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Choice Experiments for Estimating the Non-Market Value of Ecosystem Services in the Bang Kachao Green Area, Thailand

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Received: 23 July 2020; Accepted: 15 September 2020; Published: 16 September 2020

Abstract: Bang Kachao, the largest green area in the Bangkok metropolitan area, delivers significant ecosystem services to sustain society free of charge. It is therefore difficult to achieve socially optimal services because of inefficient allocation of resources, over-consumption, and negative externalities resulting from market failures. This study's purpose is to assess consumers' willingness to pay (WTP) for enhancing ecosystem services from the Bang Kachao Green Area and to investigate factors influencing the WTP of Bangkok residents. A choice experiment was applied by interviewing 200 respondents living in the Bangkok metropolitan area. The data were collected between July and September 2016 and analyzed using a conditional logit model. The results reveal that the respondents are willing to pay 42 USD per year to improve the ecosystem services in Bang Kachao. The respondents demand clean air the most, followed by food, recreation, and bird diversity. The government of Bangkok may take proactive steps to promote agroforestry and ecotourism in Bang Kachao. A Payment for Ecosystem Services (PES) scheme may ensure the provision of ecosystem services in Bang Kachao.

Keywords: choice experiments; ecosystem services; the Bang Kachao Green Area; willingness to pay

1. Introduction

Green areas are demanded by urban residents because they deliver significant ecosystem services, including clean air, water regulation, food and agricultural products, biodiversity protection, and cultural services [1,2]. Trees and forests in urban areas provide various services to the environment, and citizens value the natural amenities that trees provide [3]. Lee et al. [4] confirmed that people are influenced by both economic conditions and residential conditions, especially natural amenity variables, when choosing to move into or remain in an area.

Bang Kachao is the largest green area in Bangkok, the capital city of Thailand [5]. Hence, it is a major source of oxygen, which can reduce air pollution in the metropolitan area [6]. Because a large area of Bang Kachao is covered by a rich biodiversity of trees, herbaceous plants, and food crops [7], it offers various provisioning services to community members [8]. Another benefit provided by this green area is cultural services, especially the Sri Nakhon Khuean Khan Park, which was created as a green space for recreational users. The park and Bang Kachao's greenery are well known to both Thai and international tourists, which, in turn, could generate additional income for local communities [9]. Thus, the Bang Kachao Green Area has contributed to the wellbeing of local communities and millions of Bangkok citizens.

However, rapid urbanization and land-use changes have been major drivers of the loss of agricultural land and forested areas of Bang Kachao. With the gradual increase in land prices, traditional mixed orchards have been transformed into over-populated warehouses. Local people have left their farmland and migrated to work in the capital city [9]. Moreover, because the ecosystem services in Bang Kachao are provided free of charge as public goods, policymakers typically ignore the value of these services. This has resulted in a market failure, which makes it difficult to achieve socially optimal services because of over-consumption and negative externalities. Consequently, the reduction of green areas has continued, causing social disorder, including pollution and health problems.

Assigning a monetary value to ecosystem services under the concept of non-market valuation suggests a potential solution because it allows us to assess the tradeoffs that are inherent in developing human societies within ecological systems. The monetary value can be used to support policy decisions in a number of ways. First, it provides a common unit of comparison between benefits and costs when choosing optimal policy options. Second, value assessment helps policymakers to quantify the environmental impact in monetary terms and inform the planning and budgeting of the project. In addition, the willingness to pay the value of ecosystem services can be useful for evaluating the feasibility of a Payments for Ecosystem Services (PES) scheme to guarantee the quality of ecosystem services. For instance, it is important to know whether the price service providers demand a matching offer from the buyers [10].

In the economic literature, although a series of non-market valuation techniques have been used to estimate the monetary value of ecosystem services, interest in stated preference approaches, which rely on preferences or values as stated by individuals, has been increasing [11]. The major advantage of the stated preference approaches is the flexibility to capture both use and non-use values [12,13]. Two common methods of stated preference approaches are the contingent valuation method (CVM) and choice experiments (CE). The contingent valuation method can provide the value of total environmental changes, while the choice experiment is capable of valuating multidimensional environmental changes [14]. Thus, the choice experiment method allows for the estimation of the relative importance of multiple environmental attributes and their levels [15]. Christie et al. [16] also stated that public preferences for different attributes of biodiversity and ecosystem services can be of much assistance in guiding the design of environmental restoration policies. Environmental economists have been increasingly interested in the choice experiment method. Several recent studies [17–19] have estimated the Willingness To Pay (WTP) for improvements in urban green spaces using the contingent valuation method, whereas other studies have used choice experiments to explore preferences for various urban forest attributes and green infrastructure in developed countries [20,21]. However, there is a gap in the literature on the use of the choice experiment to investigate people's preferences and willingness to pay for urban forest ecosystem services in Thailand; only a small number of economic valuation studies have been conducted to estimate the value of urban forest resources in the country. For example, Yotapakdee et al. [6] evaluated the monetary value of the benefits of big trees in Bang Kachao by using the market value of the available timber and carbon credits. Another example is the recent study that focused on valuating the total benefits of Yang Na, a plant species, in an urban area using the contingent valuation method [22]. Nevertheless, the choice experiment method has not been applied to the context of urban forests in Thailand. This study, in particular, has an emphasis on whether the choice experiment technique can be applied to obtain information associated with Thai people's preferences for various types of ecosystem services provided by an urban forest.

