

## **Valuing wetland conservation: a contingent valuation analysis among Iranian beneficiaries**

Mansour Ghanian<sup>1\*</sup>, Omid M. Ghoochani<sup>2</sup>, Hossein Noroozi<sup>3</sup>, Matthew Cotton<sup>4</sup>

<sup>1</sup> Professor, Department of Agricultural Extension and Education, Faculty of Agriculture Engineering and Rural Development, Agricultural Science and Natural Resources University of Khuzestan, Ahvaz, Iran.

<sup>2</sup> PhD. Graduate. Department of Agricultural Extension and Education, Faculty of Agriculture Engineering and Rural Development, Agricultural Science and Natural Resources University of Khuzestan, Ahvaz, Iran.

<sup>3</sup> PhD. Student. Department of Agricultural Economics, Faculty of Agricultural Economics and Development, University of Tehran, Karaj, Iran.

<sup>4</sup> Professor of Public Policy, School of Social Sciences, Humanities and Law, Teesside University, Middlesbrough, UK.

\* Corresponding author: [m\\_ghanian@asnrukh.ac.ir](mailto:m_ghanian@asnrukh.ac.ir)

*Author accepted preprint.*

**Final version forthcoming in the *Journal for Nature Conservation***

<https://www.sciencedirect.com/journal/journal-for-nature-conservation>

### **Abstract**

Wetland ecosystems conservation is a critical environmental policy and practice challenge. Though policy protection mechanisms ostensibly establish a commitment to long-term protection, the level and types of wetland threats are growing. Management of sustainable wetland resources requires community commitments to protection amongst predominantly rural stakeholders that draw upon wetland ecosystem services for their livelihoods and is vital to forming a policy strategy. This empirical study uses contingent valuation methodology with rural residents around four key wetlands areas in the ecologically fragile Khuzestan province in Iran. We find that 65% of the residents are willing to pay an amount of personal income to protect wetland ecosystems. The estimated Logit model with 84% prediction accuracy showed the variables of education and job relationship with the wetland had a positive effect on the probability of price acceptance, and the variables of living costs and marital status had a negative effect on the probability of price acceptance. In total, the conservation value of wetlands is estimated at 103,351.52 USD. Finally, we assess the policy-relevance of our findings towards community windfall payments, tax disbursements, community resource management schemes, public participation, and social outreach programs to improve social learning buy-in to long-term conservation practices.

**Keywords:** Wetland services, Contingent Valuation Methodology (CVM), Logit model, Rural participation, ecosystem valuation.

## **Introduction – the importance of wetland conservation**

Wetlands have unique ecological, hydrological and biogeochemical features (Bassi, Kumar, Sharma, & Pardha-Saradhi, 2014) that provide multiple ecosystem services to human settlements. Ecosystem services include fresh water supply and storage for human uses (including agriculture), flood defence, prevention of saline infiltration, carbon storage, biomaterial production, provision of wildlife sanctuary (for migratory birds for example) (Barbier, 2019; Junk, et al., 2013), and bioremediation of pollution – acting as the “kidneys of the earth” (Guo, Li, Sheng, Xu, & Wu, 2017). Wetlands also provide secondary human land use benefits such as education, recreation and tourism (e.g. Ghoochani, Ghanian, Khosravipour, & Crotts, 2020) vital to community wellbeing and livelihood strategies.

Wetlands cover 6 % of the Earth’s surface, however, environmental pressures from land reclamation and dredging, resource over-exploitation, point-source pollution and drying due to climatic changes, threaten wetlands across all continents. An estimated 30–90 % of the world’s wetlands have already been destroyed or strongly modified. Despite protective policy measures, notably the Ramsar Convention, there is no immediate sign of abatement to this ecological damage (Junk, et al., 2013). Support for wetland conservation and sustainable management is therefore an urgent global priority to meet three high priority 2030 Agenda targets of the Global Sustainable Development Goals , namely to ensure Target 6.3 “Improve water quality”; 2.4 “Sustainable food production”; and 12.2 “Sustainable management of resources” (Jaramillo, et al., 2019). Developing and applying effective economic and policy mechanisms to encourage wetland protection is an important task for conservation research.

## **Wetland conservation in Iran**

The degradation of wetland ecosystems is a particular concern in The Islamic Republic of Iran (hereafter Iran). Iran has an average rainfall of 250 mm per year, leading to chronic water shortages and persistent uneven water resource distribution challenges (Ghanian, et al., 2020; Mesgaran, Madani, Hashemi, & Azadi, 2017; Yazdandoost, 2016). Under semi-arid/arid conditions and declining precipitation under climate change, wetlands play a vital role in regional water management and distribution within Iran. Wetlands are vital ecosystems for water storage and purification necessary for human and non-human life to flourish, yet Iran remains a critical case study for wetland preservation, conservation and ecosystem services management (Eskandari-Damaneh, Noroozi, Ghoochani, Taheri-Reykandeh, & Cotton, 2020). Iran has 24 sites designated as wetlands of international importance (referred to as Ramsar sites) out of 2,290 worldwide. Of Iran's 24 sites roughly one third are under pressure or in a critical condition (Dabiri, 2016). The total area of Iranian Ramsar Sites is 585,500 hectares, yet only 39.5% of the total recorded wetlands are in the Ramsar Convention and on the Montreux Record (Eskandari-Damaneh, et al., 2020).

Wetland ecosystem services are demonstrably essential to human life, as both common pool and common-sink resources. However, in Iran, as in many developing countries, wetlands lack a relative market through which to express ecosystem service values and so they remain ‘invisible’ to land-use policy makers and planning authorities relative to other pressing concerns (i.e., the growth of agricultural and fossil fuel economies). Appropriate valuation of non-market environmental functions and services are therefore an important element of conservation practice.

Effective environmental valuation provides a link between economic policies and natural resources – allowing policy makers and environmental managers to meet multiple human welfare and sustainable development goals, set financial incentives to compensate ecosystem service suppliers for conservation to guarantee implementation, and adjust national income calculations to prevent the degradation and over-exploitation of natural resources (Ramajo-Hernández & del Saz-Salazar, 2012; Xu, Jiang, Tan, Costanza, & Yang, 2018).

