Indian Journal Of Natural Sciences www.tnsroindia.org. © IJONS

Vol.6 / Issue 31 / August 2015 *International Bimonthly* *ISSN: 0976 – 0997*

RESEARCH ARTICLE

The Economic Valuation of Arasbaran Forests' Animal Species in Iran (An Application of Contingent Ranking Approach)

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Received: 29 May 2015 Revised: 30 Jun 2015 Accepted: 31 Jul 2015

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ABSTRACT

Regardless of the preserving, economic, social and cultural attractions, Arasbaran forests have provided unique treasures of environmental resources in the northwestern Iran due to rare plant and animal species they host. Recent destruction and deforestation activities have led to loss of a large portion of forest-associated interests, besides this has endangered the animal species' Lifeisin it, thus motivating forest conservation stirs. Since one of the best ways to preserve such treasures, especially in the countries withpooreconomy, is to use people's aid, the present study aims to estimate the economic value of Arasbaran forests' three valuable animal species using contingent ranking method. Required data was acquired through field studies and questionnaires filled by 334 visitors and citizens from ten cities in three provinces: East-Azerbaijan, West Azerbaijan and Ardabil. According to the valuation method used in this study, the Ranked ordered Logit regression model was applied. Results showed that the tiger, with 18.2 million dollar and the bear, with 8.6 million dollar values are the most and the least valuable animal species. Based on the results, respondents' level of education, income, number of annual visits from the forests and their friendly attitudes towards Arasbaran forests had significant positive impacts on WTP of respondents for the animal species. Results of the present study can be served as proper guidelines not only for policymaking and planning purposes, but also to attract public participation in the course of conservation and sustainable use of the valuable resources.

Keywords: Arasbaran forest, contingent ranking, ranked ordered logit, economic valuation of animal species

INTRODUCTION

Accelerating economic developments through recent decades has caused excessive pressure on global environment which has faced irreversible damages to natural resources around different countries. Hence, concentrating on environmental impacts of development patterns gradually becomes more important, so that attention to environmental issues and following them, in rich countries is the main cause of economic transformation.The civilized world must move to a new approach from "economic environment" to "environmental economics". The approach needs to be strengthened and supported by interdisciplinary cooperation between specialists of natural resources and environmental experts with elites and governmental economic experts and policy makers since further this issue is one of the most essential parts to ensure sustainable development.

Economic valuation of environmental resources led to the discovery of the demand curves for environmental goods and environmental services and the value that people attach to the environment. A basic condition for the policymakers and planners to changes destructive applications of environmental resources is the economic analysis and detailed assessment of the resources (Bateman and Willis,1999). Unlike the values that forests have, increasing population has led to increased demand for forest goods and services and thus increases the rate of deforestations. Statistics show that between 2005 and 2010, the population growth rate which was the lowest in Europe has the lowest rate of degradation of forest resources (about 0.1 percents) and African continent with the highest population growth rate has the highest rate of deforestation in the world (about 0.8 percent) (Fao, 2010). Along with degradation and loss of forest resources, the quality and quantity of services that benefit the community are reduced. Awareness of the benefits that the destruction of forest resources take away from the community, motivates the protection activities of these resources. In other words, this leads to a willingness to pay for forest conservation.

According to estimates presented by the World Bank, the net present value cost of damages caused by deforestation and degradation of forests in the Caspian Sea in Iran, which is the loss of benefits and functions of the forest in 2002, is about 760 $ and 147 million $ respectively which is 0.8 of Iran's GDP in this year (World Bank, 2005).

There are various divisions of the economic value of natural resources such as forests.The non-consumption values are one of them which includes the "refugium function" (Protection of animal species).

The total area of East Azerbaijan's forests are about 188,000 hectares in which about 164000 hectares of forest belongs to Arasbaran. The area of 148,000 hectares of this forest has been reported as conservational and protected forests. (Approximately 78,560 hectares-about 56% of the area-are specified as protected forests). Arasbaran is very diverse in the terms of biodiversityand isthe only habitant of Black Cock which is one of the rarestbirdsin the world.With respect to Arasbaran's biodiversity, specific climatic conditions, the existence of 1072 species of plants and 97 species of wood have been reported in the area, therefore it is supported as a reserve of "Biosphere" by UNESCO since 1976 and is one of the ten Biosphere reserves in Iran. Arasbaran with its beautiful nature, pleasant landscapes, historical monuments and places of power has a powerful potential to attract tourists. Medicinal plants in the region with significant value, as one of the pillars of regional development can be of particular importance (Department of Natural Resourcesin East Azerbaijan, 2003).

