Iranian Journal of Economic Studies, 5(1) 2016, 79-100

Shiraz University

Iranian Journal of Economic Studies

Journal homepage: ijes.shirazu.ac.ir

An Economic Valuation: Is the Society Willing to Pay for Conservation of Hoor-al-Azim Wetland?

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Article History

Received date: 2 March 2017
Revised date: 11 October 2017
Accepted date: 6 November 2017
Available online: 11 November 2017

JEL Classification:
Q50
Q51

Keywords:
Willingness to pay
Use and non-use value
Choice modeling

Abstract

Examining society's preferences for any change in the status of wetlands can translate their direct and indirect benefits into monetary values and provide useful information for the policy makers and planners. Hoor-al-Azim Wetland (also Hoor-al-Hoveizeh) is one of the four large wetlands with an area of over 125 thousand hectares located in Khuzestan province located in southwestern Iran on its border with Iraq. In this study, using market-pricing method, the direct use value of the wetland including agriculture, horticulture, animal husbandry, fishing and hunting was calculated for the year 2015. Also, using choice modeling analysis, indirect use values, option values and non-use values of the wetland were estimated for the non-market attributes including natural landscape, ecological function, bio-diversity and educational services. The values obtained are indicative of the significance that Hoor-al-Azim wetland has for the society. Therefore, any conservation programs of the wetland are supported by the society.

1. Introduction

Wetlands' ecosystem includes components, functions and attributes based on which researchers identify the wetland (Barbier et al., 1997). In other words, wetlands serve as a safe haven for organisms and are suitable for plant growth, and they also offer a variety of services to human society that directly or indirectly affect their welfare. Among the services that wetlands provide some are marketed and valued while others are not due to lack of market for them. The non-marketability of these services distorts any good understanding of the value of wetlands causing significant harms to their processes of economic growth (Kaffashi et al., 2012).

To understand the significance of valuation of wetlands, the role of valuation in decision-making with regard to the use of their resources should be stressed. Valuation of wetlands enables the measurement and comparison of the diverse benefits of wetlands and is a powerful tool in the management of their resources on the basis of a cost-benefit analysis. Based on the value of a

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DOI: 10.22099/ijes.2017.24565.1311

wetland, policy makers can decide on the options of using a wetland or protecting it based on the criterion of economic efficiency and thereby manages wetlands in order to achieve sustainable developments. This would not be possible unless policymakers are provided with the results of studies concerning the wetlands' valuating. Determining the market and non-market values of goods and services of Hoor-al-Azim Wetland, this study attempted to provide helpful information for decision makers.

Total economic value (TEV) of a wetland is obtained from its combination of its use value (UV) and non-use values (NUV) (Pak et al., 2010; Richardson and Loomis, 2009; Perman et al., 1995; Adamowicz, 1995; Bateman and Longford, 1997; Freeman, 1993; Peace and Turner, 1990; Peterson and Sorg, 1987; and Randal and Stoll, 1983). UV consists of direct use value (DUV) and indirect use value (IUV). In some studies, option value (OV) is also included in use value (e.g., Huang and Wang, 2015; Pak et al. 2010; and Merlo and Brials, 2000). NUV is the existence value that emanates from the two feelings of vicarious consumption and stewardship (Mitchell and Carson, 1989; and Thomas and Callan, 2007). UV is the utility gained from direct use of goods and services associated with a wetland while only IUV enjoys from indirect use of goods and services. Furthermore, OV obtained by excluding time dimension from demand function could be considered as another component of UV (Huang and Wang, 2015; and Togridou et al., 2006). Freeman (1993) argued that based on the degree of uncertainty that one confronts, OV may be considered as part of UV or even NUV. Plottu and Plottu (2007) believed that OV should be distinguished from UV and NUV and treated separately. Estimating OV helps estimating TEV more accurately. Although, several studies have been devoted to estimating services of natural ecosystems (e.g., Loomis et al., 2000; Whitehead, 1993; Parumog et al., 2003; Zander et al., 2013; Yang et al., 2008; and Cui et al., 2016#Cui), only a few have incorporated OV in calculation of TEV (Huang and Wang, 2015). Based on the findings of the authors, this study is among the few studies that have considered OV in Iran.

To derive the annual value of market and non-market benefits, analysis of market pricing and choice modeling were used respectively. Then the values obtained for the annual value of the sample were generalized to the beneficiary population, and using the real interest rate in agriculture and natural resources, the wetland’s capital value was calculated.

2. An overview of Hoor-al-Azim wetland

Hoor-al-Azim (or Hoor-al-Hoveizeh) is the only remaining of the great wetlands of Mesopotamia and is known as one of the largest wetlands in the region. This wetland is very rich in terms of plant and animal resources. The Iranian section of this wetland with an area of 125 230 hectares is located in Khuzestan province in southwestern Iran on the border with Iraq.

