# ESTIMATION OF THE WILLINGNESS TO PAY FOR PRESERVING PUBLIC PARKS IN NAGASAKI CITY BY USING CONTINGENT VALUATION METHOD

by

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The main objective of the study is to estimate the willingness to pay (WTP) for conserving public parks in Nagasaki City. In doing so, contingent valuation method is applied. The results of the study showed that the residents of the Nagasaki City are willing to pay in total 920 million yen (5,225 yen per household) for preserving the public parks in the city. The negative relationship between the persons visiting the public parks and the WTP, revealed from the multivariate analysis indicates that, non-use value of public parks in Nagasaki City is also very high. Finally, based on the findings of the study, some policy guidelines were given for development and maintenance of public parks in Nagasaki City, which will in turn enhance its livability.

*Key Words: public parks, willingness to pay, contingent valuation method, non-use value, multivariate analysis*

## 1. INTRODUCTION

Public parks provide different benefits to the community such as: recreational benefits, economic benefits, environmental benefits, safety benefits and so on. Among them environmental benefits provided by public parks are stressed strongly, as parks significantly improve surrounding environment by contributing to the heat island phenomenon by increasing greenery, reducing air, water, and noise pollution, and helping in wildlife preservation. Also recently the Japanese Ministry of Land, Infrastructure and Transport underscored the need for public park maintenance and development, by including it as one of the key agenda amongst thirteen targets set for future public works projects in Japan[1]. In this context it is interesting to investigate the state and condition of public parks in Japan. In doing so we took the Nagasaki City as a case to value the public parks in Nagasaki City by estimating the willingness to pay (WTP) for preserving it.

## 2. BACKGROUND OF THE STUDY

In the ranking list of easily livable urban cities, Nagasaki is ranked as 497th C grade city among 678 urban cities of Japan, where the rank C denotes the fifth rank among seven levels of ranking [2]. For an exotic city like Nagasaki, having long traditions of international linkage, this ranking is very unfortunate. Among the ranking parameters, one of the important factors is the ratio of per person square meter (PPSM) of public parks. This ratio of PPSM is alarmingly low in Nagasaki City as compared to the national standard and actual national average of Japan. As we can see in **Fig. 1**, national standard of public park is 9.5 PPSM and the actual national average is 8.1 PPSM. Whereas, in Nagasaki city it is 6.6 PPSM. Thus, although being a hillside city where public parks have more wide uses, adequate space or number of public parks are lacking in Nagasaki City, which can be considered as one of the important reasons for making the Nagasaki city poorly ranked urban city.
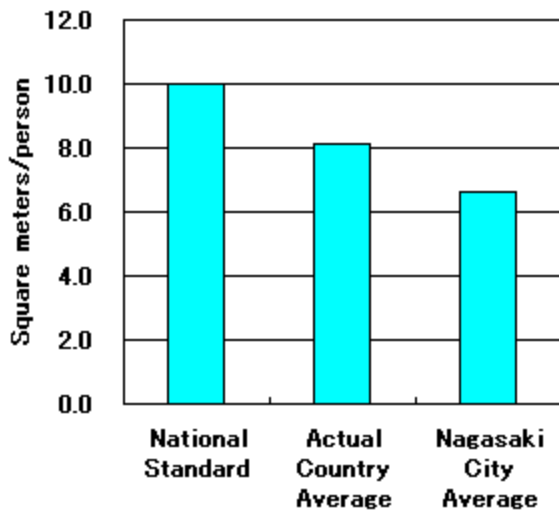
**Fig.1**  A comparison of square meters
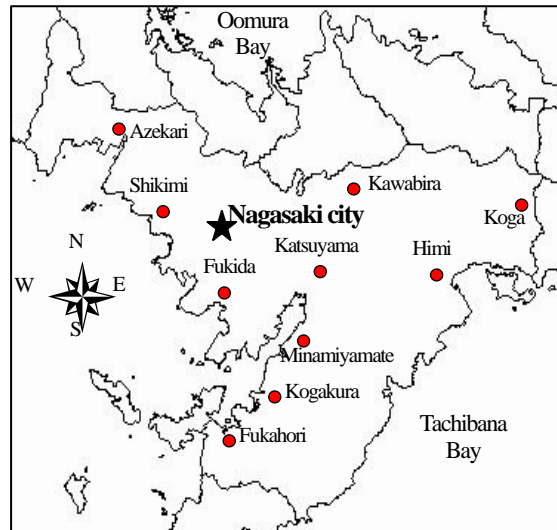of   public parks per person