Due to the deforestations and exorbitance hunting, the animal species in the forests are in the danger of demolition (Department of Natural Resourcesin East Azerbaijan, 2003). Arasbaran forests are one of the natural treasures which are located in Iran's North West region and like any other natural sources consist of non-use values. The overall purpose of this study is to estimate the habitant value of Arasbaran forest which is a large part oftotaleconomicvalue of these forests. Since in the developing countries, with fragile economic conditions, one of the most important ways to preserve the environment and forests are public aids, many studies have tried to evaluate the public willingness to pay for environmental protections.

Because of the importance of economic valuation of environment including the forests, from the point of public view, many researchers have addressed this issue. In some studies Contingent Valuation Methods have been applied to estimate the economic value of forests and other environmental services (Sattout et al. 2007, Khodaverdizadeh et al. 2008, Barala, et al. 2008, Mollaee, 2009, Pattison, 2009, Jahanshahi and Mousavi, 2011, Tao et al., 2012).

Some other researchers have used the choice experiment for environmental valuations. (Meyerhoff et al. 2009 , Taylor and Tongo 2010,Wallmo and Lew 2011, Cerda et al. 2013, Salehnia 2011). In other studies contingent ranking approach is applied for economical valuation of environment (such as: Garrod and Willis 1997, Kumar and Kant 2007). In some studies, to assess the recreational value of the environmental services, the travel cost method is used (such as: Hayati et al. 2011, Chae et al. 2012). While some studies have used two valuation methods and tried tocompare their results in valuation of environment (like: Sayyadi et al. 2005, Bateman et al. 2006, Mogas et al. 2009).

Results from literature review indicate that despite the different effects of variables in the studies, briefly, factors such as demographic, economic and social variables associated with each studied resource's characteristics, besides respondent's environmental attitudes could influence respondent's willing to pay (WTP) for different features of environmental resource, including the living animal species on it.

Given that the non-productive functions, including refugium functions are the most valuable functions of Arasbaran forest and one of the most important ways to protect and restore natural resources such as forests is assistance of public participation, motivating social orientation, in order to protect this resource is valuable. The emphasis of this study is estimation of people's WTP for Arasbaran forests' animal species using the Contingent Ranking (CR) method, which seems to be compatible with the general behavior of a consumer which is based on ranking of preferences and choosing between them. Therefore, The rank-ordered logit model, which is also suitable for CR method and is introduced by Beggs et al(1981) is applied in this study. Since Arasbaran possesses numerous biodiversity and animal species, to do the research, three main species: the Tiger, the Black Cock and the Bear were chosen among them through the pre-test andInterviews withexperts.

MATERIALS AND METHODS

The economic value as a valuable tool is connected to the human utility maximizing and is a human-oriented value. This means that it is based on people and their preferences. If there was a direct market for environmental goods and services, using the normal pricing methods to value environmental services, would be possible. But the lack of a suitable market for many environmental functions makes usage of these methods almost impossible. Hence one of the best methods of estimating non-market services is stated preference methods.

Stated preference methods, have beendevelopedin recent decades. These methods attempt to measure people's willingness to pay directly.The stated preferences approach relies on the data which gather through direct questioning of respondents and their preferences.The methods consist of several valuation techniques. The common feature of all these techniques, are the direct questions from people about their possible choices, in a hypothetical market. This approachincludes "contingentvaluationmethods" (CVM)and"multi-valuation techniques"such as: "choice experiment"and "contingent ranking". In the present study, the contingent ranking method is applied.In this approach, the respondent is asked to rank his choices according to his preferences from the most important to the least important alternatives. For this reason, ranking data, could offer more information comparing with the choice experiment (in which respondent is asked to choose between deferent alternatives). However, this method is more complicated compared to other methods. Contingent ranking method could result in welfare- adapted estimations, provided that the status quo option is one of the alternatives in the choice series. So that in the case the respondent does not interested in any of improvement alternatives, could choose that one (Liu and Wirtz , 2010).

