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SOCIAL PERCEPTION OF TREES IN THE LANDSCAPE: THE CONNECTION BETWEEN ATTITUDES AND VISUAL PREFERENCES

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ABSTRACT

The study presented in this paper uses a representative sample of the Czech population to analyse the relationships between attitudes to trees and preferences for landscapes with trees. We ask whether a positive assessment of the environmental benefits of trees in general and old and dead trees in particular leads to preferences for close-to-nature forms of the tree landscape. The results show that tree landscape preferences are primarily affected by attitudes attached to trees, rather than by sociodemographic factors. People who appreciate the environmental benefits of trees are more likely to prefer transparent and organized landscapes with trees, whereas the more specific environmental attitude appreciating old or dead trees is reflected in higher preferences for wilderness-like landscapes. The results of our research suggest that the perceived environmental benefits of trees are anthropocentric in nature, in a way utilitarian; trees serve people and their environment, and not nature as such.

Keywords: trees, landscape with trees, attitudes to trees, visual preferences, Czechia

INTRODUCTION

Understanding of cultures and societies requires knowledge of the natural environment in which they exist as well as the landscapes that arose from interaction between culture and its natural environment (Konijnendijk, 2008). Above that since the capacity of landscape to adapt to climate change largely depend on the ways society understands its functions and values, we need to examine in detail how people relate to their landscape, and to trees as its indispensable part.

In the context outlined, we must ask what factors lead to the appreciation of close-to-nature forms of landscape that natural scientists believe are resistant to climate change. What preferences and attitudes towards trees actually prevail in Czech society, which is characterized by a high proportion of biocentric attitudes? Can we assume that people who appreciate the environmental and ecological functions of trees also prefer nature-like landscapes with trees in which nature processes dominate over human interventions? Natural sciences present trees as important landscape features, lately especially as an indispensable

means of "fighting" climate change, given their ecological functions such as local cooling, water retention, carbon capture, and soil erosion prevention. However, human society appreciates trees for many other reasons and those reasons have changed over time. In the evolution of human consciousness, diverse meanings have been attached to the tree as a landscape feature, ones that may importantly differ not only between historic periods but also between individuals in the same society. While modern history is characterized by the prevalence of economic and practical uses of trees, the last century saw a new debate on so-called immaterial meanings, especially aesthetic, cultural or psychosocial ones. Although societies rediscovered the spiritual meaning of trees, the greatest emphasis has lately been placed on ecological and environmental meanings. The ways individuals and entire groups relate to trees are determined both by external conditions and internal ones, namely individual characteristics, knowledge of the area, and perceptions shaped by culturally determined and socially constructed meanings.

Besides the social and visual-aesthetic aspects, trees and vegetation can have a strong relaxing effect on individuals. There is ample evidence of the link between well-being and health, whether physiological or mental, and exposure to green environments, whether rural landscapes or greenspaces in urban areas (Dwyer *et al.*, 1991; Lohr, Pearson-Mims *et al*., 2004; Swanwick, 2009). Trees are currently becoming more important for their climatic and environmental functions. In cities, trees are planted with the primary goal of improving local environment. Trees in rural landscapes, too, are increasingly attached environmental significance in terms of water retention, erosion prevention, facilitating the water cycle, improving biodiversity, carbon capture, etc. (Lohr, Pearson-Mims *et al*., 2004). Old or dead trees have recently become the focus of natural scientists thanks to the essential environmental functions they perform in addition to their social and cultural value. An integral part of people's identities and cultural heritage is awareness of large old trees, which are sources of aesthetic, symbolic, religious and historic value as well as concrete ecological functions and practical uses (Blicharska & Mikusiński, 2014).

The deep-rooted symbolism of trees has existed throughout history and across cultures: trees were worshipped by pagan cults, spirits inhabited them, they symbolized the connection between land and heaven or the flow of life (Klvač, 2006). Even today people highly value the esoteric and spiritual effect of trees, for example interesting sounds, or their spiritual connection with trees (Clark 2011; Lohr, Pearson-Mims *et al*., 2004). The spiritual value of trees is generally difficult to define because it is abstract, too complex, and interwoven with cultural assumptions. Nevertheless, the intangible benefits of trees play a particularly important role in the process of evaluating trees in society in general.

On the other side, there exist negative effects influencing human attitudes towards trees. As for safety, there is a real danger in the event of branches or entire trees falling, and trees can be found annoying due to fallen leaves or shade. While people may want to get rid of the annoyances from particular trees near their own homes, they still appreciate the benefits of trees in general (Schroeder *et al*., 2006). Many studies suggest high levels of overall satisfaction with trees, benefits generally outweighing the annoyances caused by trees, and the fact that overall satisfaction is more strongly related to the intangible benefits of trees than to their physical benefits or annoyances (Schroeder *et al*., 2006).

