Economic Valuation and Conservation - Do People Vote for Better Preservation of Shadegan International Wetland

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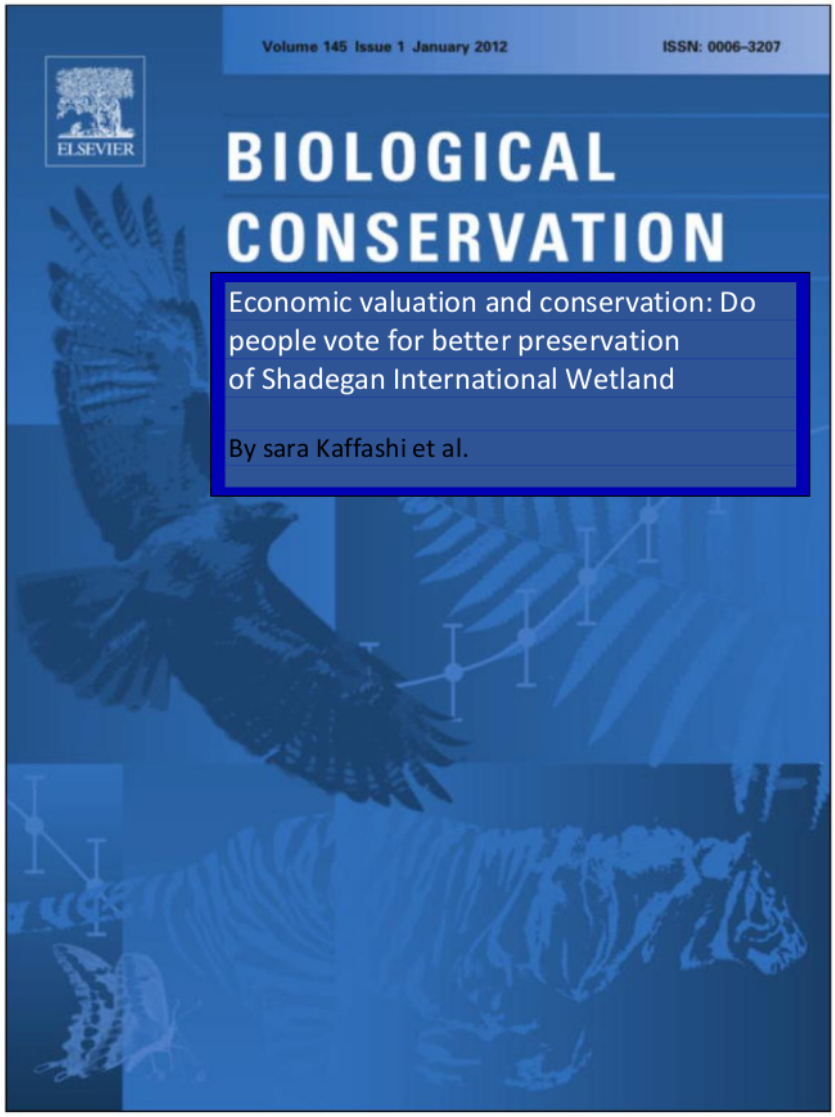

Abstract

Situated in the southern part of Iran, the Shadegan International Wetland (SIW), designed under Ramsar Convention, serves excellent functions such as rich biodiversity, ecological, hydrological, and economical. The natural ecosystem of this wetland has been under severe threats from various development activities that are resulted in conversion and excessive depletion of its resources. The main reason lies in the economic austerity of the country where development decisions outweigh wetland conservation. This study aims to estimate the economic benefits of SIW as an equalisation indicator to development proposals. A choice experiment (CE) survey was undertaken to assess the value of different non-market attributes of SIW. In addition to the overall model, users and non-users preferences are also estimated. A random parameter logit model was employed to derive the marginal value of the respondents for different attributes of the non-market values of SIW. Results indicated the respondents' positive preferences towards better conservation of SIW.

Keywords: Shadegan International Wetland; choice experiment; non-market value; users and non-users models; marginal value.

1. Introduction

The Ramsar Convention defines wetlands as "areas of marsh, fen, peatland, 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 Convention Bureau, 2004). Nowadays, there is a growing concern about the understated importance of wetland ecosystems in human wellbeing (Shchuyt and Brander, 2004). Most natural services, such as water purification and aesthetics, or biodiversity supported and provided by wetlands cannot be captured through their market price (Roberts, 1997; Lindemann-Matthies et al., 2010). This future places them at great risk of underestimation of their real benefits, and hence,

favouring wetlands conversion (Roberts, 1997).

