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Forest management and public perceptions — visual versus verbal information

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Abstract

Forest and landscape management measures have impacts on the amenity value of forests. People may have certain attitudes towards management, in particular near urban areas. The aim of this study was to evaluate the impacts on scenic beauty and recreational value of five different management practices: small clear cutting, thinning, removal of undergrowth, natural state, and traditionally managed cultural landscape. In order to compare visual perceptions with preconceptions, two evaluation methods, visual presentation (pictures produced by image-capture technology) and verbal questions were used. Scenic beauty and recreational value were assessed from slides in which management measures were presented by the pairwise comparison technique. The results indicate that scenic beauty and recreational preferences differ considerably from each other. In the study areas, small clear cuttings had the most positive effect on scenic beauty and natural state had most positive effect on recreational value. Furthermore, preconceptions concerning different silvicultural measures did not consistently correspond to perceptions based on the assessment of visual images. This fact supports the use of visual presentation methods in future preference studies as well as in participatory forest planning projects. © 2001 Elsevier Science B.V. All rights reserved.

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1. Introduction

The total value of a forest consists of many different values. Traditionally the most important has been the direct utility value which is derived chiefly from timber. During the past decades, however, the amenity values of the forest, such as scenic beauty and recrea-

tional value have become increasingly significant. This is especially true in forests near urban areas where the significance of recreational value is emphasised (Sievänen, 1992; Tyrväinen, 1999). The scenic beauty of the landscape affects recreational value since landscape forms the central environment for recreation activities (Karhu and Kellomäki, 1980). Aesthetic quality, however, may not be a key factor in all recreational activities (e.g. Heikinheimo et al., 1977; Pukkala et al., 1988). For example, a clear cut area can have a high recreational value for someone picking berries even though the scenic beauty is not appreciated.

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The main part of landscape perception occurs through the sense of sight and, therefore, visual impacts of land-use or management activities are important. There has been large amounts of empirical research focused on the aesthetic perception of forest scenery (e.g. Ribe, 1989). Much of the aesthetic experience is subjective in nature and has impacts on person's mental and emotional state (e.g. Kaplan and Kaplan, 1989; Korpela, 1995). Visual variation is often stressed as being key factor for aesthetic experiences (Kellomäki, 1975; Hultman, 1983; Axelsson Lindgren, 1995). In particular, forest edges which are many in urban setting are essential for human aesthetic experience and visual perception and, therefore, the structure and design a forest edge is important (Lucas, 1991; Gustavsson and Fransson, 1991). A well-designed edge consists of mixture of bush and tree species which have great ecological and aesthetic importance (Gustavsson and Ingelög, 1994).

Research on forest landscape preferences in Finland has mainly been carried out during the 1970s and 1980s (e.g. Kellomäki, 1975; Jaatinen, 1976; Savolainen and Kellomäki, 1981; Pukkala et al., 1988). There appear to be many factors affecting the scenic beauty of the forest including tree species, forest structure and traces of silviculture practices. Earlier research has focused primarily on boreal coniferous forest areas and, as a result, mainly pine (*Pinus sylvestris*), spruce (*Picea abies*) and birch (*Betula pendula*), the dominant tree species, have been studied. Generally, the results of scenic valuations carried out in other forested Nordic countries correlate quite well with Finnish preferences (Jensen et al., 1995; Axelsson Lindgren, 1995). Several methods have been used to evaluate landscape preferences and the effects of forest management activities on scenic beauty (or on recreational value) (e.g. Koch and Jensen, 1988). Preferences can be examined through verbal questions or through visual presentations. Furthermore, there are many ways to evaluate landscape visually: actual visits to a forest, photographs, computer line graphics and computer-aided image-capture technology. All these methods have been frequently used, however, usually only one method has been applied at a time. There are, however, some studies in which two or three methods based on visual presentation have been compared (e.g. Savolainen and Kellomäki, 1984;

Pukkala et al., 1988; Nousiainen and Pukkala, 1992; Tyrväinen and Tahvanainen, 1999). These studies indicate that different methods of visual presentation produce similar results. In contrast, visual versus verbal information has not previously been compared although this approach would be interesting for two reasons. First, when seeking attitudes towards different kinds of forest management activities verbally, the forest terminology may be unfamiliar to respondents. Therefore, the interviewer's selection of words may contribute, either consciously or unconsciously, to the attitudes of the respondents. Verbal information has been shown to have an effect on people's acceptance/preferences of various management actions in relation to the forest environment as a recreational area (Jensen, 1998). Second, people often have negative attitudes concerning forest management activities, especially near urban areas, even if the effects of these activities went unnoticeable or were even beautiful.

The main aim of this study was to evaluate the effects of different forest and landscape management activities in a recreation area on scenic beauty and recreational value. An additional aim was to compare the public perceptions gained through two different evaluation methods: visual presentation (pictures produced by image-capture technology) and verbal questions. Furthermore, the intent was to examine the effects of background factors on the preferences.

2. Material and methods

2.1. Study area

The study area, Ruissalo island (9 km²), is situated in the archipelago of southwestern Finland, near the city of Turku (Fig. 1). Ruissalo, like the whole coastal area of southwestern Finland is part of the hemiboreal vegetation zone (Ahti et al., 1968) which lies between the northern south boreal and southern temperate vegetation zones. The hemiboreal zone is, however, more associated with the northern boreal zone, especially in respect to the dominant tree species and vegetation types. Broad-leaved trees such as oak (*Quercus Robur*) are characteristic to the zone. In terms of forest tree composition, Ruissalo is an exception in Finland and is characterised by the largest oak woods in the country. In addition, all possible oak

