

Estimating participation and willingness to pay of local communities for preservation and reclamation of desert areas (Case Study: Abuzeidabad district of Aran Va Bidgol county)

Z. Eslamian^a, M. Ghorbani^{a*}, T. Mesbahzade^a, H. Rafiee^b

^a Faculty of Natural Resources, University of Tehran, Karaj, Iran

^b Faculty of Agricultural Economics and Development, University of Tehran, Iran

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Abstract

Recently, natural resources economists have turned to valuation and appraisal of the contribution of natural resources to human's welfare and they have made striking progress in valuing the environmental and ecological services of ecosystems. The present study investigated people's willingness to pay (WTP) for participation in preservation and reclamation of Abuzeidabad desert area through contingent valuation method and by applying double dichotomous questionnaire. Logit regression model was applied for measuring willingness to pay and the parameters of this model were estimated based on maximum likelihood. It was revealed that variables including poultry farming and monthly income leave positive significant impact upon WTP but age, sex, job, farming, livestock raising, overgrazing, and proposed amount (bid) had negative effects on willingness to pay. Besides, family size (the number of family members) had negative effect on willingness to pay but it was not significant at acceptable significance level. The average amount ethical and consequentialists were willing to pay for preservation and reclamation of Abuzeidabad desert area was estimated 93986 and 95153, respectively. Therefore, ethical conduct must be institutionalized within families so as to prevent much extra expenses for preservation and development of environmental objectives.

Keywords: Contingent valuation; Participation; Ethical beneficiaries; Consequentialist beneficiaries; Willingness to pay; Abuzeidabad district

1. Introduction

Both directly and indirectly ecosystems contribute significantly to human's welfare and they are indispensable part of total economic value of earth planet. Though these services are not well acknowledged, economic valuation of ecosystem services is an effective way for understanding multiple benefits they provide (Costanza *et al.*, 1997). Among 38 serious global challenges, desertification is considered in 21st century as the

most important global crisis following climate change and fresh water scarcity. One-sixth of world's population, three-fourth of world's land, and one-third of world's land, i.e. about 38.5% of total land on earth, i.e. 5 billion hectares in 110 countries is threatened and prone to degradation. In Iran, about 100 million hectares, i.e. over 60% of the land is exposed to desertification hazard (Abdinejad, 2010).

Desert ecosystems have considerable economic capabilities and potentials. Despite considerable economic potentials of deserts, they have usually been underestimated throughout the history and human societies have wrongly conceived them lacking any economic value and even regarded

* Corresponding author. Tel.: +98 26 32223044
Fax: +98 26 32223044
E-mail address: mehghorbani@ut.ac.ir

them detrimental. Valuing environmental services is quite difficult due to the nature and variety of these services. However, since environmental capitals are invaluable and human life is dependent on them, environment economics has devised special methods for assessing and valuing such services based on units comparable to other services of other economic sectors. The idea of economic valuation of natural endowments is based on willingness to pay (Howarth & Farber, 2002). Current techniques for specifying willingness to pay are abundant. There are some evidences ratifying the usefulness of willingness to pay technique (Venkatachalam, 2003). Among existing methods, contingent valuation is the most important and the most appropriate one (Walsh *et al.*, 1984).

Several studies have been carried out applying contingent valuation method for defining the preservation value of natural ecosystems. Slue and Okeola (2010) have estimated willingness to pay for improving water supply in Vara district in Nigeria on average 10000 Naira per month. Shrestha *et al.*, (2007) have explored the recreational value of Apalachicola river region in Florida by analyzing visitors and they concluded that visitors pay on average 74.18\$ per day. Adenike & Titus (2009) applied double dichotomous method and logit model in their study to ponder about people's willingness to pay for improving water supply in Nigeria metropolis. They found out that average willingness to pay was 500 Naira per month. Jafarineghad *et al.* (2012) estimated the existence value of the international Gomishan wetland by Contingent Valuation Method (CVM). According to world approved indexes, the economic value of Gomishan Wetland per hectare and for different functions (flood control, water supply, etc.) was defined 0.201 billion dollars. Applying contingent valuation method, Salami & Rafiee (2011) estimated willingness to pay of each household per month for preservation of international Anzali wetland. This amount for ethical and consequentialist families was 1881.87 and 14219.06 Iranian Rials, respectively. Naji *et al.*, (2011) in their study of assessing the recreational value of Qaem Forest Park applied contingent valuation method. Average amount each individual was willing to pay for visiting this park was 2157 Iranian Rials and annual amount for each family was estimated 178191.33 Iranian Rials. Khodaverdizadeh *et al.*, (2008) estimated the annual recreational value of the Kandovan touristic village by applying

contingent valuation method as 1171500000 Iranian Rials. Amimejad (2007) assessed annual willingness to pay of each family for preservation of Golestan National Park through contingent valuation method as 172800 Iranian Rials. Khorshiddoust (2005) assessed monthly willingness to pay of Tabriz people for conserving urban environment and reducing pollution as 41140 Iranian Rials.

