Application of Choice Experiment to Value Improved Wetland Attributes: The Case of Wetlands around Jimma Town South Western Ethiopia

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In Partial Fulfillment of the Requirements for the Degree of

Master of Science in Natural Resources Management

(Specialization: Integrated Watershed Management)

By

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Jimma University

DEDICATION

DEDICATED TO KUMNEGER YACOB AND DAWIT FASIL!

STATEMENT OF THE AUTHOR

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BIOGRAPHICAL SKETCH

Tsegaw Abebe Haile, the author, was born on December 14, 1986 G.C, in Jimma town, Jimma zone of Oromiya Administrative Region. He attended his elementary and junior secondary school at Jiren Elementary and Junior Secondary School in Jimma. He then pursued his secondary school at Jimma Academic and Vocational Training Institute (JAVTI). After passing the Ethiopian Higher Education Entrance Qualification Certificate (EHEEQC), then he joined Jimma College of Agriculture (now Jimma University College of Agriculture and Veterinary Medicine, JUCAVM) in 2005 G.C and graduated in June 2007 G.C with BSc. in Horticulture. Soon after graduation the author was employed in non governmental organization and worked as community based development work officer in bench Maji zone. He reassigned form there and joined the School of Graduate Studies at Jimma University in September 2009 G.C for an M.Sc degree in natural resource management with specialization of integrated watershed management.

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ABBREVATIONS

ABM	Attribute-Based Methods
BTM	Benefit Transfer Method
CA	Conjoint Analysis
CE	Choice Experiment
CS	Compensating Surplus
CVM	Contingent Valuation Method
EWNHS	Ethiopian Wildlife and Natural History Society
ETB	Ethiopian Birr
HPM	Hedonic Pricing Method
MNL	Multinomial Logit
MRS	Marginal Rate of Substitution
MWTP	Marginal Willingness to Pay
MXL	Mixed Logit
NOAA	National Oceanic and Atmospheric Administration
RPM	Revealed Preference Method
RPL	Random Parameter Logit
RUT	Random Utility Theory
TCM	Travel Cost Method
TEV	Total Economic Value
TLU	Tropical Livestock Unit
WTP	Willingness to Pay

Application of Choice Experiment to Value Improved Wetland Attributes: The Case of Wetlands around Jimma Town, Southwestern Ethiopia

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ABSTRACT

Though Boye and Kitto wetlands have critical roles in providing a range of ecological and socio-economic benefits, due to increasing anthropogenic disturbances, notably through agriculture, settlement, intensive grazing, expansion of huge infrastructures, and brick making they are changing in to mosaic of small habitats. On ground of such threats and rapid degradation of the wetlands' resources, the urgent need to manage this unique ecosystem is necessary. However, decision makers cannot take management decisions based on intuition alone, they need facts and values to feed the decision making process. Though other types of values are often important, economic values are useful to consider when making economic choices. For these wetlands various benefits are not recognized so far; particularly economic value of the wetlands remains largely unexplored. Against this back drop this study investigates whether peoples of the nearby community located around the wetlands are willing to pay higher charge for improvements in fish stock abundance and water purification attributes by assuming that other attributes affecting environmental quality of the wetlands held constant. In this study choice experiment method (CE) was selected in preference to CVM because it has the ability to disaggregate wetland improvements into underlying attributes. The study carried out a Choice experiment among 120 randomly selected household heads of the nearby community to estimate the value of improvement of the wetlands quality in terms of the attributes selected. The data was analyzed using logistic regression model and derive important issues concerning the preferences of households. Results confirm that the nearby communities of the two wetlands have high levels of environmental concern and are willing to pay for the improvement of the wetlands in terms of the attributes selected. The mean WTP for fish stock improvement was estimated to be 5.04 ETB, and for improvements in water purification it was 2.05 ETB. According to this result the most preferred attribute is fish stock and therefore the most urgent action is to prevent further depletion of the fish stock and increasing its abundance. Ordered logit regression was employed to capture how socio economic characteristics of the respondents modify the effects of attributes on the probability of choice. The regression model result revealed that among the variables used only educational level of the respondent's modifies the effects of attributes on the probability of choice. Compensating surplus estimates which reflect overall willingness to pay for a change from the status quo to alternative improvement scenarios were also calculated. The estimate for the high impact improvement scenario was estimated to be 18.78 ETB, for medium impact improvement scenario-1 39.6 ETB and for medium impact improvement scenario-2 it was17.3 ETB. The total benefits derived from three wetland management scenarios are aggregated over the sampling frame. The net benefit estimates reveal that welfare maximization is achieved under the medium impact improvement scenario-1(311,968.8 ETB), which provides higher levels of Fish stock and buffer strip with sedge meadow to be planted at swath of 50 feet. The value derived from these wetlands' improvement scenarios is a way to estimate wetland ecosystem benefits to people and allows financial experts to carry out a Cost-Benefit analysis. Cost-Benefit analysis compares the benefits and costs to society of improvements to manage the wetland ecosystems. However, this is beyond the scope of this study. One important implication drawn from the study is that this partial or rapid economic valuation might be enough to show trends or give an overview of the situation and be a valuable input from economic valuation to the decision making process targeted at sustainable management of the study wetland.

Key words: Economic valuation; Choice experiment; Attributes; WTP.

CHAPTER ONE

1. INTRODUCTION

1.1. General Background

Various authors have defined wetlands differently. There is no single precise definition of wetlands because of their spatial diversity, temporal dynamic and difficulty of precise delineation of their boundaries (Barbier *et al*., 1997). Among over 50 definitions, the most frequently quoted one is the one proposed by Ramsar Convention. Ramsar defines wetlands 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 (Ramsar ,1996).

Wetlands have enormous socioeconomic and environmental values and attract a number of users that benefit directly or indirectly. Out of the estimated US$ 33 trillion worth of services global ecosystems provide annually, the values of coastal areas and wetland ecosystems is estimated to be US$ 15.5 trillion or 47% of the total value. The value of wetlands alone is estimated to worth about 14.8% of the total ecosystem value which is even greater than forest ecosystems estimated to contribute about 14.2% of total ecosystem values (Legesse, 2007). Despite their importance, historically many wetlands have been treated as wastelands and drained or otherwise degraded. Some organizations still look upon wetlands only in terms of their potential to provide farm land to feed an ever-expanding population, which normally requires alteration of the natural system (Barbier *et al*., 1997). To this day, they are under increasing pressure from anthropogenic activities; drainage as a result of excessive irrigation, pollution due to nutrient runoff from intensive agricultural production, and industry (Birol *et al*., 2005).

Drainage is the most prominent factor among the anthropogenic activities threatening all types of wetlands worldwide. Drainage of wetlands is often considered as a progressive, public spirited endeavor which enhances the health and welfare of society, to alleviate the dangers of flooding, improve sanitation, and land reclamation. Agriculture is considered the principal driving factor of wetland drainage. By 1985 it was estimated that 56-65% of available wetland had been drained for intensive agriculture in Europe and North America, 27% in Asia, 6% in South America and 2% in Africa (OECD, 1996).

The relatively recent acceptance of the socio-economic and ecological importance of wetlands in developed countries have not yet succeeded in reversing this trend (Amezaga *et al.*, 2002). The situation in Ethiopia is even worse and sometimes paradoxical. The Ethiopian wetlands are distributed in different parts of the country, in almost all ecological and altitudinal ranges covering approximately 1.5% of total surface area (EPA, 2004). Yet, in most parts of the country adequate attention is not given to wetland management and wise use it, different stakeholders use wetlands in uncoordinated manner and this approach is affecting the vigor of wetlands and speeding up their degradation (Dixon and Wood, 2003; Shewaye, 2008). For instance, in Illu-Abba-Bora Zone, Southwestern Ethiopia, the percentage of the available wetlands under agriculture was increased by more than double (from 27.7% in 2003 to 65.6% in 2006) in less than five years (Legesse, 2008). Prior to the couple of decades Boye and Kitto wetlands located at the periphery of Jimma town, southwestern Ethiopia were also critical habitats for wide range of species that are rare and endangered today. They were used to host important endemic plant and animal species including some worldwide endangered bird species and more than 25 macro invertebrate species. Wattled Crane (*Bugeranus carunculatus*), endangered bird species were reported to breed in Kitto area, but nowadays due to increasing anthropogenic disturbances they are overwhelming and have changed their characteristics (Desta and Mengistou, 2009).

1.2. Statement of the Research Problem

Boye and Kitto wetlands located at the periphery of Jimma town, southwestern Ethiopia, once were with plenty of wildlife and aquatic resources, which in the recent time have become a fast-degraded landscape facing increased pressure and threats. Though these wetlands have critical roles in providing a range of ecological and socio-economic benefits, due to increasing anthropogenic disturbances, notably through agriculture, settlement, intensive grazing, expansion of huge infrastructures, and brick making they are changing in to mosaic of small habitats. Degradation of these wetlands is mainly associated with unwise use and exacerbated by lack of understanding of wetland values. Consequently, the precious wetland resources are depleted, particularly the biodiversity is severely affected and in great danger of being lost. Prior to the couple of decades they were used to host many species that are rare and endangered today, nowadays they are overwhelmed and have changed their characteristics (Desta and Mengistou, 2009).

Though these wetlands are severely degraded, they can still be accounted for their rich biodiversity reserve including endemic species of plants and animals. Many animals spend their whole lives in these wetlands; for others, wetlands are critical habitat for feeding, breeding, resting, nesting, escape, cover, or travel corridors. They have important endemic plant and animal species including some worldwide endangered bird species. However, their ability to perform such a wide range of functions in their natural state is often ignored by decision makers. The wetlands have been treated as wastelands and drained or otherwise degraded. Some peoples still look upon the wetlands only in terms of their potential to provide farm land, which normally requires alteration of the natural system. Increasingly the development and exploitation of the wetlands is regarded as a means of transforming the areas into a form which is seen as more beneficial and economically productive (EWNHS, 1996; Desta and Mengistou, 2009).

Problems arise when these wetlands are being considered for other development actions. Each choice or option for the wetlands resource to leave in their natural state, allow to be degrade or convert to another use has implications in terms of values gained and lost. Thus, the decision as to what use to pursue for these wetland resources can only be made if these gains and losses under each resource use options are properly analyzed and evaluated (Barbire, 1997).

On ground of such threats and rapid degradation of the wetlands' resources, the urgent need to manage this unique ecosystem is necessary. However, decision makers cannot take management decisions based on intuition alone. They need facts and values to feed the decision making process. Though, other types of values are often important, economic values are useful to consider when making economic choices, choices that involve tradeoffs in allocating resources (Othman *et al.,* 2004). For these wetlands various benefits are not recognized so far; particularly economic value of the wetlands remains largely unexplored. It is against this backdrop that this study has set its objectives.

1.3. Objectives of the Study

Generally, this study focuses on using the choice experiment method in order to understand the preferences for different attributes that households living at surrounding community attach for and aims at estimating *mean willingness to pay* for different attributes of the wetlands. Moreover, assess the socio economic characteristics of the sample households and their perception about the condition of the wetlands. The specific objectives of the study are to:

- Estimates mean willingness to pay (WTP) for fish and water purification attributes in the choice sets. This will help to extract policy relevant information on attributes of the wetlands that individuals think are important;
- Estimate the mean willingness to pay (WTP) for a change from the status quo (current situation) to alternative wetland improvement scenarios (CS);
- Identify the socioeconomic determinants which significantly modify the effects of attributes on the probability of choice ;

1.4. Significance of the Study

Stated preference methods, such as the contingent valuation method and the choice experiment method, have traditionally been applied in developed countries to estimate citizens' willingness to pay (WTP) for various interventions (such as policies, programs, or projects) for environmental conservation and sustainable management of natural resources (for example, Birol et al. (2005). The economic benefits estimated from such studies (captured as WTP) are weighed against the economic costs of interventions targeted at sustainable management of natural resources to understand whether such interventions would be efficient. Environmental resources (such as biodiversity, water, air, wetlands or forests) are public goods that are not traded in markets and hence do not possess readily available prices (or economic values) that can be used for such cost–benefit analysis. Therefore stated preference methods, which rely on constructed, hypothetical markets in which respondents state their WTP for different interventions, are used to capture the value of economic benefits generated by such interventions. Such studies are not so often conducted in developing country contexts since it is assumed that due to tight budget constraints, citizens in these countries may not have the ability to pay for goods, such as interventions for environmental conservation or sustainable natural resources management. Recent studies, however, have revealed that citizens of developing countries have positive and significant WTP for the conservation of the environment or for the sustainable management of natural resources (for example, Bennett and Birol, 2010; Biroland Das, 2010). These studies reveal that, when framed in a manner relevant to the environmental conservation or natural resource management question at hand and designed well, they can yield valuable information, just as they have in developed countries for decades.

In this study attempt has made to contribute to this growing literature on developing country citizen's valuation of interventions that propose environmental conservation or sustainable natural resources management by presenting the results of a choice experiment study. This study investigates whether peoples of the nearby community located around the wetlands are willing to pay higher charge for improvements in fish stock abundance and water purification of Boye and Kitto wetlands.

The estimated values of these relevant attributes of wetlands from the society's point of view provide a sound basis for understanding the economic efficiency of these wetlands which are poorly understood, and as a result are frequently omitted from decision making. These economic values expressed in monetary terms, reflect people's preferences and thus can be used to assist decision-makers by increasing the input from economic valuation in decision-making. Nevertheless, this study is only one element in the effort to pursue management of these wetland resources. At the same time, decision-makers must take account of many competing interests in deciding how best to use the wetlands.

Better understanding of the economic values of these wetlands may not necessarily favor their conservation and sustainable use; it at least permits the resource to be considered as economically efficient systems, alongside with other possible land uses. Many people think that wetlands are not more than mosquito breeding areas. Thus, the output of the study is believed to contribute objective evidence to skeptical managers and the public of the monetary benefits of wetlands.

1.5. Limitation of the Study

This research work is subjected to time and financial constraints. Therefore, the choice experiment design and sample size selection were largely dependent on the budget constraints of the researcher. The allotted timeframe for conducting a masters' thesis in the university was another important consideration. In view of these constraints, the study is restricted to the application of choice experiment to value the benefits of improved wetland attributes of only Boye and Kitto wetlands as a case study using two nearby kebeles. The study also selected two environmental attributes of the wetlands by assuming that other attributes affecting environmental quality of the wetlands surroundings held constant. If it was not for financial, material and time constraints, its finding would be more relevant had the study be done with much bigger sample and many attributes. Generally, with these limitations this partial or rapid economic valuation might be enough to give a reliable input to the decision-making process, if decision-makers are aware of the overall objectives and limitations of valuation.

