ANALYSIS OF THE STATUS OF BOYE-KITO WETLANDS USING THE DPSIR FRAME WORK, SOUTH WEST ETHIOPIA

M.Sc THESIS

TESFAYE YIBRA TEWELDE

APRIL, 2013

JIMMA UNIVERSITY

ANALYSIS OF THE STATUS OF BOYE-KITO WETLANDS USING THE DPSIR FRAME WORK, SOUTH WEST ETHIOPIA

MSc. THESIS

SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES

JIMMA UNIVERSITY COLLEGE OF AGRICULTURE AND VETERINARY MEDICINE

IN PARTIAL FULFILLMENTS OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN NATURAL RESOURCES MANAGEMENT (WATERSHADE MANAGEMENT)

BY

TESFAYE YIBRA TEWELDE

APRIL, 2013

JIMMA UNIVERSITY

APPROVAL SHEET OF THESIS

SCHOOL OF GRADUATE STUDIES

JIMMA UNIVERSITY

As Thesis research advisors, we herby certify that we have read and evaluated this Thesis prepared, under our guidance, by Tesfaye Yibra Tewelde entitled: "Analysis of the Status of Boye-kito Wetlands Using the DPSIR Frame Work, Jimma Zone South West Ethiopia. We recommend it be submitted as fulfilling the Thesis requirement.

Debela Hunde (PhD, Associate Professor) _____ _____

Major-Advisor Signature Date

Gudina Legesse (PhD Scholar) _____ _____

Name of Co-Advisor Signature Date

As members of the Examining Board of the Final M.Sc Thesis Open Defense Examination, we certify that we have read, evaluated the thesis prepared by Tesfaye Yibra and examined the candidate. We recommended that it be accepted as fulfilling the Thesis requirement for the degree of Master of Science in Natural Resources Management with specialization in WaterShade Management.

_____ _____ _____

Name of Chairperson, Signature Date

_____ _____ _____

Name of Internal Examiner Signature Date

_____ _____ _____

Name of External Examiner Signature Date

DEDICATION

This thesis work is dedicated to my family and all my friends.

STATEMENT OF AUTHOR

First, I declare that this thesis is my original work and all sources other sources of materials used for this thesis have been duly acknowledged. This thesis has been submitted in partial fulfillment of the requirements for M.Sc. degree at the Jimma University College of Agriculture and Veterinary Medicine and is deposited at the University library to be made available to borrowers under rules of the library. I solemnly declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma, or certificate.

Brief quotations from this thesis are allowable without special permission provided that an accurate acknowledgement of the source is made. Requests for permission for extended quotation form or reproduction of this manuscript in whole or in part may be granted by the Head of the Department of Natural Resources Management or the Dean of the School of Graduate Studies when the proposed use of material is for scholarly interest. In all other instances, however, permission must be obtained from the author.

Name: Tesfaye Yibra Tewelde

Signature: _____

Place: Jimma, Ethiopia

Date of Submission: _____

BIOGRAPHICAL SKETCH

The author was born in February 05, 1987 G.C in Shire Wereda, Tigray. He attended his Elementary school at Tsehay Mulu Elementary School from 1992 to 1999 and his Secondary school at Shire Senior Secondary School from1999 to 2004. Passing the Ethiopian Higher Education Entrance Qualification Certificate, he joined Hawassa University (Wondo Genet Forestry College) in 2005 and graduated in 2007 with B.Sc. degree in Forestry. Soon after graduation he was employed in Mizan Tepi University as graduate assistance since 2008. He joined the School of Graduate Studies at Jimma University in September 2010 to pursue his M.Sc degree in Natural Resources Management; specializing in Water Shade Management.

AKNOWELEGEMENTS

First and foremost, I would like to thank the Almighty GOD for blessing me with invaluable gifts of health, strength, love, hope and patience throughout my study. I have received various forms of assistance from many people in the course of my MSc. study and producing this thesis. I am glad to use this opportunity to express my indebtness to all of them. First and foremost are my advisors Dr Debela Hunde and Ato Gudina Legesse (PhD Scholar). Their unreserved professional guidance and supervision, including field tasks helped me to complete this work with its present shape. I am very grateful to them. I am very grateful to the entire JUCAVM community. Heartly, I feel at home. My special words go to Ato Alebachew, Solomon Girmay, and Temesgen Abebe.

ABREVIATIONS

AAU ……Addis Ababa University

AWIs ……Agriculture–Wetland Interactions

BPEDORS ……Bureau of Planning and Economic Development of Oromia Regional State

DPSIR……Driving forces, Pressures, State, Impact and Responses

EEA……...European Environment Agency

MEA …….Millennium Ecosystem Assessment

TABLE OF CONTENS

Contents **Page**

TABLE OF CONTENS (Continued)

Contents **Page**

LIST OF TABLES

Page

Appendix table

ABSTRACT

Wetlands historically played noticeable role in human civilizations and cultural development. They are sources of food, tourism, cultural resources, help in flood control, improve hydrological quality, and hot spots of biodiversity and wildlife conservation. However, global wetlands in general and those in Ethiopia are subject to anthropogenic degradation. Boye-Kito wetland is one of the valuable wetland resources in southwestern Ethiopia which is a home for unique birds' and source of income for local community. However, the status of Boye-Kito wetland was not adequately recognized by the public at large. As a result, the current study was initiated to analyze the status of Boye-Kito wetlands using the Driving forces-Pressures–State– Impact – Responses Framework (DPSIR). The specific objectives were 1) to identify the socioeconomic drivers and pressures and 2) to assess the socioeconomic impacts and responses of changes in the processes and functions of the Boye -Kito wetlands. The results of the current study revealed that the major drivers in Boye-Kito wetland were Population growth (47%), government policy in reducing employment opportunity (14%), food insecurity (13%) and land shortage for cultivation and grazing (11%), respectively. Also, drainage and agricultural practice (23%), sediment deposition and municipal waste discharge (19%), upland vegetation clearance (13%), and new settlement (13%) were pressure indicators. Biodiversity loss (34%), sediment level rise (26%), decrease hydrological level and quality (27%), and erosion hazards (15%) were the notable state change indicators. On the other hand, settlement expansion (70%) and suitability to agricultural practice due to better local market (36%) were also the accompanied observed impacts. Consequently, poor grass quality (43%), long distance and hours to collect grass (20) were also undesired impacts. Typical responses technical (32%), institutional (31%), policy related (25%), and planning (21%) were given for the betterment of the wetland. Therefore, to sustain the health of Boye-Kito wetland studying on how to raise awareness of local community, identification of measures to manage Boye-Kito wetland through community participation, and identification of potentials and constraints to ensure their potential meet food security might be helpful

.

1. INTRODUCTION

Ethiopia is largely dependent on the agricultural sector which provides 85 percent of the country's employment and 41 percent of its gross domestic product (GDP) (African Development Bank, 2012). Estimates have shown that up to 3.7 million ha can be irrigated. Rain fed crop cultivation is the principal activity practiced over an area of approximately 23 percent of potentially arable land i.e. about 27.9 million hectares. However, frequent and severe droughts caused serious decreases in the incomes of rural inhabitants who tend to rely heavily on agriculture. To make matters worse, projected large and medium-scale irrigation schemes will likely do little to secure the food supply for the rapidly growing population (UNESCO, 2006).

Ethiopia is known for recurrent droughts and dry lands which present the notion of having no water resources despite the country is known as a water tower of Africa where eleven of its rivers flow into neighboring countries endowed with rich wetlands. Surface water resources are estimated to be more than 120 million m^3 from 12 river basins. Out of this an estimated 9% remains in the country representing wetlands coverage to be about only 18, 587 km^2 (1.14%) of land area (Yilma, 2003). However, to satisfy human needs, their status has been affected adversely throughout the country due to mismanagement (Yilma, 2003).

Historically, however, wetlands have played a noticeable role in the growth of human civilizations and cultural development (Yilma, 2003). They provide valuable natural resources and service functions for humanity. They are sources of food, tourism, cultural resources, help in flood control, improved hydrological quality and hot spots of biodiversity and wildlife conservation (Zerihun, 2003; Dixon *et al*., 2009). They provide valuable products and service functions for humanity. They are a source of food, tourism, cultural resources, flood control, improved hydrological quality and hot spots of biodiversity and wildlife conservation (Zerihun, 2003; Dixon *et al*., 2009). Community around wetlands in Ethiopia used to utilize wetland resources as a livelihood source for a very long time: water for irrigation, bathing, recreation and homestead and wildlife

consumption; source of fish as food and incomes for local people and beyond; grass for mattresses, house roofing and wood for construction such as 'tankua' (local boat made of grass and wood) and agricultural implements, forage, and tourism (Yilma, 2003; MEA, 2005).

Despite significant socioeconomic and ecosystem contribution of wetlands the information about them in Ethiopia (Atnafu *et al.*, 2011) specifically for Boye-Kito is very scarce, incomplete and most are under threat of conversion in to land uses including Boye-Kito. In Ethiopia, apart from general statements, no one could for sure substantiate the conditions of wetlands with reliable figures and data since they are often considered wastelands and worthless. Besides, the potential of wetlands to sustainable development has not been well understood until recently (Shimeles and Geremew, 2008). This information would be of interest to natural resource managers and the general public. Therefore, DPSIR provides guide in telling an integrated story about an environmental issue which indicate general cause-effect relationships among components of the framework. While some relationships are straightforward and easy to demonstrate, many linkages in environmental analyses are complex, and effects typically are attributable to multiple causes, related to different actors, operating on multiple spatial and temporal scales (Pintér *et al*., 2008). Therefore, this study attempted to apply the Driving forces–Pressures–State– Impact – Responses (DPSIR) framework to identify the status of Boye-Kito wetland.

