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Benefits of wetland conservation interventions to local households in southwestern Ethiopia: empirical evidence from attributes-based valuation

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The paper estimates the value of improvement of wetland quality using choice experiment approach of stated preference valuation techniques. The study is based on household level data collected in 2011 from 120 randomly drawn respondents living around two wetlands within a radius of five kilometers in southwestern Ethiopia. Results show that the local communities are highly concerned about the environmental problems of the wetlands and they are willing to pay for the improvement of selected attributes of the wetlands. The most preferred attribute is found to be fish stock. Marginal willingness to pay for fish stock is about 5.04 ETB while this value is about 2.05 ETB for water purification attributes of the wetland. The compensating surplus, which reflect the overall willingness to pay of respondents for changes from the *status quo* to alternative improved scenarios, show that respondents are willing to pay 39.6 ETB for the improved wetland management interventions. The paper concludes by highlighting strategies that may help in halting the ongoing degradation of the wetlands in the study area.

Key words: Wetlands, valuation, choice experiment, willingness to pay, Ethiopia.

INTRODUCTION

Like in most developing countries, wetlands in Ethiopia are facing increasing pressure of transformation to alternative uses for grazing and agricultural production (EWNHS, 1996; Desta and Mengistou, 2009). Wetlands are areas of marsh or swamp with water that is static or flowing, fresh, brackish or salt, including areas of marine water with its low tide depth not exceeding six meters (RCB, 1997).

In Ethiopia, wetlands are distributed in almost all ecological and altitudinal ranges covering approximately 1.5 per cent of total surface area of the country (EPA, 2004). To ensure conservation and sustainable use of its wetland resources, Ethiopia has environmental, water resources and agricultural policies dealing with the wetland issues, if not have self-standing wetland policy (Mesfin, 2003). For instance, the environmental policy recognizes the ecosystem services of the wetlands and the need to protect and rehabilitate wetlands as an integral part of water resource conservation, development and management (EPA and MEDAC, 1997). However, implementation of wetland management strategies received little attention.

The public nature of wetlands and lack of consistency among government policies in different sectors such as economics development, environment protection, physical planning are some of the challenges for implementation for wetland management (Turner et al., 2000). Particularly, in Ethiopia, wetlands are converted to farmland and sometimes used in uncoordinated way, due to lack of information on its environmental benefits (Deribe, 2008).

Wetland biodiversity are severely affected and in great danger of being lost. For instance, in southwestern parts of Ethiopia, Illu-Abba-Bora Zone, the percentage of the available wetlands under agriculture was increased from 27.7 per cent in 2003 to 65.6 per cent in 2006 (Taffa, 2008). Specifically, Kitto and Boye wetlands are located near an expanding Jimma town. As a result they are under growing pressure. The size of the wetlands is decreasing at alarming rate and its biodiversity are highly

threatened which in turn decreases its ecosystem benefits to support the livelihood of the local people. The extraction of clay soil for the small-scale brick producing local industries is aggravating land degradation in the area. Conversely, deforestation is increasing due to growing demand for fuel wood from the small-scale brick producing industries and the Jimma town dwellers (Desta and Mengistou, 2009).

With the currently growing threats, it is necessary intervening to save the unique ecosystem of the wetlands. Unless conservation measures are applied, the wetlands are at risk of complete degradation and may disappear in few years to come. Decision makers cannot take wetland management decisions based on intuition alone. They need facts and values to make informed decision. Though, other types of values are also useful, economic values are vital in making economic choices (Othman et al*.,* 2004).

Moreover, as the economic values of wetlands various spatially, extensive empirical studies remain important. Therefore, this study contributes to the growing literature assessing the value of wetland conservation interventions by providing empirical evidence on values of attributes of wetland in developing countries.

The study presents the estimated value of major attributes of wetlands using choice experiment approached of stated preference valuation techniques. It investigates whether local households are willing to pay for conservation intervention, presents estimated value of major attributes of the wetlands and identify attributes of the wetlands need to be improved using choice experiment approached of stated preference valuation techniques.