Choice modelling has been widely used in the area of marketing and transportation. However, the first study to apply CE to the non-market valuation of environmental resources was by Adamowicz et al. (1994). Since then, an extensive literature has applied choice experiments in different subjects. Some of the studies are included in Morrison et al. (1999) on the Macquarie Marshes in Australia; Carlsson et al. (2003) on the Staffanstrop Wetland in Sweden; Othman et al. (2004) on the Matang Mangrove Wetlands in Malaysia; Whitten and Bennet (2005) on the wetlands of southeast Australia; Birol et al. (2006) on the Cheimaditida Wetland in Greece; Milon and Scorgin (2006) on Greater Everglades ecosystem; Birol and Cox (2007) on the Severn Estuary Wetland in the UK; Westerberg et al. (2010) on the Marais des Baux Wetland in France; and Zander and Straton (2010) and Zander et al. (2010) on Australia's tropical river systems. So far, reviews of the literature have shown that environmental valuation studies applying CE are limited in the context of developing countries. Our study is the first application of CE for a wetland's valuation in Iran.

The organisation of the rest of this paper is as follows: the following section describes the study area. Section 3 designates the CE method and its application in this particular case. Results and discussion of the study are reported in section 4, and the final section provides a conclusion with policy implications.

2. Shadegan International Wetland

Shadegan International Wetland encompasses a vast area on the northern coastal side of the Persian Gulf, Iran. This wetland is located within the 30°, 00′ - 31°, 00′ N. Latitude and 48°, 20′ - 49°, 20′ E. Longitude, in the downstream reach of the Jarrahi River (PCE, 2002). The wetland, therefore, is a water body linking the Jarrahi River from the north and the Persian Gulf to the south. The wetland is divided into different zones with salinity ranges from freshwater in the north to seawater in the south. This presence of fresh, brackish, and saline water in the wetland resulted in a high

biodiversity. With an area of 537,731 hectares, it is the largest wetland in Iran and the 34th largest of the 1,201 designated Ramsar sites in the world (PCE, 2002).

The SIW first was designated as a wildlife refuge in 1974 and then as a Ramsar site of international importance in 1975. Important to note is that, while the Ramsar site includes almost the entire ecological boundary of the wetland, only the wildlife refuge that covers part of the wetland is protected by Iranian laws (Figure 1).

The ecosystem includes 110 plant species, 40 species of mammals, three species of amphibians, eight species of reptiles, 90 species of fish, and 174 species of birds (PCE, 2002). Thirteen globally endangered species of birds and one endemic species, namely the Iraqi balber (*Turdoides altirostris*), have been recorded in this wetland (Scott, 2001; PCE, 2002). The wetland also offers an immense socioeconomic resource to the rural population. Shadegan town, from which the wetland takes its name, is surrounded by the wetland. Ahvaz to the north, Abadan in the southeast, and Mahshahr in the east are the major nearby population centres. Approximately 90 villages, with more than 400,000 households, are registered with high dependence on wetland resources. In 2006, about 5,320 people were involved in commercial fishing and 1,500 hunting activities within the wetland (PCE, 2002).

Despite opportunities for the wetland's sustainable development, the wetland area is highly commercialised, mainly because of petrochemical industries, intensive farming, wastewater pumping and illegal hunting. This had led to the disappearance of many precious wildlife species, including "Marbel tale" from Shadegan wetland. Due to the lack of sympathetic management, since 1993, the wetland has been recorded in the Ramsar Convention's Montreux Record of wetlands at risk of ecological change (Ramsar website 2010).

3. Choice Experiment Method

The first step in developing a choice experiment is identifying relevant attributes, conducting a

series of focus group studies, and assigning the attribute levels. The attributes chosen for this study were natural scenery, water quality, biodiversity (with emphasis on endangered bird species), ecological functions, and price (Table 1). As table 1 show, each attribute is set at one of three levels, the minimum being the "current condition" or "status quo," and the maximum level implying the best condition.

Table 1
Attributes and their levels used for SIW valuation.