The objective of this study is to examine the preferences and WTP of residents in the Bangkok metropolitan area for enhancing the ecosystem services provided by the Bang Kachao Green Area through a choice experiment design. In this study, we identify factors that influence the estimated WTP and explore how important each ecosystem service attribute is in driving decisions regarding the WTP and which levels within each attribute are preferred. We expect to provide useful information for policymakers on designing community-supported strategies and to aid the design and implementation of PES schemes for enhancing ecosystem services in the Bang Kachao Green Area and other urban forest areas, especially in developing countries.

This paper is organized as follows. In the next section, we introduce the concept of non-market valuation, especially the choice experiment method, as well as the economic and econometric models. Then, in the method section, we describe the study area and the four steps in the choice experiment survey, including the model and welfare estimation. This is followed by the results. In the final section, we discuss our findings and provide policy implications.

2. Non-Market Valuation through a Choice Experiment

2.1. Non-market Valuation Methods

Natural ecosystems provide not only services that have value in the market but also non-market-value benefits. Because environmental goods and services often provide non-market benefits, a range of economic valuation methods for non-market goods and services are used to estimate these types of outcomes. The methods for measuring these economic values are the revealed and stated preference techniques, which measure the increase or decrease in the utility or economic value of environmental changes for individuals. The revealed preference approaches, such as hedonic analysis and the travel cost method, rely on aggregated data that represent people's behaviors observed in the marketplace to assess preferences regarding the environment. Although the revealed preference approaches are useful, they are not applicable to non-use valuation. There has been increasing interest in the use of stated preference techniques to help estimate non-use values. In theory, the primary advantage of stated preference over revealed preference methods is that they are capable of measuring preferences for both use and non-use values [12,13]. Unlike revealed preference methods, the stated preference methods assess individuals' values directly through survey methods, rather than observing actual choices made by people in marketplaces. Although the widely known drawback of stated preference methods is the real possibility of hypothetical bias, there is evidence indicating that the hypothetical responses in these surveys provide useful data regarding value [23]. The stated preference methods that have been widely used are contingent valuation and choice experiments. Both of these methods require individuals to directly state their preferences for environmental goods. However, the contingent valuation method can be used to estimate the total change in an environmental good, while a choice experiment is capable of valuating multidimensional environmental changes [14].

2.2. Choice Experiment Method

A choice experiment is a survey method that involves asking people to state their preference for hypothetical alternative scenarios, goods, or services, which are combinations of attribute levels generated by the experimental design. Each alternative "good" is described by several attributes in terms of different attribute levels. One of the attributes is the price of the alternative. We used the discrete choice model to analyze how people make choices. Most environmental goods are composites, made up of a variety of attributes that can be provided at various levels. This allows for the estimation of the relative importance of multiple environmental attributes and their levels, unlike contingent valuation, which cannot be used to distinguish the value of each attribute in multi-attribute environmental goods [15].

2.3. The Basis of the Choice Experiment Model

In the choice experiment approach, Lancaster's characteristics theory of value and the random utility model form the basis of model estimation. First, Lancaster's theory of demand states that "the total utility gained from a product or service is the sum of the individual utilities provided by the attributes of that good" [24]. Second, the random utility model provides the theoretical framework in which the variable of interest is the choice of an option. In this framework, the choice of any option is represented by the differences among a set of alternatives. Discussing the random utility model, Seenprachawong [15] stated that each alternative is represented by an indirect utility function that contains two components: a deterministic component (V_i) and a stochastic term (ε_i), which represent unobservable influences on individual choice. The overall utility of alternative *i* is calculated as

$$U_i = V_i + \varepsilon_i. \quad (1)$$

An individual will choose alternative i if $U_i > U_j$ for all $j \neq i$. Because the utilities include a random portion, one can only describe the probability that an individual chooses alternative i as follows:

$$Prob\{i\ is\ selected\} = Prob\{V_i + \varepsilon_i > V_j + \varepsilon_j; \forall_j \in C\} \quad (2)$$

where C is the choice set of all possible alternatives. In the choice experiment, V_i contains attributes of the situation, and in this study, there are three alternatives (status quo, plan A, and plan B). McFadden [25] showed that if the error terms in Equation (2) are independently and identically distributed with a type I extreme value distribution, then the probability of an individual choosing alternative i is given by the multinomial logit model:

$$Prob\{i\ is\ selected\} = \frac{e^{\lambda V_i}}{\sum_{j \in C} e^{\lambda V_j}}. \quad (3)$$

