ESTIMATION THE PREFERENCE OF ECOTOURISM FOR GAOMEI WETLAND IN TAIWAN

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Abstract

Gaomei Wetland is not only the biggest grassy coastal wetland, but also a wild-animal protecting area, located on the west-central coast of Taiwan.Wetlands are considered as one of the most important natural resource, which offer a lot of benefits for human and other creatures. However, it is believed that over-intensive recreational activities in Gaomei Wetland should be responsible for serious damages on natural environment and ecosystem.

This study takes Gaomei wetland as an example, and aims to estimate its landscape and ecological services values through Choice experiment. The results of this research showed that Gaomei landscape's economic value is $2.06 million (USD) per year, and $1.54 million (USD) for its value of ecological services. These findings can help to bring up the awareness of natural resource preservation, and hopefully to keep Gaomei Wetland substantial. The results also indicated that visitors with undergraduate degree or above were willing to pay $6.43 (USD) per year for entry fee to enjoy sunset scenery in Gaomei wetland.

Key words: w*etland, choice experiment, WTP*

JEL Classification: I38, Q57

I. INTRODUCTION

Wetland problem

Coastal wetlands play important roles not only in providing habitat and refuges for animals, but also possessing the functions of filtering and depositing pollutant, producing nutrients and oxygen, regulating climate and sequestrating carbon dioxide additionally in respect of environment. As carbon dioxide emissions particularly has become an international common issue. Nellemann et al. (2009) further explained coastal wetlands' role in carbon sink and suggested that coastal wetlands have the capacity of carbon dioxide adsorption. Similarly, Laffoley and Grimsditch (2009) recognized coastal wetland endows with the capacity of carbon dioxide adsorption. Therefore, as all countries are facing high-cost and high environmental risk with carbon dioxide emissions problem, coastal wetlands can be a solution. Recent studies had shown that the tropical and subtropical coastal wetlands have the capacity of natural carbon sinks for absorbing and conserving carbon dioxide (Lin, 2011). These researched again proof the importance of coastal wetlands in natural resource.

Gaomei wetland

The wetland ecosystem in Taiwan is about 12,000 hectares, in which the coastal wetlands take 11,450 hectares. Gaomei wetland locates in the west-central coast of Taiwan, which is also a national wildlife protected area. Gaomei wetland is not only the largest grassy coastal wetlands in Taiwan, but also an important stop for East Asian migratory bird during migration. In addition, it is also well known for its sunset scenery, thus more and more tourists visit Gaomei wetland for its plentiful resource of biodiversity and landscape.

Therefore, Gaomei wetland has become a unique tourism spot in central Taiwan, featured with its rich ecological conservation and the tourism resources. However, without proper management, Gaomei wetland is experiencing severe damage due to intensive recreational activities. This research assesses Gomei's recreational value, and trying to bring up attentions of environmental protection in Gaomei area. The recreational value is evaluated according to important characteristics of the Gaomei wetland. Also, demographic factors that influence estimation are considered.

Generally speaking,wetland is treated as non-market goods, which cannot be evaluated through market prices, thus we normally assess its value by non-market valuation method (e.g. Travel Cost Method and Contingent Valuation Method). Precious studies mainly focused on the overall value of wetland evaluation, but

seldom concerned the various characteristics and attributes of each wetland and neither assess their own values (Liu and Wirtz, 2010; Westerberg et al., 2010). Taking Gaomei wetland as an example, Gaomei wetland is poor in public facility, and not well managed in capacity and ecological protection. Using TCM or CVM to estimate Gaomei wetland's value can only measure current status of Gaomei wetland, but the potential characteristics of Gaomei wetland such as sunset scenery, experience guided tour, and public facility. Therefore, this study used Choice Experiment to obtain Gaomei wetland's values for specific characteristics and group of visitors. In order to let the government sector to be able to well allocate resource in the future, we assessed the tourists' preferences and their willingness to pay (WTP) for Gaomei wetland. With the results of this research, not only can effectively protect environment, but also appropriately enhance a better quality of recreation for tourists. In addition, this research also try to distinguish WTPs for tourists with different demographic characteristics to have a better understanding on visitors' sides, and thus help to improve Gaomei's current status.