METHODS

The study area

This study is conducted in two per-urban wetlands, Kitto and Boye, located at the edge of Jimma town, Oromia National Regional State, Ethiopia. Jimma town is about located 335 km southwest of the capital city, Addis Ababa, within the altitude ranges of lowest 1700 m.a.s.l. to 2010 m a.s.l. (Desta and Mengistou, 2009). It is located with geographical area dominated by wetlands. The wetland areas were once harbored by plenty of wildlife and aquatic resources and used to attract local weekend-visitors from the town. It serves as habitat for unique animals living in the area. It also serves as traveling corridor and critical habitat for seasonal feeding, breeding, resting, nesting, escape, and cover for migratory animals. However, such a wide range of functions and ecosystem service provisions of the wetlands are underestimated.

The two wetlands, Kitto and Boye, selected for this study have been treated as wastelands, drained or otherwise degraded. Currently, they are facing increased threat of being degraded, perhaps, at faster rate than ever before.

There is increasing anthropogenic disturbances, notably through agriculture, settlement, intensive grazing, expansion of huge infrastructures and brick making are changing in to mosaic of small habitats (Desta and Mengistou, 2009).

Survey design

Economic valuation focuses on how to estimate the impact of changes in goods and services support decision making. Revealed preference (RP) and stated preference (SP) are approaches used to estimate value of non-market goods and services (Freeman, 1993). The RP approach includes travel cost, hedonic pricing, expenditure, and benefit transfer methods in which the values of goods and services are inferred indirectly by observing individuals' behavior in actual or simulated markets. The SP approach elicits the value of goods and services directly from respondents by asking their preferences.

It relies on constructed, hypothetical markets in which respondents state their Willingness to pay (WTP) for various conservation and management interventions of natural resources (Birol et al., 2005). The SP approach includes Contingent Valuation Method (CVM) and Choice Experiment (CE) valuation methods.

In this study we used the CE method of the SP valuation techniques. When designed appropriately, the CE methods allows to examine respondents willingness to pay for the different attributes (or characteristic) of the resource that are useful for conservation and management interventions (Alpizar et al., 2003).

The designing of the CE includes selection of attributes, assignment of corresponding levels and construction of the choice sets are very critical (Birol et al*.,* 2005). This is usually done through literature reviews, consulting experts and focus groups discussions.

Accordingly, in addition to extensive literature review, key informant interview were conducted with lecturers from department of natural resource management of Jimma department, experts from Jimma Zone Agricultural Office and local NGOs, *kebele*[1] executives, community leaders from two *kebeles*. The key points of discussion include type and number of attributes, levels of attributes to be considered and payment vehicle.

Primarily, fish stock was identified as one of the attributes. Prior studies show that the fish stock of the wetland has declined because of over fishing and chemicals waste release discharged from the city (Desta and Mengistou, 2009).

Thus, fish stock restoration was one of key attributes of the wetlands selected as high and medium management strategies respectively. This measure is important for

[1] It refers to the smallest government administrative units.

uphold the fish population and productivity of the wetlands. Consequently, the local communities in particular will be beneficial from such program.

Secondly, water purification was another highly relevant attribute recommended for consideration considered. Water drainage and pollution due to run-off from the city 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 (Desta and Mengistou, 2009).

Establishing buffer strip with sedge meadow may help to improve the wetlands water quality through reducing silt and sedimentation into the wetlands and pollution, increases the available habitat size, and in turn increases its provision of environmental goods and service for the local community. The third attribute included in the experiment was defining the payment vehicle and payment levels. Among other proposed payment vehicles, water bills, income taxes and land levy, electricity bill were listed and finally electricity bill selected as acceptability and feasibility payment vehicle. The attributes and their levels are briefly described in Table A.1.