1.6. Organization of the Paper

The remainder of the thesis proceeds as follows. Chapter two presents theoretical background of environmental valuation and the literatures on various methods of valuation techniques followed by a review of previous studies particularly empirical literatures related to the method of choice experiment. The theoretical and methodological framework of choice experiment is described in detail in chapter three. Chapter four discusses the development of the choice experiment survey, data collection and survey design issues. In chapter five descriptive statistics of samples households and the results of the choice experiment are presented. Finally, in chapter six, the main findings of the study are summarized and some important policy implications and the possible future research dimensions are discussed.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Theoretical Background

2.1.1. The economic approach to environmental valuation

Efforts to value the environmental effects of economic activities lie at the heart of planning for sustainable development. In the past some environmental goods and services have been assigned zero or low values. This was due to difficulties involved in assigning economic values to such commodities or to the attitude that they are 'free goods'. It is important to integrate environmental values into economic decision making processes because failure to do so can have adverse implications not only for current generations but also future generations. Ecosystem health in many parts of the world has deteriorated, in large part because of the loss of habitat from an ever-expanding world population. Virgin forests are being cleared for the purpose of selling the standing timber as well as providing farm land. Wetlands are drained to obtain more land for agriculture and housing. The number of endangered species of plants and animals grows annually. The world has yet to fully come to grips with how to appreciate and protect important ecosystems (NOAA Coastal Services Center, 2006).

The economic concept of value does not encompass all possible sources of value. However, it is much broader than the narrow concept of commercial or financial value, and includes all values, tangible as well as intangible, that contribute to human satisfaction or welfare (Barbier *et al.,* 1997). This broad definition is reflected in the "total economic value" framework that underlies economic valuation and is described below.

2.1.2. The total economic value framework

The Total Economic Value (TEV) framework is based on the presumption that individuals can hold multiple values for ecosystems. It provides a basis for taxonomy of these various values or benefits. Although any taxonomy of such values is somewhat arbitrary and may differ from one use to another, the TEV framework is necessary to ensure that all components of value are given recognition in empirical analyses and that "double counting" of values does not occur when multiple valuation methods are employed (Bishop *et al.*, 1987).

Within the TEV framework an individual can hold both use and nonuse values for the services of an ecosystem. To illustrate this with examples from (Barbier *et al.*, 1997), consider an oil spill on a popular coastal beach resulting in forgone recreational trips to the beach—this is a lost use value. In addition, the oil spill could damage the ecosystem in ways that would not affect beach use and that beach users would never observe. It might, for example, kill marine mammals that live off the beach and are not seen by beach users, and beach users, as well as those who do not visit the beach, might experience a loss because of this ecosystem damage. The loss by those who do not visit the beach would be a loss of nonuse value, though there could also be a loss of nonuse value on the part of beach users. The TEV framework implies that analysts proceed to investigate the potential loss in use and in nonuse values of beach users and in nonuse values of people who do not visit the beach. A number of TEV frameworks have been proposed in recent decades. Although varied in detail and application, the distinction between use and nonuse values is a fundamental theme (Bishop *et al.*, 1987; Freeman, 1993). The TEV framework, as applied to typical wetland system services for the purposes of this and of course relevant to this thesis, is illustrated below in Table 1.

Table 1. Classification and examples of total economic values for wetland ecosystem

Use Values		Nonuse Values
Direct	**Indirect**	**Existence and bequest values**
Commercial and recreational fishing	Nutrient retention and cycling	Cultural heritage
Agriculture	Flood control	Resources for future generations
Transportation	Storm protection	Existence of charismatic species
Wild resources	Habitat function	Existence of wild places
Potable water	Shoreline and river bank stabilization	
Recreation		
Genetic material		
Scientific and educational opportunities		

Adopted from Barbier et al. (1997)

2.1.2.1. Use values

Use values are generally grouped according to whether they are *direct* or *indirect*. The former refers to both *consumptive* and *non consumptive* uses that involve some form of direct physical interaction with the resources and services of the system. Consumptive uses involve extracting a component of the ecosystem for an anthropocentric purpose such as harvesting fish and wild resources. In contrast, non consumptive direct uses involve services provided directly by ecosystems without extraction, such as use of water for transportation and recreational activities such as swimming. Although non consumptive uses do not involve extraction and hence reduction in the quantity of the resource available, they can diminish the quality of ecosystems through pollution and other external effects.

It is also increasingly recognized that the livelihoods of populations in areas near wetland ecosystems may be affected by certain key *regulatory ecological functions* (e.g., storm or flood protection, water purification, habitat functions). The values derived from these services are considered indirect (Freeman, 1993).

2.1.2.2. Nonuse values

Non use values (sometimes called passive use value or intrinsic value) as the name suggests, are inherent in the good. That is, the satisfaction we derive from the good is not related to its consumption, *per se*. Non-use or passive use values consist of existence value, bequest value and option value. Many natural environments are thought to have substantial existence values; individuals do not make use of these environments but nevertheless wish to see them preserved in their own right (Bishop *et al.,* 1987; Freeman, 1993).

Existence value arises from the benefit an individual derives from knowing that a resource exists or will continue to exist, regardless of the fact that he or she has never seen or used the resource, or intends to see or use it in the future. A good example of the significance of non-use value is the international outcry over the whaling issue. There are many people who have never seen a whale or plan to see one, but are nevertheless willing to pay significant sums of money to ensure that whales are not hunted to extinction. Other motivations for nonuse values are bequest option and cultural or heritage values. Bequest value, as the name suggests, is derived from the benefits that individuals obtain from knowing that a resource will be available for future generations. The third type of non-use value, option value, is a little more complex. Option value may be defined as the amount of money an individual is willing to pay, at the current time, to ensure the future availability of the resource. To the extent that option value is the expected value of future use of the resource, it may also be classified as a use value (Carson *et al.,* 1992).

The empirical literature generally does not attempt to measure values for individual aspects of nonuse values, but focuses on the estimation of nonuse values irrespective of the underlying motivations people have for holding this value component. The economic valuation of the impacts of the *Exxon Valdez* oil spill on the aquatic and related ecosystems of Prince William Sound, Alaska, highlights the importance of nonuse values in natural resource damage assessments and project appraisals. The *Exxon Valdez* study revealed that many Americans who have not visited Alaska and never intend to do so nevertheless place high values on maintaining the pristine and unique but fragile coastal and aquatic ecosystems of Alaska (Carson *et al.*, 1992).

2.1.3. Non-market valuation methods

The methods of valuation of non-marketed goods have become crucial when determining the costs and benefits of public projects. Non- market valuation exercises have been conducted in many different areas, ranging from health and environmental applications to transport and public infrastructure projects. In the case of a good that is not traded in a market, an economic value of that good obviously cannot be directly obtained from the market .Markets fail to exist for some goods either because these goods simply do not exist yet, or because they are public goods, for which exclusion is not possible. Nevertheless, if one wants to compare different programs by using cost benefit analysis, the change in the quality or quantity of the non-market goods should be expressed in monetary terms. Another crucial application of valuation techniques is the determination of damages associated with a certain event. Under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 in the US, and after the events that followed the Exxon Valdez oil spill in 1989, the methods of valuation have become a central part of litigation for environmental and health related damages in the United States and in several other countries (Alpizar *et al.*,2003).

Over the years, the research on valuation of non-market goods has developed into two branches: Revealed preference (RP) (or indirect) approaches and Stated (or expressed) preference (SP) (or direct) approaches. The revealed preference (i.e., indirect) approach infers value indirectly by observing individuals' behavior in actual or simulated markets.

For example, the value of wilderness area may be inferred by expenditures that receptionists incur to travel to the area. The value of, say, noise pollution may be inferred by analyzing the value of residential property near an airport. On the other hand, stated preference methods attempt to elicit environmental values directly from respondents by asking them about their preferences for a given environmental good or service. At the present time, only SP methods can be used to estimate total economic value (i.e., use and non-use values), whereas RP methods are only restricted to estimating use values (Braden and Kolstad, 1991).

2.1.3.1. Revealed preference methods

Revealed Preference methods include the Travel Cost Method (TCM), Hedonic Pricing Method (HPM), Cost (or Expenditure) Methods, and Benefit Transfer Method (BTM). The two most-well known Revealed preference methods are the travel cost method and the hedonic pricing method (Braden and Kolstad, 1991).

(a) The travel cost method

The TCM assumes that the costs that an individual incurs in visiting a recreational site are a measure of his or her valuation of that site. The approach involves asking visitors questions about where they have traveled from and the costs they have incurred. The information requested in travel cost survey includes the following: travel costs (petrol, food, and other travel-related expenses), alternative sites and personal motivations. Entrance fees to recreation sites are often non-existent or nominal. The demand curve drawn from the relationship between travel costs (a proxy for the price of recreation) and number of visits can be used to estimate the total recreation value of the given site. The main assumption of the TCM is that the value of a recreational site can be proxied by the costs that the recreationist incurs in undertaking the recreational experience. The strength of the approach is that it is based on real rather than hypothetical data and as such can provide true values. However, the assumption that the recreational value of a place is directly related to travel costs incurred in getting there could be an oversimplification of reality. For example, people who live near the site may incur zero or minimal travel costs but may nevertheless have high values for the site (Freeman, 1979; Mahmud, 1998).

(b) Hedonic pricing method

Hedonic pricing (HP) derives from the *characteristics theory of value*, developed by Lancaster (1966) and Rosen (1974), with the first HP studies being published in the late 1960s and early 1970s. The method identifies environmental service flows as elements of a vector of characteristics describing a marketed good, typically housing. HP seeks to find a relationship between the levels of environmental services (such as noise levels), and the prices of the marketed goods (houses). Here from the above empirical works we can understand that consumers consider the level of environmental quality (such as air quality) in addition to other characteristics of a house when deciding about their location for living and that house prices are expected to differ depending on the environmental quality. The HPM is applicable to all environmental attributes that are likely to affect property prices. Examples of such attributes are water supply, noise and air quality. However, it also has some limitations. The main one is that it is only applicable in areas where the property market is well developed and the property owners are aware of the environmental attributes or impacts and take them into consideration in their assessment of property values (Braden and Kolstad, 1991).

2.1.3.2. Stated preference methods

Stated preference method assesses the value of non-market goods by using individuals' stated behavior in a hypothetical setting. The method includes a number of different approaches such as conjoint analysis, contingent valuation method (CVM) and choice experiments. Stated Preference Methods can be either direct or indirect. The direct form of SP method is referred to as the contingent valuation method (CVM). Indirect SP methods include a variety of approaches including contingent ranking and choice experiment sometimes called choice modeling (Louviere *et al.*, 2000).

(a)Contingent valuation method (cvm)

The CVM directly infers values by using surveys to ask people their maximum willingness to pay (WTP) to avoid and/or minimum willingness to accept compensation (WTA) for changes in environmental goods or services.

The term ‘contingent’ in CVM suggests that it is contingent on simulating a hypothetical market for the good in question. The idea of CVM was first suggested by Ciriacy-Wantrup in 1947 and the first study ever done was in 1961 by Davis (Alpizar *et al.,* 2001). Since then, CVM surveys have become one of the most commonly used methods for valuation of non-market goods. As indicated earlier, it is the only method which can, so far, be used to estimate non-use values. The approach is fairly simple and relatively straightforward to apply. However, the CVM has many acknowledged problems. These include hypothetical bias, strategic bias, information bias, and survey techniques bias (Louviere *et al.,* 2000).

(b) Choice experiment

Choice experiment is similar in many ways to the contingent valuation method (CVM) in that both share a similar theoretical basis (random utility theory) and survey design process (Blamey *et al*., 1999). The main difference is that choice experiment seeks to communicate differences through the use of attributes and repeated scenarios, as compared to the single tradeoff of a CVM exercise. While both techniques can provide surplus estimates for moving from the status quo to an alternative, choice experiment has an advantage in that the estimates can be made for a broad number of alternatives (Blamey *et al*., 1999; Alpizar *et al*., 2003).

The applications of choice experiment (CE) reported in different studies demonstrate the capacity of the technique to provide policy relevant information on the values people hold for non-marketed environmental and social impacts. This information is important for a number of reasons. First, with more complete information regarding the values of all the impacts, policy makers are better equipped to make decisions that are in the best interests of the whole community. Second, with improved information that is widely accessible to the public the prospects of vested interest groups being able to capture the decision making process to their own advantage and potentially to the disadvantage of the community as a whole are diminished (Birol *et al.,* 2001). These are reasons for the estimation of non-market values. There are other reasons why CE can be regarded as superior to other techniques that have been designed and used to perform the same role.

A single application of the CE technique can produce estimates of value for many alternative policy outcomes. In addition, the composition of those value estimates can be examined through the analysis of the "part-worth" of the component attributes. This is in contrast to the most commonly used alternative non-market valuation technique, the contingent valuation method (CVM). Because CVM is based on a sample of affected people's responses to questions regarding their preferences for one alternative, it is capable of providing estimates of the value of that one alternative. That value estimate is therefore specific to a particular set of circumstances and cannot be disaggregated into the contributions made by the individual attributes that combine to constitute the alternative. The ability of CE to provide estimates of multiple scenarios makes it a more versatile and cost-effective technique. An advantage of the disaggregation capability inherent to CE is that estimates of value derived from an application of CE at one site are more likely to be valid when transferred to another related site. This is because the different circumstances at the transfer site can be taken into account by adjusting the levels of the attributes accordingly. Again, because CVM results are circumstance specific, they do not offer this flexibility (Louviere *et al.,* 2000).

There are also reasons why choice experiment yields results that are less susceptible to strategic behavior on the part of respondents. A continuing concern in regard to the use of stated preference techniques is that respondents deliberately misrepresent their preferences in order to bias the study's results in their favour. Specifically, if asked in a CVM application for the amount they are willing to pay to see an environmental good enhanced, a respondent who enjoys the environmental good may overstate their true willingness to pay in order to increase the chance of the good being provided. An advantage of CE in this respect is that it is much more difficult for respondents to identify a choice strategy that will influence the results in their favor (Morrison *et al.,* 1999). Moreover, Contingent valuations are generally viewed by many experts as facing respondents with a mental task which may be very difficult. Choice experiment has rather generated interesting results on what attributes of wetlands are of greatest interest to survey respondents without asking people difficult willing-to-pay questions. Choice experiments avoid this problem, since respondents get many chances in the interview to express a positive preference for a valued good over a range of payment amounts (Pearce and Ozdemiroglo, 2002).

Whilst CE demonstrates certain advantages, it is not without challenges. Foremost of these is the problem of respondent cognition. The choice sets that form the core of CE require respondents to select their most preferred option from an array of alternatives. Each alternative is described using a number of attributes. This places a significant cognitive burden on the respondent. If this is not carefully managed through questionnaire design and presentation the outcome can be biased (Louviere *et al.*, 2000). Within the range of non-market valuation techniques, the choice experiment method (CEM) is most appropriate for capturing the benefits generated by the multiple services and functions of wetlands. Thus, in this study choice experiment was selected in preference to CVM because it has the ability to disaggregate wetland improvements into underlying attributes.

