



ESTIMATING THE PRESERVATION VALUE OF TALEGHAN LAKE'S ECOSYSTEM AND DISTINGUISHING BETWEEN USE AND NON-USE VALUE

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ABSTRACT

Regarding the importance of natural resources in preserving natural ecosystem and human being survival, protecting these resources and preventing their demolition will be necessary. Since Taleghan Lake, located in Iran, is the habitat for plants and animals. The present study determined the preservation value of this lake and estimated the willingness to pay of people (WTP) for this, using the contingent valuation method (CVM). Also, hierarchical analysis method was used to determine the shares of use and non-use values in the whole economic value. Results from Logit model showed that the maximum willingness to pay amounting to 41400 rials for each person per month. On the basis of AHP approach, 3150 Rials and 10350 Rials out of 41400 rials have been estimated as use and non-use value, respectively for each person per month. Also in the second method, willingness to pay using the open-ended method has been determined as 58390 rials for each person per month from which 43792.5 rials and 14597.5 rials have been related to used and non-used values of the lake, respectively. Results from the two models for distinguishing between the use and non-use values are indicatives of allocating more amounts for use value compared with non-use value. This can be led to depletion of natural and environmental resources of the lake.

Keywords: Taleghan lake ecosystem, preservation value, contingent valuation method, AHP.

INTRODUCTION

In terms of unique water, land ecosystems and biodiversity, Taleghan region has many capabilities but due to environmental damage it needs special protection. Presentence of 76 villages inside the border region and 17 rivers in margin of this area have caused thousands of tourists to enter the region in spring and summer, especially in holidays.

During recent decades, the incidence and intensification of environmental crises have causes some growing concerns for the safety of human life. Population growth in the past three decades, the growing industrial development, increase in agricultural production and others have led to increase in energy and basic resources and consequently, to further leakages in the environment and natural resources and every day the amount of pollution in the air, water, and soil is increased and the amount of forest regions and grasslands is decreased. So that the total area of forests in Iran in forty past years has been reduced to one-third and reached 12 million hectares.

Protection of natural resources, optimum and sustainable utilization require efficient policy and planning, as well as compiling a framework that due to meeting its requirements sustainability together with development can be achieved, and at the same time the environment can be protected. Most of the present environmental problems have their origin in lack of necessary knowledge, and cultural weakness concerning the relationship between man and nature and, in fact, it is considered some kind of cultural problem, so, it needs national commitment to strengthen the culture of protecting environment among different classes of the

societies. In this regard, public education about the environment is a key for confronting this cultural problem and also a preventive and effective approach for improving the environmental awareness for the purpose of maintaining these resources.

Economists evaluate the value of environmental services from the point of view of people as estimating the amounts that people want to pay to protect or increase the services. On the other hand, when some of the environmental services are sold in the market, most of the environmental services such as watching wild life or having a look at landscape of an ocean won't be traded in the market. Thus, people don't directly pay any amount for most of the environmental services. Furthermore, since people are unfamiliar with purchasing such goods, their inclination to pay can't completely be determined. So, this doesn't mean that environment or their services don't bear any value and/or it isn't possible to determine a price for them. On the other hand, in order to determine their value in monetary term, it is not necessary for environmental services to be traded in the market. What is needed is estimating the amount of purchasing power that people tend to pay for using environmental services (Amirnejad, 2006).

There are different technical approaches for estimating the total economic value of ecosystems but a basic method for calculating the total economic value that can also cover other methods is using the willingness to pay (WTP) and willingness to accept (WTA) of individuals. Estimating the monetary value of ecosystems services is effective in managing the environment and natural resources in an integrated way. At the micro level,



studies concerning valuation make access to the data on structure and function of ecosystems and their diverse and complex roles in supporting human welfare and sustainable development. Economic valuation can be used in a positive manner to improve the environmental policies as far as possible. Today, the need for understanding and considering the environmental values in project investments assessment, civil and industrial, and policies related to decision-makings is quite sensible (Khorshiddoust, 1998).

In recent years, important advancements have been made in the presentation and application of valuation methods and determining the prices of environmental resources. Since, for most of the benefits from environment resources there isn't any market, attempt is made for valuation of such benefits by artificial valuation markets. Contingent valuation method (CVM) is used as one of the standard and flexible tools for measuring use and non-use values of environment for which the market doesn't exist (Amigues *et al.*, 2002).