Besides attitudes to landscape and trees, researchers have focused on visual preferences. Those, too, differ between historical periods but also between individuals and social groups. From the historical perspective, the ideal landscape of the 18th century was seen as a cultivated flat landscape of fields, orchards and vineyards. Large woods or high mountains were found repulsive, unaesthetic, emblematic of ugliness (Stibral, 2005). While the popularity of today's landscapes decreases with higher presence of anthropogenic features,

sceneries in which such features are sensitively integrated with the landscape or represent so-called cultural heritage obtain better ratings than purely natural ones (Zelenka *et al*., 2008). Despite increasing interest in naturalistic landscapes among landscape professionals, the public still shows prevalent preference for formal ornamental landscapes and also cultivated agricultural and forest landscapes (Özgüner & Kendle 2006).

There is evidence that visual perceptions of a landscape are generally positively affected by vegetation, and tall trees in particular. Lower visual preferences are attached to landscapes with young, undergrown vegetation, bushes and grasses, compared to ones with full-grown trees, i.e. woodland or parks. An open, transparent, subjectively safe landscape is more preferred than dense vegetation or continuous forests. People mostly prefer solitary trees with tall bare trunks and dense crowns. Shape is the most important factor of a tree's beauty, with a general preference for conical or spreading trees, trees with a broad canopy, and a high ratio of canopy size to trunk size. One of the interpretations given is that high crowns contribute to perceptions of a landscape as transparent and safe (Ulrich, 1983; Misgav, 2000; Sklenička & Molnárová, 2010; Kaplan & Kaplan, 1989; Lamp & Purcell, 1994, Librová, 1984, Zhao *et al*., 2017).

METHODS

Data

The presented analyses are based on data from a representative questionnaire survey of residents of Czechia, to which we were allowed to add several batteries with a total of 60 variables on perceptions of trees in the landscape (Stachová *et al.*, 2020). The questionnaire covered environmental, spiritual, aesthetic, and utilitarian functions of trees, tree planting at diverse sites, the frequency, duration and forms of time spent in nature, and the need for such time. Preferences for various landscapes with trees were measured by presenting the respondents with seven different photographs for rating on a four-point scale from "definitely like" to "definitely dislike". The same photographs were presented to Institute of Botany of the CAS experts for assessment on selected characteristics. There is a growing debate regarding the use of photo-questionnaires in landscape perception and preference studies as they are unlikely to assess the actual experiences made by respondents in real places (Özgüner & Kendle, 2006). The obvious pitfalls to using questionnaires and photographs in visual preference measurement include limited representation of real landscapes and the passive nature of such evaluation (Scott, 2006). This method cannot be applied, for example, in studying the relationship between preferences and place attachment or familiarity. Nevertheless, photographs were the most suitable choice in a representative survey of the general population of Czechia. As an advantage, the method helps researchers to emphasize the landscape characteristics they consider substantial and significant and to prevent random effects (Míchal, 2001). Each photograph is a symbolic representation of a landscape type that can be found in Czechia.

The data were collected from a quota-controlled sample (quota variables: NUTS-3 regions, size of municipality, gender, age and education) of the Czech population aged 15 and over in September 2020. The sample size was 1,200, and the total number of completed questionnaires was 951.[1]

[1] Data were collected by The Public Opinion Research Centre (CVVM), part of the Institute of Sociology of the Czech Academy of Sciences) and anonymised. IS AS CR (CVVM) is member

Aims and measures

This study uses a representative sample of the Czech population to analyse the potential relationships between attitudes to and preferences for trees, on one hand, and individual characteristics (e.g.sociodemographic factors), on the other hand. Given the intense expert debate conducted on various environmental factors associated with trees, we are interested in whether a positive assessment of the environmental benefits of trees can be observed in Czechia, and whether a high assessment of environmental benefits of trees leads to preferences of wilderness-like landscapes.

Our main aim is to assess the relationship between attitudes to trees and preferences for the different landscapes with trees. To achieve this, we are going to:

- explore statements about trees and discern latent attitudes towards them,
- assess the relationship between identified attitudes to trees and preferences for the different landscapes with trees while controlling for sociodemographics and municipal population size.