The survey questionnaire had two main sections. The first section was about socio-economic and demographic characteristics of the respondents such as age, gender, educational level, professional status, and income. The second section of the questionnaire was the choice experiment. It presents alternatives, the choice sets used in choice experiment design. Using orthogonal design[2], the most common approach in economic applications, the possible number of wetland improvement scenarios/alternatives 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 cognitive as well as time consuming, so the cognitive nature of the choice experiment needs to be reduced (Louviere et al., 2000).

Then fractional factorial design was used to ensure that all different attributes can be estimated independently of each other. After reducing identical combinations, 9 alternatives were identified and grouped into choice sets to be presented to respondents. Commonly, choice sets comprise *status quo* (Hanley et al., 2001; Birol et al., 2005).

The final version of the choice experiment section of the survey questionnaire had 6 choice sets, each formed by the *status quo* plus two management alternatives (Table A.2). 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. The survey was administered in 2011 to 120 randomly selected head of households living around wetlands within a radius of five kilometers using trained interviewers under close supervision of researchers.

[2] One of the advantages of orthogonal design is that the levels of the attributes of the different alternatives are uncorrelated in the choice sets, (Hanley et al., 2001; Birol et al., 2005).

Methods of data analysis

Choice experiment (CE) is based on a principle that the utility of goods and services depend on its characteristics, or attributes, which is consistent with the Lancasterian microeconomic approach (Lancaster, 1966). Theoretical model specification of the CE is therefore based on the 'Lancasterian' model of consumer choice, the random utility theory (McFadden, 1974), which can be specified as:

$U_{ij} = (V_{ij}, \varepsilon_{ij})$ such that, $(V_{ij}) = (X_{ij}, \varepsilon_{ij})$ ----(1)

Where X_{ij} is a vector of attributes describing alternative *j* or price associated with alternative *j*.

The indirect utility function may be partitioned into two components, so it can be rewritten as follows, $V(X_{ij})$ is the observable part of the indirect utility function that individual *i* gets when individual chooses *j* and ε_{ij} the random part of this function. According to random utility theory, individual *i* will choose alternative *j* from the choice set, let's say *t*, if the indirect utility of *j* is greater than that of any other choice *k*. Thus, individual *i* will choose alternative *j* over alternative *k* if and only if:

$U_{ij} > U_{ik} \rightarrow V(X_{ij}) + (\varepsilon_{ij}) > V(X_{ik}) + (\varepsilon_{ik}), \quad \forall k \neq j;\ j, k \in t$ ----------(2)

Where U_{ik} is the value taken by the indirect utility individual *i* gets when he chooses alternative *k*.

Then, the probability of alternative Y_i attribute is chosen can be specified as:

$P(Y_i = j/t) = P(U_{ij}) > U_{ik}), \forall k \neq j;\ j, k \in t = P(V(X_{ij}) + (\varepsilon_{ij}) > V(X_{ik}) + (\varepsilon_{ik})), \forall k \neq j: j, k \in t$ ----- (3)

The probability of an alternative attribute chosen as the most preferred among a definite set of alternatives is commonly expressed in terms of the logistic distribution, which results in different econometric model specifications with different assumptions (McFadden, 1974).

To analyze the importance of the choice set attributes explaining respondents preferences for the three scenarios, the *status quo option* and two improving the environmental quality in terms of its attributes *(fish stock, water purification),* three expected indirect utility functions were considered such that each function present utility generated by respective scenario.

Scenario 3 is the *status quo*. Scenarios 1 and 2 involve an improvement in environmental attributes, relative to the *status quo,* which is scenario 3. The utility for each of the functions is determined by the level of attributes in the choice sets.

$$v_i = ASC_1 + \beta_{fish}\text{FISH} + \beta_{water}\text{WATER} + \beta_{payment}\text{PAYMENT} \quad (4)$$

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

$$V_1 = ASC_1 + \beta_{fish}\text{FISH} + \beta_{water}\text{WATER} + \beta_{payment}\text{PAYMENT} \quad \text{--- (5)}$$

$$V_2 = ASC_2 + \beta_{fish}\text{FISH} + \beta_{water}\text{WATER} + \beta_{payment}\text{PAYMENT} \quad \text{- (6)}$$

$$V_3 = \beta_{fish}\text{FISH} + \beta_{water}\text{WATER} + \beta_{payment}\text{PAYMENT} \quad \text{- (7)}$$

The β values (β_{fish}, β_{water}, and $\beta_{payment}$) 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 scenario 1 and 2 is constrained to be equal, because an experimental design that was close to orthogonal was 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 cannot easily be used to predict the effects of changes due to changes in attributes. Alternative specific constants ASCs do however improve the overall model performance and should therefore be included in the estimation (Adamowicz et al*.,* 1998).