This distribution is characterized by a scale parameter λ that is inversely related to the variance of the error term and a location parameter δ. In practice, the distribution chosen is the standard Gumbel distribution with $\lambda = 1$ and $\delta = 0$ [26]. Assuming that the systematic portion of the utility is linear in parameters, the utility function for alternative i often takes the form

$$V_i = \alpha_i + \sum_{j=1}^{n} \beta_j X_j + \sum_{k=1}^{m} \gamma_{k_i} Z_k \quad (4)$$

where α_i is the coefficient representing an 'opt out'(alternative 'status quo'), X_j is the ecosystem attributes associated with the alternative, Z_k is a vector representing individual characteristics, and α_i, β_j, and γ_k are parameters [27,28]. The four selected ecosystem attributes are included in the model using effect codes. The measurement of welfare changes associated with a change in the level of an attribute can be described by Hanemann [29]:

$$CV = \frac{1}{\mu} [\ln \sum_{i \in C} e^{V_{i1}} - \ln \sum_{i \in C} e^{V_{i0}}] \quad (5)$$

where CV is compensating variation, and μ is the marginal utility of income; V_{i0} and V_{i1} represent utility before and after the change under consideration, respectively. When the choice set includes a single before and after policy option, Equation (5) reduces to

$$CV = \frac{1}{\mu} [V_{i1} - V_{i0}]. \quad (6)$$

From Equation (6), we can see that for a linear utility function, the marginal rate of substitution between the ecosystem service and cost attributes is simply the ratio of their coefficients [30], and that the marginal WTP for a change in the level of an attribute can be calculated as

$$MWTP_j = -\beta_j / \mu. \quad (7)$$

3. Study Area and Methods

3.1. Description of the Bang Kachao Green Area

Bang Kachao is located in Phra Pradaeng district, Samut Prakan Province, in the southern part of Bangkok, covering an area of 21.10 square kilometers within the Chao Praya river basin. It comprises six sub-districts: Song Khanong, Bang Yo, Bang Kachao, Bang Krasop, Bang Namphueng, and Bang Ko Bua. Figure 1 shows the location, with the Chao Praya River (a total length of 17 km) surrounding the oval-shaped green area of Bang Kachao [9].