1.1 General objective

To contribute to filling information gap on the status of wetlands in Ethiopia.

1.2 Specific objective

1. To identify the socioeconomic drivers and pressures on the Boye -Kito wetland
2. To assess the socioeconomic impacts and responses of changes in the processes and functions of the Boye -Kito wetland

Conceptual frame work

Assessment/Trends in wetland Status in the past 20-30 years	Socio economic values and Ecosystem services associated with wetland
Data collection: Interview (Expert/key informant, house hold) and literature review	
Data analysis	
Reporting	

2. LITERATURE REVIEW

2.1 Definitions of terms

Wetlands

The Ramsar Convention defined wetlands under the text of the Convention (Article 1.1) as "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".

DPSIR refers to *t*he causal framework for describing the interactions between society and the environment adopted by the European Environment Agency (EEA, 2009): driving forces, pressures, states, impacts, responses (extension of the Pressure, State, and Response model developed by Organization for Economic Cooperation and Development (OECD) (1993).

Driver refers to fundamental social processes, such as the distribution of wealth, which shape the human activities that have a direct impact on the environment (EEA, 1999). Wood and Halsema (2008) include drivers in environment such as population dynamics, market development, natural environmental processes, government policies, and community behavior.

Pressures groups according to FAO (1997**), EEA** (1999) and Wood and Halsema (2008) are defined as human activities that result from driving forces which impact the environment as resource extraction and the natural processes that have a similar impact on the environment such as flooding, volcanoes and solar radiation. Under the Ethiopian wetlands, there are various pressures to be considered responsible to degrade wetland status. Examples according to Wood and Halsema (2008) include: agricultural expansion and intensification in wetlands, vegetation clearance, nature conservation, and water resources management and use.

State refers to the condition of the environment. This condition, under current conceptualizations, is not static, but is meant to reflect current environmental trends as well. Examples according to Wood and Halsema (2008) include: water resources, water quality and pollution, soil characteristics, (chemical and biological), and biodiversity change.

Impact refers to the ways in which changes in state influence human well-being and/or associate ecosystem impacts and responses (e.g. policy and ecosystem). Livelihood gains from market-oriented production, food and nutritional changes in subsistence situations, socio-economic differentiation and conflicts, and recreational development are some typical instances according to Wood and Halsema (2008).

Responses according to Wood and Halsema (2008) refer to actions in response to drivers, pressures, state changes and impacts. These may be technical and institutional or involve policies and planning. They can be implemented by a range of actors.

2.2. Classification of wetlands

With the exception of coastal and marine-related wetlands and extensive swamp-forest complexes, all forms of wetlands are represented in Ethiopia. These include alpine formations, riverine, lacustrine, palustrine and floodplain wetlands. Floodplains are found both in highlands and lowlands of Ethiopia, although they are most common in the North-Western and Western Highlands, Rift Valley and Eastern Highlands (Yilma, 2003).

2.2. Socio-economical, ecological and potential values of wetlands

Wetlands provide some valuable natural resources and service functions for humanity. They are a source of food, tourism, cultural resources, flood control and improved water quality. Based on function categories and ecosystem services (MEA, 2005), wetlands provide hydrological, biogeochemical and ecological provisioning services. They are also

important to biodiversity and wildlife conservation (Zerihun, 2003), water storage, recreation and habitat for wild life (Dixon *et al*., 2009).

Community around wetlands in Ethiopia used to utilize the wetland resources as a livelihood source for a very long time: water for irrigation, bathing, recreation and as drinking water for domestic use and wildlife; fish as source of food and income for local people and beyond; grass for mattresses, house roofing and wood for construction such as 'tankua', and agricultural implements and forage. They also allow groundwater discharge and recharge, flood control, shoreline stabilization, nutrient retention, water supply, water purification, climate regulation, flood regulation, coastal protection, recreational opportunities, and tourism (Yilma, 2003; MEA, 2005). Despite the benefits gained however, wetlands are under threat of conversion due to intensive irrigation agriculture, expansion of human settlements, industrial pollution, agricultural pollution by pesticides and fertilizers use, and water diversion for drainage and dam construction (Atnafu *et al*., 2011).

2.3. Understanding wetlands in Ethiopia

Wetlands are the main custodians of valuable water resources. They act as 'banks' from where water may be drawn and groundwater replenished. They are best understood in terms of their intrinsic conditions (biological, chemical and physical) which allow them to carry out their distinctive functions and generate products. Their functions comprise those natural processes that sustain economic activities, fortify ecological integrity and socio-cultural values that human beings attach to them (Yilma, 2003). Therefore, wetlands deliver a wide range of ecosystem services for the benefit of human well-being. When both the marketed and non-marketed economic benefits of wetlands are included, the total economic value of unconverted wetlands is often greater than that of converted wetlands. A priority when making decisions that directly or indirectly influence wetlands is to ensure that information about the full range of benefits and values provided by different wetland ecosystem services is considered (MEA, 2005).

2.4. Challenges and constraints to sustainable wetland management in Ethiopia

Assessing the past and present conditions of wetlands provides valuable information about the potential obstacles to efforts to sustain these crucial ecosystems. Based on this perspective, efforts are being made to identify the challenges that these wetlands face. Wetlands globally and specifically in Ethiopia are the most threatened (Yilma, 2003). Wetlands degradation and loss is more rapid than that of other ecosystems. Dugan (1990) claims that 65% of wetland disturbances to be of human origin. Their destruction and alteration has been and is still seen as an advanced mode of development. Their value remain little understood and their loss is increasingly becoming an environmental disaster. Industrial activities, land degradation, urbanization, agricultural activities and dam development are among others responsible for major threats to the proper functioning of wetlands in Ethiopian (Yilma, 2003). Also vegetation mismanagement, improper land use patterns, tenure, lack of awareness on value of wetlands and unsustainable resource extraction adversely affects the quality and quantity of wasteland resources in the country.

Wetlands in Ethiopia are converted in to agriculture, settlement, etc. They are drained to improve/control waterborne diseases and provide land for urbanization and agriculture. These changes brought about shifts from wetland to terrestrial vegetation and many alterations to soil and water properties and processes (Dixon *et al*., 2009). Land use transformation disturbs the quality and healthy functioning of wetlands. Conversion of wetlands for urban/suburban expansion, increasing agricultural activities results in habitat changes and species loss. Their disruption and fragmentation affect migrating species (UNEP, 2006). Massive deforestation and loss in surface vegetation are responsible for recurrent flood which in turn causes economic and social damage (UNESCO, 2006). The shift from native vegetation to new ones in Ethiopian wetlands may take many years to occur , but it may be possible to detect changes before vegetation can respond, thus enabling corrective action to be undertaken before more irreversible damage occurs (Dixon *et al*., 2009).

Fertilizer use in agricultural and urban areas subjected to drainage waters entering to wetlands causes an increase in the nutrient concentrations of soil and water. Associated changes include increases in soil accumulation, water quality, wild life patterns and other environmental effects. The most evident results of the nutrients input is the replacement of the primary native vegetation with newly appearing plants. This in turn has altered the ecosystem considerably. Consequently, the results of wetland loss are far-reaching and disastrous. Humans and other life close to wetlands which depend upon them are the first to feel the impact of wetland loss (Yilma, 2003). Altering or transforming wetlands affects the benefits they previously generate. This can be particularly damaging to the interests of the poor and women. Hence, wetland development and transformation can worsen social equity. Therefore, a use regime needs to be developed which ensures that the fullest range of benefits are produced from wetlands for the local community in a sustainable way within a framework which also maintains the wetland's ecological functions indefinitely. Management needs to ensure equitable access to wetland-produced benefits to satisfy all wetland stakeholders over the uses to which a wetland can be put and how it should be managed (Yilma, 2003).

2.5. Wetlands policy in Ethiopia

At present, wetlands are only addressed as components of other national water or environmental policies putting them in a variety of management problems that they face and demand for a self-standing wetlands policy. Appropriate coordinated management of wetlands should be based on monitoring, research and planning that satisfies the interest of beneficiaries and relevant stakeholders. Proper wetland policy requires the accomplishment of social (Jonathan, 1998; Stuart and Bennett, 2005) and environmental impact assessments (EIAs) before any development activities are invested in wetlands.

2.6. DPSIR framework overview for wetlands (in Ethiopia)

The DPSIR framework was devised in the late 1990s as a tool for the reporting and indicating of environmental problems, ranging in scale from global systems to localized watersheds. Since then, international organizations have begun to apply this framework to the evaluation of sustainable development initiatives to better understand and overcome barriers to sustainability (Edward *et al*., 2007). Thus, the DPSIR framework addresses root causes of the socioeconomic activities that impact the environment, incorporates natural variability as a pressure on the current state and responses as motivated by the impact of changes in state on human well-being (EEA, 1999). It can also be used as a means of framing particular environmental problems and identify appropriate responses.

