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On the distance to recreational forests in Sweden

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Abstract

There is a strong tradition in Sweden of using forested areas for recreation. Earlier research has shown that on average, Swedes visit a forest at least every other week. This study surveyed 1000 randomly chosen individuals about their present distance, and what they considered to be the preferred (ideal) distance, between their residence and the closest recreational forest. Attitudes towards an increase in the present distance are studied together with an economic measure using the contingent valuation method. We found that over 40% of the Swedish population would prefer a shorter distance to the forest, and argue that residential areas should be planned so that most individuals have the closest recreational forest within walking distance (<1 km). In general, we found a shortage of housing possibilities within 1 km from recreational forests in Sweden. Forty-five percent of all respondents considered an increased distance to the forest (doubled) as negative. The probability of giving a positive willingness to pay bid to avoid an increase in the distance increases with the respondent's present distance to the forest.

Keywords: Forest recreation; Distance; Urban planning; Forest planning; Contingent valuation

1. Introduction

Forest recreation has a strong tradition in Sweden. The ''Right of Common Access'' and the abundance of forested areas often make access easy. Several studies have shown that Swedes visit forests regularly, with a frequency of 1–2 visits every 2 weeks (Lindhagen, 1996; Lindhagen and Hörnsten, 2000; Statistics Sweden, 1993a). About 60% of Sweden's total land area is covered by forest. The northern and central parts, outside the mountain region, are covered by up to 80% of forest, while the landscape in the south is a mixture of forests and open agricultural land. In the most southwesterly region (Malmöhus County), forest cover is only 18% (National Board of Forestry, 1997). Approximately 1% of the total forest area in Sweden is classified as urban forest[2], and visitor frequency in such areas is estimated to be 250 times higher than in other forested areas (National Board of Forestry, 1991). A majority of the Swedish population, a total of 8.8 million people, live in the southern third of the country (cf. Fig. 1). This is also where most urban areas are located including the major cities of Stockholm, Gothenburg and Malmö.

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[2] Urban forests are defined by the National Board of Forestry as forest land primarily used for recreation in the relative proximity of urban areas or other recreational facilities.

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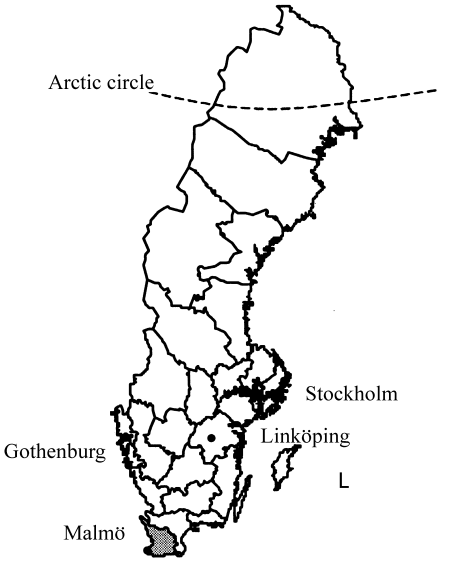

Fig. 1. Map of Sweden. Southwesterly region (Malmöhus County) shaded.

Natural environments, such as green areas, parks and forests, can positively affect human health. In comparison with indoor and urban environments, natural environments better contribute to recovering mental capacity (Kaplan and Kaplan, 1989). Grahn (1997) showed that kindergartens, in which children play in a natural environment, have less sick leave and better physical ability among children than compared to those kindergartens in which children play in an ordinary playground.

Also the distance to green spaces, such as forests and parks, matters to people. When Swedish city residents were surveyed, it was found that living close to a park or natural setting was equally as important as having traditional services within walking distance from the home (Berglund and Jergeby, 1992). Lindhagen (1996) found 95% of the respondents to a postal inquiry to be anxious or very anxious to live close to an area suitable for outdoor recreation. Kardell (1982) surveyed the use of urban forests surrounding Linköping, a city of approximately 110 000 inhabitants in southern Sweden. He discovered a negative non-linear decreasing relationship between the distance to the recreational forest and number of visits. A Nordic study of criteria and norms for planning public areas (Nordisk Ministerråd, 1996) claims that 250–300 m is a critical walking distance to recreational areas during weekdays, while areas used during weekends and holidays are located further away. For those who live further away from forested areas, distance can work as a barrier and hinder visits (Norling, 1995).