Implicitpriceof eachattributeis the finalrateof substitutionbetweennon-monetaryandmonetaryattributes and it is calculated from the ratio of non-monetary factor to the monetary one:

$$M\arg inal\,WTP = -\left[\frac{\beta \quad non-monetary}{\beta \quad monetary}\right] \quad (1)$$

The firstand most important stepin amultiple valuation techniques, including contingentranking, is designing of choicecards. To this end, the main attributes of the resource and the level of each attribute is identified; then the cards and henceforth the questionnaire are designed according to the characteristics of the test. In practice, attributes are selected from reviewing of previous studies or interviewing with experts group (target group). It should be noted that the price paid for the studied resources are one of the reviewed attributes and through the monetary factor it is possible to estimate the willingness to pay for each attributes of the forest. Also the levels of each attribute are identified through the exploratory studies, literature reviews and interviews with the target groups. The statistical design theory is used for level compositionandformationofappropriatescenarios to present to the respondents. Complete factorial design is one of the available options in this stage, however,because of alarge number ofcompoundsin this technique, alternative methodssuch as"Partial factorial design" is used in which thenumber ofpossible combinations are greatly reduced.

Table 1 shows the selected attributes (animals) in valuation of Arasbaran forests' animal species. As it can be seen, the refugium functions of Arasbaran forests are divided into 3 attributes (three main animal species) with 3 levels. In this regard, the 12 alternatives and 6 choice set was determined that were gathered in 2 trio-blocks. The SAS 9.2 software was used for designing the cards. Each choice set, includes the relative improvement and optimum conditions of animals besides one status quo option.

All levels have special characteristics which are presented in Figure 1. The characteristics of each level are designed and presented to the respondents through consulting with the Environment Agency's experts and their improvement plans for the Arasbaran forests

Figure 2. shows a sample ofthe selectedcardsto calculate thevalue of three chosenanimal species ofArasbaran forests.

Ranked ordered Logit model (exploded logit regression)

The exploded logit regression conducted in many marketing researches. This model, in fact, is the expanded conditional logit model of McFadden (1987) which is presented by beggs et al (1981) in the economic literatures. The model was developed by Hausman and Rudd (1987) and presented entitled Ranked ordered logit model. Basic techniques of this model is based on random utility model (RUM)(kummar and count, 2007).

It is supposed that respondent i derive utility U_{ij} for each animal value j, which includes a systematic component μ_{ij} and a random component ε_{ij} :

$$U_{ij} = \mu_{ij} + \varepsilon_{ij} \quad (2)$$

The respondent i would rank the animal species j upper than animal species k, providing that $U_{ij} > U_{iik}$. The error terms ε_{ij} is supposed to be independent and identically distributed, and assuming that:

$$\Pr ob(\varepsilon_{ij} < t) = \exp\{-\exp(-t)\} \quad (3)$$

Therefore the odds of ranking j higher that k could be explained through:

$$\exp\{U_{ij} - U_{ik}\} \quad (4)$$

The utility's systematic component U_{ij} can be specified through a linear function of a set of explanatory variables X_i s as below:

$$U_{ij} = \beta_j X_i \quad (5)$$

In which the X_i vector contains some variables which describe respondents' characteristics yet they do not differ among various biodiversity of the forest. Also β represent coefficients' row vector which should be estimated. The coefficients for those variables would differ among forest attributes, moreover one of the β_j vectors needs to be set equal to 0 for the identification achievement (the selection of the reference animal species is arbitrary).The model is equipollent to the common multinomial logit regression model. Although, the name "exploded logit" name is applied to indicate an observed rank ordering of J animal species and could be regarded as an "explosion" into J-1 independent observations, in a way that if $U_{i1} \succ U_{i2} \succ ... \succ U_{ij}$, it can be expanded as: $U_{i1} \succ U_{ij}$, $j = 2,...,J$ و $U_{i2} \succ U_{ij}$, $j = 3,...,J$ و ... و $U_{ij-1} \succ U_{ij}$ (Salomon, 2003).Therefore, the data are considered to be a sequence of choices, in which the animal species or value with the highest preference is chosen over all other species, while the value with the second highest preference is picked out over all but the first one, and this can be continued like above. This explosion is possible through the independence assumption from irrelevant alternatives (IIA) which is also known as Luce's choice axiom, which indicates that the relative preference for any two forest attribute is indifferent to the choice set's other features (kummar and count, 2007).

The random utility model connotes the following likelihood L_i for a single respondent as below:

$$L_i = \prod_{j=1}^{j} \left[\frac{\exp\{\mu_{ij}\}}{\sum_{k=1}^{j} \sigma_{ijk} \exp\{\mu_{ik}\}} \right] \quad (6)$$

in which the $\sigma_{ijk}=1$, if $Y_{ik}>Y_{ij}$, and $\sigma_{ijk}=0$, otherwise.