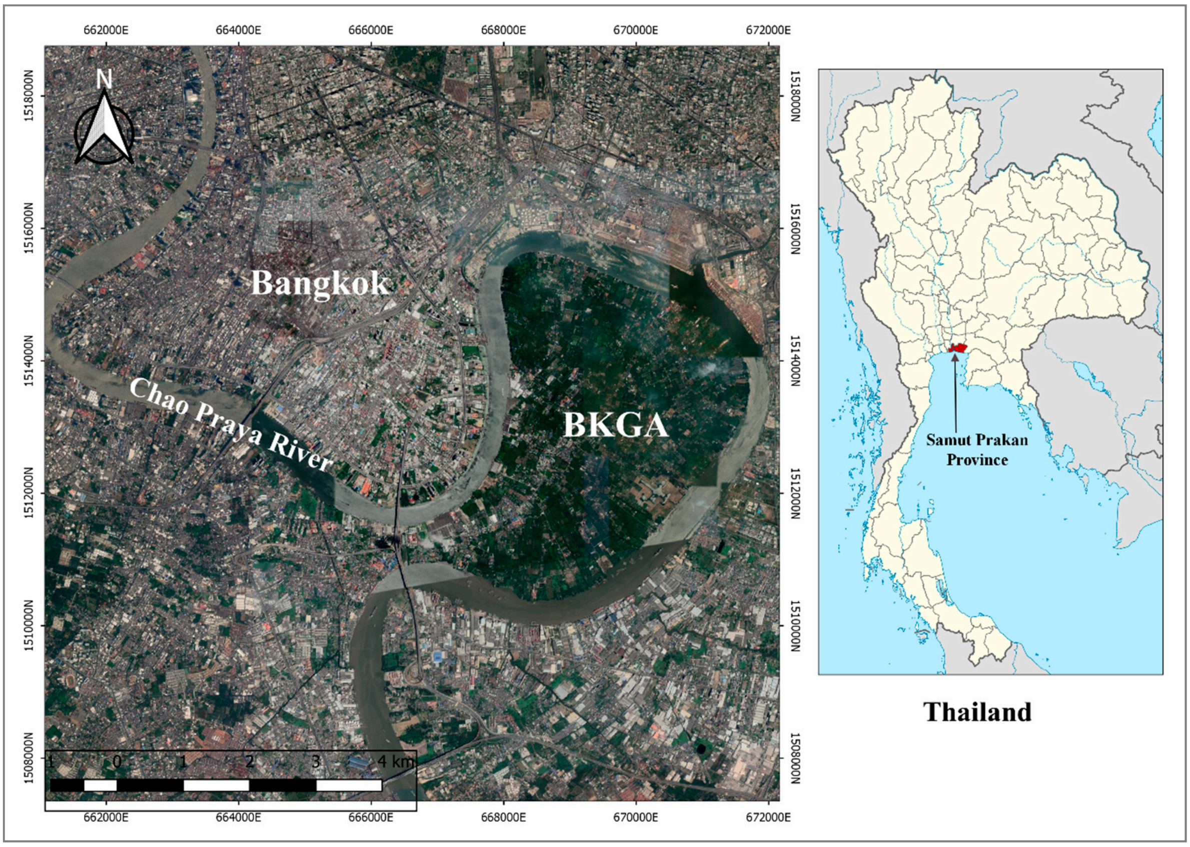


Figure 1. Location of the Bang Kachao Green Area.

The ecological structure of Bang Kachao comprises four main types. The first type is a rehabilitation forest that includes five habitats, namely, moist evergreen forest, dry evergreen forest, floodplain, swamp, and abandoned orchard. Home-garden agroforestry, in which traditional farmers cultivate mixed fruit and native tree species, is the second type. The third comprises mangroves found along the riverbanks. The final type comprises the Sri Nakhon Khuean Khan [7]. Thus, Bang Kachao is ecologically important and contributes significant ecosystem services to sustain urban society [6].

There have been several attempts to protect the green area and sustain its benefits, such as the provision of the main source of oxygen that reduces the industrial air pollution generated by Samut Prakan province. Initially, the government conducted research and sustainable management programs initiated by Princess Maha Chakri Sirindhorn to maintain the integrity of Bang Kacaho. Consequently, the government developed the Sri Nakhon Khuean Khan Park to protect and restore the designated green areas for ecological and recreational benefits. Meanwhile, the Royal Forest Department (RFD) has been conducting restoration and tree planting projects in 10 percent of the area [8]. Figure 2 shows the photo of the park and the greenery's natural beauty and richness in the Bang Kachao Green Area.

Figure 2. The Sri Nakhon Khuen Khan Park and the natural beauty of Bang Kachao (Source: The Royal Forest Department).

However, as a result of urbanization, the quality of this urban green area and the provision of its ecosystem services have been affected. The area of Bang Kachao has decreased through land-use changes. Between 1996 and 2006, about 1.5 square kilometers or 7.11 percent of the total area was transformed from mixed orchards to residential areas. The reduction of green areas causes social disorder due to pollution, including stress and health problems [9].

Bang Kachao was selected for the study because it is the main source of clean air for Bangkok city and provides unique food products and recreational benefits to the public. It represents other urban areas in both Thailand and other countries where polluted urban environments remain a critical issue. Another reason for selecting this green area is that there have been several attempts to protect it, especially with strong community participation in forest conservation. Private sectors such as banking institutions, the hospitality industry, and the manufacturing industry have also supported funding to protect Bang Kachao's green areas through Corporate Social Responsibility (CSR) [8]. Thus, it is important to understand the possibility of implementing a PES scheme in this green area in order to enhance the integrity of the provided ecosystem services while supporting people's livelihoods.

3.2. Survey and Choice Experiment Design

This study focused on the estimation of the welfare gained by improving ecosystem services provided by the Bang Kachao Green Area, and it employed a choice experiment method to estimate the value of, or the so-called WTP for, quality changes in different ecosystem service attributes in the green area. We assume that the present quality of ecosystem services in Bang Kachao is at a status-quo level (no change) and presented respondents with two different restoration projects (Plans A and Plan B) for the Bang Kachao Green Area. We explained that the new restoration projects would improve the quality of ecosystem services gained from the Bang Kachao Green Area. Each plan is described by four ecosystem attributes, which can be assigned to the status-quo, good, or excellent level, and the price attribute. Thus, there were four main steps in the choice experiment survey: selecting attributes and attribute levels, creating choice sets, designing the questionnaire and pretesting, and conducting the survey.