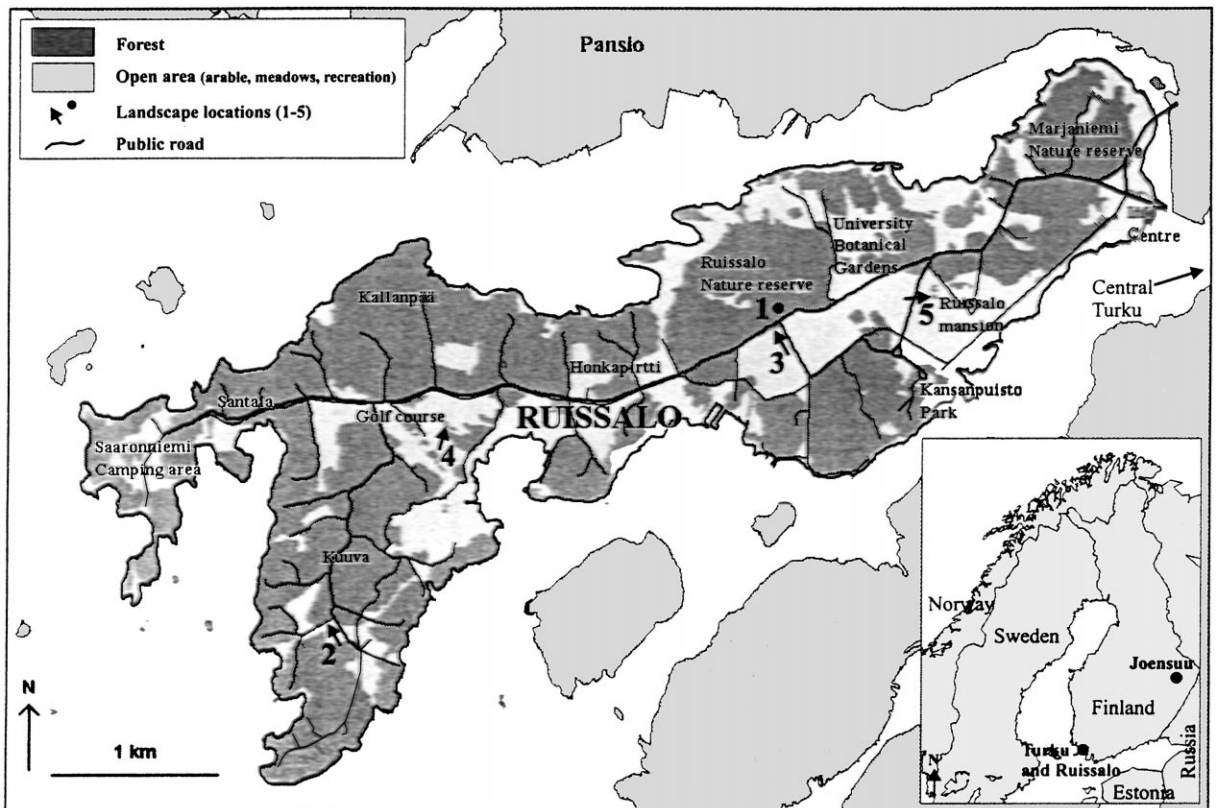


Fig. 1. The island of Ruissalo.

ecosystems are represented on the island (Hinneri and Kortesharju, 1979).

About half of the island's area is covered with woodlands. Although Ruissalo is well-known for its oaks, pine is the most common tree species on the island. Pine is dominant in 43% of the woodlands in comparison to oak, which comprises about 37% of the woodlands (Antikainen, 1991). Other typical tree species are spruce and birch. Flora in Ruissalo is diverse, partly because of the human influence (Vuorela, 1997). Many species have spread from gardens or are rare in Finland. Tree species such as oak, lime (*Tilia cordata*) and hazel (*Corylus avellana*) are naturally occurring, but ash (*Fraxinus excelsior*), elm (*Ulmus glabra*, *Ulmus levis*) and beech (*Fagus sylvatica*) have either been planted or spread from gardens (Antikainen, 1991).

Ruissalo is mainly used today for recreation. There are two nature reserves as well as several recreation

facilities. The land is owned by the state but the city of Turku has administrative rights and is responsible for the management activities on the island. In addition to the two nature reserves, all broad-leaved woodlands on the island are part of the national conservation program of herb-rich forests. The island has been and still is facing strong pressures from landscape management practices and recreation. There are, however, no studies on the recreational use of the island nor scenic preferences of the visitors to it.

2.2. Landscapes

To study the impact of different management regimes on landscape, typical scenes representing the area were chosen. The scenes included both near and far-views, because a typical recreational visit to the area includes both type of scenes. The study material consisted of five scenes (Fig. 2):



scene 1



scene 1 – alternative A



scene 1 – alternative B



scene 1 – alternative C



scene 1 – alternative D



scene 1 – alternative E



scene 2



scene 3



scene 4



scene 5

Fig. 2. The scenes and some examples of the forest and landscape management alternatives used for evaluation.

1. forest stand in a nature reserve;
2. pine forest in Kuuva;
3. broad-leaved woodland in a nature reserve;
4. on the golf course;
5. a woodland patch within the surroundings of Ruissalo manor.

The first landscape represents a spring scene within a forest stand while the others are distant summertime scenes. Two landscapes were located in a nature reserve area (Fig. 1). The Ruissalo Nature Reserve is mainly a broad-leaved forest dominated by oaks nearly 200 years old. Other tree species are birch, lime, pine and spruce. The management of these woodlands has led to conflicts. In the nature reserves, they have mainly been related to a lack of management which has resulted in decaying wood and the closing of the forest structure. People are aware of the biodiversity and conservation issues related to no management, but others prefer more managed landscapes. The two landscapes at the nature reserve form an interesting comparison. The landscapes differ in respect to season and viewing distance. In close-up photographs taken in spring within the forest, decaying wood and the overall structure is clearly visible in the scenery while during the summer much of the woodland structure would be undetectable. On the other hand, in distant views, details such as rotten wood often go unnoticed. Spring is, however, one of the most popular seasons for woodland recreationists and is, therefore, considered an important factor in choosing landscapes and seasons.

The Kuuva pine forest was selected as one of the original scenes since, in spite of the abundance of oak on the island, pine is the most common tree species both in Ruissalo and in Finland. Pine forests are more dominant in the western part of the island and have been neglected most often in the discussion of woodland management, which has focused on broad-leaved trees and woodlands. The Kuuva pine forest (age 70 years) is located on a SW-facing slope, partially on bedrock with a shallow soil cover. The forest changes gradually into a mixture of pine, birch and mountain ash (*Sorbus aucuparia*).

The golf course is a popular recreation area in Ruissalo, and the forest patches of the golf course are aesthetically appreciated. The margins of the patches are heavily managed which includes removing

the understory. These half-open forest stands are comprised of oak, and the oldest individuals are about 200 years old.

The scene surrounding Ruissalo manor represents the most traditional landscape on the island in terms of human management. There has been active agriculture in the area since the 16th century and the overall character of the area is still open. The landscape of the manor is characterised by a dry and poor coniferous woodland patch with a half-open dry meadow.

2.3. Photography and image processing

The photographs were taken in May and June 1997 using a panoramic camera with a 28 mm lens, and colour negative film with a sensitivity of 200 ASA. The pictures were taken on a tripod, horizontally at the eye level of the observer. The first scene was photographed from a path, thought to be the most usual place for walkers and joggers to observe the landscape. The other scenes were photographed at a long distance, and suitable locations for this purpose were fields and a path on the golf course.