Neighboring forest areas also feature as a significant and positive factor in several economic valuation studies. Property prices may reflect willingness to pay (WTP) in order to live near a forest environment, both for reasons of access to such areas as well as its value in terms of a pleasant landscape. Willis and Garrod (1992) studied amenity values in Great Britain by the hedonic pricing method, and observed that house prices varied according to differences in the type, composition and age of forests and woodlands in the neighborhood. Bateman et al. (1996) estimated mean WTP per annum for establishing recreational woodlands near cities in Great Britain to £9.94. Here aggregate WTP was estimated to be almost twice the aggregate willingness to accept compensation (WTA) farmers stated for converting agricultural land into forests. In a valuation study by Tyrväinen (1998), a majority of the respondents were willing to pay for the use of forested recreation areas. About half of the respondents were willing to pay to prevent a decrease in urban forest land in a housing area through construction activities that would result in a longer distance to the forest. Li and Mattsson (1995) collected willingness to pay data for access to forest amenities in northern Sweden. They derived a positive relation between WTP and the distance between residence and the most frequently visited forest.

The objective of this study is to analyze attitudes towards changes in the distance between the residence and the closest recreational forest among Swedish citizens in general. Such knowledge may contribute to improve physical planning and facilitate the development of urban areas with respect to recreational opportunities. The distance between residential areas and nearby recreational forests is to a large extent an urban planning problem. Norms used for planning purposes about the distance to outdoor recreation areas close to population centers in different Nordic communities range between 2 and 5 km (Nordisk Ministerråd, 1996). But as cities grow larger, the need for transport capacity and residential space increases and urban development often brings with it negative externalities in terms of poorer access and longer distances to forests. In Sweden, the accessible forest

land in urban settlements of over a 10 000 inhabitants decreased by 1.4% during the period 1980–1990 (Statistics Sweden, 1993b, 1997). In this study, the present distance between the residence and the closest recreational forest is used as a starting point for the analysis, followed by studies of: (1) what respondents consider their preferred (ideal) distance; and (2) attitudes towards an increase in the distance. The latter scenario is also measured as willingness to pay in order to avoid such a negative change.

2. Study method

The results reported in this article originate from two mail-outs that were part of a larger survey studying forest recreation. In February and June 1998, two postal questionnaires were sent to a random sample of 500 individuals in Sweden, who were between 16 and 74 years of age. Enclosed were an addressed reply paid envelope and an introductory letter. Two reminders were distributed, the last one including a new questionnaire.

The two questionnaires both included questions on personal characteristics (age, gender, size of home municipality, membership in environmental organizations) and a section of questions on forest visits during leisure time, including means of transportation to forest areas. Questions were posed on the present and preferred (ideal) distances to the closest recreational forest in an open-ended format (see Appendix A), and about attitudes towards an increase in the present distance. The two questionnaires differed in the latter part. The February mail-out (referred to as sample/questionnaire 1) included a multiple-choice question asking what would make the respondent visit the forest more often, while the June mail-out (referred to as sample/questionnaire 2) had an economic valuation section. The final response rates were 54% for questionnaire 1 and 48% for questionnaire 2. To test the sample, the age, gender and income levels of the respondents were compared with the Swedish population as a whole (Statistics Sweden, 1999). While no differences were found for age, the frequency of females is significantly[3] higher in samples 2 and 1+2. The household income of respondents in sample 2 was found to be significantly higher than average. Similar findings are reported in other studies of this kind, but are notable in this case because of the over representation of female respondents, who on average have a lower income than men (see Table 1).[4] The representativity of those respondents who gave a valid WTP answer (including zeros) is very similar to individuals in sample 2.