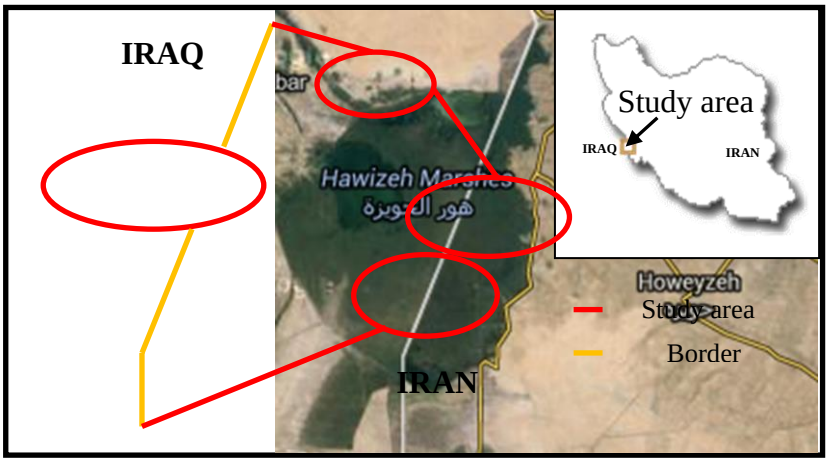

Figure 1: Location of the study area

Two-thirds of the area of this wetland is in Iraq and one-third in Iran. The primary source of water of this wetland is the Karkheh River (Department of the Environment, Khuzestan Province 2011).

Local residents living around the wetland mostly use its water for agriculture, and animal husbandry purposes and some parts of the wetland areas are occupied for these purposes. Some residents are also busy fishing in the wetland. However, because of the minefields planted by the Iraqi army during the Iran-Iraq war, now the area does not receive any tourists, and its pristine natural landscapes have remained unused.

3. Methods

The total economic value of an environmental resource is calculated from the sum of its use and non-use values. The use values are in fact obtained from the actual use of or access to environmental goods and services and can be direct or indirect.

The direct and indirect use values are related to the individual's consumption at present, but economists also consider the society's expectations of future consumption within the use value. Incorporating uncertainty within the interest rate is called the option value (Mitchell and Carson, 1989). Non-use values are interests that are not obtained from the individuals' actual use of the environmental resource but from the continuation of service from that resource. Mitchell and Carson (1989) considered "Vicarious" consumption and "Stewardship" as the main motives for this value. Vicarious consumption refers to the value of a good or a public service which is worthwhile to people because of the benefits it provides for the others. In other words, the utility created for an individual depends on the others, meaning that an individual acquires a utility by simply knowing what public good generates utility for the others. Intergenerational consumption also arises from the sense of commitment to

protect the environment for future generations.

According to Turner et al. (1993), there are two approaches to assess the willingness to pay the ultimate consumers of goods and non-market services: Methods that are based on the demand curve and those that are not. The latter do not offer appropriate measures to measure welfare changes. In the former, however, the price of goods is determined by the demand curve and divided into two categories of revealed preferences and stated preferences. Revealed preferences methods are associated with normal (Marshall) demand curve. In these methods, the individuals' choices in the real world and when they exchange money and goods are identified and measured. In other words, the revealed preferences of the value and benefit of a given good or service that are determined through the purchase investigations of individuals are measured.

Since in the method of stated preferences, the preference for non-market goods is evaluated by the consumer, the welfare function and consumer surpluses are the basic foundation of the studies. In fact, in this method, by designing a hypothetical market value for the product, people are asked about their willingness to pay or their willingness to accept regarding the improvement or lack of improvement of that given product quality. This method is associated with the compensated demand function (Hicksian demand). There are various methods for revealed preferences such as market pricing and substitute pricing while methods dealing with the stated preferences consist of two major methods of contingent valuation and choice modeling analysis.

Choice modeling method is based on McFadden's (1974) random utility theory in combination with Lancaster's (1966) theory of attributes value to explain the random utility function. In this method, by comparing the high level of services to the status quo of the wetland N, the respondents state their willingness to pay from the current status to a desired one from among the scenarios of each card (N, Z and T), and select their preferred scenarios. In other words, if respondents wish to keep their money, they choose neither Z nor T, so the scenario N will be selected. The data obtained from such choices will be analyzed under the framework of random utility theory. Therefore, it is assumed that every respondent compares the utility resulting from scenarios N, Z and T and opts for an option that maximizes utility. In modeling the preferences of individuals, the preference of the individual *i* based on the alternative *m*(Uii) is a function of the attributes of the wetland (*Xn*), the cost of protection is *C* and the socio-economic attributes of the respondents is *S* (Newell and Swallow, 2012). Therefore, the individual's utility function is defined as follows:

$$U_{im} = U(X_m, C_m, S_i) = V(X_m, C_m, S_i) + \varepsilon_{im} \quad (1)$$

where X_m is a vector of m scenarios (N, Z and T); V(.) is the non-random component of utility and ε_{im} is the random component that reflects the difference between random utility U_{im} and is a non-random component of V_{im}. Each respondent compared the three scenarios (N, Z and T) provided and chose the one that maximizes utility, as follows:

Maximize U_{im}
So that,

$$U(X_m, C_m, S_i) > U(X_j, C_j, S_i),\ m \neq j \text{ for all } j = \{N, Z, T\} \quad (2)$$

For example, if in (2), m = z, the person selects Z scenario because the utility (or preference) of Z is more than that of T and N. Therefore, the general probability of choosing *j* by individual *i* is as follows:

$$P_i(j) = Pr[V(X_j, C_j, S_i)] + \varepsilon_{ij} > V(X_m, C_m, S_i) + \varepsilon_{im} \text{ for all } j \neq m,\ j = \{N, Z, T\} \quad (3)$$

where, Pr (.) is the probability operator. It is assumed that the residuals ε is distributed independently and identically such that Pi(j) in equation (3) will be a logistic function. Random parameters logit (RPL) model which is the generalized polynomial logit model is used in this study. The advantage of the RPL model is its non-adherence to the assumption of independence of irrelevant alternatives (IIAs) and its capability of estimating unobserved heterogeneity in preferences among people. Therefore, we modeled the random utility function (1) as follows:

$$U_{im} = \beta_X X_m + \beta_c C + \beta_s S_i \quad (4)$$

The coefficients of this model are estimated by maximum likelihood method, and if U(.) is linear, coefficients β_x and β_c show the marginal utility of the attribute X and money respectively. Marginal willingness to pay is obtained by dividing the price coefficient by the coefficient of each attribute as follows:

$$MWTP = \beta_X / \beta_c$$

Using previous studies (Kaffshi et al. 2012; and Newell and Swallow, 2013), recommendations of university lecturers and staffs of Khuzestan Environmental Conservation Office, the attributes which selected included natural landscape, biodiversity, ecological functions, and educational services (see table 1).

Then for each attribute, three levels were considered. The first or basic level shows the quality of existing services of the wetland and the other two, i.e., the intermediate and higher levels demonstrate the quality of services offered by the wetland. In this study, since on primary purpose was to calculate the welfare measure, it was necessary to include a monetary attribute as the last question. This monetary value was calculated on the basis of the entrance fees of national parks and consulting with experts in Iranian Environmental Protection Organization. Prices used in this study were set at $ 0, $1.82 and $2.83 respectively.

Five cards were developed in order to design modeling. Using fractional factorial design and removing improbable scenarios by SPLUS software program, ten different modes between the four attributes of the wetland and wetland conservation costs were selected.

Table 1. The attributes of the Hoor-al-Azim Wetland and their selected levels

Attributes	Level
Natural landscape: The part of the natural landscape that continues to be pristine.	Not satisfactory less satisfactory satisfactory
Ecological function: That part of the wetland function that is independent of human intervention, such as nutrient cycling, flood prevention, dust control, moisture and temperature regulation, maintaining the flow of underground aquifers and pollution reduction.	Weak Average Strong
Conservation of biological diversity: Wetlands as a safe haven for living organisms, such as plants, animals and aquatic animals.	Not acceptable Somewhat acceptable acceptable
Educational performance: Each year the wetland is the subject and purpose of many studies, dissertations and academic papers. Many classrooms are held at the wetland.	Weak Average Good
Conservation value (USD)	0 1.82 2.83

The improbable modes are those in which a low level of the wetland's attribute is next to a high cost of conservation or a high level of the wetland's attribute is next to a low cost of conservation. Then the ten modes were set in 5 cards containing two scenarios T and Z and a status quo scenario (N). In order to use comments from academic experts for enriching the quality card, a number of cards were submitted to some faculty members of economics departments. Using their expert opinions, we then distributed the cards among a number of respondents (who were chosen randomly) to assess the clarity, understandability, and correctness of the cards. After examining the collected cards and considering the opinion experts at the Environmental Protection Organization, the cards were finalized (see figure 2).

	N	T	Z
Natural joyful outlook	Bad	Good	Good
Biodiversity	Weak	Average	Weak
Ecological performance	Weak	Good	Average
Educational performance	Weak	Average	Average
Monetary value of conserving wetland services ($)	0	2.83	1.82

Figure 2. A sample of choice sets

Comparing the desired level of the wetland's services with its current ones, the respondents state their willingness to pay for switching from the current

status to the desired one by choosing the appropriate alternative from the cards. During the interviews with respondents, they were first ensured that this study had nothing to do with government agencies such as the Tax Office. Then in order to help the respondents understand the wetland's attributes and scenarios, a series of pictures, maps and written description of Hoor-al-Azim wetland was presented to each respondent.