The original paper photographs were scanned using an Agfa table scanner. These digital raster images were introduced into Adobe Photoshop image-processing software for the landscape management manipulations. The final digital images were printed using an Agfa Alto slide printer to produce 35 mm slides for the evaluation. Using tools for image manipulation in the Adobe Photoshop 2.5.1, the following forest and landscape management alternatives were produced in each original photograph (Fig. 2):

- A. small clear cutting and removal of logging residue;
- B. thinning and removal of logging residue;
- C. removal of undergrowth and logging residue;
- D. natural state;
- E. traditional management of cultural landscapes (e.g. pastures, grazing).

Small clear cutting, thinning and removal of undergrowth were forest management alternatives produced in each photograph and, thus, represented a future scene. These alternatives also included removal of logging residue, which is considered detrimental in recreation areas near urban regions (e.g. Heino, 1974; Ribe, 1989). Natural state represented an alternative of

the future (estimated 50 years later), assuming no management practices were carried out. In the visualisation, the natural succession of the forest was followed as accurately as possible; for example, by taking into account the characteristics of each habitat. In the case of distant sceneries, the fields and the golf course were also considered as changing elements in the landscape. Thus, for example, open arable land was gradually closing due to the invasion of pioneer trees and shrubs like birch and willow (*Salix spp.*).

Alternative E (traditionally managed) contained the visualisation of the landscapes according to actual land use from the mid-19th century. An old map (Ekqvist, 1846) was used in conjunction with written data to gather all relevant information for the visualisations. The idea behind the traditional landscape was to include management and restoration of cultural biotopes in the alternatives. These questions have been much discussed lately and relate closely to the southwestern archipelago, where much of the landscape, especially that related to broad-leaved trees, is closely connected to traditional landscape management and land use. Therefore, alternative E can also be considered as a possible future landscape management alternative.

The management alternatives were visualised in each original picture although an alternative would not have been completely realistic in a specific landscape location; this was due to the statistical method used in this study. However, since the pine forest of Kuuva and the forest island on the golf course lacked undergrowth, it was impossible to visualise alternative C in these landscape locations.

2.4. Evaluation of landscapes

The scenic beauty and recreational value of the landscapes represented in the $m = 28$ slides were evaluated through pairwise comparisons. Pairwise comparisons were made and analysed according to the method of Alho et al. (2001). Before composing pairs, the slides were randomised and marked with the labels $1, 2, \dots, m$. The pairs were formed so that slide number 1 was compared to number 2, 2 to 3, ..., and $m - 1$ to m . Then comparisons 1 to 3, 2 to 4, ..., $m - 2$ to m were added. Thus, the total number of pairs was $(m - 1) + (m - 2) = 53$. Finally, the

order in which the pairs were presented to the evaluators was randomised.

The slides were evaluated at meetings in the cities of Joensuu and Turku. The evaluators were people from three interest groups: people who lived in Joensuu, experts, and people who lived in Turku. The first group was a reference group because its members were expected to be generally unfamiliar with Ruissalo or matters concerning it. This assumption was made since Joensuu is situated in eastern Finland, about 550 km from Turku. The two latter groups, in contrast, were thought to know Ruissalo well. The experts were professionals of land-use planning and management involved in natural resource management through their work in the Turku region. They represented different educational backgrounds such as forestry, agriculture, horticulture and physical planning. Some participated in actual decision-making matters concerning Ruissalo.

Each person evaluated the set of 53 pairs of slides twice. In the first, their task was to evaluate scenic beauty; in the second, they evaluated recreational value. In this study, recreational value meant the suitability of the environment depicted in the slides for recreational activities. Each pair to be compared was projected on the same screen, adjacent to each other, for 15 s. On the basis of a preliminary test this time was sufficient for making an evaluation. Prior to starting the pairwise comparisons, three slide pairs were presented to the evaluators to practice the comparison technique. The actual comparisons were made to assess which of the two landscapes was more beautiful (or better for recreation), and how much more beautiful (or better for recreation) it was. The evaluations were recorded on a sheet that included both numerical and verbal evaluation scales. The correspondences between numerical and verbal expressions were: 1 = equal value given to both landscapes, 3 = weak preference of one landscape over another, 5 = notable preference of one landscape over another, 7 = strong preference and 9 = absolute preference of one landscape over another. It was also possible to use the intermediate values 2, 4, 6 and 8.

After the pairwise comparisons the original landscapes were shown to the evaluators, one at a time. For each landscape, the evaluators were asked verbally how the forest and landscape management measures of this study would affect the scenic beauty and

recreational value of the landscape. The opinions, which were examined through the seven-step Likert-scale, were marked on a form. The alternatives used in the Likert-scale were: 1 = very negatively, 2 = negatively, 3 = quite negatively, 4 = neither negatively nor positively, 5 = quite positively, 6 = positively and 7 = very positively. Finally, some background characteristics of the evaluators were sought.

2.5. Statistical analysis

The pairwise comparisons were analysed at the University of Joensuu, at the Department of Statistics. In the following, the model used in this study is introduced briefly Alho et al. (2001). In the regression model, the scenic beauty (and recreational value) of the landscapes (a combination of landscape location, i , and treatment, j) was explained through the background characteristics of the evaluators (k). The evaluators could be divided into classes, for example, according to sex. Assuming that an evaluator belongs to class $h = 1, \dots, H - 1$, then the value of (i, j) for k is of the loglinear form

$$v(i, j, k) = \exp(\mu + \alpha_{ij} + \gamma_{jh}) \quad (1)$$

where v is the scenic (or recreational) preference and μ an intercept term. The term $\alpha_{ij} = u + u_{1(i)} + u_{2(j)} + u_{12(ij)}$, where $u_{1(i)}$ measures the effect of the landscape location i , $u_{2(j)}$ measures the effect of the treatment j , and $u_{12(ij)}$ is the location-treatment interaction. The term γ_{jh} shows how the background characteristic of k influences his/her evaluation relative to the baseline.

When computing the results the regression coefficient of each landscape was decomposed, and in the results the effects of the treatments on scenic beauty and recreational value are examined. To facilitate interpreting the results, the effects of treatments ($u_{2(j)}$) have been converted into exponential form ($e^{u_{2(j)}}$). These values are relative, and the value one means that the effect of a treatment is on the average level (in this consideration the treatment of the original landscape is included). For example, if some treatment has a higher value than the value of the original treatment, it indicates that this treatment has a positive impact on scenic beauty (or recreational value) relative to the original landscape. The effect of treatment j is the same in each landscape location.