Estimation of marginal willingness to pay (MTP)

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 β coefficients estimated under the regression models can be used to estimate the rate at which respondents are willing to tradeoff one attribute for another. This estimated tradeoff is the marginal willingness to pay[3] (MWTP). The MWTP (or implicit prices) are useful in understanding the trade-off between individual attributes, the relative importance that respondents hold for them (Hanley et al*.,* 2001; Carlsson et al*.,* 2003). Following Bennett and Blamey (2001), the MWTP can be specified as:

$$Part-worth = -\left(\beta_{non-monetaryattribute} / \beta_{monetaryattribute}\right) \text{-(8)}$$

This formula represents the rate of substitution between income and the attribute in question, i.e., the marginal WTP for a change in the attribute. Furthermore, compensating surplus (CS) can be obtained for different wetland management scenarios associated with multiple changes in attributes (equation 9) (Birol et al., 2005). It measures the change in income that would make an individual indifferent between the initial (lower environmental quality) and subsequent situations (improved wetland quality).

This change in income reflects respondent's WTP to obtain an improvement in environmental quality (Freeman, 1993).

$$Compensatingsurplus = -(V^n - V^1) / \beta_m \quad \text{----- (9)}$$

Where, V^0 and V^1 represent the initial and subsequent utility states respectively and βm is the coefficient of the monetary attribute. The attribute levels that characterize alternative wetlands improvement scenarios along with the current situation/ status quo attribute levels (See Appendix, Table A.3).

Finally, using 720 choices elicited from 120 respondents (120 respondents * 6 choice sets), a logistic regression with linear specification was estimated using Stata version 10 statistical software. Following (Cameron and Trivedi, 2005) the logistic regression model can be specified mathematically as:

$$P_i = \Pr[y_i = 1 | x_i] = \frac{e^{(\beta_0 + \beta_1 x_i)}}{1 + e^{(\beta_0 + \beta_1 x_i)}} \quad \text{-------- (10)}$$

If P_i is the probability of preferring option i .

Prior to fitting the regression model, descriptive statistics such as frequency and percentage is used describe socio-economic and demographic characteristics of sample respondents, and their perception about environmental problems of the wetlands selected for the study.

[3] It is also known as *part-worth* or *'implicit price'* in some literature (e.g. Bennett and Blamey, 2001).

RESULTS AND DISCUSSION

Respondents' perception about environmental problems of the wetland

Descriptive analysis results show that more than 80% of the sample respondents have lived in their current area of residence for more than 6 years. The sample respondents were also asked as to how often they go to the wetlands. Most of them, about 57.5%, mentioned that their family members seldom go to the wetlands mainly for recreation while about 17.5% replied that their family members go to the wetlands frequently and the remaining 15% of the respondents reported that they had no experience of visiting the wetlands.

Respondents we also asked to identify the type of family members engaged in some of the activities taking place in and around the wetlands. The frequency result presented in Table 1 shows that most of the respondents, about 42.5%, reported that they don't know which family member is engaged in activities affecting the wetlands. However, when we compared men and women household members, mostly of the family members associated with activities undertaken in and around the wetlands are found to be women, about 28% (Table1). The result indicates that each member of the households were subject to activities in and around the wetlands in one-way or another.