**Fig.2**  Survey area in Nagasaki City

Now, on the basis of the background portrayed above, it is interesting to investigate how the residents of Nagasaki City are viewing the need for public parks, in order to plan for the increase and improvement of it. And one common and more easily understood method to articulate the need of some public good, is to express it in monetary terms by valuing it. Consequently, in this study we are going to estimate the willingness to pay for preserving the nearest public parks as a means to express the urge for the maintenance and development of public parks in Nagasaki City. As a method for estimating the WTP, we are going to use contingent valuation method (CVM). The results of the study are expected to provide some concrete guidelines to the concerned interest groups in deciding about the development and/or increase of public parks in Nagasaki City based on empirical study results.

## 3.  OBJECTIVES OF THE STUDY

Accordingly, the main objective of this study is to value the public parks in Nagasaki City by estimating the willingness to pay (WTP) for preserving it, which will provide us a monetary estimate about its importance. And the more specific objectives of the study are as follows:

    a)  To identify the explanatory factors influencing the willingness to pay.

    b)  To trace out the main problem (s) prevalent in public parks.

    c)  To suggest ways to concerned bodies for improvement and development of public parks.

## 4.  WHY CONTINGENT VALUATION METHOD?

In valuing environmental goods like public parks, the value includes both use (value derived from actual use of a good or service) and non-use (also referred to as passive use values, are those not associated with actual use, or even the option to use a good or service) values, because there are people who regularly go to parks and also there are a large group of people who do not go to parks, but feels the need of it and want to pay for it. Accordingly, contingent valuation method (CVM) would be relatively more appropriate for our study, which is used to estimate both use and non-use values and can be applied to find economic values for almost all kinds of environmental amenities. Since non-use values are also significant, other methods, such as the travel cost method, would underestimate the benefits of preserving the public parks.

## 5.  METHODS

### (1) Overview

In this study double bounded dichotomous-choice (DC) elicitation method has been used for deriving the WTP figures. For calculating the mean WTP, non-parametric estimation Turnbull method is followed, which uses equation (1) to calculate the WTP.

**Table 1**   Contents of the questionnaire used in the survey

| Category of questions | Contents of the questions |
| --- | --- |
| A<br>Current status of public parks | A detailed description regarding the possible and potential use of public parks, their current status in Nagasaki in comparison with the national standard of Japan were elaborated, with the aid of pictures, graphs and supporting data. |
| B<br>Warm-up questions regarding the image of public parks | 1. How far do you know about the possible use of public parks?<br>2. What kind of place is a public park to you?<br>3. How many times in a month do you go to public parks and the reasons for going (if you go) and the reasons for not going (if you don't go)? |
| C<br>WTP elicitation questions | 4. *Suppose the closest public park to your residence is going to be disappeared for some reason. In order to protect and preserve the parks, we are going to establish a 'Public Parks Protection Fund'. Would you be willing pay ---------- yen in this fund, for preserving the public parks in Nagasaki city?* (This was followed by a follow-up question where the amount is increased or decreased, depending on whether the respondent's initial answer was positive or negative, respectively).<br>4-1. Reason for willing to pay<br>4-2. Reason for not willing to pay |
| D<br>Socio-demographic questions | 5. Gender and family member<br>6. Age<br>7. Profession<br>8. Name of the town, period of stay, and name of the closest public park<br>9. Annual Income<br>10. Free comments |

$$LL = \sum_{i \in yy} \ln S(T_{hi}) + \sum_{i \in nn} \ln \left[1 - S(T_{li})\right]$$
$$+ \sum_{i \in ynorny} \ln \left[S(T_{li}) - S(T_{hi})\right] \qquad (1)$$

Where, $LL$ is the maximum likelihood estimate. $S(T)$ denotes the probability to accept bid value $T$, $T_{hi}$ is highest bid value and $T_{li}$, the lowest bid value to the *ith* individual. On the other hand, *yy* shows the set of respondents who answered yes for both the bid values. Accordingly *nn, yn,* and *ny* represent the set of respondents who responded both time no, first time yes and then no and first time no and then yes, respectively.