2.6.1. Drivers

Different concepts of driving forces have been applied in literature, depending on the context and dimension of the study (Camanho *et al*., 2010). In European Environmental Agency (EEA) (1999) reports driving forces indicators are described as social, demographic and economic developments in society. Similarly, Henriques *et al*. (2008) suggested driving forces of ecological status of a marine environment measured with DPSIR were economic activities such as Agriculture, Aquaculture, Fishing and Industry. Socioeconomic activities and land use change mainly attributed to agriculture–wetland interactions (AWIs) are increasingly important as rising demand for food and fuel production exacerbates pressures on wetlands. Also, the Millennium Ecosystem Assessment (MEA) identified agriculture as the main cause of wetland degradation and loss (Adrian and Gerardo, 2008).

2.6.2. Pressures

Pressures are the human actions that can induce environmental change (Impacts). Maxim *et al*. (2009) reviewed and stated DPSIR as indicators normally linked to the unwanted changes, which are human actions with potential to cause damage and degradation. The authors reported that CO2 emissions per sector and amount of land used for roads are reported as pressure indicators. Similarly, industrial effluents discharges were considered as an industry pressure (Henriques *et al*., 2008).

2.6.3. State changes

State indicators aim to illustrate the changes exploited ecosystem with chemical, physical and biological parameters. It can also belong to a social or economic dimension. The EEA (2002) report exemplifies consumption preferences as a state indicator to describe consumers and public opinion.

In-situ agricultural development, in Illubabor, mainly maize cultivation, caused the wetland environment in poorer regulating and support services due to the change in the state of the hydrology, soils and biodiversity within the wetland (Wood, and Van Halsema, 2008). Drainage followed by prolonged cultivation and reduced organic matter content in the wetlands leads to an increase in soil acidity and declining soil fertility which reduces dry-season water storage. Wetlands loss creates major habitat change for wildlife due to major biodiversity change. Often cultivation also encourages dry land weed species to invade wetlands, while the changed vegetation may reduce the buffering role of the wetlands in moderating peak flows. The lowered water table and reduced water storage in the swamps during the dry season due to drainage to cultivate maize attributes to the major state change (Dixon, 2005; Dixon and Wood, 2007).

Wetland soils compaction is also the other major change attributed mainly to grazing pressures. Consequently, the change in state may affect water infiltration into wetland soils and sediments, increase runoff and erosion and possibly reduce groundwater recharge in the flood season. When combined, these various state changes, especially in hydrology and soils can undermine the ability of the wetlands to sustain crop production. In some cases, wetlands degrade to rough dry-season grazing within a few years of cultivation. Alteration of wetland hydrology might change the soil chemistry and the plant and animal community. It cause the ecosystem to change to an upland system or, conversely, to a riverine or lacustrine system (Line *et al*., 1995).

2.6.4. Impacts

Impacts can be defined as the negative effects of human activities, perceived into the environment and society. The increase in temperature and the rise of sea level are two major examples pointed out in the EEA (1999) report. Impacts can also be related to social and economic dimensions. Impact indicators according to Pirrone *et al*. (2005) through DPSIR application eutrophication in a river pointed out habitat loss and reduced tourism.

The major positive socio-economic impact generated from wetlands as a result of dry-season agriculture is mostly in the form of improved food security and/or increased cash income. From the government perspective, the reduced food imports into the zone, especially for feeding the urban population is seen as positive (Streatfield and Karar, 2008). However, agricultural-wetland interaction disrupts the supply of domestic water, seasonal grazing and the collection of medicinal plants and grass. Specifically, spring loss has considerably tends to increase the workload of women and so affects child care and child health, use of less clean and less reliable water sources affects health negatively (Wood and Halsema, 2008).

2.6. 5. Responses

Responses are all the measures performed by society with the aim to improve the system, directly on D, P, S or I categories. This can be achieved performing preventive, adaptive or curative actions. Lin *et al*. (2007) studied temporal changes in a coastal wetland, and some response indicators applied were the rational use of coastal wetland, the waste water treatment capacity and the natural conservation area.

In the Illubabor situation, according to Wood and Halsema (2008) diverse responses have been developed in different periods. Due to their contribution to food security and economic development at large supported by national policy, wetland cultivation is continued and encouraged with little or no attention being given to the problems associated with the pressures, state changes and negative impacts. Though degradation of wetlands continues, a number of coordinated community-based adaptive management institutions and technical practices have been developed for the management of the wetlands to prevent excessive drainage to the extent that the wetlands cannot support agriculture through ditch blocking and spring protection (Aaron, 2011). Local communities have recognized the value of wetlands through adopting by-laws in order to limit the negative effects of excessive drainage and encourage the use of specific practices (Dixon, 2005). A continued application of indigenous community's wetland management practices under rapidly changing environmental, socio-economic and political conditions will create sustainable hydrology (Dixon and Wood, 2007). Consequently, local responses have attracted local partners and scale the best local practices out to encourage sustainable wetlands use while improving agricultural productivity.

3. MATERIALS AND METHODS

3.1. Description of the study area

The study area is located in Boye-Kito wetland which is on the periphery of Jimma town, Oromia Regional State, Southwest Ethiopia. Jimma town, is located 335 km away from Addis Ababa at about 70 33'N latitude and 360 57' E longitude. Jimma town encompasses an area of 4,623 hectare (46.23 km2). The population of the Jimma town is above 125,569 people making the population density about 138.5 persons per km2 (CSA, 2005).

Altitude within the town boundary ranges from 1700 m.a.s.l. to 2010 m.a.s.l. Jimma town receives an average annual rainfall of 1477 m.m. average daily temperature is 24.15°C. The area is suitable for growing coffee, cereals, pulses, and root and fruit crops. The highlands and the wetland (swampy and marshy) areas grow maize (short growing) as 'Belg' season crop using residual moisture in the depressions (CSA, 2005).

3.2. Data collection

Interview and focus group discussion sampling technique

Four focus group discussions were held, each containing members of six residents of the kebeles under study (Appendix 1 and 2) according to the participatory rural appraisal (PRA) tools to understand their perspective on status of Boye-Kito wetlands. Household, key informant interviews and focus group discussion were conducted to collect relevant information. There were about 3428 total inhabitants (171households) in the four kebeles considered. Of these, about 120 (6 %) households were interviewed from 4 kebeles adjoining the wetland purposively which are on the immediate border line of the wetland (Appendix 3). The sample size for house hold interview was maintained to 30 due to resource limitation. Ten key informants including experts in each kebeles were interviewed using semi-structured questionnaire.

The sample size for collecting quantitative data for this research was determined using Cochran's (1977) formula as indicated on Bartlett Kotrlik and Higgins (Bartlett and Higgins, 2001):

$$n = \frac{N}{1+N(e)^2}$$

Where:

n ……sample size the research uses;

N ….total number of households in both Kebeles assuming that women in all households are affected by the issue;

e…… maximum variability or margin of error 5% (.05);

1 ……probability of the event occurring.

Therefore:

$$n = N/(1+N(e)^2)$$
$$= 171/(1+171*(0.05)^2$$
$$= 171/(1.43)$$
$$= 120$$

3.2. Data analysis

The values reflected from stakeholders were analyzed using statistical social package software (SPSS). The DPSIR followed four major steps; (1) interpretation of drivers and pressures, (2) description of the state changes, (3) description of the socio-economic and environmental impacts and (4) reviewing of the responses.

The use of an environmental assessment tool called Drivers-Pressures-State-Impacts-Responses (DPSIR) framework as a methodology was used to analyze status of Boye-Kito wetlands was employed due to some advantages witnessed by OECD (1993), Turner *et al*. (2000) and EEA (2009): simple, provides intuitive analysis, combines integrated

complex socio-economic analyses with spatial analysis of environmental, allows analyzing the impact of environmental change on human well-being, and it brings together multi-stakeholders with disparate expertise (e.g., social sciences, natural sciences, policy and law). Moreover, the framework permits the identification of the impact of socio-economic development on the qualitative state of wetlands in terms of interaction between the trophic system and ecological conditions (Pirrone *et al*., 2005). Though it has difficulty to see horizontal linkages among environmental issues, its little guidance on the type of impacts or the types of policy responses might be worth to consider (Pintér *et al*., 2008).

4. RESULT AND DISCUSSION

For simplicity, the results and discussion of this study are put in a logical order of drivers, pressures, state, impact and response.

4.1 Socio-economic characteristics

About 50.80% (61) of the respondents were male while 49.20% (59) were female. The age class of the respondents between 36 and 45 years old (38.30) ranking first while people older than 55 years old (14.20%) were the least. Most of the community attended their school or are within grade 8 to 10 (31.70 %) while the least (5%) had attended or finished vocational schools and above. Housemaids' account the largest group (35.80%) followed by daily labors (34.20%) where as farmers were about 4.20% in the four kebeles considered. (See appendix Table 3)

4.2 Understanding of Boye-Kito wetland ecosystem change

Resident community in the vicinity of the Boye-Kito wetland who has day-to- day interaction with the wetlands reflected their understanding of the Boye-Kito wetland over the past years. They are described in a logical order as shown below.

4.2 Drivers

The result indicated that, the collective responsible anthropogenic processes (factors) that drive change in Boye-Kito wetland ecosystem among others according to the respondent were population growth, government policy to improve national food security, land shortage for cultivation and grazing, encouraging government policy in employment opportunity, land reform in 1975, encouraging local market of wetland products, and tenure issue (Table 1). Population growth accounted to have the maximum contribution than the other drivers (47 percent) which was maximum in Bochebore followed by Bosa kito kebele. The current result is in agreement with the findings of Lin *et al*. (2007) who

have reported in China rapid human population growth was the major anthropogenic driver which lead to the expansion and increasing of human activities in wetland resource. Bidone and Lacerda (2004) explained that urbanization adds an increased discharge of contaminated materials without any treatments. Wood and Halsema (2008) indicated that population growth coupled with seasonal food deficits and shortage of cleared land for cereal cultivation were the prominent drivers of wetland use change to farm land in Illubabor, Southwestern Ethiopia.