Human activities in the catchments have imposed undesirable impacts on wetlands. There are various kinds of human activities such as settlement, grass and reed collection, grazing, brick production, agriculture taking place in and around the wetlands. For instance, there are 15 legally organized small-scale brick producers' associations that depends on the wetland area for their row material inputs, clay soil and fuel wood. They induced deforestation and siltation, which increasing threatened the ecosystem service provision of the wetlands.

Sample respondents were asked to how they evaluated the change they observed about the wetlands in their lifetime. About 52.5% of the respondents believe that the wetlands is shrinking while 23.3% of the respondents think that the wetlands tend to expand during wet season and shrinking in dry season. About 17.5% of the households perceive that the wetlands were expanding in size. The remaining 6.7% of the households surveyed stated that they have no observed considerable changes on the wetlands size in their lifetime.

Those respondents believe the wetlands are shrinking were asked to elaborate underlying causes of the change as open ended question. They identified expansion of urbanization, encroachment local households to the wetland for farming, and the growing brick making activities in the area. Similarly, those who believe the wetland areas increased were asked to state the possible causes they think cause expansion of the wetland. About 46% mentioned construction of micro-dam on the out flow of Boye wetland, around 25% mentioned the increase in amount of rainfall while the rest of them, 29%, responded that they don't know the reason behind the its expansion.

The survey asks respondents to give their opinion as to whether they believe that wetlands will disappear or not. About 78.3 % of households mentioned their concerned that the wetlands will dry up in the near future unless expansion of farming and settlement is halted. The remaining 21.7% of the respondents mentioned that they are not worried that the wetland will dry up. Respondents were asked who they think should be most responsible for managing the wetlands. About 64.5% of the respondents believe that government as the most responsible for managing the wetlands, while 21% of the respondents think that it is the responsibility of the local community. A considerable percentage of the respondents, about 14.5% both the local community and the government are responsible.

Logistic regression model results

The logistic regression model was fitted to show the importance of the choice set attributes in explaining respondents preferences between the status quo and improved scenarios. It is worth mentioning that there were three expected indirect utility functions, however, all the respondents choose improvement scenarios. None of the respondents choose the current situation (status quo scenario) indicating that they want a policy change.

Therefore the utility functions for fish and water purification attributes were analyzed using logistic regression model (equation 10). Prior to fitting the model, we checked for possible econometric problems such as multicolliniarity among the explanatory variables. The results of variance inflation factor shows that the data has no seriously problem of multicolliniarity. As reported in Table 2, the McFadden's ρ^2 =0.24 shows the overall goodness of fit of the specified models. According to Hensher and Johnson (1981), the McFadden's ρ^2 values between 0.2 and 0.4 indicate that the specified model fits the data well.

Results of the logistic regression model presented in Table 2 show that the coefficients of the attributes are positive and statistically significant at 1% significance level except for payment. The positive sign imply that change from the *status quo* scenario to the corresponding level of attribute increases the probability of choosing improvement option over the status quo.

That means respondent's value wetlands improved scenarios, more fish stock and wider buffer strip with sedge meadows, as being an improvement of the wetlands environmental quality. The payment attribute is found to be insignificant which indicated that it hardly has effect on utility of choosing a choice set, may be because

Table1. 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
Don't know	51	42.5
Total	120	100

Source: Own survey data, 2011.

Table 2. Results of logistic regression model.

Variable	Coefficients	Standard errors
ASC	0.00	0.00
FISH	1.26***	0.21
WATER	0.05**	0.01
PAYMENT	-0.25	0.41
Summary Statistics		
Log likelihood	-376.19	
Pseudo ρ2	0.24	
Number of Observations	720	

Note: **, ***significance at 5% and 1% significance level, respectively.
Source: Own survey data, 2011.

Table 3. Estimates of marginal willingness to pay (ETB).

Variables	Marginal WTP
WTP Fish	5.04
WTP Water purification	2.05

Source: Own survey data, 2011

both rich and poor households have 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 scenario).