First, the effects of different treatments were studied using the model of interactions (α_{ij}) in which background characteristics, or explanatory variables were not considered. The background characteristics were then included in the regression model. The F -test identified those background characteristics which significantly increased the goodness of fit of the regression (R^2). If some variable increased R^2 , differences in scenic (and recreational) valuations between different classes in a case of each treatment were studied with the aid of t -tests.

In this study, the Likert-scale was assumed to be on an ordinal level. Answers to the verbal questions were analysed by calculating medians and by using the non-parametric Mann–Whitney U -test (two classes to be compared) and the one-way variance analysis of Kruskal–Wallis (more than two classes to be compared). If the Kruskal–Wallis test found differences in the opinions of the classes, the differences were localised through pairwise comparisons by means of the Mann–Whitney U -test. In that case, the number of pairs to be compared was $k(k - 1)/2$, and the two-tailed P -values of the test were multiplied by $k(k - 1)/2$, where k is a number of classes (Noether, 1991). The same explanatory variables were used as in the regression model described above. The significance level used in all statistical tests was 0.05.

3. Results

3.1. Background characteristics of the evaluators

In this study, 94 persons participated. Of them 45 were women and 48 men. They represented three interest groups: people who lived in Joensuu (42 persons), experts (20) and people who lived in Turku (32). Three age classes were identified: 18–34 (age class 1 = young persons), 35–59 (class 2 = middle-aged) and people over 59 years (class 3 = older persons). The first age class included 31 persons, the second 42 and the third 21. The evaluators were divided into three classes according to residential environment; 8 persons lived in rural areas, 61 in suburbs and 24 in cities. A total of 23 persons were forest-owners while 70 persons did not own forest. Some observations were missing in the data on background characteristics.

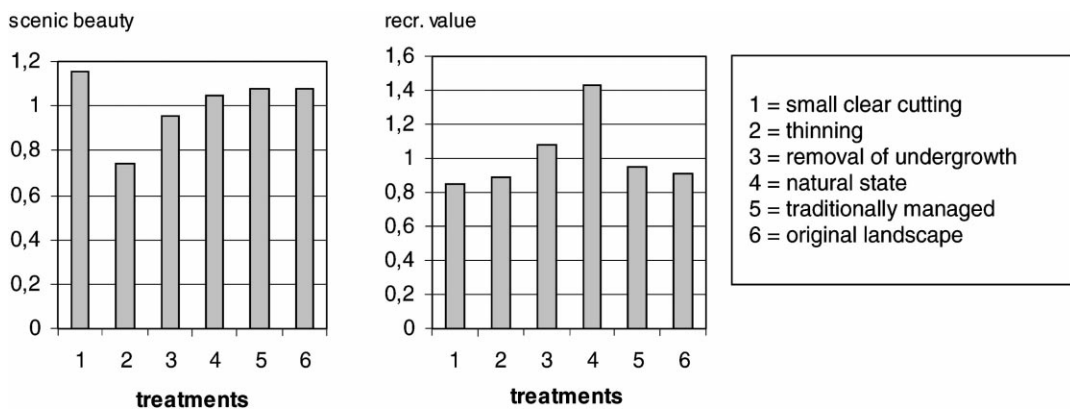


Fig. 3. Effects of different forest and landscape management measures on scenic beauty and recreational value. The values (1) scenic beauty and recreational value are relative, and the value (1) means that the effect of a treatment is on the average level. If a treatment has a higher value than the value of the original treatment, it indicates that the treatment has a positive impact relative to the original landscape.

3.2. Preferences based on visual perceptions

When the effects of different forest and landscape management measures were studied without considering background characteristics, small clear cutting affected scenic beauty most positively (Fig. 3). Thinning was valued least, and removal of undergrowth also had a negative impact on scenic beauty relative to the original landscape. Valuations of the alternatives “natural state” and “traditionally managed cultural landscape” were at the same level as that of the original landscape. The goodness of fit of the model (R^2) was 0.215.

When recreational value was the object of evaluation, the preferences differed considerably from one described before (Fig. 3). Clearly natural state was valued most. Removal of undergrowth also had a positive effect on recreational value relative to the original landscape. Preferences for small clear cutting, thinning and “traditional management” did not differ greatly from the original landscape. R^2 was 0.115.

In the regression model scenic beauty and recreational value were also explained by the following variables, one variable at a time: sex, age, interest group, forest-ownership and residential environment.

Age ($P = 0.01$) and residential environment ($P = 0.01$) both increased the R^2 value in respect to scenic beauty ($R^2 = 0.219$). In other words, these background characteristics affected valuations of different forest and landscape management measures.

According to the t -tests and the significance level used, there were differences in the attitudes of age classes towards small clear cutting; middle-aged and older persons (classes 2 and 3) thought that clear cutting increased the scenic beauty of the original landscape while young persons (class 1) considered the effect of clear cutting to be negative (Fig. 4).

People who lived in different residential environments also had dissimilar attitudes towards small clear cutting (Fig. 5). According to rural residents, clear cutting had a negative impact on scenic beauty whereas city dwellers (living either in a suburb or a city) thought that clear cutting increased the scenic beauty of the original landscape. Furthermore, persons who lived in suburbs believed that if forests were left in their natural state, they would look like more beautiful. City-dwellers, however, had the opposite opinion.

When the object of assessment was recreational value, each of the background characteristics had a statistically significant effect on the valuations of different forest and landscape management measures. Sex ($P = 0.01$) increased R^2 only slightly ($R^2 = 0.117$), and therefore, the t -tests did not indicate any differences in the opinions of women and men. Age, in contrast, was the most significant ($P < 0.001$) explanatory variable ($R^2 = 0.123$). Although all age classes adopted a positive attitude towards the natural state, there was a clear trend in the opinions: the younger the person, the more positive the attitude

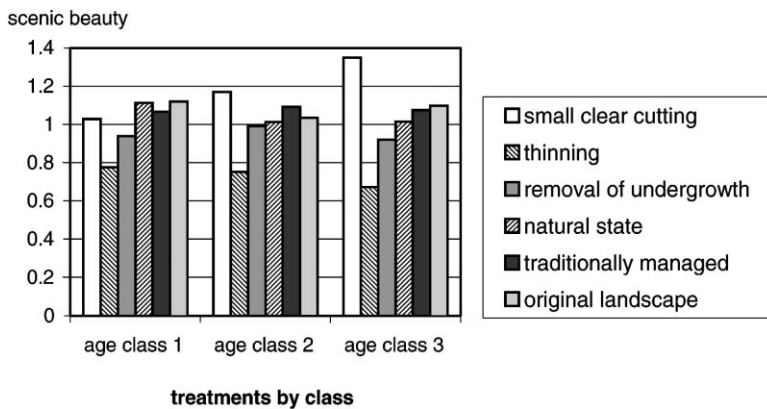


Fig. 4. Effects of different forest and landscape management measures on scenic beauty according to the opinions of three age classes.

towards the natural state (Fig. 6). In addition, young persons thought that restoring present landscapes as traditionally managed cultural landscapes would have a positive effect on recreational value. Middle-aged and older persons had slightly negative attitudes towards the alternative “traditionally managed cultural landscape”.

