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Public preferences for structural attributes of forests: Towards a pan-European perspective

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ABSTRACT

This paper presents the findings of a Delphi survey, conducted in four European regions (Great Britain, Nordic Region, Central Europe and Iberia) to assess public preferences for 12 key structural attributes of forests. The objectives were to explore the extent to which generalisations can be made about preferences of forests as sites for recreational use, and how regional variations in preferences may be explained in terms of cultural differences in local populations and bio-physical characteristics of the forests in each region. Survey participants were asked to classify the relationship, and quantify the relative importance, of each attribute to the recreational value of forests in their respective regions. While there was agreement across regions on the type of relationship and level of importance for many of the attributes, there were some notable outliers, for example 'residue from felling and thinning' scored lowest in Central Europe and highly in the other three regions. Indicative explanations for regional variations are proposed, focusing on combinations of cultural and biophysical factors, and drawing on the literature on forest preferences, place attachment and cultural landscapes.

1. Introduction

Since the 1960s, a considerable body of work has been published on public preferences for different types of forest and the attributes that characterise them (e.g. Arthur, 1977; Jensen and Koch, 1998; Lee, 2001; Yarrow, 1966; Zube et al., 1982). In most cases, the explicit goal of researchers has been to improve the evidence available to forest managers of the types and features of forests that are likely to enhance recreational and aesthetic values, and the impacts of different management options on those values. Research to date has been dominated by local or regional case studies, which explore how preferences for different attributes vary between different social groups within the case study area. The findings are typically disaggregated by categories such as age, gender, ethnicity, class, education, profession, type of recreational activity, and rural or urban residential location (e.g. Koch and Jensen, 1988; Silvennoinen et al., 2001; Stamps, 2004; Blasco et al., 2009; Buijs et al., 2009). Despite the large number of studies on this topic, few review articles and meta-analyses have sought to synthesise the findings across wide geographical areas. Most of these have been qualitative, and have made descriptive generalisations about preferences for attributes across social groups and geographical regions (Gundersen and Frivold, 2008; Ribe, 1989; Stamps, 2004; cf. Rametsteiner et al., 2009; Zandersen and Tol, 2009). Similarly, few studies have sought to compare public preferences between geographical regions, with their respective cultures and forest types. This paper responds to these knowledge gaps through a systematic, comparative study of preferences across a wide geographical area, i.e. Europe.

Of the few studies that have made explicit cross-regional comparisons, Schraml and Volz (2009) compared preferences for tree species across different German states, Arnberger et al. (2010) contrasted trail preferences among visitors to similar forests in Austria and Japan, and Ueda et al. (this issue) used an innovative participatory method to explore forest preferences in Japan and Russia. Rametsteiner et al.

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(2009) conducted a meta-analysis, stakeholder survey and public survey of perceptions of forests and forestry across Europe, highlighting a number of regional differences. There is also a growing body of work on inter-ethnic differences in perceptions of forests and the rural environment (e.g. Buijs et al., 2009; Jay et al., this issue; Rishbeth, 2001). This literature tends to explore differences in preferences for the same forests within a given case study, although it hints at the possibility of differences across geographical regions. Overall, the findings appear to highlight the similarities as much as the differences, often stressing that the diversity in preferences and perceptions within ethnic groups can be greater than it is between groups (cf. Jay et al., this issue). In the absence of robust evidence about the generalisability or comparability of preferences across wide geographical areas, authors have drawn divergent conclusions depending upon the context of their work and the level of 'difference' that is considered to be significant. From one perspective, the difference is minimal. Thus, de Groot and Ramakrishnan highlight "the overwhelming similarity in aesthetic preferences between people from different subgroups and with different backgrounds" (de Groot and Ramakrishnan, 2005: 467–8, citing inter alia Kaplan and Kaplan, 1989). In contrast, Jensen and Koch (1998: 43) suggest that: "preferences of visitors can vary considerably, even over shorter distances, from one cultural area to another and even between different segments of the population".

The paper addresses two related questions. First, we ask: to what extent can we generalise across Europe about public preferences of forests as sites for recreational use? We address this by classifying the relationship, and quantifying the relative importance, of 12 structural attributes (size of trees, visual penetration, etc.) to the recreational value of forests. This provides a consistent way to measure how each attribute contributes to public preferences for the dominant forest types in different regions. Data were collected through a Delphi survey carried out simultaneously in four contrasting regions (Great Britain, Nordic Region, Central Europe, and Iberia). Secondly we ask: how can we explain or interpret variations in preferences across Europe? We approach this by focusing on sets of factors that are directly attributable to 'people' and 'places' (the subjects and objects of forest landscape preference research): a) cultural (or social or human) values, attitudes and behaviour towards forests and their use (Tindall, 2003), and b) biophysical differences in how the attributes are manifested in the forest types of each region (Schraml and Volz, 2009). A third alternative is that regional differences are best explained by a combination of both sets of factors, i.e. a historical interaction or co-evolution between 'people' and 'places' that is unique to a particular region. Importantly, both sets of factors are likely to be shaped by a host of other external variables, including economic and political drivers that may affect forest commodity prices, land use and human settlement patterns across the four regions.