Attribute	Attribute level
Natural Scenery: A natural scenery is as close as possible to its natural state – one that is relatively unaffected by human activity	**Not satisfactory***: several constructions and activities destroyed natural beauty **Less Satisfactory:** allowed some constructions in those parts of wetland which is closed to petrochemical and industrial zone **Satisfactory:** The natural scenery preserved beautifully with little damage and pollution, no threats to the scenery from industrial development
Water quality: physical, chemical and biological characteristics of Shadegan wetland with emphasize on nutrients, Electrical conductivity, biological and chemical oxygen demand, water color, odor and phytoplankton bloom	**Unacceptable***: polluted water, stink, unclear, algal bloom **Moderately acceptable:** unclear, moderately polluted water **Acceptable;** without odor, color and acceptable water quality standard view point of contaminant
Biodiversity: Refers to the number of endangered, vulnerable and rare bird species	**Low***: 50% of historic population with no strict management and continued decline of familiar, rare and endangered species **Medium:** Improvement some essential condition of wetland and mend ecosystem health until we have 65% of historic population **High:** Improvement wetland condition including restoration habitats, ecosystem health and process and prevention of pollution and diverse human activities until we have 80% of historic population
Ecological functions	**Weak***: allow further degradation of Shadegan wetland and losses in wetland functions until wetland has no more capacity for flood control, sediment and nutrient retention and other functions
Wetland functions are those processes that wetlands perform independent of human intervention, such as nutrient cycling, flood flow alteration, sediment stabilization and pollution retention	**Moderate:** restoration just those functions that have direct Impact on human like e.g. flood control **Perfect:** Improvement all functions to original condition
Conservation value	Rials **0*** Rials **15,000** Rials **22,500** Rials **30,000**

* Status quo or current condition of SIW.

In our study, since one primary purpose was to calculate the welfare measure, it was necessary to include a monetary attribute. The monetary value was selected based on national parks' entrance fee in Iran and also from consultations with the Department of Environment (DOE) of Iran. The price vector used in the design was RLs 0 (US$0), RLs15, 000 (US$1.61), RLs 22,500 (US$2.42), RLs 30,000 (US$3.2), and the payment vehicle was assumed to be a hypothetical donation to contribute to the wetland's conservation. The fractional factorial design of the final design included ten alternatives in five choice sets, each choice set including two purposed alternatives plus the status quo (Figure 2).

	OPTION A	OPTION B
Natural Scenery	Satisfactory	Satisfactory
Biodiversity	Medium	Low
Water quality	Acceptable	Moderately acceptable
Ecological Functions	Moderate	Weak
Conservation Value	RLs 22500	RLs 15000
OPTION		
OPTION C		
OR would you prefer no change with current condition for **Not satisfactory** Natural Environment, **Poor** Biodiversity, **Unacceptable** Water Quality, **Weak** Ecological Functions and **NO** Conservation contribution		

Fig. 2. Sample of choice set.

3.2. Sampling, Questionnaire and Data Collection

In-person interviews were conducted from January through March 2010. A stratified random sample of respondents was chosen. For this survey, the stratification factor was the regions in which respondents' homes were located, which served as a proxy for the level of their standard of living. Simple random samples were then selected from each stratum. A sample of 500 respondents was selected for this study, covering all towns, cities, and villages that were associated in some way with the wetland (120 subjects from the city of Ahvaz, 120 from the city of Abadan, 110 from the city of Mahshahr, 90 from the town of Shadegan, and 80 from Shadegan villages). Respondents at least 18 years old were chosen in the survey. The respondents' attitudes toward various aspects of SIW were gauged through a Likert scale of five values ranging from "extremely important" to "not important at all". The last part of the questionnaire was designed to obtain respondents' socioeconomic profile. This section included questions about respondents' age, gender, occupation, education level, family size, income level, residential status, and distance from home to the wetland.

Statistical analysis and model estimations were carried out using the Limdep 8 (Nlogit 3) and SPSS software.

Table 2
Socioeconomic characteristics of the respondents.

Variable	Frequency		Mean	St. deviation
	Number	(%)		
Income (Rials)	84	16.8	5357981.00	242954.140
Low (<30,00,000)				
Medium (31,00,000–64,00,000)	239	47.8		
High (>65,00,000)	177	35.4		
Region				
Abadan	120	24		
Ahvaz	120	24		
Mahshahr	110	22		
Shadegan	97	19.4		
Naseri	18	3.6		
Rogbeh	17	3.4		
Sarrakhieh	18	3.6		
Residential status				
Urban	447	89.4		
Rural	53	10.6		
Distance to wetland			49.97	35.355
<10	150	30		
November-50	98	19.6		
51–100	245	49		
50<	7	1.4		
User/nonuser				
User	380	76		
Nonuser	160	24		

4. Results and Discussion

Several model specifications were tested. Since using the MNL model, we could not relax the assumption of IIA; we tried to apply a model which relaxes the IIA assumption. The RPL model, capable of catching unobserved, unconditional heterogeneity (Birol et al., 2006), was applied to account for preference heterogeneity in the present study.