When recreational value was explained by the variable “interest group” ($P < 0.001$), R^2 was 0.122. The opinions of experts and people from Turku were similar in the case of each measure (Fig. 7). In contrast, attitudes of people from Joensuu differed from the two above-mentioned groups in regard to natural state and “traditionally managed”. Although all interest groups believed that natural state has a positive impact on recreational value, the experts and

persons who lived in Turku thought that natural state would even double the recreational value in comparison with the original landscape. These interest groups also had a positive attitude towards the alternative “traditionally managed” while persons who lived in Joensuu regarded the effect of this alternative to be negative.

Forest ownership ($P < 0.001$) had an effect on the recreational valuations of natural state and the “traditionally managed” ($R^2 = 0.120$). As a general rule, forest-owners had a more negative attitude towards these measures than non-owners (Fig. 8). Although forest-owners considered natural state to increase the recreational value of the original landscape, the effect of the measure was very small when compared to the views of non-owners. Furthermore, forest-owners

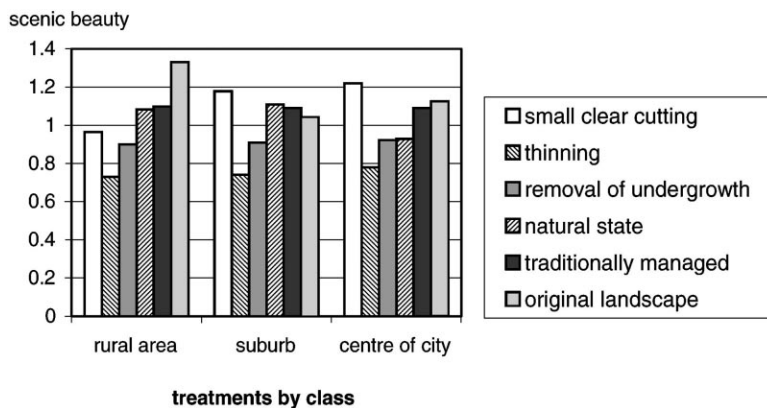


Fig. 5. Effects of different forest and landscape management measures on scenic beauty based on different residential environments.

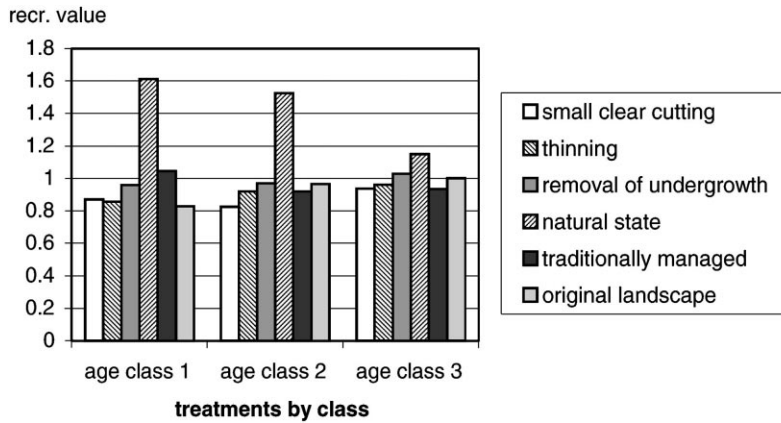


Fig. 6. Effects of different forest and landscape management measures on recreational value according to the opinions of three age classes.

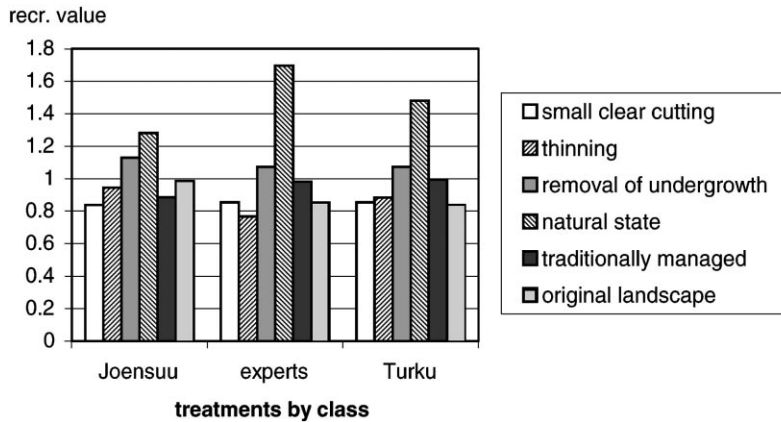


Fig. 7. Effects of different forest and landscape management measures on recreational value according to the opinions of three interest groups.

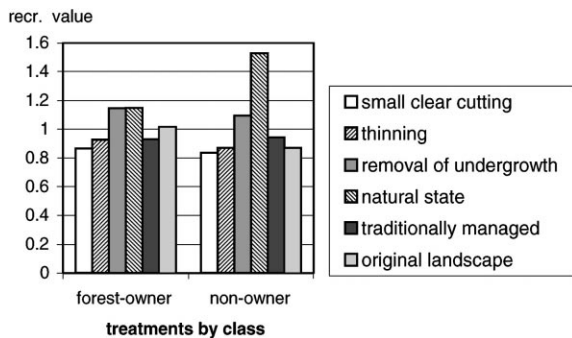


Fig. 8. Effects of different forest and landscape management measures on recreational value according to the opinions of forest-owners and non-owners.

thought that if present landscapes were restored as traditional landscapes, the recreational value of a forest would decrease. Non-owners had the opposite opinion ($P = 0.038$).