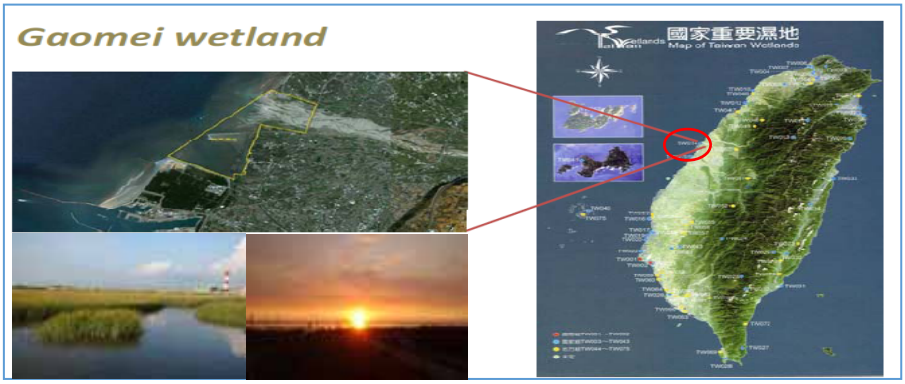

Figure 1 –Gaomei wetland site in Taiwan

II. CHOICE EXPERIMENT METHOD

Taking Gaomei wetland as an example, this study used Choice Experiment, where each choice set included alternatives that combined multi-attributes and levels according to the significant characteristic of Gaomei wetland. The subjects then were asked to choose one alternative from the choice set provided. By doing so, the probability of certain preferred alternatives can be acquired. In order to measure preferences towards attributes and levels, the measuring scale need to be well defined. Choice Experiment is preferred for not only let the respondents just consider the most favorite alternatives, but also more efficient in collecting preference data than Rating and Ranking. Furthermore, Choice Experiment is often used to predict consumers' preferences prior the final design of new commodity available to the public.

There are two ways to design Choice Experiment: Two-Factor at-a-Time Procedure and the Full-Profile Approach. Although Two-Factor at-a-Time Procedure is easy for application and convenient for respondents to answer, it may need too many times of assessment and thus reduce authenticity. So Full-Profile Approach is favored. However, presenting all alternations in one survey may exhaust the respondents. Therefore, Orthogonal Arrays is applied to reduce the number of alternatives.

Experimental Design

The study selected six attributes as activities design, and each contains three levels. Using orthogonal design, there were only 22 kinds of product portfolio provided for tourists to choose. The questionnaire can be divided into three parts: (1) to understand the wetland perception of tourists; (2) to provide combinations of attributes and levels (alternatives) for subjects to choose; (3) to collect demographic data of tourists. In the second part of survey, five essential attributes and related levels were selected in respect of conservation, landscape, facility and recreational demand. According to the related references, characteristics, and current issue of Gaomei wetland, the attributes and levels are listed as following:

(1) the gazebo of sunset (Yes/No): the sunset and the landscape of Gaomei are precious nature resource that is found to be attractive to tourists. Thus, this research used the gazebo of sunset to present the preference on Gaomei wetland's landscape.

(2) experience guided tour of wetland (Yes/No): according to the previous researches, interpretive services plays an important role in ecotourism development. The interpretive services not only indirectly protect the environmental conservation, but also enhance the recreational quality.

(3) public facility (wetland footway, parking facility, information center, none of above is preferred): Gaomei wetland is not being operate appropriately, especially the absence of public facilities. In order to take care of environmental protection and to improve recreational quality at the same time, three essential public facilities were selected. The first one is to set up the wetland footway, which is expected to create the distance between tourists and wetland (to avoid direct tread on the wetland). The second is to set up parking facility,

which can improve the traffic in the surrounding area, and reduce the abuse of farmland. The third is to build an information center, which can educate the tourists the concept of ecology conservation.