2.2. Empirical Literature

Birol *et al.* (2005) conducted a choice experiment taking the case of cheimaditida wetland located 40 km southeast of Florina in North West Greece. This wetland includes Lake Cheimaditida, one of the few remaining fresh water lakes in Greece and constitutes a total wetland area of 168 km2 surrounded by extensive marshes with reeds. The wetland is rich in flora, fauna and habitat diversity. They tried to value the non use value of the wetland and attributes were selected to reflect non use values generated by the wetland. Namely, biodiversity, *open water surface area, research and educational* values that can be extracted from the wetland and the values associated with environmentally friendly *employment opportunities*. Two wetland management scenarios were presented to the public. Finally, a choice experiment was employed to estimate the benefits of the non use values of the Cheimaditida wetland that accrue to the Greek public and to investigate heterogeneity in their preferences. Results from the choice experiment reveal that there is considerable preference heterogeneity across the public, and that they attach positive and significant values for the sustainable management of the wetland. In particular results from the conditional logit model indicated that all of the management attributes are significant factors in the choice of wetland management scenario, and ceteris paribus any single attribute increases the probability that a management scenario is selected. The Random parameter logit model (RPL), which accounts for unobserved, unconditional heterogeneity, was also used in order to account for preference

heterogeneity. Random parameter logit model estimates of the sample result in significant derived standard deviations for the ASC and three attributes(*open water surface area, research and education, and retraining*) indicating that the data supports choice specific unconditional unobserved heterogeneity for these attributes and a similar result was found using *RPL model with interaction* (which fits the data best), based on this model, respondents are willing to pay 32 cents for an extra local re-trained in environmentally friendly employment. Respondents' average willingness to pay for high levels of biodiversity was €36.68 and willingness to pay for an increase in the open water surface area from 20 percent to 60 percent was €20.26, and the average willingness to pay for an improvement in research and educational extraction from the wetland was €21.36. To account for heterogeneity of preferences across respondents the effects of social, economic and attitudinal characteristics of the respondents on their choice of wetland management scenario variables were interacted with both the attributes and the ASC. On account of positive interactions between the ASC and the four characteristics, higher levels of Environmental consciousness index (ECI) and higher numbers of dependent children, as well as having a university degree and being located in the urban areas increases the likelihood that the respondent will select a wetland management scenario. Respondents with university education and higher ECI's are more likely to choose higher payment levels, as the interaction between both of these characteristics and payment attribute are positive. Respondents located in the urban areas prefer higher levels of open water surface area, as well as higher levels of research and educational extraction from the wetland. Finally, those respondents with higher numbers of dependent children are more likely to choose wetland management scenarios with higher levels of biodiversity, thereby revealed their bequest motives.

A similar valuation technique was conducted by Carlsson *et al.* (2003) to value attributes of a wetland. The choice experiment concerns a wetland area in staffanstorp, southern Sweden where the municipality of staffanstorp planned to develop a wetland in the area. They found that a choice experiment is essentially suitable for the design of the wetland. Through focus group discussion and pilot survey six attributes of the wetland that is about to be developed were selected.

These attributes were: *surrounding vegetation, fish stock, introduction of Cray fish, biodiversity, walking facilities and fence*. And a choice experiment was conducted on 130 randomly chosen individuals. The study identified attributes that increase and decrease citizen's perceived value of wetlands. Using a *random parameter logit model* they found that biodiversity and walking facilities are the two greatest contributors to welfare, while a fenced waterline and introduction of crayfish decrease welfare. The important additional information they found from the Random parameter logit model was that, there was a strong heterogeneity in the preference for the attributes. Among the socio-economic characteristics, only ''Age'' is significant, but negative. The negative sign indicates that elder respondents are less likely to choose an improved and more costly wetland.

In Carlsson *et al*. (2005), a choice experiment stated preference analysis survey was conducted in two zones in the Amhara regional state namely, East Gojjam and south Wollo. In the experiment, farmers were asked to make choices between an agricultural extension package and a local public good. The survey covered a total of 1520 house holds from the two zones. The situation in East Gojjam is generally considered to have a good potential for agriculture, where as South Wollo is considered to be seriously affected by soil erosion and subjected to recurrent drought. Farmers were asked to make choices between an agricultural extension package and a local public good. Before the choice experiment, a scenario describing the attributes and the choice task was read out to them. The extension package was described as improved seed (maize and teff) and modern agricultural inputs. The extension package was described by two additional attributes: (i) the amount of money they have to pay back at harvest time, and (ii) an insurance scheme. The insurance was described as a system where they would not have to pay back the cost for the extension package if there is a crop failure. This extension package was to be compared with a local public good; the good is either a health station or a protected spring. The result from *random effects binary probit model* indicated that a large majority opted for the public good. The share of choices made in favor of the extension package was as low as 20 percent. The proportion of households that choose the health station and protected spring were 84 percent and 76 percent respectively. From these two public good, health station was preferred than protected spring.

Another interesting result of the study was that when the extension package is combined with insurance in terms of no payback of the credit in case of crop failure, a significant increase in the choice of the extension package was observed. This result gives a clear indication of the importance of risk aversion in reducing the adoption rate of modern inputs in Ethiopian agriculture and gives evidence of how stated preference (choice experiment) methodologies can be utilized for development policy design. The socio-economic characteristics also give some interesting insights. The probability of choosing the extension package decreases with age in Gojjam while age is not a significant factor for Wollo. There was also a significant difference across gender. Female respondents are less likely to opt for extension packages than their male counterparts both in the Wollo and Gojjam sub-samples. Literacy is surprisingly insignificant for each of the two sub samples, maybe because increased literacy has a similar impact on both the preference for extension packages and health-improving local public goods. Family size has a negative and significant effect on choice of extension package in Gojjam suggesting that larger families in Gojjam prefer health facilities and protected springs to extension package. The coefficients for livestock holdings are negative and significant throughout. A possible reason for this could be that manure from the livestock is a close substitute to chemical fertilizers.

Wikstrom (2003) studied a willingness to pay for sustainable coffee, using a choice experiment approach. The purpose of the study was to measure the willingness to pay for *KRAV*certified (*ecologically/organically* grown coffee*)* and *fair*-certified and to find the underlying factors for an *ecological* and *fair* choice. The data was collected by a choice experiment executed on 100 respondents. The results from the *random effects binary probit* model showed that the monetary attribute has a significant impact for the experienced utility of the consumer and the *KRAV*-certified attribute proved to generate a higher impact on utility for the consumer than did the *fair*-certified attribute. This was also reflected in a higher willingness to pay for *KRAV*certified coffee. From the socioeconomic variables a high coffee consumption contributed to a lower willingness to choose ecologically and fairly produced coffee. This was expected since the certified brands often come at a higher cost. In addition, it was shown in the study that individuals who are educated and being members in some non-profit organization tend to be more likely to buy ecological and fair coffee.

This variable is expected to be positive in the socioeconomic analysis because being educated and a membership in such organization imply a bigger commitment regarding environmentally and fairly produced goods. Results showed that there exist a clear market for both *KRAV*-certified and *fair* certified coffee. Consumers are ready to pay a premium for a coffee that has been produced in an *ecological* and *fair* manner. The study also elucidated that if the organizations behind *KRAV*-certified and *fair* certified coffees could lower the premiums they would have a major opportunity of increasing the market shares for their brands. Another fact that might be useful in the marketing of organic coffee is almost 20 percent of the respondents expressed that they chose the alternative with organically grown coffee since they wanted to prevent to get any chemical substances in their coffee.

Hala and Fredric (2004), tried to analyze the *welfare effects* of improved health status through increased water quality using a choice experiment. The survey was administered to a random sample of 750 households in metropolitan Cairo, Egypt. Focus group discussion and a major pilot study were conducted to produce a final questionnaire. The questionnaire contained a number of sections, other than the choice experiment, including questions about the socio-economic characteristics of the household and questions about the water quality and health status of the household. Focus groups and pre-testing with a sample of individuals were used to determine some measurable attributes associated with the effect of the quality of drinking water on health. These attributes are: (1) short run health effect. This was described as the number of ill days caused by water borne diseases during the year, e.g. diarrhea (2) long run health effect. This was related to the risk of contracting a dangerous disease in the future. A bundle of diseases such as hepatitis and cholera were mentioned in the scenario. (3) The cost attribute was formulated as an increase in the water bill due to the program. The descriptive statistics of the socio-economic characteristics of the interviewed respondents showed that, 40 percent of the sample chose the *status quo* in the four offered choice sets, while 38 percent never chose the *status quo*. Around 26 percent of the participants supported the positive short run effects of better water quality, while 51 percent of the respondents believed in the reduction of long run ill health effects by enhancing the water quality. Since better water quality may lead to better health, around 26 percent of the respondents were willing to contribute to the program.

Results from the *random parameter logit model* they used showed that, households in metropolitan Cairo have a positive willingness to pay to reduce health risks related to water quality. The mean willingness to pay concerning a 50 percent decrease in the short run health effect due to poor water quality, and a reduction in the probability of contracting waterborne diseases in the long run to 2 percent is found to be almost 15 Egyptian pounds per month. They also found significant heterogeneity among most of the socio-economic characteristics of households. Households with higher incomes, as well as household heads with higher levels of education are more prompted to choose an alternative that is not the *status quo.*

Bergman *et al.* (2004), tried to value the attributes of renewable energy investments in Scotland. The methodology used to do this was the choice experiment technique. Renewable technologies considered include hydro, on-shore and off-shore wind power and Biomass. Five key attributes were then identified from examining the focus groups, government announcements and statements, and literature. These attributes were: *impacts on landscape, impacts on wildlife, impacts on pollution levels, creation of long-term employment opportunities and potential increase in electric prices* to pay for renewable sources. The combination attributes and their respective levels were created using an orthogonal design procedure. Four choice sets were then presented and the survey participants were requested to indicate their preferences. Results for all the 211 respondents from the Multinomial logit (MNL) model (the *simple model* shows results when only the choice experiment attributes are included in the regression) showed that all attributes coefficients have the expected sign. Price was negative and therefore in accord with standard economic theory. All of the environmental attributes were significant determinants of utility at some level: these were changes in air pollution, landscape effects and wildlife effects. However, they found that employment creation is not a significant attribute. In the *extended model* many socio-economic variables were included. The covariates used in the "expanded" model show either statistical significance; or are included on theoretical grounds. A likelihood ratio test was used to compare the "simple" and "expanded" models, and rejected the null hypothesis that the parameter values of the two models are equal at the 95% significance level. They also derived implicit prices from the two models which are not statistically different. Households are

willing to pay £8.10 to decrease high impact landscape change to having no landscape impact. They are willing to pay £4.24 to change a slight increase in harm to wildlife from renewable projects to a level that has no harm. However, households would be willing to pay £11.98 per annum to change a slight increase in harm to wildlife from renewable projects to a level that wildlife is improved from the current level. Households are also willing to pay £14.13 to have renewable energy projects that have no increase in air pollution compared to a programme which results in a slight increase in pollution. The conclusions of the paper indicate that, renewable energy offers a partial solution to the problem of reducing greenhouse gas emissions whilst meeting future energy needs. Yet different renewable energy projects can have varying external costs in terms of impacts on the landscape, on wildlife and on air pollution. In addition, strategies vary in their likely impacts on jobs and electricity prices. The choice experiment method used in the paper enabled these effects to be jointly evaluated in welfare consistent terms.

Hanley *et al.* (2005) studied the economic value of improvements in river ecology using choice experiment. They located their choice experiment in the context of improvements to the ecology of the River Wear, in County Durham, England; and the River Clyde, in Central Scotland. These were chosen as broadly representative of the kind of water bodies in the UK where moderate improvements in water quality are likely to be needed in order to meet Good Ecological Status. Focus groups were recruited from local residents living around the two rivers in both case study areas in order to (i) gauge local attitudes to the rivers and to their problems (ii) investigate current uses of the two rivers and (ii) identify the attributes by which the rivers could best be characterized. They also gauged reaction to the idea of the need to pay for improvements in river ecology. As a result of group discussions, three river quality attributes were chosen for the choice experiment. These were in-stream ecology, aesthetics/appearance, and bank side conditions; each attribute was set at one of two levels. The ‘fair’ level was described in such a way as to be consistent with current conditions on the Rivers Wear and Clyde. The ‘good’ level was consistent with regulators’ expectations as to what will likely constitute good ecological quality status under the Water Framework Directive. These merely represent the characteristics of ‘water quality’ as perceived by the general public.

A cost or price attribute was established as higher water rates payments by households to the local sewerage operator. Sampling was undertaken with a randomized quota sampling approach, using in-house surveys by trained market research 36 personnel. They collected 210 responses for each river. They used both *multinomial logit model* and a *random parameters logit model*. First, they conducted the Hausman test for IIA. This test was carried out on a pooled sample of both survey sites ('both river') and individually for each survey site ('River Wear' and 'River Clyde'). In all three cases the acceptance of IIA was firmly rejected with the Hausman statistic being very large and statistically significant well below the one per cent level. The random parameters logit model allows for such variation in preferences across individuals and adjusts for error correlation across the choices made by each individual. Turning first to the multi-nomial logit estimates, in all three samples the three attributes have the expected positive signs and all are statistically significant below the one percent level. Likewise, in all three samples, price has the expected negative sign. However, price is not statistically significant at even the generous ten per cent level in the River Clyde sample. Turning next to the random parameters logit estimates, in all three samples the three attributes have the expected positive signs and all are statistically significant below the one percent level. Therefore, with respect to the attributes both estimators are generating similar results. But in the river Clyde sample price is statistically significant at the five percent level. This result confirmed that people 'value' and are prepared to pay for water quality improvements and such improvements are valued 'even more' the lower the cost associated with obtaining them. From the standard deviations and standard errors for the parameters of the random parameter logit estimates, they noted that the standard deviation for the 'river ecology' attribute is statistically significant at the five per cent level or lower in all three samples. The standard deviation for the 'aesthetics' attribute is only statistically significant (below the one percent level) in the River Clyde sample. The standard deviation of the 'bank sides' attributes is not statistically significant in any of the samples. Results suggested two things relating to preferences. The first is that the major component of preference heterogeneity is preferences towards 'river ecology'. The second is that preference heterogeneity in the River Clyde sample compared to the River Wear sample is 'larger', i.e. preferences appear to be more homogeneous amongst river wear respondents. They also reported the implicit prices along with their standard errors. These values are the amount of money individuals are willing-to- pay for the specified improvement.

Most of these prices are statistically significant below the one percent. It was also indicated in the study that both the multinomial and random parameters logit models generate a set of implicit prices that are very similar for the river wear sample and this suggested according to them that preference heterogeneity is likely not a factor of much importance and the prices are robust. For the River Clyde sample, the multi-nomial logit model generates prices that are not statistically significant to zero. However, the random parameters logit model gives prices for the River Clyde sample that are statistically significant at the five per cent level. The fact that these prices are not significant in the multi-nomial logit model but are significant in the random parameters logit model demonstrates the potential importance of controlling for preference heterogeneity in choice experiments.

In Othman *et al.* (2004) the choice modeling concerned about the matang mangrove wetlands located in the sub district of matang in the state of perk, Malaysia the wet land measures about 40000 hectares and represent 40 percent of the total mangroves in Malaysia. The study was specifically aimed at generating data on non-market values so that policy makers can better ascertain if the forest resources have been managed in the most desirable way from the perspective of society at large, i.e. to assist decision makers in determining the optimal management strategy. On the basis of focus group five forest attributes was identified including animal contribution to matang mangroves fund; namely, environmental forest area, direct employment, number of migratory bird species, visitation rates for recreation and annual contribution. Each attribute has three levels and combined with the attributes using the fractional factorial design method. There were three management options presented to the respondents including the current management regime. Stratified random samplings of 571 respondents from three selected sub-district were undertaken. Results from the multinomial logit model indicated that the coefficients for all of the attributes in the choice sets are significant at the 1 percent level and all have the a priori expected signs. They also developed a nested logit model to avoid the problem of independent of irrelevant alternatives violation. Results from this model also showed that all the environmental and social attribute variable parameters showed positive signs and are significant at the 1 percent level, i.e. options with more area devoted to environmental forests, more migratory bird species, more employment and visitation rates are preferred.

