

## Vegetation density of urban parks and perceived appropriateness for recreation

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### Abstract

There is a growing body of evidence indicating that exposure to, and activities in, nature have beneficial effects on human health. Since a majority of people in many countries live in urban areas, availability and use of urban green areas is of increasing importance to public health. In the present study we measured urban residents' (Trondheim, Norway) recreational preferences for urban park landscapes varying in vegetation density, and aimed at an identification of background variables and environmental value orientations that we hypothesised to influence such preferences. The results showed that moderately dense scenes received the highest preference ratings. Socio-demographic variables and value orientations predicted preferences for moderate to densely vegetated scenes: A curvilinear effect of age of respondents was found, with subjects in their mid-40s expressing a higher preference for moderate to dense vegetation, compared to younger and older subjects. Preference for moderate to dense vegetation also increased as the educational levels of the respondents increased. The preference was lower among people living in apartment blocks, relative to those living in detached houses. Of attitudinal and value-related variables, interest in wildlife, and pro-ecological value orientation (measured with the NEP scale) predicted preference for urban parks with moderate and dense vegetation. The existence of preference for relatively dense vegetation in urban parks in segments of the population has consequences for the designing of urban parks in Norway.

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### Urban parks: the importance of vegetation density

Urban parks are popular destinations for outdoor recreation (e.g., Grahn and Sorte, 1985; Bussey and Coles, 1995; Holm, 2000; Roovers et al., 2002). One of the characteristics that have been shown to influence the attractiveness of natural landscapes is vegetation density. While direct evidence on the effect of vegetation density on preferences for urban parks as recreation settings is relatively scarce, indirect indications can be

found in environmental perception and preference studies, and we will describe central findings from this research before looking at the existing evidence on vegetation density of urban parks and recreation. Studies of landscape preference have been able to identify a number of environmental attributes of high relevance to recreation research. First, the most preferred environments have repeatedly been shown to be those where human influence does not dominate the natural elements or where nature dominates (Gallagher, 1977; Anderson, 1978; Hammitt, 1978; Herbert, 1981; Ellsworth, 1982; Herzog et al., 1982; Hudspeth, 1982; Kaplan, 1985; Strumse, 1994a), thus confirming the importance of urban nature. It is equally clear, however,

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that not all nature scenes are highly preferred, and the interesting question in the context of the present study are the more precise characteristics of preferred natural environments, as these may be assumed to influence the perception of appropriateness for recreation purposes.

Through the process of re-analysing a number of studies at a more abstract level, Kaplan and Kaplan (1989) developed an environmental preference model, stating that in preferred settings, the following qualities should be present: First, the direct processing of information must be possible. For this to occur, the scene in question must be easy to understand both immediately and more indirectly, thus it needs to possess a certain degree of coherence, as well as a degree of legibility. Second, preferred settings should also possess exploration-enhancing qualities such as complexity and mystery (cf. Kaplan, 1992). Implications of this model are that outdoor settings in which humans feel at ease must be easy to understand and to find one's way through, but they should also be interesting and invite further exploration. In addition, the spatial configuration of the setting is of obvious relevance to vegetation density. Thus, across a number of studies, perceived openness (ranging from wide-open to apparently blocked) and the experience of depth or focus, have proved to be important. Highly preferred scenes are characterised by a moderate degree of openness, high degrees of smoothness of ground texture and ease of locomotion (see for example Kaplan et al., 1989; Strumse, 1994b).

From the perspective of landscape ecology, Parsons (1995) remarks that while densely planted wood patches support diversity of wildlife habitats, people tend to prefer more open grassy areas punctuated by occasional groupings of trees and shrubs, i.e., moderately open settings. However, in a recent Dutch study, De Groot and van den Born (2003) found that more than half of their respondents expressed preference for landscapes "in which one may experience the greatness and forces of nature" and another third preferred "wild, interactive landscapes". This may indicate that, in this cultural context, people are inclined to prefer landscapes with relatively dense vegetation.

Staats et al. (1997) examined, in the forest context, the effects of accessibility and vegetation density on mood. In this study, arousal and pleasure scores were both affected by the accessibility manipulations, while the manipulations of vegetation density were somewhat less influential.

### Vegetation density and security considerations

Considerations about safety have proved important in American studies of urban park preferences, particularly among poor African-American urban residents (Kaplan

and Talbot, 1988). Findings are mixed, however, with respect to how park characteristics are related to sense of safety. Often, perceived safety seems to decrease as the density of the wooded area increases, but this relationship is complex, since areas used for picnic and social events may be rated high on both density and sense of safety (Schroeder and Anderson, 1984). Thus, the effect of tree density on safety depends on context. Although dense under-story often is connected with decreased perceived safety, similar dense vegetation near urban public housing may be accepted, possibly because of otherwise good surveillance. Kuo et al. (1998) presented photographs of various landscapes to low-income residents in Chicago, and found that both tree density and grass maintenance increased both preference and sense of safety. Schroeder and Green (1985) found that 60–65 trees per acre (= 0.4 ha) was considered to be the ideal against an open background, but the number dropped if the background was dense. Well-maintained vegetation has been found to enhance attractiveness and security of urban parking lots in the US (Anderson and Stokes, 1989). In Sheffield, UK, Jorgensen et al. (2002) found that more open woodland spaces are considered safer than closed ones. Women more than men felt unsafe in the urban parks shown, which were simulations based upon a local park.

Finally, in a study of preference, perceived danger, and fear for field/forest settings, Herzog and Kutzli (2002) found that visibility and locomotor access both were positive predictors of preference and negative predictors of danger.