(4) restoration funds (agree/disagree): the restoration may be allocated from partial entry fee. Not only preserve environment, but also deliver the important message of ecology restoration to the tourists.

(5) entry fee ($3.3, $5, $6.7): these entry fee were based on prices of other ecological parks in Taiwan. The fee was designed to compensate the service or facilities provided, such as interpretive service and parking.

The five attributes described above are listed in Table1:

Table 1. Attributes and levels

Attribute	Level
Sunset Gazebo	(1) Yes; (2)No
Experience Guided Tour of Wetland (providing the interpretive services)	(1) Yes; (2)No
Public Facility	(1) Wetland Footway; (2) Parking Facility; (3) Information Center; (4) None of above is preferred
Restoration Funds (allocate the part of entry fee)	(1) Agree; (2) Disagree
Entry Fee (as the fee of guided service and parking)	(1) $3.3; (2) $5; (3) $6.7

Unit: USD

According to Table1, there are 96 combinations of attributes and levels can be found, which can be difficult for a subject to choose from, and thus creates bias to the research. Therefore, this study reduced the number of combinations by orthogonal arrays, and randomly assigned them into 5 choice sets. Each choice set has 3 alternatives (The example is shown in Table 2). A subject is then required to choose the most preferred alternative out of three.

Table 2. An example of a choice set

~~Alternatives~~ Attributes	*Alternative A* ☐	*Alternative B* ☐	*Alternative C* ☐
Sunset Gazebo	Yes	Yes	No
Experience Guided Tour of Wetland	Yes	No	No
Public Facility	Information Center	none is preferred	Footway
Restoration Funds	Disagree	Disagree	Agree
Entry Fee	$ 6.7	$ 3.3	$ 5

To sum up, with Choice Experiment, we can understand respondents' preferences among provided attributes and levels. Thus this research use Choice Experiment to design the questionnaire to evaluate economic value of recreation in Gaomei wetland. The survey contains five choice sets, where the Gaomei tourists were required to choose the most preferred alternative from each set. Furthermore, each alternative were picked from all the combinations of important attributes and levels based on Gaomei's characteristics and potentials.

Model Application

To be more precisely, Choice Experiment is based on random utility theory (McFadden 1973; Hanemann 1984), and McFadden (1975) added the concept of error term in random utility, where denotes the respondents would choice the alternative to maximum their utilities, which is:

$$U_{ij} = V_i(Z_j) + \varepsilon_{ij} = V_{ij} + \varepsilon_{ij} \quad (1)$$

Let U_{ij} be the utility of the *j*th alternative for the *i*th individual. Further assume each utility value can be divided into observed variables (V_i) and uno bserved variables (ε_{ij}). Z_j defines a *j*th alternative vector and ε_{ij} is a random component.

With different assumptions of the error term in the probability function, the probability of a specific choice then can be derived. When the error term is multivariate normal distribution, the Multinomial Probit model (MNP) then can be derived. Similarly, when the error term is IID (independently and identically distributed), and Gumbel distributed, the Multinomial Logit model (MNL) then can be derived (Ben-Akiva and Lerman 1985). So, within the same choice set (C), the probability of individual *i* choosing alternative *j* over m can be presented as following:

$$P_{ij} = \frac{e^{\beta X_{ij}}}{\sum_{q=1}^{Q} e^{\beta X_{iq}}} \quad , \quad q \in C_i \tag{2}$$

In equation (2), the probability of a respondent *i* choosing *j* over m need to satisfy IIA (Independence from Irrelevant Alternatives). That is, the probability of a certain alternative is chosen is only related with the utility of that certain alternative, in other words it is independent from other alternatives. Generally speaking, MNL is usually estimated with Maximum Likelihood Estimation (MLE) to maximize the joint probability. The likelihood function is defined as:

$$LL(\beta) = \sum_{i=1}^{I} \sum_{j} y_{ij} \ln(P_{ij}) \tag{3}$$

Where P_{ij} is the probability of alternatives *j*, and y_{ij} equals to one if the alternatives *j* is chosen by individual *i*.