The negative cost coefficient implies that respondents were less likely to choose the more costly option. The explanatory power of the model (*adjusted R square*) is satisfactory at 24 percent. The coefficients for the socioeconomic and attitudinal variables (educational level, total household income, livelihood dependency etc...) are also statistically significant, except for age, and the signs are consistent with their expectations. All the signs are positives. Respondents with higher educational levels, income and livelihood dependency are likely to prefer management options that provide higher levels of the attributes (environmental forest area, direct employment, number of migratory bird species, visitation rates for recreation and annual contribution). Since the alternative specific constants for these variables relate to the baseline option in the nested logit model; negative coefficients reflect that respondents who had higher income and education levels, and were pro-environmental were less likely to choose the status quo option or the current management regime. Interestingly, their findings compare very well with that of the MNL model. The estimates of implicit prices from the two models do not differ substantially. Using the nested logit model, they found that, non-user households were, on average, willing to pay RM0.81(RM stands for Ringgit Malaysia, 1.00 RM=0.286177 USD) for an additional 1 percent of environmental forest area and RM1.36 for an additional 1 percent of migratory bird species to be present in the matang mangroves, ceteris paribus. The models also enabled the estimation of welfare changes (CS) associated with an array of changes in wetland management away from the 'status quo' scenario. The results showed that the CS estimates from both models differ significantly, while the order of magnitude remains consistent. Generally, the study showed that by weighing up these values along with the market values of benefits and costs for the available alternative plans, the relevant authority can identify a management plan that yields the greatest net benefit to society.

CHAPTER THREE

3. MATERIAL AND METHOD

3. 1. Theoretical Framework and Method of Choice Experiment

3.1.1. Methodology

Choice experiment applications have been commonly used in marketing, psychology, and transport research, and have recently become increasingly popular in environmental valuation applications (see for instance, section 2.2). The estimation of the preferences for environmental non-market goods and for changes in environmental quality constitutes an important element of the environmental economics literature. Applications of non-market valuation techniques are common in public transport infrastructure projects, and in different environmental damage assessment cases have also prompted considerable research activities in this area. The contingent valuation method (CVM) has been used extensively, during the last decade indifferent environmental applications, although it has also been questioned. Problems associated with the contingent valuation technique have made elicitation formats that ask respondents to choose between discrete alternatives rather than to state their maximum willingness to pay for a particular environmental good increasingly popular. Discrete choice CVM were the first to be applied in environmental economics context, but other stated preference techniques, such as choice experiments (CE), have also become increasingly common (Garrod and Willis, 1999).

While a typical CV study generally examines the actual environmental scenario as a package, the CE approach permits the analyst to examine the preferences over the different attributes (or characteristic) included in the scenario. In addition, the marginal rates of substitution for each included attribute relative to a monetary attribute are useful outputs from choice experiments since they indicate the relative importance of each of the attributes included in the experiment. In CE questionnaires, respondents are asked a series of questions in which 'Choice sets' are presented. Each choice set usually contains three or more resource use options.

Respondents are asked to choose their preferred option from each choice set. The options in each choice set are described using common attributes, which take on various levels. The combinations of attribute levels for each option in each choice set are established using experimental design techniques (See section 4.6). Similar to a contingent valuation (CV) study, before the choice sets are presented to respondents, there is a description of the study site, the research issues, the proposed policy changes, and the implication for the environmental attributes that are being modeled (see appendix B, section 2) (Hanley *et al.,* 2001; Carlsson *et al.,* 2003). The theoretical framework of choice experiment built up on two fundamental building blocks: Lancaster's characteristics theory of value, and random utility theory. They are clearly discussed in the following two sections.

3.1.2. The characteristics theory of value

The basic assumption in choice experiment application is that consumers derive utility from the different characteristics that a good possesses, rather than from the good itself (Birol *et al., 2005*). According to Lancaster (1966) characteristics theory of value, the probability of choosing a specific alternative (i.e. a good) is a function of the utility linked to that same alternative. Moreover, the utility derived from each alternative is assumed to be determined by the preferences over the levels of the characteristics (or services) provided by that alternatives. Hence, according to the characteristics theory of value, utility is a function of the services provided by the commodities. The assumption that individuals derive utility from the characteristics of a good rather than from the good itself, implies that a change in one of the characteristics (such as the price) may result in a discrete switch from one good to another will however affect the probability of choosing that specific commodity.

3.1.3. Random utility theory (RUT)

The random utility theory (RUT) says that utility derived by individuals from their choice is not directly observable, but an indirect determination of preferences is possible. The random utility theory thus, provides a link between the deterministic model outlined below and a statistical model.

In other words, under RUT it is assumed that the utility function of a good can be broken down into two parts, one deterministic or systemic (V) and one stochastic part (ε) (McFadden, 1974).

3.1.4. Econometric model specification

Ideally, the model should try to identify and capture all possible attributes that influence choice behavior. However, due to unknown influencing factors this may not be possible. To capture these unknown influencing factors, a random variable is incorporated in the individual's utility function. Hence, the utility function through which the individual is assumed to derive utility can be expressed in a formula (Louviere *et al.,* 2000):

$U_{i=}V(Zin, Sn) + \varepsilon(Zin, Sn)$ While Zin are attributes and Sn are socio-economic variables

Or,

$U_{in=}V_{in} + \varepsilon_{in}$---------- **(1)**

Where, U_{in} is the latent utility that exists in the mind of the consumer but cannot be observed directly, unobserved utility for choice alternative, V_{in} is the systematic, observable component of the latent utility, it is usually include the choice set attributes and socioeconomic variables and ε_{in} is the random component of the latent utility associated with option *i* and consumer *n*. Because of the random component, it is impossible to understand and predict preferences perfectly. This leads to the expression of the probability of choice. Following (Bennett and Blamey, 2001), the probability that individual *n* will choose option *i* over another option *j* is given by:

$$prob(i|C) = prob\{V_{in} + \varepsilon_{in} > V_{jn} + \varepsilon_{jn} ; j \epsilon c \text{ and } i \neq j\}$$

Or

$$prob(i|C) = prob\ [(V_{in} - V_{jn}) > (\epsilon_{jn} - \epsilon_{in})], i \neq j$$ ---------- **(2)**

In words, the probability of consumer n selecting option *i* from choice C_n is equal to the probability that the systematic and random components of option *i* for consumer *n* are greater than the systematic and random components of option *j* for consumer *n* in choice C*n.* The most basic form of **V***i* is an additive structure, which includes the attributes from the choice sets only,

$$Vi = ASC + \Sigma\beta kZik \text{---------- (3)}$$

Where ASC is an alternative specific constant, β is a vector of coefficients, and Zs are attributes from the choice sets. The effects of attributes in the choice sets are captured by the Z variables, while the ASC captures any systematic variations in choice observations that are associated with an alternative that are not explained either by the attribute variation or respondents' observed socio-economic characteristics (Louviere *et al.*, 2000; Hanley *et al.*, 2001).

3.1.5. Estimation of willingness to pay (WTP)

The β coefficients estimated under the regression models can be used to estimate the rate at which respondents are willing to trade-off one attribute for another. The tradeoff estimated is known as '*part-worth'* or an *'implicit price*' or the '*mean willingness to pay'*. They demonstrate the amounts of money respondents are willing to pay in order to receive more of the non-marketed environmental attribute. Estimates of implicit prices are made on a 'ceteris paribus' basis-that is, they are estimates of the willingness to pay of respondents for an increase in the attribute of concern, given that every thing else is held constant.

Hence, as shown below in equation 4 by division of β coefficients, the marginal rates of substitution across all the attributes, monetary and non-monetary, can estimate (Bennett and Blamey, 2001).

$$part\ worth = -\left(\boldsymbol{\beta} non\ marketed\ attribute / \boldsymbol{\beta} monetery\ attribute \right) \text{--------- (4)}$$

The implicit prices are useful in that they demonstrate the trade-off between individual attributes. A comparison of the implicit prices of attributes affords some understanding of the relative importance that respondents hold for them. On the basis of such comparisons, policy makers are better placed to design resource use alternatives so as to favor those attributes which have higher (relative) implicit prices (Hanley *et al.,* 2001; Carlsson *et al.,* 2003).

This part-worth (or implicit price) formula represents the marginal rate of substitution between income and the attribute in question, i.e., the mean WTP for a change in the attribute. Further, compensating surplus welfare measures can be obtained for different wetland management scenarios associated with multiple changes in attributes, using the following equation (i.e., equation 5) *(*Birol *et al., 2005*).

Compensating surplus (CS) measures the change in income that would make an individual indifferent between the initial (lower environmental quality) and subsequent situations (improved environmental quality). This change in income reflects the individual's willingness to pay (WTP) to obtain an improvement in environmental quality (Freeman, 1993)

$$compensating\ surplus = -(V^0 - V^1) / \beta_m \text{----------} \quad \textbf{(5)}$$

Where, V_0 and V_1 represent the initial and subsequent utility states respectively and β_m is the coefficient of the monetary attribute.

3.2 Survey Construction Data Collection and Design Issues

3.2.1. Description of the study wetlands

The study wetlands are located in Jimma town, in southwestern part of Ethiopia. Jimma town is the capital and administrative center of the zone, located 335 km away from Addis Ababa. The zone covers a total area of about 18,412.54 km^2, of which Jimma town encompasses an area of 4,623 hectare (46.23 km^2). The population of the zone is around 2 million, of which about 125,569 people live in Jimma town. The town is the largest urban center in the zone. In Jimma Zone**,** rainfall varies between 1,200 and 2,400 mm per annum and the area receives an average annual rainfall of 1,477 mm. The mean annual rainfall in the town is 1450-1800 mm. The average maximum and minimum temperature is 28.8^0C and 11.8 ^{0}C respectively. The population density is 138.5 persons per km^2. Latitude in the zone varies from 880 to 3,340 m a.s.l., and altitude within the town boundary ranges from the lowest 1700 m a.s.l. (Kitto, airfield) to the highest 2010 m a.s.l (Jiren, abajifar palace). It is within these geographic location and altitudes that Jimma valley bottom wetlands, dominated by marshes and swamps, are found (CSA, 2005; Desta and Mengistou, 2009).

The present study was conducted in two preferentially selected wetland sites about 8-10 km from the center of Jimma town. The town is located at 07^0 40' N and 36^0 60 'E. Both the study sites are found in the periphery of Jimma town extending from the area of airfield (Kitto wetland) to the outskirt of Addis Ababa road (Boye wetland) and they are interconnected wetlands. Boye is located in the east while Kitto is in the south of the center of Jimma town. However, there is no available data indicating the total area coverage of the two sites. The two studied sites are on areas of flat lands surrounded by small hills having dominant vegetation of Typha grasses, eucalypt plantation (*Eucalyptus grandis*) and some other plant species. With regard to wildlife in the study sites, Hippopotamuses are found in Boye wetland while Reedbuck (Bohor) can be seen regularly on Kitto site around the airfield. 24 bird species comprising 1,517 individuals were also recorded. Boye wetland contained significantly a greater number of species than the kitto site. Indeed, of the species detected, the highest numbers of bird species across the sites were recorded at Boye site (54.8%) compared to 45.2% in Kitto site.

But, three species such as sacred ibis (*Threskiornis aethiopia*), yellow-billed egret (*Egretta intermidia*) and cattle egret (*Bubulcus ibis*) were about 1.2-2.9 times higher in Kitto than Boye site.

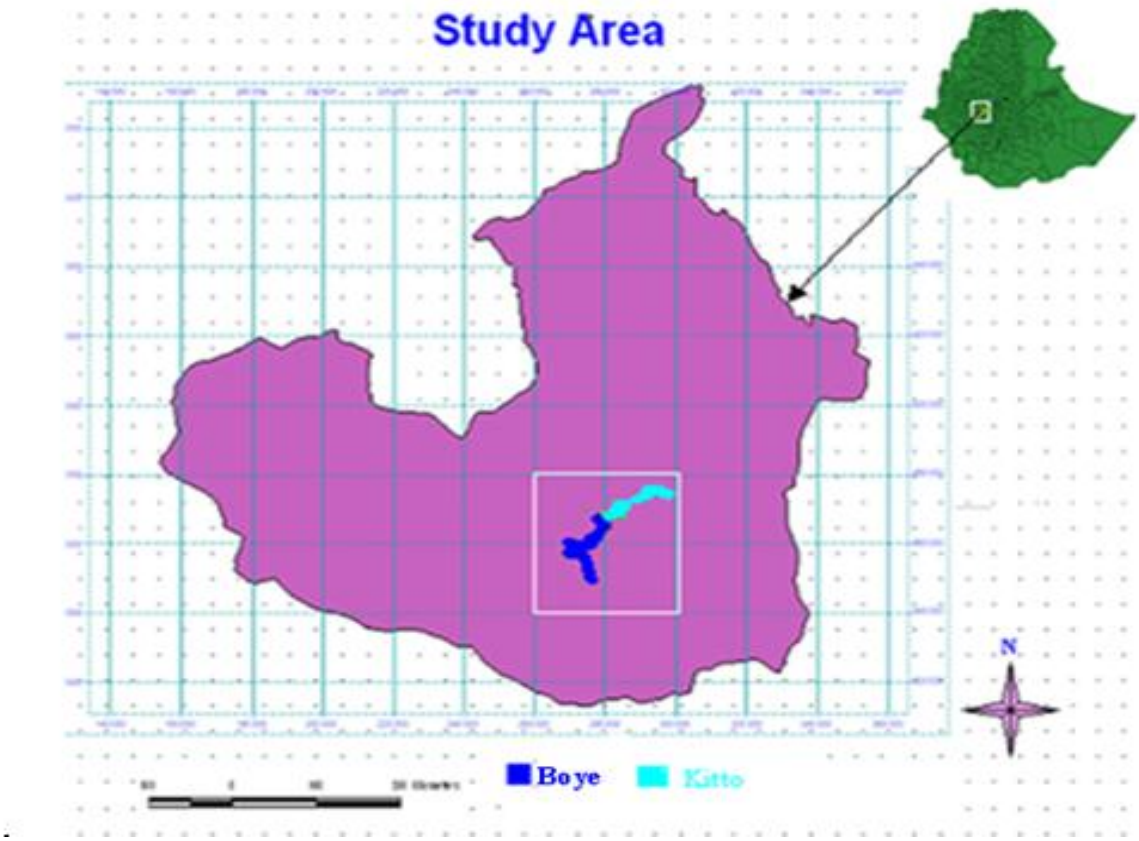

Figure 1. Map of Jimma and the study sites within it
(*Adopted from:* Desta and Mengistou, 2009)

The sites are unprotected with regard to conservation issues. The major challenges in the areas leading to the degradation of the environment are the expansion of farmlands at the expense of forestlands and wetlands. There are also small-scale industries in the areas producing bricks for which clay soils are dug up here and there from the wetland areas aggravating land degradation, and also deforestation because of the large amount of fuel wood demand for these small-scale industries and the down dwellers (Desta and Mengistou, 2009).

