fuel, construction wood and charcoal are critical factors deteriorating forest resource in rift valley lakes basins. Charcoal production is becoming a serious cause for concern in the rift valley system of Ziway, Langano, Abijiata and Shalla (Lemlem 2003).

Figure 8. Forest lands near ASLNP (left) and Abijiata lake shores (right) were converted to Permanent residences/villages. Photo: Author field survey, January, 2010.

4.3.4. Wild life resources

During the field survey, there was a number of wild life resources observable in the area. For example, there are a great Varity of bird species that resides in the area; Flamingos are among the bird paradise found in the lake Abijiata. Moreover, Ostrich non-flying bird species and other bird species are in the area. However, these bird species are in ex-situ conservation or habitat management problem, this clearly evidenced in the Ostrich farm, these bird species brought from Afar area, the Eastern savannah grassland of Ethiopia in 1983.Thier number was more than 50 up on a time in the nearest past (G/Michael,2008). But now it declined to 19 due to various reasons. In addition to the avifauna, large mammals have been using the area. From these mammals monkey, Hyena, Jackals, Great kudu and Baboons are the major ones and remained in the area. But, these mammals are now rare in abundance and species composition. These have been reduced or eliminated by human disturbance and species composition (Fayera and Fekadu, 2006). There are also small mammals like different kinds of Rats, mouse, and Rabbits found in the area. Thus, besides the habitat management problem, even the park/sanctuary in the area is not functioning well to save the remaining wildlife resources.

Lake Abijiata has been proposed as a Ramsar site of international importance and it forms part of the then proposed ASLNP. In some years significant fishery of tilapia developed in which Oreochromis niloticus was the dominant catch (Tenalem, 2009). However, today fishing is impossible in the area, Mohammed (1993), explained that, Abijiata soda Ash plant was established without conducting in depth and sounding feasibility study. Indeed, the cost that may be incurred on

the area as a result of ecological disturbance by soda ash factory in general and ultimate loss of the whole water specter bird population and the fish etc were not well articulated (Debele, 2007). Confirming this idea the sample household's have explained that it has become common for them to see many dead fish and birds along the shores of the lake Abijiata where water pumps planted in the north western side of the lake.

The study area is found in the ASLNP which is one of the most scenically beautiful spots of Ethiopia, possessing a unique aspect of blue lakes edged with flat-topped acacia trees and alive with spectacular wealth of avifauna (Stephenson, 1978). Abijiata Lake is specially known for the large number of lesser flamingo, and as a major feeding ground for the great white pelican. The alkalinity nature of the lake encourages the production of phytoplankton, zooplankton and fish (Mohammed, 1993). In addition to its alkaline edge and the surrounding lake side pasture attract arthropods required as food for share birds. Such nature of the lake makes it an ideal site for bird watching (Yilma and Mengistu, 2002). Much frequented by water birds for drinking and bathing, the lake is surrounded by gentle grass covered slopes and acacia woodland.

Fekadu and Rezenom (2002) have noted that the area under the study including the park has a total of 76 mammal species representing 9 orders and 27 families. Historically, abundant species including Oryx, Swayne's Hartebeest, Buffalo, Water buck, Giraffe, and lion have been exterminated and are replaced by other species like Grant's gazelle, colobus monkey, warthog, great kudu, klipspringer, oribi and Jackal (Fekadu and Rezenom, 2002, G/Michael, 2008). These species are rare nowadays and there are only exceptional sights if one ever sees them at all. Today even the park has some endemic mammals and bird species because of anthropogenic interventions as well as environmental crises in the area.


Figure 9.Few wild animals in the fence of the ASLNP and bird species in Abijiata Lake (Photo: Author field survey, January, 2010)

The area under the study, is found in the ASLNP and has over 436 bird species, of which 6 are near endemic to Ethiopia(G/michael,2008;Fayera and Fekadu,2006).The most notable have been the Great White pelican, Stork, Flamingos, Egrets, Herons, Cormorants and plovers. Lake Abijiata is specially known for the large number of Lesser Flamingos, and as a major feeding ground for the Great White Pelican. The area is specially known for its significance to migrating wetland birds from the arctic during northern winter months(EWNHS, 2002).During the annual African waterfowl count of 1992/93,a total 37,000 Shoveler;700 Black-winged stilt; 11,000 Avocet; 7,000 Littlestint;and10,000Ruffwerecounted (Syvertsen,1995;EWNHS,2002;G/Michael,2008).The African water waterfowl census conducted for over ten years indicated that the area entertains unusual records of birds including Dunlin, Mongolian sand plover, pacific Goldenplover, Kentish plover, Grey plover, pictorial sand piper, Red-necked phalarope, watt led crane, southern poached,GreateBlack–headedGullandyellow–leggedHerringGull (EWNHS,1996;G/Michael,2008).

4.4. Livelihood System

In the study area the households generate their livelihoods, from arrays of activities. Indeed, crop and livestock production are the major sources of livelihood of the community in the study area. Accordingly, livestock husbandry is the major type of livelihood activity practiced by the local community of the study area before 20 years. However, due to the increase of their population number the possibility of making their livelihood had decreased considerably specially after the 1980_s (Mohammed, 1993; Debele, 2007). Although crop production has long history in the rift

valley regional it seems a recent activity in ASLNP (Stephensen, 1978; Debele, 2007). Short growing period, rainfall scarcity and poor soil fertility of the area might have discouraged crop production. However, population increment in the area led to a declining in livestock herding and made the quest for farm land mandatory (Dagnachew, et.al 2005). In other words, due to the above mentioned factors the local communities forced to shift their livelihood system from animal husbandry to crop production.

Accordingly, the survey result indicated that 41 percent of the sample households were dependent on animal husbandry followed by crop production before 1970s (Table 10). However, at present time, more than 50 percent of the sampled households have replied that they rely on mixed farming in order to led /earn their living.

Table 10. Households' response to their means of livelihoods (income)

Source of Income	Before 1970s*		At present time	
	Frequency	%	Frequency	%
Crop production	44	37	25	21
Animal husbandry	50	41	28	23
Mixed farming	20	17	60	50
Fuel wood selling &charcoal making.	6	5		6
Total	120	100	120	100

Source: Own survey, January 2010

*1970s taken as a reference point because of the satellite image of the area is taken in this year.

Although the respondents were asked if they have additional means of earn their livelihood system besides the above to diversify their income. The result shows that more than 29 percent of sample households have mentioned that they practiced sand and mineral salt extraction to win their live.

The farmers were asked if there was a change in the income situations between ten years ago and now; the result shows that the income from activities increased for some of households while it decreased for others. The over all directions of change was increased for most of households. However, it appears that income from livestock production declined for some significant number of households and more than 60% of the respondents felt that the income from selling of fire wood &charcoal declined.(Table 11)

Table 11: Proportion of respondents indicating changes in income from different sources (%)

Income source	Direction of change relative to 10 years ago						Total	
	Increased		Decreased		No change		Frequency	100%
	Frequency	100%	Frequency	100%	Frequency	100%		
Crop production	55	46	40	33	25	21	120	100
Livestock production	59	49	51	43	10	8	120	100
Selling of fire wood/charcoal	26	22	76	63	18	15	120	100
Sand and mineral salt extraction	31	26	74	62	15	12	120	100
Tourist guide	30	25	50	42	40	33	120	100

Source: Author field survey January, 2010

However, the dependence of some of the households on natural resources such as sales of sand, mineral salt, fire wood and charcoal has negative consequences on the environment.

Figure 10. Mineral salt extraction from shores of Abijiata lake (photo: The Author field Survey January, 2010)

Figure 11.Cattle grazing near Abijiata lake shores(photo:Author field survey,January;2010)

Fishery also provides means of livelihood for many people in the past/before 10 years back. However, the reduction of the size of Abijiata Lake, due to extraction of the lake water for soda ash factory and recurrent drought in the area made difficult for the fish life. Therefore, today this activity stopped because of the elimination of fish from this lake

4.5. Threats and Challenges in Abijiata Lake Wetlands Management

Wetlands produce an ecological equilibrium in the environment by maintaining the integrity of life support systems for sustainable socio-economic development.. There is little or no awareness of the current status, threats or values of wetlands, or even the need for their conservation and sustainable utilization in the study area. Therefore, there are different threats to Abijiata Lake wetlands. These could be broadly divided into natural, demographic pressure, and overexploitation water for irrigation and soda ash factory and lack of institutional coordination.

4.5.1. Natural factors (Climatic Changes)

Rift Valley wetlands are often rainfall deficit and prone to drought, experiencing semi-arid climate with evapo-transpiration exceeding precipitation. The inter-annual variation in rain fall and water inputs is also significant and exerts pronounced impacts on the wetlands. Freshwater and/or seasonal run-off discharged to the wetlands is progressively decreasing while the evaporation rate around the wetlands is increasing promoting chemical concentration of the water.