In CVM individual's WTP is determined under hypothetical market scenarios (Lee, 1997). The mentioned method wants respondents, due to market terms, to state the amount of money they can pay in favor of environment (Khorshiddoust, 2005).

Most of the applications of the above mentioned method can be observed in evaluation of quality of climate, benefits of public gardens, fishing, effects of state programs on environment and willingness to pay for protecting the underground water. Using the CVM, Lee and Han (2002), studied the value of benefits of five national parks in Southern Korea. Amir Nejad *et al.*, (2006) estimated the annual preservation and recreational values of Sisangan forest park in Iran as 5.8 and 2.5 million rials per hectare, respectively. Khorshiddoust (2005) obtained the WTP of Tabriz citizens to protect civic environment and to reduce the present pollutions in the city as 41140 rials per month.

Serkan Gürlük (2005) study an application of survey based on contingent valuation method for valuation of the non-use benefits of improvement in ecosystem services through Misi Rural Development Project (MRDP), which is integrated with environmental considerations, in Bursa-Turkey.

Jianjun Jin *et al.*, (2005) used double-bounded dichotomous choice contingent valuation method (DC-CVM) and choice experiment (CE) study that aimed to examine Macao residents' preferences for alternative solid waste management policy changes in Macao. The results suggest that both double-bounded DC-CVM and CE can be successfully implemented for environmental valuation in Macao.

The subjects of Amirnejad *et al.*, (2005) research are the determination of existence value of north forests of Iran (NFI), adjacent to Caspian Sea, and measure of individual's willingness to pay (WTP) based on contingent valuation (CV) and dichotomous choice (DC). Results showed that 65.8% individuals are willing to pay for the existence of NFI, while about 20% of these individuals

have not yet visited, and 41% of them only visited the NFI once or twice. The mean of WTP for existence value of these forests is US\$2.51 household/month or annual value of US\$30.12 for a household.

Zhongmin *et al.*, (2003) used CVM to obtain estimates of willingness to pay for restoring Ejina ecosystem services. They employed a parametric model to estimate the benefits of restoring Ejina ecosystem. Results from 700 in-person interviews indicate that households would pay an average of 19.37 (RMB) per year with 20.78 per household for the main river area, and 16.41 per household for the rest of Hei basin. The results suggest that the general public in Hei Valley would be willing to pay to restore the Ejina ecosystem, although this amount is substantially less than the estimated costs of restoration.

Christopher *et al.*, (2010) develop an attribute-based contingent valuation approach that allows them to perform cost-benefit analysis on control programs and inform the distribution of mitigation effort over land units that provide different types of environmental services. They use this approach to examine conservation efforts on three land management units in the southern Appalachian Mountains. They find that there is substantial support for protection of hemlock stands providing ecological services with very little human-use value. Further, they show that benefits from the current mitigation strategy could be increased by shifting effort to protect more ecological services at the expense of sites that generate primarily human-use value.

According to scientific research done by Environment Protection Organization of Taleghan region, because of a lot of difference in height and diversity in topography, this region has 510 plant species including 30 medical species and 29 pasture types, trees and shrubs. Mountainous and appropriate nature of this region has made the ground ready for most of the wild animals such as goat, male buffalo, brown bear, leopard, wild cat, boar, jackal, fox, wolf, partridge, quail, eagle, falcon, vulture, dal (some kind of eagle), sargieh and Caucasian partridge to live in. Shahrood River which originates from the range of Taleghan's Kahar heights and passes through the plains of this district and finally flows to Taleghan's lake, is an appropriate habitat for different fish species, including red-spotted trout, black moon fish, river fish and bride fish, and it has provided another manifestation of places of the lake that are worthy to be seen. Therefore, presence of executive plans to protect this area is something essential.