Table 1
Average age, proportion males/females and income for Sweden and the survey samples (Statistics Sweden, 1999)

	Age	Male (%)	Female (%)	Income (SEK)[a]
Sweden	44	50	50	180 300
Sample 1	45	46	54	–
Sample 2	45	40	60	224 400
Sample 1+2	45	43	57	–
WTP respondents	43	41	59	226 900

[a] Income estimated as yearly per household. 1 US$≈8 SEK.

A unit non-response rate in the proximity of 50% is somewhat high, but not remarkable for Swedish standards. Other comparable studies have typically reported response rates between 50 and 70%. Item non-response for the open-ended WTP question was an additional 12% when zero bids were included and 48% when zero bids were not included.[5] According to Carson (1991), an item non-response of 20–30% for the economic elicitation question is common when the sample is random, the scenario is complex and people are not accustomed to valuing the object in question in monetary terms. In light of the over representation of female and high income individuals in the data used for WTP estimates, we cannot rule out the possibility of a sample non-response bias in this case. Response rates were found to be significantly lower for densely populated areas as compared with the rest of Sweden.

[3] If not specified, a 5% significance level is used in all statistical analyses in this study.

[4] Swedish Official Statistics treat persons of age 18 and older as separate households even if they live with their parents. Persons older than 74 years are also included in official statistics. These categories are typical low-income groups and will to some extent explain the differences between the sample and Swedish average income.

[5] WTP estimates are based on the 40.5% of the respondents to questionnaire 2, who indicated a negative attitude towards an increase in distance to the forest.

A comparison of data from the two questionnaires indicates no significant[6] differences with respect to variables used for this presentation or effects of the time lag between the two mail-outs. Unless otherwise specified, data from the two questionnaires cited in this study has been combined and is used in all statistical analysis.

Because of the different forest conditions in the southwestern region of Sweden (Malmöhus County, cf. Fig. 1), data from this area is excluded from the analysis or is analyzed separately when appropriate.[7] This procedure considerably reduces the number of extreme observations with respect to the present distance to a forest. Almost 80% of all respondents who live more than 10 km from the closest recreational forest reside in this area.

Attitudes toward an increase in the distance to recreational forests were sought in the question below:

> Suppose the distance to your closest recreational forest increases, from the present to twice that distance (everything else in your neighborhood remaining unchanged). How would you experience such a change (positive, negative or does not matter)?

The main advantage of using a double distance as the measurement with which the distance to the nearest forest would hypothetically increase is the comprehensive scenario the respondents need to recognize. This implies that the relative change in distance is equal for all respondents, while the absolute change will differ. It is less likely that any real change in the physical environment will render such a ''double distance'' scenario for all individuals, but since this study focused on the Swedish population as a whole it was difficult to identify a useful absolute measurement of change in distance.Those of the respondents who gave a negative answer to the above question were also asked about their maximum willingness to pay to avoid the proposed increase in distance (see Appendix A). The economic welfare measure used is known as the *equivalent variation* (EV):

$$v(y - EV, p, z^0) = u^1 \tag{1}$$

Here $v(\cdot)$ is the indirect utility function, y the income, p the prices and z is the distance to the forest. The present distance to the forest is z^0 and $u^1 = v(y, p, z^1)$ is the alternative utility level after the distance has been increased to z^1. The equivalent variation is interpreted as the amount of reduction in income necessary to achieve the new utility level (Boadway and Bruce, 1984). Since ordinary least-squares (OLS) regression in the linear form was found to have limited explanatory power with respect to WTP data, a logit model was applied:

$$L_i = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 D_{4i} + \beta_5 D_{5i} + \varepsilon_i \tag{2}$$

where $L_i = \ln(P_i/(1 - P_i))$, with L_i the natural logarithm of the odds ratio in favor of WTP>0, i.e. the ratio of the probability that a respondent will have a willingness to pay that is larger than 0 to the probability that he or she will give a zero bid. Both X_2 and X_3 are continuous (present distance to the forest and age), while D_4 and D_5 are dummy variables (D_4 is equal to 1 if household income $\geq$19 000 SEK per month and 0 otherwise; D_5 is equal to 1, if female and 0, if male).

