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The economic value of urban forest amenities: an application of the contingent valuation method

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Abstract

Green spaces have important amenity values contributing to the quality of urban life. The deconstruction of green spaces cause negative externalities e.g. the loss of non-priced benefits. In land-use planning, therefore, amenity values should be systematically assessed and measured commensurately, i.e. in monetary terms with material values. This paper discusses the suitability of the contingent valuation method in assessing urban forest benefits, and presents the main results of an empirical study conducted in Joensuu, the capital of North Carelia, Finland. The study was designed to measure the use-values of urban wooded recreation areas, and the residents' willingness to pay for small forest parks contributing to the quality of the housing environment. The results suggest that most visitors were willing to pay for the use of wooded recreation areas. Furthermore, approximately half of the respondents were willing to pay to prevent the conversion of forested parks to another land-use. The results can be used to assess the profitability of the management of urban forests. In addition, the results are useful in assessing the value of green space benefits in different land use options.

Keywords: Contingent valuation; Urban forests; Amenity values; Environmental impact assessment; Urban planning

1. Introduction

Many qualitative surveys show that urban forests are an appreciated characteristic in the home environment (Suomalaisten elinympäristö: toiveet ja todellisuus, 1992; Kuntien maapolitiikka ja sen vaikutukset asukkaiden ja yritysten sijoittumiseen eräissä Etelä-Karjalan kunnissa, 1987). Most of the values attached to urban forests are non-priced environmental benefits that include e.g. pleasant landscape, peace and quiet and potential recreation opportunities (Robinette, 1972; Grey and Deneke, 1978; Miller, 1997).

Benefits and costs of land-use change and management of urban forests are often assessed in monetary terms. Qualitative valuations of green spaces are difficult to integrate into the assessment procedure. Nonetheless, if the benefits are not valued explicitly, they will still be valued implicitly through policy decisions. At present, many municipalities have not specified their urban forest policies and many forested areas are considered as left over areas waiting for more intensive use (Löfström, 1990, 1998). Low appreciation of green spaces is also reflected in the recent cuts in the maintenance budgets of many towns.

Quantitative information concerning urban forest benefits is needed as a component for urban land use planning. Urban development projects have negative

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externalities, loss of the amenity values of green spaces, which should be taken into consideration in planning. Suitable methods for the monetary valuation of the benefits are contingent valuation (CVM) and hedonic pricing methods (HPM). The travel cost method (TCM), which is widely used in estimation of recreational benefits, has limited applicability in urban settings because there is often no travel or similar expense involved in accessing the areas (Tyrväinen, 1994).

The CVM is at present the most frequently applied method in the valuation of environmental assets. Mail surveys or interviews (in person or by telephone) are normally used in data collection. In a CV survey the respondents are asked what they are willing to pay (WTP) towards the preservation or an improvement of an environmental asset. The researcher can then estimate the monetary value of the asset by calculating the average WTP of respondents and multiplying this by the total number of consumers. As the CV questionnaire is the principal tool for using the method, formulating a good questionnaire is crucial.

Typically, CVM surveys have three types of components: a description of the good being valued and the situation in which the respondent has to imagine him/herself; willingness to pay questions for the environmental good; and questions concerning general attitudes towards the good in question and the socio-economic characteristics of the respondent. The problems of survey design have been widely discussed and carefully documented in the literature (e.g. Cummings et al., 1986; Carson, 1991; Arrow et al., 1993; Freeman III, 1993; Mitchell and Carson, 1993; Turner et al., 1994).

CVM provides a way of assessing a larger number of amenities than do indirect methods such as TCM and HPM (Mendelsohn and Markstrom, 1988; Carson, 1991). For instance, CVM enables the estimation of the willingness to pay for wooded green spaces or facilities for urban recreation areas which are contemplated but not yet provided. Furthermore, it is the only method that produces direct estimates of amenity values for benefit-cost analysis. Carson (1991) suggests the use of conservative estimates such as 5% trimmed mean WTP in the final calculations or presentation of a range of values.

This method has been widely applied in the USA. Carson et al. (1995) list about 2000 references on a great number of subjects including applications dealing with water and air quality, health risks and wildlife. CVM has also been accepted as a method for natural resource damage assessment (Arrow et al., 1993). In Europe, the method has not yet found routine application (Navrud, 1992). The primary reason seems to be the absence of a legal obligation to require a monetary evaluation of environmental policies, and also scepticism about the method by policy-makers (Hoevenagel et al., 1992).

Empirical applications seeking to determine the amenity values of urban forest in monetary terms have been few. In the US Darling (1973) has used CVM to study the value of amenities at urban parks and Dwyer et al. (1989) for measuring the urban dwellers' WTP for trees in recreation areas. In Germany, Elsasser (1994) has applied the method in a study dealing with the recreational use of forests. In Finland, the CV method has been used for estimation of benefits of regional recreation areas on the outskirts of Helsinki (Mäntymaa et al., 1992).

One of the special characteristics of green areas in Finland is their 'natural state'. In Central Europe the majority of areas are man-made parks while in Finland most green spaces are formed from preserved forest vegetation (Tyrväinen, 1997). The public sector is responsible for the supply of green spaces. This usually means that people have already paid for their provision through taxes. Furthermore, in Nordic countries forest recreation is traditionally based on the right of public access to all natural, undeveloped areas ('everyman's right'). These facts may cause negative attitudes towards WTP questions concerning urban forest use (e.g. Bostedt, 1995a; Mäntymaa, 1997).

The aim of this study was to apply CVM for the valuation of urban forest benefits in Nordic conditions, where most green spaces are formed from preserved forest vegetation and the use of forests is based on free access to all forest areas. The purpose of the investigation was to measure the use-values of wooded recreation areas and the residents' willingness to pay for forested parks.