While our interpretations necessarily remain tentative, we argue that our attempt to identify and explain regional variations in preferences in terms of interactions between people and place opens up new avenues for further research. Put simply, to understand why a given attribute of forests is valued in a given country, it helps to understand whether, and why, a similar or different value is assigned in other countries. As with other preference research, specific findings may inform decision-makers of the likely public acceptance of policies, for example to diversify forest structure or increase biomass production. At a broader level, the study represents one way in which we might bridge the gap between the long tradition of forest preference research grounded in positivist psychophysical methods (Zube et al., 1982), and constructivist approaches that explore the historical interaction of people and place.

One way in which the interaction between people and place is expressed is through public resistance to any kind of change in the forest landscape, a conservative attitude that is encountered frequently in forest management discourse (cf. Bell, 2001: 206). Schraml and Volz (2009) reported regional differences in preferences across Europe for tree species types, and discovered a correlation between the preferred type and the dominant type growing in that region. Their systematic comparison of German states concluded that: "People from broadleaf-rich regions show a higher preference for broadleaves than those from broadleaf-poor areas" (ibid: 246–7). This evidence suggests that people tend to prefer the forest types that they are most familiar with (cf. Koch and Jensen, 1988). Related evidence was provided for attitudes towards coniferous plantations in Ireland (Schraml and Volz, 2009: 245, citing O'Leary et al., 2000). The role of familiarity is also supported by the literature on 'place attachment', which helps explain the historical emergence of regional differences in the importance assigned to structural attributes by highlighting the psychological and cultural processes that link forest use, attachment, and preference over time. Thus, in their study in Switzerland, Hunziker et al. note how "strong feelings existed regarding all kinds of 'unspectacular' landscape features" as a result of familiarity with a place built up since childhood, and how appreciation of particular features may change over time: "some are considered as disturbing at the beginning, but later they become a symbol of the community" (Hunziker et al., 2008: 143, cf. Hay, 1998; Praestholm et al., 2002). While this literature focuses primarily on the individual and community level, related processes at larger spatial and temporal scales are embodied in the notion of 'cultural landscapes', which can be seen as broader expressions of historical interactions between cultural values and biophysical characteristics of the landscape (e.g. Konijnendijk, 2008).

2. Methods

The methodology comprised a literature review of forest preference research focusing on Europe which informed the research design and selection of attributes to be included in the study, and a Delphi survey to determine the relationship and relative importance (or contribution) of each attribute to the recreational value of forests in four European regions.

2.1. Literature review and selection of attributes

The review identified 330 studies relating to public preferences for forests primarily in Europe (Edwards et al., 2010a). Relevant peer-reviewed work was supplemented by reliable grey literature, and key published studies from the USA. A range of assessment approaches are represented in this literature, in particular the Scenic Beauty Estimation (SBE) method, a 'psychophysical' approach whereby subjects score the visual quality of photographs or computer images of a series of forest stands that have been measured on-site using standard inventory techniques. Statistical relationships between the scores and the inventory data are then derived, allowing predictions of the visual attractiveness to be made of other forest stands not covered by the original sample (e.g. Daniel and Boster, 1976; Silvennoinen et al., 2001). Other approaches include expert or 'formal aesthetic' models (e.g. Lucas, 1991), existential or phenomenological models (e.g. Scott et al., 2009), and psychological models (e.g. Kaplan and Kaplan, 1989). Together they lie on a continuum from an emphasis on the physical attributes of the setting to a focus on the subjective meanings attached by individuals who encounter the landscape (cf. Lee, 2001; Zube et al., 1982). Examples of all of these approaches informed our definition of the research problem to be addressed, and the precise design to be used, while studies that used versions of the SBE method were the most useful in guiding our selection of attributes.

Structural attributes were selected through an iterative process alongside the literature review, and revised during a workshop with 20 researchers in outdoor recreation held in Tuscany in 2008 (see Acknowledgements), and during the pilot phase of the Delphi survey (Table 1). The aim was to select attributes that had been used frequently in previous preference studies, and were separable, additive, clearly defined, measurable, and where differences in the level of the attribute

Table 1
Structural attributes covered by the study.

1. Size of trees within stand Stand age: from establishment to maturity. Canopy height: from low to high
2. Variation in tree size within stand Variation in tree size: from uniform to diverse. Number of canopy layers: from one to many
3. Variation in tree spacing within stand Variation in tree spacing: from regular to different sized groups of trees and openings
4. Extent of tree cover within stand Tree cover: from sparse (e.g. retention trees) to moderate (e.g. shelterwood) to full (closed canopy)
5. Visual penetration through stand Distance visible: from short to long. Understorey and shrub layer: from dense to absent
6. Density of ground vegetation cover up to 50 cm height within stand Ground cover: from absent to dense
7. Number of tree species within stand Number of species: from one to many
8. Size of clear-cuts Size of clear-cuts: from absent to large
9. Residue from harvesting and thinning Volume of tree stumps, branches and other visible woody residue: from absent to high
10. Amount of natural deadwood (standing and fallen) Volume of deadwood: from low to high
11. Variation between stands along a 5 km trail through forest Number of forest stand types* encountered: from one to many
12. 'Naturalness' of forest edges Proportion of 'natural' looking (i.e. not straight) edges: from low to high

* 'Forest stand types' differ according to stand age, management regime, and/or tree species composition.

