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Evaluating rural participation in wetland management: a contingent valuation analysis of the set-aside policy in Iran

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Abstract
Growing conditions of water scarcity and population growth necessitate measures for improved water availability to meet agricultural, industrial, and domestic and consumer water demands; generating new environmental pressures on wetlands and other aquatic ecosystems. In Iran, the "set-aside program" incentivizes farmer participation in wetland conservation through mandated land management practices, making them key stakeholders in environmental conservation action. This study explores attitudes to participation in the set-aside wetland conservation program to revive the Jazmurian wetland in Iran, using a random sample of 226 farmer-stakeholder respondents. Farmers were surveyed to investigate economic and social participation using a willingness to accept (WTA) and willingness to pay (in money per ha) (WTP) model. Results show strong (45%) respondent opposition to wetland conservation participation. On the basis of their WTA, the amount of compensation offered by the villagers was significantly affected by "the cultivated area", "gender", "education", "family size", "residency", "income", "moralism", and "Inverse Mills Ratio index" factors. Also, "the cultivated area", "age", "education", "marital status", "family size", and "income" were found to be significantly affecting their WTP. We argue firstly, that policies to improve wetland conservation must join together infrastructure and agricultural development planning – such that dam projects, agricultural and water conservation planning are better integrated across wetland catchments. Secondly, that wetland conservation participation will be improved through land consolidation agreements for small-holders, and through incomes stabilisation, capacity building, social learning and awareness-raising initiatives for farmers towards sustainable agricultural practices.

Keywords: dams; rural participation; wetland protection, set-aside program; Heckman two-stage model; contingent valuation

Highlights
We researched motivation for farmer participation in conservation practices in the context of a set-aside policy for reviving the Jazmurian wetlands in Iran.

We used a contingent valuation approach - investigating the willingness-to-accept (WTA) and willingness-to-pay (WTP) of farmer-stakeholder, assessed using a Heckman two-stage model.

Our results showed strong (45%) respondent opposition to wetland conservation participation.

The amount of compensation offered by the villagers was significantly affected by "the cultivated area", "age", "gender", "education", "family size", "marital status", "residency", "income", "moralism", and "Inverse Mills Ratio index" factors.

We propose wetland conservation policies that integrate grey infrastructure planning with agricultural extension training to provide justice to farmers and support self-reinforcing cultural norms of wetland conservation practice.

1. Introduction

1.1. Wetland management

Wetlands are key ecosystem service providers. They support biodiverse habitats, protect gene banks, sequester carbon, feed and discharge groundwater, regulate water flow (providing flood abatement), prevent saltwater intrusion, retain sediments and nutrients, prevent soil erosion, produce biomass, cleanse toxins, act as sources of recreation and tourism, and produce food (fisheries) and natural products (Zedler and Kercher, 2005; Ryan et al., 2012; Clarkson et al., 2013; Sandifer et al., 2015; Fish et al., 2016; Zhu et al., 2016; Jayathilaka and Serasinghe, 2018; Negev et al., 2019). *Wetland management* is therefore an active process of ecosystem support through which human activity simultaneously extracts economic and social benefits from ecosystem services, whilst balancing immediate resource needs against sustainable long-term maintenance through appropriate planning and decision-making (Plaster, 2002; Baghaee, 2006; Ebadi and Tabatabaee, 2006).

Support for wetland management is an urgent environmental policy priority. Despite conservation efforts by scientists and environmental non-governmental organisations, the global status of wetland biosecurity is alarming. Estimates of global wetland area range from 5.3 to 12.8 million km^2. However, approximately 50% of wetland habitat has been lost due to a range of pressures. Wetlands face many threats, primarily from competing land uses from the agricultural sector (for planting and grazing), contamination from extractive and other polluting industries, and from expanding water uses (such as for domestic consumption, commercial use in manufacturing, irrigation or electricity production). Dam construction has a particularly detrimental effect upon wetland systems. Water management experts and decision-makers have twin goals to reduce water loss from primary sources by proposing control and conservation measures, and to simultaneously increase water availability for public consumption (Ghoochani et al., 2017; 2015). Storage dams are therefore commonly built to hold water from seasonal and non-seasonal rivers, provide flood control, a water supply for agriculture, industry and drinking sectors, energy production, fishing and tourism (WCD, 2000; Pazvakawambwa, 2018; Zou et al., 2018). However, dam construction has significant social (including out-migration), economic (such as employment, income, and etc.), and ecological (including changes in cropping pattern and ecosystem) impacts on downstream of their construction (Richter and Thomas, 2007; Fung et al., 2019; Sok et al., 2019). Dams lead to drying wetlands (Kingsford, 2000), changing patterns of land morphology, use, and flow (Gordon and Meentemeyer, 2006; Zhao et al., 2010), relocation, resettlement and dramatic population migration (Xi and Hwang, 2011; Lerer and Scudder, 1999), accumulation of sediment (Yang et al., 2005; Kondolf et al., 2014; Rãdoane and Radoane, 2005), changes in the quality and characteristics of water (Brainwood et al., 2004), as well as the destruction of forests and wildlife in the areas downstream (Benchimol and Peres, 2015). As such, the socio-environmental impact of dams is deeply significant and a diverse array of stakeholders across multiple scales of governance have demanded greater policy-making attention to the environmental and socio-economic consequences of dam projects worldwide – in some cases advocating a moratorium on dam construction (Sait Tahmicioglu et al., 2007; Yang et al., 2011; Newell et al., 2019; Del Bene et al., 2018; Miles and Ebrey, 2017).