The process of distributing the questionnaires and data collection was done in February 2015 in the cities of Ahvaz, Hoveizeh, Bostan and Susangerd and their surrounding villages. Based on information gathered from a pilot study, the final sample size of 64 was calculated for rural areas and 100 for urban areas. Of the 164 people who were randomly selected, 104 had seen the wetland while the rest had not. Among the remaining 60 respondents, 38 were going to see the wetland in the future whereas 22 did not have any plan to see it. Estimation of the indirect use values was done only based on the data collected from the 104 individuals who had seen the wetland. These people live in the vicinity of the wetland and benefit from its services every day. Data collected from all the 60 remaining respondents were used to estimate the option value and non-use value of the wetland. Data partitioning for indirect users, option users, and non-users will yield more accurate results (Kaffashi et al., 2012).

In order to extract the indirect use, non-use and option values of the wetland, random parameters mixed logit model was used. The maximum likelihood estimation method was used for the estimation of regression coefficients using *Stata* version 12. The reason for using logit model with random parameters was the heterogeneity in the respondents' preferences. According to Birol et al. (2006), this model well controls unconditional unobserved heterogeneity.

In order to obtain the value of the wetland as a natural capital, the uniform-series present value factor was adopted (equation.5). The reason for using this method of discounting is the continuity of the services of the wetland. Calculating the present value of the wetland's services for a long period provides the possibility of conducting a cost-benefit analysis, which could be used for the economic evaluation of projects implemented within or surrounding the wetlands.

$$P = A/i \tag{5}$$

where P is present value, A is the uniform-annual value and i is the real interest rate.

Due to unavailability of social discount rate, the real interest rate was used for agriculture and natural resources. The real interest rate was equal to the average interest rate made by long-term deposits officially reported by the Agricultural Bank (20%) minus the average inflation rate in agriculture and natural resources sector (13.7 %). This rate was calculated to be 6.3% for the year 2015. This rate was also used for other benefits of the wetland.

To collect the required data, questionnaires were designed separately for

each direct-use benefit of Hoor al-Azim. These questionnaires involved two parts. The first part was about the socio-economic attributes of the respondents and the distance from their home to the wetlands. The second part involved questions about the method of market values.

Data collection was performed in 2015. To this end, the sample size was determined by stratified sampling design operations in sectors and rural districts surrounding the wetland. The selected rural districts and villages in each district and the number of collected samples in each activity in year 2015 are presented in Table 2.

Table 2. Sample size for each fishery, agriculture, horticulture and animal husbandry

City	Rural district (village)	Sample size for each activity			
		fishery	agriculture	horticulture	animal husbandry
Dasht-e-Azadegan	Bostan -Bostan Mihan Abad	8	10	-	14
	Bostan – Sa'dyeh (Northern Ramim)	2	2	-	4
	Principal – Western suburbs (Choolaneh - Bardieh)	-	30	27	40
Hoveizeh	Nissan -Nissan (Rafi)	47	12	-	13
	Northern Hoveize (Hooreh Agool)	-	16	12	24
	Principal – Southern Hoveizeh (Hoort al-Abbas)	-	14	-	26
	Total	57	84	39	121

4. Results

4.1 Direct-use values

In this study, the method of market values is used for valuing the benefits of the direct use values. In this method which is widely used in the valuation literature (e.g., Goldberg & Roosen, 2007; Hanely et al., 1998; Mogas et al., 2005; Christie & Azevedo, 2002; Cui et al., 2016; and Kaffashi et al., 2012), the prices of the goods and services provided by the wetlands are extracted. Then adjustments are made in relation to the absence of competition in the market and government intervention such as taxes. Finally, profits from the sale of these goods and services, after deduction of costs paid by the individual, are calculated as the value of wetland benefits (Fisher et al., 2011). Therefore, by field observations and consulting faculty members of the department of the environment economics and using previous studies, the direct-use benefits of Hoor al-Azim wetland including fishery, agriculture, horticulture and animal

husbandry were identified. A majority of the inhabitants surrounding the wetland are engaged in these activities, and the products resulting from these activities are used for their own consumption and market sales. Also, part of the wetland bed is used by residents living in its vicinity for agriculture and horticulture which are considered as its direct services. Moreover, employment is regarded as a special interest of the wetland, which means that the employment created by wetlands involves significantly lower costs than other sectors. Due to its special military position and the fields mined by Iraq during the Iran-Iraq war, no tourists are attracted for the time being. Therefore, this part has been removed from the services of the wetland.

Using data collected from the sample, the market value of fish caught from the wetland and the price of agricultural and horticultural crops harvested from the land surrounding the wetland were extracted. Their market value was obtained by multiplying the product price by the quantity. Finally, the costs paid by the individual (including the cost of inputs and labor) were deducted from the obtained value and the resulting value was considered as the value of wetland benefits. With regard to those areas of the wetland which were available for the residents of the surroundings of the wetland for farming and gardening purposes, the total area of the land was obtained for each rural district and city. The values obtained were then multiplied by the total annual rental value. The resulting values obtained for fishing, agriculture, horticulture, livestock and land which were extended to the total population (the entire villages surrounding the wetland) are presented in Table 3.