It is often argued that the associations between the density of the vegetation and feelings of security relate to the viewing distance. According to Appleton's (1975) Prospect/Refuge theory, landscapes may be evaluated according to whether they fulfil a basic human survival need "to see without being seen", either as "prospect" or "refuge". Dense vegetation leading to closed scenes would not fulfil this need.

### Vegetation density in urban parks related to demographic variables

When establishing and maintaining urban natural areas, urban planners and park managers have to consider the needs and preferences of different groups of residents. In the present study we chose to focus on two important demographic factors regarding use of urban parks, i.e., the life span perspective (mainly effects of age), and whether recreational preferences vary across residents in different types of housing (from detached house, often with a garden, to apartment blocks).

Locomotion abilities, strength, and endurance often weaken as age increases. Such physical changes could affect preferences for dense and less accessible

landscapes in a negative way. However, young persons in a life stage with young children at home also have reasons to prefer open and accessible landscapes, where use of bicycles and prams is possible. These considerations could produce an inverted U-shaped relationship between age and recreational preferences for urban parks characterised by relatively dense undergrowth.

In fact, [Balling and Falk \(1982, p. 17, Fig. 2\)](#) found this relationship when measuring preferences for four natural environments (savannah, coniferous forest, deciduous forest, rain forest) across ages from 18 to 70 years and above. A reduction in preference for natural landscapes with increasing age of subjects was found also by [Lyons \(1983\)](#), and [Zube et al. \(1983\)](#) found that high naturalism is important in the assessment of scenic value among young and middle-aged adults, but relatively unimportant among the elderly.

Data of relevance for a life span perspective on the preferences for landscapes of varying vegetation density exist also in Finland. [Tahvanainen et al. \(2001\)](#) studied the effects of varying management techniques in the forests on people's assessment of scenic beauty and recreational value. When exposed to visualisations of the techniques, for example 'removal of undergrowth', scenic beauty was negatively affected, but the recreational value was positively affected. Age was the most significant explanatory variable; the desire for a natural state in a forest decreased with increasing age. Surveys on the use of urban parks also show that older age groups tend to be underrepresented ([Bussey and Coles, 1995](#); [Oguz, 2000](#); [Roovers et al., 2002](#)).

Demographic variables like gender and educational level are less relevant when studying effects of vegetation density, since both genders and all educational groups equally well manage to move around in parks of varying vegetation density. However, effects of educational level on landscape preferences have been found (e.g., [Yu, 1995](#); [Van den Berg et al., 1998](#)) and should be included in analyses of landscape preferences.

## Effects of environmental values

### General environmental values

It has been hypothesised that behaviour related to our environment (recreational behaviour included) is integrated into a cognitive hierarchy ([Homer and Kahle, 1988](#)). The model implies that values, value orientations, attitudes, normative beliefs, and behaviours are built upon one another so that values and attitudes influence (recreational) behaviour and preferences. Thus, when we ask people about which urban park types they prefer for recreational activities, these preferences may reflect more basic environmental value orientations. One

widely used measure of environmental value orientation is the New Environmental (or Ecological) Paradigm (NEP) Scale ([Dunlap and Van Liere, 1978](#); [Dunlap et al., 2000](#)). This scale consists of items that reflect the so-called new ecological world-view (NEP), assuming that humans are part of nature and must realise this in the use of resources. NEP represents an alternative to the traditional "dominant social paradigm", also called the "Human Exemptionalism Paradigm (HEP), according to which humans are exempt from the laws of nature and rule over the physical world. Items reflecting HEP are also included in the scale. Evidence exists that the NEP scale possesses known-group validity, predicts pro-environmental behaviour, relates negatively to age, and relates positively to educational level ([Dunlap et al., 2000](#)).

It has been shown that both the structure and the strength of environmental value orientations (as measured by the NEP scale) varies across cultures ([Bechtel et al., 1999](#); [Corral-Verdugo and Armendariz, 2000](#)), and that differences exist across demographic groups within one culture. Groups that are dependent upon natural processes for their income (fishers, farmers) have been found to express relatively low NEP scores ([Edgell and Nowell, 1989](#); [Kaltenborn et al., 1998](#)). Environmental values have also been shown to associate with landscape preferences. Using the ecocentric/anthropocentric scale ([Thompson and Barton, 1994](#)) in a rural sample, [Kaltenborn and Bjerke \(2002\)](#) found positive correlations between ecocentrism and preference for wild lands, and for cultural landscapes. The anthropocentric value orientation correlated positively with a preference for more modern farm environments. Thus, we expect environmental values also to influence preferences for urban recreational areas.

In the present study we chose to apply a version of the NEP scale as a measure of general environmental values, fully aware that the scale (like any other method) should be interpreted on the background of the multitude of challenges always met when human attitudes are measured. Space does not allow a discussion of the huge and disciplinary diverse issues involved in the measurement of attitudes; a comprehensive review is to be found in [Eagly and Chaiken \(1993\)](#). In addition, [Dunlap and Jones \(2002\)](#) have discussed the major critical issues involved in the measurement of environmental attitudes, like the construction of central concepts, related and alternative methods, and the dimensionality of environmental attitudes.