Iran is a critical example of a country that lacks the necessary economic and policy structures to effectively value wetland ecosystem services. Lack of knowledge and awareness of the total value of goods and services provided by wetlands leads to de-prioritisation within land-use decision-making and the neglect of negative socio-economic impacts stemming from a decline in resource quality. Ultimately this means inadequate conservation measures to protect wetlands (De Salvo & Signorello, 2015) leading to long-term negative impacts upon biodiversity, water quantity and availability, and other indicators of ecosystem stability, along with a decline in the quantity and quality of ecosystem services. The expression of environmental resource benefits in policy and land-use planning requires an effective and reliable valuation mechanism in order better provide sustainable management measures that mesh with economic policy at regional and national scales. Mechanisms such as cost-benefit analysis (CBA) of resource conservation projects, assessment of social damage due to environmental resource degradation (Duffield, 1997), provide appropriate tools for policymakers to better articulate resource conservation value (Sarraf, Owaygen, Ruta, & Croitoru, 2005), creating a link between economic policy and the interests of environmental conservation (Tisdell, 2005), and the prioritisation of investment measures (Sarraf, et al., 2005).

### **Valuing wetlands – the role of Contingent Valuation Methodology**

Environmental economists use valuation methods to produce artificial markets for natural resources that would otherwise have no direct equivalent (García-Llorente, Martín-López, & Montes, 2011; Ghermandi, Sheela, & Justus, 2016; Lipton, Wellman, Sheifer, & Weiher, 1995). Valuation methods can utilize stated preference techniques, revealed preference methods, or production function methods. Although revealed preference methods are based on responses to an actual situation, stated preference methods are based on respondent's behaviour under given hypothetical situations and the only way to estimate non-use values (Hanley, Mourato, & Wright, 2001). Among stated preference methods, contingent valuation method (CVM) has a long history in environmental valuation (Ciriacy-Wantrup, 1947). CVM is a survey-based instrument to value non-market resources through assessment of stated preferences – concerning the maintenance of an existing environmental resource, or the compensation needed for its loss. CVM is commonly used to value changing stocks of public goods and common-pool resources such as, in this case, wetlands (Chambers, Chambers, & Whitehead, 1998), by using monetary values to determine stakeholder preferences by gauging how much they are willing to pay (WTP) for given benefits or certain environmental attributes (including current use and non-use, option, and existence values, see: Stevens, Echeverria, Glass, Hager, & More, 1991) or willingness to accept (WTA) its loss through monetary compensation. Though critiques of cost-based models remain an important aspect of their application and use in environmental valuation (notably: Diamond & Hausman, 1994) CVM is nonetheless growing in popularity and applicability to ecosystem services assessments (Gandarillas, Jiang, & Irvine, 2016; Tao, Yan, & Zhan, 2012) as it recognises a need

to understand respondents' valuation of public goods whilst demonstrating that an explicit link between non-market goods and market price is unnecessary.

CVM is highly suited for research into beneficiaries' WTP for ecosystem services and the level of ecological compensation required. In this empirical study, we apply a WTP model for the ecological compensation of wetlands in the Khuzestan province of Iran and to express payment levels in a manner that will ultimately benefit wetland conservation policy and action. We use the Logit model to analyse the factors influencing WTP and their mechanisms, based upon data collected amongst agricultural stakeholders in the region. In doing so, we assess the importance of the complementary values on beneficiaries' WTP for ecological compensation of Khuzestan Province Wetland and its application to Iran's overall lake wetland ecological compensation policy.

### **Theoretical framework**

The assumption within natural resource economics is that wetland destruction is due to incorrect calculation of the value of services provided by wetlands in market conditions (Barbier, 2019). Wetlands are public goods, and so the methods of pricing public goods differ from those of private goods. Optimal management of resources and the adoption of appropriate environmental policies necessitates mechanisms to identify the real benefits of wetlands and the social cost of destroying natural habitats, water stocks and water purification mechanisms. WTP for these ecosystem services reflects the highest price a person is willing to put forward for maintaining these natural resource qualities and features (Landry, Shonkwiler, & Whitehead, 2020; Manning, et al., 2020; Schmidt & Bijmolt, 2020). Fundamentally, this form of economic valuation refers to a relative change in a *stock*. To give an example, WTP for *biodiversity* refers to the economic value of a change to biodiversity in monetary terms; it does not determine the true or intrinsic value of biodiversity or ecosystems but rather values relative changes and compares them with their alternatives (Raviv, et al., 2020). It is the WTP a price for *using* a resource that gives it an economic value. The economic value is linked to resource scarcity. Accordingly, economic value is determined as an opportunity cost to that person from trading monetary for finite environmental resources (Mehvar, Filatova, Dastgheib, De Ruyter van Steveninck, & Ranasinghe, 2018). Ergo, the more the residents within an area are willing to protect the wetland, the more they will value the wetland and its benefits.

### **Methodology**

The Khuzestan Province Wetland in southwest Iran, is a critical case study for wetland conservation policy and action. Within the province the Horolazim and Shadegan wetlands, and Karun, Karkheh and Jarrahi rivers, are critical water resources, and yet they are heavily depleted and contain high levels of toxic pollutants (Ashayeri, et al., 2018). The province is oil-rich but also lies in the Fertile Crescent. More than 1 million hectares of land are used for agricultural purposes, though wetland land reclamation and water depletion from oil and gas production are shrinking the wetland area, harming farmer livelihoods. The drying of Khuzestan's wetland regions is also causing a rise in dust storms that plague surrounding cities Ahvaz, Mollasani, Shushtar and Gotvand (Correspondent, 2015; Shahsavani, et al., 2012). As such, these collective environmental impacts are causing considerable outmigration from the province (Khavarian-Garmsir,

Pourahmad, Hataminejad, & Farhoodi, 2019), with negative impacts upon tourism and other livelihood strategies in the region (Ghoochani, et al., 2020). Stronger valuation of wetland resources in the context of broader land use, agricultural and petrochemical industry planning is thus critical to long-term regional environmental and socio-economic sustainability (see for example: Ghoochani, Dorani, Ghanian, & Cotton, 2017; Shamsudin, et al., 2011).

