Measurement of the Value for the Economic Benefits from Leisure-An Application of Nested Logit Model

Chich-Ping Hu*

Department of Urban Planning and Disaster Management, Ming Chuan University, Taiwan

Abstract: Most of the employees in Taiwan now have two days off per week, increased participations in leisure and sport have raised the utilizing on the environmental resources at maple-watching sites for viewing maple trees. Therefore, a balance policy between environmental conservation and economic growth must be considered. Specifically, what will be the result of removing these maple-watching spots? Comparatively, what is to be gained when leisure activities increase? This study adopts six maple tree viewing sites and uses questionnaires to survey tourist experiences. The Nested Logit model is applied to construct a nested choice structure and estimate the value of economic benefits from leisure and sport using a Random Utility model. Finally, this study shows the economic benefits of leisure participation in these sites and proves that these values will increase by improving each maple tree viewing site's characteristics. Additionally, various economic benefits are to be derived when the maple tree viewing sites are removed in case of requests from public policy.

Keywords: Economic benefits, leisure and sport, maple trees, nested logit model, random utility model.

1. INTRODUCTION

In recent years, viewing maple trees during fall has become a popular pastime, as it is the United States, Canada, and Japan. However, the maple trees grow in mountainous districts that are now predominantly defined as environmentally sensitive areas. Consequently, inhabitants in Taiwan should pay additional attention to issues of water and sand retention and the effects of severe rainfall. For example, the main road to Ao-wan-da, which is a famous scenic area for viewing maple trees in NanTou County, was destroyed and temporarily closed due to the Coral typhoon. The continuous downpour in June 2006 caused a disaster in Ren-ai Village in NanTou County. The roads leading to the Ao-wan-da Forest Recreational Area and the connecting roads of the Red Incense Tribe were severely damaged by the downpour.

The need for outdoor recreational areas has increased; however, the natural environment must be protected. Consequently, current strategies regarding areas tourists visit to view maple trees should meet recreational demands and minimize the negative influence of tourism by removing the areas for viewing maple trees. Based on the strategies for maple tree areas in Taiwan, policy design is important for estimating the recreational benefits and providing evidence of the case in Taiwan for national planning, the allocation of recreational resources and tourism policy.

Only, the study, "Research on the Paying Behavior of Tourists at the Ao-wan-da Forest Recreational Area—Application of the Multi-Factor Model" by Lin, Chen and Wang [1], used the Contingent Valuation Method to estimate scenery benefits of the Ao-wan-da Maple Forest. Studies of recreational benefits primarily apply the Travel Cost Method (TCM) and Contingent Valuation Method (CVM) for a single site to value the resources. Studies that assess recreational benefits of more than one location are valuable for recreational policy; furthermore, many studies utilized the Nested Logit Model (NLM) for the purpose of recreational goods valuation, which is used in this study to assess the real behavior of tourists under the assumption that tourists engaging in recreational activities will select recreational area as well as site sequentially. This study uses the NLM to investigate tourist behavior and further estimate the recreational benefits associated with viewing maple trees.

The purpose of this study is to investigate domestic maple tree viewing, selection behavior of tourists viewing maple trees, and consumption behavior and recreational experience at various viewing locations. Additionally, this study determines the recreational benefits associated with the maple tree viewing activities and offers suggestions on how this industry can be managed effectively to meet the recreational needs of large numbers of tourists engaged in viewing maple trees.

*Address correspondence to this author at the No.5 DeMing Rd, GweiShan District, 333 Tao Yuan City, Taiwan; Tel: +886-3-3507001 ext.5050;
Fax: +886-3-3593886; E-mail: chphu@mail.mcu.edu.tw

E-ISSN: 2409-9821/16

2. THE SCOPE AND OBJECT

The 24 main areas for viewing maple trees are as follows [2]: one in New Taipei City; three in TaoYuan City; four in HsinChu County; two in MiaoLi County; two in TaiChung City; seven in NanTou County; two in ChiaYi County; one in TaiNan City; one in KaoHsiung City; and, one in TaiTung County. These locations are primarily in the central-northern mountainous area north of NanTou County. This study uses the same maple tree viewing areas as did by Liu [2]. The six areas analyzed in this study are as follows: the Ancient Stone Deer Trail (ASDT, HC) and Sau Crest Highway (SCH, HC) in HsinChu County; TungShih Forestry (TSF, TC) in TaiChung City; and, Ren-ai Maple Forest Farm (RAMFF, NT), Ao-wan-da Forest Recreation Area (AWDFRA, NT), and Red Incense Tribes (RIT, NT) in NanTou County. Table **1** lists the attributes of each area. The tourists engaged in maple tree viewing at these six locations are surveyed using questionnaires.

3. RECREATIONAL RESOURCES AND BENEFITS ASSESSMENT MODEL

3.1. Recreational Resources and Recreational Benefits

Recreational benefit assessment provides information regarding the development and use of resources for managers can then enhance management effectiveness and efficiency, as well as provide a reference for the planning process and feasibility analysis to reduce risk associated with decision-making failure. Additionally, with the recent increase in pollution, sustainable recreational benefits will be undermined if recreational resources are not effectively assessed. In light of the importance of recreational benefits assessment, this study assesses the recreational benefits of six-maple tree viewing areas, and assesses current use value generated by using the recreational resources when tourists visit these areas. Analytical results can also provide a reference for future regional planning for HsinChu County, TaiChung City, and NanTou County. Consequently, the recreational benefits associated with viewing maple trees include direct and indirect benefits.