were likely to reflect different levels of preference. This process generated a list of 12 attributes, which we judged to represent all the structural characteristics of forests likely to be recognised as relevant by our survey participants. Each attribute was provided with a description which specified the scale and direction in which changes in the level of the attribute are measured, so that an assessment of the relationship to recreational value can be made (Table 1). For example, for 'size of trees within stand', respondents were asked to consider how a change in canopy height from 'low' to 'high' would impact on recreational value of forests in their region. Many of the studies in the literature blur the distinction between structural attributes and silvicultural interventions such as thinning and harvesting regimes. In contrast we avoided the latter, and focused on attributes that could be measured in any forest stand regardless of management regime (including unmanaged forest nature reserves). Inclusion of both categories would have caused repetitions. For example, the structural attribute 'visual penetration' implicitly covers thinning intensity, and the attributes 'variation in tree size' and 'variation in tree spacing' implicitly cover the effects of using a range of silvicultural regimes from seed and retention trees through to group selection and shelterwood systems.

2.2. Delphi survey

The Delphi method is an established social research technique that seeks to provide a reliable group opinion on how to solve a complex problem through the use of expert judgement (Landeta, 2006: 468; Linstone and Turoff, 1975: 3). When applied rigorously, the approach is seen to produce data of high quality, and at a lower financial cost than traditional surveys (Landeta 2006: 476). The steps in the Delphi process used in this study were adapted from the protocol of Novakowski and Wellar (2008) and are reported in Edwards et al. (2011). The survey was carried out between September 2009 and January 2010 in parallel in each of four contrasting regions of Europe: a) Great Britain (i.e. upland areas of Scotland, England and Wales), b) Nordic Region (i.e. boreal areas of Norway, Sweden and Finland), c) Central Europe (i.e. alpine areas of southern Germany, Austria and Switzerland) and d) Iberia (i.e. Mediterranean areas of Spain and Portugal). Each region was judged by the authors to have common socio-cultural and biophysical characteristics. Together the four regions were seen to reflect the geographical diversity of Europe (cf. Pröbstl et al., 2009).

For each region, a panel of experts with experience of forest preference research was invited to participate anonymously in a questionnaire survey. Overall, 46 experts participated: 10 in each of the Great Britain and Iberia panels, 12 in the Nordic panel, and 14 in the Central Europe panel (see Acknowledgements). Each panel was coordinated by different members of the research team, who resided in or near the region covered by their panel. Potential participants were identified and recruited primarily through existing professional networks. Candidates who declined the offer to participate were asked to suggest other potential participants. The majority were academic social scientists or economists specialising in forest and landscape research, although a small number of participants were included who had strategic roles in forest policy or planning and were judged to have similar skills and experience to participants from academia. Efforts were made to ensure the panels were similar in composition, particularly in terms of the range of academic disciplines and professional roles that were represented. One of the reasons for using experts in forest preference research rather than directly sampling forest visitors was that the questionnaire used verbal descriptions of attributes, rather than images of forest types, which greatly simplified the task of ensuring that comparable information was presented to each panel. Several of the attributes are abstract concepts, and experts were selected partly on the basis of their expected ability to visualise each attribute and how it is manifested in the forest types of their respective regions. An additional criterion for selecting experts was their expected ability to respond on behalf of the 'average visitor' rather than provide their own personal responses.

The questionnaire was first piloted with eight professional colleagues, two from each region, with similar profiles to those participating in the full survey. Their suggestions were incorporated in the final survey design. Following established Delphi protocols, the full survey was designed to be conducted over successive rounds (Edwards et al., 2011). Two iterations were required before stability in the responses was reached.

For each of the 12 attributes listed in Table 1 participants were asked to: a) indicate whether its relationship to the recreational value of the forests in their region is best described as: positive, negative, bell-shaped, U-shaped, or even (see Fig. 1) (for example, for attribute 1, if participants judged that recreational value increases when 'stand age' increases from establishment to maturity, they would write 'P' for 'positive'), b) assign a weighting, on a scale from 1 (low) to 10 (high), to indicate its relative contribution to the overall recreational value of the forests in their region (using the same weighting for different attributes if appropriate), and c) indicate their level of confidence in their answers for 'a' and 'b' (low, medium, or high). Responses to 'c' allowed us to highlight any notable differences in the level of confidence between the four panels and the 12 attributes. Participants were also asked to provide comments and explanations.

In the questionnaire, several points of definition and context were clarified to help focus participants' responses. 'Recreational value' of a forest was defined in terms of the preferences of people who regularly use forests as sites for recreation (i.e. 'forest visitors'). While preferences for a given forest are likely to be influenced by many factors, it was explained that the survey was concerned only with structural attributes. For most visitors, these are important because they affect the visual attractiveness of the forest. However, some visitors may also value the

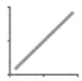
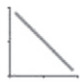
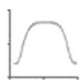
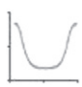
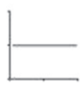
	**Positive ('P')** Recreational value increases when the level of the attribute increases from low to high
	**Negative ('N')** Recreational value decreases when the level of the attribute increases from low to high
	**Bell-shaped ('B')** Recreational value is enhanced by the attribute, except when the level of the attribute is very low or very high
	**U-shaped ('U')** Recreational value is reduced by the attribute, except when the level of the attribute is very low or very high
	**Even ('E')** Recreational value is not affected by the level of the attribute

Fig. 1. Relationships between structural attributes and recreational values.

same attributes for non-aesthetic reasons, e.g. because they provide better habitats for hunting, bird-watching, or collection of mushrooms and berries. When completing the questions, participants were asked to take these differences into account, and answer on behalf of the 'average' visitor. This request implied that each participant should make an intuitive assessment that takes into account the response that would be expected from each major group of visitors, weighted by its representation in the region's visitor profile. (A sample questionnaire is given in Edwards et al., 2010b.) At the end of Round 1 the scores and comments were collated by each panel coordinator, and provisional analysis was carried out on all the results by the lead author and a statistician.