The statistical population of this study, is approximately 334 people which are chosen randomly between visitors of the Arasbaran forests and also citizens of ten neighborhood cities (all were Within a radius of250km from the forests), from three abutting provinces: West Azerbaijan, East Azerbaijan and Ardabil. It should be noted that the sample size is calculated using the formula introduced by Orme (1998).

RESULTS AND DISCUSSIONS

Descriptive results of statistical population

Statistical characteristics of respondents are presented in Tables 2. The mean of age variable represents a middle-aged population of respondents. The majority of study subjects were married men and individuals with small families. The mean of annual gross income indicates a normal income for majority of respondents, which have less than 1 visit per year from the forests. The ars variable indicates individuals' friendly attitude toward Arasbaran forests. (Index of friendly attitude towards Arasbaran). The index was consisted of 10 speeches to measure respondents' friendly attitudes towards the forests, such as ignoring some utilities for safeguarding them. Each species is evaluated through codes from 5 (very important) to 1 (not important). Mean of this variable indicates relative importance of Arasbaran forest from respondents' point of view. Also the variable **edu** represent the education level of respondents,

which is an ordinal variable identified as: 1=Illiterate, 2= Primary School, 3= Junior high school, 4= Senior high school,5= Associated Diploma (AD), 6= BSc,7=MSc and 8=PhD. Mean of this variable states that most respondents have academic education levels.

Inferential result of estimating the value of animal species

Table 3, shows the result of estimation of ranked ordered logit regression to determine the value of animal species of Arasbaran forests. The variablescockmed and cockwell show the relative improvement and optimum condition of blackcock, respectively. Also variables bearmed and bearwell indicate the relative improvement and optimum condition of bears in the Arasbaran forests, respectively. Moreover the variables tigermed and tigerwell show the relative improvement and optimum condition of the tigers in he forests, respectively. Finally the variable P, shows the bid price.

Toinferthe effectsof individualvariables that affect people's willingness topay, the ranked ordered logit model with interactions of bid price (p) with these factors was also estimated, which the results of estimation of both models are presented in the table 3. The variables pedu, pinc, pars and pbaz show the interactions of P with respondent's education level, his income, his friendly attitude towards the Arasbaran forests and his number of annual visits from the forests, respectively.

According to the tables' result, relative improvement and optimum condition of each attributes have positive effect on respondents' WTP, as expected. Also according to the interaction model results, respondents' level of education, their income, their number of annual visits from the forests and their friendly attitudes towards Arasbaran forests significantly increases the WTP of respondents for the animal species. The similar results from these variables' positive effect on respondents' WTP are presented in the other studies such as: Sayadi, et al (2005), Bateman, et al (2006), Sattout, et al (2007), Mogas, et al (2009) and Tao, et al (2012). The monthly, annual and total (considering population of three studied provinces) WTP for each animal species is calculated through equation (1), and the results are presented in the table 4. As it can be seen the tiger and the bear are the most and the least important features, respectively. The same ranking results were obtained through the direct ranking question of the attributes which was asked from the respondents in the questionnaire.

CONCLUSION

As it can be inferred from table 4, public willingness to pay for animal species of Arasbaran forests is a large amount of money. This issue shows the great importance of environmental valuation especially the habitant value of Arasbaran Forests.The study's results showed that total economic valuation of Arasbaran forests is considerable amount of money. This issue could be helpful in the policy making for the improvement of forests condition, especially the habitant condition of the forests since the people's aid, considering the present situation of Iranian economic, could provide a major amount of money for preserving the environmental resources including Arasbaran forests.

On the other hand, Prioritizing of the animal species shows that the tigerand the blackcock are the favorite animal species among the other ones. This could be helpful in the prioritizing of the improvement plans of Arasbaran's habitant situations. Also along with the betterment of their condition,making a natural zoo in the forests, thatcould increase the tourism income of the region and these earnings could be used for investment for the improvement of forests' environmental conditions and increasing the utility of consumers.

The positive relation between income and WTP indicates that improvementofincomeinforested areas could help to better the habitant conditions. In this respect suitable policies and employment programs along with policy makings which support the environmental protection programsare suggested.Finally since the study shows a significant link

between respondents' positive tendencies towards Arasbaran forests, assisting NGO's formation regarding environment, especially forests, and related subjects, along with encouraging them to do activities todevelop society's awareness of environmental resources and their values, besides disadvantages of deforestation and other environmental damages, is another suggestion; since the philosophy and nature of such organizations is to raise these kinds of information in the society or do activities like that. Besides them, governmental activities, like special TV programs, or advertisement billboards in appropriate places to augment society's knowledge towards natural treasures like forests is suggested.