3.2.2. Data source and type

The data sources for this study were based on primary data collected from 120 randomly selected households. The study adopted a random sampling framework; which was based on two nearby kebeles. The first one is Bocho-Bore kebele which is found at the outskirt of Addis Ababa road around Boye wetlands. The second one is Bosa-Kitto kebele which is found in the periphery of Kitto wetland near to the area of airfield. The choice experiment therefore concerns Boye and Kitto wetlands and the surrounding communities. The survey was administered using a face to face (in-person) interview. Interviewers[1] were supervised by the researcher. Before the main survey interviewers were trained carefully on how they approach the problem to the respondents, explain the whole scenario and the attributes and their levels to be used in the survey.

3.2.3. Preliminary decisions

Description of the development of a choice experiment, which is applicable to all types of stated preference surveys is given by Ryan *et al.* (1997), Hanley *et al.* (2001), and Birol *et al.* (2005) and all of them identified the following stages:(i) selection of attributes and assignment of corresponding levels, (ii) construction of the choice sets by combining the attribute levels in each of the alternatives, (iii) collection of responses and (iv) econometric analysis of data. The details of the process that enabled the selection of the attributes and attribute levels, experimental design, and sampling design used in this choice experiment are also reported in great detail in Birol and Das (2010). Here we summarized these steps for this study. The first stage consists of identifying the relevant attributes and their corresponding levels to be valued. This is usually done through literature reviews, consulting experts and focus groups discussions. Following an extensive literature review of existing valuation studies and the specific issues pertaining to these wetlands, the relevant wetland management attributes were identified in consultation with natural resource management experts at Jimma University and environmental economists from Addis Ababa University. Then, focus group discussion and key informant interview were conducted to avoid the problems of bias that harm the credibility of valuations and to gain insights about the issues of interest.

During focus group discussion 10 individuals were participated from Jimma university natural resource management department, experts from Jimma zone agricultural and rural development office, local NGOs, kebele executives, community leaders, development agents and local households from two Kebles. To keep the session on track and allow the respondents to talk freely and spontaneously, the discussion guide was prepared that lists the main topics or themes to be covered in the session. The discussion was structured around these key themes using the probe questions prepared in advance. During focus group discussion participants were given the opportunity to express their thoughts and feelings using the probe questions. We kept to the minimum number of items in the guide to leave enough time for in depth discussion.

The probe questions were listed in logical sequence, and the respondents were free to express their views on each of the topics. The probe questions were open-ended to give the participants opportunities to express their thoughts and feelings based on their specific situations. This method allowed the required information to be gathered in a relaxed and informal atmosphere. In return, participants appeared to enjoy their time and many felt they had learned something new.

Due to rapid development activities right on the wetlands, the precious environmental resources, particularly the biodiversity is severely affected and being lost. Thus, the majority of the participants were contracted in its management. Although biodiversity degradation was a concern, comments were focused on anthropogenic impacts on water quality. The impact of development on water quality was something everyone could see and all were concerned about. Participants were not anti development but there had been rapid development in recent year's right on the wetlands. All but two participants had lived in the area long enough to have seen the changes. In particular they had seen the decline in the water quality and subsequent lose of species diversity. Biodiversity and water quality improvement were then the main issues that kept being raised and all were concerned about.

During focus group discussion the following key points were acknowledged: the type and number of attributes, the number of levels to allow each attribute to take, what these levels should be, how both levels and attributes should be describe, the way in which each household would pay for the improvement (the payment vehicle) and every critical points were also raised and discussed. After focus group sessions, the second step was key informant interview on a few purposely selected individual (key informants) who can provide detailed information and opinion based on his/her knowledge on the issue of interest. The key informant interview with ten inhabitants who have specialized knowledge about the issues was used in providing information that supplements or clarifies what we had learned from focus group discussion (Appendix A). Finally the last version of choice experiment household interview questionnaire designed in light of the practical experience gained from focus group discussion and key informants interview. The actual survey implementation was conducted inJanuary/2011.

3.2.4. Defining attributes and levels

Clearly choosing the attributes to be included in the choice set is a task of crucial importance. First, the attributes included in the experiment should, in one way or another, be relevant for the policy making process (Hanley *et al*., 2001). For example, fish stock is one of the attribute we have identified and used in the study . The fish stock has declined because of over fishing, illegal instruments used by fishermen and other factors like chemicals discharged from the municipality. In this regard protecting the endangered fish species and enhancing the stock is likely to be a highly relevant attribute. The underlying criterion in the selection of each of the attributes was that each attributes associated with separate and distinctive management strategy. There are fishing ponds in the study wetland designed to produce fish couple of decades. Thus fish stock enhancement at maximum and average fish holding capacity of the ponds were selected as high and medium management strategies respectively. This measure is important for uphold the fish population and productivity of the wetlands. Consequently, the local communities in particular and the town peoples in general will be beneficial from such program (the way the attributes are selected has been explained in detail in section 3.2.3).

Water purification was another highly relevant attribute as well. Water drainage and pollution due to run-off from the municipality have adverse effects on water quantity and quality of these wetlands. These in turn affect the level of biodiversity that the wetlands able to support. Establishing buffer strip with sedge meadow helps to improve the wetlands water quality through reducing silt and sedimentation into the wetlands and pollution from chemicals such as pesticides and herbicides applied to neighboring fields. Establishing buffer strip with sedge meadow also increases the available habitat size. Thus, species diversity will increase, which leads to healthier, more vibrant ecological communities. Moreover, having buffer strip surrounding the wetlands increases open water surface area and the scenic view of the wetlands. This intern increases the attractiveness of the area to tourists/visitors and hence other employment opportunities will be created. The attributes and their levels are briefly described below in Table 2.

Table 2. Attributes and attribute levels

Attributes	**Description**	**Levels**
Fish abundance/stock	The program rehabilitates and improves the condition and the level of abundance for adaptable fish species.	**Low**, medium, high(maximum fish stock holding capacity)
Water purification	It is possible to establish buffer strip with sedge meadow horizontally from the edge of the wetlands in order to reduce siltation into the wetlands, restore habitat, improving the scenic view and encourage ecotourism.	**Deteriorate:** Overwhelmed by outside inputs and results in inability to trap nutrients and sediments. Establishing buffer strip with sedge meadows at swath of 50, 75, and 100 feet.
One of payment	A one-off payment for Boye/ Kitto wetland management Fund.	3 payment levels: **0**, 15, 25 and 35 ETB.

Note: bold levels are the current situation (Baseline/status quo level)

As water quality improvement strategy, establishing buffer strip with sedge meadow was selected. Because of the degraded cover of the wetlands surrounding, the wetlands become highly susceptible for sedimentation, which in turn affects the depth of the wetlands. There are a number of alternative approaches for setting the buffer distance usually defined in feet measured horizontally from the edge of the defined wetland. Many ordinances simply prescribe a fixed buffer distance for all wetlands subject to the ordinance (*e.g.*, 75 feet or 100 feet). Others vary the prescribed distance depending upon the type of wetland or the quality of wetland from which the buffer is extended (*e.g.*, 75 feet from least vulnerable wetland type; 100 feet from most vulnerable) (James *et al.,* 2008).

According to James et al. (2008), Buffers of less than 50 feet were more susceptible to degradation by human disturbance and no buffers of 25 feet or less were functioning to reduce disturbance to the adjacent wetland. James concluded that buffers of 50 feet and above showed fewer signs of human disturbance and the effectiveness of buffers to protect adjacent wetlands are increased when buffers are larger and vegetated. James also found that much of the sediment and nutrient removal may occur within the first 15-30 feet of the buffer, but buffers of 30-100 feet or more will remove pollutants more consistently. Thus, considering the type and intensity of the surrounding land uses, establishing buffer strip with sedge meadows at swath of 50, 75, or 100 feet were selected as plausible water quality improvement management strategies and acknowledged during focus group discussion. This allows sediment and nutrients to settle before the water drains to the wetland and improve the quality of water& enhance the biodiversity of the wetlands.

The third attribute included in the choice experiment was a monetary one, which was required to estimate welfare changes. The payment levels which used were 15, 25 and 35 ETB. Assigning these appropriate cost attributes levels were a difficult task. To the best of our knowledge, no economic valuation studies have been applied on these urban wetlands to take them as a reference. Thus, the levels of the monetary attributes and the payment vehicle used in the CE were determined through extensive literature review of previous similar valuation studies, focus group discussion and key informant interview.

3.2.5. The Development and the design of the questionnaire

The questionnaire consisted of two parts; one with questions about socio demographic characteristics such as age, gender, educational level, professional status, income and other factors. The second section is the choice experiment, in this section attempt was made to make the choice sets clear to the respondents. Finally, one with debriefing question, this is question which sometimes known as follow-up question. It comes immediately after the choice set questions and designed to explore the motivations behind respondents' choices. In particular, these follow-up question targeted at picking up any response irregularity such as Lexicographic preferences (respondents always choose the alternative with the highest level of one attribute, or the lowest cost, or appear always to choose on the basis of a single characteristics of the task) (Bennett and Blamey, 2001; Alpizar *et al.*,2003).

Poor design of a stated preference questionnaire can result in interpretation of the question in a number of different ways (Carlsson *et al*., 2005). Through the complexity of choice experiment and careful questionnaire design strategic behavior problems were attempted to address. The study recognized plausibility of the scenarios as an important factor for improving the incentive compatibility of the study. To control lack of plausibility, improvements were presented in the questionnaire that seems to be fully achievable in the eyes of the respondents. The descriptions of the attributes were adequate and their provisions were plausible, not to make it difficult for respondents to identify the relevant scope.

According to Carlsson *et al*. (2005) the unfamiliarity with a good can influence WTP and leads to a high systematically biased estimate. To address the issue of preference uncertainty, respondents were necessarily checked whether they are familiar with goods (wetlands under study) or not during focus group discussion and verified with key informants interview.
To avoid people's motivation by ethical or moral grounds, during interview the enumerator tried to inform respondents to make meaningful tradeoffs based on what the attributes are really worth to them only. The questionnaire was also designed to ensure respondents considered it to be consequential.

Respondents were ensured of the importance of the study and its further use in the decision making process. Therefore, the respondents viewed their choices as potentially influencing the decisions. Moreover, in the questionnaire critical details were not missed or too many details were not presented (Appendix B).

3.2.6. Designing the choice experiment

Experimental design deals with how to create choice sets in an efficient way. i.e., how to combine attribute levels into alternatives and choice sets. Orthogonal design, the most common approach in economic applications, in which the levels of the attributes of the different alternatives are uncorrelated in the choice sets, is used. The creation of the alternatives to be used in the choice sets was the first phase of the creation of an experimental design. The second phase was the combining of alternatives together to form the complete choice set. Commonly, choice sets comprise a constant base or status quo option that stays the same across all choice sets and two or more alternatives that involve varying attribute levels. The number of wetlands environment improvement scenarios that can be generated from 3 attributes, 2 with 3 levels and 1 with 2 levels, is $3^2*2=18$ combinations. From the point of view of maximizing the amount of information, it would be desirable if all individuals could face possible attribute levels combinations according to their preferences. However, this would be too cognitively as well as time consuming, so the cognitive nature of the choice experiment thus needs to be reduced. According to Louviere *et al.* (2000) when designing the choice sets for a choice experiment, the aim is to ensure that all different attributes can be estimated independently of each other. On the other hand it is unrealistic to assume that respondents will carry out a high number of choices. Thus, to manage this trade off, a fractional factorial design was used. After reducing identical combinations and combinations that seemed unreasonable, 9 alternatives remained. Afterwards, the profiles (alternatives) identified were then carefully grouped into choice sets to be presented to respondents. The final version of the questionnaire had 6 choice sets, each formed by the status quo plus two management alternatives. Respondents were asked to choose their preferred alternative, i.e. the alternative yielding the highest utility to them. In each choice sets respondents were asked to choose between three alternatives.

The first alternative was the base alternative (status quo), in which there would be no improvements to the wetland area, at no cost. The two other alternatives implied improvements to the wetland area. Individuals' preferences were revealed by their choices. Appendix B, section-2, presents the choice sets used in the valuation exercise.

3.2.7. Framing the payment vehicle

The payment vehicle is a crucial component of the choice experiment design and the way in which it is presented to respondents can affect their choice selection. To select a payment vehicle, three criteria were used: a good coverage, acceptability and feasibility. A good coverage means that the payment vehicle should have applicability and relevance across the studied population. Acceptability means that the payment vehicle should be widely acceptable to the respondents. Feasibility means that it is not too costly and complicated to implement in reality. Focus group discussion participants were argued on the proposed payment vehicles. Participant remarked that water rates would not be an appropriate payment vehicle as not all households pay water rates in the study sites. It was therefore decided and consensus was then reached that electricity charge which would be collected by the government in the rates bill would best suit these criteria. For non-home owners, the charge would flow through as higher rent payments. Among other proposed payment vehicles of water bills, income taxes and land levy, electricity bill was believed to be superior because of its broad coverage and high degree of compulsion. This is a realistic frame to overcome any potential hypothetical bias, because people do not have objections to this payment method and trust the State Government to spend the charge as stated.

CHAPTER FOUR

4. EMPIRICAL RESULTS AND DISCUSSION

4.1. Sample Households' Socio Economic Characteristics and Status of Wetlands

4.1.1 Demographic information of the sample households

In Table 4 below, the descriptive statistics of the sample households' used in the estimations are presented. The average family size for the sample respondents is about five members per household. However, it ranged from one to eleven. This high family size may be due to the fact that most of the households are married. The socio demographic survey result indicates that about 90 percent of the interviewed head of households are married male and they are predominantly Oromo people.

In terms of education, it was found that nearly 24.2% of the interviewed heads of households had no schooling, of which 37.9% of the heads of households were illiterate, and the rest 62.1% could only read and write. 29.2% of the interviewed heads of households had primary education (1-8 grade) while 26.6 had access to secondary education (9-12 grade) and 20 % had college diploma/ university degree. There were prominent differences in primary occupation across sample households. 35 % farmers, 34.2 % governmental and private employee and, 30 % are private business man /petty tread/. With regard to religion composition, the area appears to be quite diverse. Large Proportion of the heads of households who were covered by the questionnaire survey were Muslims (46.6%), followed by Orthodox Christian and Protestant believers with 43.3% and 10%, respectively.

Table 3. Descriptive statistics on demographic information of the sample households

Variable	Mean	Std.Dev	Minimum	Maximum
AGE	45.1250	10.38305	28.00	75.00
FAMS	5.5667	2.11729	1.00	11.00
RESTIME	18.2750	10.20213	2.00	40.00
DEPCH	2.7667	1.54883	0.00	6.00
EMPLOYED	0.7250	1.04490	0.00	4.00

Source: Own survey data, 2010/11

When interviewed for how long years they have been in their respective wetland areas 9.2% of the heads of households answered about 2 to 6 years, and more than 80% of the heads of the households who were covered by the questionnaire survey were living for more than 6 years. According to their response, nearly half of the households are local, in the sense that the heads of households were born in the areas concerned and hence felt the problems of the wetlands ecosystem in general. This may be one indicator for them to support the improvement plans relative to continue current situation. According to the survey results, all of the households are males. The maximum and minimum annual household incomes are 80,000 and 1700 ETB respectively. Average annual household income is 12,000 ETB. This income level is adjusted to include incomes from all other sources as reported by the respondents.