Table 1: Anthropogenic factors which caused change in Boye-Kito wetlands ecosystem

Kebele	**Nonexclu-dability of wetlands**	**Land reform in 1975**	**Wetland products market**	**Land shortage for cultivation and grazing**	**Food insecurity**	**Government employment policy**	**Population growth**	**Total**
Bosa Kito	2(2%)	1(1%)	1(1%)	4(3%)	3(3%)	4(3%)	15 (13%)	30
Hermata Mentina	1(1%)	1(1%)	4(3%)	5(4%)	4(3%)	5(4%)	10(8%)	30
Mentina	0(0%)	4(3%)	4(3%)	3(3%)	3(3%)	4(3%)	12(10%)	30
Bochebore	0(0%)	1(1%)	0(0%)	1(1%)	5(4%)	4(3%)	19(16%)	30
Total	3(3%)	7(6%)	9(8%)	13(11%)	15(13%)	17(14%)	56(47%)	

Similar cases in China have been reported by Lin *et al*. (2007) that resource exploration, urbanization and aquaculture caused the most serious pressures on wetland. From the 1950s to 2000, a total of 90.13km^2 of coastal wetlands were reclaimed into urban, industrial or aquaculture area to meet the city's socioeconomic requirements. Moreover, Wood *et al*. (2002), and Wood and Halsema (2008) in Illubabor swamp wetlands have reported that increased population growth and the presence of increased unemployed youth driven the wetlands as opportunity to invest in wetland agriculture.

4.3 Pressure

Wet land drainage for settlement, agriculture, sediment deposition and municipal waste discharge, free livestock/horse grazing, upland vegetation clearance, brick making and absence of alternative income were the pressure indicators identified by the community in Boye-Kito wetland (Table 2). Municipal waste discharge, drainage and agricultural practice, up land vegetation clearance around/upper stream were ranked top pressure indicators by the community according to their importance to Boye-kito wetland, respectively. As a result the wetland environment was polluted with pollutant substances revealed with presence of mal odor due to the presence of contaminants without pretreatment. Direct cow dung dumping from established cattle farms on the immediate shoreline, free cattle grazing and municipal waste discharges (liquid and solid) in to the wetland are responsible in addition to compaction effect. The current result is in agreement with the findings of Tariku and Abebayehu (2011) who reported that principal pressures which led to Boye wetland degradation were agricultural land expansion, over grazing, waste disposal to the wetland from Jimma town and Eucalyptus plantation. Consistently, the findings of Abebayehu *et al*. (2011) noted that fertility depletion and shortage of agricultural lands are the major driving forces for marginal land cultivation. Wetlands are preferred to agriculture and Eucalyptus plantation than the normal land due to the fact that Eucalyptus demands more water. Consequently, expansion of Eucalyptus plantation increased through time because people living around the wetland were growing Eucalyptus to generate income through supplying fuel wood and construction poles to Jimma town. In addition, the expansion of Jimma town towards the wetland and the disposal of both solid and liquid wastes were the major factors affecting the ecology of

the wetland. Similar findings were reported by Wood and Halsema (2008) in Illubabor swamp wetlands (southwest Ethiopia) that double-cropping agricultural expansion and intensification due to longer six to eight months drainage facilitated the drying out process and degradation of the resource base.

Another socio economic pressure which driven agricultural intensification in the Boye - Kito wetlands is high vegetable local market demand and access to supply products to the local market. Wetland cultivation is favored by attractive urban agricultural products market opportunities. Currently, the tradition of wetland drainage drives and facilitates market demanded vegetable, sugar cane and maize cultivation. Therefore, during dry season wetlands become source of supplementary food production and income generating opportunities, a survival strategy to overcome the "hungry" season to produce crops while also reducing pollution due to improper damping. According to Wood and Halsema (2008), the collective pressure indicators (natural vegetation clearance, poor agricultural practice and eucalyptus planting coupled with free cattle grazing) eventually disturb the soil which lead to rapid runoff, soil compaction in the wetland, gully formation and adversely affect soil biodiversity. Millennium Ecosystem Assessment (2005) reported that sediment deposition has contribute for the loss of wetland biodiversity.

Table 2: Pressure indicators in the Boye-Kito wetland environment

Kebele	**Absence of alternative income**	**Brick making**	**Free livestock grazing**	**New settlement**	**Up land vegetation clearance around/upper stream**	**Municipal waste discharge**	**Drainage and agricultural practice**	**Total**
Bosa Kito	1(1%)	4(3%)	2(2%)	3(3%)	9(8%)	3(3%)	8(7%)	30
Hermata Mentina	4(3%)	3(3%)	7(6%)	2(2%)	3(3%)	9(8%)	2(2%)	30
Mentina	6(5%)	0(0%)	1(1%)	3(3%)	4(3%)	4(3%)	12(1%)	30
Bochebore	1(1%)	4(3%)	4(3%)	8(7%)	0(0%)	7(6%)	6(5%)	30
Total	12(10%)	11(9%)	14(12%)	16(13%)	16(13%)	23(19%)	28(23%)	120

4.5 State changes

Respondents indicated that sediment deposition, mal odor occurrence, soil compaction, biodiversity change, decreased fish stock quantity, and predator and/or harmful wild life in the Boye-Kito wetland were the state indicators (Table 3). Sediment deposition, biodiversity change and soil compaction were the prominent changes observed associated to the wetland change due to the drivers and pressures acting, respectively.

Communities in order to secure their food security prefer and enjoy decreased water level/amount for easy agricultural practice (Table 4). However, the biodiversity loss linked to wetland change was ranked the first (41%) followed by sediment level rise, and Hydrological level and quality decreased.

During the off-rain season both the flood passage line and buffer zone gets dry and become sparsely covered with plant biomass while encouraging for wetland agriculture. Consequently, people plough with oxen or manually and establish cash crops such as vegetables, sugar cane, and *Eucalyptus camaldulensis* both within and on the upland of the catchment. According to Gitay *et al*. (2002), therefore, in situ agriculture changes the state of wetlands' hydrology, soils and biodiversity. Consequently, wetland drainage during the dry season to permit maize cultivation in the wetlands leads to lower water table, reduces dry-season water storage, reduces the dry-season flow and may alter the flood regime which it may eventually cause to the poorer regulating and support services (McCartney *et al*., 2010).

Table 3: Observed negative changes in Boye-Kito wetland

Kebele	**Decreased fish stock quantity**	**Predator and/or harmful wild life seen than before**	**Mal odor and malaria infestation**	**Soil compaction**	**Biodiversity change**	**Sediment deposition**	**Total**
Bosa Kito	0(0%)	1(1%)	3(3%)	7(6%)	9(8%)	10(8%)	30
Hermata Mentina	0(0%)	3(3%)	3(3%)	5(4%)	6(5%)	13(11%)	30
Mentina	0(0%)	1(1%)	0(0%)	3(3%)	9(8%)	17(14%)	30
Bochebore	4(3%)	0(0%)	9(8%)	4(3%)	8(7%)	5(4%)	30
	4(3%)	5(4%)	15(13%)	19(16%)	32(27%)	45(38%)	120

Table 4: Physical processes in Boye-Kito wetlands

Kebele	I don't know	Erosion	Sediment level rise	Decreased hydrology	Total
Bosa Kito	2(2%)	16(13%)	1(1%)	5(4%)	30
Hermata Mentina	0(0%)	2(2%)	5(4%)	9(8%)	30
Mentina	1(1%)	0(0%)	13(11%)	5(4%)	30
Bochebore	0(0%)	0(0%)	12(10%)	8(7%)	30
Total	3(3%)	18(15%)	31(26%)	27(27%)	120

Eventually, continuous disturbance of wetlands for agriculture, and the wide spread removal of natural indigenous vegetation and the accompanied replacement with *Eucalyptus camaldunesis* has aggravated soil erosion hazards changes the state of their moderating functional role leading to undesirable observable effects due to changes in water tables and increased soil acidity, colour, odour (pungent smell), and biodiversity in wetlands. Consequently, along the route of the wetland, specifically at the rear end, sediment level rise and encouraged weed infestation and pungent smell emission. Eventually, the rise in sediment deposition retreats back Boye-Kito wetland flow. Cultivation in the Boye-Kito wetland is favored since the sediment deposition retains sufficient soil organic matter content for vegetable and maize production. This is in contrast to the case in Illubabor wetlands where agricultural practice reduces soil fertility and enhances soil acidity.

Consequently, at points where water rests for prolonged months, water hyacinth (*Eichhornia crassipes*), a newly appeared invasive plant species is observed. However, community around the wetland didn't know the behavior of the newly appeared weed plant. Wetland agriculture encourages invasion of wetlands by dry land weed species once they are cultivated, while the changed vegetation may reduce the buffering role of the wetlands in moderating peak flows (Wood and Halsema, 2008). Wood and Halsema (2008) have added also that free livestock grazing pressures accompanied by soil

compaction can replace local plant species, increase runoff and erosion, coarse sediment deposit from upland erosion, reduce groundwater recharge in the flood season, and consequently alter soil quality.