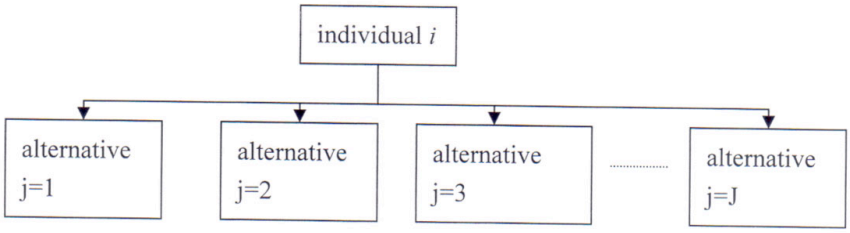
3.2. Assessment Model of Recreational Benefits

In the related literature of recreational benefit estimation for multiple sites, the Random Utility Model(RUM) derived from Luce [3] and McFadden [4] is based on an alternative theory of choice used to derive conventional demand curves. According to RUM, an individual's preferences can be represented by a utility function that can be broken down into two parts: deterministic and observable part, and an error part. Since error is not observable, we make several assumptions about the nature of the error component when making predictions using this theory. Consider an individual who is asked to choose between two goods, such as different recreational sites for traveling, which are assumed to be differentiated according to their attributes and situation. In making a choice, the respondent is assumed to compare utilities, and then select the alternative with the highest utility. An error component is introduced because respondents may assess options according to information other than that shown, such as all possible alternatives to the

Table 1: Attributes of each Maple Tree Viewing Site

Site	Location	Maple types	Tenure	Accommodation situation
ASDT	WuFeng Village, HsinChu County	Sweet gum, Green maple, Taiwan red maple, Palmately maple	State-owned	No accommodation, but self-camping
SCH	JianShi Village, HsinChu County	Sweet gum, Green maple	State-owned	No accommodation, but self-camping
TSF	TungShih town, TaiChung City	Sweet gum, Green maple	Privately run	accommodation
RAMFF	Ren-ai Village, NanTou County	Sweet gum	Privately run	No accommodation, but self-camping
AWDFRA	Ren-ai Village, NanTou County	Sweet gum, Green maple, Palmately maple	State-owned	accommodation
RIT	Ren-ai Village, NanTou County	Sweet gum	State-owned	No accommodation, but self-camping

Source: Fieldwork of this Study.



Source: Fieldwork of this Study.

Figure 1: Structure of the multinomial logit model.

individuals. The list of all available options can be used as the choice set. Given that an error component exists in the utility function, predictions cannot be made with certainty. Therefore, analysis becomes a probabilistic option. To derive an explicit expression for this probability, identifying the distribution of the error component is necessary. A common assumption was that it was in accordance with an extreme-value distribution, which implied that the probability of any particular alternative was chosen as the most preferred, could be expressed as a logistic distribution [4]; this procedure was known as the CLM. A Multinomial Logit Model (MNLM) was then required when data consisted of alternative-specific attributes rather than individual-specific characteristics (Figure **1**).

4. QUESTIONNAIRE DESIGN AND SURVEY RESULTS

4.1. Surveying and Questionnaire Design

In considering the preferences of tourists viewing maple trees, this study divides these activities into three periods according to the colors of the maple trees—green, after the color changes, and after leaves drop. The tree leaves are green during spring and summer, ranging from March to October. The tree

Figure 2: Maple tree leaves colors changed by seasons.

Table 2: Number of Tourists who Visited Maple Tree Viewing Sites during Different Seasons

Seasons (Period)	Tourists Observations drew	ASDT, HC	SCH, HC	TSF, TC	RAMFF, NT	AWDFRA, NT	RIT, NT
Spring and Summer (3-10)	Total	1920	1440	10960	2000	6240	1280
	Observations drew	9	7	52	9	30	6
Autumn and Winter (11-12)	Total	4220	6100	28940	4640	43740	3580
	Observations drew	20	29	137	22	208	17
Winter (1-2)	Total	640	2240	3180	220	3540	1500
	Observations drew	3	11	15	1	17	7
Total	Tourists	6780	9780	43080	6860	53520	6360
	Observations drew	32	46	205	33	254	30

Source: Fieldwork of this Study.

leaves change color during contains autumn and winter, ranging from November to December. The trees shed their leaves in winter, ranging from January to February in Taiwan (Figure **2**). Accordingly, tourists were surveyed from March 25 to April 15, 2014 (spring), November 12 to December 10, 2014 (fall), December 24 2014, to January 21, 2015. Questionnaires were distributed by researchers at the sites, or by local hotels and related companies near sites. Observations of the sample drawn from each site are determined using the stratified sampling method; sample size is determined by the number of tourists. Therefore, this study identified the number of tourists engaged in viewing maple trees. One method for identifying the number of tourists is to first calculate the number of tourists during peak or non-peak periods on holidays and non-holiday days during each season, and then estimate the number of tourists on one-day tours during holidays and non-holiday days during each season (Table **2**). Based on the number of estimated visitors, sample size in this study is 600 tourists. According to the number of tourists at each site, the number of observations for each site (Table **2**), can then be determined as follows. Thirty-two tourists visited ASDT, HC, 46 tourists visited SCH, HC, 205 tourists visited TSF, TC, 33 tourists visited RAMFF, NT, 254 tourists visited AWDFRA, NT, and 30 tourists visited RIT, NT (Figure **3**).