To improve valuation efforts of critical wetland resources, empirical survey research was conducted in the villages around four key wetlands areas (i.e., Shadegan, Horolazim, Mianganran, and Bamdezh) in the Khuzestan province. The geographic location and the area of each of these four wetlands are listed in Table 1.

**Table 1. The geographic location and the area of each wetland**

Wetland	Geographical Location		Area (Ha)
	Eastern longitude	Northern latitude	
Shadegan	'17°-48 to' 50°-48	'17°-30' to 58°-30	400000
Horolazim	'16°-47 to' 58°-47	'53°-31 to' 00°-41	117000
Mianganran	'45°-49 to' 47°-49	'50°-30 to' 45°-31	2440
Bamdezh	'27°-48 to' 42°-48	'38°-31 to' 51°-37	40000

Villages were selected as a statistical population located in the wetland area, each composed of local stakeholders with *experiential knowledge* of the wetland ecosystem (Fazey, Fazey, Salisbury, Lindenmayer, & Dovers, 2006) – in the sense that villagers draw water, biomaterials and benefit from other ecosystem services directly from the region, and use this for productive work in agriculture and other artisanal industries. Our study population is composed of households within the selected villages, totalling 6,548 households. A sample of 565 households was randomly selected from the list of households in the district listed in the resident directory of each community. We arranged times and places to meet with villagers either in their home or workplace to administer the questionnaire that was conducted verbally by interviews. Villagers selected to participate in the survey were given the right to refuse or to decline from answering any questions that they felt uncomfortable with. All responses are anonymous. No incentives were provided to the respondents. All responses were checked to ensure they were complete. In total, a member of 316 households completed the questionnaire yielding a response rate of 55.9 percent. The demographic characteristics of the respondents are presented in table 2.

**Table 2. Demographic characteristics of the respondents**

Variable	Level	Frequency	Valid percent	Mean/S. D
Age*	41.30<	184	59	41.30/15.19
	≤41.30	128	41	
	No answer	4	-	
	Max	92	Min	28
Number of children*	3<	169	58.1	3.18 / 2.70
	≤3	122	41.9	
	No answer	25	-	
	Max	14	Min	0
Livelihood cost	1198<	113	35.8	1198.22/2973.7
	≤1198	203	64.2	

Variable	Level	Frequency	Valid percent	Mean/S. D
(USD per year) *	Max	37,500	Min	0
<b>Gender</b>	Male	277	87.7	-
	Female	39	12.3	-
<b>Education</b>	Illiteracy	42	13.9	-
	Primary	64	21.1	-
	High school	57	18.8	-
	Diploma	55	18.2	-
	Higher education	33	10.9	-
	Bachelor's degree or higher	52	17.2	-
<b>Marital status</b>	Married	253	82.4	-
	Single	54	17.6	-
	No answer	9	-	-
<b>Does your job relate to the wetland?</b>	Yes	58	19.4	-
	No	241	80.6	-
	No answer	17	-	-

\* Categorized according to the mean.

## Survey design and analysis

A researcher-made questionnaire was used to collect data. The questionnaire was designed to meet two defined objectives, and so was administered in two distinct phases:

*1. To assess the attitudes of residents towards the protection of the wetland environment.*

Respondents were instructed to rate their agreement or disagreement on a five-point Likert scale. The face validity of the questionnaire was approved by a group of experts. The reliability of the questionnaire was confirmed by conducting a pilot study in different villages from those selected in the main sample but with similar characteristics, with a Cronbach's alpha coefficient higher than 0.7. Data were analysed using SPSS (20) software.

*2. Estimating the conservation value of the wetland. In this study, to estimate the conservation value, the contingent valuation method (CVM) with a Double Dichotomous Choices questionnaire were used.*

In this phase, we sought to understand the factors affecting the WTP of wetland beneficiaries using contingent valuation methodology. We employed a survey of beneficiaries' WTP for changes in the quality and environmental performance of the wetland, measured in a hypothetical market (Callan & Janet, 2004) – a method that is core to environmental impact assessment practice (Eskandari-Damaneh, et al., 2020). Our primary aim was to assess the perspectives held by the villagers in Khuzestan province and to differentiate the factors affecting local stakeholder involvement in wetland conservation efforts using an econometric model (Lee & Han, 2002).

To determine the desired amounts in the final questionnaire, a pre-test using 30 questionnaires was completed in the study area. Respondents were asked to express their proposed amounts for the protection and restoration of the wetland. Beneficiary WTP was estimated using the parameters of the logit model using the maximum likelihood method assessed using Shazam (9) software. In this questionnaire, the respondents can answer positively or negatively in the face of the bid annual price for the protection and rehabilitation of the wetland. The middle of the pre-test data was approximately 50000 Rials (equivalent to 1.25 USD<sup>1</sup>). This was used as the first question in the final questionnaire. Respondents then proposed higher or lower amounts within the questionnaire. Specifically: the first WTP question in the questionnaire was posed as follows: Are you willing to pay 1.25 USD per year to protect the wetland? If the respondent negatively answers this question, a lower bid 0.625 USD (e.g., 25,000 Rials) will be submitted, and if the answer was yes, a higher bid 2.5 USD (e.g., 100,000 Rials) will be asked. Also, along with the proposed amounts (i.e., 25,000, 1.25 USD, and 2.5 USD) we ask all respondents to show their maximum WTP.

In the dual selection method, it is assumed that individuals have the following utility function (Dadkhah, 1984).

$$U = u(Y, S) \quad (1)$$

$$U(1, Y - A; S) + \varepsilon_1 \geq U(0, Y; S) + \varepsilon_0 \quad (2)$$

U: Indirect utility that a person achieves.

Y and A: respectively household expenditure and proposed amount,

S: Other social, economic characteristics that are influenced by individual preference are shown in function number 2 (Hanemann, 1984, 1989). Where  $\varepsilon_0$  and  $\varepsilon_1$  are random variables with a mean of zero that are randomly distributed independently of each other.