4.6 Impact

Communities appreciated that Boye-Kito wetland has the potential to provide habitat for many species. Various aquatic plants (grass, weeds and shrub) and animals (Birds, Mammals and reptiles) species make their habitat within it. Respondents recognized the declined water level of Boye-Kito wetland as an opportunity for agriculture (Table 5). Lowered water level encourages intensive vegetable production, avoids weed, and eucalyptus production to Jimma market. The most important products communities benefited from Boye-Kito wet-land are grass for animal feed, mattress making, for house thatching, for ornament/ceremony, small fish, agricultural products and brick.

However, community claimed that due to decline in wetland water level people who depend on grass (for sale or home consumption) their household income decreased (Table 6). Moreover, community faced difficulty to collect grass from Boye-Kito wetland (Table 7). However, two constraints were mentioned: scarcity of grass for livestock or other use, and unavailability of fish. Therefore, people who depend their income on grass (for livestock feed, mattress making, ornamental, etc.) and those who practice fishing shifted their means of income to other practice. Therefore, grass collection becomes too hard the fact that people take long hours and/or distance to collect grass to get grass.

About 25 respondents witness that they collect products/service from Boye-Kito wetlands expressed in terms of grass and brick. Beneficiaries collect more grass (human carry load) during the rainy and flood seasons but less during the dry seasons as a result people are forced for extra cost to buy grass for cow and/or horse feed. Eighteen of the respondents collect grass for sale while 7 of them dedicate for home consumption. At the expense of the wetland dryness/low water level, the trade-off in wetland agriculture outweighs so that people who used to produce locally demanded marketable vegetable

construct broad diversion channel possibly sometimes accompanied by burning to facilitate the drying. Similarly, the low water level of the wetland encourages urban cattle farming practice and settlement expansion in the wetland. However, community along the wetland belt suffer from malaria infestation ever before. As a result, the livelihood of community who depend on this wetland is critically affected.

Boye–Kito wetland is a home for some mammals, and birds (resident and migratory birds). However, wetland agriculture causes the loss of habitat for wildlife (Wood and Dixon, 2002). As a result, hippopotamus is restricted to habituate in to out the bottom rare end of the wetland pond in search of palatable and sufficient grass and affected due to the above stated pressures. Also, despite, fishing was one of the common socio-economic practices in the Boye-Kito wetland, due to the cumulative effects of the above anthropogenic drivers and pressures, consequently there is no fishing practice since the wetland ecosystem is no more conducive for fish resource currently. The current result is in agreement with the findings of Tariku and Abebayehu (2011) who have indicated that despite Boye wetland is a home for 36 bird identified species (two endemic and three near endemic), due to the effect of the above pressure groups change the state of *Balearica pavonina* and *Balearica regulorum* into vulnerable list and *Macronyx flavicollis* in to nearly threatened. IUCN (2009) estimated about 37% of freshwater fish species and 30% of amphibian species threatened with extinction due to the continued impacts of wetland systems change.

Table 5: 'Positive impacts' due to Boye-Kito wetland ecosystem change (values in bracket are in percent)

Kebele	Allow agricultural practice due to better local market	Allows settlement expansion
Bosa Kito	8(7%)	22(18%)
Hermata Mentina	15(13%)	15(13%)
Mentina	9(8%)	21(18%)
Bochobore	4(3%)	26(22%)
Total	36(30%)	84(70 %)

Table 6: Negative impacts community faced to collect grass from Boye-Kito wetland (values in bracket are in percent)

Kebele	Long distance and hours to collect grass	Long distance to collect grass	Long hours to collect grass	Total
Bosa Kito	6(5%)	13(11%)	11(9%)	30
Hermata Mentina	5(4%)	10(8%)	15(13%)	30
Mentina	11(9%)	10(8%)	9(8%)	30
Bochobore	10(8%)	9(8%)	11(9%)	30
Total	32(27%)	42(35%)	46(38%)	120

Table 7: Negative effects of change in Boye-kito wetland environment (values in bracket are in percent)

Kebele	Decrease in agricultural production	Favours opportunity for weed invasion	Constraints human movement, and harbors harmful wild animals	Decrease in wetland products such as grass and fish	Total
Bosa Kito	3(3%)	5(4%)	8(7%)	14(12%)	30
Hermata Mentina	5(4%)	3(3%)	6(5%)	16(13%)	30
Mentina	5(4%)	6(5%)	9(8%)	10(8%)	30
Bochobore	1(1%)	7(6%)	6(5%)	16(13%)	30
Total	14(12%)	21(18%)	29(24%)	56(47%)	120

4.7 Response

Actions made in response to drivers, pressures, state changes and impacts in Boye-Kito wetland in the period specified above to meet food security and population pressure are not strategic. Moreover local responses given by the community are fragmented and periodic; as a result there is a need for strategic planning and monitoring scientific approaches to achieve sustainable management which can satisfy both social and ecological requirements. Despite the contribution of wetland agriculture to food security, little or no attention is given to the problems associated with the pressures, state changes and negative impacts. For the betterment of Boye-Kito wetland, response/measures in place according to respondents were technical, institutional, involving policies and planning. McInnes (2010) suggested that for the benefit of future generations and the protection of wetland biodiversity, it is essential that society moves away from resource exploitation and adopts a more conservation based natural resources utilization.

Table 8: Responses in Boye-kito wetland (values in bracket are in percent)

Kebele	Planning	Organizational	Policy related	Technical	Total
Bosa Kito	7(0.06)	4(0.03)	5(0.04)	14(0.12)	30
Hermata Mentina	8(0.07)	7(0.06)	8(0.07)	7(0.06)	30
Mentina	5(0.04)	12(0.10)	7(0.06)	6(0.05)	30
Bochobore	5(0.04)	7(0.06)	10(0.08)	9(0.08)	30
Total	24(0.21)	30(0.25)	30(0.25)	36(0.30)	120

Institutional responses mainly were delivered by Jima University. The university's community based service wing is capable to address and mitigate water related problems in Boye-Kito wetland. The university used to construct and maintain common toilet and water points in each kebeles considered in this research. Also, Jima University in collaboration with the community undertake plantation scheme, sanitary and hygiene development activities, weed clearing, and awareness creation. The community indicated that Jimma University takes the pioneer role in research and awareness creation and periodic sanitation practices.

Policy related responses in Boye-Kito wetland, however, are not to suit the sustainability of the wetland, but they can aggravate the wetland destruction. Urban settlement and establishment of urban agriculture mainly in Bochebore and along the belt of the wetland. The government's policy and strategic plan is to reduce unemployment rate while also improving food security options. Similar cases were reported by Wood and Halsema (2008) in Illubabor wetlands where the major view of the government agencies in the 1980s and 1990s was increased encouragement of wetland cultivation to improve food security and avoid grain food import.

Technical or socio-economic actions to in response to specific impacts were awareness creation campaigns and research. However, the community claimed that technical and/or socio-economic actions in place weren't sufficient in comparison to the gravity of the problem so as to maximize the benefit from the Boye-Kito wetland. People based on their

traditional knowledge construct diversion ditches which possibly aggravates the degradation speed of the wetland.

Ethiopia lacks a specific policy on wetlands that enshrines wetlands of the land from deleterious actions that affect their contribution to the national development (Gemechu, 2010). Wetlands in Ethiopia are small ecosystems which to date have not attracted much policy attention (Dessalegne, 2003). As a result management practices such as soil and water conservation, and forest management made in the upper or within wetland level in response to pressures for Boye–Kito wetland were negligible in comparison to the magnitude of the problem (personal observation).

Respondents claimed that an action plan for Boye-Kito wetland hasn't been in place. Amongst others, a strategic plan formulation which includes the identification of biological diversity, unique flora and fauna, endangered species, or those that is of national or international importance and makes recommendations for their protection. The plan should also require the improved management of the wetland including construction of ditch, waste water treatment, recycling of solid waste, and exclusion of free grazing. Moreover, adoption of community bylaw might be helpful so that the various uses of the wetland can be retained without conflict. Participatory wetland planning and management which involve and directly benefit local people in wetlands conservation can be vital (Ramsar Convention Secretariat, 2010). Otherwise, conservation objectives will be unattainable due to the alarming human population growth rate. Moreover, rehabilitation activities in the upper catchment areas will ensure that functions and benefits from wetland resources are maintained well into the future (Simenstad *et al*., 2005).

CONCLUSION

The anthropogenic factor that drives a maximum change in Boye-Kito wetlands ecosystem was population growth.

The prominent pressure indicators in Boye-Kito wetland were drainage and agricultural practice, municipal waste discharge up land vegetation clearance around/upper stream and new settlement, respectively.

As a result the state changes in Boye-kito wetland environment based on their order of importance, were sediment deposition, biodiversity change and soil compaction respectively.

The associated change due to drivers, pressures and state has consequently contributed to settlement expansion and permissibility to agricultural practice due to better local market. However, community contrasted that some people get their house hold income improved due to wetland agriculture .While others experienced their house hold income decreased due to decline in wetland water level.

The community has appreciated the technical and institutional responses given by Jimma University through its community based development services to address the changes in Boye-Kito wetlands.

FUTURE LINE OF WORK

Wetlands have historically been important for food production in south-west Ethiopia, especially in years of poor upland harvests. The continued role of wetlands as a 'food security safety requires identification of potentials and constraints in Boye-Kito wetland to ensure their potential meet food security at times of greatest need.