The estimated mean WTP is extrapolated to the total number of households in Nagasaki City to calculate the aggregate willingness to pay of the residents of Nagasaki City for conserving public parks. Then, a multivariate analysis is conducted by forming an econometric model, to check the variables having influence on WTP.   Finally, the results of the multivariate analysis is verified by running diagnostic tests for identifying the existence of outliers, if any and ensuring the robustness of the full model.

**(2) Survey Description**
**a) Study region and selection of respondents**

The questionnaire was sent to a random sample of 1,000 households of Nagasaki City. The distribution of the sample respondents is shown in **Fig. 2.**   Mail survey technique was used for data collection and households are selected randomly from the registered telephone directory.

**b) Pre-testing study**

A Pre-testing study was conducted before entering into the final survey. A total of 23 respondents of different age and profession were questioned to test the survey instrument. Bid values were varied between 1000 yen to 12,000 yen and dichotomous-choice elicitation method was used. In the pre-testing study, the mean WTP were estimated to be approximately 4,077 yen. Based on the experience of the pre-testing study, the final survey questionnaire was modified to some extent and the numbers of bid values were finally fixed to five.

**c) Contents of the questionnaire**

The questions contained in the questionnaire of the study can be categorized into four broad headings. The starting bid value is changed from
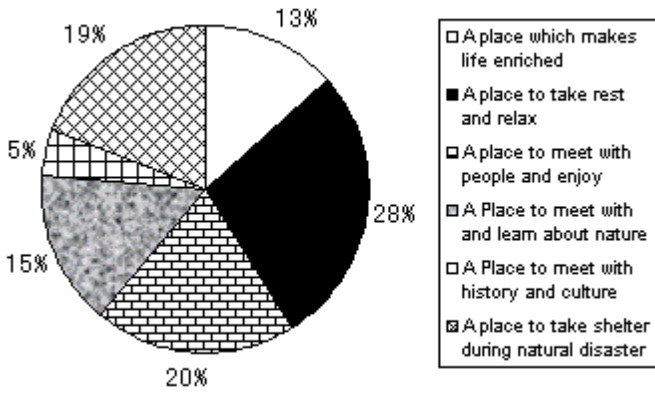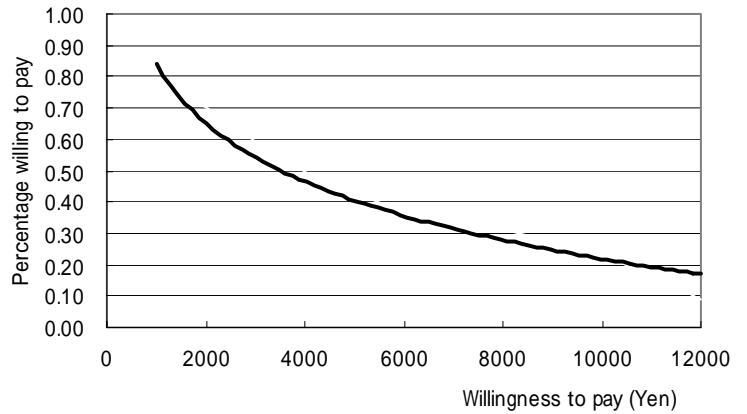
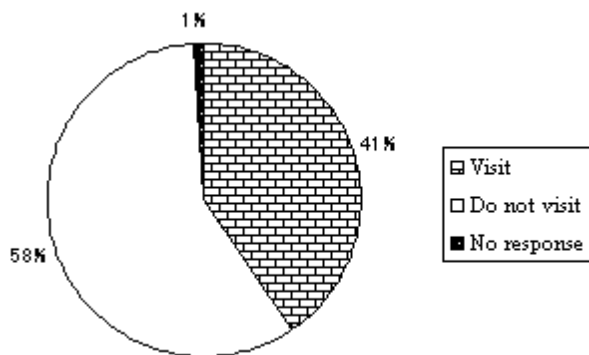**Fig.3** Image of public parks in Nagasaki City



**Fig.4** Visit rate of respondents to the nearest public parks

**Table 2** Bid values used under double-bounded dichotomous-choice elicitation method

| Versions | Starting Bid Value (Yen) | Second Bid Value | |
|---|---|---|---|
| | | YES (Yen) | NO (Yen) |
| First | 2,000 | 4,000 | 1,000 |
| Second | 4,000 | 6,000 | 2,000 |
| Third | 6,000 | 8,000 | 4,000 |
| Fourth | 8,000 | 10,000 | 6,000 |
| Fifth | 10,000 | 12,000 | 8,000 |

**Table 3** Actual versus study demographic characteristics

| | Nagasaki City | This Study |
|---|---|---|
| Age (Year) | 42.4 | 58.9 |
| Percent Male | 47 | 49 |
| Annual Income (in ten thousand yen) | 403 | 488 |

2,000 yen to 10,000 yen divided into five different bid values, which were randomly assigned to survey



**Fig.5** Percentage of respondents WTP

respondents. The contents of the questionnaire and the bid values are summarized in **Tables 1** and **2**.