### Wildlife-related activities and values

Interest in wildlife should be expected to influence the attractiveness of landscapes varying in vegetation density. Experiencing wildlife seems to be important

for satisfaction with the residential environment, and observing wildlife is one often-mentioned motive for recreational activities in urban natural areas. For example, two types of green areas were rated as important by all age groups in Denmark; “Informal green areas” (trees, bushes, flowers, and peace/quietness), and “Area with wildlife”. Ninety per cent emphasised the importance of birds, and 87% wanted natural vegetation and wildlife (Holm and Jakobsen, 2001). A very strong endorsement of animal life, and of animal-related activities, has been shown to exist among urban residents in other Nordic countries (Aasetre et al., 1994; Bjerke et al., 2001; Bjerke and Østdahl, 2004). In addition, research in the United States has shown that many urban residents participate in nature-oriented activities in or near their homes, like watching TV programs about wildlife, feeding birds, observing, and photographing animals (Brown et al., 1979; Witter et al., 1981; Harris et al., 1997; US Department of the Interior et al., 2001).

## Background and hypotheses of the present study

Parks and other green areas in Norwegian cities are characterised by a low degree of vegetation density; park lawns and fields for ball games often predominate. Do the local residents really like open fields when recreating outdoors, or would they rather prefer denser vegetation? The main purpose of the present study was to measure urban residents’ recreational preferences for urban park landscapes varying in vegetation density, and to identify some of the background and attitudinal variables that could be expected to influence these recreational preferences.

First, research and theories referred to above led us to expect that the recreational preference for landscapes with moderately dense vegetation should be highest, for the total sample. Second, middle-aged adult residents should express a stronger preference for landscapes of a higher vegetation density, relative to young adults and older people. This expectation is based upon previous research, and upon considerations concerning the ease of locomotion and visibility requirements of young adults accompanied by children, and that the elderly often experience some reduction in locomotor abilities, and probably also in an interest for natural scenes. Third, preference for landscapes with dense vegetation was expected to be lower among those living in apartment blocks, relative to people living in detached houses. Blocks are often inhabited by families with young children (and some elderly) who are expected to prefer relatively open fields for play and walking. Fourth, the widespread interests in wildlife-related activities and experiences among urban residents led us to include a measure of wildlife-related motives for outdoor recreational activities. We hypothesised that a

positive correlation exists between wildlife interests and preference for urban park landscapes with dense vegetation, and fifth, a positive association should be found also between respondents’ environmental value orientation (as measured by NEP), and preference for relatively dense vegetation.

## Material and methods

### Study area, sampling and data collection

A sample of residents in the city of Trondheim, Norway ( $n = 1500$ ) was drawn from the telephone directory by a professional sampling and marketing company, with the aim to compose a sample representative of the population in the area. A questionnaire with a pre-stamped envelope was sent by post in November 2001. A reminder was sent 2 months later to all persons that had not answered. Of these, 500 received another copy of the questionnaire. Forty-eight per cent completed and returned the questionnaire (49% male, 51% females).

### The questionnaire

The questionnaire consisted of six parts: Attitudes toward animals and animal-related activities practised, attitudes and activities regarding gardening and other green spaces, recreational use of the neighbourhood, environmental and wildlife values (including the NEP-scale translated to Norwegian by Aasetre and Strumse (1994)), demographic variables, and an evaluation of 12 colour photographs of scenes from various sites in the city, buildings included.

One aim of the present study was to identify a potential influence of vegetation density on the respondents’ preferences as regards recreational activities. Therefore, five of the photographs (shown in Fig. 1) were taken in order to represent a vegetation density gradient from an open urban park landscape on one side, to a very densely vegetated park landscape on the other side. The five photographs were all of areas in the most visited local park in the study area (Festningsparken), and the instruction was that respondents should evaluate park landscapes “in the area in the city where they live” (in order to make respondents focus on urban parks). Within this gradient the bottom layer of the vegetation varies from an urban park lawn to natural field layer vegetation with grass and herbs, the shrub layer varies from not present at all to a dense layer of natural shrubs and bushes, and the tree layers from single trees to a dense mix of trees of different sizes. The respondents were asked to evaluate each of the 5 pictures representing the vegetation density gradient for their appropriateness for recreation on an eleven



step scale from  $-5$  to  $+5$ . ( $-5$  representing “not appropriate for recreation”, and  $+5$  “appropriate for recreation”).

## Statistics and analyses

The variation in how favourable the respondents found the various landscapes for recreational purposes were analysed by means of a series of OLS (ordinary least squares) regression analyses. The considered *socio-demographic variables* in this respect were gender (male proportion = 49%), age (mean = 49.72; SD = 17.46), education (primary school only = 1; three or more years in university = 5; mean = 3.57; SD = 1.40), and dwelling location (dense and old urban area = 12%; detached house = 27%; semi-detached house = 22%; undetached houses = 13%; and apartment block = 26%). The *wildlife motivation index* ( $\alpha = .84$ ) was based on the answers given to the following general question, “How important are the following factors regarding your walks in your neighbourhood?” (1 = of no importance, 5 = very important): watching birds, watching wild mammals, watching insects, watching flowers/trees in gardens and parks, and watching wild flowers and trees. The mean of this index, ranging from 1 to 5, was 3.07 (SD = .86). Finally, the items forming the basis for the New Ecological Paradigm measure were all derived from the original NEP Scale (Dunlap and Van Liere, 1978; Dunlap et al., 2000). These statements were: The balance of nature is very delicate and easily upset (item 1); Humans are severely abusing the environment (item 2); The so-called “ecological crisis” facing humankind has been greatly exaggerated (item 3; reversed scaled); Plants and animals have as much right as humans to exist on earth (item 4); The balance of nature is strong enough to cope with the impact of modern industrial nations (item 5; reversed scaled); If things continue on their present course, we will soon experience a major ecological catastrophe (item 6); and Human ingenuity will ensure that we do not make the earth unlivable (item 7, reversed scaled). The response categories to these seven statements ranged from total disagreement (= 1) to total agreement (= 5). Item 4 and item 7, however, were not included in the final additive index ( $\alpha = .78$ ) ranging from 1 to 5 since their inclusion lowered the overall reliability of the scale (mean = 3.80; SD = .71).