Identification of ways to manage Boye-Kito wetland through community participation might be required to envisage ways to satisfy local needs and acknowledge local management practices that can enable the Boye-Kito wetlands satisfies the increased urban population over the years to come.

To raise awareness of local community at the grass root level, and provide guidance on the importance of wetlands benefits to urban populations, incorporation of responsible stake holders might be the best remedy to safeguard the unique biodiversity in Boye-Kito wetland.

REFERENCES

African Development Bank, 2012. African Economic Outlook 2012. Ethiopia 2012. http://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/Ethiopia%20Full%20PDF%20Country%20Note.pdf

Abbot, P. G., and Afework H., 2000. EWRP Policy Briefing Notes Wetlands and Food Security In South-west Ethiopia. *Ethiopian Wetlands Research Programme*. Issue 4

Aaron M., 2011. Wetlands: a review with three case studies: the people's republic of china, the United States of America, and Ethiopia. Fnatural resources 323: international resourcemanagement. http://www.uwsp.edu/forestry/StuJournals/Documents/IRM/aMarti.pdf

Abebayehu, A., Eyasu E., Diels J., 2011. Comparative analysis of soil nutrient balance at farm level: A Case Study in Jimma Zone, Ethiopia. *International Journal of Soil Science*, ISSN 1816-4979/DOI:10.3923/ijss.

Atnafu, N., Dejen, E. and Vijverberg, J., 2011. Assessment of the ecological status and threats of Welala and Shesher Wetlands, Lake Tana sub-basin (Ethiopia). *Journal of Water Resources Protection*, **3:** 540–547

Bartlett, J. E., II, Kotrlik, J. W., and Higgins C., 2001. Organizational research: Determining appropriate sample size for survey research. *Information Technology, Learning, and Performance Journal,* **19(1)** 43-50

Bidone, E. D., and Lacerda, Æ L. D., 2004. The use of DPSIR framework to evaluate sustainability in coastal areas. Case study: Guanabara Bay basin, Rio de Janeiro, Brazil *Regional Environental Change*, **4**:5–16

Camanho, A.S., Hora, J., Gaspar, M.B., Oliveira, M.M., 2010. Analysis of the artisanal fisheries in the Atlantic Arc based on the DPSIR framework. FEUP/IPIMAR Report of Project PRESPO, pp. 18.

Cochran, W. G., 1977. Sampling techniques (3rd ed.). New York: John Wiley & Sons.

CSA, 2005. Ethiopian statistical abstract. Federal Democratic Republic of Ethiopia, Central Statistical Agency, Addis Ababa, Ethiopia.

Dixon, A., Afework, H., Tilahun, S., and Legesse, T., 2009. Local Responses to Marginalisation: Human-Wildlife Conflict in Ethiopia's Wetlands. *Geography*, **94 (1)**:38-47

Dixon, A.B., and Wood, A.P., 2003. Wetland cultivation and hydrological management in East Africa: Matching community and hydrological needs through sustainable wetland use. Natural Resources *Forum*, **27(2)**: 117-129.

Dixon, A.B. , 2005. Wetland sustainability and the evolution of indigenous knowledge in Ethiopia. *The Geographical Journal*, **171(4)**:306-323

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

Eastman, J., and Filk, M., 1993. Long sequence time series evaluation using standardized principal components. *Photogrammetric Engineering and Remote Sensing*, **59(6)**: 991-996.

Edward R.C., Philip, M., and Roberson, J., 2007. Applying DPSIR to sustainable development. *International Journal of Sustainable Development and World Ecology*, **14:** 543–555

EEA – European Environmental Agency, 1999. Environmental indicators: Typology and overview, Coppenhagen, EEA Technical report no. 25.

EEA – European Environmental Agency, 2002. An indicator-based approach to assessing the environmental performance of European marine fisheries and aquaculture, Coppenhagen, EEA Technical report no. 87.

EEA, 2009. Glossary. European Environment Agency. http://ia2dec.ew.eea.europa.eu/knowledge_base/Frameworks/doc101182 (accessed on October 7, 2012)

FAO, 1997. Land Quality Indicators and Their Use in Sustainable Agriculture and Rural Development. Proceedings of the Workshop organized by the Land and Water Development Division. FAO Agriculture Department and the Research, Extension and Training Division. FAO Sustainable Development Department 25-26 January 1996. World Bank United Nations Environment Programme, United Nations Development Programme. Food and Agriculture Organization of the United Nations, Rome.

Gemechu, B.D., 2010. 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. Addis Ababa, Ethiopia.

Gerrard, P. 2004. Integrating Wetland Ecosystem Values into Urban Planning: The Case of That Luang Marsh, Vientiane, Lao PDR. IUCN, Asia Regional Environmental Economics Programme and WWF Lao Country Office, Vientiane. 35pp.

Gitay, H., Suarez, A., Watson, R.T., Anisimov, O., Chapin, F.S., Cruz, R.V., Finlayson, M., Hohenstein, W.G., Insarov, G., Kundzewicz, Z., Leemans, R., Magadza, C., Nurse, L., Noble, I., Price, J., Ravindranath, N.H., Root, T.L., Scholes, B., Villamizar, A.,

Rumei, X., 2002. Climate change and biodiversity. Intergovernmental Panel on Climate Change, Geneva, April 2002. IPCC Technical Paper V, pp. 77

Hayal D.Y., and Seyoum M., 2009. Water quality parameters and macro invertebrates index of biotic integrity of the Jimma wetlands, southwestern Ethiopia. Journal of Wetlands *Ecology*, **3**:77-93

Henriques, S., Pais, M.P., Costa, M.J., Cabral, H., 2008. Development of a fish-based multimetric index to assess the ecological quality of marine habitats: the Marine Fish Community Index. *Marine Pollution Bulletin,* **56:** 1913–1934.

IUCN, 2009: Extinction crisis continues apace, International news release. International Union for Conservation of Nature. Available at: http://www.iucn.org/?4143/Extinction-crisis-continues- apace (Accessed on January 2013).

Line, D.L., Gale, D.E. Gannon, J.A., Knott, R.W., Bartenhagen, C.B., and Lehning, D.W., 1995. Watersheds: Water, Soil and Hydro-Environmental Decision Support System

Lin, T., Xue, X.Z., YI Lu C., 2007. Analysis of Coastal Wetland Changes Using the "DPSIR" Model: A Case Study in Xiamen, China. Coastal Management, 35:289–303

Maxim, L., Spangenberg, J.H., O'Connor M., 2009. An analysis of risks for biodiversity under the DPSIR framework. *Ecological Economics*, **69**: 12-23

McInnes, R., 2009. Urban development, biodiversity and wetland management expert workshop report. Expert Workshop 16 to 17 November 2009. Kenya Wildlife Service Training Institute, Naivasha, Kenya.

McCartney, M., Rebelo, L-M., Sellamuttu, S.S., De Silva, S., 2010. Wetlands, agriculture and poverty reduction. Colombo, Sri Lanka: International Water Management Institute. 39p. (IWMI Research Report 137)

MEA, 2005. Ecosystems and human well-being: wetlands and water synthesis. Millennium Ecosystem Assessment, World Resources Institute, Washington, DC.

OECD, 1993. OECD core set of indicators for environmental performance reviews. OECD Environment Monographs No. 83. Organization for Economic Cooperation and Development, (OECD). Paris.

Pauchard, A., Aguayo, M., Peña, E. and Urrutia, R. 2006. Multiple effects of urbanization on the biodiversity of developing countries: The case of a fast-growing metropolitan area (Concepción, Chile). *Biological Conservation,* **127 (3)**: 272-281

Pirrone, N., Trombino, G., Cinnirella, S., Algieri, A., Bendoricchio, G.., Palmeri, L., 2005. The Driver-Pressure-State-Impact-Response (DPSIR) approach for integrated catchment-coastal zone management: preliminary application to the Po catchment-Adriatic Sea coastal zone system. *Regional Environmental Change*, **5:** 111–137.

Pinter, L., Swanson, D., Jelil, A.J., Yoshida, K. N., Rahman, A., Kok, M., 2008. IEA training manual. A training manual on integrated environmental assessment and reporting. Training module 5, United Nations Environment Programmers Environment for Development, UNEP.

Ramsar Convention Secretariat, 2010. Participatory skills: Establishing and strengthening local communities' and indigenous people's participation in the management of wetlands. Ramsar handbooks for the wise use of wetlands, 4th edition, vol. 7. Ramsar Convention Secretariat, Gland, Switzerland.

Shimeles S., and Geremew G., 2008. Ethio wetlands and natural resources association proceedings of the national stakeholders' workshop on creating national commitment for wetland policy and strategy development in Ethiopia. 7 – 8th August 2008, Ghion Hotel, Addis Ababa, Ethiopia.

Simenstad, C.A., Tanner, C., Cordell, J., Crandell, C., White, J., 2005. Challenges of habitat restoration in a heavily urbanized estuary: evaluating the investment. *Journal of Coastal Research*, **40:** 6–23

Streatfield, P.K., and Karar, Z.A., 2008. Population Challenges for Bangladesh in the Coming Decades. *Journal of Health, Population, and Nutrition*, **26(3):** 261–272.