**d) Response rate and non-response bias**

The response rate was approximately 20 percent. Based on the experience of the mail survey response rate of studies conducted in Japan, the response rate in our study can be considered to be satisfactory for conducting the CVM study[3), 4)].

The basic assumption is that, persons having interest on public parks have returned the questionnaire. However, we have attempted to determine non-response bias usually arises from lower response rate and we have found no such possibility by comparing the means of the survey demographic variables with that of the actual data of the Nagasaki City (see **Table 3**). As we can see from the table, that the *age, percent male* and *annual income* of the respondents of the study are a little bit higher form that of the actual data of the Nagasaki City, but this difference is not so significant. From this we can conclude that, the sample of 194 is representative of the population we sampled from.

## 6. RESULTS

### (1) Image of Public Parks

Regarding the image of public parks to the respondents of Nagasaki City, 28 percent and 20 percent of the respondents reported to be a place to rest and relax and also a place to meet with people respectively (see **Fig. 3**). But image of parks as a place to meet and learn about nature were comparatively lower (15 percent). Thus there are possibilities of lack of presence of nature in public parks of Nagasaki.

**Table 4**   Willingness to pay

| | |
|---|---|
| 1. Sample Size (complete) | 194 |
| 2. Mean WTP (¥/household) | 5,225 |
| 4. Standard Deviation of the Mean | 320 |
| 5. Range of 95% confidence interval (¥) | ± 628 |
| 6. Total Number of Households[*] | 176,110 |
| 7. Estimated Total WTP (in million yen) (Row 2 multiplied by row 6) | 920 |

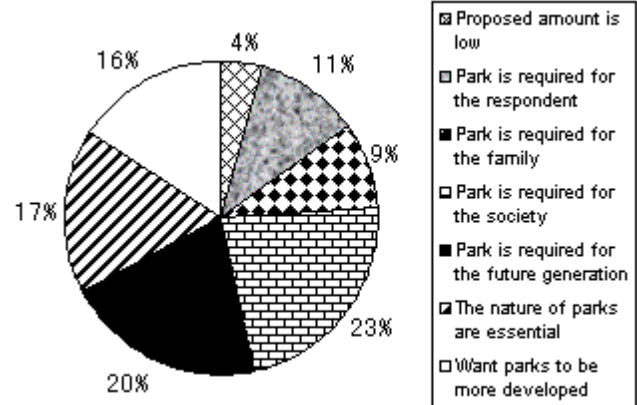[*] *Statistical Yearbook of Japan, 2002* [5)]



**Fig.6**   Reasons for willing to pay

**(2)  Visit in public parks**

In response to the question '*whether the respondent visit parks at least once in a month*', 41 percent of the respondents reported that they visit, 58 percent responded that they do not and 1 percent refrained from answering (see **Fig. 4**). This indicates that a large portion of the citizens of Nagasaki city is not visiting parks regularly.

**(3) Average willingness to pay**

As shown in **Table 4**, by applying the non-parametric estimation under Turnbull method cited above, the mean willingness to pay (WTP) for preserving public parks in Nagasaki City is estimated to be 5,225 yen per household. This indicates that on an average each sampled household in Nagasaki is willing to pay 5,225 yen for preserving the nearest public park. If we plot the mean WTP in percentage form against different amount of WTP, then the WTP curve takes the decreasing slope form as shown in **Fig. 5**. From this graph, the gradual decrease in the percentage WTP with corresponding increase in the amount can be observed.

**(4) Benefit-cost analysis**

Finally, if we extrapolate the mean WTP to the entire household of Nagasaki City, then the economic value for preserving public parks in Nagasaki city would become 920 million yen (see **Table 4**).