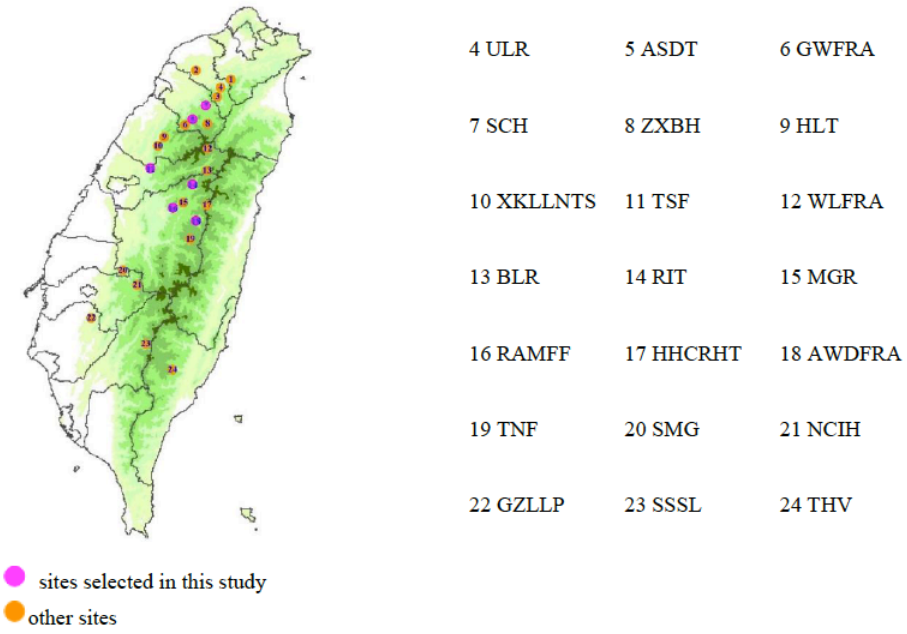


Figure 3: Locations and distribution of maple-trees viewing sites in Taiwan.

Table 3: Descriptive Results of Tourist Characteristics

Gender		Age		Educational Level	
Item	**Frequency (%)**	**Item**	**Frequency (%)**	**Item**	**Frequency (%)**
Male	300 (51)	15–24	65 (11)	Junior high school below	20 (3)
Female	289 (49)	25–34	203 (34)	Senior high school	100 (17)
		35–44	215 (37)	Colleague	131 (22)
		Above 44	106 (18)	University	201 (34)
		Average (Years)	35.63	Graduate school above	137 (23)
				Average number of years	15.22
Occupation		Personal income per month		Family income per month	
Item	Frequency (%)	Item	Frequency (%)	Item	Frequency (%)
Public official	28 (5)	20000 below	74 (13)	40000 below	25 (4)
Service	106 (18)	20000–40000	227 (39)	40000–80000	220 (37)
Industrial	93 (16)	40000–60000	227 (39)	80000–120000	299 (51)
Business	104 (18)	60000–80000	35 (6)	120000–160000	36 (6)
Teaching	26 (4)	80000–100000	11 (2)	160000 above	9 (2)
Learning	67 (11)	100000–120000	9 (2)	Average (NT$ per month)	82127
House keeping	43 (7)	120000 above	6 (1)		
Technical personnel	78 (13)	Average (NT$ per month)	36786		
Free industry	31 (5)				
Retired	5 (1)				
Waiting for work	8 (1)				

Source: Fieldwork of this Study.

Questionnaire content can be divided into three categories: tourist recreational experiences; experience evaluations; and, socio-economic characteristics. The recreational experience survey investigates duration stayed, traveling time spent, motivation, information sources, activities arranged, transportation mode taken, tourist composition accompanied and travel cost expended. The experience part of the survey analyzes satisfaction levels of tourists engaged in viewing maple trees, including affordability of the experience, number of trees appreciated at the site, convenience of transportation facilities near the site, quality of recreational facilities, and level of congestion at the site. Socio-economic characteristics obtained were tourist gender, age, residence location, education level, occupation, personal income and family income.

4.2. Descriptive Survey Results

In total, 589 tourists comprised the effective sample size; the recovery rate is 98%. Males accounted for 51% of tourists surveyed (Table **3**). The age distribution of tourists is 35–44 years (37%), followed by 25–34 years (34%), and > 45 years (18%). Average age is 35.63 years old, suggesting that middle-aged tourists comprise the largest group engaged in viewing maple trees. Distribution of tourist residence is listed in Table **4**. Tourist residences are located in NanTou County (17%), TaiChung County (16%), Taipei County (12%), HsinChu County (12%) and MiaoLi County (10%), suggesting that tourists prefer sites that are close to their homes. Moreover, residential locations of tourists visiting TSF, TC and AWDFRA, NT are much more decentralized than locations of other sites; in other words, tourists are from various counties and cities in Taiwan, which is related to site management and size. Educational levels of tourists (Table **3**), are university (34%), graduate school (23%) and college (22%). Average number of years in educational is 15.22. Tourist occupations are mainly service (18%), business (18%) and industrial (16%). Personal monthly income is 20,000–40,000NT$ (39%) and 40,000–60,000NT$ (39%), followed by < 20,000NT$ (13%); average personal monthly income is 36,786NT$. Additionally, family monthly incomes are primarily