Further, in order to calculate WTP, the attribute for the respondents and the function is derived as:

$$WTP_r = dP_j / dX_{jr} = -\beta_r / \delta \tag{4}$$

When demographic characteristics are taking into consideration, equation (2) can be rewrite as following:

$$U_{ij} = \sum_{r=1}^{R} \beta_r X_{jr} + \delta P_j + \sum_{r=1}^{R} \sum_{d=1}^{D} \tau_{rd} X_{jr} S_{id} + \sum_{d=1}^{D} \tau_{pd} P_j S_{id} + \varepsilon_{ij} \tag{5}$$

Where S_{id}represented individual *i* with *d*th characteristic, and $\tau_{rd}$and τ_{pd} are coefficients for interaction terms. The WTP for *r*th attribute from an individual *i* with *d*th demographic characteristic then can also be derived.

III. RESULTS

This survey was commenced in July 2011, and focused on visitors in Gaomei wetland. 507 questionnaires were handed out to randomly select tourists in Gaomei wetland, and 496 questionnaires were returned, which indicated a 97% of response rate. The respondents were 44.8% female, and half of them were between 21 to 30 years old. Moreover, 68.8% of the respondents were undergraduate or above, and about half of samples' yearly income were 6,700 (USD) or more. In addition, 61.9% of tourists were the first time visitors of Gaomei wetland. The survey results showed that Gaomei visitors were younger than average population in Taiwan, and a lot visitors had their first visit to Gaomei wetland due to its abundant ecology and attractive natural scenery.

Wetland perception can be roughly divided into three categories: the wetland landform, wetland capability, and cause of environment damage for Gaomei wetland. The landform of a tide beach, swamp and grassy marsh were mostly considered as wetlands by respondents. Similarly, the aspects of ecology and recreation mainly depended as wetland capability, including biodiversity, natural scenery, ecology education, and recreation. But the carbon sequestration and groundwater recharge were seldom unknown by the majority of respondents. Moreover, most participants believed that over capacity and industrial pollution were the two main reasons, which cause serious environment damages in Gaomei wetland. There were 76.4% of respondents thought capacity management is a direct way to help protect Gaomei wetland. These results showed that most of tourists did not have enough knowledge about wetland.

Wetland model

Preferences for Gaomei Wetland were estimated through random utility function. Equation (1) indicates the individual *i* choice *j*th alternative from various alternatives. The individual *i's* utility of visiting Gaomei Wetland can be defined as

$$U_{ij} = \beta_1 X1_{ij} + \beta_2 X2_{ij} + \beta_3 X3_{ij} + \beta_4 X4_{ij} + \beta_5 X5_{ij} + \beta_6 X6_{ij} + \delta P_{ij} + \varepsilon_{ij} \tag{6}$$

Where the total sample size are 496 (*i*=1,……,496), the number of alternatives are 15 (*j*=1,…….15).
Further, when the error term is IID, and Gumbel distributed, the MNL then can be derived. The probability of alternatives *j* is chosen by individual *i* can be defined as following:

$$P_{ij} = \sum_{C=1}^{5} \frac{e^{\beta X_{ij}}}{\sum_{m=1}^{3} e^{\beta X_{im}}} \quad , \quad m \in C_i \tag{7}$$

Attributes estimation

The aim of this study is to understand visitors' preferences of Gaomei wetland, as well as socio-economic characteristics' influences on preferences. Table 3 shows MNL assessment from 496 samples. With respect to

individual attribute and level, all attributes were found to be significant at 99% confidence level. All coefficients but ENTRY FEE are positive, which means providing these services will enhance the utility of individuals. The coefficient of sunset gazebo is the largest among all attributes, which implies having sunset gazebo can increase number of tourists to Gaomei wetland in the most efficient way. Similarly, the coefficient of entry fee has negative sign, which indicated that as entry fee increased, the fewer visitors are willing to visit Gaomei wetland. In addition, the footway attribute is the most preferred in particular for public facility. Compared with information center and parking facility, footway received more desire in Gaomei wetland.