Since the prominence of public participation in natural resources management is undeniable, present study made an attempt to specify willingness to pay of the study area people for their participation in preservation and reclamation of desert areas through applying contingent valuation method. The main research question is therefore what factors impact upon willingness to pay of local communities for co-management of desert areas. Besides, how is willingness to pay economically valued in line with co-management?

2. Materials and Methods

2.1. Study Area

The 3700 hectares *Abuzeidabad* district is located 40 kilometers away of *Aran va Bidgol* county and the severity of wind erosion of this area is so high. The latitude of this region is $33^{\circ} 54' 00''$ and its longitude is $51^{\circ} 45' 00''$ and its elevation is 941 meters. Extremely hot and dry summers and mild winters is typical of *Abuzeidabad* climate. Average annual temperature is roughly 20°C but in summers it occasionally even exceeds 40°C . average temperature difference from summer to winter is considerably high and up to 28°C (Mesbahzadeh, 2007).

2.2. Methodology

The contingent valuation method (CVM) was applied in present study for estimating the value of preservation and reclamation of desert areas. The method was initially developed in 1947 by Ciriacy-Wantrup and Davis applied it for the first time in 1960. This is one of the best and most controversial methods among many others for environmental impact assessment (Venkatachalam, 2003).

Research data was gathered through random sampling method by applying double dichotomous choices (DDC) questionnaire (Haneman, 1984). Prior to proposing any amount, 30 questionnaires (pre-test) were distributed among participants and

they were required to stipulate their proposed payment (bid) for participating in desert preservation and reclamation project. Next, based on Cochran formula, regarding the population of the study area (i.e. 5559 people), and variation of individuals' willingness to pay, the sample size was specified and 174 questionnaires were filled in 2014 in *Abuzeidabad* region. In this study, the willingness to pay (WTP) of people for participation in preservation and reclamation of desert areas was analyzed based on logit model parameters (estimated by maximum likelihood) by applying Shazam 9 software. When respondents were interrogated if they agreed with the bid for preservation and restoring desert areas, they could either reply positively or negatively or even they could leave the question unanswered. Whatever the answer, their reason for that choice was written down. Three bids were suggested i.e. 50000, 25000, and 100000 Iranian Rials. The first question about WTP was if they were willing to pay 50000 Iranian Rials monthly for preservation and reclamation of desert areas? Once the answer to this question was negative, lower bid (i.e. 25000) was suggested but if the respondent replied positively, higher bid (i.e. 100000) was also suggested and the respondent was inquired about accepting the higher bid, too. In double choices dichotomous method, the following utility function is presumed for respondents (Judge et al., 1982);

$$U = u(Y, S) \tag{1}$$

U is indirect utility one gains. Y and A are respectively one's income and proposed payment, and S refers to other socio-economic properties influenced by personal utility and it is as follows (Haneman, 1984);

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

ε_0 and ε_1 are random variables which are distributed equally and independently and their average equals 0. Utility difference is explained as follows (Judge et al., 1982);

$$\Delta U = (1, Y - A; S) - U(0, Y; S) + (\varepsilon_1 - \varepsilon_0) \tag{3}$$

The double choices dichotomous questionnaire applied for investigating the willingness to pay of individuals includes one dependant variable with double choice. Therefore, logit model was used for exploring the impact of various explanatory variables upon WTP of respondents for defining the value of preservation and reclamation. Based

on logit model, probability (Pi) of accepting one of the either choices is as follows (Judge et al., 1982);

$$P_i = F_n(\Delta U) = \frac{1}{1 + \exp(-\Delta U)} = \frac{1}{1 + \exp\{-(\alpha - \beta A + \gamma Y + \theta S)\}} \tag{4}$$

Where, $F_n(\Delta U)$ is a cumulative distribution function with standard logistic difference and some socio-economic variables include income, proposed payment, age, sex, family size, and education. β, γ, θ are calculable coefficients and it is expected that $\gamma > 0, \beta \leq 0$, and $\theta > 0$.