Table 4: Distribution of Tourists' Residential Locations

Residential Location \ Site		ASDT, HC	SCH, HC	TSF, TC	RAMFF, NT	AWDFRA, NT	RIT, NT	Total
		Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
Location of residence	KeeLung	0 (0)	0 (0)	4 (2)	0 (0)	5 (2)	0 (0)	9 (2)
	Taipei	6 (20)	14 (30)	18 (9)	3 (10)	32 (13)	0 (0)	73 (12)
	TaoYuan	6 (20)	3 (6)	6 (3)	1 (3)	20 (8)	0 (0)	36 (6)
	HsinChu	12 (40)	15 (32)	5 (2)	2 (6)	37 (15)	1 (3)	72 (12)
	MiaoLi	2 (7)	9 (19)	20 (10)	1 (3)	19 (8)	7 (24)	58 (10)
	TaiChung	4 (13)	4 (9)	42 (21)	7 (23)	33 (13)	6 (21)	96 (16)
	NanTou	0 (0)	1 (2)	40 (20)	10 (32)	40 (16)	12 (41)	103 (17)
	ChangHua	0 (0)	0 (0)	4 (2)	7 (23)	10 (4)	3 (10)	24 (4)
	YunLin	0 (0)	1 (2)	20 (10)	0 (0)	2 (1)	0 (0)	23 (4)
	ChiaYi	0 (0)	0 (0)	9 (5)	0 (0)	10 (4)	0 (0)	19 (3)
	TaiNan	0 (0)	0 (0)	10 (5)	0 (0)	10 (4)	0 (0)	20 (3)
	KaoHsiung	0 (0)	0 (0)	6 (3)	0 (0)	25 (10)	0 (0)	31 (5)
	PingTung	0 (0)	0 (0)	10 (5)	0 (0)	5 (2)	0 (0)	15 (3)
	TaiTung	0 (0)	0 (0)	2 (1)	0 (0)	0 (0)	0 (0)	2 (0)
	HuaLien	0 (0)	0 (0)	2 (1)	0 (0)	0 (0)	0 (0)	2 (0)
	YiLan	0 (0)	0 (0)	3 (1)	0 (0)	3 (1)	0 (0)	6 (1)

Source: Fieldwork of this Study.

80,000–120,000NT$ (51%) and 40,000–80,000NT$ (37%), followed by 120,000–160,000NT$ (6%); average family monthly income is 82,127NT$.

Most tourists remained for two days and one night (47%) at a site, followed by one-day tours (33%), and three days and two nights (16%) (Table **5**). One-day tours are most popular at SCH, HC and RAMFF, NT, accounting for 87% and 90% of total tours, respectively—the viewing location at SCH, HC is beside the road, and the capacity of RAMFF, NT is small and only provides camping sites. Most respondents spent 2.0–3 hours (31%) to get to the viewing site, followed by 3.0–4 hours (24%), and within 2 hours (18%); average travel time is 3.41 hours. The TSF, TC is near an exchange road off a superhighway; thus transportation to the site is relatively convenient. Accordingly, most tourists spent 2 hours to reach a viewing site (52%); average travel time is the shortest at 2.62 hours. Conversely, the AWDFRA, NT site has a large viewing area and a good reputation that attracts numerous visitors from various counties and cities. Average travel time to AWDFRA, NT is the longest at 4.15 hours. Travel costs for most respondents are mainly 1,000–2,000NT$ (40%), followed by 2,000–3,000NT$ (23%), and 3,000–4,000NT$ (18%); average travel cost is 2,617NT$. These travel costs are relatively high, among overall the sites as most tourists stayed for two days and one night at a site. The motivation for viewing maple trees are mainly for leisure entertainment (93%), parent-child activities (76%), followed by plant appreciation (65%). In addition to these motivations, mountain climbing at ASDT, HC and SCH, HC also accounts for a high proportion of visitors (73% and 72%, respectively)— the ASDT, HC is an ancient famous trail, and the SCH, HC site is near a mountain climbing line in Town Salih, HC which is the most famous tourism area around HC. The AWDFRA, NT site is the most prestigious national area for viewing maple trees in Taiwan. Motivation such as "plant appreciation" (75%) and "curiosity" (73%) accounted for high proportions of tourists. Information for these sites are obtained from friends and relatives (56%), the Internet (49%) and magazines and books (48%). The principal information sources for the AWDFRA, NT site are restaurants and hotels (59%), magazines and books (57%) and TV (43%). Differing from other sites, the proportion tourists citing TV as their information source is higher than that for other sites, indicating that tourism information for this site was well spread. The activities of all respondents are primarily travel (37%), touring with friends (26%), followed by institute groups