But, although construction around Taleghan Lake has caused to create water storage source for supplying drinking water, it has created some problems in terms of environment and ecosystem for residents of the area. These problems can include changes in regional ecosystem that have caused changes in vegetation types, going under water several hectares of the area's gardens, changing land use, the indiscriminate spread of building villas, and unexampled expensiveness of land prices, and development in mediation. Mutually, created lake and its landscapes, have caused unscheduled arrival of thousands of tourists during holidays (especially in summer) to the



people's pastures, gardens, and farms. Due to the lack of tourism infrastructure in the region, lack of recreational facilities (restaurants, temporary accommodations surrounding the lake, lack of purchase centers and health facilities), the only heavy road traffic, increased accidents, various piles of garbage remains and human sewage leakages have been brought to pastures and gardens. And this, has had any consequent unless soil erosion (and loss of vegetation), lake water pollution (and the destruction of some aquatic animals of the lake) and outside the nature pressure to environment of the region.

Furthermore, considering the existing environmental problems in the area, the necessity for evaluation of environment (in terms of economy) and determining the monetary value for different functions of the under consideration area (in terms of environmental services) are among those measures that should be paid much attention to in order for accessing to a sustainable development.

Broadness of natural areas and weakness of government in supporting all of these natural resources reveals the necessity for using financial participation of people for protecting the environmental resources and preventing their destruction. Therefore, the question to be asked in the present research is: "Has Taleghan Lake been enjoying enough value for being helpful in improving the welfare of citizens of Tehran Province, in a manner that, through continuous financial supports, the region can be protected against threats such as changes in land use by irregular constructing around the lake and consequently destruction of animals and vegetations, arrival of sewages and rubbishes into the lake, irregular arrival of tourists in this region and illegal hunting?"

In doing so, estimating the amount of individuals' willingness to pay, for the purpose of direct use and protecting the mentioned lake was considered. On the other hand, regarding the considerable importance of separation of use and non-use values on the basis of individuals' viewpoints and determining the share of these values of the total economic value of the lake, estimating relative accumulative weight of each values of the lake was considered.

Requested dataset were collected in spring and summer of 2010 by completing the designed questionnaires and referring in presence to visitors (who enjoyed independent income) from Taleghan Lake. Results from questionnaire have estimated willingness to pay annually by each family - pleased to pay for protecting this lake - and at the end, using the AHP approach, they have determined the difference between use and non-use values of Taleghan Lake.

MATERIALS AND METHODS

The study area

Taleghan city located in 120 kilometers from north-west of Tehran is a relatively high mountainous basin in the heart of the Alborz Mountains. This region leads to Alamut and Kalardasht from the north, to

Hashtgerd from the south, to Alborz Province from the east, and to Qazvin Province from the west. Taleghan Lake in Taleghan valley has been located in about 135 kilometers from north-west of Tehran and on Taleghan River. Taleghan River originates from heights of Alborz Mountains, and after connecting several small side branches it flows towards Taleghan Lake.

Research method

The sample included 143 individuals that have been obtained using Michael and Carson (1989) sampling approach based on 30 pre-tested questionnaires. Calculating the amount for V, coefficient of variation and TWTP of the real amount of WTP, the amount of sample size will be determined.

$$n = \left[\frac{t \times v}{d} \right]^2 \quad (1)$$

In order to measure the visitors' willingness to pay, Double Bounded Dichotomous Choice (DDC) questionnaire were used. Three bid amounts were 50000 rials, 25000 rials and 10000 rials, respectively.

Assuming that utility of individuals is a function of protection of the lake, income, and other eco-social characteristics, utility function can be written as:

$$u = u(h, y; s) \quad (2)$$

If an individual is inclined to pay for the purpose of protection of the lake, h equals 1; otherwise, it will be 0. On the other hand, y and s also show income and vector of eco-social characteristics of an individual. Contingent valuation method is based on the fundamental assumption that the individual is aware of his/her utility function, however, enough information about utility function of individuals is not available for economists, thus from the view point of economists utility function of individuals are as follows (Hausman, 1993):

$$u(h, y; s) = v(h, y; s) + \varepsilon_h$$

Accordingly, utility function of individuals is a random variable with average of v (0) which also represents indirect utility. If A rials are suggested to the person to pay to participate in protection of Taleghan Lake, if the person is inclined to pay, one can write:

$$v = (1, y - A; s) + \varepsilon_1 > v(0, y; s) + \varepsilon_0 \quad (3)$$

Hence, the possibility of person's willingness to pay and lack of this willingness can be expressed as:

$$p_1 = p_1 \{ \text{willing to pay} \} = p_1 \{ v(1, y - A; s) + \varepsilon_1 > v(0, y; s) + \varepsilon_0 \} \quad (4)$$

$$p_0 = 1 - p_1 \quad (5)$$

If η equals $(\varepsilon_0 - \varepsilon_1)$ and $F_\eta(\cdot)$ is indicative of accumulative distribution of the function η , the probability of individual's willingness to pay can be written as:



$$p_1 = F_{\eta}(\Delta v) \quad (6)$$

Δv is difference of indirect utility in case of willingness and non-willingness to pay, and it equals:

$$\Delta v = v(0, y; s) + \varepsilon_0 - v(1, y - A; s) - \varepsilon_1 \quad (7)$$

$$\Delta v = v(0, y; s) - v(1, y - A; s) + (\varepsilon_0 - \varepsilon_1) \quad (8)$$

$$\Delta v = v(0, y; s) - v(1, y - A; s) + \eta \quad (9)$$

Assuming the logistic distribution and using Logit function for $F_{\eta}(\cdot)$, it can be written as (Lee & Han, 2002):

$$p_1 = F_{\eta}(\Delta v) = \frac{1}{1 + \exp(-\Delta v)} \quad (10)$$

So, if desirability function is of linear type, considering the linearity of indirect utility function, difference between indirect utility can be written as:

$$v = (1, y - A; s) = \alpha_1 + \beta y + \varepsilon_1, \beta > 0, h = 0, 1 \quad (11)$$

$$v = (1, y - A; s) = \alpha_1 + \beta(y - A) + \varepsilon_1 \quad (12)$$

$$v = (0, y; s) = \alpha_0 + \beta y + \varepsilon_0 \quad (13)$$

$$\Delta v = v(0, y; s) + \varepsilon_0 - v(1, y - A; s) - \varepsilon_1 = (\alpha_0 - \alpha_1) + \beta A + \eta \quad (14)$$

Since the expected η is zero, function (15) will take the following form:

$$\Delta v = v(0, y; s) - v(1, y - A; s) = (\alpha_0 - \alpha_1) + \beta A \quad (15)$$

Considering the Δv equal to zero, the amount of

maximum willingness to pay will be $-\frac{\alpha_0 - \alpha_1}{\beta}$.

For estimating WTP in open-ended approach Tobit model was used. Estimation process of Tobit model for visitors' WTP is as follows:

$$Y_i^* = \beta X_i + \varepsilon_i \quad (16)$$

$$Y_i = Y_i^* \text{ if } Y_i^* > 0 \quad (17)$$

$$Y_i = 0 \text{ if } Y_i^* \leq 0 \quad (18)$$

In the above model β is regression coefficient vector and X_i is independent variable of the model. In case of a visitor who is willing to pay, Y_i^* shows the amount of willingness to pay in rials and Y_i^* of visitors who are not willing to pay is considered zero.

After estimating WTP using DDC and open-ended approaches, AHP had been used for distinguishing individuals' use and non-use values.

RESULTS AND DISCUSSIONS

In order to estimate the preservation value of Taleghan lake, independent variables include the age of individuals (AGE), education (EDU), family size (FN), family monthly expenditures (EXPE), dummy variable of visiting the region (VIS), environmental tendencies (EI) and environmental consider index (WI) had been considered (Table-1).

Table 1. Description statistics of some important variable in the study lake of Taleghan

Variables	Unit	Mean	Maximum	Minimum	SD
AGE	year	37	80	20	11.8
EDU	year	16	20	0	2.74
FN	individual	4	11	1	1.47
EXPE	million Rials	0.64	3	0.05	0.42

Source: Research findings.

Results from bid acceptance have been shown in Table-2. As it is clear, 60 percent of sample individuals didn't accept the initial bid and they were not willing to pay 50 thousand Rials from their monthly income for the lake preservation. When the lower bid (25 thousand Rials) was offered to whom that were not accept the initial bid, 49 percent of sample individuals didn't accept it and only

15 percent individual accepted it. Individuals who accepted the initial bid were asked whether they are willing to pay 100 thousand Rials for protection of the lake. 29 percent of the respondents didn't accept the upper bid and 28 percent of them accepted it. Results showed that 68.8 percent of investigated individuals were willing to pay some amounts for protection of Taleghan Lake.