Once logit model was estimated, the expected willingness to pay for participation in preservation and reclamation is calculated according to the following relation by numerical integral from 0 to maximum willingness to pay (A) (Lee & Han, 2002);

$$E(WTP) = \int_0^{\max A} F_n(\Delta U) dA = \int_0^{\max A} \left(\frac{1}{1 + \exp[-(\alpha^* + \beta A)]} \right) dA \tag{5}$$

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

Where, E (WTP) is expected WTP and α^* is adjusted constant that has been added by socio-economic component to intercept of the original sentence (Judge et al., 1982).

Marginal effect (ME) showed amount of change in probability of accepting bid for each one unit change in explanatory variables and it is calculated as follows;

$$ME = \frac{\partial P_i}{\partial X_{ki}} = F(X_i' \beta_k) \beta_k = \frac{\exp(-X_i' \beta)}{[1 + \exp(-X_i' \beta)]^2} \beta_k \tag{6}$$

Elasticity at means (E) shows change percentage in the probability of acceptance of bid for each one percent change in each of the explanatory variables (Socio-economic factors) that is obtained from equation (7) (Judge et al., 1982);

$$E = \frac{\partial(BX_k)}{\partial X_k} \cdot \frac{X_k}{(B \cdot X_k)} = \frac{e^{kX}}{(1 + e^{kX})^2} \cdot B_k \cdot \frac{X_k}{(B \cdot X_k)} \tag{7}$$

Logit model parameters were estimated by maximum likelihood, which is the most common technique for estimating logit model (Lehtonen et al., 2003);

$$E = \frac{\partial(BX_k)}{\partial X_k} \cdot \frac{X_k}{(B'X_k)} = \frac{e^{kX}}{(1 + e^{kX})^2} \cdot B_k \cdot \frac{X_k}{(B'X_k)} \tag{8}$$

3. Results

Once required data was extracted out of 174 questionnaires, some properties of continuous

variables of the target population were investigated, results of which are presented in Table (1). Among these parameters, maximum willingness to pay showed the highest variation.

As depicted in Table (2), self-employment had the highest frequency and it was followed by clerk occupation.

Table 1. Personal traits of continuous variables of target population

Parameters	Maximum	Minimum	Mean	SD	Coefficient of Variation
Age	71	20	36.64	10.75	0.29
Maximum WTP	200000Iranian Rials	0	28563.22	44681.743	1.56
Monthly Family Income	25000000	0	8487179	5166057.03	0.60
Family Size (members)	8	2	4.07	1.27	0.31

Source: Research Findings

Table 2. Frequency of target population occupation

Job	Clerk	Self-Employed	Housewife	Retired	Worker	Student	Other	Total
Number	56	68	20	8	6	8	8	174
percent	32.18	39.08	11.49	4.59	3.45	4.59	4.59	100

Source: Research Findings

Table (3) shows the frequency distribution based on type of activities individuals do in the target population. Among respondents, the highest

frequency (i.e. 66.66%) belonged to others (non-agriculture).

Table 3. Frequency distribution based on type of activity of target population

Activity	Gardening	Farming	Livestock raising	Poultry farming	Distribution of Agriculture Input	Others
Number	36	42	10	4	2	116
Percent	24.13	20.68	5.74	2.29	1.15	66.66

Source: Research Findings

Table (4) shows the willingness to pay of respondents. The highest frequency goes to those who are not willing to pay at all and they are

followed by those who accept to pay 50000 Iranian Rials.

Table 4. Frequency of maximum WTP (Iranian Rials)

Maximum WTP (Iranian Rials)	0	5000	10000	20000	25000	30000	40000	50000	100000	150000	200000	Total
Number	98	2	2	2	8	2	2	22	20	2	4	174
Percent	56.32	1.14	1.14	1.14	4.59	1.14	1.14	12.64	11.49	1.14	2.29	100

Source: Research Findings

Table (5) shows frequency distribution of non-willingness to pay. It was found out that 38.77% believed this amount must be paid by the government and 36.73% suspected that the

collected money will not spent on preservation and reclamation, and 24.48% believed there are more important problems than preservation that must be dealt with.

Table 5. Frequency based on non-willingness to pay

Reason for not- payment	Frequency	Percent
Government must pay	38	38.77
It is not spent on preservation and reclamation	36	36.73
There are more important problems to be dealt with	24	24.48

Source: Research Findings

The results of estimating the coefficients of explanatory variables of logit model, their significance levels, and their influence upon

dependent variable through maximum likelihood method for valuing preservation and reclamation of

desert areas in *Abuzeidabad* district are represented in Table (6).