Table 5: Tourists' Travel Experiences

Items of Travel Experience \ Site		ASDT, HC	SCH, HC	TSF, TC	RAMFF, NT	AWDFRA, NT	RIT, NT	Total
		Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
Pattern with traveling	One day tour	3 (10)	41(87)	57 (28)	28 (90)	60 (24)	3 (10)	192 (33)
	Two days one night	13 (43)	6 (13)	95 (47)	2 (6)	127 (51)	20 (69)	263 (47)
	Three days two nights	9 (30)	0 (0)	30 (15)	1 (3)	51 (20)	5 (17)	96 (16)
	Three days above	5 (17)	0 (0)	19 (9)	0 (0)	13 (5)	1 (3)	38 (6)
Travel time	2 Hours below	0 (0)	0 (0)	105 (52)	0 (0)	0 (0)	0 (0)	105 (18)
	2.0–3 Hours	20 (67)	27 (57)	25 (12)	24 (78)	84 (33)	0 (0)	180 (31)
	3.0–4 Hours	10 (33)	19 (40)	58 (29)	0 (0)	31 (12)	21 (72)	139 (24)
	4.0–5 Hours	0 (0)	1 (2)	8 (4)	3 (10)	72 (29)	7 (24)	91 (15)
	5.0–6 Hours	0 (0)	0 (0)	5 (2)	3 (10)	55 (22)	1 (3)	64 (11)
	6 Hours above	0 (0)	0 (0)	0 (0)	1 (3)	9 (4)	0 (0)	10 (2)
	Average time (Hours)	2.97	3.10	2.62	3.13	4.15	3.81	3.41
Travel cost	1000 Below	2 (7)	5 (11)	17 (8)	4 (13)	6 (2)	0 (0)	34 (6)
	1000–2000NT$	23 (77)	28 (60)	69 (34)	17 (55)	80 (32)	21 (72)	238 (40)
	2000–3000NT$	5 (17)	12 (26)	43 (21)	5 (16)	63 (25)	5 (17)	133 (23)
	3000–4000NT$	0 (0)	1 (2)	34 (17)	3 (10)	63 (25)	2 (7)	103 (18)
	4000NT$ above	0 (0)	1 (2)	38 (19)	2 (6)	39 (16)	1 (3)	81 (14)
	Average cost	1652	2755	2669	2030	2814	1957	2617
Motives of travel	Leisure for entertainment	29 (97)	47 (100)	191 (95)	25 (81)	231 (92)	24 (83)	547 (93)
	Parent-child activities	13 (43)	28 (60)	170 (85)	29 (94)	181 (72)	24 (83)	445 (76)
	Sightseeing	3 (10)	7 (15)	66 (33)	9 (29)	200 (80)	1 (3)	286 (49)
	Outdoor teaching	0 (0)	5 (11)	10 (5)	0 (0)	30 (12)	3 (10)	48 (8)
	Curiosity	2 (7)	1 (2)	72 (36)	7 (23)	183 (73)	0 (0)	265 (45)
	Academic research	0 (0)	0 (0)	2 (1)	0 (0)	10 (4)	0 (0)	12 (2)
	Plants appreciation	15 (50)	22 (47)	129 (64)	17 (55)	188 (75)	10 (34)	381 (65)
	Mountain climbing	22 (73)	34 (72)	40 (20)	3 (10)	113 (45)	3 (10)	215 (37)
	Expense reasonableness	2 (7)	27 (57)	22 (11)	2 (6)	98 (39)	6 (21)	157 (27)
Information sources	TV media	0 (0)	1 (2)	42 (21)	11 (35)	108 (43)	1 (3)	163 (28)
	Broadcaster	0 (0)	0 (0)	18 (9)	0 (0)	58 (23)	0 (0)	76 (13)
	Travel agency	2 (7)	19 (40)	62 (31)	1 (3)	100 (40)	9 (31)	193 (33)
	Newspaper	0 (0)	0 (0)	0 (0)	3 (10)	8 (3)	0 (0)	11 (2)
	Internet	16 (53)	35 (74)	147 (73)	3 (10)	75 (30)	14 (48)	290 (49)
	Friends and relatives	20 (67)	40 (85)	129 (64)	22 (71)	103 (41)	17 (59)	331 (56)
	Magazines and books	4 (13)	32 (68)	92 (46)	10 (32)	143 (57)	3 (10)	284 (48)
	Restaurant and hotel	9 (30)	5 (11)	10 (5)	2 (6)	148 (59)	3 (10)	177 (30)
	Poster	0 (0)	0 (0)	40 (20)	1 (3)	27 (11)	1 (3)	69 (12)
	Service center	0 (0)	18 (38)	6 (3)	10 (32)	10 (4)	1 (3)	45 (8)

Table 5 Continued…

Items of Travel Experience \ Site		ASDT, HC	SCH, HC	TSF, TC	RAMFF, NT	AWDFRA, NT	RIT, NT	Total
		Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
Arrangements of activities	Primarily travel	13 (43)	20 (43)	66 (33)	14 (45)	88 (35)	17 (59)	218 (37)
	Friends tour	12 (40)	15 (32)	43 (21)	13 (42)	73 (29)	10 (34)	155 (26)
	Institute groups	5 (17)	8 (17)	60 (30)	4 (13)	68 (27)	2 (7)	147 (25)
	Travel agency	0 (0)	4 (9)	32 (16)	0 (0)	22 (9)	0 (0)	59 (10)
Transportation modes	Motorcycle	2 (7)	1 (2)	12 (6)	1 (3)	8 (3)	0 (0)	24 (4)
	Automobile	28 (93)	32 (68)	163 (81)	27 (87)	180 (72)	29 (100)	455 (77)
	Passenger Transport	0 (0)	0 (0)	6 (3)	0 (0)	13 (5)	0 (0)	19 (3)
	Tour bus	0 (0)	14 (30)	20 (10)	3 (10)	50 (20)	0 (0)	87 (15)