2. The study area and the survey

The study was conducted in Joensuu, a town of 48 000 inhabitants in North Carelia, in eastern Fin-

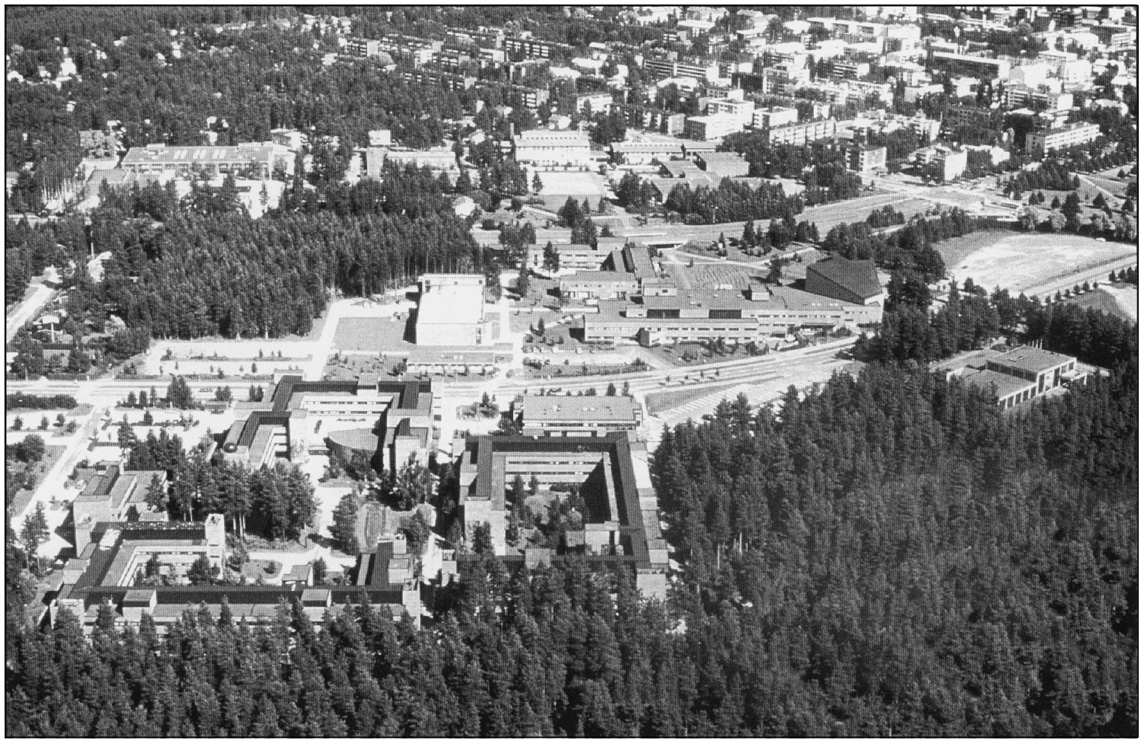

Fig. 1. The majority of green spaces in Joensuu are forested parks, dominated by Scots pine, preserved from natural forest vegetation. View to the north from the University area.

land. The terrain of the town is rather flat and typical features in the landscape are water and abundant urban forests. Joensuu is bounded on the south and southwest by Lake Pyhäselkä, and the River Pielisjoki runs through the town centre. Green spaces represent 34% of the town area, the majority of which is forested parks preserved from natural forest vegetation (Fig. 1). The dominant tree species in 69% of the forest areas is Scots pine and most of the areas are middle-aged (50–60 years old) forest stands. The town has two main wooded recreation areas within town limits. In addition, most of the housing areas have some sort of wooded recreation area with facilities such as skiing and jogging trails.

The CVM questionnaire was sent in spring 1995 to 500 randomly chosen Joensuu residents between 15 and 75 years of age. The sample was drawn from the database of the Finnish Official Register of Persons and Addresses. Two follow-up letters were sent to increase the responses. The questionnaire was pretested twice before the main survey; some 80 respondents in two housing districts were involved in the test. The purpose of the test was to see whether the questionnaire was logical and in particular, if the WTP questions were understood correctly. Arrow et al. (1993) suggest assessing the of degree of understanding and acceptance of information with follow-up questions in the survey itself. In this study the comprehension of definition of urban forest was pre-tested using different questions.

The final questionnaire consisted of four different parts. When designing the survey, care was taken to make it interesting also for the non-users of urban forests. First, respondents were made to consider the benefits of urban forests and their use. Subsequently, people were asked to express their valuations in monetary terms.

The first part of survey consisted of instructions for answering, the definition of urban forests with examples (Appendix A) and the attached three maps were explained. The first map presented the size and locations of all urban forests (minimum size 0.5 ha) in the

town. The second one showed the three main recreation areas of which people were asked to state their WTP. The third map presented a potential construction area i.e. a particular green space in the housing district.

The second part of the survey consisted of general questions concerning attitudes towards the use of urban forests. The first two questions dealt with the benefits and negative effects of urban forests. The next seven question dealt with the use of different areas and the type of recreation.

The third part included (willingness to pay) questions. First, the users were asked to state their WTP for the use of the three main wooded recreation areas in the town. The areas differed with respect to the size and location; the largest area, Lykynlampi, was located outside town limits and the smallest, but most frequently used, Linnunlahti area was located in the town center (Fig. 2, Table 1). The respondents were asked to imagine a situation where free access to and use of the areas was denied. It was explained that the