This paper considers Iran as a critical case study for wetland conservation and management. With 6 sites, Iran is in second place behind Greece (with 7). The total area of Iranian Crisis Sites is 585,500 ha, which, from this perspective, is preceded by the USA (1 site with an area of 610,497 ha). Yet Iran's situation is unfavorable, given that only 39.5% of the total recorded wetlands in Iran are in the Ramsar Convention and on the Montreux Record[1] (Ramsar Sites Information Service, 2016). Moreover, changes in water management policy and practice in Iran towards supply-based water policies that have increased water insecurity also pose a long-term systemic threat to wetlands: such as facilitating deep-pumped well drilling, inter-basin water transfer, and dam construction (Saatsaz, in press; Pirestani and Shafaghi, 2009). Iran is ranked 11th among global dam building countries; as of 2016, more than 802 large and small dams are in operation (ICOLD, 2016). Understanding the dynamics of Iranian wetland conservation in the context of changing systems of water management, and the relative success of failure of environmental management outcomes is therefore of growing international interest to ecologists, environmental scientists and policy authorities in other wetland-threatened contexts worldwide.

1.2 Participatory wetland management

Though wetland conservation is often driven by conservation scientific and advocacy organizations, the actual 'managers' of wetland ecosystems are often rural people who live in communities within wetland watershed, and who also rely upon the ecosystem services that they provide (Ghoochani et al., 2020). Rural communities play a key role in achieving conservation objectives and in turn, due to their ongoing interactions with the environment, gain familiarity with the surroundings through recreation and resource use practices (Schelhas et al., 2002; Berkes and Turner, 2006).

In Iran, participation in wetland management takes place within the context of a policy strategy referred to as the *set-aside program* – implemented by Iranian authorities to alleviate agricultural pressures on wetland ecosystems. For example, the set-aside program has been promoted as a solution to revitalize Lake Urmia - a 5,200km^2 endorheic salt lake of critical environmental significance. The set-aside program stipulates that farmers reserve a certain percentage of their total planted acreage and devote this land to approved conservation uses (such as grasses, legumes, and small grain which is not allowed to mature) in order to be eligible for non-recourse loans and deficiency payments (Bourgeon et al, 1995; Herkert, 2009). Essentially, participation in the program requires farmers to reduce their planted areas to meet conservation goals. This model has drawn attention from researchers and environmental policymakers globally towards wetlands and lake protection. For instance, it has been modelled in Switzerland as a policy solution to increasing the area of arable land devoted to ecological compensation (Eggenschwiler et al., 2009).

The concept of *rural participation* in wetland management, conservation and agricultural adaptation is of central importance to achieving socially and politically legitimate environmental management outcomes under conditions of environmental change, institutional complexity and stakeholder conflict (Cotton and Mahroos-Alsaiari, 2015; Herath, 2004; Mermet, 1991; Millar et al. 2018; Parker and Thapa, 2011; Pimbert and Pretty, 1997; Shiferaw et al. 2009). Wetlands are fundamentally, long-term, participatory environmental management projects (Azami and Sadi, 2008). Therefore, understanding the motivating factors for

[1] Montreux Record Including list of wetlands that have been registered in the Ramsar Convention but their ecological characteristics changed or is changing

(specifically rural) participation in wetland management remains a key research priority (Millar et al, in press; Huilan, 2009).

In practice, participatory wetland management commonly requires local resident involvement in specifying local development actions, stages, scales and procedures for achieving desired outcomes. However, the lack of significant participation in the management and supervision of natural resources often leads to failures in meeting environmental management outcomes, alienation of rural communities from decision-making processes, and poor uptake of sustainable agricultural practices (Adhikari, 2012). Understanding the factors that influence rural participation in environmental management (broadly) and wetland management (specifically), is therefore a key research priority to support both ecological conservation and sustainable livelihoods (Hejazi and Arabi, 2008). Assessing the influencing factors of participation through willingness-to-pay (WTP) models has proved fruitful in previous research (Yu and Belcher, 2011); with factors such as age, education (Kibet Rono, 2013), acreage, location, benefits, cultural values, economic incentives (e.g. household income, increased funding, donations, and income-generating activities), household size, settlement distance from wetlands (Zhang et al., 2011; Guan et al., 2015) shown as valuable dimensions to consider.

Though of growing scientific and policy interest, there remains a paucity of data regarding farmer attitudes to participation in sustainable wetland management actions and the factors that influence their involvement. One of the major issues raised by opponents of the set-aside plan is that rural economic and social participation is under-represented, and yet is needed for the successful implementation of wetland protection procedures (Oen et al., 2016). Understanding the barriers and motivations for participation is therefore of significant policy relevance (Ghanian et al., 2020), not only in Iran, but also in other regions where farmers are high-priority stakeholders in wetland conservation under conditions of population growth, climate change, institutional complexity and water stress.

Our empirical analysis centers upon a critical case study: examining rural participation in the management of the Jazmurian wetlands project in Iran. The novelty of this research is threefold. Firstly, we present an investigation of the individual, cultural, economic and social factors that influence farmers' participation in wetland management. Secondly, we proffer a novel willingness-to-pay model applicable to other wetland management contexts. Thirdly, we provide specific insights into the alignment of agricultural land management, water management and conservation goals in the context of the set-aside policy program. The latter has relevance to Iranian environmental management policy, and application internationally to cases where similar conservation practice policies are in place, to protect Ramsar sites (notable examples of similar set-aside programmes include the South African Palmiet wetlands and Lakes Mikri, Prespa and Kerkini in Greece; Pyrovetsi and Daoutopoulos, 1997; Rebelo et al, 2019).