With respect to effects of socio-economic characteristics, this study considers age, education, and income as basis to assess the preference of Gaomei's characteristics and potentials. The coefficients of ENTRY FEE interacting AGE, EDU, and INC are all significant. Above coefficients are all positive but ENTRY FEE *AGE. Moreover, the sunset gazebo attribute has significant for EDU (-0.3561), and the coefficient is negative which implied having sunset gazebo is more important for higher education.

Table 3. Assessment results by MNL

Variable	Coefficient	P[|Z|>z]	Variable	Coefficient	P[|Z|>z]
ENTRY FEE	-0.0074	0.0000***	FOOTWAY*AGE	-0.0425	0.6071
SUN	1.2056	0.0000***	FOOTWAY* EDU	0.0690	0.6701
GUIDE	0.7192	0.0000***	FOOTWAY* INC	-0.0849	0.6854
PARKING	0.6507	0.0002***	CENTER* AGE	-0.0393	0.6113
FOOTWAY	0.8431	0.0000***	CENTER* EDU	-0.1835	0.2324
INFORMATION CENTER	0.6846	0.0001***	CENTER* INC	0.1120	0.5698
RESTOR	0.7823	0.0000***	RESTOR* AGE	-0.0373	0.4760
SUN*AGE	0.0140	0.8542	RESTOR* EDU	-0.0965	0.3558
SUN*EDU	-0.3561	0.0224**	RESTOR* INC	-0.0547	0.6751
SUN*INC	-0.1418	0.4398	ENTRY FEE* AGE	-0.0014	0.0549*
GUIDE* AGE	0.0673	0.2620	ENTRY FEE * EDU	0.0043	0.0035***
GUIDE* EDU	-0.1334	0.2618	ENTRY FEE * INC	0.0033	0.0684*
GUIDE* INC	-0.0444	0.7638			
PARKING* AGE	0.0651	0.4177			
PARKING* EDU	0.1422	0.3673			
PARKING* INC	-0.0467	0.8177			
LR			-2366.6060		
N			496		

Note: ***significant at the 1% level.
** significant at the 5% level.
* significant at the 10% level.

WTP assessment

Table 4 shows the WTP for attributes of Gaomei wetland. The visitors are willing to pay $8.77 (USD) per person to have sunset gazebo provided in the Gaomei wetland area. Also, the participants are likely to pay $6.58 (USD) to experience guided wetland tour,. For public facility, visitors are willing to pay $6.27, 7.14, and 6.42 (USD) to use parking facility, footway, and information center, respectively. Finally, the price premium for agreeing establishing wetland restoration funds is $6.86 (USD) per person. For socio-economic characteristics, visitors with undergraduate degree or above are willing to pay $6.43 (USD) for entry fee to enjoy sunset scenery in Gaomei wetland.

These findings implies that the sunset gazebo is the most preferred, compared to other attributes in Gaomei wetland, on the other hand parking facility is the least preferred. For preferences on public facility in Gaomei wetland, this research has discovered that footway is the most favored. Furthermore, the recreational value is calculated with respect to landscape value and ecology value. With average number of annual tourists in Gaomei wetland, the annual landscape recreational value and ecology recreation value for Gaomei can be obtained. These two values are approximately $2.06 million (USD) and $1.54 million (USD), respectively. In this case, Gaomei visitors are likely discovered with more interests in Gaomei landscape than its ecological services.