First, the attributes of the Bang Kachao Green Area restoration scenarios were selected from prior research and after discussions with forestry experts in the Royal Forest Department and professors at Kasetsart University, who are experienced with forest ecological restoration projects within the Bang Kachao Green Area. Four ecosystem service attributes and the payment option were designed. The first attribute was food products, a proxy for consumptive use, provided by agricultural areas and mixed fruit orchards within the Bang Kachao area. The second attribute was air quality as a proxy for indirect use or regulating service provided by the green area. The third attribute, recreational amenity, is a proxy for recreational use, including the scenic view of the area and its attractiveness to tourists and visitors. The fourth attribute is bird species richness as a proxy for non-use value or existence value. The bird species richness attribute was chosen because this green area attracts a lot of bird species, including natives and passage migrants, especially in migratory periods. The Bioblitz survey, which was conducted to establish a biodiversity database of the Bang Kachao area, reported about 82 species of birds [31]. Moreover, ecological restoration programs, especially the planting of native fruits and endemic plants, can bring back various bird species [8]. All four attributes were assigned three different levels (no change, good, and excellent), which were defined as a 0 percent, 25 percent, and 50 percent enhancement, respectively. These attribute levels are similar to those included in Seenprachawong [15]. We also designed a payment option (i.e., monetary attribute) that represents a one-year voluntary donation to the Bang Kachao Restoration Fund that would be managed by an independent and trustworthy body. The payment options are 100 Baht (2.9 USD), 200 Baht (5.8 USD), 500 Baht (14.4 USD), and 1000 Baht (28.9 USD). The selected attributes and their levels are presented in Table 1.

Table 1. The attributes and attribute levels used in the study.

Attribute	Level
Food products	Status quo: no change Good: 25% increase in the quantity of food products from the agricultural area and mixed fruit orchards within the Bang Kachao area Excellent: 50% increase in the quantity of food products from the agricultural area and mixed fruit orchards within the Bang Kachao area
Air quality	Status quo: no change Good: 25% improvement in the air quality Excellent: 50% improvement in the air quality
Recreational amenity	Status quo: no change Good: 25% increase in the scenic view Excellent: 50% increase in the scenic view
Bird Species Richness	Status quo: no change Good: 25% increase in the number of bird species Excellent: 50% increase in the number of bird species
One Time Payment (Cost)	0, 100, 200, 500, 1000 Baht

The second step is to combine the selected attributes and levels into several choice sets. The full factorial experimental design produces L^{AC} possible combinations, where C is the number of alternatives and each alternative has A attributes with L levels. However, this produces so many alternatives that it would be overly cumbersome and intellectually demanding for respondents to choose among them. Thus, the fractional factorial and orthogonal design in SPSS (version 17.0) was used to obtain 40 alternatives (Plan A). Then, we used a cyclical design to create an alternative option (Plan B). Thus, each choice set provided three scenarios: The first option is always the status quo or the base alternative; Plan A consists of one of the 40 alternatives; and Plan B is created by increasing one level in each attribute in Plan A. The 40 choice sets were subsequently split into 10 blocks of 4 choice sets, which were distributed in ten versions of the questionnaire.

Subsequently, ten different versions of the questionnaire were created. Each version contains three sections. Every questionnaire version comprises the same information for Sections A and B, but there is a difference in Section C. Section A is used to collect the socioeconomic characteristics of respondents, such as age, gender, marital status, education, occupation, income, and the number of family members. Section B is designed to obtain information regarding the respondent's environmental concerns, experiences, and expectations of the Bang Kachao Green Area. The last section is Section C, the choice experiment, and comprises four choice sets with three alternatives in each set. An example of a choice set is presented in Figure 3. With the consideration of all attributes and a hypothetical payment, respondents were asked to choose which option they thought would be the best plan for the Bang Kachao Green Area and which one they most preferred. Next, we conducted an initial pilot survey with 45 respondents to obtain prior estimates for the experimental design used in the main survey.

Given the following Bang Ka Chao's restoration plans, which one do you prefer? A cost will be required of you if you choose either plan. However, no payment would be required for the "No restoration plan" option, but the condition of ecosystem services would not be improved for the food product, air quality, scenic view, and bird species attributes.

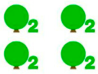
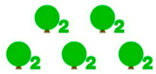
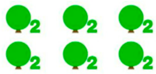
Attribute	**Status Quo (No restoration plan)**	**Plan A**	**Plan B**
Food Products	No change 	Good  25% increase	Excellent  50% increase
Air Quality	No change 	Good  25% improvement	Excellent  50% improvement
Recreational amenity	No change	Excellent	No change
Bird Species Richness	No change 	No change 	Good  25% increase
One Time Payment (Baht)	0	100	200
Please choose the most appropriate			

Figure 3. Example of a choice set from the questionnaire.

The final step is administering the survey through a face-to-face interview. We used a random sampling method by interviewing every fifth person who entered the park; this was conducted between July and September 2016 in five famous public parks in Bangkok and the metropolitan area, namely, Sri Nakhon Khuean Khan Park, Lumpini Park, Chatuchak Park, Suan Luang Rama 9 Park, and Sri Nagarindra Park. Respondents were randomly allocated to one of the 10 blocks (questionnaire versions). The most important part is Section C, the choice experiment questions. In this section, respondents were presented a set of four choice sets. In a given choice set, each respondent was asked to choose his/her most preferred option from three options: two plan options and one status-quo option. As each one had four independent choice tasks in total, a total of 200 interviews generated 800 observations (200 × 4).