2. Materials and methods

2.1. Case study characteristics

The Jazmurian wetland is a critical case for conservation and environmental management – it is widely regarded as a highly sensitive ecosystem in South East Iran. The wetlands lie between 58° 39' to 59° 14' E, and 27° 10' to 27° 10' N, between the provinces of Kerman and Sistan-Baluchistan. This area measures 300km East-to-West and 100km North-to-South. The area of the watershed of this seasonal lake reaches 69,000km^2, and lies approximately 300m above sea-level. The total surface area of the wetland under optimal conditions expands to as much as 3,300km^2, which shrinks to 2500km^2 with decreased inflows (Gandomkar, 2009). The Jazmurian wetland is a critical case because it is threatened by a storage dam built on the river leading up to it, as shown in Figure 1. The site is selected specifically to illustrate the direct conflict of environmental priorities between wetland conservation and domestic and agricultural/industrial use of scarce water resources.

Figure. 1 here.

Annual precipitation in the western part of the Jazmurian wetlands is about 200 mm, whilst other parts are more arid with average annual precipitation of less than 100 mm and evaporation rates high – reaching up to 2500mm per year (Rashki et al., 2017). The reduction in annual rainfall (in part a consequence of anthropogenic climate change), as well as the construction of diversion and storage dams on the river Halil Rud, has driven this large wetland into its currently dry condition (Gandomkar, 2009; Rashki et al., 2017). Together these factors threaten biodiversity and ecosystem services in the region. Of note is the significant reduction in migratory birds (Sarhaddi-Dadian et al., 2019). With the drying of the wetlands, the region has become a significant source of dust particles – leading to dust storms affecting the northern coast of the Arabian Sea (Makran mountains), the Oman Sea, the southeastern Arabian Peninsula and western Pakistan (Rashki et al., 2017). Dust affects regional air quality and associated health impacts from particulate air pollution. Fluctuations in the wetland levels and degradation to the currently dry state, have caused significant changes to the socio-economic status of farmers. The agricultural economy is deeply threatened, and the loss of ecosystem-service supported livelihoods is stimulating rural-to-urban migration (Lotfinasabasl et al., 2019).

Jazmurian wetland management is increasingly subject to socio-environmental conflict. Sustainable management practices are threatened by competing policy interests, stakeholder priorities and incommensurable value tradeoffs. As such, social scientific analysis of wetland management is needed. Data for this evaluation was collected in a case study of the Jiroft district of the Kerman Province - a key region within the wetland ecosystem. Jiroft is an exemplar case of ecosystem service disruption causing a weakening of the agricultural economy, significant negative impacts to the livelihoods of local people, and hence an adjustment of livelihood strategy - including significant regional out-migration in response to the drying effect. Understanding the interaction between the ecological dimensions of wetland management and the socio-economic participation of rural farmers in the region is therefore important to improving regional sustainable development outcomes, and lessons from this case are instructive for facilitating rural participation in other Ramsar wetland socio-environmental development contexts.

2.2. Sample description

Data collection involved surveys completed in 2018 by farmers that use water from the dams leading to the Jazmurian wetland. Researchers met with farmers either in their home or farm to conduct the surveys. No financial incentives were offered. Data that was not accessible via the questionnaire was supplemented through review of existing documents and surveys from related agencies, including the Agriculture Services and Regional Water office of the Kerman province. For the survey, a simple random sample was initiated. In order to determine the number of samples needed, a preliminary study was completed using 30 questionnaire responses. Then, using the Cochrane's (1963) formula (without having population size), the sample size was determined to be 243.

$$n = \frac{\sigma^2 t^2}{d^2} = \frac{0.904 \times 1.64^2}{0.1^2} = 243 \qquad (1)$$

In the equation above, *n* is the sample size, σ^2 is variance, t is the confidence level, and *d* is the desired accuracy. Finally, by reviewing and removing inappropriate observations from the data, 226 questionnaires collected and analyzed using SPSS 21 and Shazam 9 software.

2.3. Data collection

The questionnaire was designed according to three defined objectives (in three main sections):

1. To assess rural participant responses to a range of environmental issues. Farmer/respondents were instructed to rate their agreement or disagreement on a five-point Likert scale.
2. In order to assess their attitudes and views, the mean of the responses were compared with pre-assumed average of 3 using a t-test to examine farmer's agreement or disagreement with proposed environmental attitudes.
3. To assess social and economic factors related to wetland management, and agricultural practices.

2.4. Data Analysis

In this study, we seek to better understand the factors affecting the willingness of farmers to participate using contingent valuation methods. We employed a survey of farmers' willingness to pay (WTP) and willingness to accept (WTA) for changes in the quality and environmental performance of the wetland, measured in a hypothetical market (Callan and Janet, 2004) – a method that is core to environmental impact assessment practice (Venkatachalam, 2003). Our primary aim is to assess the perspectives held by the villagers in Jiroft city and to differentiate the factors affecting villagers' willingness to participate in wetland management practices.

In order to analyze the factors based on the willingness to accept (WTA) and willingness to pay (WTP) of the program and how they affected by those factors, we estimate an econometric model (Lee and Han, 2002). In single equation econometric methods there is the possibility of second-type errors in the estimates. Type I and Type II errors, respectively, are due to non-random samples and the lack of distinction between the variables affecting the decision to participate, and those on the amount of compensation requested (and WTP) once the initial decision has been made. A Type II error means that the factors that affect an individual's decision to participate or not are not necessarily those factors that influence the amount of compensation requested (and WTP) to participate and, hence, these two sets could be different variables (Green, 1993). The use of models that consider referred-to cases is therefore crucial.

