Estimation of Non-Market Value of Qeshm Hara Forest Using the Approach Selection Modeling

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Abstract

The Hara forest, also known as the mangrove protected area, with an area of 200 square kilometers, is located in the Khoran Strait, between Qeshm Island and Khamir Port in Hormozgan Province. These forests provide countless services to the community in terms of ecology, economy and tourism, and are very important from this perspective. The purpose of this article is to help policy makers and planners to manage the forest efficiently and sustainably. For this purpose, using selection modeling analysis, the value of qualitative benefits provided by this forest to the community was estimated. For this purpose, the logit model with simple random parameters and then the logit model with combined random parameters (with action sentences) were used to estimate the heterogeneity in community preferences for different forest characteristics. The results of this study show that people's preferences are significantly heterogeneous. Also, in this study, the tendency of final payment for non-market characteristics of mangrove forest including natural landscape, ecological yield and biodiversity was estimated. Finally, the numbers obtained for the willingness to make the final payment were generalized to the whole community, resulting in the annual value of the qualitative benefits along with their total value. These numbers for the annual and total value (capital) are equal to 321109 and 1.536.084 billion rials, respectively. The calculated existential value shows that the community is willing to pay to protect this forest and there is a potential to use the results of the present study as a baseline study to improve the level of public awareness and witness a very high level of public participation in conservation projects. It was from this forest. The obtained numbers can also be used for economic-environmental evaluation of projects in and around this forest.

Keyword: Existen Value, Choice Modeling, Hara Forest.

JEL Classification: Q50, Q51.

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1. Introduction

Qeshm Hara forests are of special importance as one of the most important biological centers for migratory waterfowl and marine fish in southern Iran. There are currently a variety of laws to protect natural habitats, all of which seek to prevent the destruction of these areas. According to the author's research, no comprehensive study on the economic valuation of hara forests is available, and studies have generally focused on the tourism aspect of these forests. Also, the value of non-market interests of these forests has been neglected in most previous experimental studies. The consequence of this will be a lack of sufficient information available to policymakers, which in turn can lead to the implementation of incorrect policies and inefficient management in the protection of these forests. The present study is also methodologically different from previous studies. From the perspective of the choice modeling method.

Figure 1: Spatial location of mangrove forest and research area

2. Purpose

In order to increase the accuracy of the results, two models were estimated separately for the data type; A model for indirect users (first group) and a model for extracting potential and non-existent or existential value (second group). Of course, in the stage of generalizing the results of the second model to the whole society, potential and non-existent (existential) values will be separated from each other. Using two models for these two groups will lead to more accurate and reliable results (Montazer Hojjat and Mansouri, 2020).

In order to improve the results, socio-economic characteristics of individuals including age, distance from the place of residence to the forest, education and

gender were used in the model. The introduction of socio-economic characteristics increases the accuracy of the selected models (McConnell and Tsang, 2000, 325; Rolf et al., 2000, 291; Kafashi et al., 2012, 155; Montazer Hojjat and Mansouri, 2020, 79).

3. Method

Choice modeling method has been used to extract the value of non-market benefits of hara forests. In this way, people's preferences are modeled. In modeling people's preferences, individual I desirability for the m (U_{im}) scenario is a function of forest characteristics (X_n), conservation cost C, and socioeconomic characteristics of S respondents (Newman and Swallow, 2012). Therefore, the individual utility function is defined as follows:

$$U_{im} = U(X_m, C_m, S_i) = V(X_m, C_m, S_i) + \varepsilon_{im} \quad (1)$$

Where X_n is the vector of n scenarios (N, Z and T); V(0) Is the non-random component of utility and εim is the random component that reflects the difference between the random utility U_{im} and the non-random component of V_{im}. Each respondent compares the three scenarios (N, Z, and T) presented and selects the scenario that maximizes utility.

The random parameter logit model (RPL), which is a generalization of the polynomial logit model, is used in this study. Therefore, the stochastic utility function (1) is modeled as follows:

$$U_{im} = \beta_x X_m + \beta_c C + \beta_s S_i \quad (2)$$

The coefficients of this model are estimated by the maximum likelihood method, and if U (0) Is linear, the coefficients X_β and c_β will show the final desirability of the X and money properties, respectively.

Final payout ratio (MWTP) is obtained by dividing the coefficient of each feature by the price coefficient as follows:

$$MWTP = \beta_x / \beta_c \quad (3)$$

4. Findings

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Table 1 shows the results of estimating the RPL model in two simple modes with action statements for direct and indirect users.