Table 3
Results of basic RPL model.

Coefficient (*t*-ratio)	Marginal value (Rial)
2.531* (3.989)	46000.00
1.456* (3.832)	26363.63
−0.698 (−1.548)	Not significant
−1.770 (−2.073)	−32181.81
2.879** (4.343)	5218.181
4.726* (3.017)	8581.818
−0.365 (−1.076)	Not significant
−0.558 (−1.042)	Not significant
−0.00058*** (−1.496)	
Log likelihood function −1765.768	
R-sqrd .35709	
RsqAdj .35,490	

Dummy coding was used where current condition got value of 0 and alternative value of 1.
* Significant at 1% level.
** Significant at 5% level.
*** Significant at 10% level.

4.2. Results of RPL model with Interactions

The results demonstrated that the RPL model was superior to the MNL model due to the model fit and expected variables signs. Variables NS2 and NS3 were significant at 5% and 1%, respectively, with an expected positive sign. The sign of BIO2 and BIO3 were positive with prior expectation, but both were insignificant. However, our result was compatible with the findings of Hanley et al. (2005) and Hynes and Hanley (2009), in which respondents preferred to move away from the status quo and rationally contribute to greater biodiversity in the wetland even if they would have to pay for that. Although respondents cared about biodiversity in the present study, local people, especially anglers and hunters, were afraid that this research would result in limitation and restriction rules in their access to wetland resources. Hence, primarily those who directly depend on wetland resources did not significantly contribute to preserving and improving the wetland's biodiversity. This decision enabled them to secure their free access to the wetland without restriction and additional payment.

The variable WAT (Water Quality) was significant at 1% for level 2 and 5% for level three. Both levels had the expected positive sign. The WAT variables had a higher coefficient compare to other variables. It seems that, since water quality was much more familiar than other attributes, people were more concerned about that. Positive signs mean that better water quality results in greater utility for respondents. The coefficient on water quality is very high compared to the magnitude of other attributes. The results imply that, even though residents recognise the need to increase environmental quality in general, they are especially concerned about water quality since that is especially tangible. Several previous studies found that respondents make payment (or are willing to pay) from their income for improved water quality (Ready et al., 2002; Kostas and Chrysostomos, 2006). The improvement also happened in the EF3 variable, where it was significant at a 10% level. The cost variable (CV) was significant at a 5% level with an expected negative sign. Households prefer those conservation programs that do not require any additional cost. Thus, the sign of the payment coefficient is negative, which indicates the effect on the utility of choosing a choice set with a high payment level, as expected.

The interactions between gender and natural scenery (both levels), membership in environmental NGOs and level 3 of ecological functions, distance to the wetland and level 2 of ecological functions are positive and significant. It means men, those with membership in environmental NGOs and closer distance to wetland were more concerned about higher levels of the wetland attributes. The interaction between income and level one of the water quality is negative, indicating those with lower income prefer the status quo and do not afford to pay any cost to improve wetland attributes. The negative interaction between the number of households and natural scenery indicates that large-sized families are less concerned about improving the wetland environment. The positive interaction between NS2 and use-value shows that user people are more interested in improving this attribute than the respondents without any use-value from the wetland. The interaction between the first level of ecological functions and age is negative. It indicates that older people are less willing to contribute to improving the ecological functions of Shadegan wetland. The interaction

between WAT1 and use-value is negative, implying non-users care less about improving water quality to a higher level than users respondents.

The interaction of socio-demographic variables with choice attributes resulted in a better fit of the final model. In the RPL model, decreasing the log-likelihood from -1765 to -1516 and increasing the adjusted R^2 from 0.35 to 0.44 imply the better fit of the interaction model as well as the superiority of this model to the MNL model.

4.3. Users and Nonusers Models

The overall data was categorised as "users" and "non-users". The reason was to find specific results and ideas related to respondents who were using wetland goods and services directly or indirectly or and those who did not. E.g. those respondents living in Shadegan town and villages that are surrounded by wetland and those respondents who had visited wetland for recreation, fishing or hunting purpose categorised as direct users. While, those respondents without direct or indirect use (however they might have the decision to visit wetland in future, or the existence value of wetland was important to them) classified as non-users. Based on this definition, in this study, data collected from respondents indicated that 380 respondents are using wetland resources directly or indirectly for different purposes, while 230 of them enhance non use benefits from SIW. The results of this breakdown are shown in Table 4.