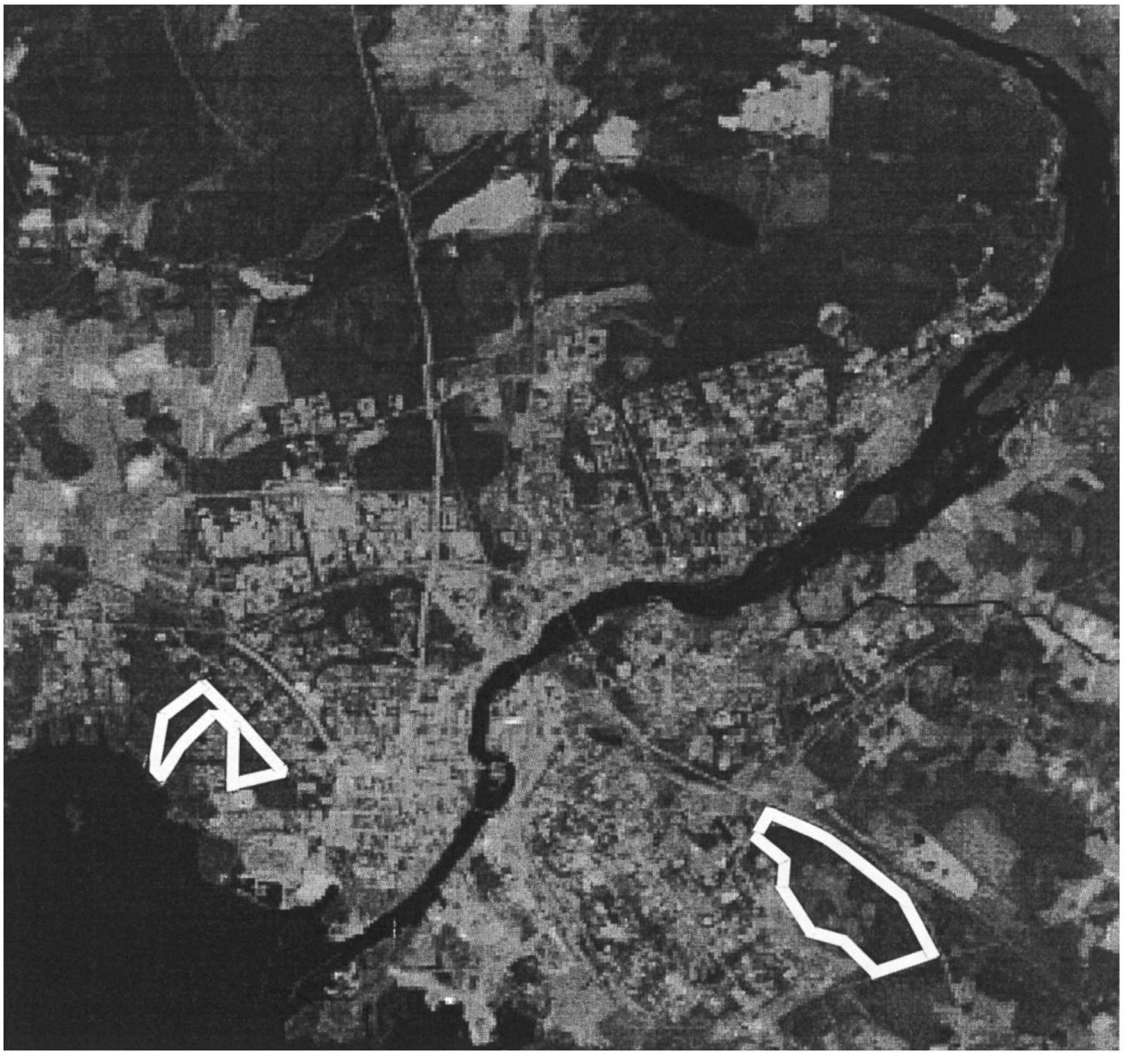

Fig. 2. Satellite view of the study town. The recreation areas used in the survey are located in the south-eastern (Repokallio) and in the western part of the town (Linnunlahti). Lykynlampi is located in the west outside town limits. *ESA, 1988 EURIMAGE, National Landsurvey of Finland/Satellite Image Centre.

Table 1
Description of recreation areas

Recreation area	Size (ha)	Location, average distance (km)[a]	Forests/landscape	Facilities
Repokallio	86 ha	Eastern part of the town, 4.8 km	Mixed forest, varying topography	Nature trail, skiing/jogging trail (1.3 and 3.9 km), lights
Linnunlahti	45 ha	Town centre 3.5 km	Pine forest, flat terrain	Nature trail skiing/jogging trail (1.7 and 3.7 km), lights
Lykynlampi	200 ha	Outside town limits, western part, 10.2 km	Pine forest, varying topography	Lodge, skiing/jogging trails (2.0, 3.0, 6.0 and 11.4 km) lights, orienteering

[a] Measured from the respondents place of residence.

maintenance costs of the areas was to be collected from the users and not covered by taxes because of the recent budget cuts by the town council.

The payment card technique was used because of the preliminary nature of the study. The payment card presents an array of potential WTP amounts to the respondent, who is asked to identify his/her maximum WTP for the good. The method is thought to be less burdensome for the respondent, because the card provides visual assistance. The weakness of the method is that answers may be influenced by the range presented (Boyle and Bishop, 1988; Mitchell and Carson, 1993). Furthermore, the design of a bid-vector for discrete choice questions would have been too difficult without any previous experience of the level of the WTP.

The sample was split into two subsamples to test for the payment vehicle. Half of the visitors were asked to pay an entrance fee per month and half a seasonal fee for the use of recreation areas. The summer season was defined to be five months (May–September) and the winter season seven months (October–April). The question was: ''What would you be willing to pay for a month (or season) to use this recreation area?''. A payment card with a scale from 0 to 300 FIM/month (0–1100 FIM/season, FIM = 0.17 Ecu) was used. The values on the card were presented with a segment of a line divided in 10 FIM (25 FIM) intervals. The question mode also allowed the respondents to specify a larger amount if they wished to.

The second WTP question was connected to the ongoing general town planning project, where the town structure was condensed by seeking additional building sites for housing inside the present housing districts. All the respondents were asked to state their WTP to prevent the development of forested parks in the town for housing purposes. Two potential areas were chosen from two of the main housing districts. Each household was asked to state their WTP for one of the areas. It was explained to the respondents that the areas were owned by a private developer.