The difference in utility ( $\Delta U$ ) by using environmental source is included (Hanemann, 1984, 1989):

$$\Delta U = U(1, Y - A; S) - U(0, Y; S) + (\varepsilon_1 - \varepsilon_0) \quad (4)$$

The structure of the Double Dichotomous Choices questionnaire in assessing the WTP has a dependent variable with a dual choice. Therefore, the Logit model was used to investigate the effect of various explanatory variables on the WTP of respondents to determine the value. According to the Probability Logit model (Pi), the acceptance of one of the propositions is expressed as the following function (Dadkhah, 1984).

$$P_i = F_n(\Delta U) = \frac{1}{1 + \exp(-\Delta U)} = \frac{1}{1 + \exp\{-(\alpha + \beta A + \gamma Y + \theta S)\}} \quad (5)$$

Where  $F_n(\Delta U)$  is a function of cumulative distribution with a standard logistic difference and includes some socio-economic variables such as proposed amount, age, household expenditure, and education in this study.  $\beta$ ,  $\gamma$  and  $\theta$  are estimated coefficients that are expected to be  $\gamma > 0$ ,  $\beta \leq 0$  and  $\theta$  for each variable according to its nature can have a different sign.

---

<sup>1</sup> In study time, each 1 US Dollar was equivalent to 48000 Rials of Iran.

After estimating the logit model, the expected annual WTP amount to participate in conservation and restoration, with the help of numerical integration in the range of zero to maximum bid (A), is calculated from the following equation (Lee & Han, 2002).

$$E(WTP) = \int_0^{\max A} F_n(\Delta U) dA = \int_0^{\max A} \left( \frac{1}{1 + \exp[-(\alpha^* + \beta A)]} \right) dA \quad (6)$$

$$\alpha^* = (\alpha + \gamma Y + \theta S)$$

That E (WTP) is the expected value of the willingness to pay and  $\alpha^*$  is the modified intercept, which is added by the socio-economic sentence to the sentence of the original intercept ( $\alpha$ ) (Dadkhah, 1984).

Marginal Effect represents the amount of change in the probability of accepting the proposed amount per unit change in each explanatory variable according to the following function:

$$ME = \frac{\partial P_i}{\partial X_{ki}} = F(X_i' \beta_k) \beta_k = \frac{\exp(-X_i' \beta)}{[1 + \exp(-X_i' \beta)]^2} \beta_k \quad (7)$$

The amount of elasticity in the mean (E) also represents the percentage change in the probability of accepting the proposed amount for a one percent change in each of the explanatory variables that can be obtained from function 8 (Dadkhah, 1984). The parameters of the Logit model are estimated using the maximum likelihood method, which is the most common method for estimating the logit model (Lehtonen, Kuuluvainen, Pouta, Rekola, & Li, 2003).

$$E = \frac{\partial P_i}{\partial X_{ki}} \cdot \frac{X_{ki}}{P_i} = \frac{\exp(-X_i' \beta)}{(1 + \exp(-X_i' \beta))^2} \cdot \beta_k \cdot \frac{X_{ki}}{1} = \frac{\exp(-X_i' \beta)}{(1 + \exp(-X_i' \beta))} \cdot \beta_k \cdot X_{ki} \quad (8)$$

## Findings

### Attitudes of residents towards the protection of the wetland environment

Environmental attitudes represent a set of feelings, inclinations, beliefs, aesthetic and affective values and judgments of an individual towards an environmental phenomenon (Spash, 1997). In this section, the environmental attitudes of respondents were measured using several ranked items. As shown in table 3, the results showed that the items of “environmental monitoring is important for proper wetland management” with a mean rank of 4.23; and “the entry of industrial and agricultural effluents into the wetland causes the gradual death of the wetland and the surrounding villages” with a mean rank of 4.14 were in higher priorities than other items. In this respect, it is noting that ideas and beliefs play a key role in directing personal responsibility towards sustainable/pro-environmental behaviours (Engqvist Jonsson & Nilsson, 2014; Gatersleben, Murtagh, & Abrahamse, 2014).



**Table 3. Attitudes of residents towards the protection of the wetland environment**

Items	Strongly agree (Frequency)	Agree (Frequency)	I have no idea (Frequency)	Disagree (Frequency)	Strongly disagree (Frequency)	Mean rank	Rank
Environmental monitoring is important for effective wetland management.	114	169	26	3	3	4.23	1
The entry of industrial and agricultural effluents into the wetland causes the gradual death of the wetland and the surrounding villages.	126	125	46	13	3	4.14	2
Farmers, ranchers, and fishermen play an important role in protecting the wetland.	110	139	40	17	2	4.097	3
In my opinion, the vegetation of the wetland can be an important source of employment in the region to produce handicrafts and medicines, and so it must be preserved.	109	152	31	21	2	4.095	4
Protecting the wetland is more important than gaining its economic benefits.	106	154	23	25	6	4.04	5
Harvesting and use of reeds around the wetland should be controlled.	110	142	30	31	1	4.04	5
Improper grazing of livestock in and around the wetland should be controlled.	116	119	29	39	11	3.92	7
It is wrong to spend public money to protect the wetland when the people of the area are poor.	74	81	29	86	38	3.21	8
In my opinion, turning a part of the wetland into agricultural land can help the development of agriculture and increase the income of farmers.	66	101	29	59	59	3.17	9
Hunting should not be forbidden in the wetland, and we should enjoy this God-given blessing as much as we want.	55	89	42	68	61	3.02	10

### Estimating the conservation value of wetland ecosystem services

The results show that 64.3% of the residents agreed to pay an amount of their income for the protection of the wetland (Table 4).

51.6% (163) of the respondents accepted the first offer and were willing to pay 1.25 USD annually to protect the wetland. For the lower bid (0.625 USD per year), 19.3% (61 people) agreed to pay this amount. Those respondents who were willing to pay the first bid amount (1.25 USD per year) were faced with a higher bid of 2.5 USD. Among these people, 20.6% (65 people) were willing to pay this amount.