Table 3. The annual value of direct-use benefits of Hoor-al-Azim Wetland in terms of activities

Rural district	The total value of the service (Million USD)
fishery	16.8
animal husbandry	37.8
horticulture	0.19
agriculture	8.9
Total	63.8

Note: US dollar was considered equivalent to 24,700 IRR.

To calculate the value of the wetland in terms of employment, using the Statistical Yearbook of Khuzestan, the ratios of those working in agriculture, industry and services to the total employed population was extracted. Then the total number of jobs created by the wetland was multiplied by these ratios. The resulting value showed that if the whole employment created by the wetland was created in all other sectors (industry, agriculture and services), the average number of those employed in any sector would be determined. Using the information regarding the creation of jobs in each of the mentioned sectors, which is calculated and provided annually by Research Center of Parliament, the

value of jobs created by the wetland was calculated. The results are presented in Table 4.

Table 4. Employment generated by the wetland in agriculture, industry and services

Sector	Employment contribution of each sector in the(%) province	The number of jobs created by wetlands in each sector	The annual value of jobs created by the wetland (USD)
agriculture	47	3747	48877957
industry	7	558	24265652
services	46	3667	63784000
total	100	7973	136927609

Note: US dollar was considered equivalent to 24,700 IRR

Using the sum of the values obtained for fishing, horticulture, agriculture, animal husbandry, employment and land, the annual value of direct-use benefits in terms of US dollars was calculated and the results are provided in Table 5.

Table 5. The annual value of direct-use services

Direct-use benefits	Value (US$)
fishing	16830957
animal husbandry	37852238
Horticulture	196272
Agriculture	8985417
Economic value of the wetland's job creation	133464087
annual rental value of the wetland's lands	55409573
Annual value (USD) of the wetland's services	10232

Finally, the value of direct capital benefits of the wetland was calculated as follows:
Capital value (USD): 162416

4.2 Estimation of indirect use values

Table 6 illustrates the results of basic and interaction RPL model. As can be seen, the coefficients of the variables E2 and E3 (improvement of ecological performance) are statistically significant but do not have the expected signs. Other factors including N2 and N3 (recovery of natural landscape), B2 and B3 (improvement of biodiversity, with an emphasis on endangered species) and ED2 and ED3 (improvement in educational services) were not statistically significant, all having the expected signs except ED3. The coefficient of the conservation cost (cost) is statistically significant and has the expected sign. The negative sign of the coefficient indicated that an increase in conservation costs may decrease individuals' contribution, which could be in turn due to reduced utility. Also, the expected sign of coefficients of the wetland's attributes was positive, indicating that the improvement of these attributes would increase

individuals' utility.

To improve the results of the model, the socioeconomic characteristics of individuals were used. According to McConnell and Tseng (2000), Rolph et al. (2000) and Kaffashi et al. (2012), importing these variables into the model would increase the accuracy of the model selected.

Table 6. The results of basic and interaction RPL model

	RPL model	RPL with interaction terms
Attributes	Coefficient (z-stat)	Coefficient (z-stat)
N2	0.45 (1.25)	2.60***(2.40)
N3	0.003 (0.01)	5.40***(4.88)
E2	-2.29*(-1.67)	2.69* (1.66)
E3	-1.97**(-1.96)	3.55 **(2.49))
B2	0.30 (0.70)	0.88* (1.62)
B3	0.28 (1.22)	3.21* (1.96)
ED2	0.21 (0.77)	0.61 *(1.79)
ED3	-2.57*(-1.89)	1.31 *(1.76)
Cost	-0.00075***(-2.09)	-0.0009** (-2.14)
N2A		-0.07***(-3.66)
N3A		-0.05***(-2.92)
N3G		0.10 (1.12)
B2G		0.23**(2.23)
E3D		-0.02**(-2.33)
ED2D		-0.01** (-2.38)
N2E		0.16***(3.68)
N3E		0.08**(2.15)
ED2E		0.15***(3.10)
Log likelihood = - 609.99		Log likelihood = -576.55
LR chi2(8) = 25.94 (prob = 0.001)		LR chi2(17) = 41.14 (prob =0.000)

Note: *, **, *** show significance levels of 0.1, 0.05, and 0.01

The attributes are the same in the process of selecting different scenarios of the cards, and in this study they included the respondents' age, gender, income, education and distance from the wetland. All these variables other than gender (which is a dummy variable) were continuous variables. Using these attributes and the three levels of wetland attributes, 9 interaction variables were generated and entered into the model. The status quo scenario was considered as the base model in all models. The right column of Table 6 shows the results of the model with the interaction variables. As can be observed, this model is preferred to the base model, and this is due to the decreasing of log likelihood. By entering the interaction variables into the base model, the log likelihood drops from 609.99 to 576.55. Also, based on the likelihood ratio, the null hypothesis of the

simultaneous existence of all variables is rejected at 0.01 level, and the model has adequate validity. Based on the significance of coefficients and their sign, the model containing interaction variables is to the base model. All coefficients of wetland attributes including the natural landscape, ecological function, biodiversity conservation and educational services have positive signs. The positive sign of the coefficients of the variables show that in case of improvement in each wetland attribute, responsive utility increases compared to that of the baseline. All these variables were significant at 1%, 5% and 10% significance levels, except for B2 which is marginally significant at 10% level. The price variable had a positive value and was significant at 5% level, indicating that respondents prefer to participate in conservation programs that do not require additional costs. Therefore, the sign of the price coefficient was negative, indicating a negative impact on a person's utility (Kaffashi et. al, 2012).