In this WTP question, the town was split into three regions: The residents in the northern and western region were asked to pay for a change in their own housing district and the southern region was asked to pay for a change in another area i.e. in the western region. The first potential construction area (size 50 ha) in the western part, Noljakka, was located in the middle of the housing area (Fig. 3). The second area which was larger (102 ha) was located in Rantakylä in the northern town border and expanded beyond the present housing area. The question presented was ''how much additional tax would your household be willing to pay annually during the next three years in order to help the town to buy the land and maintain it as a green space''. A payment card with a scale of 0 FIM to 1500 FIM was used.

The zero responses were classified into two categories: true WTP = 0 and protest bids, depending on peoples' motives. Protest zero occurs when the respondents resist a feature in the scenario. For instance the respondent opposes to pay in a certain form or refuses to place monetary values on non-marketed goods (Freeman III, 1993).

The fourth part of the questionnaire dealt with socio-economic variables describing the respondent.

The response rate of the survey was high, 68.0%. However, some of the questionnaires were not complete and therefore, the amount of accepted questionnaires was 64.8%. The representativeness of the data was tested and found to be statistically representative of the whole population, i.e. the residents of Joensuu,

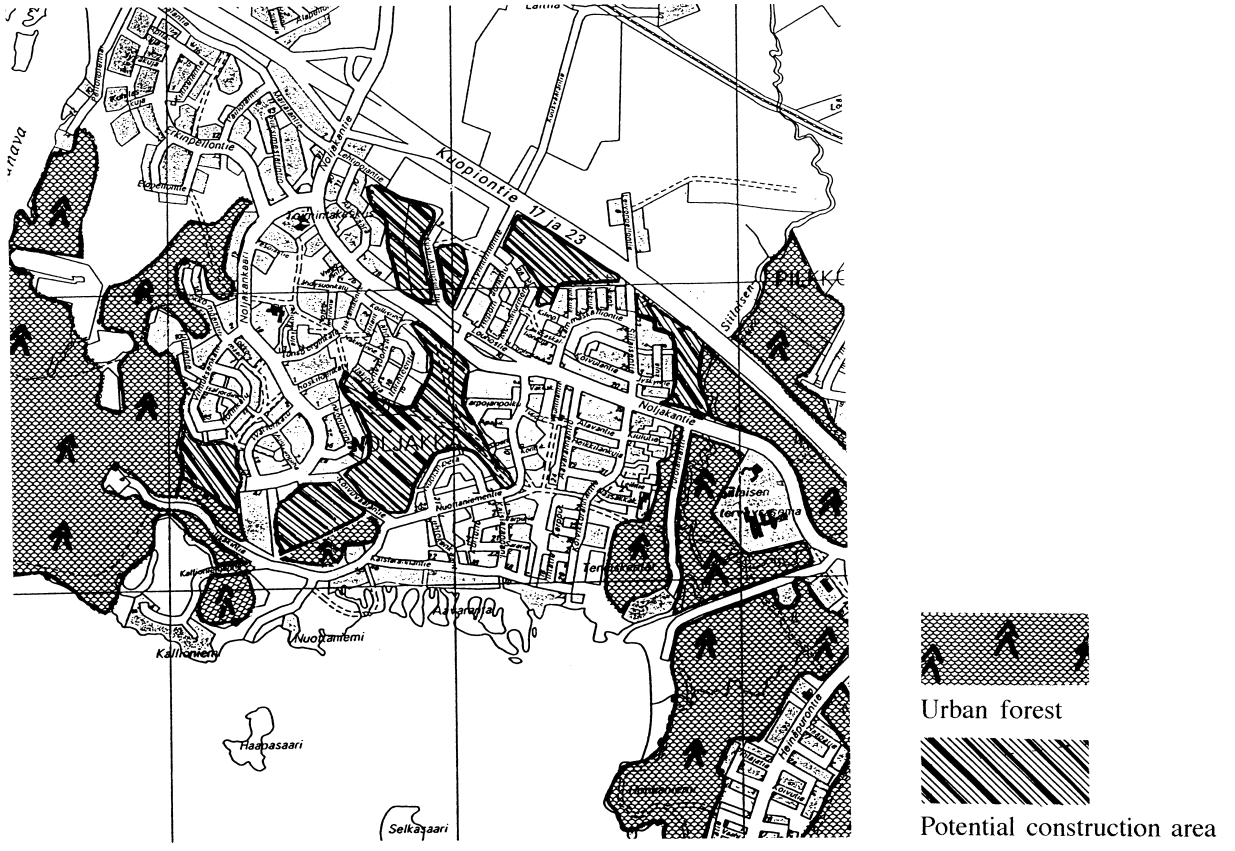

Fig. 3. The potential construction areas were illustrated with a map to the respondents. In Noljakka housing district the conversion area consisted of several smaller forested parks. Part of the third map attached to the survey.

according to sex and age distribution, education, housing type and place of residence.

The statistical analyses were made using SPSS and LIMDEP-software. The effect of socio-economic variables on WTP was analysed by linear regression and tobit models. Theoretically, the tobit model (censored regression model) is better suited for analyzing the data, because the estimates received by OLS techniques may be biased in the case when the dependent variable is limited in its range (WTP is 0 or positive). The estimation of the model is usually undertaken by maximum likelihood techniques (Maddala, 1983; Kennedy, 1992). The validity of WTP answers were assessed using two techniques: first, regression analysis was used to explain WTP. The observations that exceeded standardized residual value 3.0 were discarded as outliers. Second, the questionnaires were checked to see whether the stated WTP was too high with respect to the stated income. The respondents whose WTP answers were more than 5% of their income were discarded as outliers.