**(5)   Reasons for willing to pay**

**Figure 6** presents the reasons why the respondents are willing to pay to protect the public parks in Nagasaki City. From the figure we can see that, the majority of the respondents wants to pay for *preserving parks for the family, society* and *the nature* (23 percent, 20 percent and
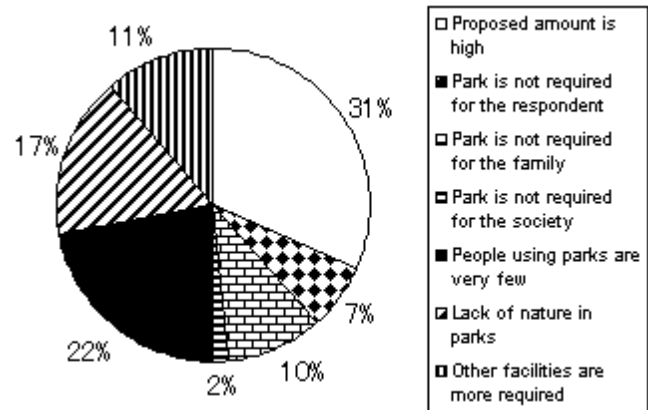


**Fig.7**   Reasons for not willing to pay

17 percent, respectively). On the other hand, only 4 percent mentioned that the *proposed bid value was low* as a reason for willing to pay. Thus the economic value of preserving public parks calculated in this study contains a big amount from the feeling that the parks are also needed for the future generation. And the influence of the proposed amount on the respondents who agreed to pay was insignificant.

**(6)   Reasons for not willing to pay**

Among the reasons for not willing to pay, 31 percent of the respondents quoted that the *proposed amount is high* (see **Fig. 7**). The next major reasons cited are *people using public parks are few* and *lack of nature in public parks* (22 percent and 17 percent, respectively).  Thus, absence of nature and non-visit to public parks seemed to be related, as was also refereed as one of the main reason for not going to parks (see **Fig. 3**).

## (7) Multivariate Analysis

Next, a multivariate model is constructed to determine the factors, which influences willingness to pay for preserving public parks in the Nagasaki City. It comprises the variables that are assumed to have an influence on willingness to pay, such as: bid value, visit, income and demographics. Accordingly, bid value and income are included to test the *rational choice theory*. Visit is included to test the impact of *non-use value*. And finally, demographic variables such as age and sex are included to check whether *social forces* play a role in the willingness to pay. These factors, which are hypothesized to have influence on WTP based on economic theory, can be summarized by the following conceptual model:

WTP = $f$(bid, visit, income, demographics)    (2)

In case of CV studies with dichotomous structure of the dependent variable, the model can be estimated through a non-linear probability model and the most common one is the logit model[6]. Because of the discrete nature of the dependent variable, the ordinary least square regression can be used to fit a linear probability model, but its heteroskedastic nature of the error terms and the possibility to predict values beyond the range of 0 and 1, led us to use the logistic regression model.   Accordingly, the logistic regression model, which can be developed to analyze hypothesized model in Eq. (2), takes the following shape:

Ln[prob(yes)/{1-prob(yes)}] =

$b_0$-$b_1$ (lbid)+ $b_2$ (visit)+ $b_3$ (income)+ $b_4$(age) +$b_5$(sex)

(3)

The explanation of the variables and the descriptive statistics are presented in **Table 6**. The willingness to pay is expected to be inversely related with the bid value, positively with the number of visit and the ability to pay (income).

### a) Results of the multivariate analysis

Logistic regression results are presented in **Table 5** and the analysis is conducted by SPSS. The results of the model indicate that, the coefficient of lbid, visit, income, and age are statistically significant. On the other hand, the

**Table 5** Results of the model

Dependent Variable = WTP (probability of responding yes)

| Variable | Model Coefficient (Wald Stat) |
|---|---|
| Constant | 1.8838(0.4850) |
| Lbid | -0.6653(5.2664)[a] |
| Visit | -1.2906(14.0117)[a] |
| Income | 0.0025(12.3353)[a] |
| Age | 0.0546(11.8240)[a] |
| Sex | -0.1158(0.1133) |
| Initial log –likelihood value | 270.058 |
| Ending log –likelihood value | 226.865 |
| Model Chi-Square | 43.194 |
| Correct Predictions | 71.94% |
| McFadden's $R^2$ | 0.16 |

Note: [a] Indicates that the coefficient is statistically significant at, at least, the .10 level
        [b]McFadden's $R^2$ is one of the Psedudo-R-Square , varies between 0 and 1, is calculated as follows:
  McFadden's $R^2$ = 1-[ending log-likelihood value/ initial log-likelihood value]

sex coefficient is insignificant According to the model chi-square statistic; the overall model is significant at the 0.01level (critical value = 13.277 [df=4]). The model reasonably predicts 71.94% of the responses correctly. And also the McFadden's $R^2$ is calculated as 0.16.

