E C O N O M I C S   B U L L E T I N

Providing quality recreation experiences in Japan

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Abstract

This paper uses a choice experiment to evaluate the benefits to trekkers of the natural environment and the provision of appropriate recreation experiences in the Uryu-numa Mire, northern Japan. The result, applying a conditional logit model, shows that restoration of the natural environment are positively valued by trekkers, and their respective willingness to pay for one percentage point improvement are JPY 32.6 and 59.6. Likewise, provision of appropriate recreation experiences, setting a limit on the number of trekkers a day, is also positively valued. The results indicate that the optimal number of trekkers is 458, and the willingness to pay for controlling the number of trekkers from 800 to 458 is JPY 1,457. In Japan, importance of the quality of recreation experiences is not well recognized by park managers. However, our results indicate that both restoring the environment and providing excellent recreation experiences are significant challenges for recreation areas.

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1. Introduction

The biggest challenge natural parks[1] in Japan face is overuse. Overuse has two problems: first, excessive visitor numbers have an impact on the natural environment; and second, high visitor numbers lead to crowding and reduce utility per visit (Hanley *et al.* 2003). For example, the Daisetsuzan National Park, the largest terrestrial national park in Japan, contains one of a handful of vast unspoiled natural areas. Its popularity as a trekking destination has resulted in increasing areas of camping sites with bare grounds, as well as trampling damage to trails (Aikoh *et al.* 1992; Park and Asakawa 1993; Aikoh *et al.* 1995; Kobayashi 1995). Furthermore, especially in wilderness areas of this park, visitor numbers not only have an excessive impact on the natural environment, but also seriously degrade the wilderness experience (Yamaki *et al.* 2000; 2003).

This paper addresses valuation of the benefits to trekkers of restoring the natural environment and providing appropriate recreation experiences using a choice experiment. The central problem of this paper is to value the latter benefits. In Japan, benefits from recreation experiences have been receiving increasing attention. For example, according to a survey by the Ministry of the Environment, 99% of respondents said that some kind of visitor controls should be introduced in those national parks seen as overused.[2] Originally, in Japan, the concept of quality of recreation experiences was not well recognized; thus, hardly any measures were taken to improve the situation. In other words, we can go to Japanese natural parks, wherever, whenever and as often as we want. In contrast, in North America, the economic costs of congestion or crowding on recreation areas have long been recognized, as shown by the large number of papers evaluating things such as visitors' willingness to pay to avoid encounters (Cicchetti and Smith 1973; 1976; Deyak and Smith 1978; McConnell 1977).

These days, in Japan, the general public is well acquainted with well-designed park management in foreign countries (*e.g.* user fees and quota system), as many Japanese have visited national parks all around the world and have come to understand the need for measures to preserve and enhance recreation experiences. However, very few attempts have been made to study recreation experiences in Japan (Ito 2003). Quantitative valuation has rarely been undertaken to date. Therefore, we explore the benefits to visitors of provision of appropriate recreation experiences, and discuss whether providing appropriate recreation opportunities can be tackled by park management in Japan.

2. Study Area

Our study area, Uryu-numa Mire, is located in the Shokanbetsu-Teuri-Yagishiri Quasi-National Park, Hokkaido, northern Japan (Figure 1), and the largest Moliniopsis-Sphagnum poor fen in the mountainous regions of Hokkaido. The main recreation resources in this area are various swamp and alpine communities and fascinating fen scenery from boardwalks. The annual number of trekkers visiting the mire is about 20,000 (Tachibana *et al.*

[1] There are three categories of natural parks in Japan: national parks, quasi-national parks, and provincial natural parks.

[2] A questionnaire survey by the Ministry of the Environment is available from: http://www.env.go.jp/nature/park_an/index.html (Japanese).