The interaction variables of age and natural landscape (N2A and N3A) had negative values at levels 2 and 3 and were significant at 10% level. The negative value means that older people are less concerned about the protection of the wetland. This is similar to the interaction variables made based on the distance from the wetland along with the second level educational services ED2D and the third level ecological performance E3D. These two variables had negative values and were significant at 0.05% level. This means that the farther people get from the wetland, the less they are concerned about its conservation. All other interaction variables made based on the second level biodiversity conservation B2G along with the third level natural landscape N3G have positive value and are significant at 5% and 10% levels. This means that women are more concerned about the conservation of the wetland than men are. Also, the values of interaction variables of the respondents' level of education and natural landscape N2E, N3E and the second level educational services ED2E are positive and significant at 5% and 10% levels.

According to Table 6, the marginal willingness to pay was derived by dividing the coefficient of wetland attributes by the cost variable in the model including interaction variables. The results are reported in Table 7. The marginal willingness to pay shows a trade-off between money and wetland attributes, ceteris paribus. In other words, it shows the marginal rate of substitution between attributes and money. For instance, if the natural landscape of wetlands improves from an unacceptable to a less favorable condition (N2), each wetland indirect users will be willing to pay 0.1 USD per month on average (equivalent to 1.24 USD annually). Similarly, if this situation improves from an unacceptable situation to a fully satisfactory (N3) one, each wetland indirect users will be willing to pay 0.23 USD per month on average (equivalent to 2.77 USD per year). The highest indirect users' willingness to pay was related to the natural landscape attribute at a fully satisfactory level.

The marginal value of the wetland attributes can be calculated using the obtained values. The results are presented in Table 7. For example, if the natural

landscape of wetlands improves from an unacceptable to a less favorable condition (N2), its marginal value will be 0.11 USD, and if it changes from less satisfactory to fully satisfactory its marginal value will be 0.12 USD.

Table 7. Marginal willingness to pay for indirect users (USD per Month)

Attributes	WTP	Status quo to second level	Second level to third level
N2	0.111	0.111	-
N3	0.231	-	0.120
E2	0.115	0.115	-
E3	0.152	-	0.036
B2	0.038	0.038	-
B3	0.137	-	0.099
ED2	0.026	0.026	-
ED3	0.056	-	0.029

In order to extract the indirect use value of the wetland, the obtained values for the marginal willingness to pay must be generalized to the entire population of indirect users of the wetland. Therefore, the number of this category of people should be determined and then multiplied by the numbers obtained in the above table for the third level of all the wetland's attributes. As a result, the obtained number will show the annual value benefits of the wetland. In order to determine the value of the wetland as an environmental capital, its annual value should be calculated for a long period. According to the collected statistics, 100% of the population of Hoveizeh, Bostan and Susangerd are indirect users of the wetland. This number was 134143 according to the Statistical Yearbook of the Statistical Center of Iran. By generalizing the total value of indirect use to the whole population, we obtained:

The annual value (USD) = 2,318,407

In order to change the annual value of indirect use benefits to the capital value of the wetland, the uniform-series present value factor was adopted. As explained earlier, the real interest rate was 3.6%. The numbers were obtained as follows:

Capital value (USD) = 36,800,112

4.3 Estimation of the option value and non-use value

The option value and non-use value of Hoor al-Azim wetland was estimated using random parameters logit model in base and interaction modes. The results are reported in Table 8.

Table 8. The results of basic and interaction RPL model

	RPL model	RPL with interaction terms
Attributes	Coefficient (z-stat)	Coefficient (z-stat)
N2	0.6052(1.63)	1.0107*(1.62)
N3	0.0428(0.13)	5.2790***(4.49)
E2	-0.7487(-0.54)	7.1912***(2.62)
E3	-1.5830(-1.44)	0.1385 (0.08)
B2	0.0937(.2819)	1.4081 **(2.19)
B3	-1.2439(-0.90)	2.9716* (1.41)
ED2	-0.2499(-0.64)	0.4302**(1.29)
ED3	0.0568(0.22)	2.4926 (2.17)
Cost	-0.00044(-1.20)	-0.0002463** (-2.14)
N2A		-0.0947***(-3.34)
E3A		0.1276***(2.75)
B3A		-0.0892*** (-3.02)
ED2A		0.0759***(2.58)
N3G		0 .1635 (1.48)
E3G		0.5576* (1.78)
N2D		0.0216***(3.04)
N3D		0.0295***(4.63)
E3D		0.0696***(3.72)
B3D		0.0204***(3.32)
E3E		0.0991 (1.03)
B2E		0.1099**(2.55)
Log likelihood = - 715.78 LR chi2(8) = 83.81 (prob =0 .000)		Log likelihood = - 649.68 LR chi2(20) =144.59 (prob =0.000)