3. Results

The urban forests in Joensuu are actively used for recreation purposes. One-third of the respondents visit the urban forests 2–3 times per week and 80% visit an urban forest at least once a week. In addition, 18% of the residents visited the areas daily. The short visits were typical: the duration of the visit was usually from 1/2 h to 1 h (32% of the visits) or less than half an hour (42%). Exercise (40%) and relaxation (36%) were the most typical motives for outdoor recreation. In gen-

Table 2
Willingness to pay (WTP) a monthly fee for the use of forested recreation areas (users)

Recreation area (Nr. of respondents)	Willing to pay (%)	WTP = 0%	Protests or cannot state (%)	Mean WTP FIM/month[a]	Amount of users among residents (%)	Recreation value/ season milj. FIM[b]
Repokallio summer (39)	82.1	5.1	12.8	46	21.6	2.51
Repokallio winter (32)	75.0	9.4	15.6	53	20.1	1.93
Linnunlahti summer (80)	75.0	6.2	18.8	51	46.0	5.94
Linnunlahti winter (63)	70.0	9.5	20.6	42	34.9	2.64
Lykynlampi summer (40)	67.5	10.0	22.5	47	20.4	2.43
Lykynlampi winter (39)	64.1	15.4	20.5	50	21.3	1.92

[a] Protests are not included.
[b] Summer season May–September; winter season October–April.

eral, the respondents had a positive attitude towards urban forests. Most of the respondents (56%) felt that urban forests caused no negative effects in the town.

The majority of the visitors were willing to pay for the use of wooded recreation areas. The amount of positive bids for monthly payments varied from 64% to 82% of visitors depending of the area and season (Table 2). The amount of positive bids for the seasonal fee varied from 69% to 83% (Table 3). A small proportion of the users stated their true WTP as zero; 5–15% depending on the area, season and type of fee. The amount of protest bids varied between 5 and 22%. Although there was no statistical difference found between different response categories for seasonal and monthly payments, the amount of protest answers was higher for the monthly payment. The main motives for true zero WTP were either the possibility to use substitute areas or economic reasons. The main reasons for protest bids were either that the question was not meaningful or that the respondents felt that it was difficult to express their valuations in monetary terms (Fig. 4).

Two-thirds of the visitors stated their WTP between 25 FIM and 200 FIM per season (10–50 FIM/ month). The visitors' average WTP for seasonal payments varied between 108 and 141 FIM (42–53 FIM/month) depending of the area and season. Accordingly, the WTP for the whole year varied from 238 FIM/year to 278 FIM/year using seasonal fees. The aggregate recreational value was calculated multiplying the average WTP in the area by the amount of users among residents. The recreational value for the whole year was 1.79 milj. FIM in Repokallio area, in the most intensively used recreation area Linnunlahti, it was 4.04 milj. FIM and in Lykynlampi area it was 1.94 milj. FIM (Table 2).

Using monthly payments results in distinctly higher WTP estimates for the whole year (549–601 FIM/ year) as well as higher aggregate benefit estimates for the different areas (4.35–8.58 milj. FIM/year) assuming that the people would use the areas every month (Table 3).

The second WTP question dealt with converting forested parks into another land use (Fig. 5). Approxi-

Table 3
Willingness to pay (WTP) a seasonal fee for the use of forested recreation areas (users)

Recreation area (Nr. of respondents)	Willing to pay (%)	WTP = 0%	Protests or cannot state (%)	Mean WTP FIM/season[a]	Amount of users among residents, (%)	Recreation value/ season milj. FIM[b]
Repokallio summer (36)	83.4	11.1	5.5	130	21.6	1.01
Repokallio winter (38)	76.4	10.5	13.1	108	20.1	0.78
Linnunlahti summer (85)	73.0	12.9	14.1	139	46.0	2.31
Linnunlahti winter (64)	68.8	12.5	18.7	137	34.9	1.73
Lykynlampi summer (38)	71.0	13.2	15.8	117	20.4	0.86
Lykynlampi winter (40)	72.5	10.0	17.5	141	21.3	1.08

[a] Protests are not included.
[b] Summer season May–September; winter season October–April.

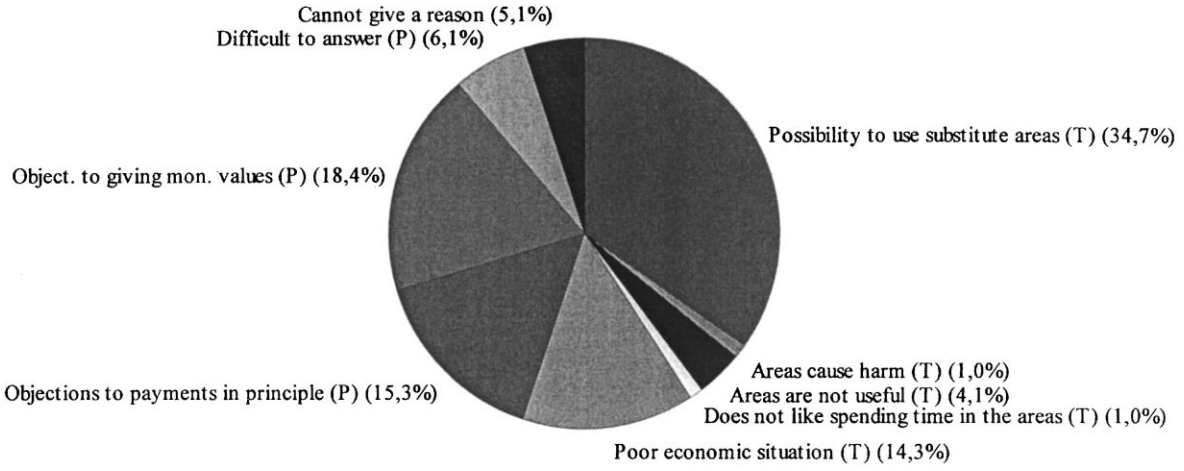

Fig. 4. Reasons for true zero WTP (T) and protest bids (P) concerning recreation areas ($n = 107$, 100%).