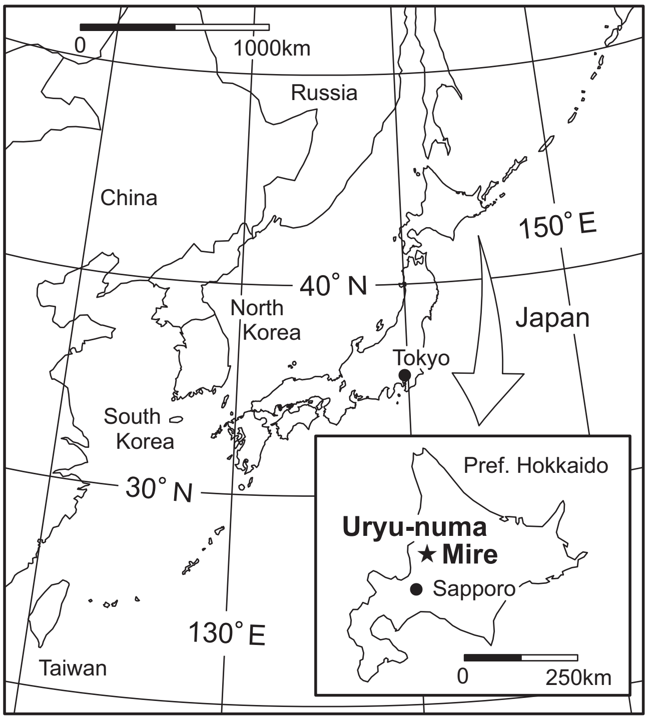

Figure 1: The location of Uryu-numa Mire, northern Japan

2001). Compared with other recreation areas, the annual number of trekkers is not high, but the only places accessible to trekkers are bounded boardwalks on the mire; therefore, it readily becomes congested, with overuse creating three main problems.

The first problem is the degradation of fen scenery. Uryu-numa Mire has passed its peak formation period; aridification and incidental invasion by substitutional vegetation, mainly dwarf bamboo (*Sasa kurilensis*), have begun. This will change the current fen scenery in the long term. Installation of boardwalks on the mire and trampling by trekkers is likely to accelerate the aridification and invasion by dwarf bamboo. Second is degradation of swamp and alpine vegetation. Human trampling destroys vegetation, especially alongside the boardwalks. Given that the sedimentation rate of the mire is 0.3 mm/year, peat deposits created over 600 years have already been degraded at the most vulnerable spots (Tachibana *et al.* 2001). The third problem is visitor dissatisfaction with their experience on the boardwalks. On Saturdays, Sundays, and public holidays, enormous numbers of trekkers concentrate on this recreation area, especially during the middle weekend of July, when 800-1,000 trekkers come to the area; this is almost 10 times the number of weekday trekkers (Kuriyama and Shoji 2005). This congestion means trekkers cannot stop to look at flowers and it is hard for them to find a space to have lunch.

3. Method

3.1 Choice Experiment

CE, initially developed by Louviere and Hensher (1982) and Louviere and Woodworth (1983), belongs to the stated preference approach (Louviere *et al.* 2000). The contingent valuation method, which is another stated preference approach method, can be used only where a single attribute changes; however, CE can estimate multiattribute changes simultaneously. CE has its origin in conjoint analysis, which is a set of techniques for measuring consumers' tradeoffs among multiattribute products and services (Green and Srinivasan 1978; 1990), and has been employed in marketing, transportation, and other fields (for details see Louviere 1994; Hensher 1994). CE differs from typical conjoint analysis in that individuals are asked to choose from choice sets (alternative bundles described as attributes) instead of ranking or rating. Once one understands how changes in the attributes affect satisfaction levels, CE analysis can be used to predict how possible alternatives will influence satisfaction (Louviere and Timmermans 1990).

Since the late 1990s, the method had been frequently used in environmental valuation (Mackenzie 1993; Adamowicz *et al.* 1998; Hanley *et al.* 1998; Schroeder and Louviere 1999; Hanley *et al.* 2002). In particular, CE was often used in environmental economics to study outdoor recreation, because CE shares a common theoretical framework with other environmental valuation approaches, such as the travel cost and contingent valuation methods using discrete choice data. For example, Adamowicz *et al.* (1994) attempted to combine revealed preference and stated preference data and suggested that the stated preference method provided similar choice behaviors illustrated by the revealed preference method, if error variance was properly scaled. Boxall *et al.* (1996) compared contingent valuation and choice experiment empirically and suggested that choice experiment can be a more appropriate method than contingent valuation. Many previous studies included not only the attributes related to the natural environment and facilities but also congestion, clearly showing, in contrast to Japanese work, that providing appropriate recreation opportunities is considered to be one of the key elements of recreation management.