3. Results

A shorter distance to a forested area would make 18.2% of the respondents to questionnaire 1 visit the forest more often. Among 16 defined alternatives (multiple answers possible) ''a shorter distance to the forest'' was ranked as number 6, outscored by ''more spare time'', ''more berries or mushrooms'', ''a safer forest free from violent people'', ''less disturbance from other people (noise, trash, etc.)'' and ''better paths and tracks''. The qualitative aspect of ''another type of forest'' was chosen by only 11.3% of the respondents, and hence ranked as number 10 among the alternatives.

3.1. The preferred distance

Fig. 2a and b features the two distance measures as proportions distributed among seven classes, e.g. looking at Fig. 2a, approximately 27% of the respon-

[6] Gender differs between the two samples at the 10% significance level (p=0.080).

[7] The present distance to the closest recreational forest in the southwestern region is on average 10.1 km, compared to 1.4 km for the rest of Sweden. The percentage of forest cover is 18% in the southwest and 60% in the rest of the country.

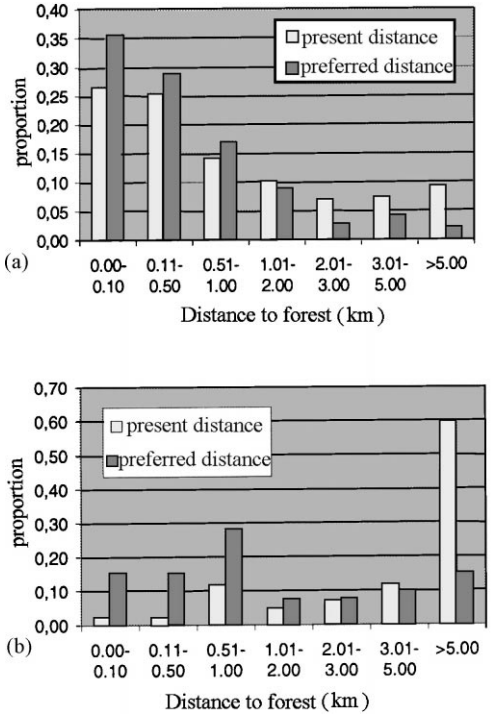

Fig. 2. Distribution of the present and preferred distances between residence and closest recreational forest: (a) all of Sweden excluding SW region; (b) SW of Sweden.

dents currently live 0.00–0.10 km away from their closest recreational forest, while 10% live 1.01–2.00 km away. The southwest of Sweden, which obviously features a different distance pattern, is here treated separately. Hence, for most of Sweden there are less residence possibilities within 1 km from the closest recreational forest than desired.

In Table 2, three categories of respondents are distinguished depending on the sign of the variable diff, which is defined as the difference between the present distance and the preferred distance. If diff>0, the respondent wishes to have a shorter distance to the closest recreational forest, if diff=0, the respondent does not want any change, and if diff<0, the respondent wishes to have a greater distance to the forest. Hence, 40.6% of all respondents wish to have a shorter distance, while 48.8% do not want any change. Multinomial regression shows that categorization here depends significantly upon present distance to forests ($p<0.001$) and whether the respondent lives in a city of more than 100 000 inhabitants ($p=0.005$).

There is a regional variation in the frequencies of the three categories. Respondents living in typical forest regions (the north and southeast of Sweden) have a low frequency of diff>0 and a high frequency of diff=0, whereas respondents with a high frequency of

Table 2
Descriptive statistics of the present and preferred distance between residence and closest recreational forest measured in kilometers

		All of Sweden		All of Sweden excluding SW		SW[a]	
		Present	Preferred	Present	Preferred	Present	Preferred
All respondents	Mean	2.16	0.97	1.44	0.77	10.10	3.13
	Median	0.50	0.50	0.50	0.30	7.00	1.00
	n	453	453	415	415	38	38
diff>0[b]	Mean	4.15	*0.82*	2.69	*0.66*	12.66	1.74
	Median	2.00	*0.50*	2.00	*0.30*	10.00	1.00
	n	184	184	157	157	27	27
diff=0	Mean	*0.83*	*0.83*	*0.70*	*0.70*	–[c]	–[c]
	Median	*0.30*	*0.30*	*0.30*	*0.30*	–[c]	–[c]
	n	221	221	213	213	8	8
diff<0	Mean	0.66	2.17	0.53	1.47	–[c]	–[c]
	Median	0.20	1.00	0.20	1.00	–[c]	–[c]
	n	48	48	45	45	3	3