**Table 4. Status of responding to the three proposed amounts for estimating the conservation value of wetlands in Khuzestan province**

Accept the offered amount	Offered price (Up to 1.25 \$)	Offered price (Up to 0.625 \$)	Offered price (Up to 2.5 \$)
Number	163	61	65
Percentage	51.6%	19.3%	20.6%

**Table 5. The logit model to estimate the conservation value of the studied wetlands**

Variables	Estimated logit model			
	Coefficient	t statistics	Elasticity	Marginal effect
Offer amount (\$)	$-0.52 \times 10^{-3***}$	-11.14	-0.66	$-0.12 \times 10^{-3}$
Education (year)	1.60***	6.01	0.26	0.39
Livelihood cost (\$)	$-0.60 \times 10^{-7*}$	-1.70	$-0.54 \times 10^{-1}$	$0.14 \times 10^{-7}$
Job relationship with wetland (yes = 1, no = 0)	0.93***	4.29	0.29	0.23
Marital status (married = 1, single = 0)	-1.08***	-4.51	-0.44	-0.26
Number of children in the family (persons)	$0.14 \times 10^{-5}$	-0.36	$0.14 \times 10^{-1}$	$0.35 \times 10^{-6}$
Virtual Variable of Shadegan Wetland	-0.90**	-2.25	-0.20	-0.22
Virtual variable of Miangaran wetland	0.90*	1.75	$0.78 \times 10^{-1}$	0.22
Virtual Variable of Bamdezh Wetland	-1.76***	-4.07	-0.20	-0.43
Intercept	1.43***	3.25	-	-
Estrella R <sup>2</sup>		0.52		
CRAGG-UHLER R <sup>2</sup>		0.58		
Prediction accuracy percentage		0.84		
Likelihood ration test (P-value)		403.69 (0.000)		

\*, \*\* and \*\*\* were significant at the level of 10%, 5% and 1%, respectively.

Table 5 shows the factors influencing beneficiaries in wetland conservation based of their WTP. The R-square as Estrella and CRAGG-UHLER were measured at 52 and 58, respectively, indicating a valid explanation by the Logit model. The maximum likelihood ratio was measured at 403.69, which was greater than the value provided in the table, confirming the significance of the regression at 1%. Prediction accuracy was calculated at 84%, due to the minimum acceptable value for this parameter in the Logit model, so the pattern was satisfactorily estimated. The results showed the variables of education and job relationship with the wetland had a positive effect on the probability of price acceptance, and the variables of living costs and marital status had a negative effect on the probability of price acceptance.

We find that if the proposed amount increases by one unit or one percent, the probability of payment by the respondent will decrease by  $0.12 \times 10^{-3}$  units and 0.66%, respectively. In this way, increasing education increases the likelihood of participation. By interpreting the elasticity of the above-mentioned variable, assuming all other factors being equal, we conclude that an average of 1% in this variable will increase the beneficiaries' willingness to participate by 0.26. Livelihood

cost had negative effect on the likelihood of participation. According to the elasticity of livelihood cost, with an average of 1% in this variable will decrease the likelihood of participation by  $0.60 \times 10^{-7}$ . Also, given the issues in interpreting the elasticity of the dummy variables, their total marginal effect was interpreted. The marginal effect of job relationship with wetland in the model was 0.23, showing that the likelihood of beneficiaries with wetland-related employment participating in wetland conservation was 23% more than beneficiaries who were engaged in unrelated jobs. Marital status of the respondents also had a significant effect on their participation in the wetland conservation. The marginal effect of marital status in the model was -0.26 showing that the likelihood of single beneficiaries was 26% more than married beneficiaries.

Table 6 shows the WTP amounts for each of the wetlands within the study. Residents of Shadegan Wetland therefore show the strongest desire for wetland protection and the residents of Bamdezh Wetland the least.

**Table 6. Willingness to pay for the protection of wetlands in Khuzestan province**

Wetland	Estimation of the conservation value of the wetland (US \$)
Bamdezh	29.76
Horolazim	16.29
Mianganan	40.44
Shadegan	42.09

## Discussion and policy recommendations

Rural residents dependent upon wetland ecosystem services for their livelihood strategies are key stakeholders in the ongoing process of conservation and sustainable resource management. They are, in essence, direct beneficiaries and so it is necessary to estimate the conservation value of wetland sites to provide a clear view towards the efficacy of current and future conservative activities in these threatened ecosystems.

Our results estimating the conservation and sustainable management value of wetlands in Khuzestan province reveal that more than 60% of regional residents are willing to pay (WTP) an amount of personal income to protect wetland ecosystems. This leads to challenges for land use and agricultural decision-makers. The first is to identify the factors that prevent stronger wetland conservation-relevant valuation amongst the minority of residents, and the second is to encourage and facilitate the efforts of those that do value them. It is in understanding the dimensionality of these challenges that the CVM has promise. We find that wetland conservation values among residents of Bamdezh is equal to 3,395.76 USD, Horolazim 2715.41 USD, Mianganan wetland 17,012.81 USD and Shadegan wetland 80,227.54 USD. In total, the conservation value of wetlands in Khuzestan province is estimated at 103,351.52 USD, which illustrates the respective value of regional conservation efforts to agricultural and land-use policymakers and environmental regulators and gauges the level of support and active participation amongst local community stakeholders in protecting regional wetland habitats.

Estimates show that higher education levels lead to an in-step increase in the probability of accepting the proposed amounts. A combination of formal and informal education and training to

improve levels of scientific and sustainability literacy is therefore a conservation-relevant policy mechanism for long-term resource management. Household spending in the study area was detrimental to the likelihood of accepting the proposed amount, local economic concerns and poverty alleviation are therefore also key – the social and economic sustainability of the region is inherently tied to environmental protection motivation. In addition to the economic valuation of ecosystem services, innovative payment mechanisms can be implemented to protect these services. The ecosystem services of carbon sequestration, flood protection, water supply and other ecological services can be secured through payment mechanism innovations include environmental markets such as voluntary and mandatory carbon markets, as well as payment mechanisms for the recreational enjoyment of natural resources.