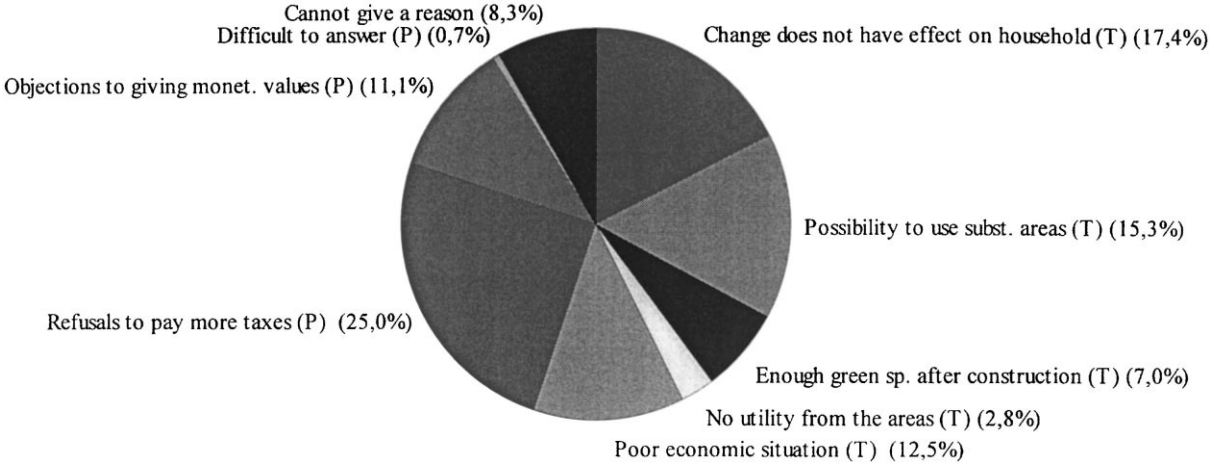

Fig. 5. Reasons for true zero WTP (T) and protest bids (P) concerning forested parks ($n = 144$, 100%).

mately half of the respondents were willing to pay during the next three years to prevent the reduction of forested parks in the housing area. The amount of respondents willing to pay something varied from 45% to 55% depending on the area (Table 4). The average WTP for the different areas varied from 126 FIM to 206 FIM. The lowest WTP was found among the residents living in the southern part of the town, which was least affected by the proposed construction. The 5% trimmed mean was calculated in order to find a conservative estimate for peoples' average WTP. The estimates varied between 86 and 162 FIM/year.

The amount of true zero WTP varied from 23% to 30% depending on the area The main reasons for true zero WTP were either that the respondents were not affected by the suggested land-use change, or they had the possibility to use substitute areas or that there were enough green spaces in the town after construction. Furthermore, the amount of protest bids varied between 19 and 25%. These respondents objected to the economic valuation of amenities, but could

Table 4
Willingness to pay for preventing construction of green spaces

Part of the town	Willing to pay%	WTP = 0%	Protests or cannot state (%)	Mean WTP FIM/year[a] (median)	5% trimmed mean WTP FIM/year[a]
Westerm ($n = 121$)	55.4	23.1	21.5	206 (100)	162 mk/v
Eastern ($n = 98$)	55.1	25.5	19.4	190 (100)	166 mk/v
Southern ($n = 84$)	45.2	29.8	25.0	126 (100)	86 mk/v

[a] Protests are not included, payments for 3 years.

not state their valuations in monetary terms or refused to pay more taxes.

The aggregate WTP was calculated for different parts of the town multiplying the mean WTP by the number of households in the particular town area. The highest aggregate willingess to pay (1.79 milj. FIM) for preventing the construction was found in the western part of the town, where potential construction areas were located in the middle of the housing areas The total WTP for preventing construction was 3.81 milj. FIM in the whole town area (Table 5).

A linear regression and a tobit model were calculated to explain the WTP for forested parks in the housing districts (Table 6). The protest bids were excluded from the analysis. Since the residuals in the model explaining WTP were heteroskedastic, the independent variable in the final models was the square-root of the stated willingness to pay. In both the models, the use of the areas and a view to the forest from the apartment were significantly positive explanatory variables for the households willingness to pay. Having a view had a higher positive influence on respondent's WTP than the recreational use of the area. The effect of income had the positive sign a priori expected, but was not statistically significant in the tobit model at the 10% level. In addition, the distance from the apartment to the potential construction area was not entered this model, due to its high correlation with the variables describing the use of and the possible view to the area. In the model, where these two latter variables were excluded, the distance to the potential construction area was found to be a signifi-

Table 5
Aggregate willingness to pay for preventing construction of green spaces

Part of the town	Mean WTP FIM/year[a]	Number of households	Total WTP/year/ha (FIM/ha)	Total WTP/year[a] (milj.FIM)
Western	206	8704	37360	1.79
Eastern	190	6330	11240	1.20
Southern	126	6502	17067	0.82
Total WTP				3.81

[a] Protests are not included, payments for 3 years.

Table 6
Regression and tobit models for WTP for preventing the construction of green spaces (dependent variable sqrt (WTP))

Independent variable	Coefficient	*T*-ratio	Coefficient	*T*-ratio
Income	$2417^{a}10^{-4}$	1.80	$2.764^{a}10^{-4}$	1.376
Age	−0.122	−3.18	−0.194	−3.238
View (D)	4.754	2.62	6.605	2.502
Use of the area (D)	4.353	3.25	6.194	3.070
Constant	10.176	4.97	8.779	2.846
	Linear model Adj. $R^2 = 0.15$		Tobit model. Log-likelihood = −634.19	

[a] D = 0–1 variable ($n = 227$).

cant explananatory variable for the household's WTP at the 5% level. Sex, family type or size, as well as education level or housing type, did not have statistically significant influence of WTP.