Residential environment was as significant ($P < 0.001$) an explanatory variable as interest group ($R^2 = 0.122$). According to the opinions of rural residents, removal of undergrowth decreased the recreational value of a forest (Fig. 9). City dwellers (living either in a city or a suburb) had a positive attitude towards this measure. The impact of natural state on recreational value was positive despite the residential environment, but the amount varied depending on the environment. Persons who lived

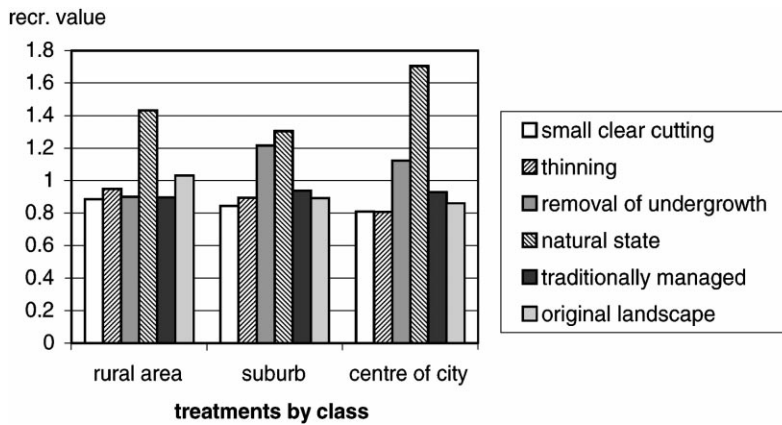


Fig. 9. Effects of different forest and landscape management measures on recreational value based on different residential environments.

in a city thought that a virgin forest could be even twice as suitable for recreation as the original environment. Attitudes of persons who lived in rural areas or in suburbs were not as strong concerning natural state.

3.3. Preferences gained through verbal questions

The general attitude towards small clear cutting was very negative and towards thinning quite negative (Fig. 10). Removal of undergrowth evoked neither positive nor negative opinions. Natural state and “tra-

ditional management” were considered quite positive alternatives. The estimations of scenic beauty and recreational value were the same for each alternative.

Preferences gained through verbal questions, or preconceptions, of women and men differed in regard to removal of undergrowth. Otherwise they corresponded to the general opinions. Generally, women had a more negative attitude toward removal of undergrowth than men. When evaluating scenic beauty, women thought that the effect of the measure was quite negative while men thought it quite positive. Moreover, women thought that a forest without under-

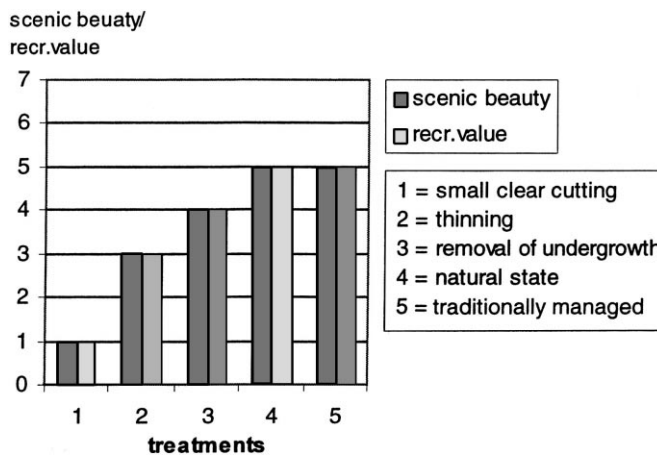


Fig. 10. Attitudes towards different forest and landscape management measures. Scenic beauty and recreational value on the Y-axis are medians calculated from values given on a seven-step Likert-scale.

growth is as suitable for recreation as one with undergrowth. Men, however, believed that removal of undergrowth increases recreational value.

Older persons had a more positive attitude towards removal of undergrowth than young and middle-aged persons because they thought that the measure has quite a positive effect on scenic beauty. Young persons did not have a clear opinion, and the middle-aged believed that removal of undergrowth decreases scenic beauty somewhat. Although all age classes considered the traditional landscape to be more suitable for outdoor recreation than the original environment, older persons supported the alternative “traditionally managed” slightly more than young and middle-aged persons.

The preconceptions of interest groups differed from each other in the case of three alternatives: removal of undergrowth, natural state, and “traditional management”. Experts and persons who lived in Turku considered undergrowth removal to have quite a negative effect on scenic beauty whereas persons who came from Joensuu had the opposite opinion. Furthermore, the experts perceived that natural state would not have any impact on scenic beauty or on recreational value, but persons who lived in Turku believed that the impact would be fairly positive. The experts also had a neutral opinion towards the alternative “traditionally managed” while persons who came from Joensuu thought that a traditional landscape would somewhat increase recreational value.

When scenic beauty was assessed, forest-owners had a more positive attitude towards thinning than non-owners ($P = 0.0001$) (Fig. 11). A similar trend was found towards removal of undergrowth when considering both scenic beauty and recreational value. In the case of natural state, the trend was opposite; persons who did not own forest thought that natural state would have quite a positive effect on both parameters while forest-owners adopted a neutral attitude.

Residential environment influenced preconceptions with respect to removal of undergrowth and natural state (Fig. 12). When evaluating scenic beauty, country people had a more positive attitude towards removal of undergrowth than persons who lived in cities. Regarding natural state, the effect of residential environment was the opposite. When recreational value was assessed, the preferences of both country people and persons who lived in a suburb deviated from those of persons who lived in a city. The differences between these two groups followed the guidelines described above.

3.4. Verbal versus visual information

The preconceptions differed greatly from the visual perceptions (cf. Figs. 3 and 10). When considering scenic beauty, the most significant difference was for small clear cutting. Although the preconception was very negative, the visual assessment was that small clear-cut scenery enhanced scenic value. Furthermore,

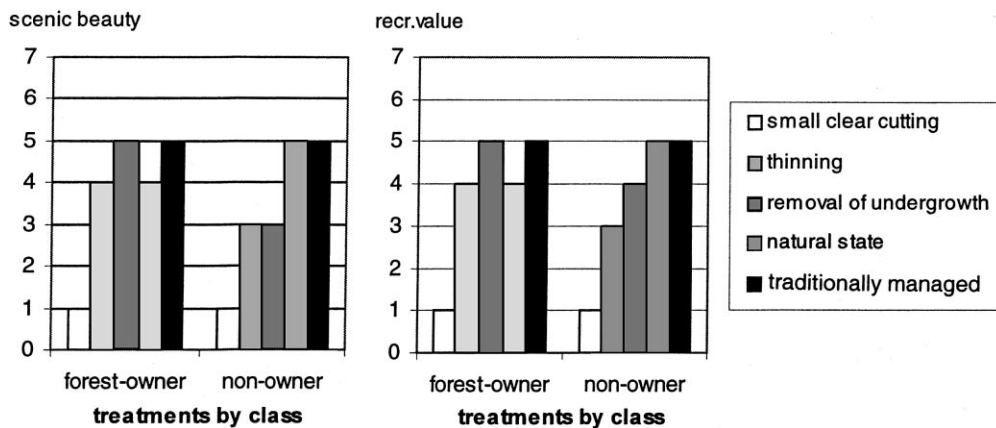


Fig. 11. Attitudes of forest-owners and non-owners towards different forest and landscape management measures. Scenic beauty and recreational value on the Y-axis are medians calculated from values given on a seven-step Likert-scale.