Table 4 shows that the users' model provides better results than the non-users model. For the non-users model, the main attributes except BIO3 are positive (as expected). In this model, all variables are significant at a 1% level. Variable BIO3 was negative, contradicting our expectation. It seems that non-user people do not prefer a higher level of biodiversity. However, in the users' model, except for BIO3 (improved biodiversity), and EF3 other variables were significant. It shows that, while people prefer higher levels of biodiversity or ecological functions, they are unwilling to contribute monetarily.

Table 4
Results of Interaction models.

RPL with interaction		User model		Non-user model	
Attributes	Coeff. (*t*-ratio)	Attributes	Coeff. (*t*-ratio)	Attributes	Coeff. (*t*-ratio)
NS2	2.105** (2.40)	NS2	3.57* (3.38)	NS2	2.26* (2.61)
NS3	2.417* (4.11)	NS3	2.23* (2.86)	NS3	2.012* (3.63)
BIO2	0.00962 (0.014)	BIO2	0.045 (0.082)	BIO2	0.86***(1.68)
BIO3	2.596 (1.20)	BIO3	4.29* (2.63)	BIO3	−3.64* (−2.73)
WAT2	3.196* (3.09)	WAT2	2.77** (2.32)	WAT2	4.11* (3.96)
WAT3	4.868** (2.25)	WAT3	4.51*** (1.72)	WAT3	8.22* (3.79)
EF2	0.758 (1.09)	EF2	1.36*** (1.94)	EF2	1.009 (1.62)
EF3	1.433*** (1.74)	EF3	0.32(0.29)	EF3	1.70***(1.81)
CV	−0.00106** (−2.01)	CV	−0.0011*** (−1.90)	CV	−0.0014* (−2.82)
NS2_Gender	1.049* (3.44)	NS2_Gender	0.66*** (1.77)	NS2_Gender	0.72* (2.58)
NS3_Gender	2.739* (4.27)	NS3_Gender	0.90** (2.21)	NS3_Gender	1.38* (4.12)
WAT1_Income	−0.0015** (−2.41)	WAT1_Income	0.002* (2.88)	WAT1_Income	−0.001***(−1.85)
EF3_NGO	1.44*(1.91)	EF3_NGO	0.39 (0.42)	EF3_NGO	1.88**(2.17)
NS3_Household size	−0.183*** (−1.81)	NS3_Household size	−0.19* (−2.31)	NS3_Household size	−0.16** (−2.12)
EF2_Distance	0.291** (2.53)	EF2_Distance	0.31*** (1.72)	EF2_Distance	0.35** (2.32)
EF1_AGE	0.0265*** (1.75)	NS2_Education	0.20* (2.93)	NS2_Education	0.23*(3.83)
NS2_USE value	0.49*** (1.68)	WAT2_Income	0.005* (5.41)	WAT2_Income	−.0001(−0.13)
WAT1_USE value	−1.28* (−3.47)	EF3_Household size	−0.21* (−2.66)	EF3_Household size	−0.20* (−2.79)
		EF1_AGE	0.024*** (1.74)	EF1_AGE	0.030* (2.61)
		NS3_Distance	0.63* (3.28)	NS3_Distance	0.42* (2.77)
Number of observations	2500	Number of respondents	380	Number of respondents	120
Log likelihood function	−1516.24	Log likelihood function	−1036.55	Log likelihood function	−462.3028
R-sqrd	0.447	Log-Lfncn No coefficients	−2087.36	Log-L fncn No coefficients	−659.16
RsqAdj	0.445	McFadden Pseudo *R*-squared	0 .50	McFadden Pseudo *R*-squared	0.29

dummy coding was used where current condition got value of 0 and alternative value of 1.
* Significant at 1% level.
** Significant at 5% level.
*** Significant at 10% level.

4.4. Marginal Willingness to Pay

As reported in Table 4, the results indicate that acceptable water quality in the wetland has the highest marginal value. In contrast, both medium and high levels of biodiversity are insignificant, which mean no effect on utility. In addition to the marginal value between attributes and the monetary variable, the marginal value between attributes was also estimated. The aim was to show the attribute changes from each level. Table 5 shows the results of the RPL model.