In order to code the data from the choice experiment section, effect codes were set up following Louviere [32]. The effect codes used for the food products attribute correspond to FE (excellent food products) and FG (good food products). The coefficients on FE and FG provide the "marginal utility" of these levels of the attributes, while –1 times the sum of these coefficients provides the marginal utility of the average level of food products. Three other attributes (air quality, recreational amenity, and bird species richness) had their effects coded in the same way.

3.3. Model Estimation

Using data collected from 200 face-to-face interviews in the Bangkok metropolitan area and LIMDEP 9.0 software, we analyzed a conditional logit model. The discrete choice experiment method was employed to find the factors affecting WTP in each alternative consisting of different attribute levels.

According to the choice experiment model, ecosystem service attributes were categorized into three hypothetical options for the respondents to choose their most preferred option. These data were used to indicate the importance of the attributes. The monetary and respondent characteristics were also included in the conditional logit model so that we could estimate the WTP for improving the quality of the ecosystem services by maximizing the likelihood function. Subsequently, we estimated the WTP for restoring the green area. We also examined socio-demographic variables that affected the preferences.

4. Results

4.1. Respondents' Profile

The data consist of 200 completed interviews. The majority of the respondents (121 respondents (60.5%)) are women, and 109 respondents (54.5%) are married. People of all ages between 19 and 70 were interviewed, but young people of between 26 and 35 represent one-third of the respondents. The average age is 38 years, and the average number of years of education is 15.41 (bachelor's degree). The average monthly income of respondents is 20,800 Baht (600 USD), while the average household income is 51,000 Baht (1473 USD) per month. Most respondents have an average number of family members of 3–4 people. Of the total, 88 respondents (44%) were found to live in Bangkok; the others live in the surrounding provinces of Samut Prakan, Nonthaburi, Pathum Thani, and Samut Sakhon, accounting for 32%, 13%, 6%, and 5%, respectively. These respondents' information was used to determine if any particular characteristics were associated with the preference and willingness to pay for Bang Kachao's ecosystem services.

4.2. Environmental Concern, Experiences, and Expectations of the Bang Kachao Green Area

Section B of the survey lists questions associated with general environmental concerns, including the experiences and expectations of respondents. These questions seek to understand the motives of the respondents for supporting the protection of Bang Kachao. First, when we asked respondents to choose the most serious environmental problem from various issues of concern, 72 respondents (36%) stated that deforestation was the most serious environmental issue in the country. Twenty-seven respondents (13.5%) were concerned about air pollution. The percentages of the respondents who were concerned about the problems of drought, water pollution, global warming, and biodiversity loss were found to be similar, namely, 25, 23, 21, and 18 respondents (12.5%, 11.5%, 10.5%, and 9%), respectively. Only 8, 4, and 2 respondents (4%, 2%, and 1%) believed that flooding, mangrove degradation, and solid waste were important issues, respectively.

Next, respondents were asked if and how often they had visited Bang Kachao in the last five years. Fifty-six percent of respondents stated that they had visited the Bang Kachao Green Area at least once before the study was conducted. Among these individuals, thirty-five percent had visited the area 2–3 times, thereby suggesting that most respondents were familiar with the area and that at least one-third appreciated the area enough that they made repeat visits. Those who visited the area reported that they had used it for recreational activities such as walking, biking, bird watching, and buying traditional food and fruits. Some residents reported that they had received income from tourists and agricultural products. Although only half the respondents had visited Bang Kachao, most of them (88.5%) perceived that they had gained benefits from this green area, especially air purification (67%). Lastly, when we asked if they would like to visit Bang Kachao within the next five years, 180 respondents (90%) reported they would.

4.3. Conditional Logit Model

For the analysis, after obtaining the 200 valid questionnaires, we used the LIMDEP 9.0 software to estimate the conditional logit models: with no socio-economic variables (Model 1) and with socio-economic variables (Model 2) as presented in Table 2. The coefficients' magnitude and signs of both models are in line with expectations, especially the prediction that the coefficient on cost is negative and significant, meaning that respondents prefer lower costs. Typically, Bangkok residents show a strong preference for an improved level of all attributes: food products, air quality, recreational amenities, and bird species richness. The coefficients on air quality are significant and positive, as expected, for both good and excellent levels. The coefficient estimates for food products, recreational amenities, and bird species richness are positive and significant for the excellent level. This means that respondents value an excellent level of these attributes over other attribute levels. In other words, most respondents prefer an excellent level to a good level. However, the coefficient estimate for the excellent level of bird species richness is only significant at the 10% level and remains the lowest value. Moreover, the age of respondents is the single socioeconomic factor influencing the WTP for restoring the green area; however, the coefficient is negative and significant (at the 10% level).

Table 2. The coefficient estimates for the Conditional Logit Specifications with two models: no socio-economic variables (Model 1) and with socio-economic variables (Model 2).