## Results

### Descriptive results

Fig. 1 presents two main findings. First, the five landscapes in question (i.e., pictures 1–5) are generally assessed as favourable for recreation purposes, in the sense that all the mean values are clearly on the positive

end of the scale. Second, Fig. 1 also suggests that the landscapes portrayed in pictures 3 and 4 are generally thought of as more useful for recreation purposes than any of the other landscapes. That is, the mean values of, respectively, 3.20 and 3.06 are significantly higher (at  $p < .05$ ) than all the other mean values.

### Regression results

The multiple OLS regression models did not have any explanatory power concerning the landscapes portrayed in pictures 1 and 2. As for the landscapes depicted in pictures 3, 4, and 5, however, there are some important variations in terms of the considered explanatory variables. Table 1 shows these results more closely.

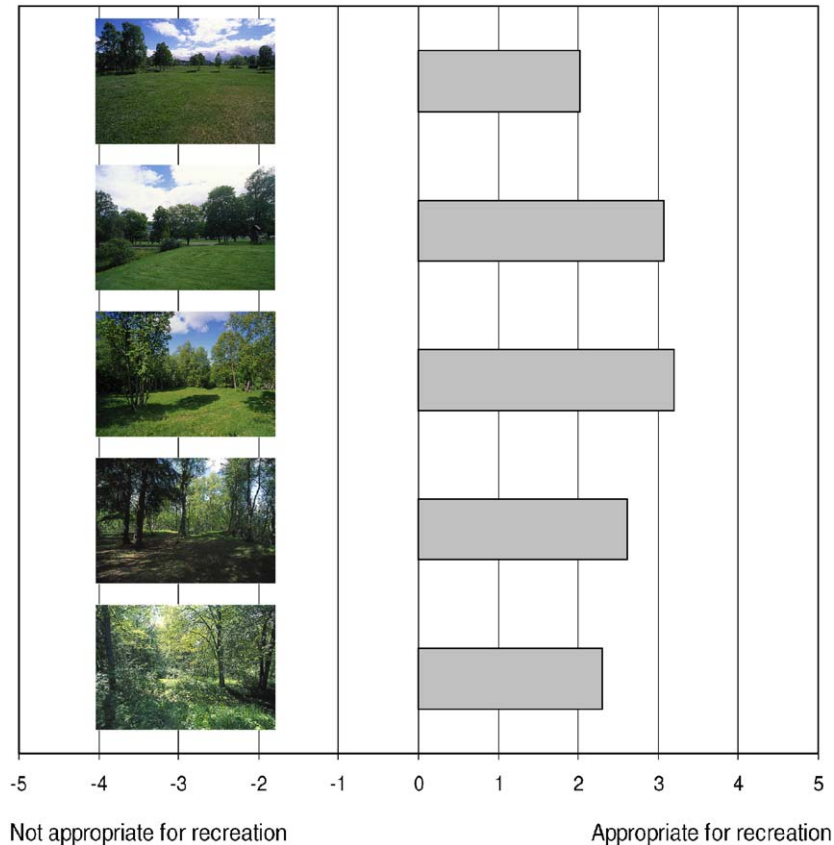
Gender did not appear to have an impact on how any of the landscapes in pictures 3–5 were assessed in terms of their recreation usefulness. In contrast, age of the respondents had a curvilinear relationship with this assessment, most notably for pictures 4 and 5. Age was associated with more favourable appraisals of the pictures, but only up to a certain age point (i.e., 46 years for picture 4 and 44 years for picture 5). Beyond this age, age was associated with less favourable evaluations of the two landscapes as destinations for recreation activities. Fig. 2 displays this trend more visibly according to the regression model for picture 4.

More educated people found the landscapes in pictures 3–5 more appropriate for recreation than the less educated. As regards dwelling location, the general tendency was that people living in environments other than dense and old urban areas assessed the three landscapes as less favourable for recreation. This trend was particularly visible for people living in apartment blocks.

Wildlife motivation and endorsement of the New Ecological Paradigm were both positively associated with the evaluation of the three landscapes’ recreation usefulness. People that could be characterised by a pronounced wildlife motivation and those scoring higher on the NEP scale found the three landscapes in question especially adequate for recreation. These effects were significant for all pictures, and most visible for the effect of wildlife motivation. Another interesting feature of these effects is that the denser the landscapes, the stronger are the regression coefficients in question. Based on the regression model for picture 5, Fig. 3 depicts more clearly how wildlife motivation and ecocentrism are related to the assessment of the landscape’s usefulness for recreation purposes.

## Discussion

Urban parks are very popular destinations for outdoor recreation, with data showing that the visit



**Fig. 1.** Ratings of appropriateness for recreational activities among an adult urban population in Trondheim, Norway, across five scenes varying in vegetation density. Scale from  $-5$  (absolutely inappropriate) to  $+5$  (absolutely appropriate).

frequency is high, and that the average visit is of considerable duration. Vegetation density is one of a number of environmental characteristics highly likely to contribute to the perceived appropriateness of urban parks for outdoor recreation. However, few studies provide direct evidence for the role of vegetation density. Some authors suggest a current change in attitudes in urban populations towards “wild, interactive landscapes”, increasing the likelihood of a more widespread acceptance of dense vegetation than previously assumed (e.g., de Groot and van den Born, 2003).