Estimation of marginal willingness to pay

The interpretation of model coefficients is not straightforward except to assess significance of parameters. Therefore, from the parameter estimates, the rate at which respondents are willing to tradeoff price for changes in any of the other attributes, the MWTP (*implicit price)* were calculated as indicated in equation 8. The result shows that the local households are willing to pay 5.04 ETB[4] (one-off payment) for an improvement in the fish stock and 2.05 ETB for water purification attribute (Table 3).

The 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.

Welfare implication of conservation interventions

Respondents' willingness to pay for a change from the current situation 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 (Table 4). 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 changes 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

[4] During the survey 1ETB (Ethiopian Birr) was about 0.11 US dollar.

Table 4. Estimates of compensating surplus (CS).

Alternative wetlands improvement scenarios	Mean WTP (ETB)
High impact improvement scenario	18.78
Medium impact improvement scenario1	39.6
Medium impact improvement scenario 2	17.3
Low impact improvement scenario	-

Source: Own survey data, 2011.

payment attribute. Based on equation 9, compensating surplus for medium impact improvement scenario 2 is 17.3 ETB, and under the medium impact improvement scenario 1as 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. The findings are, in general, in line with prior empirical studies (e. g. Birol et al. 2005) that local households show positive willingness to pay for improved environmental scenarios as compared to the status quo. However, the magnitude and types of contribution various considerably due to characteristics of the resources and respondents.

Conclusion and policy implications

The paper discussed how local households value the various environmental attributes associated with the wetlands and depicted how development interventions that improve conservation and management of the wetland can contribute to the welfare of the local communities. The study is based on household level data collected in 2011 from 120 randomly drawn respondents living around two wetlands within a radius of five kilometers in southwestern Ethiopia. The study employed choice experiment approach of the stated preference methods to estimate local households' willingness to pay for selected attributes of the wetland.

Human activities such as settlement, grass and reed collection, grazing, brick production, agriculture taking place in the catchments have imposed undesirable impacts on wetlands.

The descriptive analysis shows that more than half of the surveyed respondents believe the wetlands are shrinking. Particularly, about three-fourth of the total respondents mentioned their concerns that the wetlands will dry up in the near future unless expansion of farming and settlement is halted. We also found that about two-third of the sample respondents believe that government is responsible for managing the wetlands.

Findings show that respondents' willingness to pay. This can be evidenced from the estimates that, the compensating surplus for changes from the *status quo* to scenarios increase with improved environmental conditions of the wetlands, particularly, fish stock restoration and improving water quality. Compensating surplus estimates which reflect overall willingness to pay for each changes, from the *status quo* to three alternative improvement scenarios, were also calculated. The mean WTP for the high impact improvement scenario was estimated to be 18.78 ETB, for medium impact improvement scenario-1 is about 39.6 ETB and for medium impact improvement scenario-2 is about 17.3 ETB. It is also found that the welfare of the local households can be maximized under medium impact improvement scenario-1 wetland management interventions and that sustainable-efficient utilization of the resource can be achieved.

In sum, the results of the study show that most of the local households are aware of the adverse impact of human activities on the Kitto and Boye wetlands. It also appears that they are willing to contribute to development interventions that improve some of the attributes of the wetlands such as restoration of fish stocks. It implies that management strategies that fully involves local households at all levels of the implementation, starting from preferred attributes selection, may help development planners and practitioners to address the problems.

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Appendices

Table A.1. 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[2]	Intervention to establish buffer strip with sedge meadow horizontally from the edge of the wetlands in order to reduce siltation in to 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 feets.
One of payment	A one-off payment for the wetland management Fund.	3 payment levels: **0**, 15, 25 and 35 Ethiopian birr (ETB).
Note: bold levels are the current situation (Baseline/status quo level)		

Table A.2. Sample choice set.

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 **YOUR CHOICE:** (please tick (√) one only	35	15	

Table A.3. Alternative wetlands improvement scenarios and their attribute levels

Alternative wetlands improvement scenarios	Attribute levels
Status quo scenario	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.

[2] According to McElfish 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. The third attribute included in the choice experiment was a monetary one, which was required to estimate welfare changes.