During the focus group discussions, they were asked how they perceive the trends in annual crop yield in the area; they respond that it is decreasing since the area is vulnerable to drought/rain fall deficient. Sharing this view some of the elder men of the local community have told me that drought has caused the river Bulbula and Hora Kelo the main feeder rivers of Abijiata Lake to

shrink to some extent as compared to fifteen to twenty years ago. Regarding the lakes water body and the moisture of the wetland (environment), they told me that the Abijiata Lake shows fluctuation in size according to the precipitation trends in the adjacent highlands. Therefore based on this, one can generalize that, the recurrent drought in the rift valley lakes region is the main factor for the shrinkage of Abijiata Lake. In addition, the author of this thesis believes that this issue needs further climatic analysis which is beyond the scope of this study.

4.5.2 Demographic Pressure

The population of Ethiopia is growing exponentially at a rate of 2.5 – 2.9% per year (Bedru 2006; G/Michael; 2008); this is also true in the rift valley lakes region. This is always resulted in expansion of agricultural land to feed the increasing population demand.

The respondents were asked whether there was increase in population growth or not in the area. They responded that if we compare the population number of the area before 20-30 years ago with that of today, high population number was observed today. As a result, the farmers are forced to find an extra farming land to feed their family. As a result of this activity/action wetland resources like forests and grasses were over exploited. This was supported by key informants .The practice of polygamy in the area is one of the big challenge noted by key informants for increase in population. Since the majority of the people of the area are Muslims, it is possible to have more than one wife according to their tradition. Thus, the growth of population resulted in enforcing the people to encroache the wetlands in the area, apparently over exploiting the resource base.

It is clear that the Abijiata Lake wetland is found within Abijiata-Shala Lakes National Park (ASLNP). However, the local community has little knowledge concerning the boundary of the park. Due to this misconception, the local community claim to use, and are using vegetation from ever corner of the park. This area therefore, under continual threat from deforestation due to population growth and associated accelerating such as charcoal production and fuel wood production.

According to Arsi Negele Agricultural and Rural Development Office , mineral salt and sand extraction from Abijiata Lake shore is partly responsible for forest degradation, disruption of the natural landscape and disturbance of lake shore. The Shore of Abijiata Lake is known for its salty 'soil' which is locally called 'Boojii' widely used as cattle feed in many parts of the country (NACID, 2004). The extraction of sand exposes the acacia wood land to fall down by wind, ending

up as a raw material for charcoal and fuel wood gatherers (G/Michael, 2008). In addition to these, the extraction of mineral salt and sand is seen as a cause of siltation and a threat to the bird species that use the site as nesting and feeding ground during migration. According to the Agricultural and Rural Development Offices of the two woredas , shifting cultivation is also noted as one cause of deforestation.

Poverty- Even if agriculture, the main source of livelihood in the area, is not satisfactory for supporting food security and realizing long term socio-economic development Michael (2008) explained that, low genetic potential of the livestock breed, shortage of livestock feeds (over grazing) and high rate of livestock diseases and practice incidences are the other factors which aggravated poverty. The area also suffers from moisture stress, and the soil of the area is characterized by low moisture holding capacity. This nature of the soil affects the agricultural productivity of the area, as well as preventing regeneration or rehabilitation, as the vegetation in the area is removed or degraded. Therefore, intensive cutting of acacia trees as an alternative means of livelihood, source of income and energy for the local people, supplemented by unsatisfactory farming and livestock herding aggravate the over exploitation of the wetland resources.

4.5.3 Over use of water resources

The problem facing wetland management could emanate from excessive use of wetland resources such as water resources as a follow up of the prevailing miserable poverty of communities residing in and around the wetlands. This in turn leads to application of un wise resource management and use.

The conversion of wetlands for intensive irrigation agriculture, have emerged as a controversial development issues in recent years. This is particularly sever in the rift valley regions and lowlands where water stress and drought critical. Moreover, irrigation is the most obvious response to water scarcity in agricultural areas. As a matter of fact some lakes and tributary rivers are being used for irrigation. This situation by itself could be a major threat to the very existence of the lakes and associated wetlands (Tenalem, 2009).

Table 12 : Irrigation farms abstracting water from lake ziway and Bulbula river

S/N	Name of irrigation farm	Water source for the farm	Number of pumps/ valves	Discharging capacity of each pump/valve/in lt/sec	Irrigated farm in hectare	Duration of active operation of each pumper day in hr	Method of water utilization
1	Ethioflora private farm	Bulbula	5	3of them=75lt/s 2of them=82lt/s Total=389/s	92	8hr/day	Surface irrigation
2	Segel private farm	Bulbula	4	112.5lt Total=450lt/s	90	10hr/day	Surface irrigation
3	Ethio/Hawi/private farm	Bulbula	3	2ofthem=85lit/s 1ofthem=175lit/s Total=345lt/s	72	8hr/day	Surface irrigation
4	Gerbi-ziway fruit and vegetable state farm	Bulbula	5	50lt/s Total=250lt/s	876.09	15hr/day	Surface irrigation
5	Maremiyabetcho fruitand vegetable farm	Ziway	3	1of them=46lt/s 2of them=225lt/s Total=496lt/s	128	12hr/day	Surface irrigation
6	Sher Ethiopia floro culture farm	Ziway	23valves	8994lt/20min 399.7lt/min	>500	34.5hr/day	Drip irrigation
7	Ziway city domestic water supply	Ziway	3	20 lt/s	-	12hr/day	Pipeline

Source: Adami Tulu Jido Kombolcha woreda irrigation department and water supply office (Sher Ethiopia, 2007; Debele, 2007)

From hydro-geological and ecological point of view all RV lakes are inseparable (Tenalem, 2009).Abijiata Lake is hydrologically connected to Lake Ziway and langano via rivers Bulbula and Horal Kelo respectively. i.e., the size of Abijiata Lake is controlled by Ziway and Langano Lakes through discharge of the Bulbula and Hora Kelo rivrs. Due to this interconnection between lakes pumping of water from Ziway Lake and diversion of Bulbula River, for perennial plantations and for irrigation farms may result in Abijiata lake drying up. The importance of maintaining year round flow of Bulbula Rivers, apart from its effect on the size of Lake Abijiata relates to the need for domestic water supply and livestock and it represents the only source of fresh water in this semi-arid region where good quality water is very scarce due to high fluoride and salinity. The excessive use of rivers that feed the lakes for irrigation decreased the lakes water depth and

consequently resulted in drastic effects on the fish and other terrestrial as well as aquatic communities/ wetland ecosystem as a whole. According to site manager at Abijiata soda Ash Factory, inflow from Lake Ziway has diminished from 220 mcm(million cubic meter) and to 60 mcm resulting in reduced inflows to the lake in 1994 and the year that followed. At present the situation is shocking. Most of the lake area is converted to blowing sand plain.

Abijiata Soda Ash plant is a factory which was established in 1984/85 near Lake Abijiata on the northern shore and it is the only soda ash producing factory in Ethiopia (Debele, 2007). The factor entirely depends on brine or salt water abstracted from Lake Abijiata through pumping and evaporation for soda Ash production. NACID (2004) indicated that the factory abstracts 5 million m3 of water annually, which is 1% of the amount of water lost from the lake due to natural evaporation. A clear evidence of the effect of this factory on the lake started to be seen since 1985, when the lake began to decline in depth, level, volume and surface area (Dagnachew et al, 2005). According to Ayenew (2003), in 1998, the Abijiata Lake showed a depth reduction of 0.7m for approximately 13 million m3 of brine water abstraction by the factory. Thus, this clearly indicates that, the Soda Ash Factory is one of the responsible factors for the decline of water volume in Lake Abijiata. Therefore, one can't deny that if the situation is continued, it affects the wild life, the vegetation, aquatic and terrestrial ecosystem as a whole.

Tenalem (2009), explained that before the commencement of the irrigation activity in the Ziway catchments, and the diversion of Bulbula river the main feeder of Abijiata lake as well as the establishment of the Abijiata Soda Ash Factory in the mid 1980s, in the absence of human interference the lake maintained the natural balance between inflow and out flow until the mid of 1970s.

Abstraction of brine water from Lake Abijiata by soda Ash Factory not only caused dramatic depth, surface area and volume reduction of the lake but it also leads the lake to have high concentration of solutes which in turn increase the alkalinity of the lake (Debele, 2007). Higher alkalinity in turn causes reduction of population of various species and ultimately leads to the death of fish eating birds (Dagnachew et al, 2005).