[a] Southwest of Sweden.
[b] Present distance−preferred distance.
[c] Small number of observations.

diff>0 typically live in agricultural regions in the southwest and central parts of the country. The choice of the preferred distance to the forest is also analyzed by means of a log-linear regression model.[8] We found that an increase in the present distance by 1% increases the preferred distance by an average of 0.6%, and that the average preferred distance is relatively higher for respondents aged 55 and over and lower among members of environmental organizations.

3.2. An increased distance

An increase in the distance to the closest recreational forest by twice the present distance is said to be negative by 45% of the respondents, while 45% are indifferent. Only 2% of the respondents say that they will experience a distance twice as far as positive. The only variable that significantly explains these attitudes is the respondents' present distance to the closest recreational forest. There is a tendency that respondents, who are negative to an increase of twice their current distance, live on average further away from a forest area than those who are indifferent.

Among respondents to questionnaire 2 with a negative attitude, 88% answered the subsequent WTP question (n=84), of which 34 were zero bids. Mean WTP is estimated at 110 SEK[9] and median at 50 SEK (zero bids included), while excluding the zeros yields a mean WTP of 185 SEK and a median of 100 SEK. Table 3 summarizes the regression output of the logit model. After taking the anti-log of the parameter estimates, the results show that, for a unit increase in the present distance, the odds in favor of WTP>0 increase by a factor of 1.58. Since logistic regression is non-linear in the probabilities, any change in the odds-ratio will lead to different changes in probability depending on the initial state. The sign of the odds-ratio and probabilities are thus always the same, and it is possible to study the direction of change in the probability of stating a WTP>0 from the parameter estimates. Given the significance levels obtained, it can be concluded that the probability of bidding WTP>0 increases with the present distance to the forest and incomes $\geq$19 000 SEK, while it decreases with age and if the respondent is a female.

Table 3
Estimated logit willingness to pay model

Dependent variable	LOGIT (dichotomous)[a]	WALD statistics
Constant (β_1)	1.652	(2.931)
Present distance (β_2)	0.457[d]	(4.325)
Age (β_3)	−0.041[d]	(4.466)
INC[b] (β_4)	0.906	(2.697)
GENDER[c] (β_5)	−1.060	(3.626)

[a] Dependent variable=1 if WTP>0 and 0 if WTP=0, n=84, −2LL=83.1, Cox and Snell R^2=0.21, Nagelkerke R^2=0.28, model χ^2=17.5 (p=0.0015).
[b] INC=1 if income≥19 000 SEK and 0 otherwise.
[c] GENDER=1, if female and 0, if male.
[d] Significance level: 5%.

3.3. Means of transportation

Respondents were also asked about the means of transportation they used for their *most recent visit* to a recreational forest.[10] About half of the individuals walk or ski to a forest, the next popular mode of transportation being by car/motorized vehicle and bicycle. The average distance traveled by car (22.9 km) is significantly greater than the average distance traveled by bike (3.5 km), foot or skis (0.6 km). Public transportation does not appear to be a notable means of transportation to recreational forests in Sweden. Note that using trimmed data implies that the average distance traveled by foot or on skis is very close to the preferred distances presented in Table 2. In Fig. 3, the distance traveled is presented for each of the means of transportation as proportions in the seven distance classes used earlier. Hence, among those who traveled 1 km or less to reach a recreational forest 74–97% did so by foot or on skis.

[8] A large number of explanatory variables were tried, but only three were found significant at the 5%-level. A logarithmic transformation of distance data reduces problems with heteroscedasticity.

[9] 1 US$≈8 SEK.