A Tobit model, using both groups of people (villagers who desire to participate and those who are not willing to participate), neutralize Type I errors (non-random sample); but the risk of Type II error is still present. Heckman (1979) proposed a two-step procedure in order to fix the second issue in the Tobit model. In the Heckman method for determining important factors, the Tobit model is broken into two Probit and linear regression models in any of the above-mentioned two sets of variables. The dependent variable in the Probit model contains a binomial variable, with values of zero and one in which the number 1 constitutes a WTA the proposal and number 0 denotes an unwillingness to accept. This variable is made from the dependent variable in a Tobit model, so that for $Y_k > 0$, number 1 is considered, while $Y_k = 0$ remains the same. The independent variables in the Probit model are made for all the observations. According to the description above, the two patterns obtained from the segregation of the Tobit model are shown as follows (Heckman, 1979):

$$Z_k = B'X_k + V_k \quad , \quad k = 1,2,...,N \qquad \text{Probit model} \qquad (2)$$

$$Z_k = 1 \quad if \quad Y_k^* \geq 0$$

$$Z_k = 0 \quad if \quad Y_k^* \leq 0$$

$$Y_k = B'X_k + \sigma\lambda_k + e_k \quad , \quad k = 1,2,...,N \qquad \text{Linear regression model} \qquad (3)$$

Where Z_k is the villager's willingness to participate, Y_k is the proposed compensation (WTA) in order to participate; X_k is the vector of explanatory variables;and σ are B', B model's parameters; and e_k V_k are error terms in the above-mentioned models which are independent from explanatory variables and are based on the assumption of normal distribution with the mean of 0 and constant variance of δ^2. λ_k is the Inverse Mills Ratio which is calculated from the estimated parameters of the Probit model for all $Y_k > 0$ from eq. 4 as given:

$$\lambda_k = \frac{\varphi(B'X_k)}{1-\phi(B'X_k)} \qquad (4)$$

Here, $\varphi(B'X_k)$ and $1-\phi(B'X_k)$ represent the probability density function (PDF) and distribution function of a standard normal variable. To explain the behavior of the dependent variable divided into two groups, an appropriate cumulative distribution function (CDF) is used. The estimated model arises from a normal CDF, commonly known as a Probit model. The Probit model, using normal probability distribution, estimates probability values between 0 and 1 for the binary dependent variable. The Probit model has a standard normal distribution function, as follows (Greene, 1993):

$$F(t) = \int_{-\alpha}^{t} (2\pi)^{-\frac{1}{2}} \exp\left\{-\frac{x^2}{2}\right\} dx \qquad (5)$$

The variance of the random variable in a standard normal distribution is 1, and as a result of its symmetrical distribution we have $F(-t) = 1 - F(t)$, thus:

$$P_i = \Pr(Y_i = 1) = 1 - F(-B'X) = F(B'X) \qquad (6)$$

The Probit model, based on the standard normal cumulative distribution function is as follows. In other words, the probability (P_i) which is the probability of the acceptance of the proposal (A), is defined, based on the Probit model, as given (Greene, 1993):

$$P(Y_t = 1) = \int_{-\alpha}^{B'} \varphi(t)dt = \phi(B'X) \qquad (7)$$

The interpretation of the estimated coefficients in the Probit model is not reliable and their marginal effects have to be calculated. Changes in the probability of success are due to a unit change in the independent variable, which is known as the marginal effect, and is calculated as follows (Judge et al., 1982):

$$ME = \frac{\partial P_i}{\partial x_k} = \frac{\partial \phi(B'x)}{\partial x_k} = \varphi(B'x).B_k \qquad (8)$$

As can be seen, the change of probability depends on the initial probability and therefore on the basic values of the independent variables and their coefficients.

The elasticity of each variable suggests a one percent change in the explanatory variable, the amount of change in probability of $Y_k = 1$. For example, the elasticity of the K explanatory variable in the Probit model can be obtained from the following equation (Judge et al., 1982):

$$E^P = \frac{\partial \phi(B'x)}{\partial x_k} . \frac{x_k}{\phi(B'x)} = \frac{\varphi(B'x).B_k.X_k}{\phi(B'x)} \qquad (9)$$

In this study, in order to assess the presence or absence of co-linearity among the estimated independent variables, an analysis of variance was used. In order to test the overall significance of the model and the suitability of the fitted Probit model, the maximum likelihood ratio was used. In order to assess the explanatory power of the model, the coefficients of determination (R-square), including Estrella, Maddala, and Mac-Fadden, were calculated (Maddala, 1983). To test the accuracy of the estimated model's predictions, the percentage of right predictions was estimated. Figures higher than 70% in this parameter indicates high accuracy of the model's prediction.

After the Probit model estimation, Heckman's two-stage method of linear regression model was estimated for the observations greater than zero using an ordinary least squares method. At this stage, the Inverse Mills Ratio was added to the proportion of independent variables in the regression model. Greene (1993) showed that the presence of this variable in the linear regression model obviates the model's heteroscedasticity and provides unbiased, adapted coefficients, which allows for the application of the ordinary least squares estimator. The coefficient of this variable expresses the error that comes from sampling. If the coefficient of this variable is statistically greater than zero, removing zero observations from the set will bias the estimated parameters. However, if the coefficient of this variable is statistically equal to zero, eliminating the zero observations, although it puts the results into biased estimated parameters, will eliminate the estimator's efficiency (Cheng & Capps, 1988). So, with the two-stage Tobit model parameter estimation, the factors affecting willingness-to-contribute could be separated from the factors that affect the amount of compensation proposed (and WTP) by the villagers in order to participate. Therefore, the role and the impact of each of these factors could be determined in the two groups.