Figure 12. *Partial view of soda ash plant while abstracting (pumping) water from Abijiata Lake (Photo: Author field survey January, 2010)*

During the group discussion, the key informants were asked that what they think the major reason for the shrinkage in the size of Lake Abijiata and 47 percent, 28 percent and 25 percent of respondent said that the establishment of soda ash factory in the area, recurrent drought and climate change, and intensified irrigation activities in the vicinity area major reasons for the decline of the size of Lake Abijiata respectively.

Table 13: Amount of brine abstracted from lake Abijiata from 1988-2009

S/N	Fiscal year	Amount of extracted brine from lake in m^3	S/N	Fiscal year	Amount of extracted brine from lake in m^3
1	1988	2,094,756.51	12	1999	1,242,187.06
2	1989	1,121,351.08	13	2000	1,125,365.56
3	1990	1,430.242.00	14	2001	1,297,594.19
4	1991	1,814,447.70	15	2002	1,551,829.55
5	1992	1,525,880.75	16	2003	1,131,905.05
6	1993	1,424,717,.75	17	2004	575,442.07
7	1994	1,170,576.00	18	2005	248,196.30
8	1995	1,685,661.80	19	2006	333,908.00
9	1996	1,256,102.00	20	2007	579,340
10	1997	1,525,299.27	21	2008	883,666
11	1998	1,282,709.78	22	2009	1,002,138
	Total				**26301316.43**

Source: Abijiata soda ash share company site office January, 2010 ;Debele,2008

Finally, the alarming reduction of the level and size of the lake has certainly pause great threat to the fish which is already eliminated from this lake and bird population in particular, the ecology and the lake wetland ecosystem in general. If the pumping continues at the present rate in the Abijiata it will dry out in the very near future like Lake Haromaya, unless corrective measures should be taken by concerned body.

Figure 13.Abstracted brine (salty) from Abijiata Lake after evaporation, ready for soda Ash production (Photo: Author field survey, January 2010).

To bring the national economic development the regional and national government of Ethiopia promote investment activities in the area and in its surrounding. The establishment of Soda Ash factory in the northern Abijiata Lake, Andola cattle fattening and breeding, irrigation farm activities in the Ziway lake catchments and along the banks of Bulbula River, without seeing the adverse consequences on the environment. However, others preach for strict nature conservation neglecting the local people's livelihood and the nation's quest for economic development.

Thus, the above all mentioned institutions blame one another for what is happening in the area, and advocated different programme reflecting different objectives in different direction. However, wetland related issues must, therefore, be cross cutting in nature, and an integrated wetland resource management strategy calls for the coordination of several sectors, agencies or institutions.

4.6. Land use Change Detection Analysis

In light of the recent severe environmental degradation in developing countries, monitoring and analysis of land use/cover changes has become critical. Because land use/cover changes have significant effects on basic processes such as biogeochemical cycling, soil erosion and biodiversity (Douglas ,1999, Chapin et al. ,2000). Therefore, comprehensive understanding of land use/cover changes at both local and regional scales is important since it plays a pivotal role in socio-economic development and global environmental changes (Xiuwan, 2002). In Africa, it is estimated that five million square kilometers of land is moderately to severely degrade due to rapid land use/cover changes, which have been caused by population increase, agricultural expansion, deforestation, mining, poor land management and recurrent droughts (Economic Commission for Africa (ECA) 2001).

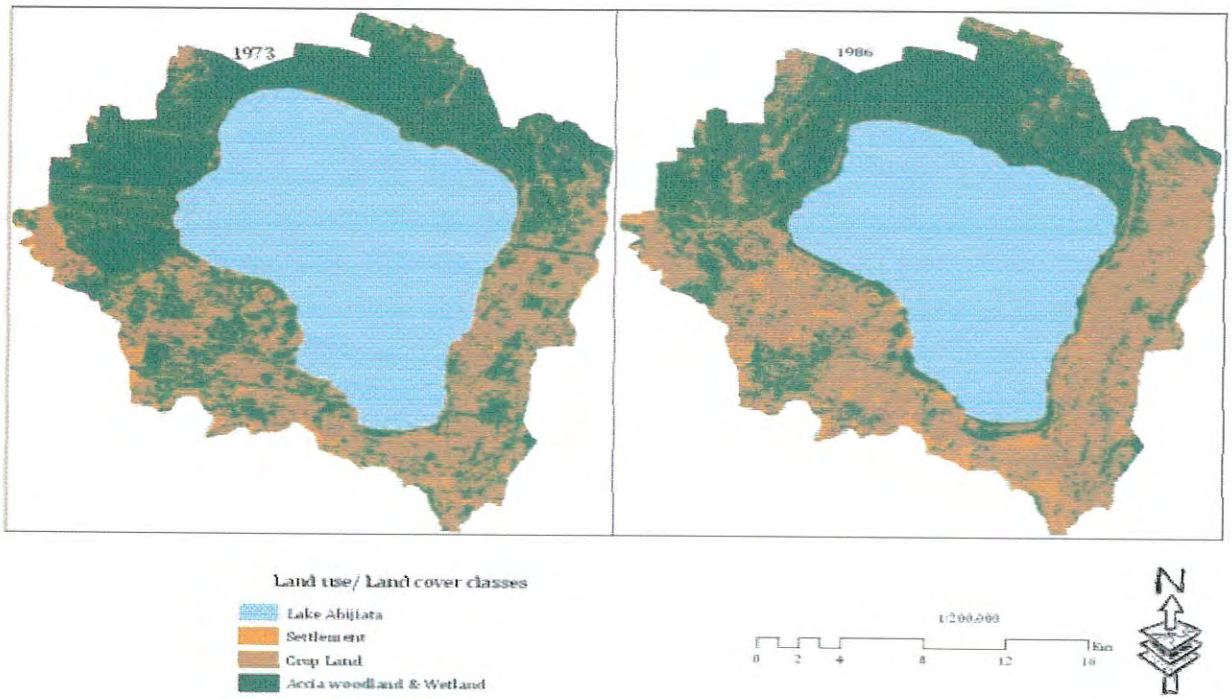
Land use/land cover changes are important elements of the global environmental change processes (Dickinson 1995, Hall et al. ,1995). A common method for the detection of land use change is to compare two or more images covering the study area at different dates. The present study used Land sat Multispectral Scanner (MSS) from 1973, a Land sat 5 Thematic Map per (TM) from 1986, and a Land sat Enhanced Thematic Map per Plus (ETM+) from 2000 & 2009 for land use/cover mapping (Table 6). The selection of the image data was based on: (1) coverage of the study area and (2) the availability of high quality satellite data with minimal cloud coverage.

Wetlands resource utilization issues, are becoming increasingly challenging, especially in arid and semi-arid regions with rapidly growing population .Ethiopian people with a low level of education and low income tend to settle quickly around wetlands. So, remote sensing data such as that of satellite images are a powerful tool for monitoring because they give visual assessment of land cover changes over a period of time and provide information on the trade-offs between different land cover categories. Therefore, wetland information is part of wetland conservation plan. This study planed in assessing and predicting the changes of the wetlands surrounding Abijiata lake. The data and information would be useful as a planning tool.

Figure 14: Summary of images used in Land Use/Land Cover change analysis between1973-2009

Figure 15. LU/LC change detection maps between1973-1986 A and 1973-2000 B

A)



B)