[10] Note that this question does not specifically refer to the closest recreational forest, which implies that travel could be to any forest. This is obviously the case when travel distances in some cases were up to 1000 km. Because of this, data has been trimmed by the highest 5% values in each category. This procedure deletes some obvious misinterpreted responses and considerably reduces the number of extreme observations.

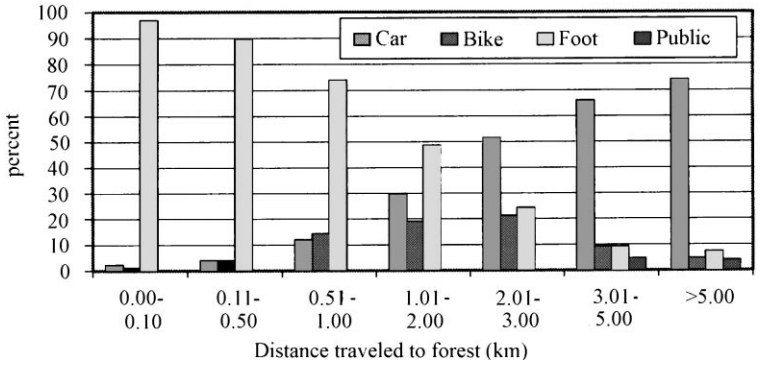

Fig. 3. Means of transportation to recreational forests. Proportions within distance classes.

Once the distance traveled is 2 km or more, travel by car appears to be the prevailing mode of transportation.

4. Discussion

In a country covered by forests with more than 60% and a legal right of common access to nature, one would expect that most people are satisfied with the supply of, and accessibility to, forest recreational areas. Nevertheless, over 40% of the respondents in this study claim that they would prefer a shorter distance to a forest area than they presently have. While much research has focused on the relationship between forest characteristics and human benefits, we found that the distance to recreational forests may be just as important.

Deciding where to live probably involves a great number of factors for most people, e.g. distance to work, or proximity to shopping areas, relatives and daycare. When tradeoffs are made, it is reasonable to assume that the distance to a forest is sometimes given a lower priority than other factors. In this study, we asked for the hypothetical preferred distance and attitudes toward a doubled distance to the closest recreational forest, given that everything else in the neighborhood remained unchanged. This scenario implies that some individuals will experience an environmental deterioration without compensation. However, changes in the physical environment sometimes imply a reduction in forested areas at the cost of longer distances to recreational forests. Since no compensation is usually paid for such a change, the property right regime implies the use of an equivalent variation willingness to pay measure.

Those respondents in this study who are satisfied with their present distance to the closest recreational forest have a mean distance of 0.70 km and median of 0.30 km (southwest of Sweden excluded). The corresponding measures for the preferred distance among those who would like to live closer are 0.66 and 0.30 km, respectively, which matches the previous figures remarkably well. With these results in mind, consult Fig. 3 which shows that the main mode of transportation to recreational forests located within 1 km from the residence is by foot or on skis. Taken together, these findings suggest that the distance to the closest recreational forest for a majority of the Swedes should be within walking distance. From Fig. 2a and b, one can also identify a housing shortage within 1 km of recreational forests in Sweden in general, while there is a surplus for longer distances.

When a recreational forest is within walking distance, travel to the forest may be considered as a part of the recreational experience to a larger degree than if the travel, due to a longer distance, is by bike or car. In this case, it is reasonable to assume that the walk itself yields benefits to individuals. Furthermore, one of the respondents made the following comment: ‘‘I want to see the forest from my residence’’. This statement reflects another important aspect of the relation between forests and humans that can be termed an ‘‘off-site non-use value’’. In a valuation study by Mattsson and Li (1993), the off-site experience of the forest environment accounted for one-third of the total non-timber value of forests in northern Sweden. In this study, no distinction is done between such off-

site values and on-site recreational values. Neither are any benefits associated with travel to, or from, recreational forests considered explicitly.