3.2 Questionnaire Design

The initial steps of a CE analysis are to identify choice alternatives and their relevant attributes. This study adopted the above-mentioned three attributes: recovery of scenery, recovery of vegetation, and limits on the number of trekkers a day. These measures are assumed in our scenario to be funded by a hypothetical user fee. Although it was a hypothetical user fee, park managers have introduced a voluntary payment system (JPY 200) with which most trekkers agree. Therefore, respondents may relate this kind of payment to reality.

The measurement unit of recovery of scenery and vegetation is the percentage of area recovered from that totally changed or ruined. The Uryu-numa Mire recreation area was developed after World War II; therefore, the highest level (100%) is equivalent to the situation of the mire before the war, and the lowest (0%) is the current situation. Eventually, five levels were set at even intervals from 0% to 100%. Respondents had already visited the study area, so presumably they could easily understand the current situation and imagine the fully recovered situation. In contrast, respondents encountered difficulties when asked to judge the number of trekkers a day, as they had little idea of the relationship between crowding and the number of trekkers a day. Therefore, for our CE survey, we showed information on the relationship between the number of trekkers a day and frequency of passing each other on boardwalks (Table 1). This table relies on interviews with park managers. The highest level was set at 800 trekkers referring to the

Table 1: Relationship between number of visitors and crowding

Number of trekkers	Situations
800 trekkers	Visitors cannot stop
500 trekkers	Visitors pass each other almost all the time
300 trekkers	Visitors often pass each other (about every five minutes)
100 trekkers	Visitors sometimes pass each other (about every 10 minutes)
50 trekkers	Visitors rarely pass each other

number of visitors in the peak season; the lowest level was set at 50 trekkers, which is the number of visitors on weekdays. In addition, our scenario mentioned the disadvantages of introducing visitor controls, for example, waiting time or a reservation system. Similarly, five levels of user fee were set: JPY 500, 1,000, 2,000, 5,000, 10,000[3] , referring to a contingent valuation study for recovery of vegetation (Shoji and Kuriyama 1999).

Once attributes and levels are decided, profiles and choice sets can be designed. In this case, $5^4 = 625$ combination of profiles can be assumed, as there are four attributes each with five levels. To reduce the number of profiles and to avoid multicollinearity, we used an orthogonal main effect design, in which profiles are designed to maintain their orthogonality for each attribute (for details see Louviere *et al.* 2000; Holmes and Adamowicz 2003). Our orthogonal main effect design generated 25 profiles. These are randomly blocked to 8 different versions; each version consists of 8 choice sets. Each choice set contained three profiles and a no measure *status quo* option as shown in Figure 2. The *status quo* profile will be a benchmark against which to measure welfare changes. After providing respondents with an explanation of the scenario, using photographs, the researcher presented the above-defined choice sets to them.