3. Results

Descriptive statistics of the studied variables are presented in Table 1. We find that the average farm area measurement to be 3.29 ha. Approximately 86% of the farmers work on lands with cultivated areas between 0.25-6.6 ha. Farmers were also often middle-aged, married, and with a level of education (in 61% of the cases) equal-to-or-less-than a high school diploma. More than half of the respondents live in rural areas and the rest live in the city. The average annual income in the sample was $4,397.

When examining the role of environmental values, we find that more than 67% of farmers identify with what we identify as *deontological* ethical values towards wetland management and agricultural practices - whereby participation is motivated by a sense of *duty* towards environmental protection. We find that deontologically-motivated participants tend to be *task-oriented*, whereas the conversely *consequentialism-motivated* farmers conversely align their behavior (participation or non-participation) towards receiving (i.e. paying for) the *benefit* of environmental services (Salami and Rafiei, 2011; Tanner et al., 2008).

Table 1

Results of the comparison of the mean response to the approaches and environmental perspectives is presented in Table 2. We find that the views and attitudes of the villagers significantly differed from the presumed average of 3.0. For example, we find significant farmer advocacy for the view that "any program of development and construction projects in the region leading to environmental damage to biodiversity must be stopped". Likewise, we find significant farmer opposition to the view that "to achieve higher employment levels and increased revenue, all the region's natural resources must be exploited in any way irrespective of costs and environmental damages to biodiversity". The majority of regional farmers in our sample show clear pro-environmental attitudes towards protecting biodiversity and the conservation of animal and plant species, to the point that any detrimental development plans and projects in the region must be stopped. They also believe that achieving higher levels of employment and income growth should not occur at the cost of degradation to the region's natural resources. However, a slim majority (over 55% of farmers) did not agree with the implementation of the set-aside programme. Thus, although there is overall pro-environmental sentiment, the majority remain skeptical about the success of plans to alleviate environmental harm in the Jazmurian wetland.

Table 2

Farmers were asked to reflect upon two participation scenarios. In the first, we asked whether they are willing to participate in a plan to revitalize the wetland in exchange for an amount equivalent to the replacement income from the crop (i.e. to replace income lost due to non-cultivation) as shown in table 3. In the second, farmers were asked whether they would be willing to contribute to the restoration and protection of the wetland without compensation (i.e. equivalent to the income lost due to non-cultivation) or by government facilities, shown in table 4.

Table 3 shows the factors affecting farmers' participation based on their WTA. As specified in the table, in the first step of the Probit model, the R-square of Estrella, Madala, and Mac-Fadden measured 43%, 37% and 33%, respectively, which represents the appropriate explanatory level of variables within the Probit model. Prediction accuracy was 77%, which according to the minimum acceptable value for this parameter in the Logit and Probit models (approximately 70%), suggests that patterns were estimated satisfactorily. The Maximum Likelihood Ratio was equal to 103.6, which was greater than the value from the table, with 10 degrees of freedom. This implies a significant regression of 1%. Results of the second-step linear regression model also show that the R-square for the model was 61%; thus, independent variables could explain the mean change in the amount of compensation requested by the farmers to participate. Likewise, diagnostic tests indicated that the establishment of the classical assumption for the above regression models made the patterns valid in terms of econometric criteria.

In the Probit model, elasticity for the independent variable of the area of cultivated land was 0.13. According to the positive and significant relationship of this variable with the participation of rural farmers, ceteris paribus, an average of 1% increase in the variable will increase the probability of willingness to participate as much as 0.13. Elasticity for the variables of education (0.41) and income of rural farmers (0.22) had a significant and positive relation with the desire to participate in Jazmurian wetland restoration. Likewise, elasticity for the age variable obtained -0.58, which represents a reduction of 0.58% of the possibility of farmers' participation in wetland restoration by a 1% increase in this variable. On the other hand, due to the difficulty of interpreting the elasticity for numeric variables that vary on a small scale (dummy variables), the marginal effect of these variables was interpreted. For example, according to the marginal effect of the gender variable as 0.38, the possibility of participation of male farmers was 38% higher than for female farmers. The net effect of the moralism variable as 0.23, showed that if farmers have a deontological ethical stance, they are 23% more likely to participate compared to farmers with a consequentialist stance. On the other hand, the variables of employment, marital status, family size and location had a significant impact on farmers' participation in Jazmurian wetland restoration.

In the linear regression model, it was also observed that the cultivation area, gender, education level, number of household members, residency, income, moralism, and Inverse Mills Ratio had a significant effect on the WTA of farmers. Each unit increase in the average acreage and farmers' income variables (with the other factors constant), reduced the average compensation per ha demanded by the farmers to let their lands lie fallow by 34.30 and 1.1. As with gender, it can be concluded that the average compensation offered to the male farmers will be 1,078.7 units higher than to female farmers. On the other hand, the number of years of education had a significant negative effect on the dependent variable, in the sense that each unit increase in this variable (with the other factors constant) reduced the amount of compensation by an average of 57.60 units. The number of household members had a positive effect on the dependent variable, such that each unit increase in this variable increased the amount of compensation proposed by farmers by 224.71 units. The dummy variable of residing in the village also had a negative effect on farmers' proposed amount of compensation. Deontological values also had such an effect on the dependent variable that indicates the amount of compensation proposed by such farmers, at 858.86 units less than consequentialist farmers. The Inverse Mills Ratio variable was statistically significant at 10%. Therefore, removing zero observations from a series of observations causes a bias in the parameters estimated by the model. In addition, the significance of this variable showed that there was a difference between the factors affecting farmers' willingness to participate and variables affecting the amount of compensation offered to participate.