Questionnaires for Round 2 were prepared and circulated. These were tailored for each individual: a table was provided which gave the aggregated results from the first round of everyone in their panel. Also, on a separate page, alongside a new score-sheet, their personal scores from Round 1 were provided. Participants were invited to reconsider their previous answers in the light of the aggregated group's response, and to revise them (or comment upon them) if they felt this was appropriate. All 46 participants completed the two rounds of the survey, with 72% changing at least one response during Round 2. If 'relationship', 'importance' and 'confidence rating' for each of the 12 attributes are all considered as separate 'responses', then, overall, only 10% of responses were changed in Round 2, which is less than the rule of thumb proposed by Nelson that stability is reached when fewer than 20% of individual participants' responses have changed (Nelson, 1978: 45, cited in Novakowski and Wellar, 2008: 1494). Once all responses to Round 2 had been received, the results were analysed and, since it was clear that stability in responses had been reached, participants were informed that the survey was completed and asked whether they were willing to have their names identified.

Overall, around 90 points were raised in the comments provided by participants. Most related to individual attributes, providing an explanation for the respondent's ranking or stating the assumptions that had been made. Six points related to the importance of attributes associated with 'variation' and 'naturalness' to recreational value. Around 20 points were made on the conceptual framework including difficulties experienced when selecting a single score for different types of forest and types of visitor (see Edwards et al., 2010a: 16 ff.). Despite these reported difficulties, almost all participants completed all questions.

2.3. Analysis of data

For the data on 'relationship', the allocation of distribution types across all four regions was analysed separately for each attribute using a Pearson Exact Chi-Square Test. The 'Exact Test' is used because the data are on a nominal scale: there is no association between the five distribution types. For the data on 'relative importance', it was apparent that there were differences between the four regions in the distribution or 'shape' of the weightings for each attribute, partly because respondents for a given region had tended to use the scale in a different way: the shape of the distribution may have been the same but shifted up or down the scale. The mean importance for all attributes was different between regions indicating that there was a difference between regions in how the average individual used the scale (see Edwards et al., 2010a: 14, Table 5). To resolve this problem and allow the scores for each region to be compared, the scores were converted into rankings. The ranked importance values were then analysed for each individual respondent using Kendall's Coefficient of Concordance, both within and across the four regions. This test assessed whether individuals agree or differ in their scoring of the relative importance of the 12 attributes, i.e. whether they are in the same order (and therefore whether they can be combined and represented as an average ranking for each attribute). Finally, the median confidence rating for each attribute in each region was calculated by giving a score of 1 for low, 2 for medium, and 3 for high level of confidence. All analyses were undertaken using the statistical software SAS 9.2 (SAS Institute Inc., 2008).

3. Results

3.1. Relationship

Across all four regions, there was good agreement on the nature of the relationship (or the 'distribution type') to the recreational value of forests (Table 2). For every attribute, at least 50% of participants agreed on the term that best described the relationship. The results of the Exact test, given in Table 2, indicated that the allocation of distribution types for each attribute can be regarded as similar across the four regions, with the exception of attributes 4, 5 and 6 ('extent of tree cover', 'visual penetration' and 'density of ground vegetation') where the P value was less than 0.05. Table 2 also indicates that there

Table 2
Most frequently identified relationship to recreational value, and Exact test results, by region.

Attribute	Relationship to recreational value[a]					Exact test (P)
	Great Britain (n = 10)	Nordic Region (n = 12)	Central Europe (n = 14)	Iberia (n = 10[b])	All regions (%[c])	
1. Size of trees	P	P	P	P	P (91)	0.35
2. Variation in tree size	P	B	P	P	P (63)	0.43
3. Variation in tree spacing	P	P	P	B	P (59)	0.06
4. Extent of tree cover	B	P/B	B	B	B (74)	0.03
5. Visual penetration	B	B	B	P	B (54)	0.02
6. Density of ground vegetation	B	B	B	N	B (59)	0.02
7. Number of tree species	P	P	B	P	P (52)	0.49
8. Size of clear-cuts	N	N	N	N	N (93)	0.43
9. Residue	N	N	N	N	N (69)	0.84
10. Amount of natural deadwood	B	N	B	B	B (59)	0.10
11. Variation between stands	P	B	P	P	P (59)	0.09
12. 'Naturalness' of forest edges	P	P	P	P	P (93)	0.06

[a] P = positive; N = negative; B = bell-shaped.
[b] n = 9 for attribute 12 in Iberia.
[c] Percentage of participants across all regions that selected the most frequently identified relationship.

was some disagreement in the most frequently identified relationship in each region for these and some other attributes, although no attribute had more than one region disagreeing with the majority. For example, the Nordic Region panellists disagreed with other regions on the effect of 'variation in tree size' and 'variation between stands', judging high levels of both kinds of variation to be negative.