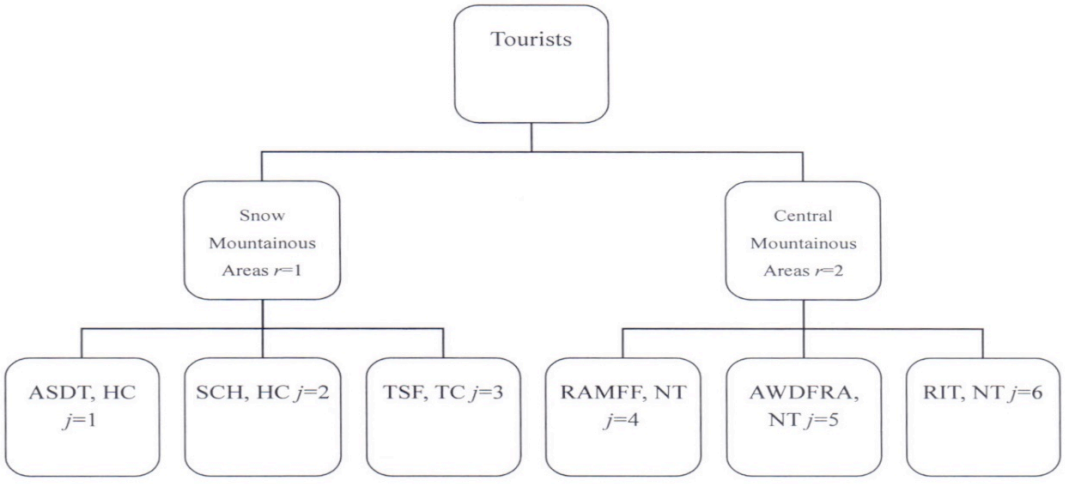
Source: Fieldwork of this Study.

(25%). Most travel arrangements were made by travel agencies, accounting for 16% of visits to TSF, TC, and 9% of visits to AWDFRA, NT and SCH, HC. The reason why these three sites amount to a high proportion of travel agencies is that AWDFRA, NT and TSF, TC are large, thus, travel agencies and institute groups can maintain travel itineraries during trips. However, the reason that the destination of the respondents visiting SCH, HC is relatively high is this location is en route to TS, HC to appreciate the maples. Transportation modes are mainly automobile (77%), tour bus (15%) and motorcycle (4%). The tour bus is also primarily used to travel to SHC, HC (30%), AWDFRA, NT (20%) and TSF, TC (10%), which is a product of good arrangements for activities by travel agencies and institute groups at these three locations.

5. EMPIRICAL MODEL AND RECREATIONAL BENEFITS MEASUREMENT

5.1. Modeling and the Estimating Results

This study uses Limdep 8.0 software to construct various nesting structures whose parameters in NLM are applied during the empirical test. Finally, the best moderate structure is used for further discussion (Figure **4**). Assuming that tourists have a two-stage selection while traveling suggests that they first choose an area, and then choose a site. The topography, namely, mountains, affect the locations of the six sites. This study uses Taiwan's terrain to classify the Snow Mountainous Range and the Central Mountainous Range. The former includes the ASDT, HC, SCH, HC



Source: Fieldwork of this Study.

Figure 4: Moderate choice structure.

and TSF, TC sites, whereas the latter has the RAMFF, NT, AWDFRA, NT and RIT, NT sites.

The utility function of a tourist choosing an area r and site for viewing the maple trees j can be expressed in a linear form as Eq. (1), where V_{rj} is the deterministic utility, and ε_{rj} is the error component.

$$U_{rj} = V_{rj} + \varepsilon_{rj} \tag{1}$$

The variables that have significant effects on the selection sites for viewing maple trees in the utility function are travel time, travel cost and tourist satisfaction in viewing the maple trees. Substituting these variables into Eq. (1) yields the deterministic utility equation, Eq. (2):

$$\begin{aligned} V_{rj} = {} & \beta_{rj}(TT)_{rj} + \beta_{rj}(TC)_{rj} + \beta_{rj}(IS)_{rj} + \beta_{rj}(QM)_{rj} \\ & + \beta_{rj}(TR)_{rj} + \beta_{rj}(FA)_{rj} + \beta_{rj}(RS)_{rj} + \varepsilon_{rj} \end{aligned} \tag{2}$$

where *TT* is travel time, *TC* is travel cost, *IS* is the number of available information sources, *QM* the amount of maple trees, *TR* is regarding traffic volume, *FA* is the number of available facilities, and *RS* is the number of available recreational systems around this site.

Based on the RUM, we assume that error component ε_{rj} is in accordance with the Gumbel distribution. The nested structure is then constructed. This study uses MLE *via* Full Information Maximum Likelihood (FIML) to adjust variable coefficients in the tourist utility function. The estimated results obtained by this model are classified into two principal categories.

5.2. Nested Structure

Table **6** lists estimation results. The number of the log likelihood function, log L, is -845.6430 and the probability of chi-square > 419.4066 is approximated to zero.

McFadden (1981) demonstrated that the coefficient of the inclusive value should be distributed between 0–1, which is a necessary condition for a nested structure to be consistent with utility maximization. As the coefficient of the inclusive value nears zero, the strength of the correlation between alternatives increases. According to analytical results (Table **6**), the coefficient of inclusive value for the Snow Mountainous Range, $1-\sigma_{snow}$, is 0.0752, and that for the Central Mountainous Range, $1-\sigma_{central}$, is 0.1703; both are very close to zero. Thus, constructing the nested structures from topographical information is reasonable, suggesting that strong correlations exist among ASDT, HC, SCH, HC and TSF, HC, which are grouped into one nest, and strong correlations exist among RAMFF, NT, AWDFRA, NT and RIT, NT, which are grouped into the other nest.