Table 3

Table 4 provides shows the factors influencing farmer participation on the basis of their WTP. The R-square as Estrella, Madala, and McFadden were measured, respectively, at 74, 57, and 67%, indicating a proper explanation by the Probit model. Prediction accuracy was calculated at 91%, due to the minimum acceptable value for this parameter in the Logit and Probit models, the pattern was satisfactorily estimated. The maximum likelihood ratio was measured 150.9, which was greater than the value provided in the table, confirming the significance of the regression at 1%. Results of the R-square in the linear regression model showed that 88% of the mean change in farmers' participation based on WTP could be explained by the independent variables. Diagnostic tests indicated that the establishment of classical assumptions for the two aforementioned patterns, thus the patterns of econometric criteria were considered valid. In the Probit model, the elasticity of the independent variables of the cultivation area, education, and farmers' incomes were respectively 0.31, 0.56, and 0.56. Cultivated area and income reflect the state of the agricultural economy, and in accordance with expectations, a positive and significant impact was observed in farmers' participation in set-aside activity. Also, increasing education and improving the level of environmental awareness increases the likelihood of participation. By interpreting the elasticity of the above-mentioned variables, assuming all other factors being equal, we conclude that an average of 1% in these variables will increase the farmers' willingness to participate by 0.31, 0.56, and

0.56, respectively. Elasticity for the family size was measured to be -0.12. This shows that a 1% increase in the number of household members reduces farmers' participation in the Jazmurian wetland restoration to 12%. Also, given the issues in interpreting the elasticity of the dummy variables, their total marginal effect was interpreted. The marginal effect of employment in the model was -0.63, showing that the likelihood of employee farmers participating was 63% of farmers who were engaged in other jobs. Age, gender, marital status, and place of residence had a significant effect on farmers' participation in the Jazmurian wetland restoration. In the linear regression model, it was also observed that the cultivation area, educational level, marital status, and income, also had a significant and positive effect on willingness to participate. The coefficient of the marital status indicator showed that the average willingness to participate among farmers was higher in the group of married participants. Age and family size had a significant negative effect on farmers 'willingness to participate and each unit increase in the average of these variables (with the other factors constant) reduces the average. The Inverse Mills Ration index had a statistically significant effect at the 1% level. The latter shows the difference between the factors influencing farmer's participation and the factors influencing the value of participation.

Table 4

4. Conclusions

The Jazmurian wetland is a high-risk ecosystem in the South-East of Iran; one that is heavily impacted by the construction of diversion and reservoir dams (Halil Rud and Bampur) on the main river. As in many aquatic ecosystems, dam construction necessitates an adaptive response to water management downstream. One way to do this is to incentivize farmers downstream of dam construction to leave a portion of the irrigated agricultural land fallow so that the release of excess water would revive the aquatic ecosystems. Iran's set-aside program is an exemplar model of this practice, though environmental management success then becomes dependent upon shifting responsibility for ecosystem conservation almost exclusively onto farmer-stakeholders. We therefore adopted a systematic approach to evaluate farmer attitudes to and participation in the set-aside program in the Jazmurian wetland in order to assess the efficacy of this wetland management measure.

In Iran, as in many developing rural economy contexts, the prevalence of traditional (often subsistence) cultivation methods and the lack of significant financial savings encourages farmers to be risk-averse and presents a barrier to social participation in sustainable wetland management. Farmers under pressure from financial insecurity, water stress, biodiversity loss and climate change are disincentivized towards sustainable agricultural land use through suitable cropping patterns and water-saving practices. Part of the problem is that isolated small holders under financial stress feel powerless to act on environmental conservation efforts given their relatively small size. Policy measures such as increasing cultivation acreage will, according to our findings, likely improve rural farmers' participation in conservation projects. Given that dispersed small-holder farming hampers broader participation efforts at a regional scale, land consolidation agreements could be a beneficial measure to increasing rural farmers' participation in land reserve conservation programs such as set-aside and its international equivalents.

We find that the set-aside program creates an unwanted shift of responsibility for conservation away from upstream 'polluters' i.e. dam proponents, to downstream water users that must adapt their practices as a consequence of this imposition of water management grey infrastructure upon them. We recommend therefore that participation should be adaptive and multi-scalar in nature – encompassing regional-level evaluation of water needs and priorities such that the construction of dams as major infrastructure projects may be rejected if it contradicts the need for sustainable management of wetland habitats. At the moment, grey infrastructure projects for water management are treated as separate from wetland conservation and agricultural development initiatives, which creates a *responsibility gap* (see Cotton, and Stevens, 2019) between local farmers (who are skeptical about set-aside success, and concerned about the imposition of land-use management practices that result from the dam), dam project developers, and policy-makers who do not successfully resolve these two environmental policy domains.

From our findings, we recommend that governmental authorities should join together policy programmes for centralized infrastructure for water management with ecological conservation of wetland habitats, specifically by increasing the level and types of public participation amongst rural populations. In this sense, participation needs to become multi-sectoral (across utilities and conservation planning) and multi-scalar (across regions and governance systems) in order to avoid social/stakeholder conflict over wetland management strategy in the context of dam construction, regional water management priority-setting, and a need to encourage trust, social and institutional cohesion between local famer communities, dam project developers and regional political authorities. To this end, we find the factors that significantly affect the tendency to participate and the level of farmers' participation in the set-aside program are the cultivation area (Zhang et al., 2011), age (Zhang et al., 2011; and Guan et al. 2015), gender (Hejazi et al., 2014), education (Hejazi and Arabic, 2008), income level (Thacher et al., 1996; Stone et al., 2008; and Ghorbani et al., 2011), and ethical stance (Sallami and Rafiei, 2011; and Peterson 2015) – thus participatory processes of wetland management must be designed in such a way as to be sensitive to these components of socio-environmental values and demographic characteristics. By understanding these dimensions as significant factors influencing farmer participation, policy-makers can better design socially adaptive planning responses to land-use management within the set-aside program, and bring in a broader range of voices and perspectives into water, agricultural and land use management within the region.