3.2. Relative importance

Respondents were asked to provide a score on a ten point scale for the relative importance of each attribute to the recreational value of forests in their region. The ranking for each attribute in each region is given in Table 3. Across Europe, the highest importance was attached to the attribute 'size of trees within stand', which was stated by a large majority of respondents across all four regions (91%) to have a positive relationship to recreational value. The second highest importance was attached to 'size of clear-cuts', with a similarly large majority (93%) agreeing that this had a negative relationship. The next attributes, in descending order of importance, were: 'residue from thinning and harvesting' (69% stated it was negative); 'visual penetration' (54% stated it was bell-shaped), and 'variation between stands' (59% stated it was positive).

The analysis using Kendalls' Coefficient of Concordance showed that, within each of the four regions, there was strong agreement between individuals in the ranking of the importance of the attributes ($P<0.001$). A similar analysis was then carried out across all four regions. There was also agreement ($P=0.06$), but to a lesser extent, indicating that it could be stated with 94% confidence that the rankings for all four regions were in the same order. Overall, this analysis suggests that, for each attribute, the variation in rankings by individual respondents was greater between regions than within regions. Attributes 1, 4, and 8 ('size of trees', 'extent of tree cover' and 'size of clear-cuts') showed the highest agreement in the order of importance across the four regions, while attributes 2, 3, 9 and 11 showed the lowest agreement. For these latter attributes there were notable outliers: attribute 2 ('variation in tree size') scored highest in Great Britain but was given low or very low scores elsewhere; attribute 3 ('variation in tree spacing') scored lowest in Iberia and highly in Great Britain; attribute 9 ('residue') scored lowest in Central Europe and highly elsewhere, and attribute 11 ('variation between stands') scored low in Great Britain and joint highest in Central Europe. Possible explanations for these findings are considered in the discussion below.

Table 3
Ranked mean importance to recreational value, by region[a].

Attribute	Ranked mean importance				Overall ranking
	Great Britain	Nordic Region	Central Europe	Iberia	
1. Size of trees	11	12	11.5	10	12
2. Variation in tree size	12	2	6	2	5
3. Variation in tree spacing	9	4	8	1	5
4. Extent of tree cover	7	6	7	7	7
5. Visual penetration	4.5	8	5	12	9
6. Density of ground vegetation	1	1	3	5.5	1
7. Number of tree species	4.5	5	2	8	3
8. Size of clear-cuts	10	10	10	9	11
9. Residue	8	11	1	11	10
10. Amount of natural deadwood	2	7	4	3	2
11. Variation between stands	3	9	11.5	5.5	8
12. 'Naturalness' of forest edges	6	3	9	4	5

[a] 12 = highest; 1 = lowest.

3.3. Confidence ratings

The median confidence ratings indicated that respondents had medium or high confidence in the information they provided for 'relationship' and 'relative importance' for all attributes with the exception of attribute 6 ('density of ground vegetation') in Nordic Region where the level of confidence was between low and medium. Overall, participants' confidence was highest in Central Europe and lowest in Iberia. Attributes that were given higher overall rankings for relative importance also tended to be given slightly higher confidence ratings (see Edwards et al., 2010a: 16, Table 8, for full dataset).

4. Discussion

4.1. Methodological issues

The use of the Delphi method has recognised strengths and weaknesses (Landeta, 2006; Novakowski and Wellar, 2008). Landeta (2006) notes that much depends upon the selection of participants, and that the results can be manipulated by those running the survey. A more robust approach would have been to use a psychophysical survey using images of forest stands that are scored by representative samples of the population in each region (e.g. Blasco et al., 2009; Daniel and Boster, 1976; Jensen and Koch, 1998). Given the broad scope of the study this option was prohibitively expensive. Although experts were selected partly for their perceived ability to respond on behalf of the average visitor in their respective region, it is possible that the narrow professional background of participants may have reduced the variation between regions. Also, while efforts were made to ensure the panels were similar in composition, some bias may have resulted from differences in the academic traditions of forest preference research in each region. The decision to run the survey over successive rounds provided participants with the opportunity to revise their responses, but in practice this made little difference to either the most frequently identified relationship, or the ranked mean importance, to recreational value. Also, few new points were raised in the comments during Round 2. In retrospect, given the extra work required by both researchers and participants, the survey may have been carried out more efficiently as a simple questionnaire administered in a single round to individual experts in each region, although with a small loss in the accuracy of the results (Edwards et al., in review).

4.2. Generalisations across Europe

Broadly speaking the results presented in Tables 2 and 3 are supported by the literature (see Edwards et al., 2010a). For example, the positive relationship and very high importance attached to 'size of trees within stand' is stated consistently (e.g. Blasco et al., 2009: 76; Gundersen and Frivold, 2008: 248; Ribe, 1989: 62). Similar evidence is apparent for the high negative impact of large 'clear-cuts' and 'residue' (e.g. Bliss, 2000; Ribe, 1989: 66; Tindall, 2003). The high positive impact of 'visual penetration' is supported for example by Kaplan (1985: 173) and Gundersen and Frivold (2008: 248). 'Variation between stands' has been under-researched, but the generally high positive effect indicated by our results is supported by a Swedish study conducted by Axelsson-Lindgren and Sorte (1987). Such findings largely confirm what is already known within the field of forest preference research. Our main contribution in this respect has been to go beyond these generalizations and quantify the relative importance of each attribute using a common methodology in four European regions.