4.1.2. Socio-economic profiles of sample households

It is being observed in Jimma zone that people away from the wetland areas are allotting their land to coffee and chat production to meet their cash needs through selling rather than producing food crops. Nevertheless, farmers in the wetland areas are also poor that they are allotting wetlands to crop production to try to meet their cash needs. Though considerable proportion of households found to be dependent on farming, maize is the only annual agricultural outputs. The product is entirely used to serve at household level even without satisfying the households demand.

As shown below in Table 4, households' land holding by category, considerable proportion of the households (40 %) have annual cropland, and 60% do not have annual croplands. With regard to the perennial cropland holding, the majority of households (79.2%) do not have land in this category. However, 20.8 % of households have perennial cropland. The majority of households that do not have land among the stated land categories belong to the wood land (96.7%).Only 3.3% of the households have wood land dominated by eucalyptus. 17.5 % of households accounted for landholding in the wetlands, The result also shows land holding size among the different land category types. All of the respondents had land holding size between 0.1 and 1.0 ha.

Table 4. Land holdings of sample households

Land size(ha)	Annual cropland	Perennial Cropland	Wood Land	Landholding in the wetland
0 (landless)	72 (60%)	95 (79.2%)	116 (96.7%)	99 (82.5%)
≤1 .0	48(40%)	25 (20.8%)	4 (3.3%)	21 (17.5%)
Total	120 (100%)	120 (100%)	120 (100%)	120 (100%)

Source: Own survey data, 2010/11

With regard to livestock ownership, the result revealed that the number of livestock in a household ranges from zero (have no livestock) to eight. Oxen are one of the most important assets for farmers in this country as they play a crucial role in the agricultural activities. However, nearly 82.5% of the heads of households covered by the questionnaire survey reported that they had no oxen. The survey result therefore suggests that shortage of farm oxen is acute among households. This indicates that human labor predominate the agricultural activities of the majority of the households. This fact could also be associated with the small size land holding of the majority of the households. In general, as can be observed from the table 5, it is possible to infer that the economic contribution of the livestock to the surveyed households is very low.

Table 5. Livestock holdings of sample households

Livestock type	No. owned	No. not owned	Mean	Std. Deviation	Minimum	Maximum
	Frequency (%)	Frequency (%)				
Oxen	21 (17.5)	99(82.5)	0.3417	0.78318	0.00	3.00
Cows	26 (21.7)	94(78.3)	0.5250	1.20198	0.00	7.00
Calves	8 (6.7)	112(93.3)	0.2583	1.09618	0.00	8.00
heifer	8 (6.7)	112(93.3)	0.0917	0.36658	0.00	2.00
young bulls	10 (8.3)	110(91.7)	0.1417	0.49017	0.00	2.00
sheep	6 (5)	114(95)	0.1500	0.72934	0.00	5.00

Source: Own survey data, 2010/11

This clearly indicate that the large majority of grazing cattle found in and around the wetlands concerned did not belong to the residents in the area rather belonging to people from Jimma town. This could also strengthen the fact that the households in particular and the surrounding people in general are economically poor.

When asked how frequently they took the livestock to the surrounding wetlands for grazing, nearly all of the livestock owners reported that they take them every day. This showed that livestock rearing is entirely dependent on the wetlands under study as they are the main source of grasses and water. The evidences of this study suggested that wetland in the region serve the needs of the people in one-way or other at various levels (individuals, family, community, and village). This is because 17.5% of the households covered by the questionnaire survey stated that they had livelihood directly linked to the wetlands. Thereby, which their livelihood is linked to the wetlands is perceived in many ways. For instance, of the 17.5 % of households it was found that 50% of the respondents were engaged in cultivation of crops using water from the wetlands mainly for subsistence reason. However, a large majority of them (78.38%) was found engaged in daily collection of grasses from the wetlands. According to the survey great majorities, above average of the respondents (56.8%) are Government / Private Employee, 17.5% are farmers mainly engaged in crop production and 26.7% are Private Businessman.

In addition to these it was found out during the survey that some of the households: decompose reeds to use as an input for soil fertility, use reeds for seed bed preparation and making mattress for selling and household demand, use wetland soils, reeds and water for making bricks and potteries, use reeds for house roofing, use water from the wetlands for household purposes except drinking and for enjoying the view of the wetlands.

When asked whether or not there are disadvantages of living around the wetlands, 100% of the households reported that there are disadvantages, of which according to their responses, malaria infection took the largest share (93.3%). Malaria is severe health problems around Boye and Kitto areas. This was proved to be true in the macro invertebrates sampling study by Desta and Mengistou (2009) where the presence of mosquitoes was detected in the areas. Moreover, as to personal communication with Jimma health center officials, it is true that people living around the wetlands are highly at risk for malaria infection as there are no prevention efforts being implemented or put in practice to alleviate the problems. As result of which the people around are being enforced to spend their limited income for malaria treatments. Next to malaria, 12.5 % of the households reported that their areas were highly susceptible to cattle disease locally known as *''Gubet Beshita''*, which means to say liver disease. And also 10.83 % of the respondents particularly in Boye area reported that their farmlands were affected by rising water level during the rainy season (mainly in July and august). Besides the stated disadvantages, the households also mentioned that bad smell of wetland in rainy season (particularly mentioned in Boye site) and *Bilharzia* disease (*Schistsoma*) were among the major disadvantages associated with the wetlands.

Having mentioned the disadvantages they are facing, the heads of households were also asked how often they go to the wetlands, and 17.5% replied that their family members go to the wetlands frequently and 57.5 % said that their family members rarely go to the wetlands for various reasons mainly for recreation. However, when compared which household members are mostly associated with activities undertaken in and around the wetlands, women took the largest share (29.2) (Table 6). This survey result therefore indicates that each member of the households were subject to activities in and around the wetlands in one-way or another.

Table 6. Association of family member to activities in and around wetlands

Family members	Numbers of households	%
Men	14	11.7
Women	34	28.3
Children	11	9.2
Whole family	10	8.3
I don't realize	51	42.5
Total	120	100

Source: Own survey data, 2010/11

4.1.3. Conditions of wetlands

Human activities in the catchments are expected to pose undesirable impacts on wetlands. Various kinds of human activities, for instance settlement, grass and reed collection, grazing, brick production, agriculture etc., are taking place in and around the wetlands concerned. For instance, according to personal communication with the local dwellers, let alone the illegal ones, there were 15 legally organized small-scale brick producers' associations till the end of this study. All of these have been working in the wetland catchments posing environmentally bad impacts such as deforestation and siltation in the wetlands. When the households were asked as to how they evaluated the status of the wetlands in their lifetime, 17.5 % of the households stated that the wetlands were expanding in size. When assessed their understanding with respect to the possible causes of the expansion, nearly 46 % cited the construction of dam on the out flow of Boye wetland, around 25 % said the increase in the amount of rain in the areas while another 29 % did not know the reason behind the expansion. 23.3 % of the households stated that the wetlands were expanding during wet season and shrinking in dry season while 52.5% of the households evaluated the wetlands as being shrinking. When asked the causes behind shrinking, the possible causes provided all of the respondents (100%) were the expansion of urbanization, the increase in agricultural activity and expansion of brick making. The remaining 6.7 % of the households surveyed said that they would not detect any

change on the wetlands in their lifetime. In assessing the conditions of wetlands, households were also asked whether they fear that wetlands in their surrounding may one day disappear or not. The majority of the households (78.3 %) said that the wetlands would disappear one day in the future as the result of human's demand for the expansion of arable lands and settlements. However, nearly 15% of the respondents had no fear. In general, as stated above the majority of households had no education background. This low level educational background of households might aggravate the unwise use of the wetlands, and might also influence their understanding of the current status of the wetlands due to impacts as a result of human activities.

4.1.4. Wetland management and conservation issues

During this study, it was also understood that there were no any local mechanisms in place to conserve the natural resources in general and the wetlands in particular in the areas studied. This is an indication that conservation of natural resources has not been given due emphasis in area. However, when the households were asked whom they think should be responsible for managing the wetlands, the highest percentage of households (64.47 %) rated the government as the most responsible body while 21.05 % of the households rated the local community, and 14.47 % rated both the local community and the government together as the most responsible bodies. However, it was understood from the survey that all of the households (100 %) had not seen or heard about any of the government effort to manage the wetlands and the natural resources as a whole in their respective localities.

4.1.5. Analysis of debriefings

Results of the debriefing questions showed (Table 7) that as many as 42.5 % of the households always choose the cheapest alternative. The second most chosen alternative was aggressive rehabilitation program, 25.8 % of the households indicated that they could pay the higher payment, if both the attributes, 'fish stock' and 'water purification', to be attained the highest level.

In other words, they are willing to pay the stated amount for the aggressive rehabilitation alternative [2] of the wetlands environment. About 24.2 % of the households expressed a wish to have both the attributes to be of a higher level but they could not afford it. 7.5 %of the households choose only the alternative that gave them 'high' fish stock. It can be seen from the analysis of the debriefing responses that respondents also have a lexicographic answering pattern. This kind of respondents always picked up that alternative that was better in just one of the attributes; the result shows an answering pattern that is characterized by always choosing for 'high' level of fish and only the alternative with lower price level.

Table 7. Results of the debriefing question

Attitudinal variable	***%***
I found the fish stock is important and choose exclusively such attribute in the alternatives.	7.5
I exclusively choose the cheapest alternative (an alternative with lower price level).	42.5
I wish I could pay more for the aggressive rehabilitation program, but I cannot afford it.	24.2
I found water purification is important and choose such attribute in the alternatives.	-
I choose the aggressive rehabilitation program (both attributes).	25.8

[2] The study specified the choice set that has both attributes of a higher level as aggressive rehabilitation alternative.

4.2. Econometric Models

Two different regression models (logistic regression model and ordered logistic regression model) were executed using the data collected from the actual survey. The first model is a basic specification which shows the importance of the choice set attributes in explaining respondents preferences for the three different wetland environment rehabilitation scenarios/options: *Continue with the current situation (status quo option)* and improving the environmental quality of the wetlands in terms of its attributes *(fish stock, water purification).* The second model incorporates interactions of the socio-economic variables with the attributes selected. The attributes used in the estimation are listed below in Table 8.

Table 8. Definition of variables

Variables	Definition
ASC	Alternative specific constant taking the value of one for scenario 1 and scenario 2 and zero for status quo scenario.
FISH	Level of fish stock to be enhanced.
WATER	Width of buffer strip to be planted surrounding the wetlands for water purification (feet).
PAYMENT	One-off payment for Boye/ Kitto wetlands management fund (ETB).
INC	Respondent's mean annual income in the year 2009/10 G.C. (ETB).
EDU	Respondent's education level(in years)
LIH	Livestock holding (in number)
LHIAW	Land holding in and around the wetlands(in number)
AGE	Respondent's age (in years)
DEPCH	No. of dependant children in the family(in number)
EMPLOYED	Above 18 years gain fully employed family member(in number)
RESTIME	Resident time of the respondents (in years)

[1] They are three in number and all are post graduate students at Jimma University.

Model 1:

There are three expected indirect utility functions, each presenting the utility generated by the respective rehabilitation scenarios/options. Scenario 3 is the status quo, while scenarios 1 and 2 involve an improvement in environmental attributes, relative to the status quo scenarios 3. The utility for each of the functions is determined by the level of attributes in the choice sets: The choice experiment was designed with the assumption that the observable utility function would follow a strictly additive form. The model was specified so that the probability of selecting a particular wetlands rehabilitation scenario/option was a function of attributes of that alternative scenario and of the alternative specific constant.

$$V_i = ASC + \beta_1 \text{FISH} + \beta_2 \text{WATER} + \beta_3 \text{PAYMENT} \quad \text{(6)}$$

For *i* =1, 2, 3 and where *ASC* =0 for the status quo and 1 for scenario/option 1 and 2, or more specifically the three indirect utility functions can be represented as,

$$V_1 = ASC_1 + \beta_{fish} \text{FISH} + \beta_{water} \text{WATER} + \beta_{payment} \text{PAYMENT} \quad \text{(7)}$$

$$V_2 = ASC_2 + \beta_{fish} \text{FISH} + \beta_{water} \text{WATER} + \beta_{payment} \text{PAYMENT} \quad \text{(8)}$$

$$V_3 = \beta_{fish} \text{FISH} + \beta_{water} \text{WATER} + \beta_{payment} \text{PAYMENT} \quad \text{(9)}$$

The β values (β *fish*, β *water*, and β *payment)* are the coefficients associated with each of the attributes FISH, WATER and PAYMENT respectively. There are two alternative specific constants (ASC1 and ASC2) in this model for improvement scenario/option 1, and 2. The alternative specific constants for option 1 and 2 is constrained to be equal because an experimental design that was close to orthogonal were used to develop the choice sets and hence we included one common alternative specific intercept for the two alternatives that imply changes (Bennett and Blamey ,2001; Carlson *et al.,* 2003). These constants can be thought of as representing all other determinants of utility for each option not captured by the attributes.

They are not related to specific attributes so they can not easily be used to predict the effects of changes due to changes in attributes. ASCs do however improve the overall model performance and should therefore be included in the estimation (Adamowicz *et al.,* 1998). Before turning to the results that includes only the three attributes including the monetary attribute 'payment' and 'alternative specific constant'(ASCs) , it is worth noting that in the survey almost all the respondents answered the choice questions. None of the respondents choose the current situation (status quo option scenario) indicating that they want a policy change. There were only two utility functions derived, thus the survey result was modeled through logistic regression model.

Model 2:

It is assumed that some socio-economic variables influence individual's intentions and behavior. To introduce respondents' heterogeneity (i.e., differences between the individual respondents), some of the socioeconomic variables (EDU, FAMS and INC) interacted with the attributes. Since the response categories (attributes) are naturally ordered, ordered logistic regression model was satisfactory (William and David, 2009)**.** This interaction attempted to capture how the variables modify the effects of attributes on the probability of choice.

4.3. Discussion of Models Results

Using 720 choices elicited from 120 respondents (120 respondents * 6 choice sets), a logistic regression with linear specification and ordered logistic regression models were estimated using STATA version 10. The data was coded according to the levels of the attributes. We have three attributes: For fish stock, we have high level coded as 2 and medium level was coded as 1.The levels for water purification attribute (100 feet, 75 feet and 50 feet) and the payment (15, 25, and 35), i.e. the cost attribute were entered in cardinal-linear form. The alternative specific constants (ASC) were equal to 1 when both rehabilitation/improvement scenario 1 or 2 was selected.