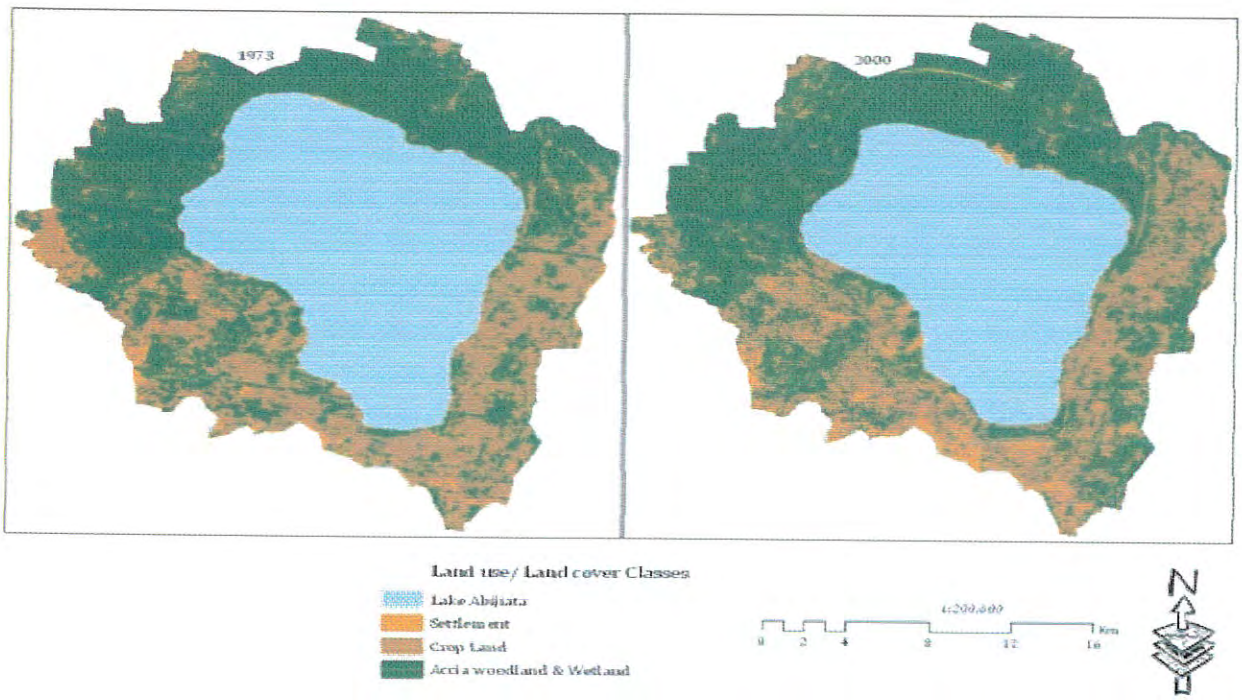
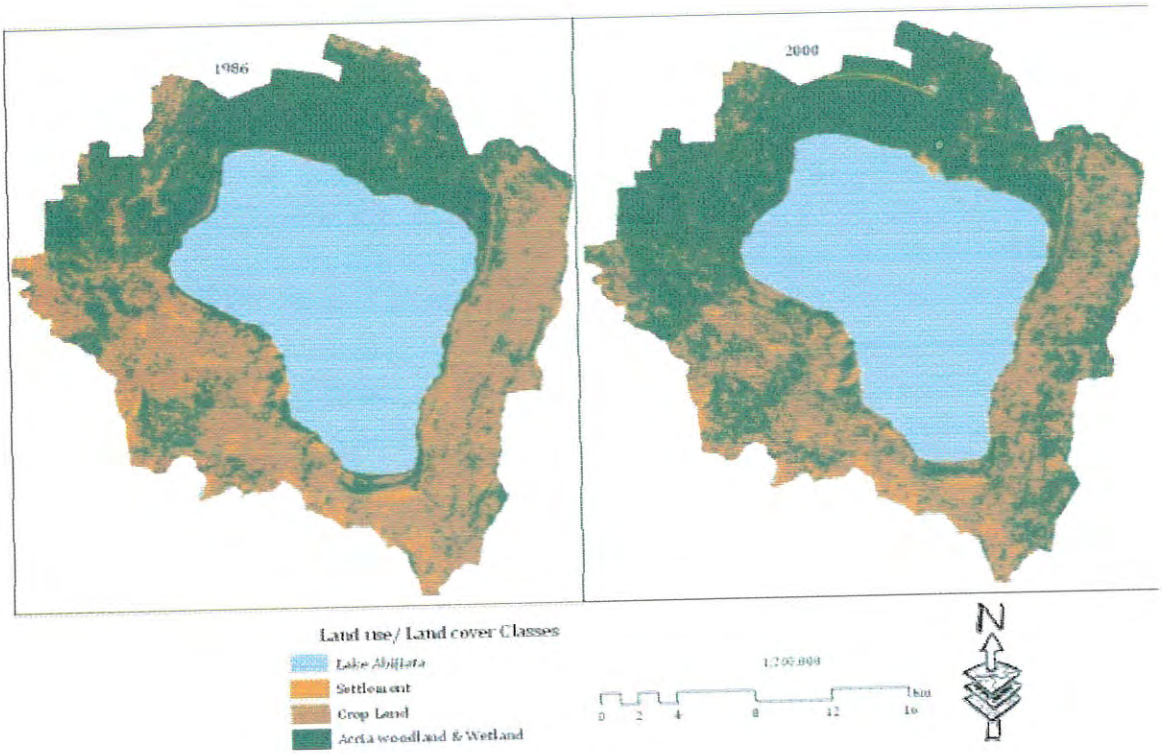


Figure 16. LU/LC change detection maps between1986 -2000 C and 1986-2009 D

C)



D)

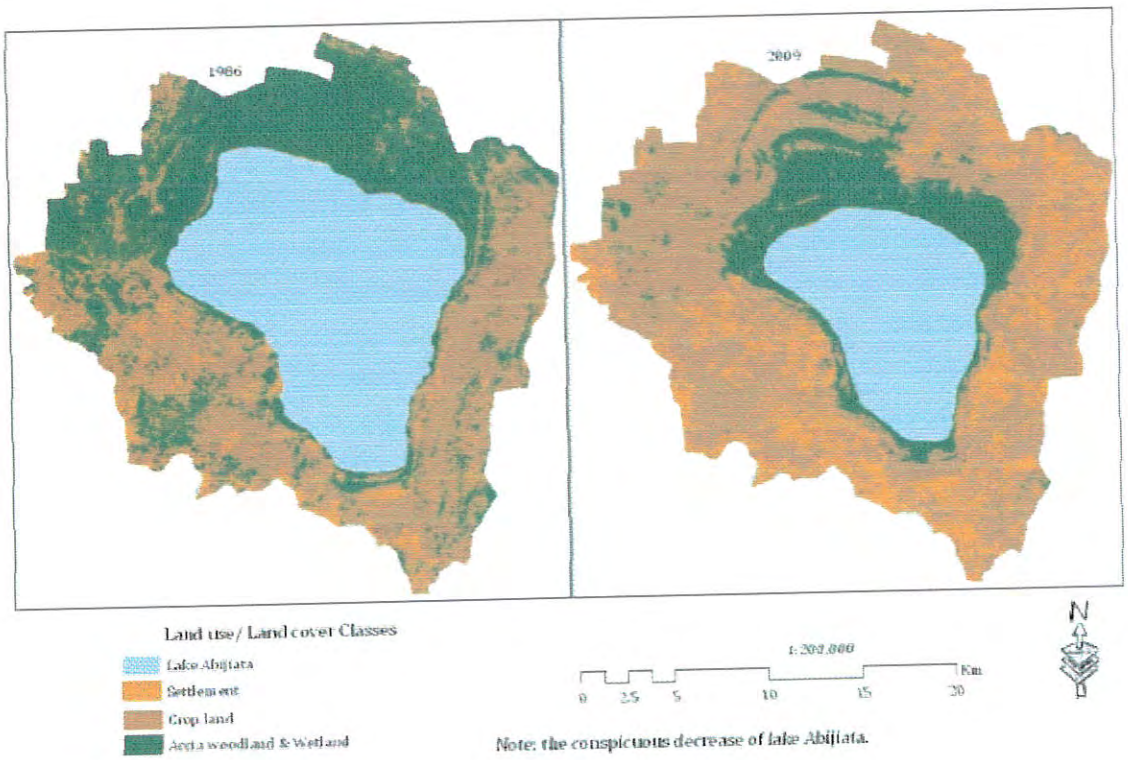
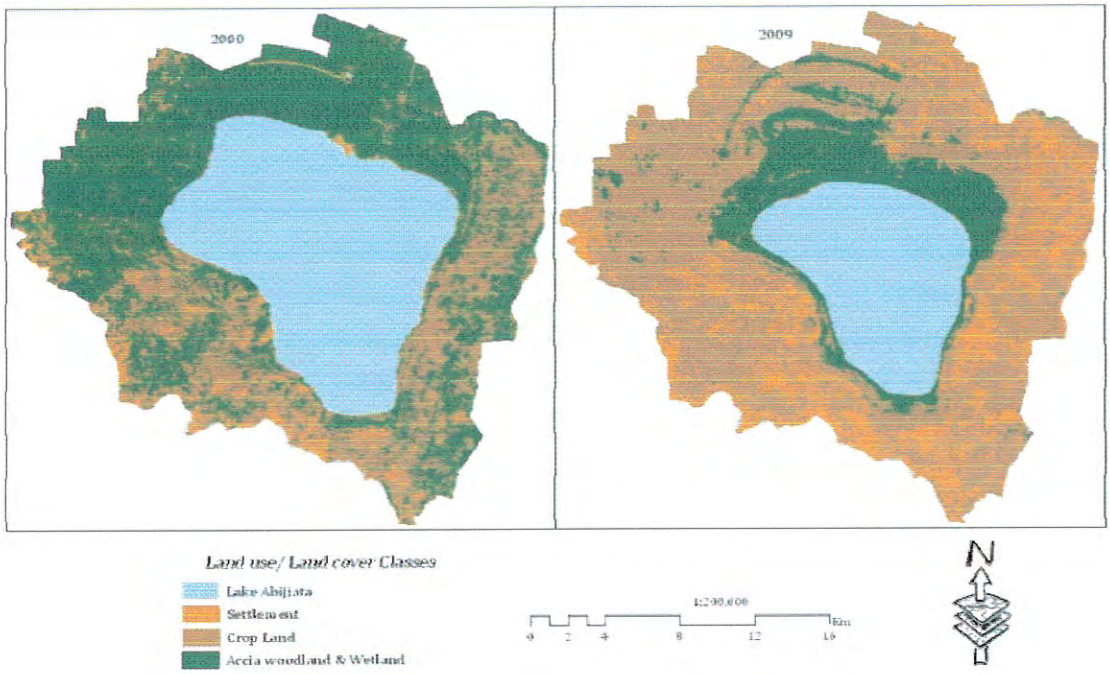
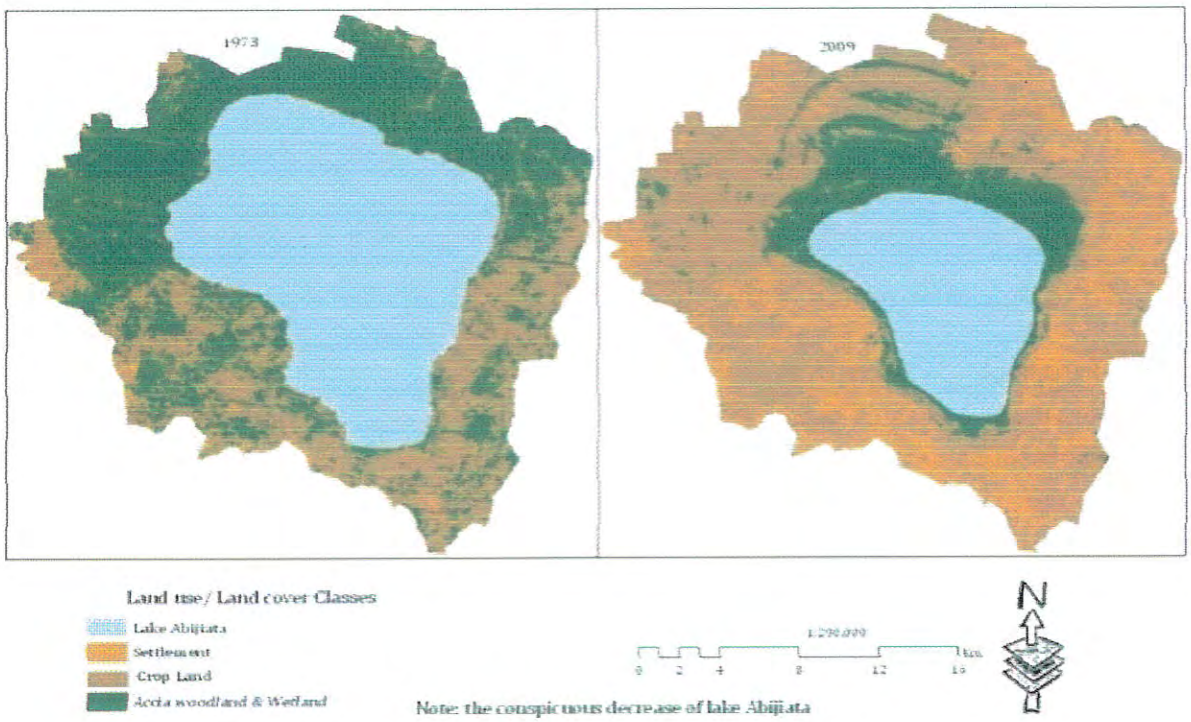