4.3. Interpreting regional variations

While there is broad agreement regarding their importance, we identify some marked differences between regions that deserve further attention. Using the theoretical framework of interaction between 'people' and 'place' outlined in the introduction to this issue (i.e. between cultural values, attitudes and behaviours, and biophysical differences in how the attributes are manifested in the forest types of each region), we now propose tentative explanations for the regional variation in the relative importance of the attributes covered in this study.

One attribute that illustrates our reasoning is 'residue from harvesting and thinning'. An absence of residue is preferred across all regions, yet there are considerable differences in the importance attached to this attribute in different regions, with the lowest ranking assigned in Central Europe, and very high rankings for the Nordic Region and Iberia. Assuming these results accurately express the preferences of forest visitors, three explanations are proposed, based on each of the alternatives outlined above. The first alternative, based on 'people', is that residue is accepted by visitors in Central Europe because its presence in forests is compatible with local cultural norms regarding how forests should look and be utilised, i.e. as an environment for timber production as well as for recreational use. (A related explanation could be that residue does not hinder recreational activities in Central Europe because visitors stick to the paths, in contrast to the Nordic Region where a substantial proportion of visitors collect mushrooms and berries within the forest stand itself, an activity that is hindered by the presence of residue.) A second alternative, based on 'places', could be that residue is not evident in the productive forests of Central Europe compared to other regions, possibly because it is removed and utilised in processing. A third alternative, based on a combination of the two, i.e. interaction between 'people' and 'places', could be that residue is not evident because it has been 'tidied up' possibly in response to prevailing cultural norms (e.g. through public pressure) and possibly in ways that help to reinforce those norms. Importantly, numerous other demographic, social, economic and political factors may lie behind each of these alternatives, such as timber and bioenergy prices and local levels of recreational use. (Part of the explanation also lies in the factors that made residue important in other regions.) The question as to which of these alternatives provides the closest explanation may have significant implications for forest managers. For example, if residue were present in forests, but accepted by local recreational users (i.e. the first alternative), then its removal to meet recreation objectives would appear to be unnecessary. However, the efficacy of these explanations may be less important than the overall conceptual framework of interacting cultural and biophysical factors that is illustrated by this example.

Similar sets of explanations could be proposed for each attribute whose importance rankings are markedly different between regions. However, in most cases it has proved difficult to propose compelling cultural explanations for the regional variation. In contrast, credible explanations grounded in biophysical factors (i.e. the second alternative) can be proposed. Examples include 'variation in tree size within stand' and 'variation in tree spacing within stand'. These attributes are respective measures of the vertical and horizontal diversity or 'naturalness' of the stand structure. The data imply that structural variation within stands is of particular importance in Great Britain and minimal importance in Iberia. While a high level of structural variation is likely to be a characteristic common to the forest nature reserves and close-to-nature forests of all regions, there are regional differences for the more intensively managed forest types. In particular, in upland Great Britain, production forestry is dominated by dense, evenly-spaced, even aged, plantations of Sitka spruce (*Picea sitchensis*), with relatively short rotation lengths (i.e. small 'size of trees') and a legacy of geometric forest design dating from the mid-Twentieth Century (i.e. low 'naturalness of forest edges'). In contrast, in Iberia and the other three regions, there are traditions of the use of seed and retention trees, group selection, and shelterwood systems that have made structural diversity an integral feature of production forestry, thus reducing the relative importance of this attribute compared to Great Britain.

A related example is provided by 'variation between stands', which was of low importance in Great Britain yet ranked joint highest in Central Europe. While any kind of 'variation' is generally regarded positively across all regions, the importance attached to variation within stands (discussed above) contrasts with the importance attached to the variation between stands. Arguably this is partly a consequence of the scale of forestry in the landscape. In upland Great Britain forests rarely comprise a high proportion of the landscape; they are intersected by areas of agriculture or open moorland, so the structural diversity across the landscape as a whole is high. In Central (and Northern) Europe the percentage of forest cover is higher (MCPFE, 2007: 184), and a preference to break up the uniformity of the landscape may be reflected in the higher importance attached to this attribute.

5. Conclusions

While there appears to be general agreement across Europe about the relationship and relative importance of many attributes, there are several outliers in the data that deserve further exploration. Indicative explanations have been put forward focusing on combinations of factors associated with 'people' and 'place'. The ways in which regional cultural values, attitudes and norms shape preferences are harder to demonstrate and separate out from other more tangible factors, which can give the impression that 'culture' has relatively little influence on the importance of structural attributes and preferences for types of forest across Europe. However, plausible explanations for some attributes such as 'residue', which draw on both cultural and biophysical factors, point to the possibility that a more complex and nuanced interaction between people and place lies behind many of the importance rankings generated by the study. Such a conclusion is also suggested by the literature on place attachment, and cultural landscapes, which reveal historical processes through which the preferences of individuals and communities might co-evolve with changes in forest and land management.