It was found out that there is a negative relationship between age and probability of willingness to pay that was significant at 5% significance level. In other words, every one unit (year) increase in age, the probability of willingness to pay reduces 0.014 units. Besides, as one percent increase occurs in age variable, willingness to pay decreases 0.965%. Sex variable was significant at 5% significance level but it was negative and female participants were more willing than men to pay. The probability of willingness to pay among men was 0.196 units less than females. Job variable is indicative of people's job type that was significant at 5% significance level and there was a negative relationship between this variable and the probability of willingness to pay. The clerks showed 0.190 units probability of willingness to pay less than other jobs. The variable of farming variable was significant at 1% significance level. Those who don't do farming are 0.095% less willing to pay. Livestock raising variable was significant at 1% significance level and it had negative value. Those who are engaged with livestock raising are 0.437 units less willing to pay than those who don't do so. Regarding poultry farming, the probability of willingness to pay was 0.094 units more than those who don't do so. Negative value of overgrazing shows those who blame grazing as a factor driving desertification were controversially less willing to pay than others. One unit increase in people's outlook to overgrazing as the most important factor driving desertification, willingness to pay reduces 0.063 units and these individuals believe that those who do pastoralism have to pay somehow for their utilization of the area. The income variable was as expected positive so it is inferred that higher probability of willingness to pay is tied with higher income. Based on the elasticity at means of income variable, as monthly income of family increases 1%, the probability of accepting bid increases by 0.676%. Therefore, regarding the marginal effect of this variable (3.694×10^{-8}), 1 Iranian Rials increase in income of respondents, the probability of accepting an amount for preservation of the area increases 3.694×10^{-8} units. The variable of

family size (number of family members) was not significant. Regarding the elasticity at means, for each one percent (Iranian Rials) increase in bid, the probability of willingness to pay reduces 1.199 units. Regarding the marginal effect, as family size variable increases 1 unit, the probability of willingness to pay reduces 0.003 units. According to research findings, if bid variable increases 1 percent, the probability of accepting the proposed amount reduces 0.826%. Besides, for one unit (Iranian Rials) increase in proposed amount variable, the probability of willingness to pay reduces 0.833×10^{-5} units. Ultimately, proposition variable refers to those who believe it is ethically incumbent upon everyone to pay some amount for preservation of environment and this variable had negative value. Therefore, ethical people were 0.02 units less probable than consequentialists to be willing to pay.

Mcfadden R-square shows that explanatory variables of the model explain the variations of model's dependent variable well (49%). Maddala R-Square and Esterlla R-Square also confirm this explanatory power. Percentage of right prediction of the model was 0.89%. Therefore, the estimated model could predict high percentage of values of dependent variable with regard to explanatory variables.

Average expected amount that shows willingness to pay for preservation and reclamation of desert areas of *Abuzeidabad* was estimated 200000 Iranian Rials based on maximum likelihood method. It must be noted that other significant variables has been entered in the model in the average level. Numerical integral for ethical people is calculated as relation (8) and for consequentialists is calculated as relation (9);

$$WTP = \int_0^{200000} \frac{1}{1 + \exp\{-4.84801868 + (0.000034091 \text{ bid})\}} = 93986 \quad (8)$$

$$WTP = \int_0^{200000} \frac{1}{1 + \exp\{-5.08596868 + (0.000034091 \text{ bid})\}} = 95153 \quad (9)$$

Average willingness to pay for ethical and consequentialists for preventing desertification of *Abuzeidabad* was 93986 and 95153 Iranian Rials, respectively.

Table 6. The Results of estimating logit regression model for preventing desertification of Abuzeidabad district

Variable	Estimated Coefficient	Standard Error	T value	Elasticity at Means	Marginal Effect
Age	-0.056**	0.029	-1.971	-0.965	-0.014
Sex	-1.307**	0.514	-2.544	-0.265	-0.196
Job	-1.282**	0.524	-2.446	-0.205	-0.190
Farming	-0.758***	0.289	-2.632	-0.056	-0.095
Livestock Raising	-2.320***	0.665	-3.490	-0.298	-0.437
Poultry Farming	2.492**	1.279	1.947	0.031	0.094
Overgrazing	-0.260***	0.095	-2.741	-0.334	-0.063
Family Monthly Income	1.512×10^{-7} ***	3.560×10^{-8}	4.251	0.676	3.694×10^{-8}
Family Size	-0.012	0.011	-1.037	-0.199	-0.003
Proposed Amount	3.408×10^{-5} **	1.601×10^{-5}	-2.129	-0.826	-1.601×10^{-5}
Proposition* Variable	-0.238**	0.108	-2.207	-0.091	-0.020
Constant	5.863	2.502	2.343	2.484	-