Variable	Model 1			Model 2		
	Coefficient	T Statistic	*P* Value	Coefficient	T Statistic	*P* Value
Optout	−0.4166 **	−2.2760	0.0229	−0.4301	−0.5690	0.5691
Cost	−0.0015 ***	−9.3690	0.0000	−0.0015 ***	−9.000	0.0000
Excellent food product	0.3139 ***	4.5270	0.0000	0.3198 ***	4.5930	0.0000
Good food product	−0.4971	−0.7280	0.4663	−0.0547	−0.8030	0.4222
Excellent air quality	0.4024 ***	6.0090	0.0000	0.3931 ***	5.8840	0.0000
Good air quality	0.1269 *	1.8610	0.0627	0.1413 **	2.0550	0.0399
Excellent recreational amenity	0.1959 **	2.9130	0.0036	0.1955 **	2.9050	0.0037
Good recreational amenity	−0.0057	−0.0840	0.9334	−0.0036	−0.0520	0.9584
Excellent bird species richness	0.1245 *	1.8230	0.0683	0.1276 *	1.8670	0.0618
Good bird species richness	−0.0758	−1.0970	0.2727	−0.0718	−1.0380	0.2993
Male				−0.0922	−0.4670	0.6408
Age				−0.0171 *	−1.7400	0.0819
Income				−0.4188	−0.5080	0.6116
Education				0.0495	1.2930	0.1961
Log-likelihood		−733.42			−729.27	
No. of respondents		200			200	
No. of observation		800			800	

*** 1% significance level, ** 5%significance level, * 10% significance level.

4.4. Willingness to Pay

Even with the significance and relative size, the implications of the coefficient values presented in Table 2 are not straightforward. We need to compute the marginal rates of substitution between the attributes using the coefficient for the cost as the numeraire [29]. Thus, we interpreted the ratios as the average marginal WTP for a change in each attribute. The results are presented in Table 3.

Table 3. Marginal WTP for a change in each attribute and the average WTP of improved ecosystem services.

Attribute	Status Quo	Good	Excellent	WTP (%) (Baht/Person/Year)
Food products (Consumptive Use Value)	−207	-	207	414 (29%)
Air quality (indirect use value)	−347	92	255	602 (42%)
Recreational amenity (non-consumptive use value)	−127	-	127	254 (18%)
Bird species richness (non-use value)	−83	-	83	166 (11%)
Total				1436 (100%)

1 Baht = 0.03 USD (2016/09/01).

Then, using Equation (6) we assessed the welfare implications of moving from the status quo (no change) to a good level and an excellent level as the compensating variation (CV) [29]. Due to effect coding, the base levels (status quo) of utility coefficients are the negative sum of the other levels of the given attributes. Consequently, unlike in the case of dummy coding, these are not confounded with the alternative specific constant or with each other. Thus, the CV for enhancing food products from the status quo to excellent is 414 Baht/person/year. The CV for improving air quality from the status quo to excellent is 602 Baht/person/year and from the status quo to good is 439 Baht/person/year. The CV for enhancing recreational amenity is 254 Baht/person/year. Besides, the CV for enhancing bird species richness is equal to 166 Baht/person/year. Thus, the average WTP for restoring the ecosystem services of the Bang Kachao Green Area was 1,436 Baht (USD41.5) per person per year. The highest estimated WTP figure is for an excellent level of air quality followed by a good level of air quality, an excellent level of the food product; an excellent level of recreational amenity; and an excellent level of bird species richness (i.e., USD17.3, USD12.7, USD12, USD7.3, and USD4.8, respectively). The average WTP estimates are as shown in Table 3.

5. Discussion and Conclusions

Urban dwellers in Bangkok seem to have a desire to improve the ecosystem services of the Bang Kachao Green Area. This concern is indicated by the relatively high WTP estimates for ecoservice attributes and also by the fact that approximately 56% of respondents had visited Bang Kachao. Among the “experienced” respondents, about 89% were aware of the benefits of the environment.

Using a choice experiment, we estimated both use and non-use values of changes in the quality of ecosystem services in the Bang Kachao Green Area. Our results indicate that residents in Bangkok are willing to pay 1436 Baht (41.5 USD) per year for improved ecosystem services in the green area. The respondents considered enhancing air quality to be the most important ecosystem service in this green area, followed by food production, recreational amenities, and bird species richness.