Note: *, **, *** show significance levels of 0.1, 0.05, and 0.01 respectively

Based on the significance of the coefficients and their signs, the model including interaction variables is preferred to the base model. In this model, based on the likelihood ratio, all variables are simultaneously significant, and the model has the sufficient validity. In addition, all coefficients of the wetland attributes ranging from the natural landscape, ecological performance, biodiversity and educational services had positive values. All these variables were significant, except B3 which is marginally significant at 10% level.

The price variable is significant at 5% and had a negative value indicating that the respondents prefer to participate in conservation programs that do not require additional costs. As for the interaction variables, all but N3G are significant. Also, all the coefficients had the expected signs.

According to the results of Table 8, the marginal willingness to pay was derived by dividing the coefficients of wetland attributes by the cost variable in the model including the interaction variables. The obtained values showed the marginal rate of substitution between money and the attributes of the wetland. The results are presented in Table 9. The highest willingness to pay was related to ecological performance at the average level. If the natural landscape of

wetlands improves from an unacceptable to a less favorable condition (N2), each wetland indirect users will be willing to pay 1.66 USD per month on average (19.9 USD annually). By the same token, if this situation improves from an unacceptable situation to a fully satisfactory (N3) one, each wetland indirect users will be willing to pay 0.86 USD per month on average (equivalent to 10.41 USD annually).

The marginal value of wetland attributes can be estimated using the obtained values. The results are depicted in Table 9. For instance, if the natural landscape of the wetland improves from an unacceptable to a less favorable condition, its marginal value will be 0.16 USD, and if it changes from less satisfactory to fully satisfactory, its marginal value will be 0.70 USD.

Table 9. Marginal willingness to pay for non-users (USD per month)

Attributes	WTP	Status quo to second level	Second level to third level
N2	0.166	0.166	-
N3	0.867	-	0.701
E2	1.181	1.181	-
E3	Insignificant	-	-
B2	0.231	0.231	-
B3	0.488	-	.256
ED2	0.409	0.409	-
ED3	Insignificant	-	-

In order to extract the option value of the wetland, the obtained numbers for the marginal willingness to pay must be generalized to the entire population of those who have never seen the wetland but are planning to visit it. Therefore, it is necessary to specify the population of this category of people in Khuzestan province. According to the collected statistics, about 63 % of the whole population of Khuzestan have never seen the wetland but are planning to visit it in future. Therefore, this portion of the province population should be specified and subtracted from the whole population of the province. It was 1627103 for people who have no planning to see, 2770474 for people who have planning to see and 4397577 for people who never have seen the wetland.

According to the values obtained for the marginal willingness to pay presented in Table 9, the annual option value by generalizing to the entire population of the province was calculated as follows:

The annual value (USD) = 85,874,823

Given the fact that the option values are not limited only to residents of the province, it is necessary that the values of willingness to pay be generalized to the whole population of the country because a large number of people who live outside the province have never seen the wetland but are planning to see it in the future. Therefore, this portion of the whole country population was extracted. For this purpose, a telephone survey was used. Eight major cities of the country

(Shahrekord, Bushehr, Shiraz, Hamedan, Isfahan, Rasht, Tabriz, Mashhad) along with Tehran having different distances from the wetland were chosen. After extracting the telephone code numbers for different districts of these cities, the systematic sampling method was used and the numbers of a few subscribers were extracted randomly. From each city, 30 subscribers from different districts were chosen. However, given the importance and the extent of Tehran, 60 subscribers were chosen from this capital. Then at different intervals (morning, afternoon and evening), calls were made with the selected subscribers. In case there was no response, another subscriber was chosen randomly. In each call, explanations about the nature of the study were given in order to gain their confidence regarding the conservation of personal information. Then questions about personal information such as age, education level, gender, etc. were asked. Next, it was determined whether or not the respondent had seen the wetland. If the answer was negative, the respondents were asked whether or not they plan to see the wetland in the future. Finally, a databank including 300 respondents' information including phone numbers, personal information, and their answers to key questions was prepared and stored.

Then the country was divided into three zones: Khuzestan province, outside the province within a radius of 600 km, and above 600 km. In the next step, taking into account the size of each geographical zone, the population of each zone was calculated using the 2015 Census. The proportion of those who were willing to visit the wetland in the near future was determined, and according to the population of each zone and its proportion, the number of potential visitors was obtained. Finally, the marginal willingness to pay was generalized to the population of areas outside the province. The results are reported in Table 10.