Based on earlier studies, this study’s main research question started from the assumption that environmental preferences and behaviours are influenced by basic environmental value orientations. In this regard, we expected that the NEP scale – arguably the most well-known operationalisation of basic environmental values – should be statistically related to environmental landscape preferences. More precisely, we hypothesised that there would be a positive association between a pro-environmental value orientation (as measured by the NEP scale) and preference for relatively dense vegetation. In a related manner, we also expected a positive relationship between motivation for observing wildlife

and perceiving urban parks with a moderate to high vegetation density as appropriate for recreation. Furthermore, the existing literature also suggested that middle-aged adult residents should express a stronger preference for higher vegetation density. Finally, preference for landscapes with dense vegetation was expected to be lower among those living in apartment blocks, as this housing category often is inhabited by families with young children likely to prefer open fields for play and walking.

On a descriptive level, the results indicate that the five landscapes included in the study were perceived as favourable for recreation purposes, although the moderately dense scenes received the highest ratings. This confirms previous studies of the role of openness as an environmental attribute and those that show that moderately open scenes are preferred (Kaplan et al., 1989; Kaplan, 1992; Strumse, 1994b). The results of a series of regression analyses suggest the following: for the two scenes containing the lowest degree of vegetation density, and thus the highest degree of openness and accessibility, none of the independent variables predicted variance in perceived appropriateness for recreation. This may either mean (1) that the variance is negligible because people in general find these two

landscapes beneficial for recreation, or (2) that the variation in the assessment of how beneficial these landscapes are for recreation, if any, is caused by factors not included in the present regression models. In any event, further examination is needed in order produce

**Table 1.** Assessment of landscapes' appropriateness for recreation by independent variables. Multiple OLS regression results<sup>a</sup>

	Picture 3	Picture 4	Picture 5
Gender (male = 1)	.009 (.163)	.175 (.173)	-.089 (.217)
Age	.040 (.028)	.098*** (.030)	.077** (.037)
Age <sup>2</sup>	-.000* (.000)	-.001*** (.000)	-.001** (.000)
Education	.181*** (.062)	.151** (.065)	.228*** (.082)
Dwelling location <sup>b</sup>			
Detached house	-.143 (.263)	-.244 (.279)	-.210 (.351)
Semi-detached house	-.576** (.282)	-.293 (.300)	-.576 (.377)
Undetached houses	-.448 (.298)	-.328 (.316)	-.684* (.397)
Apartment block	-.672** (.264)	-.453 (.281)	-.979*** (.353)
Wildlife motivation	.339*** (.096)	.537*** (.102)	.793*** (.129)
NEP	.242** (.113)	.277** (.120)	.362** (.151)
Constant	.258 (.836)	-1.927** (.888)	-3.459*** (1.117)
<i>N</i>	587	584	584
<i>R</i> <sup>2</sup>	.09	.12	.14

$p < .1$ ; \*\*  $p < .05$ ; \*\*\*  $p < .01$  (two-tailed tests).

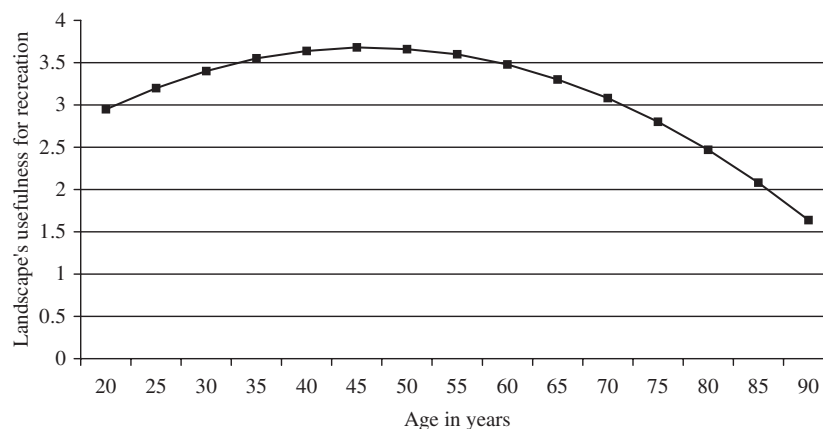
<sup>a</sup>Unstandardised regression coefficients. Standard errors are in parentheses.

<sup>b</sup>Reference category = dense and old urban area.

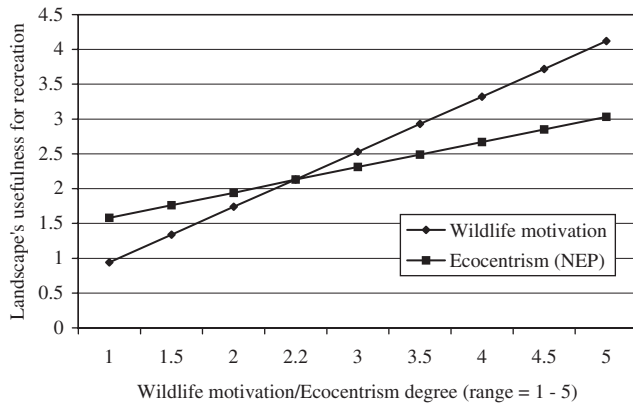
more conclusive results. Endorsement of the New Ecological Paradigm and in particular, wildlife motivation, were both clear predictors of perceived appropriateness for recreation. Thus, persons with strong motivation to observe wildlife or supporters of an ecological paradigm found the three landscapes in pictures 3–5 especially adequate for recreation. These effects were significant for all three pictures, and most visible for wildlife motivation. Another interesting feature of these effects is that the denser the landscapes, the stronger are the regression coefficients in question.