Table 4. WTP for attributes and levels

Attributes	Average WTP
Sunset Gazebo	$ 8.77
Experience Guided Tour of Wetland	$ 6.58
Public Facility	
Parking Facility	$ 6.27
Footway	$ 7.14
Information Center	$ 6.42
Restoration Funds for Wetland	$ 6.86
Total landscape recreation value	$ 2.06 million
Total ecology recreation value	$ 1.54 million

unit: USD

IV. CONCLUSION

This study assesses Gaomei wetland's values for specific characteristics and group of visitors with application of Conjoint Analysis and Choice Experiment. The findings of this study are summarized as following:

The on-site survey in Gaomei wetland shows that Gaomei visitors are relatively young. In this survey sample, most of the respondents were visiting Gaomei wetland for the first time. The findings reveal that the majority of visitors are attracted by the characteristics of landscape and ecology in Gaomei wetland. Moreover, most visitors are found to have only limited knowledge of wetland and its capability. Furthermore, most of visitors consider over-intensive recreational activities are the main reasons, which result in serious damages around Gaomei wetland area. Therefore, limitations on capacity are believed to be able to reduce the damages around Gaomei wetland area. Thus, it can be concluded that lack of wetland knowledge and proper regulation could indirectly lead to serious crisis of in Gaomei's ecological environment, especially while the number of visitors are increased dramatically.

With respect to the preference for wetland attributes, the tourists' WTP for entry fee are as following: Sunset Gazebo ($8.77), Experience Guided Tour ($6.58), Parking Facility ($6.27), Footway ($7.14), Information Center ($6.42), and Restoration ($6.86). Overall, the sunset gazebo is preferred by the most visitors, and the visitors thought parking facility is the least important to them. Among public facilities, footway has received the highest WTP premium from the subjects. This study further indicates the WTP of visitors with undergraduate degree or above was $6.43 (USD) for entry fee to enjoy sunset scenery in Gaomei wetland.

As recreational values for Gaomei wetland, the landscape value ($2.06 million) is higher than ecological value ($1.54 million). Consequently, the findings of this study can identify the tourists' recreational preferences for Gaomei wetland and their demographic segments, and thus further provide government suggestions on resource allocation and management in the future. The results indicated that the tourists preferred sequentially by cultural activities, industrial activities and experience culture. Coastal wetlands are not only for recreational purpose, but also gradually transform into one of the best environmental education field. Gaomei wetland provides rich resources and habitat, thus becomes one of the best sites for various migratory birds. In Taiwan, due to the implementation of two-day weekend policy in 2001 and the transformation of people's life style, the demand for outdoor recreation has increased, thus visiting coastal wetlands have become a recreational alternatives in recent years. Gaomei wetland will not be the only for recreational purpose, but also gradually transform into one of the best environmental education field.

V. REFERENCES

1. Ben-Akiva, M. and Lerman, S. R. (1985), Discrete Choice Analysis: Theory and Application to Travel Demand, Cambridge: The MIT Press.
2. Hanemann, W. M. (1984), Welfare Evaluations in Contingent Valuation Experiments with Discrete Responses, American Journal of Agricultural Economics, 66, pp.332-341.
3. Laffoley, D. and Grimsditch, G. (2009), The Management of Natural Coastal Carbon Sinks, IUCN: Gland, Switzerland.
4. Lin, H. J. (2011), The Ecology Services for Carbon Sink in Coastal Wetland of Taiwan, Taiwan Academy of Ecology, 30, pp.38-45.
5. Liu, X. and Wirtz, K. W. (2010), Managing Coastal Area Resources by Stated Choice Experiments, Estuarine, Coastal and Shelf Science, 86, pp.512-517.
6. McFadden, D. (1975), The Revealed References of Government Bureaucracy: Theory, The Bell Journal of Economics, 6, pp.410-416.
7. McFadden, D. (1973), Conditional Logit Analysis of Qualitative Choice Behavior, In P. Zarembka (Ed.), Frontiers in economics, New York: Academic Press.
8. Nellemann, C., E. Corcoran, C. M. Duarte, L.Valdes, C. De Young, L.Fonseca, G. and Grimsdilch, 2009. Blue Carbon-a Rapid Response Assessment, United Nations Environment Programme, GRID: Arendal.
9. Westerberg, V. H., R. Lifran and 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, 69, pp.2383-2393.