Figure 17. LU/LC change detection maps between 2000-2009 E and 1973-2009 F

E)



F)



In general, this study evaluates the change in wetlands around and with in Lake Abijiata from 1973 to 2009.It comprises land use/land cover change detection of wetlands and other land uses in the area.

Table 14: Land use / Land cover changes of the study area as extracted from time series of Land sat images (1973 and 1986)-developed from Figure 15 A

LU/LC	1973		1986		Percentage Change in
	Area(ha)	%	Area(ha)	%	
Lake	19880	37.98	16498.6	31.52	-6.46
Settlement	1673.56	3.20	3174.44	6.07	2.87
Crop land	14554.54	27.81	20267.3	38.73	10.92
Acacia wood land &wetlands	16227.54	31.01	12395.3	23.68	-7.33
Total	52335.64	100.00	52335.64	100.00	

Computed percentages of land use/cover classes show that in 1973, lake Abijiata (water body), settlement, cropland, Acacia woodland and wetlands occupied 37.98%, 3.20%, 27.81% and, 31.01%respectively, (Table 14). However, significant spatial expansion in settlement and cropland/agriculture where as decrease in water body (lake size), Acacia woodland and wetlands were observed in the1986 land use/ land cover (Figure A). The area of settlement increased from 3.20% to 6.07% , by 2.87% and cropland also increased from 27.81% to 38.73%,by 10.92% respectively, while the lake size , acacia woodland and the lake wetlands were reduced substantially to31.52% by -6.46% and 23.68% by -7.33%respectively in the year of 1986. Observed trends in land use/cover changes indicate that deforestation and the encroachment of cultivation in woodland areas is a continuous trend in all the land tenure systems. The results, therefore, suggest that an efficient and sustainable land use plan is required to reduce the rapid land use/cover changes, particularly the loss of natural resources.

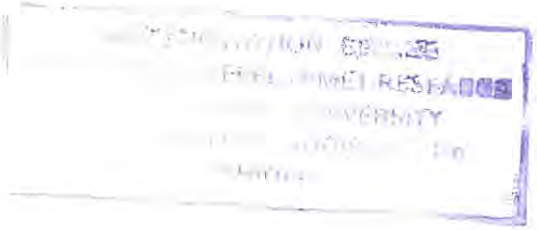
Table 15: Land use / Land cover changes of the study area as extracted from time series of Land sat images (1973 and 2000)-developed from Figure 15 B

LU/LC	1973		2000		Percentage Change in LU/LC
	Area (ha)	%	Area (ha)	%	
Lake	19880	37.98	16713.9	31.94	-6.04
Settlement	1673.56	3.20	3722.8	7.11	3.91
Crop land	14554.54	27.81	17102.54	32.68	4.87
Acacia woodland &wetlands	16227.54	31.01	14796.4	28.27	-2.74
Total	52335.64	100.00	52335.64	100.00	

Between 1973-2000, the lake size has showed a continuous change from 37.98% in 1973 to 31.94% in 2000, which is reduced by -6.04%.The difference is -6.04% in comparison with that of the year 1973;in the same tune one can understand that 6.04% of former water body(lake area) was converted to other land use. Moreover, based on land use/land cover change of the year 1973 and 2000, Acacia woodland and wetlands found in the area of 31.01% in 1973 was reduced to 28.27% in the year of 2000(reduced by-2%). However, human settlement and cropland (agricultural land) increased from 3.20% in 1973 to 7.11% in 2000 by 3. 91% and from 27.81% in 1973 to 32.68% in 2000 by 4.87 %(Table15).From this one can suggest that in the year of 2000 water body, forest lands and wetlands were converted in to settlement for human residence ,grazing land for live stocks and cropland.

Table 16: Land use / Land cover changes of the study area as extracted from time series of Land sat images (1986 and 2000)-developed from Figure 16 C

LU/LC	1986		2000		Percentage Change in LU/LC
	Area	%	Area (ha)	%	
Lake	16498.6	31.52	16713.9	31.94	0.42
Settlement	3174.44	6.07	3722.8	7.11	1.04
Crop land	20267.3	38.73	17102.54	32.68	-6.05
Acacia wood land & wetlands	12395.3	23.68	14796.4	28.27	4.59
Total	52335.6	100.00	52335.64	100.00	



Based on the satellite image of land use/land cover change analysis for the year 1986 and 2000, surface area of Abijiata was 16498.6ha and 16713.9ha respectively. This increment for the size of the lake was one of the remarkable years in the history, when the fluctuation of Abijiata lake size was considered. Therefore, the surface area of this lake was increased from 31.52% to 31.94 % by 0.42% for these reference years .However, there was a decrement for some land use classes like croplands, but this is resulted from the time/month in which the satellite image taken and the cloud cover of the area changed the color of cropland and made it similar color with that of acacia wood land and wetlands .Thus, some croplands are considered as woodland and wetlands while the satellite image was taken. In other words, from the above information one can suggest that time and cloud cover of the area during aerial photographing determining the quality of satellite image which in turn influences different land use classes in the actual ground.