LIKELIHOOD RATIO TEST = 66.115 WITH 11 D.F. P-VALUE= 0.00000

ESTRELLA R-SQUARE = 0.605

MADDALA R-SQUARE = 0.415

CRAGG-UHLER R-SQUARE= 0.625

MCFADDEN R-SQUARE=0.495

PERCENTAGE OF RIGHT PREDICTIONS = 0.898

Source: Research Findings (*, **, *** are respectively significance at 10, 5, and 1 % significance levels)

4. Discussion and Conclusion

Contingent valuation method was applied in present study for estimating the value of preservation and reclamation of desert areas of Abuzeidabad and 174 double choices dichotomous questionnaires were filled in which proposed three amounts i.e. 25000, 50000, and 100000 Iranian Rials. Since this area is severely exposed to wind erosion, average WTP of ethical and consequentialists was 93986 and 95153 Iranian Rials, respectively.

Variables such as livestock raising and monthly income of individuals had positive significant effect but age, sex (females were more willing to pay than males), job, farming, livestock raising, overgrazing, and bid had negative significant impact upon people's willingness to pay. Furthermore, the family size had negative effect upon willingness to pay of people but it was not significant at the desired significance level. In fact, ethical people were less willing than consequentialists to pay.

Several researchers applied double dichotomous method and logit model to investigate the willingness to pay for recreational value of *Tandure* national park. It was revealed that age and

initial propose leave negative effect but income has positive impact upon willingness to pay. Besides, average willingness to pay of visitors for recreational value of this area was 2639 Iranian Rials for each visit and total recreational value was 665000000 Iranian Rials (Ghorbani & Sadeghi, 2011).

Findings of another study carried out for specifying the value of *Arasbaran* forest existence value demonstrated that average WTP is 16589 Iranian Rials. In this study, variables such as income, education, family size, and people's outlook had positive effect on willingness to pay but age and proposed amount had negative impact upon willingness to pay (Piri *et al.*, 2009). In a study for estimating preservation and recreational value of *Sisangan* National park in Mazandaran province, average willingness to pay of visitors for preservation value was 6365 Iranian Rials for each family. In this study, age and the amount of bid had negative impact but income and education had positive effect upon willingness to pay (Amimejad *et al.*, 2005).

Since over one fourth of the earth is influenced by the negative effects of desertification and over utilization of natural resources accelerates this phenomenon, national, regional, and global

* The proposition variable refers to those who believe it is ethically incumbent upon everyone to pay some amount for preservation of environment

sustainable development will be challenged. Therefore, measures taken to combat desertification must also be at global and regional scale and each country should take a step in this regard.

National and international experiences in Iran regarding reclamation of degraded regions including the international carbon sequestration project in South Khorasan province (International Carbon Sequestration Atlas Project, 2014) and the international forest and degraded land reclamation projects with special emphasis on sensitive land to wind erosion and saline soils (RFLDL, 2015) in Kerman and South Khorasan province and domestic experiences with public participation and local communities empowerment including the Iranian pattern of participation and empowerment of local communities with social network approach (Ghorbani, 2015) have proved that desertification combat will not be actualized unless local beneficiaries participate. Participation is in fact engaging beneficiaries and desert area inhabitants emotionally and mentally with the significance of desertification combat so that they cooperate and collaborate and undertake responsibilities and feel a correlation between their own socio-economic needs and the necessity of such projects against desertification. In order to evaluate people's responsibility toward vulnerable environment, people's willingness to pay was measured through contingent valuation method in present study.

One of the main determinants of willingness to pay is family's monthly income. Therefore, those whose income level is low are less willing to participate in preservation and reclamation of desert areas. Therefore, it is suggested that government adopt strategies for equal income distribution so that this participation is developed as a consequence. One measure in this regard is creating alternative subsistence such as planting medicinal plants (regarding the existing potentials of the region) and developing arts and crafts. Empowerment of rural women and entrepreneurship for women is of capital importance, too. It is recommended that economic capital of residents is valued based on economic valuation of functions, services, and commodities. These commodities may either be marketable or not. At any rate, valuing helps the action plan of economic empowerment of individuals be specified. If ethical behavior is institutionalized in every person within the family they grew up and environment protection is considered incumbent upon public, much redundant expense for

preservation and development of environmental objectives will be saved. In this regard, the role of government, education system, family (especially the head of the family), and media for training ethical people is undeniable. According to findings, it can therefore be proposed that for strengthening the participation of local communities in desertification combat activities, initially those factors impacting upon participation should be identified. Afterwards, required policies are implemented by organizational agencies for removing probable challenges. What needs to be done in this region is that for removing the challenges faced with local communities and improving their subsistence, executive policies must be put into practice through strengthening organizational cohesion.

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