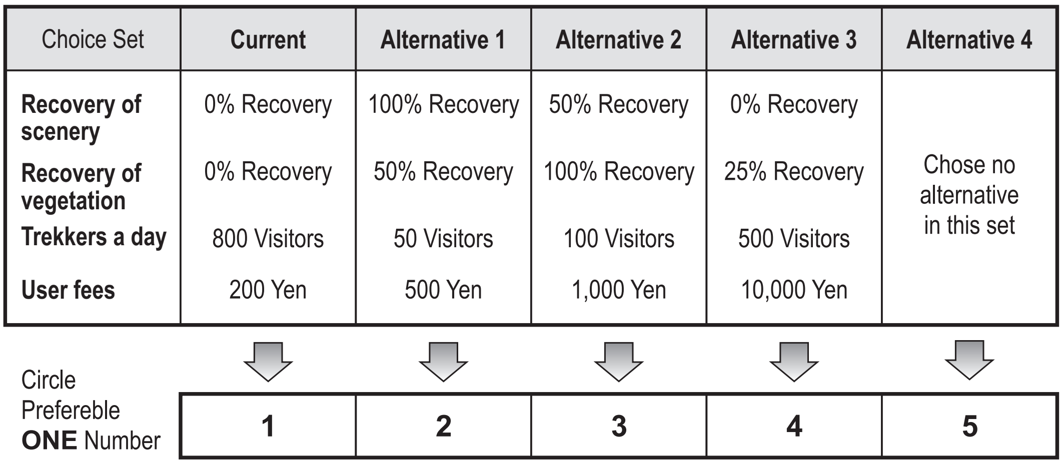

Figure 2: An example of choice sets presented to respondents

[3]USD/JPY: 107.74, EUR/JPY: 159.57 (25 Febraury 2008)

3.3 Estimation Procedures
A random utility model quantifies responses to the CE task. Each profile i in the choice set is represented by a utility function that is composed of a deterministic component and a random error component. The unobservable overall utility U of profile i for a respondent n is represented by:

$$U_{ni} = V_{ni} + \varepsilon_{ni}, \tag{1}$$

where V_{ni} is the deterministic component, and ε_{ni} is the random error component. The probability that an respondent n chooses profile i over other profiles j is given by:

$$\begin{aligned} P_{ni} &= \Pr[U_{ni} > U_{nj}, \forall j \in C, i \neq j] \\ &= \Pr[V_{ni} - V_{nj} > \varepsilon_{nj} - \varepsilon_{ni}, \forall j \in C, i \neq j], \end{aligned} \tag{2}$$

where C is the choice set of all possible profiles. With no loss of generality, the deterministic component can be expressed as linear-in-parameters, such as $V_{ni} = \beta' x_{ni}$, where x_{ni} is a vector of observable attributes, and β is a vector of utility coefficients to be estimated. Assuming a type I extreme value distribution (Gumbel distribution) for the error terms, the probability of choosing profile i produces a conditional logit model (McFadden 1974):

$$P_{ni} = \frac{e^{\lambda V_{ni}}}{\sum_{j \in C} e^{\lambda V_{nj}}}, \tag{3}$$

where λ is the scale parameter, which is typically assumed to equal one in any single sample (Ben-Akiva and Lerman 1985). The vector of utility coefficients can be estimated by the maximum likelihood method (Greene 2003).

3.4 The Data
Our on-site mail sample survey was conducted at the trailhead of Uryu-numa Mire during July and August 2000. In total, 500 questionnaires were distributed, and 245 (50.8%) were returned. After removing respondents who skipped choice tasks, we were left with 193 completed responses.

4. Results

4.1 Conditional Logit Estimates
Our results are shown in Tables 2. There is no preliminary information on the functional form, so we experimented with introducing quadratic terms (for the maximum number of visitors a day and fee payment) and effect-coded terms (for the maximum number of visitors a day) to the deterministic component of the utility function. The reference point of the effect-coded variable was specified as 800 trekkers a day = -1. All parameters in our two conditional logit models have signs that are consistent with our expectations. Positive and statistically significant parameters have a positive contribution to utility, but negative ones have a negative contribution to utility. Recovery of scenery and vegetation are positive and significant; therefore, increasing percentage points of both recoveries affects

Table 2: Conditional logit coefficients in the choice experiment

	Conditional logit (quadratic)			Conditional logit (effect coded)		
Variables	Coeff.	S.E.	t-stat.	Coeff.	S.E.	t-stat.
Improvement of scenery:						
Linear term	0.0110	0.0014	7.876	0.0116	0.0014	8.124
Improvement of vegetation:						
Linear term	0.0202	0.0015	13.873	0.0217	0.0015	14.338
Number of trekkers:						
Linear term (10^{-3})	0.0054	0.0007	7.715			
Quadratic term (10^{-3})	-0.0058	0.0008	-7.461			
50 (effect coded)				-0.6517	0.1013	-6.435
100 (effect coded)				-0.1787	0.0897	-1.992
300 (effect coded)				0.4153	0.0905	4.588
500 (effect coded)				0.3815	0.0839	4.548
Fee payment:						
Linear term (10^{-3})	-0.5658	0.0624	-9.065	-0.5928	0.0646	-9.182
Quadratic term (10^{-5})	0.0023	0.0006	3.608	0.0024	0.0006	3.734
ASC (*status quo* profile)	-0.3021	0.1929	-1.566	-0.4445	0.1734	-2.564
Number of choice set			1150			1150
Log-likelihood (no coeffi.)			-1594.2			-1594.2
Log-likelihood (max)			-1108.1			-1098.9
AIC			2230.3			2215.9
LRI			0.30			0.31