5.3. Coefficients Estimation

Table **6** presents the statistical indexes, standard error and p-values for model testing. For the estimated coefficients, all variables are significantly not equal to zero under a 10% significance level, except that $1-\sigma_{central}$ and *TR* are only significant under a 30% significance level. For the variable of influence on site choice, the utility level of tourist will be high when one selected variable coefficient is positive rather than negative. The coefficients of travel time and travel costs are both negative, whereas the other coefficients of variables are positive (Table **6**); this is consistent with the intuitiveness of tourist behavior. Furthermore, as the absolute value of a coefficient increases, its influence increases, and vice-versa. Therefore, Table **6** demonstrates that variables travel cost *TC* (-0.0003) and traffic volume *TR* (0.2948) are not the principal variables when tourists chose a site for viewing maple trees. This may be because the sites in this study are located in remote mountainous areas. That is, whenever tourists choose a site from available alternatives, they have already identified the travel costs. Other variables of available recreational systems

Table 6: Maximum Likelihood Estimates of the Nested Logit Model for Viewing Maple Trees

Variables	Coefficient	Standard error	P- value
TT	-0.8611	0.1283	0.0000***
TC	-0.0003	0.8760D-04	0.0002***
IS	1.1308	0.2271	0.0000***
QM	0.9079	0.2098	0.0000***
TR	0.2948	0.2424	0.0439*
FA	1.3562	0.2307	0.0000***
RS	1.3590	0.2427	0.0000***
$1-\sigma_{snow}$	0.0752	0.0712	0.0310*
$1-\sigma_{central}$	0.1703	0.0969	0.0248**
log L	-845.6430		
P- value of chi square	0.0000		

Note:

Superscripts of numerals like ***, ** and * indicate that variables are significantly not equal to zero under 1%, 5% and 10% of significance level.

Source: Fieldwork of this Study.

RS (1.3590), available facilities *FA* (1.3562), and available information sources *IS* (1.1308) are the important influences when tourists choose a site for viewing maple trees.

5.4. Implicit Issues

This study utilizes two conditions to assess recreational benefits: one calculates the welfare added per tourist with the assumption of improving the characteristics of each of the maple tree viewing sites by 10%, 20% and 30%, whereas the other calculates the benefits lost when each site is removed.

According to the deterministic utility function described in Eq. (2), this study calculates the benefits under the assumption that the income effect remains unchanged by taking the coefficient of variable *TC*, which can be expressed as marginal utility of income, as a denominator divided by the difference of utilities (Eq. (3)); the definitions of variables are the same as the specifications mentioned above. This study then estimates, for example, increased benefits, *C*, by measuring increased utility based on the amount of maple trees at spot *j* within area *r*.

$$C = \frac{\left\{ \ln\left(\sum_{r=1}^{2} \left[\sum_{j=1}^{J_{rj}} \exp\left(\frac{\beta_1 (TT)_{rj} + \beta_2 (TC)_{rj} + \beta_3 (IS)_{rj} + \beta_4 (QM)^1_{rj} + \beta_5 (TR)_{rj} + \beta_6 (FA)_{rj} + \beta_7 (RS)_{rj}}{1-\sigma_r} \right) \right]^{1-\sigma_r} \right) - \ln\left(\sum_{r=1}^{2} \left[\sum_{j=1}^{J_{rj}} \exp\left(\frac{\beta_1 (TT)_{irj} + \beta_2 (TC)_{rj} + \beta_3 (IS)_{rj} + \beta_4 (QM)^0_{rj} + \beta_5 (TR)_{rj} + \beta_6 (FA)_{rj} + \beta_7 (RS)_{rj}}{1-\sigma_r} \right) \right]^{1-\sigma_r} \right) \right\}}{-\beta_2} \quad (2)$$

The benefits lost, for instance, assuming that spot *j* is removed from area *r*, can be expressed in Eq. (3):

$$C = \frac{\left\{ \ln\left(\sum_{r=1}^{2} \left[\sum_{j=1}^{J_{rj}} \exp\left(\frac{\beta_1 (TT)_{rj} + \beta_2 (TC)_{rj} + \beta_3 (IS)_{rj} + \beta_4 (QM)_{rj} + \beta_5 (TR)_{rj} + \beta_6 (FA)_{rj} + \beta_7 (RS)_{rj}}{1-\sigma_r} \right) \right]^{1-\sigma_r} \right) - \ln\left(\sum_{r=1}^{2} \left[\sum_{j \neq h}^{J_{rj}} \exp\left(\frac{\beta_1 (TT)_{rj} + \beta_2 (TC)_{rj} + \beta_3 (IS)_{rj} + \beta_4 (QM)_{rj} + \beta_5 (TR)_{rj} + \beta_6 (FA)_{rj} + \beta_7 (RS)_{rj}}{1-\sigma_r} \right) \right]^{1-\sigma_r} \right) \right\}}{-\beta_2} \quad (3)$$

Table 7: Estimation of Increase to Recreational Benefits after Improving Site's Characteristics

Classification	Increased Proportion	ASDT, HC	SCH, HC	TSF, TC	RAMFF, NT	AWDFRA, NT	RIT, NT	Average
IS	10%	16.59	0.00	246.98	5.82	88.30	27.85	64.26
	20%	75.89	0.00	504.90	16.63	191.99	72.25	143.61
	30%	219.38	0.01	771.07	35.94	309.05	136.84	245.38
QM	10%	11.30	0.00	197.28	4.37	69.60	21.20	50.63
	20%	44.36	0.00	402.14	11.58	149.41	52.49	110.00
	30%	123.21	0.01	612.73	23.24	238.30	96.09	182.26
TR	10%	2.38	0.00	63.01	1.18	21.41	5.94	15.65
	20%	5.83	0.00	127.08	2.58	43.97	12.75	32.04
	30%	10.82	0.00	192.05	4.22	67.66	20.53	49.21
FA	10%	23.55	0.00	297.66	7.49	107.81	35.23	78.62
	20%	121.88	0.00	610.11	23.06	237.16	95.47	181.28
	30%	343.98	0.01	933.78	53.51	384.84	185.58	316.95
RS	10%	23.65	0.00	298.30	7.51	108.06	35.33	78.81
	20%	122.55	0.00	611.44	23.15	237.74	95.79	181.78
	30%	345.67	0.01	935.83	53.77	385.81	186.23	317.89

Note:

Unit of Benefit: NT$ Per Tourist.