Table 5
Marginal Willingness to Pay [a].

RPL interaction model		User model		Non-user model	
Variable	Marginal value (Rial)	Variable	Marginal value (Rial)	Variable	Marginal value (Rial)
NS2	19777.54 (12104.05–27451.05)	NS2	31003.4 (12510.29–49496.54)	NS2	15381.84 (9556.743–21206.95)
NS3	22706.47 (−803.33 to 46216.27)	NS3	19350.09 (−5618.245 to 44320.23)	NS3	13654.45 (1099.929–26208.98)
BIO2	Not significant	BIO2	Not significant	BIO2	Not significant
BIO3	Not significant	BIO3	37211.82 (9691.46 to 64732.19)	BIO3	−24757.60 (−38640.46to 1087.476)
WAT2	30028.15(16136.6 to 43919.7)	WAT2	24071.02 (12266.03–35876.03)	WAT2	27943.55 (18381.67–37505.4)
WAT3	45728.8 (27503.22–63954.31)	WAT3	39100.77 (16510.65–61690.91)	WAT3	55826.50 (36129.29–75523.72)
EF2	Not significant	EF2	11821.11 (2512.918 to 26155.16)	EF2	Not significant
EF3	13463.36 (−5428.764 to 32355.5)	EF3	Not significant	EF3	11555.63 (−3876.11 to 26987.39)

Marginal Value for Different Attribute Levels of RPL interaction Model

Variable	Marginal value (Std. error)
NS1 → NS2 Natural environment from: Not satisfactory to Less Satisfactory	19777.54 (440.99)
NS2 → NS3 Natural environment from: Less satisfactory to Satisfactory	2928.92 (1080.59)
BIO1 → BIO2 Biodiversity level from: Low to Medium	Not significant
BIO2 → BIO3 Biodiversity level from: Medium to High	Not significant
WAT1 → WAT2 Water quality from: Unacceptable to Moderately acceptable	30028.15 (599.58)
WAT2 → WAT3 Water quality from: Moderately acceptable to Acceptable	15700.61 (719.45)
EF1 → EF2 Ecological Functions from: Weak to Moderate	Not significant
EF2 → EF3 Ecological Functions from: Moderate to Perfect	6343.07 (795.49)
Wald Statistic = 36.48 Chi-squared [8] = 0.00	

[a] Estimated from Table 4.

The results indicated that from respondents who selected current condition and did not agree to contribute to wetland conservation, fifty-four per cent believed that the government should pay for conservation. Twenty-eight per cent of the respondents, despite supporting the conservation of SIW, could not afford to pay, 6.8% found the questions confusing and finally, 11.2% didn't know the best choice.

5. Conclusion

Based on the traditional framework of environmental conservation in Iran, protected areas such as national parks, wildlife refuges and conservation zones are defined. But this country's strong prioritisation for development and economic growth placed minor importance on environmental conservation programs most of the time. The reason is mainly that the DOE of Iran has been unable to encounter economic projects. This situation is a particular problem for wetlands such as Shadegan, where agricultural development, petrochemical industries and pollution release in the catchment area have outweighed the decision that benefited the wetland protection.

Given the diversity of social, economic, and environmental benefits that people receive from the SIW, especially those living around the wetland, the importance of this wetland to their existence

is non-negotiable. Hence, this study's objective was to estimate the economic benefits of various attributes of the SIW using a choice experiment (CE). The RPL model then was employed to derive the marginal value and compensating surplus of respondents for five attributes of the SIW's non-market values: natural scenery, biodiversity, water quality, ecological functions, and price. The results indicate that respondents had positive WTP for all attributes. The results should be treated carefully because the willingness to pay depends on the respondent's ability to pay, so the more impoverished families might be disadvantaged in expressing their real values. The study's results also indicate that the attribute valued most highly was water quality. More than two-thirds of respondents (66.7%) selected an option above the current condition. This study's findings suggest that the economic value of the SIW is considerable, and the community living nearby is generally supportive and willing to contribute to conservation programs. The results of this study can provide essential management insights. It can demonstrate to policymakers with no conservation knowledge and intention that the wetland ecosystem that most of the time is mistaken by wasteland has substantial economic value. So it might help to convince the government to allocate more financial and non-financial resources for conservation. Moreover, land-use decisions are strongly influenced by direct use values, which encourages land-use change. Therefore, knowledge on wetlands' non-use and non-market services can improve management decisions and might prevent destructive decision to benefit a small group of beneficiaries.

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