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Table 1. The studied Attributes and their levels of Arasbaran forests

Bid price (Rials)*	Refugium function (ProtectedSpecies)	Attributes
Refugiumvalue (the value of animal species) ofArasbaran forests		
5000	Crisis	levels
15000	Relative Improvement	
25000	Optimum	

Each Rial is about 3.5×10^{-5} Dollar

Table 2. Variable definition and sample statistics

Variable	definition	Mean	SD	Min	Max
Respondent's Income	inc	534.3	740.761	250	6000
Age of	age	40.396	7.70	23	71
gender	gndr	0.73	0.445	0	1
Level of education	edu	5.86	1.01	4	8
Family size	fmlsz	3.46	1.3	1	7
Number of annual visits	vst	0.63	0.73	0	3

Table 3. Estimation result of rank-ordered Logit model about information and refugium functions of Arasbaran forests

Rank-ordered logit regression with interactions		Rank-ordered logit regression		Variable
Standard eror	**coefficient**	**Standard eror**	**coefficient**	
0.0000609	***-0.0010702	0.000036	***-0.0001743	**p**
0.0361	***0.4045017	0.0450725	*** 0.3873823	**cockwell**
0.047	***0.2407826	0.0477137	*** 0.3082979	**cockmed**
0.066	***0.3465291	0.0425571	*** 0.3027793	**bearwell**
0.034	***0.2287397	0.0426952	***0.1789439	**bearmed**
0.049	***0.8272083	0.0482734	*** 0.9892697	**tigerwell**
0.037	***0.384452	0.0621523	***0.443937	**tigermed**
.0000127	***0.0000297	-	-	**Pedu**
1.41e-08	***3.87e-08	-	-	**Pinc**
0.0000224	***0.0001832	-	-	**Pars**
0.0000189	**0.0000709	-	-	**Pbaz**
LR chi2= 1109. 30 , Pseudo-R^2=.42		**LR chi2= 724.62 , Pseudo-R^2=.37**		

Table4: Results of WTP extracting and ranking of information and refugium features

Optimum condition of tiger	Relative Improvement of tiger	Optimum condition of bear	Relative Improvemntof bear	Optimum condition of blackcock	Relative Improvemntof blackcock	Attributes and their levels
772.947	359.233	323.798	213.73547	224.988	377.968	**Ind. monthly WTP(Rials)**
4310.805	9275.369	2564.826	3885.581	2699.861	4535.62	**Ind. annual WTP(Rials)**
347178.649	747008.886	206562.952	312932.446	217438.270	365284.492	**Total WTP(million Rials)**
547093.7678 **(18.236 million $)**		259747.6993 **(8.658 million $)**		291361.3816 (9.712 million $)		**Mean of two levels (million Rials)**
1		**3**		**2**		**Ranking of features**

Alternative C	Alternative B	Alternative A	attributes/ levels		
I do notwantanychange inthe current situationandI am not willing to payanyfeeforit.	Relative Improvement	Optimum		The Black Cock	**Question 1**
	Optimum	crisis		The Bear	
	Optimum	crisis		The Tiger	
	25000	5000		**WTP(Rials)**	
○	○	○	Please selectfrom 1 to3above,you willprefer **(1 is the best)**		

Figure 2: A sample of the selected cards to calculate the value of three animal species of Arasbaran Forests

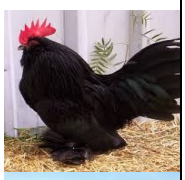
Optimum condition	Relative improvement	Critical situation	attributes/ levels
Development and conservation of reserves, trying to increasere productive, especially valuable animal species, creating reproduction centers for species that they are not capable of regeneration normally. Creating specialized centers for on going health study of animal species heaths.	Improve of certain circumstances, for changing the health of ecosystems and facilitate the lives of animals and preventing the destruction of the animals, creating a mobile veterinary clinics and periodicsurveysofhabitat.	**Present conditions (Status Que)** (the peril of valuable animal species and insufficient managements in order to protect them)	**(Protected Species)**   

Figure 1. The information and refugium functions and explanation of their levels for the Arasbaran forests