No effects of gender were found in the present study. Gender differences in preferences for outdoor recreation settings appear for the most part to be due to security concerns. The absence of gender differences in the present study may thus indicate that all environments included were perceived to be fairly safe. An alternative formulation is, of course, that the scenes are too similar to result in security-related or other gender differences. Admittedly, the sample of scenes is small, and there is a real possibility that they are not representative of the whole range of park environments in the area. In particular, wide open and high density, highly enclosed settings are not represented in the sample employed. The latter types of settings are particularly likely to be experienced as threatening. Thus, under conditions where settings are not perceived to pose any dangers, gender effects appear to be unlikely to occur.

Although it is more common to find no effect of education on recreation preferences for this type of easily accessible urban park environment, in this study increasing education levels were related to a more positive evaluation of the landscapes in question. This finding could be understood in the light of previous findings showing that higher levels of education are positively associated with wildlife motivation (Bjerke and Østdahl, 2004) and commitment to the new ecological paradigm (Dunlap et al., 2000), which both are positive predictors of perceived appropriateness of



**Fig. 2.** Perceived recreational appropriateness of scene No. 4 across age.



**Fig. 3.** Landscape's usefulness for recreation by wildlife motivation and endorsement to the New Ecological Paradigm.

scenes 3–5 for recreation. However, the effect of education on the preference scores remains after controlling for wildlife motivation and NEP scale scores, thus, the effective element(s) of education were not identified in the present study. A social desirability effect may have been in operation, in that those with higher education more frequently than those with lower education try to respond “correctly”, according to their knowledge of the influence of modern environmental movements.

The curvilinear effect of age, with persons in their mid-40s most favouring the scenes (no. 3–5), is in line with previous findings (cf. Balling and Falk, 1982; Lyons, 1983; Tahvanainen et al., 2001) and confirmed our expectations. Middle-aged persons accompany children in prams less often than younger persons, and the elderly may express a relatively low preference for dense vegetation due to somewhat reduced motor capabilities. These results are also in accord with previous studies showing that dense understorey may function as an obstruction and inhibit access (Lamb and Purcell, 1990; Roovers et al., 2006).

For dwelling location, the findings revealed that people living in residential areas other than dense and old urban areas, and particularly in apartment blocks, assessed the three landscapes as less favourable for recreation. This confirms our expectations based on the general assumption that the needs of families with young children typically inhabiting this type of dwelling are better met by open spaces. It is also of relevance that Grahn (2003) found that Swedish urban residents who did not have a private garden reported visiting urban open green spaces less often than did those who do have a garden, indicating that the absence of a garden is not compensated for by more frequent visits to nearby parks. Not only preference, but also actual use of green areas, may be affected by the variable of dwelling type.

We emphasise, however, that more work needs to be done in order to identify preferences and needs of

segments not included in the present study. For example, interests in activities like outdoor games, picnics, and other social activities were not part of our study. Asking people to rate landscape scenes along a single dimension of “appropriateness for recreation” results in a limited insight into respondents' reflections on the context, content, and additional aspects of meaning when confronted with landscape scenes. For example, one anonymous reviewer of the present paper associated pictures 1–3 with agricultural landscapes, and pictures 4–5 with a forest. While our instructions should have led the respondents to reflect on urban park landscapes, other associations may of course influence the ratings of recreational appropriateness. Various qualitative methods should be used in order to investigate these aspects. In addition, we know that children and adolescents express a stronger interest in wildlife than do adults (Bjerke et al., 2001; Bjerke and Østdahl, 2004), thus, these age groups may have other preferences and needs concerning urban areas than do adults in the same area.

## Conclusions

The urban park environments presented in the present study on average appear to be well suited to the recreational needs of the urban inhabitants in Trondheim. Scenes with a moderate degree of vegetation, however, receive a higher preference score, compared to the most open scenes, and to the scene containing the most vegetation. The effects of socio-demographic and attitudinal variables show that the middle-aged, well educated, wildlife interested, and “ecocentric” segments of the sample express a higher preference for more dense vegetation than do other segments.

In their theory about restorative environments, Kaplan and Kaplan (1989); Kaplan, 1995 point out an environmental feature which may provide an important guideline for planning of urban green areas. This component, labelled Person–environment (P–E) compatibility, addresses the degree of correspondence among environmental features and the needs, motives and actions of the individual. Environments low on P–E compatibility would be settings which only meet the needs of a narrow range of users or are suited only to a narrow range of activities. In order to secure that the needs and outdoor recreation preferences of a broad range of users are met, urban parks should be characterised by a reasonably high degree of P–E compatibility. This would imply that (a) different types of parks should be available, for example representing varying degrees of density, and (b) that attractive urban green areas should contain a variety of vegetation types, instead of being designed as a homogenous entity. We



judge these conclusions to be important for the planning and management of urban green areas, since open fields predominate in the existing urban parks in the study area. More variation in vegetation types, and more naturally and densely vegetated areas should increase the recreational attractiveness of urban parks, resulting also in health benefits for the residents.