AIC: Akaike information criterion
LRI: Log-likelihood ratio index

utility positively. In contrast, fee payment and alternative specific constant (ASC) for *status quo* profile are negative and significant. Thus, visitors avoided choosing“ no change ” to the current situation; that is, visitors want to introduce measures for restoration of the natural environment and/or provision of appropriate recreation experiences in Uryu-numa Mire. An interpretation of quadratic terms of the maximum number of visitors a day will be examined in the following subsection.

Marginal willingness to pay for a percentage point of each recovery of scenery and vegetation is obtained by dividing each marginal effect on utility by the marginal effect of fee payment:

$$MWTP_s = -(\partial U/\partial x_s)/(\partial U/\partial p) = -\beta_s/(\beta_p + 2\beta_{pq} \cdot \overline{p}), \quad (4)$$
$$MWTP_v = -(\partial U/\partial x_v)/(\partial U/\partial p) = -\beta_v/(\beta_p + 2\beta_{pq} \cdot \overline{p}), \quad (5)$$

where x_s and x_v are recoveries of scenery and vegetation, respectively, and β_s and β_v are their coefficients; p is fee payment and β_p is its coefficient of linear term, β_{pq} is of quadratic term, and $\overline{p}$ is mean fee payment ($\overline{p} = (500 + 1,000 + 2,000 + 5,000 + 10,000)/5 = 3,700$). The marginal willingness to pay for each improvement is JPY 32.6 and JPY 56.1. Recovery of vegetation has a greater contribution to utility than that of scenery.

4.2 Optimal Number of Trekkers

As mentioned above, the linear and quadratic terms of the maximum number of visitors a day are statistically significant in the conditional logit model. Now we will develop the interpretation of these parameters a little further. Let us assume there are two profiles; one is the *status quo* profile, and the other is the *status quo* profile except that the attribute of the maximum number of visitors a day and fee payment are variables. When there is no fee payment, the difference between U_m (with visitor control) and U_0 (no visitor control) is defined:

$$U_m - U_0 = \beta_m(x_m - 800) + \beta_{mq}(x_m^2 - 800^2) + (\varepsilon_m - \varepsilon_0). \tag{6}$$

Willingness to pay for visitor controls from the current (uncontrolled) number of visitors a day situation to the lower (controlled) number of visitors x_m, can be expressed as:

$$WTP_m = -\frac{(U_m - U_0)}{\partial U/\partial p}. \tag{7}$$

Note that the mean of the difference between the error components $\Delta\varepsilon = \varepsilon_m - \varepsilon_0$ is zero. Thus, WTP can be interpreted as both mean WTP and median WTP. The condition to produce the maximum WTP is the following first-order condition:

$$\frac{\partial(U_m - U_0)}{\partial x_m} = \beta_m + 2\beta_{mq} \cdot x_m = 0. \tag{8}$$

The solution x_m is 458 trekkers, the optimal number of trekkers a day. WTP is estimated given visitor controls set at the optimum, which means that a fee for access to the mire has to be paid, and utility, $\hat{U_m}$ equal to no control/no fee utility, U_0. That is, we can find it solving the following equation:

$$\begin{aligned} U_0 &= \beta_m \cdot 800 + \beta_{mq} \cdot (800)^2 + \beta_p \cdot 200 + \beta_{pq} \cdot 200^2 + \varepsilon_0 \\ &= \beta_m \cdot 458 + \beta_{mq} \cdot (458)^2 + \beta_p \cdot W\hat{T}P_m + \beta_{pq} \cdot (W\hat{T}P_m)^2 + \varepsilon_m = \hat{U_m}. \end{aligned} \tag{9}$$