Stuart, M., W., and Bennett, J., 2005. A bio-economic model of wetland protection on private lands
http://www.ecosystemservicesproject.org/html/publications/docs/wetlands.pdf

Tariku, M. and Abebayehu, A., 2011. The driving forces of Boye wetland degradation and its bird species composition, Jimma, Southwestern Ethiopia. *Journal of Ecology and the Natural Environment*, **3(11)**:365–369

Tilahun, S., Edwards, S. and Egziabher, T.B.G. (eds.), 1996. Important Bird Areas of Ethiopia. Published by Ethiopian Wildlife and Natural History Society. Semayata Press. Addis Ababa, Ethiopia.

Turner, R.K., Brouwer, R., Georgiou, S., and Bateman, I.J., 2000. Ecosystem functions and services: an integrated framework and case study for environmental evaluation. CSERGE Working Paper GEC 2001–21. Norwich, UK, University of East Anglia; and London, University College

UNEP, 2006. Migratory Species and Climate Change: Impacts of a Changing Environment on Wild Animals UNEP/CMS Secretariat, Bonn, Germany. 68 pages. UNEP / CMS Convention on Migratory Species and DEFRA

UNESCO, 2006. Water a shared responsibility UN World Water Development Report 2 United Nations Educational, Scientific and Cultural Organization (UNESCO), Paris, France, p601.

UNESCO, 2006. Water a shared responsibility UN World Water Development Report 2 United Nations Educational, Scientific and Cultural Organization (UNESCO), Paris, France, p601.

Wood, A. and Halsema, V.G.(eds.), 2008. Scoping agriculture–wetland interactions towards a sustainable multiple-response strategy. Food and agriculture organization of the United Nations, Rome, FAO water reports 33.

Yilma D. A., 2003. Wetlands of Ethiopia: an introduction pp. 1-11. In: Yilma D. Abebe and Kim Geheb (eds). Wetlands of Ethiopia Proceedings of a seminar on the resources and status of Ethiopia's wetlands. International Union for Conservation of Nature and Natural Resources (IUCN), vi + 116pp.

Zerihun D., 2003. Challenges and opportunities of Ethiopian wetlands: the case of Lake Awassa and its feeders. International Union for Conservation of Nature and Natural Resources, Debub University Awassa College, Ethiopia

Appendix

Appendix 1: Questionnaire for focus group discussion

Date _____

Code of respondent _____

General back ground

1. Sex _____Age _____
2. Educational back ground
3. A .Literate B. Illiterate
4. If literate, Grade level _____

5. How many years do you live around Boye- Kito wetland ?
6. Does the wetland unit contain individuals of Priority species listed by the WDFW for the state?
7. Has the wetland unit been documented as habitat for any state listed threatened or endangered animal species?
8. Does the wetland unit have a local significance in addition to its functions (such as opportunity to improve water quality)?
9. The wetland ponds
    a. The whole year
    b. 6-12 months
    c. 3-6months
    d. < 3 months
10. What dominant factors in the DPSIR can be listed for the Boye –Kito Wetland?
11. Do institutional factors contribute to wetland conversion to its current status? If yes, to what LU?
12. What positive and negative impacts exist on :
13. Status in natural resources (soil, water, biodiversity)
14. Does wetland conversion contribute to poverty reduction?
15. Does Boye-Kito wetland conversion contribute to competition and conflict in wetland resources use/allocation?

16. Can you describe the trade offs and loses in the Boye-Kito wetland use change?
17. What response strategies could you list to address DPSI level for Boye-Kito wetland?
18. Can you mention actor forces, responses, driver forces for the betterment of Boye-Kito wetland management?
19. What planning and monitoring responses can you mention to address Boye-Kito wetland management?

Appendix 2: Questionnaire for interviewee

Drivers: (indirect drivers) e.g.: population dynamics, market development, natural environmental processes, government policies, and community behaviour

1. Did you recognize the state of Boye Kito wetland ecosystem changes over the last 30 1980-2011) years?

A. Yes B. No

2. Which one has changed more?

A. Hydrology: Quality _____ Quantity_____
B. Plant species: Diversity _____ Abundance _____
C. Animal species: Diversity _____ Abundance _____
D. Soil deposition level :Spatial _____ Abundance_____

3. What are the responsible causes /drivers of change in plant species?

A. Natural_____ B. Artificial/anthropogenic _____ C. Both

4. What are the responsible causes /drivers of change in animal species?

A. Natural_____ B. Artificial/anthropogenic _____ C. Both

5. Of the following what are the natural environmental processes (factors) that directly or indirectly cause a change in Boye-Kito wetlands ecosystem?

A. Flood B. Weed/plant species invasion _____C. wild life invasion D. others

6. What are the anthropogenic processes (factors) that directly or indirectly cause a change in Boye-Kito wetlands ecosystem?

A. Population growth, urbanization and land shortages

B. Food insecurity
C. Land shortages for cultivation and grazing
D. Land reform in 1975 (equal access to all land types including wetlands)
E. Government policy and task force to improve national food security by drainage agriculture
F. Encouraging local market wetland based products
G. Non excludability of wetlands to every one
H. Infrastructure development
I. Water scarcity for municipal , irrigation,
J. All

7. Do you know or believe there are pollutants discharged in to Boye-Kito wetlands ecosystem?

A. Yes B. No

8. If yes, what is the source of pollution?

A. Urban runoff in to the wetland B. Groundwater
C. Polluted runoff from agricultural areas draining in to it
D. Grazing within the wetland E. Other_____

9. What will be the average distance of the pollutant?

A. <100m B. 100-300m C. 301-500 D. >500m

10. What were/are the contribution of the ff sectors against the Boye-Kito Wetlands management?

A. Transport _____
B. Industry _____
C. Agriculture _____
D. Municipal _____
E. Tourism _____
F. Others _____

Pressure (direct drivers) Examples are: agricultural colonization in wetlands, vegetation clearance, agricultural intensification, nature conservation, and water resources management and use.

1. What are the pressure(s) (consequent results of the drivers) on the Boye-Kito wetland environment?

A. Drainage and cultivation practiçe in wetlands
B. Wetland-related agriculture intensification
C. Occurrence of sedimentatioṇ from uplands due to upland degradation
D. Uncontrolled and heavy grazing by cattle in the wetlands
E. New settlement /expansion
F. Vegetation clearance, and expansion of eucalyptus in and around/upper stream
G. Nature conservation
H. Poor water resources management and use
I. Brick making
J. Attractive local market for wetland based products (e.g. eucalyptus, maize, vegetable, brick)
K. Absence of alternative income opportunities
L. Pond construction
M. All

2. Which of the following mainly depend on Boye-Kito wetland?

A. Cow/Ox B. Shoat C. Horse/Mule

3. Can you estimate the number of grazing herds which depend on Boye-Kito wetland ?

A. What pressure by water control measures can you mention?
B. Diversion construction
C. Vegetable, maize, sugar cane, and eucalyptus planting
D. Wet land closure (for grass)

4. Pressure by market in Boye-Kito wetland can be

A. Vegetable B. Maize C. Sugar cane

D. Eucalyptus E. Brick F. Grass G. Others

5. What are the human activities directly affecting these wetland environment (e.g. carbon dioxide or methane emissions)?

- Contaminated waste discharge in to it with out pretreatment
- Free cattle grazing and compaction
- Establishments of cattle farms on the immediate shoreline

- All

6. What were/are the socio economic pressures w/c drive wetland-related agriculture intensification of Boye -Kito wetlands?

A. High vegetable local market demand
B. Incompatibility of Boye-Kito wetland for other land use system
C. Better access to supply products to the local market
D. All above are responsible
E. Others

7. What other pressures can you mention that can diminish the community can benefit from the Boye-Kito wetlands ecosystems?_____

8. What are "developments that release of substances (emissions), physical and biological agents, the use of resources and the use of land by human activities"?

A. Site allocated for municipal waste discharge and incineration B Settlement B. Cattle farming C. Eucalyptus plantation D. Road construction
E. Irrigation agriculture (w/c uses chemical inputs) F. All

9. Do you know the relationship between the responsible Pressure and the changes it induces the Boye-Kito?

A. Yes, I know B. No, I don't know

10. If you know, would you please specify, ----------

11. How do you rate the effect of the short-run (e.g., land use, deforestation which can emerge already) and the long-run (e.g., climate change) pressures on these wetlands?

A. Very high B. High C. Medium D. Low

State changes (changes in ecosystem services) Examples are: water resources, water quality and pollution, soil characteristics (chemical and biological), and biodiversity.