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## References

- Aasetre, J., Strumse, E., 1994. Preferanser for jord-og skogbrukslandskaper. (Preferences for farm and forest landscapes). In: *Friluftsliv: Effekter og goder (Outdoor Recreation: Effects and Benefits)*. Referat fra forskningskonferanse. Directorate of Nature Management, Trondheim, Norway, DN-notat 1994-7, (in Norwegian).
- Aasetre, J., Kleiven, J., Kaltenborn, B.P., 1994. *Friluftsliv i Norge – motivasjon og atferd (Outdoor recreation in Norway – motivation and behaviour)*. NINA Oppdragsmelding 309, 1-55. Norwegian Institute of Nature Research, Trondheim, Norway (in Norwegian, with abstract in English).
- Anderson, E., 1978. Visual resource assessment: local perceptions of familiar natural environments. Unpublished doctoral dissertation, University of Michigan, Ann Arbor.
- Anderson, L.M., Stokes, G.S., 1989. Planting in parking lots to improve perceived attractiveness and security. *Journal of Arboriculture* 15, 7–10.
- Appleton, J., 1975. *The Experience of Landscape*. Bellhaven Press, London.
- Balling, J.D., Falk, J.H., 1982. Development of visual preference for natural environments. *Environment and Behavior* 14, 5–28.
- Bechtel, R.B., Corral, V.V., Pinheiro, J.de Q., 1999. Environmental belief systems. United States, Brazil, and Mexico. *Journal of Cross-Cultural Psychology* 30, 122–128.
- Bjerke, T., Kaltenborn, B.P., Ødegårdstuen, T.S., 2001. Animal-related activities and appreciation of animals among children and adolescents. *Anthrozoös* 14, 86–94.
- Bjerke, T., Østdahl, T., 2004. Animal-related attitudes and activities in an urban population. *Anthrozoös* 17, 109–129.
- Brown, T.L., Dawson, C.P., Miller, R.L., 1979. Interests and attitudes of metropolitan New York residents about wildlife. *Transactions of the North American Wildlife & Natural Resource Conference* 44, 289–297.
- Bussey, S.C., Coles, R.W., 1995. The structure and community use of an urban forest. *Quarterly Journal of Forestry* 85, 182–191.
- Corral-Verdugo, V., Armendariz, L.I., 2000. The “New Environmental Paradigm” in a Mexican community. *Journal of Environmental Education* 31, 25–31.
- De Groot, W.T., van den Born, R.J.G., 2003. Visions of nature and the landscape type preferences: an exploration in the Netherlands. *Landscape and Urban Planning* 63, 127–138.
- Dunlap, R.E., Jones, R.E., 2002. Environmental concern: conceptual and measurement issues. In: Dunlap, R.E., Michelson, W. (Eds.), *Handbook of Environmental Sociology*. Greenwood Press, Westport, CT, pp. 482–524 (Chapter 15).
- Dunlap, R.E., Van Liere, K., 1978. The “new environmental paradigm”: a proposed measuring instrument and preliminary results. *Journal of Environmental Education* 9, 10–18.
- Dunlap, R.E., Van Liere, K.D., Mertig, A.G., Jones, R.E., 2000. Measuring endorsement of the New Ecological Paradigm: a revised NEP scale. *Journal of Social Issues* 56, 425–442.
- Eagly, A.H., Chaiken, S. (Eds.), 1993. *The Psychology of Attitudes*. Harcourt Brace, New York.
- Ellsworth, J.C., 1982. Visual assessment of rivers and marshes: an examination of the relationship of visual units, perceptual variables, and preference. Unpublished Master’s Thesis, Utah State University, Logan.
- Edgell, M.C.R., Nowell, D.E., 1989. The New Environmental Paradigm Scale: Wildlife and environmental beliefs in British Columbia. *Society and Natural Resources* 2, 285–296.
- Gallagher, T.J., 1977. Visual preference for alternative natural landscapes. Unpublished Doctoral Dissertation, University of Michigan, Ann Arbor.
- Grahn, P., 2003. Landscape planning and stress. *Urban Forestry and Urban Greening* 2, 1–18.
- Grahn, P., Sorte, G., 1985. Hur används parken? Om organiserade gruppers bruk av grönområden (How are parks used? About the use of urban parks among organised groups). Del 1. *Stad & Land/Rapport* 39, Swedish Agricultural University, Alnarp (in Swedish).
- Hammit, W.E., 1978. Visual and user preference for a bog environment. Unpublished Doctoral Dissertation, University of Michigan, Ann Arbor.
- Harris, L.K., Shaw, W.W., Schelhas, J., 1997. Urban neighbor’s wildlife-related attitudes and behaviors near federally protected areas in Tuscon, Arizona, USA. *Natural Areas Journal* 17, 144–148.
- Herbert, E.J., 1981. Visual resource analysis: prediction and preference in Oakland County, Michigan. Unpublished Master’s Thesis. University of Michigan, Ann Arbor.
- Herzog, T.R., Kaplan, S., Kaplan, R., 1982. The prediction of preference for unfamiliar urban landscapes. *Population and Environment: Behavioral and Social Issues* 5, 43–59.
- Herzog, T.R., Kutzli, G.E., 2002. Preference and perceived danger in field/forest settings. *Environment and Behavior* 34, 819–835.
- Holm, S., 2000. Anvendelse og betydning af byens parker og grønne områder (Use and importance of urban parks). *Forest & Landscape Res. No. 28-2000*. Danish Forest and Landscape Research Institute, Hørsholm (in Danish, with summary in English).