4. Discussion

The purpose of this study was to measure the benefits of urban forests in monetary terms using the CVM. The high response rate and intensive recreational use of wooded green spaces in the study town indicate high appreciation of urban forests, which is also a general feature in Nordic recreation studies (Jensen, 1995). Typically, in Finland, it is rather difficult to formulate willingness-to-pay questions concerning forest use due to right of public access (Bostedt, 1995a; Mäntymaa, 1997). Nevertheless, in this study the scenario presented was generally accepted rather well. Most visitors were willing to pay for the use of the forested recreation areas and the number of protest bids was rather low. About 19% of respondents did not answer the question. Carson (1991) reports item non-responses from 20% to 30% to be typical in a CV study.

The effect of the two different payment formats, monthly and seasonal fees, on the WTP were different. People were willing to pay smaller amounts of money more often than bigger sums less often. This resulted in higher annual monetary values using WTP/month for the recreation areas than when using seasonal payments. The same result was also found by Elsasser (1994) in a study dealing with the recreational use of forests in Germany. Which, then, are the correct figures and which of them should be used in calculating the total value of the recreational use of the areas?

We are here dealing with an embedding problem, which is also called part-whole bias (Kahneman and Knetch, 1992; Hanemann, 1994). This means that respondents may value the asset in question at a level of aggregation which is at variance with that intended by the researcher. For example, respondent may not consider the time horizon of the payment or they may not distinguish between personal/household payments. The phenomenon is typically found in measuring the non-use values of environmental commodities, where WTP for a single species or for the whole ecosystem may be approximately the same. However, the result that the aggregated seasonal fee is lower than the monthly fee is understood to derive from the uncertainty of the future use of the good. People who buy a season ticket run the risk of not using the area every month and, therefore, a lower WTP per season is logical. A conservative choice would be to use these lower WTP estimates in cost benefit analysis.

The WTP question concerning forested parks was ascertained from all the respondents. The scenario presented in the questionnaire can be considered to be realistic, because the suggested change in the amount of green space was connected to an on-going town planning project where additional building sites were sought inside the present housing districts. The item non-response was a low 11% indicating that the formulation of the question was successful. Approximately half of the respondents were willing to pay to prevent the decrease of urban forests in the housing area. A higher amount of positive bids occurred when the potential construction area was located near the living place. In addition, a view to the forest had an even larger positive influence on people's willingness to pay than the use of the area. This refers to the importance of the urban forests in the home environment where substitute areas are difficult to find. Furthermore, the distance to the potential construction area also explained the willingness to pay. The relationship between WTP and distance from the areas was found to be non-linear. In this study people living less than 4 km from the area were found to pay more than those who lived further away.

There are only a few previous studies dealing with monetary values of urban forests. The results are similar to a HPM study conducted by Tyrväinen in the same study town (1997). The decreasing distance to a forested recreation area, as well as the increasing relative amount of green spaces, had a positive influence on house prices. In study in West Germany, Elsasser (1994) found that forests near bigger cities are valued higher than the remote ones. Most of the forest recreational visits take place in urban forests and using substitute areas, therefore, means higher travel costs.

The level of income did not seem to have an influence on peoples' willingness to pay. This implies that the green spaces are not a superior good, but rather

an essential part of the everyday life in the study town. This can be concluded from the high use of and positive attitudes towards urban forests. The same income effect has been found in several valuation studies dealing with nature conservation. These studies have shown that the protection of bio-diversity is not a luxury good (Pope III and Jones, 1990; Veisten et al., 1993).

To avoid the payment vehicle bias, payment procedures such as taxes and entrance fees are normally to be avoided (Cummings et al., 1986). Nevertheless, in Finland it is difficult to describe a credible payment scenario without their use, because these payment formats are the most common and realistic in Finnish conditions. In this study, however, the use of tax as a payment vehicle may have increased the amount of protest bids.

In addition, in this question the presence of the embedding problem may also have affected the WTP estimates: although the potential construction areas were of a different size in the housing districts, the average willingness to pay did not vary very much between the areas. This raises the question as to whether the WTP was partly understood as a general question concerning converting green spaces into housing. However, the result obtained is logical and can be explained by looking at the differences of the valued areas. The smaller construction area (Noljakka) was located in the western part of the town near to the town centre. The other area (Rantakylä) in the eastern part of the town was bigger, but located on the outskirts of the town. The results demonstrate that peoples' WTP follows a law of decreasing marginal utility. This means that people are willing to pay less for each additional hectare to be protected. The same type of result has been found in studies dealing with nature conservation (Pope III and Jones, 1990; Loomis et al., 1993).

It is also necessary to look at the presence of self-selection bias, which means that people interested in the issue or in using the forests answer the survey more often than the non-interested or non-users (Whitehead, 1991). This may lead to a result that, for example, the amount of forest use is greater than it is in reality. This is important, as use-intensities play an essential role when aggregate benefits are calculated for the recreation areas. In this study, however, the rather high response rate decreases the effect of the possible bias. The motives for not answering or use-intensities can be determined afterwards by a follow-up survey (e.g. Fredman, 1994). In this study the survey was not, however, considered to be necessary.

The question of the degree to which CV estimates are accurate representations of respondents true willingness to pay is often raised (Mitchell and Carson, 1993). The weakness of the method is that responses are based on hypothetical and not actual behaviour. In general, it seems that there is considerable validity in the estimated use values. In contrast, concerns regarding the validity of estimates of non-use values remain (Bishop and Heberlein, 1990; Arrow et al., 1993; Portney, 1994). Most values attached to urban green spaces are, however, direct or indirect use-values, e.g. pleasant landscape, peace and quiet, observation of wildlife as well as recreational benefits, suggesting that CV is a proper method for assessing the benefits (Tyrväinen, 1994). Furthermore, the credibility of the method is increased because the results can be verified with HPM.