Earlier than conducting the model analysis multicolliniarity[3] among the explanatory variables was checked, so that the parameter estimates did not seriously affected by the existence of multicolliniarity among variables. In order to see the degree of association among the variables the technique of variance inflation factor (VIF) was used and the value of VIF for the variables were less than 10, indicating that the data has no serious problem of multicolliniarity (Gujarati, 2004). Hence the variables were approved to enter the analysis.

[3]*Multicollinearity in the logistic regression solution is also detected by examining the standard errors for the β coefficients. A standard error larger than 2.0 indicates multicollinearity among the independent variables. None of the independent variables in this analysis had a standard error larger than 2.0 (Hosmer and Lemeshow, 2000).*

Regarding the logistic regression (model 1) estimates presented below in Table 9, the two environmental attributes (fish and water purification) have the expected positive signs and all the coefficients of the attributes are statistically significant at 1% significance level except payment attributes. Estimated coefficients of the attribute with a positive sign imply that a change from the status quo option to the corresponding attribute increases the probability of choosing improvement option over the status quo. i.e., the positive sign of the coefficient for the fish and water purification attributes indicates that an increase in their levels considered being an improvement of the wetlands environmental quality. In other words, the respondent's value wetlands improvement scenarios (the dependent variables) which result in more fish stock and wider buffer strip with sedge meadows. The payment attribute is surprisingly insignificant and had no effect on utility of choosing a choice set, maybe because both rich and poor households has a similar preference on improvements of wetland attributes regardless of the payment level. This could also strengthen the fact that none of the respondents choose the current situation (status quo option scenario).

Table 9. Results of logistic regression model

Variable	Coefficients	Standard errors
ASC	0.00	0.00
FISH	1.258588	0.2105916 ***
WATER	0.0512828	0.0054197***
PAYMENT	-0.2492851	0.4071539 ns
Summary Statistics		
Log likelihood	-376.1868	
Pseudo ρ^2	0.2444	
Number of Observations	720	

Source: own computation, 2010/11

***significance level at 1 percent ($p<0.01$)

ns- none significance

The McFadden's ρ2 value in logistic regression outcomes is similar to R^2 in conventional analysis, except that the significance occurs at lower levels. Hensher and Johnson (1981) comment that values of ρ^2 between 0.2 and 0.4 are considered to be extremely good fits. According to this criterion the overall fit of the model (0.2444) indicates extremely good fit, and the coefficients are statistically significant and intuitively correct except payment.

To capture how a socio economic characteristic of the respondents modifies the effects of attributes on the probability of choice some of the socioeconomic variables were associated with the attributes to see the main effect (model 2). In the following three ordered logit regressions models, the likelihood ratio chi-square (LR chi2(2)) with a p-value of $p<0.01$ tells us that our models as a whole are statistically significant, as compared to model with no predictors. The pseudo-R-squared is also given. This is McFadden's pseudo R-squared. Ordered logit model does not have an equivalent to the R-squared that is found in the linear regression model to summarize the overall strength of a given model; however, many people have tried to come up with one. There are a wide variety of pseudo R-squared statistics which can give contradictory conclusions. Because this statistic does not mean what R-squared means in linear regression model, interpreting this statistic is a great caution **(**Bo *et al.,* 2006).

The following three tables (Tabel10, 11 and 12) show the coefficients, their standard errors, the z-test and associated p-values, and the 95% confidence interval of the coefficients. Only EDU is statistically significant ($p<0.01$); INC and FAMS are not. Generally, respondent's educational level is positively associated with the tendency to choose for higher attributes levels (higher fish stock enhancement level; 100 feet buffer strip width and higher (35 ETB) payment level).

Table 10. Ordered logistic regression for fish stock attribute

FISH	Coef.	Std. Err.	z	P>|z	[95% Conf.	Interval]
INC	0.0000113	8.91e-06	1.27	0.204	-6.14e-06	0.0000288
FAMS	0.0285705	0.044642	0.64	0.522	-0.0589263	0.1160673
EDU	0.0655388	0.02214	2.96	0.003	0.0221452	0.1089325
LIH	0.0365407	0.1957579	0.19	0.852	-0.3471376	0 .4202191
LHIAW	0.0450647	0.1972209	0.23	0.819	-0.3414813	0.4316106
/cut1	0.381598	0.3815717			-0.3662689	1.129465

Source: own computation, 2010/11

Log likelihood = -474. 35283 LR chi2(5) = 22.03
Number of obs = 720 Prob > chi2 = 0.0227
Pseudo R2 = 0.0227

Table 11. Ordered logistic regression for water purification attribute

WATER	Coef.	Std. Err.	z	P>|z	[95% Conf.	Interval]
INC	7.35e-06	7.55e-06	0.93	0.351	-7.75e-06	0.0000218
FAMS	0 .0369961	0.0401053	0.92	0.356	-0.0416087	0.115601
EDU	0.0598542	0.0197845	3.03	0.002	0.0210773	0 .0986312
LIH	0.0837175	0.1760888	0.48	0.634	-0.2614102	0 .4288452
LHIAW	0.198767	0.1783364	0.11	0.911	-0.3296562	0 .3694096
/cut1	-0.0843005	0.3432361	0.11	0.911	-0.757031	0.5884299
/cut2	1.101361	0.3457851			0.4236344	1.779087

Source: own computation, 2010/11

Log likelihood = -771.63982 LR chi2(5) = 18.05
Number of obs = 720 Prob > chi2 = 0.0029
Pseudo R2 = 0.0116

Table 12. Ordered logistic regressions for cost attribute (payment)

PAYMENT	Coef.	Std. Err.	z	P>|z	[95% Conf. Interval]	
INC	0.0000139	7.90e-06	1.76	0.078	-1.58e-06	0.0000294
FAMS	-0.0058364	. 0.0502876	-0.12	0.908	-0.1043982	0.0927253
EDU	0.066396	0.0244099	2.72	0.007	0.0185534	0.1142385
LIH	-0.0013085	0.2238301	-0.01	0.995	-0.4400075	0 .4373905
LHIAW	0 .041424	0.2281654	0.18	0.856	-0.4057719	0 .4886199
/cut1	1.61352	0.4361997			0 .7585842	2.468456
/cut2	3.431743	0.4588619			2.532391	4.331096

Source: own computation, 2010/11

Log likelihood = -517.35915 LR chi2(5) = 26.86
Number of obs = 720 Prob > chi2 = 0.0001
Pseudo R2 = 0.0253

As discussed before in section 2.2, determinants of respondents' choice may largely depend on respondents' income, educational level and family size. The above three Tables presents the results of ordered logit estimations which again highlight the importance of education level of respondents' to modify the effects of attributes on the probability of choice. The educational variable is significantly correlated with respondents' choice of attributes. With a higher educational level, the likelihood of choosing the higher attributes level increases, with all of the other variables in the model held constant. On the other hand educated peoples have high levels of environmental concern and are willing to pay for the improvements of the wetlands' attributes at high management levels. This fact could also be in line with the results of several environmental valuation studies, those respondents with higher levels of environmental consciousness, income and education are likely to prefer wetland management scenarios that provide higher levels of the ecological, social and economic wetland attributes(for example, Wikstrom , 2003; Othman et al., 2004 and Birol, Karousakis, and Koundouri 2005).

4.3.1. Estimation of mean willingness to pay

The interpretation of model coefficients is not straightforward except for significance. Therefore, from the parameter estimates, the rate at which respondents are willing to trade off price for changes in any of the other attributes, were calculated, i.e., *the implicit price*. Implicit prices reflect the *marginal rates of substitution* between each attribute and the monetary attribute (Morrison *et al*. 1998). They are calculated as the ratio of the coefficients for the attribute of interest and that of the monetary attribute (see equation 4). The implicit price for *fish* attribute for instance, is the ratio of the *fish* coefficient and the *payment* (price) coefficient. Estimates of Implicit prices (mean willingness to pay) for each of the attributes in the choice sets associated with the model 1 are shown below in Table 13.

Table 13. Estimates of mean willingness to pay (ETB)

Variables	Mean WTP
WTP Fish	5.04
WTP Water purification	2.05

Source: own computation, 2010/11

These implicit prices suggest that, the local households are, on average, willing to pay 5.04 ETB for an improvement in the fish stock and 2.05 ETB for water purification attribute. The mean willingness to pay is higher for '*fish stock*' attribute compared to the '*water purification attribute'*. i.e., respondents gave more value for *fish* than *water purification* attribute.

4.3.2. Welfare measures in choice experiment

A particular strength of choice experiment according to (Adamowicz *et al.*, 1994; Alpizar *et al.*, 2003, and Bennett and Blamey, 2001) is its ability to generate estimates of the values of many different alternatives from the one application. Hence from one set of choice data, the values of an array of alternative ways of reallocating resources were estimated. This feature of choice experiment arises because it specifically investigates trade-offs between attributes.

In order to estimate the respondents' willingness to pay (WTP) for improvements in wetland management over the *status quo*, four possible management options/ scenarios were created. The attribute levels that characterize of alternative wetlands improvement scenarios are listed below in table 14, along with the current situation/ status quo attribute levels.

Table 14. Alternative wetlands improvement scenarios and their attribute levels

Alternative wetlands improvement scenarios	Attribute levels
Status quo scenario/ Current situation/	Fish stock is very low. Buffer strip with sedge meadow is low (degraded landscape).
High impact improvement scenario	Fish stock will be at high level. Buffer strip with sedge meadow at swath of 100 feet to be planted.
Medium impact improvement scenario 1	Fish stock will be at high level. Buffer strip with sedge meadow at swath of 50 feet.
Medium impact improvement scenario 2	Fish stock will be at medium level. Buffer strip with sedge meadow at swath of 75 feet.
Low impact improvement scenario	Fish stock will be at medium level. Buffer strip with sedge meadow at swath of 50 feet to be planted.

Estimates of compensating surplus (CS) are calculated using the above equation (Eq.5), to use this equation to estimate compensating surplus it is first necessary to calculate the utility associated with the current option and the option being considered. Using the model 1, this is achieved by substituting the model coefficients and the attribute levels for the current option. The value of the utility of the alternative option is estimated in a similar way, except that the coefficient for the alternative specific constant is included and the attribute levels associated with the changed scenario are used.

The compensating surplus for the change from the status quo to the new scenario is then estimated by calculating the difference between these two values, and multiplying this by the negative inverse of the coefficient for the *payment* attribute. Estimates of willingness to pay for the three scenarios are presented below in Table 15.

Table 15. Estimates of compensating surplus (CS)

Alternative wetlands improvement scenarios	Mean WTP (ETB)
High impact improvement scenario	18.78
Medium impact improvement scenario 1	39.6
Medium impact improvement scenario 2	17.3
Low impact improvement scenario	-

Source: own computation, 2010/11

The above table shows respondents' mean willingness to pay for a change from the current situation. It can be seen from the estimates that, the CS for the change from the status quo to the scenarios considered increases as we move towards improved environmental conditions of the wetlands. Based on model 1 which has a better fit, mean WTP for medium impact improvement scenario 2 is 17.3 ETB, and under the medium impact improvement scenario 1 as high as 39.6 ETB, whereas greater improvements in conditions of the wetlands under the high impact improvement scenario increases WTP to 18.78 ETB.

Further, the welfare estimates reported in Table 15 for the three wetlands quality improvement scenarios described above are aggregated over the entire sampling frame to determine the total WTP (i.e., total benefits). The sampling frame from which the sample had drawn is 7878 house holds (i.e., total number of house hold in the two Kebles). The total benefits for wetlands quality improvements are reported below in Table 16.

Table 16. Aggregate WTP (ETB)

Alternative wetlands improvement scenarios	Total WTP
High impact improvement scenario	147,948.8 ETB
Medium impact improvement scenario 1	311,968.8 ETB
Medium impact improvement scenario 2	136,289.4 ETB

Source: own computation, 2010/11

The value derived from these wetlands' improvement scenarios is a way to estimate wetland ecosystem benefits to people and allows financial experts to carry out a Cost-Benefit analysis. Cost-Benefit analysis compares the benefits and costs to society of interventions to manage the wetland ecosystems. The results can be used to design socially efficient wetland management approach that maximizes social welfare by using these estimated economic benefits and comparing these to the cost of improving the selected attributes of the wetland. However, this is beyond the scope of this study.

CHAPTER FIVE

5. SUMMERY AND CONCLUSION

Choice experiment is a stated preference technique for the estimation of non-market values. It has some distinct advantages over other techniques such as the CVM that has been more widely applied. Its ability to provide a disaggregated view of values is a key feature. With respondents' preferences broken down into components associated with the attributes that go to make up a good, it is possible to use choice experiment results to investigate the relative importance of attributes and estimate the values associated with various combinations of attribute levels. The purpose of this study was to measure household's valuation of wetland quality improvements taking case of Boye and Kitto wetlands, in particular to analyze how the household's values different environmental attributes associated with the wetlands by employing a choice experiment approach. A combination of the characteristics theory of value and the random utility theory constitutes the theoretical underpinnings for choice experiments. Two different attributes as indicators of the wetland environmental quality were employed. The data is analyzed using specification of logistic regression model. In the survey almost all the respondents answered the choice questions. None of the respondents choose the current situation (status quo option scenario) indicating that they want a strategic change. The analysis showed that the fish stock attribute proved to be generating a higher impact on the utility for the house holds than did the water purification attribute. This was reflected in a higher willingness to pay for fish stock improvement.

Compensating surplus estimates which reflect overall willingness to pay for a change from the status quo to three alternative improvement scenarios were also calculated. The estimate for the high impact improvement scenario was estimated to be 18.78 ETB, for medium impact improvement scenario-1 39.6 ETB and for medium impact improvement scenario-2 it was17.3 ETB. The total benefits derived from these three wetland management scenarios are aggregated over the sampling frame. The net benefit estimates reveal that welfare maximization is achieved under the medium impact improvement scenario-1, which provides higher levels of Fish stock and buffer strip with sedge meadow to be planted at swath of 50 feet.

The relative preference for buffer strip width to be 50 feet is mainly because the wider buffer strips (100 feet) may displace some households who have farm land near to the wetlands. These economic values reflect people's preferences and thus can be used to assist decision-makers by increasing the input from economic valuation in decision-making. This does not imply decisions must be made based on what people want. Other competing interests must be taken into account. Generally, the economic values generated by such wetlands management attributes expressed in monetary terms can serve as an important tool for placing these wetlands on the agenda of management and development decision makers.

Moreover, some of the socio-economic characteristics of the sampled households were interacted with the attributes. These interactions showed how the independent variable, educational level modifies the effects of attributes (fish, water purification and payment) on the probability of choice.

The methodological implication of this study in the context of valuing wetlands quality improvements is that, choice experiment can be successfully applied in developing countries like ours with careful construction of the choice sets and effective field data collection. There is, however, a need to investigate further how stated preference methods can be implemented. In general, this study has shed some light on non-market values of the wetlands. For the first time, these values have been quantified and justify wetland management.

Recommendation

The survey results proved that there are positive and significant economic benefits associated with environmental attributes of the wetlands and local households are willing to pay for improvements in the quality of the wetlands as depicted by the two environmental attributes (stock enhancement of fish and improving water quality). This result has interesting implication in that if local governments introduce wetland management intervention plan that welfare maximization is achieved (medium impact improvement scenario-1), there would be a sustainable and efficient utilization of the resource.