- Holm, S., Jakobsen, C.H., 2001. Rekreativ brug av byens grønne områder (Recreational use of urban green areas). *Forest & Landscape Res.* No. 31. Danish Forest and Landscape Research Institute, Hørsholm (in Danish).
- Homer, P.M., Kahle, L.R., 1988. A structural equation test of the value–attitude–behavior hierarchy. *Journal of Personality and Social Psychology* 54, 638–646.
- Hudspeth, T.R., 1982. Visual preference as a tool for citizen participation: a case study of urban waterfront revitalization in Burlington, Vermont. Unpublished Doctoral Dissertation, University of Michigan, Ann Arbor.
- Jorgensen, A., Hitchmough, J., Calvert, T., 2002. Woodland spaces and edges: their impact on perception of safety and preference. *Landscape and Urban Planning* 60, 135–150.
- Kaltenborn, B.P., Bjerke, T., 2002. Associations between environmental value orientations and landscape preferences. *Landscape and Urban Planning* 59, 1–11.
- Kaltenborn, B.P., Bjerke, T., Strumse, E., 1998. Diverging attitudes towards predators: do environmental beliefs play a part? *Human Ecology Review* 5, 1–9.
- Kaplan, R., 1985. The analysis of perception via preference: a strategy for studying how the environment is experienced. *Landscape Planning* 12, 161–176.
- Kaplan, S., 1992. Environmental preference in a knowledge-seeking, knowledge-using organism. In: Barkow, J.H., Cosmides, L., Tooby, J. (Eds.), *The Adapted Mind. Evolutionary Psychology and the Generation of Culture*. Oxford University Press, New York/Oxford, pp. 581–598.
- Kaplan, S., 1995. The restorative benefits of nature: toward an integrative framework. *Journal of Environmental Psychology* 15, 169–182.
- Kaplan, R., Kaplan, S., 1989. *The Experience of Nature. A Psychological Perspective*. Cambridge University Press, Cambridge.
- Kaplan, R., Talbot, J.F., 1988. Ethnicity and preference for natural settings: a review and recent findings. *Landscape and Urban Planning* 15, 107–117.
- Kaplan, R., Kaplan, S., Brown, T., 1989. Environmental preference: a comparison of four domains of predictors. *Environment and Behavior* 21, 509–530.
- Kuo, F.E., Bacaicoa, M., Sullivan, W.C., 1998. Transforming inner-city landscapes. Trees, sense of safety, and preference. *Environment and Behavior* 30, 28–59.
- Lamb, R.J., Purcell, A.T., 1990. Perception of naturalness in landscape and its relationship to vegetation structure. *Landscape and Urban Planning* 19, 333–352.
- Lyons, E., 1983. Demographic correlates of landscape preference. *Environment and Behavior* 15, 487–511.
- Oguz, D., 2000. User surveys of Ankara's urban parks. *Landscape and Urban Planning* 52, 165–171.
- Parsons, R., 1995. Conflict between ecological sustainability and environmental aesthetics – conundrum, canard or curiosity. *Landscape and Urban Planning* 32, 227–244.
- Roovers, P., Hermy, M., Gulinck, H., 2002. Visitor profile, perceptions and expectations in forests from a gradient of increasing urbanisation in central Belgium. *Landscape and Urban Planning* 59, 129–145.
- Roovers, P., Dumont, B., Gulinck, H., Hermy, M., 2006. Recreationists' perceived obstruction of field and shrub layer vegetation. *Urban Forestry and Urban Greening* 4, 47–53.
- Staats, H., Gatersleben, B., Hartig, T., 1997. Change in mood as a function of environmental design: arousal and pleasure on a simulated forest hike. *Journal of Environmental Psychology* 17, 283–300.
- Schroeder, H.W., Anderson, L.M., 1984. Perception of personal safety in urban recreation sites. *Journal of Leisure Research* 16, 178–194.
- Schroeder, H.W., Green, T.L., 1985. Public preference for tree density in municipal parks. *Journal of Arboriculture* 11, 272–277.
- Strumse, E., 1994a. Perceptual dimensions in the visual preferences for agrarian landscapes in western Norway. *Journal of Environmental Psychology* 14, 281–292.
- Strumse, E., 1994b. Environmental attributes and the prediction of visual preferences for agrarian landscapes in western Norway. *Journal of Environmental Psychology* 14, 293–303.
- Tahvanainen, L., Tyrväinen, L., Ihalainen, M., Vuorela, N., Kohlemainen, O., 2001. Forest management and public perceptions – visual versus verbal information. *Landscape and Urban Planning* 53, 53–70.
- Thompson, S., Barton, M., 1994. Ecocentric and anthropocentric attitudes toward the environment. *Journal of Environmental Psychology* 14, 199–210.
- US Department of the Interior, Fish and Wildlife Service, US Department of Commerce, US Census Bureau, 2001. *National Survey of Fishing, Hunting, and Wildlife-Associated Recreation*.
- Van den Berg, A.E., Vlek, C.A.J., Coeterier, J.F., 1998. Group differences in the aesthetic evaluation of nature development plans: a multilevel approach. *Journal of Environmental Psychology* 18, 141–157.
- Witter, D.J., Tylka, D.L., Werner, J.E., 1981. Values of urban wildlife in Missouri. *Transactions of the North American Wildlife and Natural Resources Conference* 46, 424–431.
- Yu, K., 1995. Cultural variations in landscape preference: comparisons among Chinese sub-groups and Western design experts. *Landscape and Urban Planning* 32, 107–126.
- Zube, E.H., Pitt, D.G., Evans, G.W., 1983. A lifespan developmental study of landscape assessment. *Journal of Environmental Psychology* 3, 115–128.