**Table 2.** Individuals answer to offered bids

Acceptance state		Initial bid (50000 Rials)	Lower bid (25000 Rials)	Upper bid (100000 Rials)
Acceptance	Number	57	15	28
	percentage	39	10	19.8
Rejection	Number	86	71	29
	percentage	60	49	20.1
Sum	Number	143	86	57
	percentage	100	60	40

Source: Research findings.

In order to estimate WTP in DDC approach, Logit model had been applied. Regression coefficients sign of VIS, EXPE, EI and WI showed that mentioned variables had direct and positive effect on individuals WTP. On the other hand, AGE, FN and BID variables had reverse and negative effect on visitors WTP.

Elasticity amount of BID showed that 10 percentages increase in mentioned variable caused 7.2 decrease in probability of WTP existence in individuals. The marginal effect amount of BID expresses 10 thousand

Rials increase in bid amounts caused 0.53 decreases in probability of WTP existence in individuals.

The amount of LR statistics equaled 40.11 which showed overall significance of logit model. Percentage of right predictions of estimated model is 71 percent which emphasized on power of estimated logit model. In order to investigate the presence of heteroscedasticity, LM2 test was applied. The amount of this statistic was 3.2 so heteroscedasticity did not exist. Also, principle component results showed that multicollinearity did not exist in mode.

Table-3. Results of Logit model

Variable	Estimated coefficient	t-Ratio	Marginal effect	Elasticity
BID	-0.0002	-4.33	-0.53×10^{-4}	-0.72
AGE	-0.04	-0.29	-0.89×10^{-3}	-0.08
VIS	0.91	3.27	0.2	0.29
FN	-0.21	-2.15	-0.04	-0.49
EXPE	0.43×10^{-6}	1.21	0.96×10^{-7}	0.16
EI	0.15	2.21	0.03	0.63
WI	0.21	1.76	0.05	0.31
Constant	-0.68	-0.80	-	-

Resource: Research findings.

Calculation of expected WTP through DDC approach revealed that individuals ready to pay 41400 Rials per month in order to preserve Taleghan Lake.

Another approach used for calculating individuals WTP for Taleghan Lake preservation was open-ended. Hence, by considering maximum revealed WTP of

individuals as dependent variable Tobit model were used to investigate independent variables effect on MWTP. Results showed that Maximum willingness to pay of each individual for preserving Taleghan Lake was 58390 Rials per month.



Table-4. Estimation results of Tobit model.

Variable	Normalized coefficient	Z-Ratio	Elasticity of index	Elasticity of E (y)	Total elasticity
AGE	0.001	0.14	0.17	0.06	0.24
VIS	0.38	2.03	0.62	0.24	0.87
FN	0.02	-0.34	-0.31	-0.12	-0.43
EXPE	0.35 x10 ⁻⁷	0.15	0.07	0.03	0.1
EI	0.08	1.84	2.11	0.82	2.93
WI	0.21	2.52	1.79	0.69	2.49
Constant	-1.42	-2.42	-	-	-

Resource: Research findings.

Total economic value of a natural resource is obtained from the sum of use and non-use values. AHP approach has been used to distinguish between use and non-use values of Taleghan Lake from the point of views of investigated individuals. AHP method is based on options pair wise comparison. Using the relative preferences of individuals, relative importance of each lake's function in total economic value had been determined.

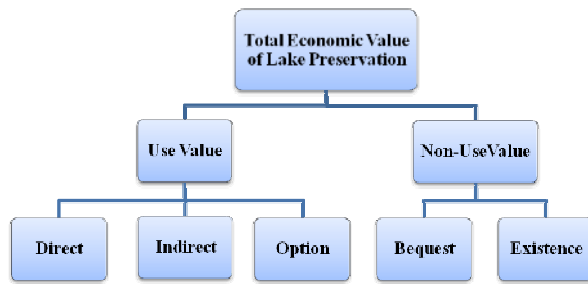


Figure-1. Hierarchy of attributes related to total values of the Taleghan Lake.