Table 1. Results of estimating a simple and actionable RPL model

Non-user (second group)		users (first group)		Forest Characteristics
Action Model	Simple Model	Action Model	Simple Model	
-0.00000534***	-0.0000682**	-0.00001*	-0.000021	**PRICE**
0.615***	0.213	0.111**	0.212	**A3**
0.668*	-0.221	0.413**	0.742	**B3**
0.792**	0.489*	0.521**	0.618*	**C3**
0.497**	-	0.231	-	**B3GEN**
0.043**	-	0.721**	-	**A3EDU**
-0.001*	-	-0.602**	-	**B3DIS**
-708.79	-744.157	-602.48	-731.024	**Log-likelihood**
65.00***	27.27***	20.49**	60.57***	**Likelihood ratio**

Based on the results of Table (1), the tendency for final payment was derived from dividing the coefficients of forest characteristics by the cost coefficient in the model with action variables. The results are reported in Table (2).

Table 2. Willingness to make the final payment (Rials per month)

Non-user (second group)	Indirect users (first group)	Characteristics
115168	11100	**A3**
125093	41300	**B3**
148314	52100	**C3**

Demonstrates a willingness to pay the final exchange between money and forest property assuming other conditions are stable. In other words, it shows the final rate of substitution between forest characteristics and the cost variable.

The population with unused forest services was divided into two groups living in Hormozgan province and outside the province. The population of each category along with the relevant calculations is presented in Table (3).

Table 3. Annual unused value of forest (Rials)

Outside the province	**Inside the province**	
84	10	**Percentage of people who do not intend to see the forest**
65.645.878	62.850	**Number of people who do not want to see the forest**
306100	293	**Value of unused services in each category (billion Rials)**
306.393		**Annual Rial value of total unused services in terms of billion Rials (existential value)**
2.785		**Annual dollar value of total unused services in billion dollars**

The annual value and total capital of the mangrove forest are presented in Table (4) from the sum of the numbers obtained for indirect and potential use services along with non-utilization services and the results.

Table 4. Value of total capital and annual value of benefits of Qeshm Hara forest (numbers in billion)

Money		Yearly		Services
USD value	**Rial value**	**USD value**	**Rial value**	
0.444	48902	0.109	12079	Benefits of indirect use
2.242	246724	0.554	60941	Potential benefits
11.27	1240458	2.875	306393	Unused benefits
13.956	1.536.084	2.919	321109	Total for the whole
0.001	167	0.0003	34	Value per hectare

Considering that not all non-market benefits of mangrove forest are included in the calculation of GDP of Hormozgan province, in order to calculate the share of these benefits in GDP, first their annual value was added to the province's GDP and then

the share of these benefits was calculated. The final number was calculated as follows: **1536084÷123432662=0.00231**

5. Conclusions and policy recommendations

Based on the results of this study, the economic value of the qualitative benefits of mangrove forest was estimated at 1,536.084 billion Rials. The numbers obtained from this study can be used as a basis for analyzing the cost-benefit of projects before implementation in the area of these forests, as well as for obtaining rents or fines from projects that have already been implemented in the area of this forest.

The share of hara forest in the province's GDP (0.00231) shows that despite the lack of budget for the protection of this forest, it plays a significant role in the province's economy. Naturally, by calculating the value of the market interests of this forest, which are considered in the province's GDP, its share in the province's production will increase, and as a result, the importance of this forest will be more clear to policymakers and can be a starting point for allocating conservation budgets.

References

Birol, E.; Karousakis, K. & Koundouri, P., (2006). "Using choice experiment to account for reference heterogeneity in wetland attributes: the case of Cheimaditita wetland in Greece". *Ecological Economics*, No. 60, Pp: 145–156 .

Cui, L. J.; Pang, B.L.; Li, W.; Ma, M. Y.; Sun, B. D. & Zhang, Y. Q., (2016). *Ecosystem services value in zhalong wetland Acta Ecol*. No. 36, Pp:1–10.

Dehghani, M.; Farshchi, P.; Danehkar, A. & Karami, M. (1389). "Valuation of Mancro Forest Resorts in the Mangrove Protected Area by Travel Cost". *Journal of Wood and Forest Science and Technology Research*, No. 17 (1), Pp: 33-48. (In Persian)

Ismaili, A. & Peron, S. (1389). "Estimation of market value of mangrove forest in Qeshm protected area". *Agricultural Economics (Economics and Agriculture)*, No. 4 (2), Pp. 131-147, (In Persian).