Source: Fieldwork of this Study.

Table 8: Estimations of Recreational Benefits Lost after Removing Viewing Sites

Removal of site	ASDT, HC	SCH, HC	TSF, TC	RAMFF, NT	AWDFRA, NT	RIT, NT
Annual amount of tourists (tourist)	6780	9780	43080	6860	53520	6360
Welfare changed per tourist (NT$)	5.06	0.00	550.72	6.39	206.89	35.19
Annual recreational benefits changed (NT$)	34330.05	0.25	23725105.95	43838.36	11072669.20	223795.59

Sources: Fieldwork of this Study.

The increase in recreational benefits at each site due to the assumption that upgraded levels of 10%, 20%, and 30% to be added with improvements on the characteristic of site is listed in Table **7**.

The common property based on implications of welfare calculation (Table **7**) is that recreational benefit, expressed by increased welfare per tourist at each site increases as site's characteristics improved. Further more, Based on the results of benefits assessment (Table **6**), and by comparing the coefficients of various site's characteristic variables, the coefficients of available facilities *FA* (1.3562) and available recreational systems *RS* (1.3590) are high, indicating that when tourists make decisions regarding the site for viewing maple trees, they will first consider facilities and the recreational system. Conversely, the coefficient of traffic volume *TR* (0.2948) is lowest, indicating that traffic condition has little influence on site choice. Overall, improving facility service and recreational system quality can increase recreational benefits. Increases with information obtained and number of maple trees had moderate effects on tourist, whereas traffic condition had the smallest effect. Comparing the increase in recreational benefits at each site (Table **7**) determines that the recreational benefits at TSF, TC and AWD, NT increase most, followed by RIT, NT and ASDT, HC; RAMFF, NT and SCH, HC increase least. The implication, according to Eq. (12), is that whenever probability of an option for a site is rather low, it has little effect on benefit change, and vice-versa. Consequently, Table **7** demonstrates that in this study, due to the probabilities of options for TSF, TC and AWDFRA, NT are high the increased recreational benefits are relatively high and SCH, HC has almost no increase in benefits on account of low probabilities of options for.

By removing maple tree viewing sites, the recreational benefits lost at each site can be determined (Table **8**). The benefits lost at SCH, HC are rather small, which is due to its low selected probability, whenever it is removed. Conversely, the selected probabilities of TSF, TC and AWDFRA, NT are high, indicating that the benefits lost are high whenever they are removed. This finding is related to the real number of visits, that is, a large number of tourists visited TSF, TC and AWDFRA, NT, whereas the tourists visiting SCH, HC generally stop at SCH, HC on their way to TS, HC.

CONCLUSION AND RECOMMENDATION

Survey results identify important issues for public officials indicating that when most tourists viewed the maple trees when color of the leaves has already changed to yellow or red, followed by green leaves. The fewest tourists viewed the trees when the leaves had fallen. Evaluation of visitors experience shows that satisfaction with information obtained at the RIT site is low, and the satisfaction with the number of maple trees at ASDT, SCH and RAMFF is not high, and the satisfaction with facilities at SCH is low. Finally, the recreational system at RAMFF is unsatisfactory. The results of NLM suggest that the coefficient of inclusive value at the Snow Mountainous Range is 0.0752, and the coefficient for the Central Mountainous Range is 0.1703, indicating that this classification is reasonable for a two-stage selection assumption while tourists engage in maple tree viewing. For benefit assessments, the improvements for facilities service and the recreational systems quality can help increase recreational benefits. Recreational benefits at TSF and AWDFRA increase most, followed by RIT and ASDT, whereas RAMFF and SCH increase least when characteristic improves, which is related to the probability of sites selected.

The estimated results of recreational benefits assessment determine that benefits increase at TSF and AWDFRA are highest; benefits lost are also high when these two sites are removed. Therefore, the

government can give TSF and AWDFRA top priority for planning and managing the surrounding environment. For other recreational sites with low recreational benefits, such as ASDT, SCH and RIT, the government can focus on ecological conservation to avoid further injury to mountainous environments through legislation. According to survey results, tourists are unsatisfied with the number of maple trees and the recreational system at the privately run site RAMFF. We recommend that the farm improves its management of the site by implementing monitoring instructions. Due to limited resources and manpower, this study only assesses the recreational benefits of six sites, and the recreational benefits are the values currently used. A follow-up study can compare these sites in the study with the other maple tree viewing sites and explore other benefits.

REFERENCES

[1] Lin JX, Chen YZ and Wang ZZ. The research on tourists' pay at Ao-wan-da forest recreational area-the application of the multi-index and factors model. Agriculture Economics 2001; 70: 91-115.

[2] Liu CY. Secret leaf: overview of secret Maple-watching sites in Taiwan, Taipei: Read the Earth 2003.

[3] Luce RD. Individual choice behavior: a theoretical analysis, New York: Wiley 1959.

[4] McFadden DS. Conditional logit analysis of qualitative choice behavior. In Frontiers in Econometrics, ed. P. Zarembka. New York: Academic Press 1974; 105-142.

Received on 10-08-2016 Accepted on 27-09-2016 Published on 14-10-2016

DOI: http://dx.doi.org/10.15377/2409-9821.2016.03.01.2