The limited sample size of this study restricted the possibility of reducing the analysis to a regional or local context. The issue of shorter distances to forested areas appears to be a problem in large cities and areas where agriculture is dominant. In these settings, the present distance to forested areas is large and a high proportion of the respondents prefers to live closer to the forest (cf. Fig. 2b). The southwestern region of Sweden, where the city of Malmö is surrounded mostly by agricultural land, is a good example of this. Further research focusing on such regions could provide a better understanding of the underlying rationale.

Both the choices of a preferred distance and attitudes toward an increase in the present distance are explained by the respondents' present distance to the closest recreational forest. In the latter case, this result is expected since the relative increase caused by a doubling of the distance increases with the present distance. For respondents who now live close to a forest, a doubling of the distance would not be of a major concern. A change from 0.2 to 0.4 km is still within reasonable limits. For respondents who presently travel 1–2 km, a doubling of the distance may cause a change in the means of transportation needed to reach the forest. Consequently, when urban development results in longer distances to recreational forests, the focus should just as much be on those who use the area and live a bit further away as on those who live close by.

The average maximum willingness to pay to avoid a doubling of the distance to the closest recreational forest was estimated by means of an open-ended question format. This format is the most obvious way of eliciting the money value of welfare variations as long as the respondent is aware of his or her true valuation. Compared with closed-ended questions, the advantages of the open-ended format are that inference about the valuation function is not required and that real WTP is more accurately estimated. However, the ''market like'' situation, the respondent experiences in a closed-ended format, which might be less mentally stressful, is lost here (Mitchell and Carson, 1989). Since the object of valuation (distance to the forest) and the concept of paying (increased monthly cost of living) are fairly easy to understand, there is reason to think that an open-ended approach will work effectively as suggested by Carson (1991). Another consequence of the open-ended method may be an unacceptably large number of protest zero bids. In this study, the number of zero bids was 40% of all valid WTP responses. However, only a moderate proportion of these was identified as protest responses. Among all respondents who gave a zero bid, 22 of 34 also left a follow-up comment and four of these indicated a protest zero with comments like ''let those who log the forest pay'' or ''the owner of the forest is not bothered about my opinion''.

Finally, the fact that a logit model gives the best fit to WTP data may have some interesting implications. Jorgensen and Syme (1999) shows that attitudes towards paying for a public good can be a stronger predictor of WTP than both variations in the intervention (storm water pollution abatement in this case) and household income. This result was insensitive to variations in the contingent valuation survey design, such as the payment vehicle and the institution responsible for implementing the intervention. Hence, the economic results of this study may possibly be a measure of whether or not respondents believe that an actual payment implies that recreational forests will be kept close to their homes.

5. Conclusions

- Over 40% of the respondents in this study would prefer a shorter distance between their residence and the closest recreational forest.
- Almost 85% of the respondents stated a preferred distance to the closest recreational forest of 1 km or less, southwest of Sweden excluded.
- The most frequent mode of transportation to recreational forests located within 1 km from respondents' residences was by foot or on skis.
- A majority of the Swedish population would prefer to have the closest recreational forest within walking distance of their residence.
- In general, there is a housing shortage within 1 km from recreational forests in Sweden.
- Forty-five percent of all respondents in the study considered a greater distance (twice that of the present distance) to the closest recreational forest as negative.

- The probability of giving a positive willingness to pay bid to avoid an increase in the distance to the closest recreational forest is positively correlated with respondent's present distance to a forest.

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Appendix A.

The present and the preferred distances were considered in the following questions:

How far is it between your residence and the closest recreational forest (not park) useful as a recreation area (where you can, e.g. walk, pick berries and mushrooms or ski)?

It is . . . . . kilometer and . . . . . meter.

If the decision were yours — how far would you prefer the distance between your residence and the closest recreational forest to be? Everything else in your neighborhood remaining unchanged.

My preferred distance between residence and the closest recreational forest is . . . . . kilometer and . . . . . meter.

Comments: . . . . . .

The wording of the economic elicitation question was as follows:

What is the maximum amount of money you are willing to pay per month to avoid this change (assume that this amount of money will be added to your monthly cost for housing)?

I would be willing to pay a maximum of . . . . . SEK per month.

Comments: . . . . . .

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