We speculate that public participation in protection and restoration of natural resources projects is also beneficial to building capacity towards practical sustainable action, and to reinforce pro-environmental values and behaviours across the regions. Examples such as the RFLDL International Project (Rehabilitation of forest and degraded lands with special emphasis on wind-sensitive lands and saline soils in Kerman and South Khorasan provinces), international carbon sequestration projects in South Khorasan province, or the local community empowerment project of Qala-e-Ganj city development plan (pilot of the country's resistance economy), are potentially valuable exemplar models. The combination of social network building, and social learning has been shown as valuable in overcoming community resistance to conservation and restoration (Lindley, 2014; Steyaert, et al., 2007) and may work to establish longer-term ethical/institutional norms of pro-environmental behaviour amongst residents (Al-Weshah, Saidan, & Al-Omari, 2016; Soleimanpour Omran, 2014).

Generally, to effectively improve the beneficiaries' WTP for the ecological compensation of Khuzestan Wetland and their payment levels, it is necessary to promote the establishment and implementation of the wetland ecological compensation mechanism through participatory means. A key policy measure is for government actively promote beneficiaries' awareness about their obligations to wetland ecological protection and their liabilities for damage caused to the area. Experience has shown that it is difficult to levy compensation funds from the beneficiaries, who traditionally view the wetland ecosystem services as "free" (for discussion of this phenomenon see for example: de Souza Queiroz, et al., 2017). Thus, there are serious gaps between the concept's ideology and its practical implementation. Although national laws obligate citizens to protect natural resources and the environment, with mandated legal liabilities for any breaches, residents within wetland areas commonly consider the use of wetland ecosystem services as a traditional right. Awareness-raising through public information campaigns and active stakeholder-engagement through participatory-deliberative mechanisms (citizen's juries, or citizen's assemblies recently popularized in climate change policy (Weitzman, 2017) could potentially foster regional beneficiary buy-in to legal strictures upon ecological resource over-exploitation and degradation thus building a shared ideological foundation for the successful establishment of an ecological compensation system for the wetlands throughout the country.

A second key measure would be to establish rural cooperatives centred upon biomaterials and food products produced within wetland areas (such as fish, shrimp, vegetables, and wood). Such cooperatives for common-pool resource management have proved beneficial in promoting a shared local-institutional governance framework that encourages long-term sustainability (see for

example: Regmi, Adhikari, Subedi, Suwal, & Paudel, 2007). Such cooperatives could be supported by government capital loans or other supporting technological infrastructure (such as telecommunications) providing a link between local environmental protection, rural livelihood strategies and government environmental policy. Wetland rural agricultural stakeholders/beneficiaries might then increase their WTP by providing a protected and sustainable market for the sale of wetland ecosystem services and products whilst reducing the risk of *tragedy of the commons*-induced resource collapse.

A third measure, we recommend is to develop wetland protection funds for real money generated by beneficiaries' willingness to pay, and then using the fund for direct conservation spending in the local community – ring-fencing the economic windfall to fund pollution remediation, grazing management and sustainable irrigation measures on the ground. We also recommend that state and local governments supplement a resident WTP windfall with ongoing financial support to continually increase investment in wetland conservation. This requires transparency and ongoing relationship-building between communities and local authorities, but that would build a sense of shared commitment amongst the stakeholder network of public and private sector interests in the region. Improving and protecting wetland environments promise to increase beneficiaries' incomes and their quality of life, therefore benefiting the overall wellbeing and biosecurity of Iranian society.

A fourth measure is to establish an ecological compensation system database to serve rural households around lakes and other wetland habitats. Information access is a key facet of long-term conservation success. This activity could be taken up as part of an annual census, wherein the relevant government departments would collate all the information related to ecological compensation, such as household income sources, arable land area, contracted water area, etc. Improved survey data would provide an important foundation for assessing beneficiaries' WTP and help the development of specific standards in the field.

Fifth, the Iranian government could develop differentiated ecological compensation standards. Following the varying characteristics/heterogeneity of rural households, it may be prudent to develop different ecological compensation fund levies or disbursement criteria, such that the poorest agricultural workers and rural livelihoods are not unduly harmed through payment measures for environmental protection.

Finally, long-term commitments for wetland conservation are an ongoing global challenge, with the depletion and degradation of resources affecting the ecosystem services, ecological stability and livelihood strategies of the world's poorest people that threaten progress towards Global Sustainable Development Goals (Jaramillo, et al., 2019; Seifollahi-Aghmiuni, Nockrach, & Kalantari, 2019). Active participation in wetland conservation and sustainable management measures is a necessary step in their protection: necessitating a multi-actor and multi-scalar approach. Within this the CVM provides a key tool for assessing the strength of stakeholder commitments to pro-environmental change, making visible the preferences, and associated social factors that influence these commitments. We argue that across arid and semi-arid regions, the combination of formal and informal/social learning about sustainable resource management, improved information access, a combination of local payments and national disbursements, social

engagement and capacity building as shown in this case study, provide potential tools to assist in establishing the long-term sustainability of wetland habitats.

### **Limitations and future research**

Though sampled within four rural regions of a critically affected wetland case study, results cannot be generalized beyond the sample populations. Given that data only refers to a 2018–2019 data collection period, further longitudinal analysis could assess beneficiary WTP changes over time. By combining WTP and WTA in future research the ecological compensation standard can be estimated for wetland beneficiaries, and this model can be applied to other sensitive wetland regions.

### **Declaration**

Funding: This research has no funding source.

Conflicts of interest/Competing interests: The authors declared they have no conflict of interest.

Code availability: Not applicable.

Authors' contributions: MG: Designed the research. OMG: Wrote the paper. HN: Analyzed and interpreted data. MC: Wrote the paper.