Table 10: Annual option value for citizens living outside the province

	Up to 600 kilometers	Above 601 kilometers
Population	16319907	54298042
Percentage of individuals planning to see the wetland	22.47	5.84
Number of individuals planning to see the wetland	3557395	3175324
Annual option value for residents outside the Province (US$)	227776859	

The collected data statistics showed that most people who plan to see the wetland in future live outside the province within a radius of 600 kilometers. Therefore, that part of the population living out of the province within a radius of 600 kilometers of the wetland make up the first group. The second group, on the other hand, includes those living outside the province within a radius of over 600 kilometers of the wetland. It should be noted that the calculations regarding the inhabitants of the province were done earlier. Table 11 shows the population of the two groups mentioned above, along with generalization of the option

value of the wetland.

In order to calculate the annual option value for the whole country (including Khuzestan) the values obtained in the above table should be added to those obtained for within the province.

The annual value (US $) = 297 974 732

Potential capital value of wetland services using a real interest rate of 3.6 percent was calculated as follows:

Capital value (US $) = 4,729,757,661

As noted, the population of wetland non-user was divided into three categories. The first category included those residents of the province who had not seen the wetland and were not planning to see it. The second and third were people with the same conditions but living outside the province up to a radius of 600 kilometers and above 600 kilometers respectively. The population in each category, along with the corresponding calculations is presented in Table 11.

Table 11. Annual non-use Value

	Khuzestan	Outside the province up to 600 km	601 km and above
Population	4531720	16319907	54298042
Percentage of individuals not planning to see the wetland	37	77.53	94.16
Number of individuals not planning to see the wetland	51040159	12729527	1676736
Annual value of the total non-use services (Million USD)		2485	

In each column, population categories, the percentage and number of people who do not plan to see the wetland along with the non-use value of each category are presented. In the last two rows of the table, the annual value of non-use services is provided in terms of USD.

Using the real interest rate of 3.6 percent, the value of non-use investment services of the wetland was calculated as follows:

Capital value (US $) = 36,742,355,643

4.4 The total value of wetland services

The total annual and capital value of Hoor wetland was calculated from the sum of the direct and indirect use values, non-use value, and option value along with the non-use services, and the results are presented in Table 12. Although the services provided by natural resources such as wetlands to human society are very diverse, some of these services are unknown and some others are invaluable. Thus, the authors of this study have no claims regarding the comprehensiveness of values obtained, and obviously by having a better and complete understanding of the services and valuation methods of wetlands' quality services, more reliable and comprehensive values would be obtained.

Table 12: The total capital value and annual value of Hoor-al-Azim wetland

Benefits		Value (US $)
Use	Direct use value	162416
	Indirect use value	36800112
	Option value	4729757661
Non-use		36742355643
Total for the whole wetland		41509075832
Value per hectare		331462
Annual value of the wetland		2615071777
Annual rent per hectare		20882

5. Conclusions

The results of this study may be used to convince policymakers and decision-makers to implement programs in the field of wetland conservation and investment in Hoor al-Azim wetland. No doubt the high value obtained for the wetland shows the ecological importance of this resource to its real owners and indicates that this precious legacy requires more attention and governmental funding in order to be protected. The users' willingness to pay indicates their support for any protective measures for the wetland. Therefore, not only the wetland conservation (which certainly continues to result in the complete destruction of the wetland) should be corrected but also serious measures should be taken to improve the quality of the attributes of the wetland. Hence, all ministries (particularly the Ministry of Oil), and all organizations in the vicinity of the wetland whose irresponsible activities lead to the destruction of or tampering with its pristine nature should be held accountable for the economic loss incurred. However, this does not mean that the destruction of wetlands is justified by paying the rent for the projects executed. The values obtained from this study should be considered in the economic evaluation of any project in the vicinity of the wetland, and then it should be checked whether or not it is economic. This has been noted in the country's five-year program according to which all relevant agencies are required that all their projects be implemented complying with environmental assessment and justification. One of the long-term protection approaches of wetlands is the advance of the cultural level of society which is solely achievable through raising public awareness of the importance of wetlands. Due to lack of information regarding the wetlands' natural landscape, water quality, ecological performance and economic value, the importance of wetlands is not perceived properly. More training programs are recommended based on the results of this study which could be used in order to raise public awareness regarding the economic value of Hoor-al-Azim wetland.

Absence of tourists is an irreparable blow to the economy of the region and its residents. It is recommended that some remnants of war (such as bulwarks, barbed wires, minefields, field hospitals, etc.) be removed so that tourists can visit the safe sections of the wetland without any risk. However, it is necessary

that recreational facilities and accommodation be also created in order to benefit from the potential of the wetland for increasing the income of local residents and regional development. According to some drawbacks in calculating the GDP, especially in developing countries, in addition to the use services (which are considered in the calculation of the province's GDP), the non-use and option value of the wetland (which are estimated in this study) can also be used in the calculation of the province's GDP. Based on the contribution of the wetland's services to the production of the province, a corresponding budget should be allocated annually for its conservation, and provincial funding can be used feasibly in this regard.

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