As mentioned before, $\Delta\varepsilon = 0$, the estimated $W\hat{T}P_m$ is mean and median WTP, and the value is JPY 1,457. Figure 3 shows the relationship between the number of trekkers and their WTP. This figure also demonstrates the point estimates of effect-coded models.[4]

5. Discussion

As Table 2 indicates, restoration of the natural environment contributes positively to our utility, and the marginal willingness to pay for restoration of scenery and vegetation of Uryu-numa Mire by one percentage point improvement is JPY 32.6 and JPY 56.1,

[4] In the current situation, almost all trekkers have already cooperated with the voluntary payment of JPY 200. Therefore, we can reasonably suppose that the true WTP for the optimal number of trekkers is the estimated WTP less that voluntary contribution of JPY 200.

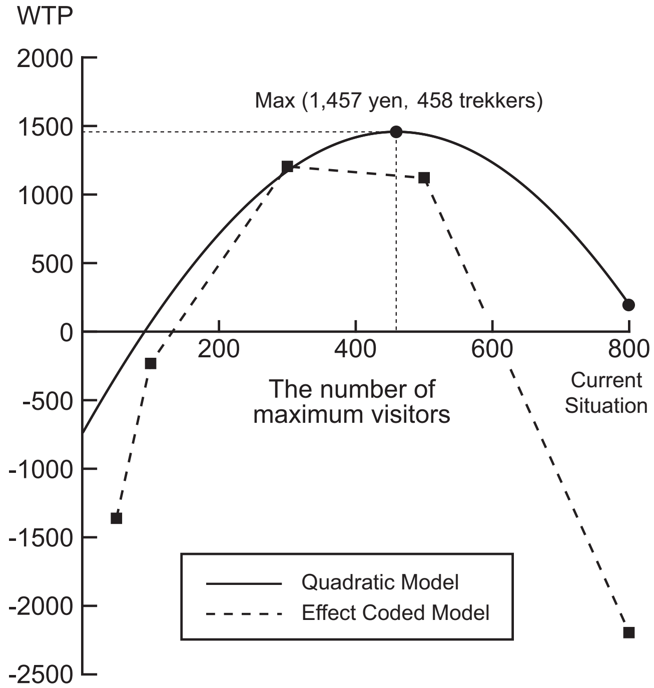

Figure 3: Relationship between the number of maximum visitors and WTP

respectively. The WTP for restoration of scenery and vegetation to half their former state (50-point improvements) is JPY 1,632 and 2,981, respectively. On the other hand, as Figure 3 demonstrates, the provision of appropriate recreation experiences also affects utility positively. Trekkers prefer an uncrowded trail with controls to a crowded trail without controls. When the park manager restricts the number of trekkers to 458 trekkers a day, the average trekker is willing to pay JPY 1,457. These WTPs clearly show that the provision of appropriate recreation experiences to trekkers is not a negligible challenge for Japanese park management, although restoration of the natural environment remains a higher priority.

In addition, the shape of the curve shown in Figure 3 is convex upward. This shape suggests that trekkers considered the tradeoff between increasing utility from improved recreation experiences in a serene environmental setting and decreasing utility from the loss of recreation opportunities with the imposition of controls on visitor numbers, leading to queues or quotas.[5] That is to say, the visitor control system is an option for trekkers, despite there being no such controls in Japan now, and they can recognize and compare the merits and demerits of such controls.

In conclusion, the current Japanese management policy—we can go to natural parks wherever, whenever, and as often as we want—does not produce satisfactory recreation opportunities, and visitor controls should be considered by Japanese park management.

[5]There is not enough evidence to derive this conclusion only from the quadratic estimates, since we cannot ascertain a goodness-of-fit between estimated and true values. But the effect coded estimates demonstrate that the quadratic model describes the tradeoff with a fair degree of precision.

Cost-benefit analysis of introducing visitor controls is too complicated to be examined in detail here, but in some recreation areas in Japan visitor controls are urgently required to cope with the problems imposed by overuse.

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