Our findings for the air quality attribute are in line with the international literature that reports that urban forests provide significant value related to air quality improvement [33,34]. For instance, a study in Beijing, China, used the expert Delphi and choice experiment method to rank the importance of six ecosystem services and revealed that air quality regulation was the most important ecosystem service for citizens. This study in Beijing found that the average willingness to pay to expand forests for improving air quality was approximately 12.2 USD and 17.3 USD for levels from low to middle and from middle to high, respectively [35]. Similarly, a study in Hong Kong revealed that most citizens perceive urban trees to be valuable for improving air quality [36]

Non-use values such as bird species richness are relatively less familiar, and there has been quite a bit of controversy surrounding the species diversity of birds in the region. Therefore, bird species richness may be regarded by the general public as less significant [15]. Although the use value of green areas retrieves higher welfare estimates than non-use values, non-use values also have an importance in adding value to ecosystem services. Promoting the understanding of supporting services and providing evidence of this benefit to urban society and individuals remains necessary for preserving biodiversity in the urban forests [1,37].

In this study, we investigate the effect of socio-economic variables on their WTP and choices by integrating individual characteristics into our conditional logit model [38,39]. We found that the age of respondents is a significant socioeconomic factor that affects the WTP for improving the green area. Compared with older people, young people were more amenable to paying for a better quality of ecosystem services in the green area. This result is consistent with previous findings [40–42]. Because the Sri Nakhon Khuankhan Park, a public park in Bang Kachao, provides various outdoor activities, such as jogging, riding bicycles, and environmental education programs for young groups [43], and it is also a well-known check-in location among young Facebook users, young people are likely to value this green area more than the aged groups do. However, this study did not find any evidence that income has a statistically significant influence on Bangkok residents' preferences regarding the ecosystem service attributes in Bang Kachao, which supports the previous findings of Koo et al. [21] that the benefit of urban forests is an essential good for urban dwellers in large cities.

In this study, we found that the overall WTP for restoring the ecosystem services of the Bang Kachao Green Area was 1436 Baht (41.5 USD) per person per year. The total value for the entire population (10.77 million people) of the Bangkok Metropolitan Region was 446.7 million USD and much higher than the monetary value of big trees in Bang Kachao, estimated using market-based methods, which was 281,364 USD annually [6]. Our choice experiment study took non-use values into account and estimated the total economic value of the urban green area, which differs from previous studies that only covered a particular part of ecosystem services in their economic valuations [6,12,13]. However, our data do not perfectly represent the population of Bangkok in terms of statistics when it comes to the proportions of demographic characteristics and social statuses, such as age, education, job, and income. Our sampling data include a high proportion of public servants relative to the census data of Bangkok, Thailand (e.g., the proportion of the civil servant group is less than 25%), which results in the over-estimation of mean WTP [44,45]. In this study, we used a limited number of survey samples, which can produce a coverage error in a statistical analysis, although we used a random sampling technique that is commonly used to avoid statistical bias. To address these statistical issues, it is critical to have a sufficient number of samples. Future studies may take this coverage error into account by comparing the difference in mean WTP between large and small samples.

Examining people's preferences for environmental goods is vital because decision-makers need to investigate the impact of various policy options or explore potential responses before implementing any projects related to social wellbeing. One of the main objectives of this study is to examine which ecosystem attributes influence the WTP decisions and the implicit ranking of these attributes through a choice experiment. Thus, we can provide useful information on implementing urban forest restoration programs and suggest that the government and local authorities take proactive steps to establish restoration projects that increase green areas for air purification. For instance, flood-tolerant species such as mangrove and swamp plants may be planted, especially in the exiting mangroves along the riverbanks [46]. In addition, preferences for food products, recreational amenities, and bird species richness need to be taken into account with the air purification benefits. Through traditional agricultural practices, such as mixed fruit orchards and agroforestry, green areas can improve the capacity of providing agricultural products. Urban agroforestry systems may generate another opportunity for traditional farmers, such as ecotourism initiatives, which help to increase the income of local people.

Implementing PES schemes helps to improve ecosystem services in the green area of Bangkok. Urban dwellers in Bangkok can support local communities to maintain their traditional mixed fruit orchards and green areas by providing incentives through voluntary payments, voluntary works, ecotourism, and environmental education activities [10]. In particular, the young generation may be willing to participate in restoration projects or PES schemes, as indicated by the increasing tendency of younger respondents' WTP. Furthermore, the local government and communities may provide recreational opportunities, such as urban forest healing activities, that help to relieve stress and health problems, so the government can satisfy the increasing demand of middle- and retirement-age people for urban green areas [4].

Author Contributions: A.P. designed the questionnaire, conducted the survey, analyzed the data, and wrote the manuscript; Y.L. supervised, edited the manuscript, and approved the final version; J.B.C. edited the manuscript and approved the final version. All authors have read and agreed to the published version of the manuscript.

Funding: This was supported by the 2019 Yeungnam University Research Grant.

Acknowledgments: We would like to express our appreciation to all anonymous reviewers for their constructive comments and suggestions to improve our manuscript. The Asian Forest Cooperation Organization (AFoCO) supported Areeyapat Petcharat through the graduate scholarship of her PhD program.

Conflicts of Interest: The authors declare no conflict of interest.

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