We find, however, that higher levels of education and income are associated with a positive effect upon reported willingness to participate in sustainable land and water management practices. This necessitates a more holistic approach to wetland conservation policy than is currently offered. Land-use reserve programs such as set-aside, are commonly siloed within agricultural and environmental policy. The assumption being that participation can be incentivized through payments to allow land to remain fallow in order to replenish water stocks. However, we find that the success of such policies is likely dependent upon the achievement of other sustainable development goals – around income support, education and training. Understanding that social development policy is an essential component to support pro-environmental management outcomes is a difficult but necessary step for policy-makers to take.

We suggest that a simple solution is for authorities to adopt policies that implement wetland revival plans which simultaneously target the increase and stabilization of farmer's incomes under conditions of environmental stress, primarily by improving the distribution of project benefits from dam construction. This is consonant with the Polluter Pays Principles of environmental justice. For instance, policy authorities could charge levies on dam construction and use compensatory payments and licenses in order to support the implementation of alternative options that would compensate of farmers for leaving part of their land fallow. Also, by investing in the features that mirror deontological (duty-based) values amongst farmers (especially among the farmers' families), such as promoting set-aside land use practices as a *social duty* towards environmental protection, will likely promote a higher rate of participation with lower costs and fewer negative environmental impacts. It is in this way that a "responsibility gap" (Cotton and Stevens, 2019) can be resolved – by sharing responsibility for water management across a 'hydro-social cycle' (Linton and Budds, 2014) between dam construction developers and agricultural workers, a *common but differentiated* responsibility between these competing interest groups for wetland conservation is established. This would likely improve wetland conservation participation uptake amongst both those that *already* see it as their duty to engage in environmental protection, and those that are motivated solely by financial payments in response to non-cultivation of agricultural resources in water-stressed wetlands.

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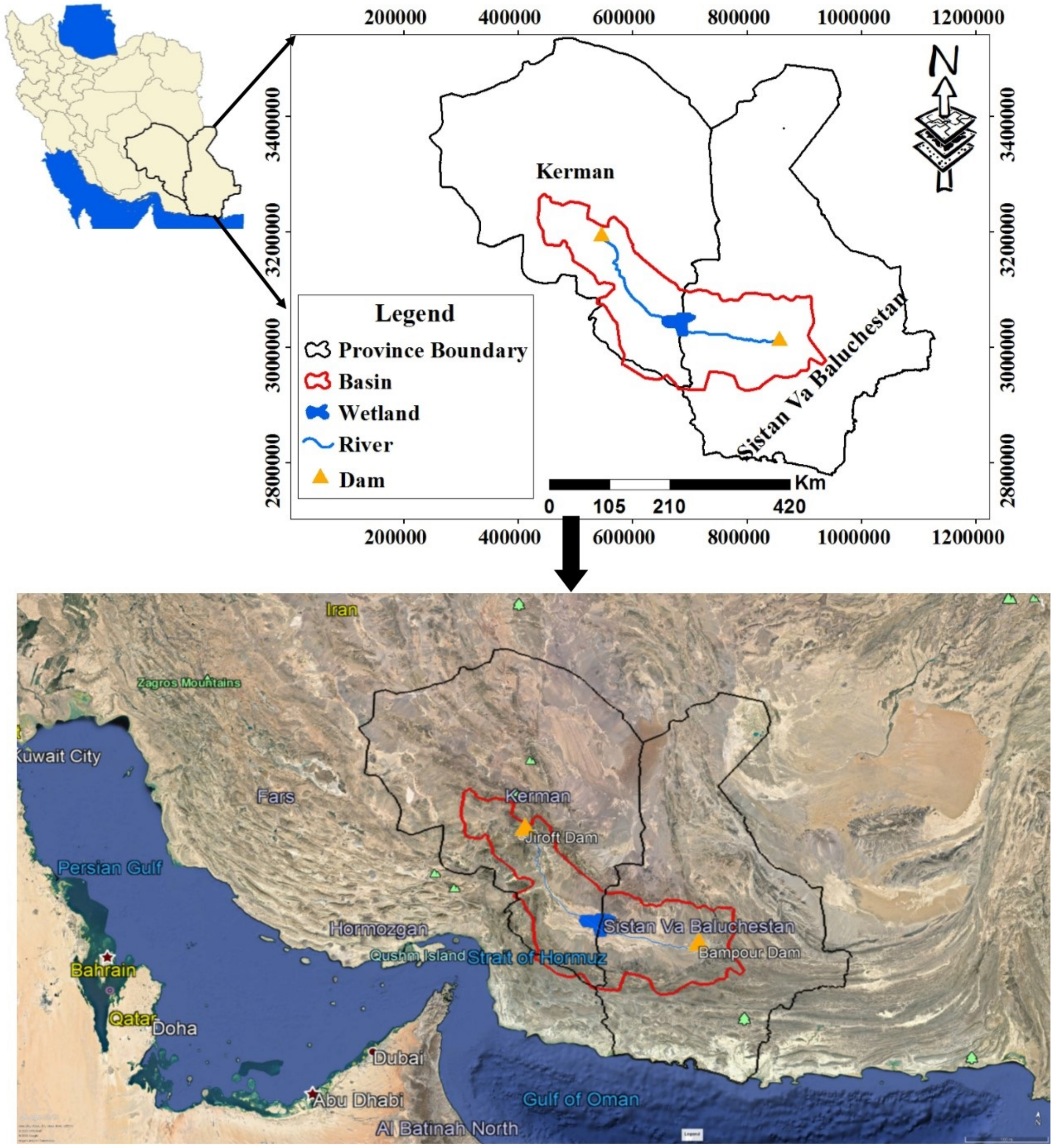

Fig. 1. Location of the Jazmurian wetland and the storage dam built on river leading up to the lake in the South-East of Iran.