In many ways the results, and our proposed interpretations, are only as important as the new avenues for further research that are prompted by this exploratory study. Our main point is to demonstrate the value of the pan-European comparative perspective presented here. We propose that this agenda is broadened to consider related aspects of public attitudes towards forests and forestry of particular importance to European policy and practice. Substantive issues might include changes in forest management intensity (cf. Edwards et al., in review; Rametsteiner et al., 2009: 75–7), or shifts towards greater use of broadleaves and tree species diversity (cf. Schraml and Volz, 2009) or continuous cover forestry and other low impact silvicultural systems (cf. Filyushkina, 2010). While insights would be gained from isolated case studies, stronger conclusions and recommendations for European policy and practice would be gained through a systematic, comparative programme of research, building on the approach outlined in this paper. Thus, quantitative data across Europe would be interpreted and supplemented through detailed historical and sociological investigations within individual case studies. In particular the findings would improve our ability to capture cultural values more fully within forestry decision-making. The practical and conceptual difficulties of assessing cultural values associated with sustainable forest management are increasingly acknowledged (Agnoletti, 2007). Related issues apply in the context of cultural ecosystem services assessment (de Groot and Ramakrishnan, 2005). While the research may not identify new pan-European indicators for cultural values (MCPFE, 2007), it may highlight distinct people–place relationships that are either specific to a given region or generalisable across Europe. Such an agenda could be developed in other directions, for example by estimating the relative contribution of attributes to the recreational monetary value of forest in different European regions, or building on recent work that quantifies the recreational value of forest types to provide input data for models that assess the impacts of European environmental policies on the sustainability of forestry (Schelhaas et al., in review).

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References

Agnoletti, M. (Ed.), 2007. Guidelines for the implementation of social and cultural values in sustainable forest management. IUFRO Research Group 6.07.00 ‘Forest and Woodland History’. IUFRO Occasional Paper 19. 23pp.

Arnberger, A., Aikoh, T., Eder, R., Shoji, Y., Mieno, T., 2010. How many people should be in the urban forest? A comparison of trail preferences of Vienna and Sapporo forest visitor segments. Urban Forestry and Urban Greening 9, 215–225.

Arthur, L.M., 1977. Predicting scenic beauty of forest environments: Some empirical tests. Forest Science 23, 151–159.

Axelsson-Lindgren, C., Sorte, G., 1987. Public responses to differences between visually distinguishable forest stands in a recreation area. Landscape and urban planning 14, 211–217.

Bell, S., 2001. Landscape pattern, perception and visualization in the visual management of forests. Landscape and Urban Planning 201–211.

Blasco, E., Gonzalez-Olabarria, J.R., Rodriguez-Veiga, P., Pukkala, T., Kolhemainen, O., Palahi, M., 2009. Predicting scenic beauty of forest stands in Catalonia (North-east Spain). Journal of Forestry Research 20 (1), 73–78.

Bliss, J.C., 2000. Public perceptions of clearcutting. Journal of Forestry 98, 4–9.

Buijs, A.E., Elands, B.H.M., Langers, F., 2009. No wilderness for immigrants: cultural differences in images of nature and landscape preferences. Landscape and Urban Planning 91, 113–123.

Daniel, T.C., Boster, R.S., 1976. Measuring landscape aesthetics: the scenic beauty method. USDA Forest Service Research Paper RM-167. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado. 66 pp.

de Groot, R.S., Ramakrishnan, P.S., 2005. Cultural and amenity services. Ecosystems and human well-being. Volume 1: Current state and trends. Millennium Ecosystem Assessment Series. Island Press, Washington, DC, pp. 455–476.

Edwards, D., Jay, M., Jensen, F.S., Lucas, B., Marzano, M., Montagne, C., Peace, A., Weiss, G., in review. Public preferences across Europe for different forest stand types as sites for recreation. Ecology and Society.

Edwards, D., Jay, M., Jensen, F.S., Lucas, B., Marzano, M., Montagne, C., Peace, A., Weiss, G., 2010a. Public preferences for silvicultural attributes of European forests. EFORWOOD Report D2.3.3, Forest Research, UK. http://www.forestry.gov.uk/fr/INFD-6LEKA9.

Edwards, D., Jay, M., Jensen, F.S., Lucas, B., Marzano, M., Montagne, C., Peace, A., Weiss, G., 2010b. Assessment of the recreational value of European forest management alternatives. EFORWOOD Report D2.3.6, Forest Research, UK. http://www.forestry.gov.uk/fr/INFD-6LEKA9.

Edwards, D., Jensen, F.S., Marzano, M., Mason, B., Pizzirani, S., Schelhaas, M.-J., 2011. A theoretical framework to assess the impacts of forest management on the recreational value of European forests. Ecological Indicators 11, 81–89.

Filyushkina, A., 2010. Continuous Cover Forestry and Preferences of Recreationists: Implications for Forest Management in North Wales. M.Sc. dissertation, Bangor University, Wales, UK.

Gundersen, V.S., Frivold, L.H., 2008. Public preferences for forest structures: a review of quantitative surveys from Finland, Norway and Sweden. Urban Forestry and Urban Greening 7, 241–258.

Hay, R., 1998. Sense of place in development context. Journal of Environmental Psychology 18, 5–29.

Hunziker, M., Felber, P., Gehring, K., Buchecker, M., Bauer, N., Kienast, F., 2008. Evaluation of landscape change by different societal groups: results of two empirical studies in Switzerland. Mountain Research and Development 28, 140–147.

Jay, M., Peters, K., Buijs, A., Gentin S., Kloek, M., O'Brien, L., this issue. Towards access for all? Policy and research on access of ethnic minority groups to natural areas in four European countries.