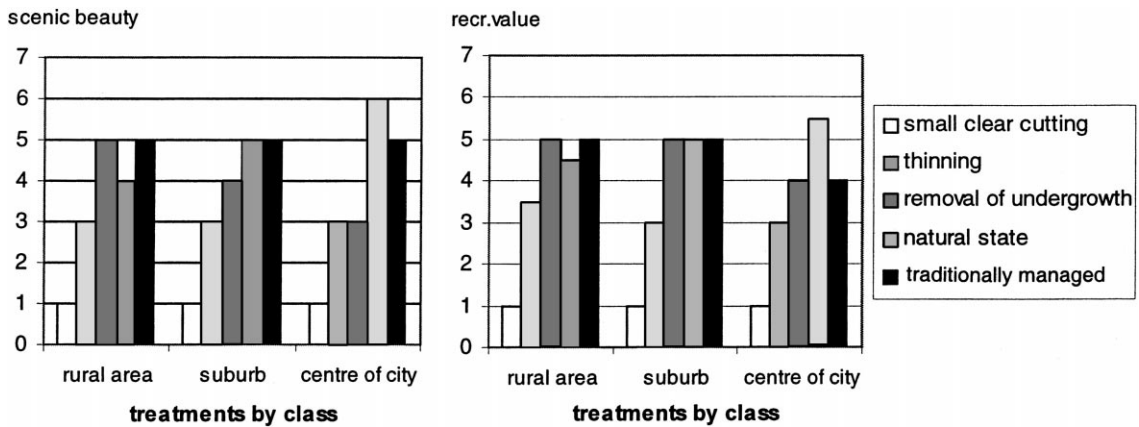


Fig. 12. Attitudes of persons who lived in different environments towards different forest and landscape management measures. Scenic beauty and recreational value on the Y-axis are medians calculated from values given on a seven-step Likert-scale.

there were slight differences in the attitudes towards removal of undergrowth, natural state and the alternative “traditionally managed”. In these cases, the images were evaluated more positively than the real perceptions. Attitudes towards thinning (quite negative) were independent of the evaluation method used.

From the point of view of recreational value, the effect of small clear cutting also proved to be most difficult to assess beforehand, although the contrast between the evaluation methods was not as great as in the case of scenic beauty. Preconceptions concerning thinning and removal of undergrowth were slightly more negative than the visual perceptions. In contrast, the traditional landscape was believed to be more suitable for recreation than it actually was on the basis of visual perceptions. Attitudes towards natural state were positive regardless of the evaluation method used.

Background characteristics influenced valuations more when preferences were examined through verbal questions than visual presentation. This was especially true when scenic beauty was evaluated. In addition, only rarely was the effect of a certain background characteristic on the parameter (scenic beauty or recreational value) similar in terms of both evaluation methods. In fact, there were two kinds of difference. First, it might have an impact on a different measure(s). Second, even if the same measure was involved, the way the background characteristic was affected might be different.

There were, however, some cases in which the effect of the background characteristic was clearly similar in terms of the visual and verbal evaluation methods. Similarities were found when the impact of natural state on recreational value was evaluated and when the background characteristics “forest ownership” and “residential environment” were considered. Both city-dwellers and persons not owning forest had more positive attitudes towards natural state than country people and forest-owners.

4. Discussion

This study addressed the effects of different forest and landscape management measures on scenic beauty and recreational value. Two evaluation methods, visual and verbal were used to compare visual perceptions with preconceptions. The results indicate that preconceptions concerning different silvicultural measures in general did not consistently correspond to the visual perceptions. This suggests that people may have different mental images about the proposed management actions without illustration. The result supports the use of visual presentation methods not only in future preference studies, but also in participatory planning, where the aim is to contribute to forest and landscape management.

Image-capture technology was used in this study because it makes it possible to illustrate the future and

also the past state of a forest. This method was chosen over another visualisation method, computer graphics, because it produces a more realistic illustration. It is suitable for areas which have a special scenic value, like the island of Ruissalo (Tyrväinen and Tahvanainen, 1999). In this study, specific features and details of each landscape location (for example, characteristics of habitat and locations of trees) were taken into account as accurately as possible. Although a certain subjectivity is always inherent in using photographic manipulation, during preparation of the illustrations several experts were consulted to guarantee that the outcome would be realistic and acceptable. However, the visualisation required a great deal of time. In some earlier studies, the method was also found to be time-consuming and costly (e.g. Johnson et al., 1994). There are, of course, many factors affecting editing speed, for example, the accuracy of the original pictures to be visualised, the qualitative requirement and the purpose of the pictures (Ihalainen, 1997).

Pairwise comparisons were made and analysed according to the method of Alho et al. (2001). This regression approach has many advantages compared to the traditional method of Saaty (1977), which is also based on pairwise comparisons. The greatest advantage is the possibility of evaluating large data sets. In this study, 28 landscapes were compared and the number of pairwise comparisons was 53. If Saaty's method had been used, which involves comparisons of all potential pairs, the total number of pairs to be compared would have been $m(m-1)/2 = 378$, which would have been impossible for practical reasons. The suitability of the method for the assessment of scenic beauty used in this study is discussed in greater detail in Tahvanainen et al. (2000).

Pairwise comparisons were made on a ratio scale whereas the Likert-scale was thought to be on an ordinal level. The measuring scale affects what tests can be used in statistical analysis. The data from pairwise comparisons were analysed by parametric tests while for analyses of the preferences gained through verbal questions (Likert-scale) non-parametric tests were used, which are not as efficient as parametric tests. As a result, differences in preferences between different classes were perhaps better expressed when the visual perceptions were analysed. Moreover, because visual perceptions and verbal ques-

tions were analysed in a different way, it made interpretation of the results more complicated. In the former case, scenic beauty values and recreational values varied between 0 and 1.8, and in the latter the scale was from 1 to 7. In addition, the values calculated from pairwise comparison data were relative, in which case it was possible to estimate the effect of a certain management measure on scenic beauty (or on recreational value) only in relation to some other measure. The most reasonable point of comparison was the original landscape. In contrast to this, values based on Likert-scale were absolute.

The results based on visual perceptions indicate that scenic beauty is easier to evaluate than recreational value. When background characteristics were not considered, the goodness of fit of the model (R^2) for beauty was 0.215 and for recreational value 0.115. The previous study by Pukkala et al. (1988), which was based on computer drawings, reported similar results. This is presumably because recreational value greatly depends on the way the person spends his or her time in the forest. Therefore, recreation valuations are perhaps more individualistic than valuations of beauty (Pukkala et al., 1988). In the present study, the background characteristics increased R^2 only slightly in a case of both parameters, but had a greater effect on recreational value than on scenic beauty.