Table 17: Land use / Land cover changes of the study area as extracted from time series of Land sat images (1986 and 2009)-developed from Figure 16D

LU/LC	1986		2009		Percentage Change in LU/LC
	Area (ha)	%	Area (ha)	%	
Lake	16498.6	31.52	9428.49	18.02	-13.5
Settlement	3174.44	6.07	13405.5	25.61	19.54
Cropland	20267.3	38.73	23309.74	44.54	5.81
Acacia woodland &wetlands	12395.3	23.68	6191.91	11.83	-11.85
Total	52335.64	100.00	52335.64	100.00	

Basically, the area under the study is known for its possession of mixed acacia wood lands. For instance, in the year 1986 about 12395.3ha was occupied by vegetation and wetlands, but in 2009 only 6191.91ha remained. In other words, Acacia wood land in 1986 was reduced almost by half from 23.68% to11.83% (reduced by-11.85%).In the same manner, the lake size (water body) showed a drastic reduction from16498.6ha in1986 to 9428.49ha in 2009(from 31.52% in1986 to 18.02% in 2009; about-13.5% reduction was observed).However, human settlement and cropland expansion was continued between the two specified years. Accordingly (Table 17), the two land classes increased from 3174.44ha in 1986 to 13405.5ha in2009 or from 6.07% to 25.61% increased by 19.54%for human settlement, and 20267.3ha in 1986 to 23309.74ha in 2009 (38.73% to 44.54% increased by5.81%) for crop land. Based on this it is possible to conclude that population growth accompanied by settlement expansion which aggravates searching for new cropland to attain food security for their family is a cause for acacia wood destruction in the area.

Table 18: Land use / Land cover changes of the study area as extracted from time series of Land sat images (2000 and 2009)-developed from Figure 17E

LU/LC	2000		2009		Percentage Change in LU/LC
	Area(ha)		Area (ha)	%	
Lake	16713.9	31.94	9428.49	18.02	-13.92
Settlement	3722.8	7.11	13405.5	25.61	18.50
Cropland	17102.54	32.68	23309.74	44.54	11.86
Acacia woodland and Wetlands	14796.4	28.27	6191.91	11.83	-16.44
Total	52335.64	100.00	52335.64	100.00	

The land use/ land cover changes of satellite images of the study area between 2000 and 2009 also depicts the same trends of other years of satellite images. That means water body (lake size) , wood lands and wetlands of the area were continued decreasing in size. The size of the lake decreased from 31.94% in 2000 to 18.02% in 2009 ,reduced by 13.92 ,where as acacia wood lands and wetlands reduced from 28.27% in 2000 to 11.83 which is decreased by 16.44%(Table 18).Therefore, this reduction of the lake size , wood land and wetlands have an implication/impacts on the sustainability of wetland resources. However, settlement and croplands expansion were continued and from this one can suggest that population growth is the main driving force in affecting natural resources of the area especially forest resources and this calls for immediate corrective measures /planning.

Table 19: Land use / Land cover changes of the study area as extracted from time series of Land sat images (1973 and 2009-developed from Figure 17F

LU/LU	1973		2009		Percentage Change in LU/LC
	Area (ha)	%	Area (ha)	%	
Lake	19880	37.98	9428.49	18.02	-19.96
Settlement	1673.56	3.20	13405.5	25.61	22.41
Cropland	14554.5	27.81	23309.7	44.54	16.73
Acacia woodland and wetlands	16227.5	31.01	6191.91	11.83	-19.18
Total	52335.6	100.00	52335.6	100.00	

The major land use/cover changes in the study area as derived from Land sat data are mainly due to the dynamic nature of agriculture practice(the abandonment of croplands) on one hand and population growth / settlement expansion and droughts on the other hand. Observed trends in land use/cover changes indicate that deforestation and the encroachment of cultivation in woodland areas is a continuous trend in all the land use systems. The land use/cover changes observed in the area clearly depicted the situation. Here human settlement and croplands were increased from

3.20% in1973 to 25.61% in 2009 by 22.41% and 27.81%in 1973 to 44.54% in 2009 by 16.73% respectively. However, for the above reason, the water body, forestland (woodland) and wetlands were reduced from 37.98% in 1973 to 18.02% in2009 by -19.96% and from 31.o1% in 1973 to 11.83% in 2009 by -19.18% respectively. The results, therefore, suggest that an efficient and sustainable land use plan is required to reduce the rapid land use/cover changes, particularly the loss of wetland resources in general and water as well as forest resources in particular.

4.7. Opportunities in Lake Abijiata Wetland Resources

Currently, it is widely accepted that wetlands perform important hydrological and ecological functions and play an important role in local livelihood and regional as well as national economic conditions. Wetlands can mitigate the impacts of floods, reduce erosion recharge ground water, maintain and improve water quality. Store Carbon dioxide and a meliorate micro-climate condition from an ecological point of view wetlands are fundamentally important for maintaining biological diversity and are excellent habitats where aquatic and terrestrial species find optimal conditions for reproduction and growth. This enables wetlands to provide food web support with in the basin ecological network. Wetlands furthermore; being as a means to improve local livelihood through agriculture and fisheries. Wetlands can also provide food, medicine, shelter, tourism and recreation. Therefore, the following wetland opportunities can be exploited to enhance any environmental friendly and sustainable development in the study area.

4.7.1 Promotion of Ecotourism

The Abijiata Lake wetlands, is situated in Abijiata -Shala Lakes National parks. The area used to be well known for its unique ecological characteristics. The park comprising three lakes: Abijiata, Shala and Chitu. The park in the study area is well known for its large number of wetland birds, over 436 species have been recorded (EWNHS, 2002). The area is situated in one of the narrowest portions of the Great Rift Valley, and a major fly way for pale arctic and African migrants, particularly raptors, flamingos and other water birds (Debele, 2007).

The area is also endowed with numerous hot springs and hot ground water potentials, which are also cited with geological faults striking parallel to the direction of the rift (Fekadu and Rozenom, 2002; G/Michael, 2008).

Lake Abijiata is specifically known for the large number of lesser Flamingo, and as a major feeding ground for the great white pelican. The area is well known for its significance to migrating wetland

birds from the arctic during northern winter months. It also serves as a stopover for a high population of different birds' species (G/Michael, 2008).

Ostrich farm in the area is the other tourism attraction, perhaps the most accessible resource that can be seen easily for the ostriches are found in the sanctuary around the park's head quarter. Therefore, if this sector is properly defined and managed accordingly, it will have significant contribution to the national economy in general and to the sustainable use of the wetland resources; also improve local livelihoods.

4.7.2 Forest Resources Development

Forest resources development has been key areas of intervention to reverse the natural resources degradation in the area. Charcoal and fuel wood production, clearing forest for construction purposes are the main factors for forest degradation. In addition to this, the extraction of sand and mineral salt along the shore of Abijiata Lake, high population growth (settlement expansion), overgrazing are also another threats in forest management in the area. Area closures, planting of seedlings, agro-forestry practices, private tree nursery development and commercial forest development have been pursued. Sanctuaries, reserve areas for wild life protection, increased scale of forest protection will help to increase the forest cover of the area. Trees ownership tenure system problem is a major challenge in the communal forest. Forest resources in ASLNP fence indicate that, the area has a potential for forest resource development if proper planning and management is takes place. Planting of trees/conserving forest resources have their own benefits for the environment through soil, water and wildlife conservation.

Figure 18.Partial view of fenced ASLNP indicating the possibility of forest Development in the Area (Photo: Author field survey January,2010)

4.8 The implication of socio-economic and LU/LC change analysis of the lake wetlands

The lake wetlands environment has united the inhabitants in to the society, which has a definite shape, culture and livelihood pattern. Due to the availability of wide variety of harvestable products, the people of A bijiata lake wetlands have subsistence-oriented economy and livelihood. The lake wetlands under the study is one of the major sources of livelihoods particularly for cultivating crops, pasture land, extracting different resources like sand, mineral salts and by providing forest resources for charcoal, fuel wood construction material production. The Abijiata lake wetlands region has also a unique ecological character, which in turn serve as a site for tourism industry that enhances the national economy.

The result of LU/LC change says to many about the effects of these changes on the wetlands in general and the lake in particular. In the analysis it is already said that acacia woodlands /forest lands and wetlands are reducing and on the contrary the seasonal peasant croplands and settlement areas increasing which shows there is decrement in vegetation cover of the land that enhances erosion and impacts on the ecology(ecosystem) of the area. The removal of vegetation covers increases erosion and enhances sedimentation of the wetlands. Farming of the catchments contributes to enhanced nutrients and particular runoff where the grassland around the wetlands is overgrazed. Therefore, the removals of vegetation accompanied by the increment of erosion and sedimentation have their own contribution on the reduction of Abijiata lake volume, size and level. The conversion of wetlands to agricultural land and settlement with long term drainage and cultivation reduces the diversity of the land habitats wetlands species are replaced by non-wetland species. As it was possible to conclude from change detection of LU/LC results presented above, some of the principal threats of the wetlands of Abijiata Lake emanate from settlement expansion, farming for perennial and annual crops.