An example of pair wise comparison of direct and indirect value can be observed in Figure-2.

Direct function									Comparison	Indirect function								
9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9		
Importance ←									Equal Importance	→ Importance								

Figure-2. Example of pair wise comparison.

Accordingly, each individual that revealed WTP answered ten pair wise comparisons that originated from five different values of Taleghan Lake. After calculating inconsistency index, only observations with less than ten percentages of mentioned index considered in AHP process.

Table-5. Relative importance of attributes with respect to total value.

Attributes	Weight (%)
Direct	49.1
indirect	15.4
option	10.5
bequest	12.5
existence	12.5
TEV	100

Resource: Research findings.

Results showed direct value is of more importance, and indirect, bequest, existence and option values had taken their places in the next priorities, respectively.

DDC and open-ended approach estimated individual's WTP for preservation of Taleghan Lake, 41400 and 58390 Rials, respectively. Use value acquired 75 percent of TEV and non-use value gained 25 percent of TEV. So, 31050 Rials out of 41400 Rials and 43792.5 Rials out of 58390 Rials belonged to use value. Also, 10350 rials and 14597.5 rials out of mentioned WTP belonged to non-use values.

CONCLUSIONS

Relative importance of use value could lead to depletion of natural and environmental resources of the lake, so it is necessary to follow some policies in order to create a balance between use and non-use importance of Taleghan Lake.

Taleghan inevitably, is in transition from a simple village society to a modern one. In future, this situation will lead to disruption of animal and plant life in the region. In its general sense, planning means intelligent intervention in the current situation to reach the favorable one. Through a series of coordinated and regular actions towards the pre-determined goal, it is possible to provide organized responses for coordinated development of the region. This process needs comprehensive and dynamic



perspectives, appropriate development plans, adequate financing, efficient managerial and professional power to have an exact control, and control tools effective in progress process. Taleghan, like any other local society requires development programs to be prepared carefully and delicately enough through partnership, support seeking, and justice oriented approaches, because solving critical issues mobilizing all beneficiary human groups and participation of people living in the region, thereby people, with a sense of belonging and responsibility in the interests of generations, will be subject to share decisions and effective measures to improve the conditions and benefit them. In this regard, planners, have a duty to defend the positions of people and their habitats in the manner that is understandable to decision makers. They should also be in bilateral and continuous relation with people of the region and through awareness improve their knowledge on their own natural rights. Thus, Taleghan valley, as a whole unit requires a comprehensive plan. This plan, in fact, is a joint ring that studies all issues and regional changes with regard to the weaknesses, strengths, threats and opportunities and determines prioritized strategic actions in executive form and together with determining required financial resources and administrative structure.

Considering the present situation some measures to maintain and improve environmental conditions of Taleghan Lake and movement to achieve sustainable development in line with optimal use of environmental resources of the lake are as follows:

- a) Preservation of environment and natural landscapes, farms and pastures to maintain regional identity, because when they were destroyed there won't be anything to sustain a human deserved life, recreation and tourism or watching and visual enjoying, and consequently, Taleghan will also experience the same grievous fate as Lavasan and Kalardasht.
- b) Prevention of all destructive elements or water, soil, air and landscape polluting factors, and fixing the funlakeental deficiencies of the network for accessing around the lake, and planning for improvement and classification of all ways of the region together with using optimal speed pattern and determining the entering restricted areas for motor transport means.
- c) Locating the limited spaces to build villas and enough centers for temporary stay of tourists and providing appropriate facilities for them including health services, dining services and together with preservation of environment and observing the standards related to earthquakes, water-course surroundings, soil drift, and determining comprehensive rules for construction in the area.
- d) Paying ownership equity for lands around the lake and legal water right for people living in Taleghan. Reviewing and precise determination of legal and quantitative surroundings of rivers and determining appropriate applications along them, such as roads and temporary residences with suitable accommodations to

create required incentives for consistent economic activities to draw and lead an active participation for preservation of water resources and reducing the tendencies to sale the lands around the lake for the purpose of construction.

- e) Preventing irregular constructions, especially on the slopes overlooking the lake and the surrounding natural landscapes.

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