Small clear cutting had a positive effect on scenic beauty; it did not reduce the recreational value even though the preconceptions were very negative. In previous studies clear cutting has been found to be one of the least acceptable silvicultural measures (Heino, 1974; Jaatinen, 1976; Karhu and Kellomäki, 1980; Benson and Ullrich, 1981; Hultman, 1983; Brunson and Shelby, 1992). There are many factors which have impact on the acceptability of the measure, for instance, the size of the gap, its adaptability to the landscape and the amount logging residue left in the cutting area (Haakenstad, 1972). Attitudes towards small clear cut areas are usually more positive than towards larger areas (Haakenstad, 1972; Korhonen, 1983; Bradshaw, 1992). Some studies have indicated that it is possible to harvest a certain proportion of the visible landscape while maintaining, or even increasing, a visually acceptable setting (Haakenstad, 1972; Paquet and Belanger, 1997). In this study, clear cut areas were small and logging residue, which has been

found to decrease scenic beauty was removed. These facts have probably contributed to the valuation of clear cutting. In fact, openings in a forest may increase its variability and make it more beautiful and suitable for recreation.

The preconceptions towards thinning were quite negative, and on the basis of visual perceptions the measure also reduced the scenic value of the original landscape. On the other hand, thinning had no effect on recreational value. Brunson and Shelby (1992) have earlier noted an identical result. However, most of the previous studies indicate that attitudes towards thinning, and relatively open stands are positive (Haakenstad, 1975; Hultman, 1983; Korhonen, 1983; Savolainen and Kellomäki, 1984; Koch and Jensen, 1988; Ihalainen, 1997). In the present study, the tree stands of the original landscape locations were for the most part sparse. For example, a pine stand in Kuuva was thinned a few years ago. Still, thinning was visualised in each location because the statistical method used in this study required similar treatments. It is, therefore, possible that forest stands have even been too sparse and that fact has decreased their scenic value.

Removal of undergrowth was considered to be a negative silvicultural measure in relation to scenic beauty. This is similar to results in some previous studies in which undergrowth increased the scenic value of a forest (Savolainen and Kellomäki, 1981; Koch and Jensen, 1988). However, undergrowth should not be too dense since it reduces visibility, a factor which is especially valued by recreationists (Loven, 1973; Savolainen and Kellomäki, 1981). This supports the result in this study, that removal of undergrowth had a positive effect on recreational value.

A natural state forest was highly valued for recreational use but had no effect on scenic beauty, even if the preconception was positive. In a study of Brunson and Shelby (1992) old growth stands were also more acceptable as places for hiking than for viewing the scenery. In this study, pictures of the natural state were visualised, including both down and standing dead wood. Dead wood was clearly visible, particularly in the scene within the forest stand. Past research has indicated that dead and down wood have a significant negative impact on scenic beauty in a forest environment (Schroeder and Daniel, 1981; Brown and Daniel, 1986; Hull and Buhyoff, 1986). Presumably, dead

wood has negatively affected visual preferences of the natural state compared to preferences based on mental images.

There seems not to be a clear and simple aesthetic dichotomy between managed and unmanaged forests, except when management creates serious disturbances (Ribe, 1989). However, this study, and others in the 1990s (Brunson and Shelby, 1992; Ihalainen, 1997), suggest that natural forests are valued more than they were during previous decades (e.g. Haakenstad, 1975; Savolainen and Kellomäki, 1981; Hultman, 1983; Koch and Jensen, 1988). The “green movement” has, in recent years, probably changed public attitudes in a more natural direction (e.g. Lindhagen and Hörnsten, 1998).

The alternative “traditionally managed” neither affected scenic beauty nor recreational value although preconceptions were quite positive towards this measure. In this study, “traditionally managed” represented much the same situation as the cultural landscape in the mid-19th century. Since the landscape locations except Kuuva were either grazing grounds or small-scale cultivated lands at that time, the “traditionally managed” landscape is a possible management alternative for the future. Previous forest preference studies have been carried out in commercial forests, where it has not been plausible to restore the area as a traditional landscape. Therefore, research has not previously been done in this field.

Similarities between this study and others can be found in respect to the effects of the background characteristics on preferences. When scenic beauty was evaluated, older people had a more positive attitude towards clear cutting than young persons (see also Ihalainen, 1997 and Korhonen, 1998). Tyrväinen et al., 2000 have come to the conclusion that the significance of the landscape for outdoor recreation and its enjoyment is significant but decreases according to age. The present study supports this result: the variation in recreational valuations of different measures by older persons was considerably smaller than that of younger persons. Furthermore, according to Tyrväinen et al., 2000, the desire of nature tourists for the natural state of a forest decreased with age. A similar trend was also found in this work. Both the present study and Tahvanainen et al. (1996) suggest that forest-owners are less critical in their evaluations than non-owners, (i.e. the prefer-

ences of forest-owners towards different alternatives did not differ greatly from each other). This may be because forest-owners include timber production in their evaluations whereas non-owners assess the scene as a potential recreation and leisure scene. It is also probable that forest-owners are more familiar with forest terminology than non-owners and have clearer conceptions about the impacts of various silvicultural measures.

The preferences of three interest groups were examined: persons who lived in Joensuu, experts and persons who lived in Turku. The first group was a reference group and their evaluations were more consistent for each measure than those of other groups. This result was in accordance with expectations since Ruissalo is an area which arouses strong opinions in both local inhabitants and experts. Furthermore, the experts had even more well-defined opinions of the effects of the different measures on recreational value than the inhabitants of Turku, which can be inferred from the fact that the experts showed slightly clearer differences among alternatives. The experts may have more knowledge about the impacts of different forest and landscape management measures, and therefore, have clearer opinions about amenity values and the scale of landscape variation (Tahvanainen et al., 1996). Moreover, the experts' perceptions could have been influenced by nature conservation groups (e.g. Jensen, 1993). In this study, the most significant difference in the valuations of experts and other groups was found specifically in the case of natural state.

In this study, scenic beauty values and recreational values did not correlate with each other. This was not surprising because judgements about the forest environment may vary depending on whether scenic beauty or suitability for recreation is under consideration. Brunson and Shelby (1992) proved that the acceptability of different forest management measures significantly varied depending on whether the setting was viewed as a place to hike or camp. It would be advisable in future research to examine the effects of different measures on various forms of recreational activities separately. Such research would provide valuable information to professionals whose task is to decide which silvicultural measures to implement in a given area to enhance characteristics that are valued at that type of location.

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