Generally, from the socio-economic and LU/LC change detection analysis, one can suggest that Abijiata lake wetlands are under continuous threats from different sources. Therefore, in order to safe and use the lake wetlands resources in sustainable manner, there should be request for an immediate corrective measures by all concerned bodies to reverse the current situation of these resources.

5. Conclusions and Recommendations

5.1. Conclusions

The Rift valley Lakes region is home for millions of people. The community of Abijiata and its surrounding has utilized the resources of the wetlands. The socio-economic analysis shows that the wetland resources provide basic means of livelihoods for the people. Hence, natural resources such as land resources, water resources, and forests/ trees provide economic, social and ecological services and supporting the livelihood of the local people.

The survey result shows that wetland resources provide basic means of livelihood for the people. Hence ,more than 50 percent of the sampled households have relay on crop production and animal husbandry ,and almost all sampled households were using the wetlands as a source of feed for their livestock, 29 percent practice sand and mineral salt extraction, and 6 percent selling forest products like fire wood and charcoal. Therefore, the wetlands under the study is not only serve as feeding ground for livestock and farming ground for crop production, but it also help the local community to diversify their means of income directly or indirectly in order to lead their living.

Eventually the major challenges of wetlands management in the study area are: population growth resulted in farmland scarcity (even poor land use practice) accompanied by poverty forced the people to encroach to the forest for settlement, farming land and to extract sand to lead their living. In addition, there is insufficient awareness among policy makers, planners and general public about the economic, biological and scientific significance of the resources of wetlands. Even if they have awareness there is no coordination among them on the management of these resources. For instance, the weak coordination among woredas agricultural and Rural Development offices, Culture and Tourism offices, ASLNP Managers and local communities clearly depicts the idea. This indicates that there is absence of focal institution in wetlands management in the study area. Lake Abijiata has long history for fluctuation owing to its shallower depth, and the few rivers (i.e Bulbula River and Hora kelo) are draining to it. Furthermore, after the commencement of soda Ash factory pumping water from the lake and excessive use of the rivers for irrigation have also contributed to lake size shrinkage and the implication is that the present tendency may lead to more wetland resources degradation. Thus, this trend needs to be corrected.

Currently there are different opportunities that have been planned and implemented by the National, regional and local governments of Ethiopia. Among these, the promotion of (eco-tourism)/ tourism industry like the establishment of ASLNP and forest resources development in line with the park are the major ones.

However, there is a forward and backward linkages between the threats/challenges and opportunities of the wetlands. The opportunity or benefit that the people obtained from this resource may a threat in the long run unless they use it in sustainable manner; in the same manner the threat caused by people may be the only benefit that they get from these resources. Therefore, in order to harmonize the two by taking in to account the inter linkages between them; sound planning and implementation is crucial.

The study LU/LC change detection analysis also indicated that there are great differences in spatial and area coverage between different land use classes /categories .This can be clearly observable in the LU/LC change between 1973&2009.Accordingly, the lake size and acacia wood/wetlands were reduced from 37.98 % in the year 1973 to 18.02% in 2009 (reduced by 19.96%) and from 31.o1%in the year 1973 to 11.83% in 2009 (reduced by19.18%) respectively. However, expansion of settlement and croplands were continued from3.20 %(1673.56ha) in 1973 to 25.61 %(13405.5ha) in 2009, and from 27.81 %(14554.5ha) in 1973 to 44.54 %(23309.7ha) in 2009. These differences could be due to anthropogenic factors like forest clearance for living residence and crop production. Therefore, based on LU/LC changes observed in the area between the specified years, one can suggest that the wetland under the study is under risk unless corrective measures could be taken by concerned body.

Generally, as the wetland's future, that the outlook is not so good. "Wetlands are dynamic ecosystems and are fairly resilient to cyclical periods of drought, regressing back and forth between marsh and desert. However, the prolonged drought and serious pressures of above mentioned factors could push the wetlands over the edge; as it will become increasingly difficult to re-establish them. Therefore, urgent action needed now, because the longer we wait the more difficult it will be to bring the wetlands and their complex web of life back to their former splendor.

5.2. Recommendations

Wetlands resources provide means of livelihood for the people in the Abijiata lake basin. In order to reduce the challenges/threats of the wetlands and enable sustainable use of the resources, the following recommendations are suggested.

- The economic/livelihood values of the wetlands for the local communities to be continued. Though environmental values also important and linked to the benefits; conservation strategies of wetlands management should be further enhanced.
- To safeguard the lake wetland resources degradation of the area, possible solution could be country wide awareness creation on the environmental protection, optimize livestock size, agri-business enterprises (diversifying sources of income), and increasing agricultural productivity(by considering family planning to determine the number of population) by linking the economic and social benefits of wetlands to its conservation for its protection.
- The wetlands resource of the study area is facing various anthropogenic and natural factors, which drive the wetlands to death. Therefore, to manage wetlands under the study in a proactive and sustainable way; there is a need for government to involve the local residents, knowledgeable individuals (indigenous knowledge), NGOs and other stakeholders.
- In order to bring sustainable use of the wetlands resources under the study, enhancing or strengthening the management of ASLNP is the key areas of intervention. This is because if the park is managed properly, not only wild life resources that protected or managed in the park but forests and other resources of the area also conserved, and this intern contribute in stabilizing microclimate (ecology) of the area. Therefore, if there is a good tourism development in the area, has its own role in environment protection specifically that of global warming and also generates national income through tourism industry and carbon trading as well as benefits the local communities by reducing the risk of drought.
- Integrated planning should be done to ensure that the use of irrigation takes due consideration of the concerns of all water users in such a way that use of water from the inflowing rivers has to be geared with lake level variation or in general based on the water budget of the basin.

- Institutional perception on the values, functions and utilization of wetlands should be harmonized. This could then be followed with formulation of focal policy on wetlands, promulgation of regulations to govern wetland use and capacity building for monitoring and control of wetland utilization.
- The land use/land cover change detection analysis indicates that, there was temporal and spatial variability in wetland resources between years. This clearly shows that to what extent the wetland resources of the study are under threat from different sources. However, the data included in the analysis (1973-2009) was not enough to establish a significant change of the wetland detection since there could be significant changes between these years. These data only illustrated the change occurred in the period. In order to obtain a complete knowledge about the wetland change, monitoring the seasonal change is recommended if possible.

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Annex 1

I. Household Survey Questionnaire

Instruction:

1. This questionnaire refers to the household (HH) and should be administered with the head of the HH, male or female.
2. Before starting with the questionnaire / interview, explain the purpose. The purpose of the questionnaire/ interview is to assess the challenges and opportunities of wetlands around Lake Abijiata and the ideas the community attaches to these resources. The opinion of the respondents on how the resources are used and managed and the type of protection they (governmental, non-governmental, private, and local institutions) give will help to draw conclusion how the resources can be used in a sustainable manner/not.
3. All information given will be held confidential and will be used for academic purpose

I: GENERAL INFORMATION

1. Enumerator

1.1 Name of the enumerator: _____

1.2 Signature of the enumerator ensuring completeness of the questionnaire and correctness.

Sign: _____ Date: _____

II. Identification of the Respondent and Household Characteristics

2.1. Zone: _____

2.2. Woreda: _____

2.3. Locality (Kebele): _____

2.4. Name of the household head (respondent) or code: _____

2.5. Age of the respondent (years) _____

2.6. Sex of the respondent (√): 1. Male 2. Female

2.7. Education level completed by the respondent (√):

1. No formal education
2. 1st cycle (1-4th grade)
3. 2nd cycle (5 to 8th grade)
4. High school (9-10th grade)
5. Completed preparatory
6. Certificate
7. Diploma
8. Degree

9. Religious education

2.8. Current marital status of the respondent (√) 1. Married 2.Unmarried

3.Divorce 4.Widowed

2.9. Religion of the respondent (√):

1. Orthodox 2.Islam 3. Protestant 4. Catholic

5. Others (specify) _____

3.10. What was/ is your major occupation

A. up to 1980s – Crop production - fuel wood selling

- Animal husbandry - charcoal production

- Mixed farming

- If others, specify

B. At present time

2.11. How long did you live in this place? _____ Years

2.12. Family size of the household by age and gender

Age	Male	Female	Total
< 18			
18-64			
>64			

III. Natural Resources and Use

3. Land and Land Use System (crop and livestock production, land, water and forest resources)

3.1. At present time do you have your own farm land?

[ ] Yes [ ] No

3.2 If your answer for Q no 3.1 is" yes" how did you get the land you are currently using?

1. Recent government land redistribution
2. Land redistribution during the Derg regime
3. Inherited from parents
4. Shared from parents/gift
5. Rented
6. Share cropping
7. Others (specify)