Table 1
Results of descriptive statistics of the variables studied in the city of Jiroft

Variable	Mean	SD	CV	Max	Min	Variable	No.	No. of category 1	No. of category 2	% of category 1	% of category 2
Area under cultivation (ha)	3.29	4.43	1.35	32	0.25	Gender (male=1, female=0)	226	205	21	91	9
Age (yr)	39.14	11.67	0.30	72	19	Employment (employee = 1, non-employee = 0)	226	48	178	21	79
Education level (yr)	11.85	5.41	0.46	18	0	Marital status (married=1, single=0)	226	162	64	72	28
Family size (N)	4.68	2.16	0.46	12	1	Residence (village=1, town=0)	226	123	103	54	46
Income ($)	4397	2300	60	16667	1000	Moralism (moralist = 1, consequentialist=0)	226	151	75	67	33

Table 2
Mean comparison of the villagers' responses to environmental attitudes with the assumed average of 3

Standpoint	No. of observations	Mean	SD	t-test	Sig.
any program of development and construction projects in the region, leading to environmental damage to biodiversity must be stopped	226	2.38	0.97	-9.83	0.000
to achieve higher employment levels and increased revenue, all the region's natural resources must be exploited in any way irrespective of costs and environmental damages to biodiversity	226	3.86	0.92	13.99	0.000
People need to save some of their annual income to participate on maintaining biodiversity for future generations.	226	2.49	0.83	-9.31	0.000
Due to the limited use of biodiversity per person, it is better to leave the protection of these natural areas to the government and citizens have no participation in the conservation of this ecosystem.	226	3.54	1.11	7.39	0.000
The value and importance of biodiversity with wildlife or without it will be the same.	226	4.27	0.77	24.83	0.000
It does not matter if the biodiversity be compromised by the human interference in the development process and important plant and animal species become extinct	226	4.43	0.69	31.10	0.000
Plant and animal species has a right to live, even if not for human-use.	226	1.93	0.94	-17.2	0.000

Table 3
The results of Heckman two-stage model (based on WTA)

Variables	Heckman two-stage model					
	Probit model				linear regression	
	coefficient	t-test	marginal effect	elasticity	coefficient	t-test
intercept	-1.92	-2.68	-	-	3425.40	3.48
Cultivation area (ha)	0.14	3.17	0.05	0.13	-34.30	-2.66
Age (yr)	-0.03	-2.18	-0.01	-0.58	14.10	1.05
Gender (male=1, female=0)	1.00	3.06	0.38	-	1078.70	3.28
Education level (yr)	0.07	2.94	0.02	0.41	-57.60	-2.03
Employment (employee = 1, non-employee = 0)	0.19	0.76	0.07	-	183.08	1.09
Marital status (married=1, single=0)	0.04	0.15	0.01	-	263.72	1.54
Family size (N)	0.05	0.74	0.02	0.11	224.71	4.27
Residence (village=1, town=0)	0.00	0.02	0.00	-	-478.15	-2.97
Income ($)	0.00	2.33	0.00	0.22	-1.10	-3.02
moralism	0.59	2.80	0.23	-	-858.86	-3.01
Inverse Mills Ratio	-	-	-	-	933.85	1.95
Statistics	Percentage of right predictions = 77 Likelihood ratio test (p-value) = 103.6 (0.00) Estrella R-square = 0.43 Maddala R-square = 0.37 Mc-Fadden R-square = 0.33				R-square = 0.61 Durbin-Watson = 1.79	

Table 4

The results of Heckman two-stage model (based on WTP)

Variables	Heckman two-stage model					
	probit model				linear regression	
	coefficient	t-test	marginal effect	elasticity	coefficient	t-test
intercept	-1.85	-1.58	-	-	-0.57	-1.63
Cultivation area (ha)	0.44	4.56	0.17	0.31	0.00	19.97
Age (yr)	-0.03	-1.51	-0.01	-0.46	-0.00	-15.47
Gender (male=1, female=0)	0.34	0.68	0.13	-	-0.00	-0.11
Education level (yr)	0.12	2.67	0.04	0.56	0.00	10.16
Employment (employee = 1, non-employee = 0)	-1.68	-3.32	-0.63	-	-0.00	-1.19
Marital status (married=1, single=0)	-0.04	-0.11	-0.01	-	0.00	5.55
Family size (N)	-0.33	-2.48	-0.12	-0.46	-0.00	-6.1
Residence (village=1, town=0)	0.29	0.83	0.11	-	-0.00	-0.29
Income ($)	0.05	3.81	0.21	0.56	0.00	5.31
Inverse Mills Ratio	-	-	-	-	0.00	3.73
Statistics	Percentage of right predictions = 91 Likelihood ratio test (p-value) = 150.9 (0.00) Estrella R-square = 0.74 Maddala R-square = 0.57 Mc-Fadden R-square = 0.64				R-square = 0.88 Durbin-Watson = 2.02	