### b) Interpretation of results

The regression coefficients of the Model with a log-linear valuation function can be interpreted loosely as the percentage change in the WTP for one-unit change in the level of each explanatory variable[7]. Accordingly the willingness to pay for preserving public parks decreases dramatically if the bid value is increased and the respondent is a non-visitor (by about 67% and 129%, respectively). And for every yen rise in income, WTP is increased by about 0.25%. Also with an additional increase in years of age, WTP increases by about 5.46%.

### c) Casewise diagnostics

Diagnostic tests were run on the multivariate models. The analysis of misclassification of individual observations showed only one misclassified cases providing an inadequate base for further analysis. As the number of misclassification is very low, no further diagnostic analysis is conducted [8].

**Table 6** Variables and Descriptive Statistics (n =194)

| Variable Name | Variable Description | Mean | Standard Deviation |
|---|---|---|---|
| Age | Age of the respondent in years | 58.90 | 12.12 |
| Lbid | Natural log of the proposed bid value | 8.57 | 0.57 |
| Income | Annual income of the respondent's household (in ten thousand yen) | 487.76 | 259.49 |
| Sex | Gender of the respondent. Male =1, Female = 0 | 0.4949 | 0.5013 |
| Visit | Whether the respondent went to visit public parks at least once in a month. Yes =1, No=0 | 0.4082 | 0.4928 |
| Yes | Yes =1 if they are willing to pay and 0 otherwise | 0.4541 | 0.4992 |

## 7.  SUMMARY AND POLICY RECOMMENDATIONS

The results of the study lead us to the following observations and conclusions:

1) Both the average WTP of 5,225 yen and the aggregate WTP of 920 million yen signifies the overall importance of preserving public parks in Nagasaki City. This amount should be considered as a vital amount by the policy makers in rethinking the need of developing and improving public parks in Nagasaki City.

2) As explained in **Fig.4**, approximately half of the respondents reported that, they do not visit public parks once in a month and absence of nature was one of the main reasons cited for not visiting. Also this was the third major reason for not willing to pay (see **Fig.7**).

3) The WTP model indicated that, willingness to pay is positively influenced by age, income and on the other hand, negatively by bid value and visit. Thus, the model satisfies the trend of rational choice theory, as the WTP decreases with the increase in bid value and increases with increase in the ability to pay (income). Lastly, positive coefficient of the age variable signifies that social forces do play an important role in the willingness to pay.

4) Among these, the visit explanatory variable is very important in our study, which pointed out that the respondents' willingness to pay decreases if he/she is a visitor. This indicates that the non-visitors are willing to pay more for preserving the public parks, reflecting higher non-use value of public parks in Nagasaki City. Hence in addition to the use value (value from the current visitors), the non-use value (value from non-visitors) of public parks is also very high.

Based on the findings of the study discussed earlier and summarized above, the following points can be suggested as policy recommendations for the concerned interested groups:

1) The estimated aggregate WTP of 920 million yen might be considered as an amount which if the policy makers spends to develop public parks in Nagasaki City, would increase the utility of the residents of Nagasaki instantly, as they are already willing to pay for it.

2) As summarized in point 2 above, necessary steps should be taken to increase natural environmental presence in public parks and reduce artificial setups, which would in turn increase the number of visitors in parks.

3) As *living environment maintenance* by developing more public parks is becoming one of the top agendas for both the local and central government in Japan, the WTP amount derived from this study might be used as a base for financing the development of public parks.

4) Environmental valuation techniques such as CVM used in this study, might be considered as one of the alternatives to know the opinion of the residents in monetary figure and incorporate them in the do or not to do decision (benefit-cost analysis).

Finally, it can be concluded from the findings of the study that, although public parks are not sufficient in the Nagasaki City compared to the national standard and average, but they are considered to be important both by

present and potential users and are valued highly. Appropriate steps should be taken by policy makers to increase and preserve the public parks in the Nagasaki City with increased existence of natural environment. This would definitely make life in Nagasaki City more comfortable and raise its livability.

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