### **References**

#### References

- Al-Weshah, R. A., Saidan, M. N., & Al-Omari, A. S. (2016). Environmental ethics as a tool for sustainable water resource management. *Journal-American Water Works Association*, 108, E175-E181.
- Ashayeri, N. Y., Keshavarzi, B., Moore, F., Kersten, M., Yazdi, M., & Lahijanzadeh, A. R. (2018). Presence of polycyclic aromatic hydrocarbons in sediments and surface water from Shadegan wetland–Iran: a focus on source apportionment, human and ecological risk assessment and sediment-water exchange. *Ecotoxicology and Environmental Safety*, 148, 1054-1066.
- Barbier, E. B. (2019). The value of coastal wetland ecosystem services. In *Coastal Wetlands* (pp. 947-964): Elsevier.
- Bassi, N., Kumar, M. D., Sharma, A., & Pardha-Saradhi, P. (2014). Status of wetlands in India: A review of extent, ecosystem benefits, threats and management strategies. *Journal of Hydrology: Regional Studies*, 2, 1-19.
- Callan, S. J., & Janet, M. (2004). Thomas. *Environmental Economics & Management: Theory, Policy, and Applications*. In: The McGraw-Hill Companies, Inc.
- Chambers, C. M., Chambers, P. E., & Whitehead, J. C. (1998). Contingent valuation of quasi-public goods: Validity, reliability, and application to valuing a historic site. *Public Finance Review*, 26, 137-154.
- Ciriacy-Wantrup, S. V. (1947). Capital returns from soil-conservation practices. *Journal of farm economics*, 29, 1181-1196.
- Correspondent, T. B. (2015). How Iran's Khuzestan went from wetland to wasteland'. *The Guardian*, 16.
- Dabiri, F. F., Fazel, A. M., Moghaddasi, N., and Mehrdadi, M. (2016). Islamic Republic of Iran - Revised National Biodiversity Strategies and Action Plan (NBSAP2) 2016-2030. . In. Tehran: Natural Environment and Biodiversity Division Department of Environment.

- Dadkhah, K. M. (1984). Introduction to the Theory and Practice of Econometrics. In: JSTOR.
- De Salvo, M., & Signorello, G. (2015). Non-market valuation of recreational services in Italy: A meta-analysis. *Ecosystem services*, 16, 47-62.
- de Souza Queiroz, L., Rossi, S., Calvet-Mir, L., Ruiz-Mallén, I., García-Betorz, S., Salvà-Prat, J., & de Andrade Meireles, A. J. (2017). Neglected ecosystem services: Highlighting the socio-cultural perception of mangroves in decision-making processes. *Ecosystem Services*, 26, 137-145.
- Diamond, P. A., & Hausman, J. A. (1994). Contingent Valuation: Is Some Number better than No Number? *Journal of Economic Perspectives*, 8, 45-64.
- Duffield, J. (1997). Nonmarket valuation and the courts: The case of the Exxon Valdez. *Contemporary Economic Policy*, 15, 98-110.
- Engqvist Jonsson, A.-K., & Nilsson, A. (2014). Exploring the relationship between values and pro-environmental behaviour: the influence of locus of control. *Environmental Values*, 23, 297-314.
- Eskandari-Damaneh, H., Noroozi, H., Ghoochani, O. M., Taheri-Reykandeh, E., & Cotton, M. (2020). Evaluating rural participation in wetland management: A contingent valuation analysis of the set-aside policy in Iran. *Science of The Total Environment*, 747, 141127.
- Fazey, I., Fazey, J. A., Salisbury, J. G., Lindenmayer, D. B., & Dovers, S. (2006). The nature and role of experiential knowledge for environmental conservation. *Environmental Conservation*, 33, 1-10.
- Gandarillas, V., Jiang, Y., & Irvine, K. (2016). Assessing the services of high mountain wetlands in tropical Andes: A case study of Caripe wetlands at Bolivian Altiplano. *Ecosystem services*, 19, 51-64.
- García-Llorente, M., Martín-López, B., & Montes, C. (2011). Exploring the motivations of protesters in contingent valuation: Insights for conservation policies. *Environmental Science & Policy*, 14, 76-88.
- Gatersleben, B., Murtagh, N., & Abrahamse, W. (2014). Values, identity and pro-environmental behaviour. *Contemporary Social Science*, 9, 374-392.
- Ghanian, M., Ghoochani, O. M., Dehghanpour, M., Taqipour, M., Taheri, F., & Cotton, M. (2020). Understanding farmers' climate adaptation intention in Iran: A protection-motivation extended model. *Land Use Policy*, 94, 104553.
- Ghermandi, A., Sheela, A. M., & Justus, J. (2016). Integrating similarity analysis and ecosystem service value transfer: Results from a tropical coastal wetland in India. *Ecosystem services*, 22, 73-82.
- Ghoochani, O. M., Dorani, M., Ghanian, M., & Cotton, M. (2017). Analyzing stakeholder water source preference based upon social capital: a case study of the Fajr Jam Gas Refinery in Iran. *Water Conservation Science and Engineering*, 2, 109-120.
- Ghoochani, O. M., Ghanian, M., Khosravipour, B., & Crotts, J. C. (2020). Sustainable tourism development performance in the wetland areas: a proposed composite index. *Tourism Review*.
- Guo, M., Li, J., Sheng, C., Xu, J., & Wu, L. (2017). A review of wetland remote sensing. *Sensors*, 17, 777.
- Hanemann, W. M. (1984). Welfare evaluations in contingent valuation experiments with discrete responses. *American journal of agricultural economics*, 66, 332-341.
- Hanemann, W. M. (1989). Welfare evaluations in contingent valuation experiments with discrete response data: reply. *American journal of agricultural economics*, 71, 1057-1061.