Ismaili, A. & Peron, S. (1389). "Estimation of non-market value of mangrove forest in Hormozgan province". *Agricultural Economics (Economics and Agriculture)*, No. 24 (12) pp. 168-162, (In Persian).

Jenkins, A. W.; Murray, B. C.; Kramer, R. A. & Faulkner, S. P., (2010). "Valuing ecosystem services from wetlands restoration in the Mississippi Alluvial Valley". *Ecological Economics*, No. 69, Pp: 1051–1061.

Kaffashi, K.; Shamsudin, M.; Radam, A.; Yacob, M.; Rahim, K. & Yazid, M., (2012). "Economic valuation and conservation: Do people vote for better preservation of Shadegan International Wetland?". *Biological Conservation*, No. 150, Pp: 150-158.

Koohgardi, I. (2011). "*An Overview of Mangrove Forests in Iran, Regional Conference on Forests and Environment Ensuring Sustainable Development*. Bushehr Islamic Azad University, Bushehr Branch, https://www.civilica.com/Paper-RCFESSD01, (In Persian).

Lancaster, A., (1966). "New approach to consumer theory". *Journal of Political Economy*, No. 74, Pp: 132–157.

Mashayekhi, Z.; Sharzei, G.; Danehkar, A. & Majid, V. (1397). "Application of selection test method in estimating the economic value of Qeshm mangrove forests". *Environmental Sciences*, No. 16(1), Pp: 69-88, (In Persian).

McConnell, K. & Tseng, W., (2000). "Some preliminary evidence on sampling of alternatives with the random parameter's logit". *Marine Resource Economics*, No. 14(4), Pp: 317–332.

McFadden, D., (1974). *Conditional logit analysis of qualitative choice behavior.* In: Zarembka, P. (Ed.), Frontiers in Econometrics, New York, Academic Press.

Mitchell, R. C. & Carson, R. T., (1989). *Using surveys to value public goods: the contingent valuation method.* Resource for the Future, Washington, DC.

Montazer-Hojat A. H. & Mansouri, B., (2020). "Valuing of the Benefits of Endangered Miangaran Wetland". *International Journal of Ecological Economics and Statitstics*, No. 41(2), Pp: 71-84.

Montazerhojat, A. & Mansouri, B. (1393). "Evaluation of services used in Shadegan wetland". *Quantitative Economics Quarterly*, No. 11(5), Pp. 18-32, (In Persian).

Montazerhojat, A. & Mansouri, B. (2015). "Economic Valuation of Environmental Benefits: A Case Study of Bamadj Wetland". *Iranian Journal of Applied Economic Studies*, No. 5(181), Pp. 1-27, (In Persian).

Newell Laurie, W. & Swallow Stephen, K., (2013). "Real-payment choice experiments: Valuing forested wetlands and spatial attributes within a landscape context". *Ecological Economics*, No. 92, Pp: 37-47.

Pouran, R.; Raghfar, H.; Qasemi, A. & Bazazan, F. (1396). "Calculation of economic value of virtual water with the approach of maximizing irrigation water efficiency". *Iranian Journal of Applied Economic Studies*, No. 6(21), Pp: 189-212, (In Persian).

Ramsar Convention Bureau (1971). *Appendix 7, Ramsar Wetland Definition, Classification and Criteria for Internationally Important Wetlands.* Ramsar Bareo, Iran .

Setlhogile, T.; Arntzen, J.; Mabiza, C. & Mano, R., (2011). "Economic valuation of selected direct and indirect use values of the Makgadikgadi wetland system, Botswana". *Physics and Chemistry of the Earth,* No. 36, Pp: 1071-1077.

Thomas, J. M. & Callan, S. J., (2007). *Environmental Economics: Applications: Policy and Theory*. Canada, Thomson.

Turner, R. K.; Pearce D. W. & Bateman, I., (1993). *Environmetal economics: An elementary introduction.* Baltimore, Maryland The John Hopkins University Press.

Westerberg, V. H.; Lifran, R. & Olsen S. B., (2010). "To restore or not? A valuation of social and ecological functions of the Marais des Baux wetland in Southern France". *Ecological Economics*, No. 69, Pp: 2383-2393.

Zulkarnaini, Y. & Mariana, M. (2016). "Economic Valuation of Mangrove Forest Ecosystem in Indragiri Estuary". *International Journal of Oceans and Oceanography*, No. 10(1), Pp: 13-17, (In Persian).