CV can be used, for example, for estimating peoples' willingness to pay for establishing new wooded green spaces. Suitable case areas can be easily found in different countries. For example, in Finland they include housing areas built in the 1970s that lack trees and other vegetation. Furthermore, it is probable that the suitable management of urban forests will increase the benefits derived from different types of areas. CV could be used to ascertain people's WTP for the upkeep of or for the increase of the protective and aesthetic functions of urban forests. This approach has been tested in production forests by Bostedt and Mattson (1995b) who found that modifying forest management practises increased the recreational value for tourism.

Since the CV method is difficult to implement without avoiding various types of design problems, each particular study needs to be scrutinized carefully and to be adapted to the circumstances of each study town or area. In an urban setting, people are probably more accustomed to pay for their leisure time and therefore payments for outdoor recreation are more acceptable than in other forest areas. However, the preferences may be easier revealed if respondents are asked to compare urban forest benefits with the use of other public services instead of being asked to pay directly.

5. Use of the CV estimates

The use of CV survey results in decision making has different levels: they may be used to stimulate public awareness of potential urban forest benefits, to influence or identify decisions throught cost–benefit analysis, or just to justify decisions in urban land-use planning and policy making. The extent and purpose of the use of CV survey results varies across countries. In Europe, the more ambitious purposes are often connected with lower policy levels (public projects). In contrast, the use of the CV estimates in national policy decisions has been so far negligible (e.g. Kuik et al., 1992). At present, for example, the environmental impact assessment (EIA) procedure required in city planning does not include monetary valuation.

The value of urban forest benefits could be concretizised by comparing the estimated benefits to, for example, the up-keep costs of the areas or the value of the land in alternative use. The results of this study show e.g. that the monetary benefits of urban forest are much higher than the present maintenance costs. The stated amount of WTP for preventing the construction of green spaces was to be collected during the next three years, 1995–1997. The value of aggregated WTP (1995) is 10.57 million FIM at 5% discount rate. The average maintenance costs of forested parks in Joensuu (1991–1995) is 10 152 FIM/ha/year, and the present management interval in urban forests is between 5 and 10 years. (Joensuun kaupungin teknninen virasto, 1996). Thus, the residents' total WTP for the parks would cover their management costs for the next 34–67 years depending on the management intensity – assuming that the raise of management costs and interest rates is the same. Accordingly, for example, the annual aggregate recreation value of Repokallio area is 10–20 times higher than the annual management costs using lower WTP estimate (mean WTP/season).

Furthermore, management decisions often concern trade-offs between timber production and recreational benefits – in particular at the urban fringe. Many municipalities in Finland treat the forested areas within city limits as a source for timber and income (Löfström, 1998). Therefore, it is relevant to compare the value of the areas in timber production to the amenity benefits of green areas.

The value of the land in forestry use can be calculated by using the summation approach most commonly used for valuing forestry in Finland since 1960s (Oksanen-Peltola, 1994). In this method, the value of the forest is estimated based on the value of the land and the value of the present timber stock. The timber stock is divided into different age classes for which an expectation value is calculated normally using 3–5% interest rate. However, in practise, these values are cut by 30–50% to cover taxation and the management costs and to reach the actual market price level (Kiinteistöjen arviointikäsikirja, 1991; Oksanen-Peltola, 1994).

The value of the potential construction areas in forestry was calculated using multiple-use forest management planning system (MONSU). The system includes the summation approach in the valuation of forest property (Pukkala, 1998). Forest inventory data (1997) received from the North Carelian District Forestry Board was used. The average timber volume in the areas was rather high: in Noljakka 194 m^3/ha and in Rantakylä 145 m^3/ha. The present value (1997) of Noljakka construction area in forestry was 1.13 million FIM and the residents' total WTP was 8.23 million FIM (1997) using 5% interest rate. On this basis the amenity benefits of urban forests were 7.3 times higher than the value of the area in timber production. If the aggregate WTP from the southern part of the town is excluded from the total WTP for the areas, the amenity benefits are five times higher than the estimated benefits from timber production. Furthermore, the Rantakylä area was twice as big as Noljakka area and was located at the urban fringe. However, the amenity benefits were still twice as high as the timber production benefits. Furthermore, it has to be kept in mind that the recreational use of these areas does not completely exclude timber production but rather decreases the received economic benefits and vice versa.

Finally, the results of the study can be used in analysing the environmental impacts of land-use alternatives in town planning. The main question in urban setting is more often where to build than whether to build at all. The loss of amenity values should be included in the analysis when choosing the best land-use alternative from the point of view of society. The estimated non-priced benefits should be compared to the increase in costs when providing the building sites somewhere else.

Theoretically the total economic value of these benefits can be measured e.g. with contingent valuation and partially using hedonic pricing method. The total value of a certain area depends of its location, size, quality, use intensity and the amount of substitute areas. In general, the more scarce the resource becomes the higher the value is per hectare. The relatively low value of green spaces in this study was thought to be due to the abundance of green areas in the town, and also because the suggested forested areas for construction were rather large.

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Appendix A

What is an urban forest

Urban forests are wooded areas located within town limits or close to town (2–6 km). The areas constitute of natural forest vegetation and provide everyday recreation opportunities for residents. Urban forests can be divided into different categories: *Forested parks* are often rather small areas located inside housing districts and provide landscaping as well as recreation possibilities. *Recreation areas* are larger wooded areas with recreation facilities and are often located further away from the town center. *Protection forests* are narrow forested belts e.g. between housing and main roads. According to this definition constructed parks are not urban forests.

Examples of urban forests	Examples of areas which are not urban forests
Forested area with skiing and jogging trails.	Constructed park with lawn.
Forested area with cycling or walking route.	Childrens playground with trees.
Narrow belt of forest vegetation between houses.	
Forested area between housing and a road.	

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