1. Typical biophysical process in Boye -Kito wetlands can be

A. Hydrological level and quality deteriorated
B. biodiversity loss recorded
C. soil quality (such as fertility, ...) degraded
D. Erosion, salinity, soil chemical changes
E. sediment level rise

F. others

2. The water level/amount of Boye-Kito wetland since the past 30 years has

A. Increased B. Decreased C. No change

3. Which water level/amount do you feel to be helpful for your livelihood?

A. Increased B. Decreased C. No change

Because, _____

4. Does Boye-kito wetland have the potential to provide habitat for many species?

A. Yes B. No

5. If yes, what is the group/class of plant species?

A. Aquatic bed B. Emergent grasses C. Weeds D. Scrub/shrub

6. What is the coverage of plant species?

A. Aquatic bed (ha) _____

B. Emergent grasses (ha) _____

C. Weeds (ha) _____

D. Scrub/shrub (ha) _____

7. What groups of animal species exist in Boye-Kito wetland?

A. Birds B. Mammals C. Reptiles D. Specify _____

8. How do you evaluate the biodiversity status of these wetlands since the last 30 years?

A. Increased B. Decreased C. No change

9. Increased, because _____

10. Decreased, because _____

11. Neutral, because, _____

12. Do you know that new plant species appear recently? (Can you name? how long?)

13. If yes, how do you classify

A. Annual B. Perennial

14. The newly arrived/introduced /expanded plants are

A. Beneficial B. Harmful C. Undetermined D. Can be both

15. The newly introduced plants are beneficial as -

A. Medicine B. Forage C. Grass for animals, ornamental…etc

D. Source of fuel energy E. Construction F. Mattress making

16. The newly arrived/introduced /expanded plants are harmful, because they caused Others to disappear

Compete for limited resources such as nutrient, space thereby limited the growth/yield of others

A. They are hazardous/toxic to grazing animal
B. They caused water points to dry
C. Act as disease vectors
D. Invade the wetland and causing movement (human/animal) difficult

17. Do you feel/know that previously existing plant species disappear or migrated due to drivers & pressures? (Can you name? how long?)

A. Yes B. No

18. Do you know newly appeared animal species recently in Boye -Kito wetlands due to drivers & pressures? If yes, what are they?

A. Migratory B. Resident

19. What are the groups of new animal species?

A. Birds B. Mammals C. Reptiles

20. Do you feel/know that previously existing animal species disappear recently? (Can you name? how long?)_____

21. What observable positive change "quantitative and/or qualitative physical and biological phenomena did you recognize over the periods mentioned in the Boye and Kito wetlands?

22. What are the most important products you gain from Boye-Kito wet-land?

A. Grass for animal feed B. Grass for mattress C. Grass for house thatching
D. Grass for ornament/ceremony… E. Recreational value F. Fish G. Others

23. What observable negative change "quantitative and/or qualitative of physical and biological phenomena did you recognize over the periods mentioned in the Boye and Kito wetlands?

A. Lowered water tables and increased soil acidity, colour, odour (e.g. pungent smell)
B. Soil nutrient decline and soil structure changes with prolonged low water table
C. Decline in soil quality at fringes of wetland owing to upland sediment deposition;
D. Soil compaction
E. Destruction of the wetland vegetation

F. Biodiversity in wetlands changes: Weed infestation increased in spatial and temporal trends

G. Fish stock quality /quantity has decreased____or totally disappeared ___

H. Predator and/or harmful wild life has nearly or totally seen than before

I. All

24. How do you evaluate the socio economic contribution of Boye and Kito wetlands?

A. The quality and quantity of products gained increases over time

B. The quality and quantity of products gained decreases over time

C. No change over the years

25. Do you collect products/service from Boye and Kito wetlands?

B. Yes B. No

26. If yes, what are the products you collect from the wet land?

A. Grass (kg) B. Fish (kg) C. Wood (kg) D. water E. Others

27. For what purpose?

A. For sale B. For home consumption C. Service (recreation,)

28. If for sale, how much do you benefit per year?.....

29. If for home consumption, how much do you benefit per year?.....

30. How do you express the benefit in 'good' days?

A. Grass (kg) _____B. Fish (kg)____ C. Wood (kg) ____D. Medicine E. Others_____

31. How do you express the benefit in 'bad' days?

A. Grass (kg) ____B. Fish (kg)___C. Wood (kg)____D.Medicine E Others_____

32. If increase, how much did you collect /gain on good days per year?

A. Grass (kg) ____B. Fish (kg)___C. Wood (kg)____D.Medicine E Others_____

33. If decrease, how much did you collect /gain on bad days per year?

A. Grass (kg) _____B. Fish (kg) _____ C. Wood (kg) ____ D. Others_____

Impact (human well-being and poverty reduction). Eg. :livelihood gains from market-oriented production, food and nutritional changes in subsistence situations, socio-economic differentiation and conflicts, and recreational development.

1. Impacts due to Due to DPS in Boye-Kito wetlands can be reflected to

   A. Subsistence farming
   B. Market oriented agriculture

2. How do feel change in Boye-kito wetland environment?

   A. Caused positive impacts in community livelihood
   B. Caused negative impacts in community livelihood

3. If positive change, what are effects of change in Boye-kito wetland environment?

   A. Allow agricultural practice/expansion due to better local market
   B. Decrease in flood level
   C. Decrease in water born disease
   D. Allows infrastructural development such as settlement
   E. All are true

4. What do you benefit?

   A. Improve community/household income (livelihood)
   B. Plan/started to intensify wetland based opportunity
   C. Increase my production quality and quantity than before
   D. Invite others to participate in wet land resources utility E. All

5. If negative impacts, what are effects of change in Boye-kito wetland environment?

   A. Decrease in agricultural production
   B. Decrease/absence in wetland products such as grass, fish, and beneficial grass
   C. Allow opportunity for weed invasion than beneficial organisms
   D. Constraints human movement, and harbors harmful wild animals
   E. Constraints/avoids fish habitat
   F. All are true

6. If negative, what are the consequences of socio economic impacts of Boye and Kito wetlands?

   A. Decrease income/benefit makes living difficult
   B. Increased water born disease makes living difficult
   C. Existence of unfriendly smell (due to green house gases) makes living difficult
   D. Harmful wild animals make livelihood difficult

E. Community/household forced to make deteriorated living hood
F. Makes movement/access road difficult
G. All are true

7. How do you express in terms of efficiency (e.g. labour requirement,..)
A. Long distance to collect products
B. Long hours to collect products
C. Poor quality wetland products with poor market value
D. All are true

Response (strategies and interventions)

These are actions in response to drivers, pressures, state changes and impacts. These may be technical and institutional or involve policies and planning. They can be implemented by a range of actors.

Actor focus

1. Which of the following three important characteristics of responses do you know very well in Boye –Kito wetland management?

A. Actor B. Measure C. Drivers addressed D. None

2. If actors focus, at which of the following level responses were/are given for Boye – Kito wetland management?

A. Household B. Community C. NGOs D. Government E. None

3. Can you specify, _____

4. When was it/they in place?

A. >30 years B. 20-30years C. 10-20years D. <10years

Type of response/measure

5. Do you know that management practice was made to help protect Boye –Kito wetland?

A. Yes B. No

6. If yes, what type of response/measure they were/are in place?

A. Technical B. Institutional C. Involve policies D. Planning

7. Technical or socio-economic actions that try to address specific impacts were/are
A. Awareness creation champagnes held

B. Research and higher learning institutions contribute their share

C. Only municipality was responsible

D. Environmental protection, water … department

E. Livelihood improvement schemes such as supply of alternatives for house hold utility

F. A+B + C G. Others

8. Do you feel that technical or socio-economic actions were/are satisfactory?

A. Yes B. No

9. If yes, would you justify_____

10. If no, would you justify_____

11. Institutional development by communities that respond to state changes by improving Boye –Kito wetland management coordination can be

A. Forestry development practice

B. Sanitary and hygiene development activities

C. Weed clearing activities

D. Waste management practice and awareness creation

E. Others

12. Do you feel that institutional development and integrity responses were/are satisfactory?

A. Yes B. No

13. If yes, would you justify_____

14. If no, would you justify_____

15. Have you ever participated in the planning strategies/responses scheme of Boye –Kito wetland and its upper stream catchments?

A. Yes B. No

16. If yes, would you justify_____

17. If no, would you justify_____

Do you feel that national-level land use policies and economic development measures helped to protect Boye –Kito wetland and address needs in the society?

A. Yes: Because _____

B. No: Because _____

18. Can you mention management practice made in the upper or within wetland level in response to pressures for Boye –Kito wetland?_____

DPSIR focus

19. were/are there actions made in response to drivers, pressures, state changes and impacts in Boye-Kito wetland in the period specified above?

A. Yes B. No

19. How do you explore responses on the bases of issues they address different elements of the DPSIR model _____

20. What measures or actions are relevant for these different elements DPSIR model?

21. Can you name responses made/attempted to address drivers as needing to have a much wider remit (policy responses perhaps?)

22. Can you name responses made/attempted to address drivers that address state changes that may be specific technical measures?_____

Appendix 3: Household characteristics of the kebeles considered

Table 3.1: Sample size of the study Kebeles

Kebeles name	House hold size of the kebeles considered	5 % of the house holds	Minimum size considered in the study
Bosa Kito	845	42.25	30
Hermata Mentina	850	42.5	30
Mentina	868	43.4	30
Bochebore	865	43.25	30

Table 3.2: Sex and age characteristics of respondents

Kebeles name	Sex		Age (Years)			
	Male	Female	25-35	36-45	46-55	>55
Bosa Kito	18	12	5	13	8	4
Hermata Mentina	17	13	4	10	10	6
Mentina	14	16	6	11	9	4
Bochebore	12	18	8	12	7	3
Total	61	59	23	46	34	17

Table 3.3: Education level and source of income of respondents

Kebeles name	Education level (grade)					Source of income				
	0	1-4	5-8	9-12	Vocational and above	Employed	House maid	Bussines/petty trade	Farmer	Daily labourer
Bosa Kito	5	9	8	6	2	5	11	4	1	9
Hermata Mentina	5	8	11	3	3	6	10	3	0	11
Mentina	6	8	11	4	1	4	9	4	0	13
Bochebore	7	11	8	4	0	2	13	3	4	8
Total	23	36	38	17	6	17	43	14	5	41