The catchments of the wetlands have been mainly subjected to agriculture, grazing, settlement, harvesting plant material for various purposes, and brick production. It is therefore evident that the general ecosystem of the wetlands is subjected to perturbation due to these human activities. Yet, no follow up activity has been put in place by the responsible bodies to undertake the wise use of the wetland resources for maintaining the ecological balance and biological diversity. This is a good indication of the reduction of the number of hippopotamus at Boye wetland, unless conservation measures are applied, these valuable resources will soon be at risk of degradation or even disappearance. Hence, there should be a mechanism to enhance awareness of resource users and promote participatory resource management system. Training and awareness creation among the users and non users in the area of socio economic and ecological function of wetlands in their natural state should be given priority. This fact could also be in line with the study results that, those households with higher levels of consciousness (education) are likely to prefer wetland management. For instance, zonal environmental protection office should teach resource users and set appropriate guiding on how to utilize the wetland resources.

Future line of the work

- Many households who have not visited these wetlands and never intend to do so may also place high value on the management of these wetlands (existence value).Thus, conducting similar studies with much bigger sample size using many relevant attributes probably would result higher WTP value (i.e., total benefits derived from the wetlands).

- Estimating the total cost of intervention for each wetlands quality improvement scenarios. This can be used to design socially efficient wetland management policies by estimating the cost of improving the different attributes of the wetlands and by comparing these to the benefits they generate.

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APPENDICES

APPENDIX A: FGD GUIDE AND KEY INFORMANT INTERVIEW QUESTIONNAIRE

I. FGD GUIDE

The major discussion points or themes

- Important attributes of wetlands and their respective levels which have greatest interest to survey respondents.

- Monetary attribute which require for estimating welfare changes.

- The payment vehicle, the way in which the respondent is expected to pay for the good (wetlands).

Probe questions

1. Have you realize the existing situation in the wetlands area?

2. What are available myriad goods, services and functions provided by wetlands that affect human welfare?

3. What are your opinions on these attributes which are selected in advance through literature review and in consultation with professionals?

   3.1 Research and educational extraction

   - Research and educational information may be derived from the existence of wetlands. Wetlands visited by researcher and higher education (university) students to learn about ecology and nature.

   3.2 Store of drinking water for cattle and local communities.

   3.3 Support key animal and plant species (biodiversity)

   - The wetlands provide habitat for varied animal communities: invertebrates, reptiles, amphibians, fish and birds. 24 endangered bird species are reported to breed in

these areas. Moreover, the two studied sites are flat lands dominated mainly by Cattail (common name for a tall perennial herb).the leaves are often used for making chair seats, mats, and baskets.

3.4 Open water surface area

- Open water surface area and the natural vistas associated with them are also creates values through feelings of serenity and tranquility. Further open water surface areas provide water quantity required for sustaining the wetland's biodiversity.

3.5 Protecting endangered fish species and enhancing the stock

4. What are other relevant attributes of wetlands that you think?

5. Total number of attributes that can be handled by respondents.

6. Further underlying criterion in the selection of the attributes is identifying a separate and distinct management strategy. Define and discuses on distinct management strategy for preferably selected attributes.

7. What Management levels are realistic and span the range over which respondents can be expected to have preferences.

8. What do you think about the Starting payment (WTP) require for estimating Welfare changes.

9. Discus on the possible types of payment vehicle in which the respondents are expected to pay.

II. KEY INFORMANT INTERVIEW QUESTIONNAIRE

Name of the key Informant _____

Kebele: _____

Involvement in the community_____

1. From your knowledge and experience in the community how do you describe the past and current wetland's scenarios?

2. What are available wetland resources?

3. What are their contributions largely to the socio economic welfare of the communities?

4. Could you describe the livelihood pattern of the communities around the area?

5. And how its provision and availability being affected? Would do you explain the wide range of problems facing wetland ecosystems?

6. Do peoples (the local community) in different groups feel that the wet land has been degrading severely?

7. What suggestions do you have in terms of how we meet these challenges?

8. What attitudes peoples do have toward rehabilitating and preserving the area in its natural state?

9. Very little study was conducted on this wetland; particularly economic value of the wetland remains largely unexplored. Against this backdrop, this study has set objectives focuses on the use of economic value as an incentive for wetland conservation through estimating the value of relevant attributes of the wetlands. What do you think of this idea? Do you have any suggestions that could help us make this happen?

10. Do you have any thoughts or ideas about the relevant wetland attributes and their alternative management strategy or activities that you think would be particularly effective for?

11. What do you think are the greatest obstacles to successfully conducting the study?

12. Why do you feel that way?

13. Is there anyone else in the community that I should speak with about this issue, who may have some ideas?

14. Is there anything important you think I missed?

Thank you

APPENDIX B: QUESTIONNAIRE

SECTION ONE: SOCIOECONOMIC SURVEY

I. Personal Background Information

1. Sex: 1.Male 2. Female
2. Age ____
3. To which ethnic/clan group do you belong?
   1= Oromo 3= Tigre
   2= Amhara 4= other (specify) _____
4. Marital status
   1= Single 3= Divorced 5= Widower
   2=Marred 4= Widowed
5. Household size: Male _____ Female_____ Total_____
6. Number of dependent children in the household _____
7. Excluding yourself (and your spouse), how many people in your household over 18 age gainfully employed? _____
8. Educational level _____ (in years, 0 if illiterate, 1 if basic education)
9. For how long have you been in this area? _____Years
10. What is your religion?
    1=Orthodox 3=Protestant
    2=Catholic 4=Muslim 5=other (specify) _____

II. Socio-Economic Conditions of Households

1. Main occupation
   1= Student 3= Government employee 5 = Retired
   2= Farmer 4=Businessman 6= other, specify_____

2. Land Holding
   2.1Total Size of landholding (in hectare)
   1=Annual cropland ___ 2= Perennial cropland__ 3=Wood land ___
   4=Grazing land___ 5=others, ___

   2.2. Size of land holding in the wetland (in hectares) _____

3. Livestock
   3.1. Types and Number
   1= Oxen _____ 2=Cows ____ 3=Calves ____ 4=Goats ____
   2=Sheep _____ 6=Donkeys ____ 7=Horse ____ 8=Other____

   3.2. How frequent do you take them to the wetland of Boye/Kitto for grazing?
   1=Everyday 2=Very Often (May weekly)
   3=Often 4= rarely

4. Do you have any livelihood that is linked to the wetland of Boye/Kitto?
   1. Yes 2. No

5. If yes, in what ways your livelihood is linked? (You may circle more than one)
   1=Cultivation of crops/ vegetables/fruits on the wetland
   2=Fishing around the wetland
   3=Grazing
   4=Collecting wood for household energy and construction
   5=Cutting grass
   6=others, specify_____

6. What purposes other than economic do you get from the wetland? (You may Circle (More than one)
   1=Recreation (e.g. swimming)
   2=Enjoying the view
   3=Sanitation (e.g. washing clothes and bathing)
   6=Fetching water and animal drinking
   7. Others, specify _____

7. Total Household income in 2010/11 G.C (ETB)? _____

8. What are the major sources of income and list the amount u earned in 2010/11G.C?

9. How close do you live from the wetland?
   1. Very close (within 30 minutes walk) 2. Close (within an hour walk)
   3. Further away from the wetland (more than an hour walk)

10. Are there any disadvantages of living an around the wetland?
   1=Yes 2=No

11. If yes, what are the disadvantages? (You may circle more than one)
   1=Malaria infection
   2=Wild animal attack (what animal?)
   3=Rising water level affecting farmland
   5=Animal diseases (List names in Amharic) _____

12. How often do you go to the Wetland?
   1=Everyday 2=Very often (Almost every week)
   3=Often (every month) 4= rarely

13. Which household member is mostly associated with activities undertaken in and around wetlands?
   1=Men 3=Children
   2=Women 4= don't realize

III Conditions of Wetlands

1. In your lifetime, have you notice the status of the wetlands?
   1=Expanding 3=do not detect any change
   2=Shrinking 4=Fluctuating

2. If expanding what do you think of the possible cause_____

3. If shrinking, what do you think of the possible cause _____

4. Do you fear that the wetlands may one day disappear?
   1=Yes 2= No

IV. Wetland Management and Conservation Issues

1. Are there any local mechanisms in place to conserve the natural resources in and around the wetlands?
   1. Yes 2. No

2. If yes what are they? _____

3. Who do you think should be most responsible for managing the wetland?
   1=The local community 3=Private sector
   2=Government 4=others, specify, _____

4. Have you seen or heard about any government effort designed to manage the wetland?
   1=Yes 2=No

5. If yes, in what ways have the concerned government departments been involved in the management of wetland? (You may thick more than one of the following).
   1=by passing legislations
   2=by providing training on how to conserve the wetland
   4=by encouraging a forestation and conservation activities
   5= others, Specify

SECTION TWO: CHOICE EXPERIMENT QUESTIONNAIRE

INTERVIEWER:
NOW READ THE INSRTUCTION TO YOUR RESPONDENT
MAKE SURE THAT HE/SHE PAY ATTENTION OF YOUR DESCRIPTION

The main objective of the study is to better understand how local households respond to the proposed management interventions. There are fundamentally two areas where the study plans to improve the environmental quality of Boye and Kitto wetlands.

(1) Fishing possibilities in particular the endangered fish species will be rehabilitated or introduced. This stock enhancement program will increase the fish species and increases the productivity of the wetlands. Currently, fish population is endangered (stock is depleted); there is very low level of fish population because of over fishing and being an open access to public. Such measure is important for uphold the fish population. Consequently, the local communities in particular and the town peoples in general will be beneficial from such program.

(2) Water purification: This includes establishing buffer strip with sedge meadow horizontally from the edge. This program helps to improve the wetlands water quality through reducing silt and sedimentation into the wetlands. These are problems which affect the wetlands water quality and quantity which in turn affects the fish population and other biodiversity in and around the wetlands. Establishing buffer strip with sedge meadow also increases the available habitat size. Thus, species diversity will increase, which leads to healthier, more vibrant ecological communities. Moreover, having buffer strip surrounding the wetlands increases open water surface area and the scenic view of the wetlands. This intern increases the attractiveness of the area to tourists/visitors and hence other employment opportunities will be created.

However, all these plans of the program cost money for the implementation of the program. The government has set appropriate implementation strategy (payment vehicle). The payment

vehicle is a one-off increase in electricity charge to be channel to the wetlands management fund, which would be managed by a trustworthy and legal body. This payment will be collected and used to finance the program.

You have been randomly selected from households who are living around the wetlands to participate in this survey. We are investigating household's choices for improvements in fish stock abundance and water purification of Boye and Kitto wetlands. We ask you to consider these factors and the costs for carrying out these measures in the choice questions that follow. There are no "correct" or "wrong" answers, but priorities have to be made; we ask you to carefully choose between the alternatives below. Please mark the preferred alternative as if it is the only choice you make. (Notice: You are expected to make tradeoffs based on what the attribute is really worth to you only).

INTERVIEWER: NOW SHOW THE CHOICE SETS
PAY ATTENTION AND HELP IN CASE HE/SHE HAS ANY DOUBT

CHOICE SET 1

Which of the following wetland management scenarios do you favor? Scenarios 'A' and scenarios 'B' would entail a cost to your household. No payment would be required for "Neither management scenario" option, but the conditions at the wetlands would continue to deteriorate.

Attributes	Scenarios A	Scenarios B	Neither scenario
Fish stock abundance	high	medium	*Neither management scenarios A nor B: I prefer NO wetland management*
Water purification	100	50	
One-off payment (ETB) with your electricity charge	35	15	
YOUR CHOICE: (please tick (√) one only			

Give reasons for not willing to pay for the scheme_____

CHOICE SET 2

Which of the following wetland management scenarios do you favor? Scenarios 'C' and scenarios 'D' would entail a cost to your household. No payment would be required for "Neither management scenario" option, but the conditions at the wetlands would continue to deteriorate.

Attributes	Scenarios C	Scenarios D	Neither scenario
Fish stock abundance	high	medium	*Neither management scenarios C nor D: I prefer NO wetland management*
Water purification	100	50	
One-off payment (ETB) with your electricity charge	25	35	
YOUR CHOICE: (please tick (√) one only			

Give reasons for not willing to pay for the scheme_____

CHOICE SET 3

Which of the following wetland management scenarios do you favor? Scenarios 'E' and scenarios 'F' would entail a cost to your household. No payment would be required for "Neither management scenario" option, but the conditions at the wetlands would continue to deteriorate.

Attributes	Scenarios E	Scenarios F	Neither scenario
Fish stock abundance	high	medium	*Neither management scenarios E nor F: I prefer NO wetland management*
Water purification	50	75	
One-off payment (ETB) with your electricity charge	35	15	
YOUR CHOICE: (please tick (√) one only			

Give reasons for not willing to pay for the scheme_____

CHOICE SET 4

Which of the following wetland management scenarios do you favor? Scenarios 'G' and scenarios 'H' would entail a cost to your household. No payment would be required for "Neither management scenario" option, but the conditions at the wetlands would continue to deteriorate.

Attributes	Scenarios G	Scenarios H	Neither scenario
Fish stock abundance	high	medium	*Neither management scenarios G nor H: I prefer NO wetland management*
Water purification	50	75	
One-off payment (ETB) with your electricity charge	15	25	
YOUR CHOICE: (please tick (√) one only			

Give reasons for not willing to pay for the scheme_____

CHOICE SET 5

Which of the following wetland management scenarios do you favor? Scenarios 'I' and scenarios 'J' would entail a cost to your household. No payment would be required for "Neither management scenario" option, but the conditions at the wetlands would continue to deteriorate.

Attributes	Scenarios I	Scenarios J	Neither scenario
Fish stock abundance	medium	high	*Neither management scenarios I nor J: I prefer NO wetland management*
Water purification	75	100	
One-off payment (ETB) with your electricity charge	25	15	
YOUR CHOICE: (please tick (√) one only			

Give reasons for not willing to pay for the scheme_____

CHOICE SET 6

Which of the following wetland management scenarios do you favor? Scenarios 'K' and scenarios 'L' would entail a cost to your household. No payment would be required for "Neither management scenario" option, but the conditions at the wetlands would continue to deteriorate.

Attributes	Scenarios K	Scenarios L	Neither scenario
Fish stock abundance	medium	high	*Neither management scenarios K nor L: I prefer NO wetland management*
Water purification	75	100	
One-off payment (ETB) with your electricity charge	15	25	
YOUR CHOICE: (please tick (√) one only			

Give reasons for not willing to pay for the scheme_____

DEBRIEFING QUESTION

Which of the following statements describes best how you reasoned while choosing between the alternatives? Mark one or more statements.

(1) I found the fish stock is important and choose exclusively such attribute in the alternatives.

(2) I exclusively choose the cheapest alternative.

(3) I wish I could pay more for the aggressive rehabilitation program, but I cannot afford it.

(4) I found water purification is important and choose such attribute in the alternatives.

(5) I choose the aggressive rehabilitation program.

(6) Other, specify

Thank you for your time and assistance!!!

Date _____
Interviewer name_____
Signature _____
Address _____
Interview started _____
Interview ended _____
Interviewee number _____