- Hanley, N., Mourato, S., & Wright, R. E. (2001). Choice modelling approaches: a superior alternative for environmental valuation? *Journal of economic surveys*, *15*, 435-462.
- Jaramillo, F., Desormeaux, A., Hedlund, J., Jawitz, J. W., Clerici, N., Piemontese, L., Rodríguez-Rodríguez, J. A., Anaya, J. A., Blanco-Libreros, J. F., & Borja, S. (2019). Priorities and interactions of sustainable development goals (SDGs) with focus on wetlands. *Water*, *11*, 619.
- Junk, W. J., An, S., Finlayson, C., Gopal, B., Květ, J., Mitchell, S. A., Mitsch, W. J., & Robarts, R. D. (2013). Current state of knowledge regarding the world's wetlands and their future under global climate change: a synthesis. *Aquatic sciences*, *75*, 151-167.
- Khavarian-Garmsir, A. R., Pourahmad, A., Hataminejad, H., & Farhoodi, R. (2019). Climate change and environmental degradation and the drivers of migration in the context of shrinking cities: A case study of Khuzestan province, Iran. *Sustainable Cities and Society*, *47*, 101480.
- Landry, C. E., Shonkwiler, J. S., & Whitehead, J. C. (2020). Economic Values of Coastal Erosion Management: Joint Estimation of Use and Existence Values with recreation demand and contingent valuation data. *Journal of Environmental Economics and Management*, *103*, 102364.
- Lee, C.-K., & Han, S.-Y. (2002). Estimating the use and preservation values of national parks' tourism resources using a contingent valuation method. *Tourism management*, *23*, 531-540.
- Lehtonen, E., Kuuluvainen, J., Pouta, E., Rekola, M., & Li, C.-Z. (2003). Non-market benefits of forest conservation in southern Finland. *Environmental Science & Policy*, *6*, 195-204.
- Lindley, D. S. (2014). *Can Expansive (social) Learning Processes Strengthen Organisational Learning for Improved Wetland Management in a Plantation Forestry Company, and If So How?: A Case Study of Mondi*. Rhodes University Grahamstown.
- Lipton, D. W., Wellman, K. F., Sheifer, I. C., & Weiher, R. F. (1995). *Economic valuation of natural resources: a handbook for coastal resource policymakers*: US Department of Commerce, National Oceanic and Atmospheric Administration ....
- Manning, D. T., Rad, M. R., Suter, J., Goemans, C., Xiang, Z., & Bailey, R. (2020). Non-market valuation in integrated assessment modeling: The benefits of water right retirement. *Journal of Environmental Economics and Management*, 102341.
- Mehvar, S., Filatova, T., Dastgheib, A., De Ruyter van Steveninck, E., & Ranasinghe, R. (2018). Quantifying economic value of coastal ecosystem services: a review. *Journal of marine science and engineering*, *6*, 5.
- Mesgaran, M. B., Madani, K., Hashemi, H., & Azadi, P. (2017). Iran's land suitability for agriculture. *Scientific reports*, *7*, 1-12.
- Ramajo-Hernández, J., & del Saz-Salazar, S. (2012). Estimating the non-market benefits of water quality improvement for a case study in Spain: A contingent valuation approach. *Environmental Science & Policy*, *22*, 47-59.
- Raviv, O., Shamir, S. Z., Izhaki, I., Sagie, H., Negev, M., Mazor-Tregerman, M., Collins-Kreiner, N., Mansfeld, Y., & Lotan, A. (2020). The socioeconomic value of multiple ecosystem types at a biosphere reserve as a baseline for one holistic conservation plan. *Ecosystem services*, *41*, 101043.
- Regmi, B. R., Adhikari, A., Subedi, A., Suwal, R., & Paudel, I. (2007). Towards an innovative approach to integrated wetland management in Rupa Lake Area of Nepal. *Journal of Geography and Regional Planning*, *2*, 080-085.



- Sarraf, M., Owaygen, M., Ruta, G., & Croitoru, L. (2005). Islamic Republic of Iran: Cost assessment of environmental degradation. *World Bank, Washington, DC*.
- Schmidt, J., & Bijmolt, T. H. (2020). Accurately measuring willingness to pay for consumer goods: a meta-analysis of the hypothetical bias. *Journal of the Academy of Marketing Science, 48*, 499-518.
- Seifollahi-Aghmiuni, S., Nockrach, M., & Kalantari, Z. (2019). The potential of wetlands in achieving the sustainable development goals of the 2030 Agenda. *Water, 11*, 609.
- Shahsavani, A., Yarahmadi, M., Mesdaghinia, A., Younesian, M., Naimabadi, A., Salesi, M., & Naddafi, K. (2012). Analysis of dust storms entering Iran with emphasis on Khuzestan Province. *Hakim Research Journal, 15*, 192-202.
- Shamsudin, M. N., Radam, A., Rahim, K. A., Yacob, M. R., Muda, A., & Yazid, M. (2011). Economic valuation of Shadegan International Wetland, Iran: notes for conservation. *Regional Environmental Change, 11*, 925-934.
- Soleimanpour Omran, M. (2014). The effect of educating environmental ethics on behavior and attitude to environment protection. *European Online Journal of Natural and Social Sciences: Proceedings, 3*, pp. 141-150.
- Spash, C. L. (1997). Ethics and Environmental Attitudes With Implications for Economic Evaluation. *Journal of Environmental Management, 50*, 403-416.
- Stevens, T. H., Echeverria, J., Glass, R. J., Hager, T., & More, T. A. (1991). Measuring the existence value of wildlife: what do CVM estimates really show? *Land Economics, 67*, 390-400.
- Steyaert, P., Barzman, M., Billaud, J.-P., Brives, H., Hubert, B., Ollivier, G., & Roche, B. (2007). The role of knowledge and research in facilitating social learning among stakeholders in natural resources management in the French Atlantic coastal wetlands. *Environmental Science & Policy, 10*, 537-550.
- Tao, Z., Yan, H., & Zhan, J. (2012). Economic valuation of forest ecosystem services in Heshui watershed using contingent valuation method. *Procedia Environmental Sciences, 13*, 2445-2450.
- Tisdell, C. (2005). Linking policies for biodiversity conservation with advances in behavioral economics. *The Singapore Economic Review, 50*, 449-462.
- Weitzman, M. L. (2017). Voting on prices vs. voting on quantities in a World Climate Assembly. *Research in Economics, 71*, 199-211.
- Xu, X., Jiang, B., Tan, Y., Costanza, R., & Yang, G. (2018). Lake-wetland ecosystem services modeling and valuation: Progress, gaps and future directions. *Ecosystem services, 33*, 19-28.
- Yazdandoost, F. (2016). Dams, drought and water shortage in today's Iran. *Iranian Studies, 49*, 1017-1028.