Jensen, F.S., Koch, N.E., 1998. Measuring forest preferences of the population; a Danish approach. In: Terrasson, D. (Ed.), Public perception and attitudes of forest owners towards forest in Europe. Perception publique et attitudes des propriétaires envers la forêt en Europe. Commentaires et synthèses du groupe de travail COST E3-WG1, 1994/1998: Cemagref éditions, Antony cedex, pp. 39–82.

Kaplan, R., 1985. The analysis of perception via preference: a strategy for studying how the environment is experienced. Landscape planning 12, 161–176.

Kaplan, R., Kaplan, S., 1989. The Experience of Nature: A Psychological Perspective. Cambridge University Press, Cambridge.

Koch, N.E., Jensen, F.S., 1988. Skovenes friluftsfunktion i Danmark. IV.del. Befolkningens ønsker til skovenes og det åbne lands udformning. (Forest Recreation in Denmark. Part IV: The Preferences of the Population). Forstl. Forsøgsv. Danm., København, 41, pp. 243–516.

Konijnendijk, C.C., 2008. The Forest and the City: The Cultural Landscape of Urban Woodland. Springer.

Landeta, J., 2006. Current validity of the Delphi method in social sciences. Technological Forecasting and Social Change 73, 467–482.

Lee, T.R., 2001. Perceptions, Attitudes and Preferences in Forests and Woodlands. Technical Paper 18, Forestry Commission, Edinburgh.

Linstone, H.A., Turoff, M. (Eds.), 1975. The Delphi Method: Techniques and Applications. Addison Wesley, Boston, MA.

Lucas, O.W.R., 1991. The Design of Forest Landscapes. Oxford University Press, Oxford.

MCPFE, 2007. State of Europe's Forests 2007. Ministerial Conference on the Protection of Forests in Europe. Liaison Unit, Warsaw.

Nelson, W.L., 1978. Statistical manipulation of Delphi statements: its success and effects on convergence and stability. Technological Forecasting and Social Change 12, 41–60.

Novakowski, N., Wellar, B., 2008. Using the Delphi technique in normative planning research: methodological design considerations. Environment and Planning A 40, 1485–1500.

O'Leary, T., McCormack, A., Clinch, J., 2000. Afforestation in Ireland—regional differences in attitude. Land Use Policy 17, 39–48.

Praestholm, S., Jensen, F.S., Hasler, B., Damgaard, C., Erichsen, E., 2002. Forests improve qualities and values of local areas in Denmark. Urban Forestry and Urban Greening 1, 97–106.

Pröbstl, U., Elands, B., Wirth, V., 2009. Forest recreation and nature tourism in Europe: context, history and current situation. In: Bell, S., Simpson, M., Tyrväinen, L., Sievänen, T., Pröbstl, U. (Eds.), European Forest Recreation and Tourism: A Handbook. Taylor and Francis, UK, pp. 12–32.

Rametsteiner, E., Eichler, L., Berg, J., 2009. Shaping forest communication in the European Union: public perceptions of forests and forestry. Final Report. ECORYS, Rotterdam.

Ribe, R.G., 1989. The aesthetics of forestry: what has empirical preference research taught us? Environmental Management 13, 55–74.

Rishbeth, C., 2001. Ethnic minority groups and the design of public open space: an inclusive landscape? Landscape Research 26 (4), 351–366.

SAS Institute Inc., 2008. SAS/STAT 9.2 Users guide. SAS Institute Inc, Cary, NC.
Schelhaas, M-J., Didion, M., Arets, A., Edwards, D., Hengeveld, G., Lindner, M. Mason, B., Moiseyev, A., Nabuurs, G-J., in review. Impact of different levels of nature conservation designation on European forest resources. Ecology and Society.
Schraml, U., Volz, K.-R., 2009. Do species matter? Valuable broadleaves as an object of public perception and policy. In: Spiecker, H. (Ed.), Valuable Broadleaved Forests in Europe. S. Brill, Leiden, Boston, Köln, pp. 213–236.
Scott, A., Carter, C., Brown, K., White, V., 2009. 'Seeing is not everything': exploring the landscape experiences of different publics. Landscape Research 34 (4), 397–424.
Silvennoinen, H., Alho, J., Kolehmainen, O., Pukkala, T., 2001. Prediction models of landscape preferences at the forest stand level. Landscape and Urban Planning 56, 11–20.
Stamps, A.E., 2004. Mystery, complexity, legibility, and coherence: a meta-analysis. Journal of Environmental Psychology 24, 1–16.
Tindall, D.B., 2003. Social values and the contingent nature of public opinion and attitudes about forests. The Forestry Chronicle 79 (3), 692–705.
Ueda, H., Nakajima, T., Takayama, N., Petrova, E., Matsushima, H., Furuya, K., Aoki, Y., this issue. Ways of seeing the forest: Landscape image sketches in Japan and Russia.
Yarrow, C., 1966. A preliminary survey of the public's concepts of amenity in British forestry. Forestry 39, 59–67.
Zandersen, M., Tol, R.S.J., 2009. A meta-analysis of forest recreation values in Europe. Journal of Forest Economics 15 (1–2), 109–130.
Zube, E.H., Sell, J.L., Taylor, J.G., 1982. Landscape perception: research, application and theory. Landscape Planning 9, 1–33.