3.3 Size of land owned by the household/Communal and its use (ha)

Sr. No	Type of use	Before 10 years	Current year (2010)	Reasons for change between the two years*
	Total land owned			
	Crop land (including gardens)			
	Grazing area (own)			
	Forest and woodland			
	Marshy area			
	Irrigated area (ha)			
	No. of plots owned			

3.4 How do you perceive the trends in annual crop yield on the cultivated wetland currently?

[ ] a. Increase [ ] b. Decrease [ ] c. Show no change

3.6 If your answer for question no, 3.4 is decrease, please reason out why?

3.7. Do you have livestock at your present holding?

[ ] Yes [ ] No

3.8 If your answer for Q No.3.7 is" yes" indicate the type of livestock you owned

3.9. What is the major source of your animal feeding?

1. Communal grazing land
2. Crop residue
3. Your own grazing land
4. Wetlands around Lake Abijiata
5. Forest land
6. Open access land
7. If others, specify

3.10 Do you have an additional (Supplementary) income source?

[ ] 1. Yes [ ] 2. No

3.11 If your answer for Q 3.10 is "yes" What are your household's means of income generation? (Multiple answer possible, rank as 1st, 2nd, 3rd, etc)

1. Handicrafts
2. Livestock trading
3. Selling forest product (firewood, etc).
4. Selling processed food (also drink)
5. Grain trading
6. Fishing
7. Employed and earn salary, tourist guiding
8. Remittance
9. Sand and mineral salt extraction

10. If others, (specify)

3.12.Do you think the change observed in your income from different sources compared to before10 years?

3.13. What is the land escape unit from which you obtain these income resources?

1) Lake Abijiata 4) Wetlands

2) Forest land 5) Hot springs

3) Farm land 6) rivers

3.14What type of raw materials you obtain from these resources?.

1) Timber 5) wild life products

2) Wood for charcoal making 6) grasses

3) Fuel wood 7) sand for construction and mineral salts

4) Other wood products 8) if others, specify

3.15. What is the major cause that insists the surrounding community to encroach to the wetland proper?

1. Farm land Scarcity 6. Market problem

2. Lack of grazing land 7. If others, specify

3. Deforestation 5. Lack of wetland awareness

4. Fire wood shortage

3.16. What constraints do you observe in the institutions that may have role to address wetland (Natural resource) management problem of Abijiata Lake and its surroundings?

a. Less attention paid to environmental conservation

b. Absence of devoted local institution

c. Much attention paid to investment activity

d. If others, Specify

3.17. From the wetlands ecosystem, identify the water sources you use and the major purpose you are using the water.

Water source you use	Major purpose
Lake Abijiata	
River Bulbula	
River Hora kello	
Hot Springs	
Lake Shalla	
Other Specify	

3.18 Do you benefit from Lake Abijiata or rivers feeding to the lake? [ ] 1.Yes [ ] 2. No

3.19 If answer is "Yes" to Q3.21 for what purposes?

1. Irrigation
2. Fishing
3. Other edible animals from the lake
4. Edible plants from the lake
5. Livestock watering
6. Drinking water
7. Household use/washing, cooking, etc)
8. Transport (using boats)
9. Others (specify) _____

3.20. Why do you like most living here in this village?

1. Better living environment
2. Cultural benefits
3. Easy access to resources
4. Lack of land for settlement and livelihood
5. Presence of wild life
6. Place where I born and live my family

Thank You So Much for Your Cooperation

ANNEX 2

IV: Checklist for Focus Group Discussions and Key Informants Interview

4.1 Land use system:

1. Identify list of crops grown and animals reared in the area?
2. What is the share of wetland in the total land holding of an average household? What are the means used by the people to increase access to land? (Land sharing among relatives, renting, share cropping, etc.)
3. Discuss land availability and changes in land size over time? If there is a sense of land shortage, what are the reasons? Rank the reasons. What is its implication for sustainable utilization of the wetland resources?
4. How does the value of wetland differ from the other land type?

4.2 Forest/trees:

5. What type of trees/grasses grows in your area? Where are they kept (garden, farmland, communal land, church compound, etc?)
6. What are the purposes of these trees (direct use value, indirect use values such as conservation and option values such as inheriting to children, recreation, biodiversity, etc.).
    a. Take area closure, if any. Describe the perception of the community on the satisfaction they get in terms of shade trees, weather/climate improvement, qualitative assessment of how big value they would attach the environmental benefits. Option value: What are the social and cultural values of trees?
7. Do people view trees /water/wetlands/as opportunity or threat?
8. What are the best ways of conserving trees/water/wetlands? What should be done?

4.3. Causes of wetland depletion in the area

9. Do you think the settlement expansion to the area in the past time?
    a. Accelerated and resulted terrestrial and aquatic habitat destruction by clearing forests in to other land use
    b. Enhanced local people's needs of making charcoal, fuel wood, cutting trees for various purposes?
    c. According to your opinion, what are the major causes of wetland degradation in the area?
10. In your perception and observation does settlers activity causes wetlands depletion in the area?

11. Which of the following factors do you think have been responsible for wetland degradation?

Factors	Degree of impact		
	No	Moderate	Severe
1. Intensive cultivation			
2. Overgrazing			
3. Deforestation			
4. Improver drainage			
5. Mineral salt extraction			
6. Others specify			

12. According to your indigenous knowledge and experience, what are the major changes have been observed on the area/ wetlands recently?

13. If there is change in the major resources of these wetland catchments, please make list of specific change you have perceived on forest, rivers or lake (streams).

14. Do you think that the lake /plant/ animal species in the wetland may still be used in the future?

15. How can these wetlands resources be conserved /saved?

a. When protected by Government
b. When protected by Community
c. When distributed to the local community
d. I don't know

16. What do you think the major reason for the shrinkage in the size of Lake Abijiata?

a. Recurrent drought and climatic change
b. The establishment of soda ash factory in the vicinity area
c. Intensified irrigation activities in the vicinity area
d. If others, specify

17. Did the past state conservation policy measures

a. Allow the surrounding local people to participate in the management and conservation of the resources?
b. Value indigenous natural resource management practices?
c. Teaches you means of diversifying your livelihood and dependency on natural resource to promote your livelihoods?
d. Consider /identify/ the socio-economic and institutional variables affecting the natural resource management in the locality.

18. From your observation to mitigate the wetland /natural resource degradation in the area. What is expected from?

a. State policy makers at regional and national levels?
b. Wetland /Natural resource conservation and management projects working in the area:
c. Woreda's administration offices
d. Kebele's administration offices
e. Local institution
f. The local community living in and surrounding the area

Concluding remark, If you have any thing to add to our discussion please, specify

ANNEX-3

V. Check list questions for office representations

1. For how long you have known the Abijiata Lake and its surrounding?
2. What is the current lake wetland community looks like?
3. What contribution does this wetland has
   - ✓ For the local community
   - ✓ -In enhancing the economic development of local, regional and country
   - ✓ -In conserving biological diversity
   - ✓ -In conserving national heritages having scientific and historic values
   - ✓ -In enhancing the eco-tourism industry in the area?
4. How do you see the present status of the lake (Abijiata Wetlands) in comparison to the past?
5. What are the factors that contributed for these Wetland degradation/ threat?
   - ✓ Settlement expansion: how?
   - ✓ Environmental policy constraints: how?
   - ✓ - The establishment of Abijiata soda ash factory in vicinity area? How?
6. What efforts you made to obtain any necessary cooperation from high level officials /organizations and local community in this wetland management?
7. Have you ever consulted the local community if they can cooperate in the lake wetlands managements?
8. Do you think the local community is beneficiary from the lake wetlands? If yes, in what aspects?

   - Please explain
     - What the country, regional state and local community of the surrounding area benefits if the lake wetlands as well sustained?
     - What the local, regional /country losses if the lakes wetlands are threatened/ disappeared?
     - What options /alternatives you suggest in bringing sustainable wetland management in the area?

Thank you in advance for your cooperation

Declaration

This thesis is my original work and has not been presented for a degree in any other university and all sources of material used for this thesis have been duly acknowledged.

Name: Gemechu B.

Signature: _____

Date: 15/07/2010

This thesis has been submitted for examination with my approval as university advisor/confirmed by

Name: Feyera S.

Signature: _____

Date: 15/07/2010

Place and date of submission: Addis Ababa, July,2010