Together with Swanwick (2009), we distinguish between attitudes and preferences. "Attitude" is taken to mean a deeply held mental stance, while "preference" means liking one landscape aspect more than another. People's attitudes to trees could be influenced by sociodemographic factors (educational attainment, gender, age), social and economic status, but also by familiarity and place attachment; place of upbringing and residence, particularly its urban or rural character, may be especially significant, value orientations. Pro-environmental attitudes were often reported by better-educated respondents, women, and older age groups (Krajhanzl *et al*.,2008; Scott & Benson 2002), women are more likely to appreciate a landscape's aesthetic value (Strumse, 1996; Lindemann-Matthies *et al.,* 2010), the preference for wilderness-like landscapes grows with education; more educated individuals are more aware of the environmental value of wilderness and put more emphasis on natural processes in nature (Sklenička & Molnárová 2010; Stachová, 2018). Closely associated with and similarly effective as education, occupation also influences attitudes to wilderness-like landscapes, with the primary line drawn between laypersons and professionals (van den Berg & van Winsum-Westra, 2010; Hunziker, 2008). Some studies find municipality size to be an important factor. Urban residents have more positive attitudes towards trees, find their presence more beneficial and less threatening, and agree that mature trees increase the comfort of visiting public places. Rural residents, on the contrary, more often believe that old or damaged trees are visually unattractive (Wojnowska-Heciak *et al*., 2020).

There is some evidence, as summarized by Scott & Benson (2002), that people's relationship with the landscape can affect their perceptions, with large differences in preferences found, for example, between farmers and tourists. A variety of studies also demonstrated that perceptions of nature and landscapes could be influenced by familiarity and place attachment (Librová, 1987; Jones *et al*., 2000; Bonaiuto *et al*., 2002; Kyle *et al*., 2004, Swanwick, 2009; Scott & Benson, 2002;). In the same way, both active and passive childhood experiences of nature have very strong effects on adult attitudes to trees (Lohr & Pearson-Mims, 2005; Hay, 1998). According to Kals *et al.* Montada (1999), the most

of SIMAR (Association of Market Research and Public Opinion Agencies), it adheres to all SIMAR and ESOMAR (European Society for Opinion and Market Research) standards, guidelines and codes of ethics. Obtaining consent from each respondent is part of these rules (both ethical and GDPR). Due to the pandemic situation, both interviewers and respondents were less willing than normally to participate in the survey. Despite these complications, sample representativeness was achieved.

powerful predictor of emotional affinity toward nature in general is the present frequency of time spent in nature, followed by past frequency of the same. There is some evidence that both affinity toward and interest in nature emerge from experiences in nature (Finger, 1994; Kals *et al*., 1999). Last but not least, attitudes to nature and landscape are shaped by reported values: the more people value self-transcendence in their lives, the more likely they are to support environmentalist beliefs and to prefer wilderness-like landscapes (Kaltenborn & Bjerke, 2002; Krajhanzl *et al*., 2008).

As for visual preferences for different landscape types, people generally prefer tall trees with naked trunks over young ones, they are also fond of solitary trees, and the least preferred landscapes include dense shrubland, trees with low lying branches, woodland with mingled canopies, or large continuous forests. One of the interpretations of those preferences is that people are fond of safe, open, and organized landscapes (Kaplan, 1989; Lamp & Purcell, 1994; Misgav, 2000; Sklenička & Molnárová, 2010; Ulrich, 1983).

Research findings point at a relationship between sociodemographic factors and landscape/tree preferences. Some researchers suggest that demographic variables such as age, gender, education attainment, and living environment have important effects on preference assessment (Lindemann-Matthies *et al*., 2010; Svobodová, 2011; van den Berg & van Winsum-Westra, 2010; Strumse, 1996; Zhao *et al*., 2017). There are significant differences in landscape perceptions between young people and the generation of their adults, the latter being more likely to prefer urbanized and cultivated landscapes (Strumse, 1996; van den Berg *et al*., 1998). Educational attainment also affects landscape perceptions, with wilderness-like landscapes more often appreciated by educated people and cultivated ones by less educated people (van den Berg *et al*., 1998; van den Berg & van Winsum-Westra, 2010; Buijs *et al*. 2009; Lindemann-Matthies *et al*., 2010; Stachová, 2018). Inclinations to certain landscape types are influenced by the familiarity factor, based on lived experience of a landscape, knowledge of the environment, and places associated with one's childhood, home, recreation, etc. (Bonaiuto *et al*., 2002; Kyle *et al*., 2004, Hay, 1998; Svobodová, 2012).

RESULTS AND DISCUSSION

Attitudes to trees

We attempted to answer the above research questions by conducting explanatory analyses of attitudes to and preferences for trees, as presented below. We started by examining evaluations of different benefits of trees based on a battery of 22 statements administered to respondents and covering a range of attitudes to trees.

The statements map numerous aspects of attitudes to trees, including environmental, health, utilitarian, psychosocial, aesthetic, and spiritual ones. Therefore, we inquired about latent dimensions of tree-related opinions as tapped by the battery. Exploratory factor analysis was used to identify dimensions (see Table 1). The results indicate four distinct factors identified, which will be elaborated in the text below. The first factor is primarily loaded by questions on the environmental or health benefits of trees, the second refers to the benefits of old or dead trees, the third focuses on the utilitarian attitude to trees, and the fourth accentuates aesthetic and spiritual benefits of trees.

Table 1: Pattern matrix showing factor analysis results of statements towards trees

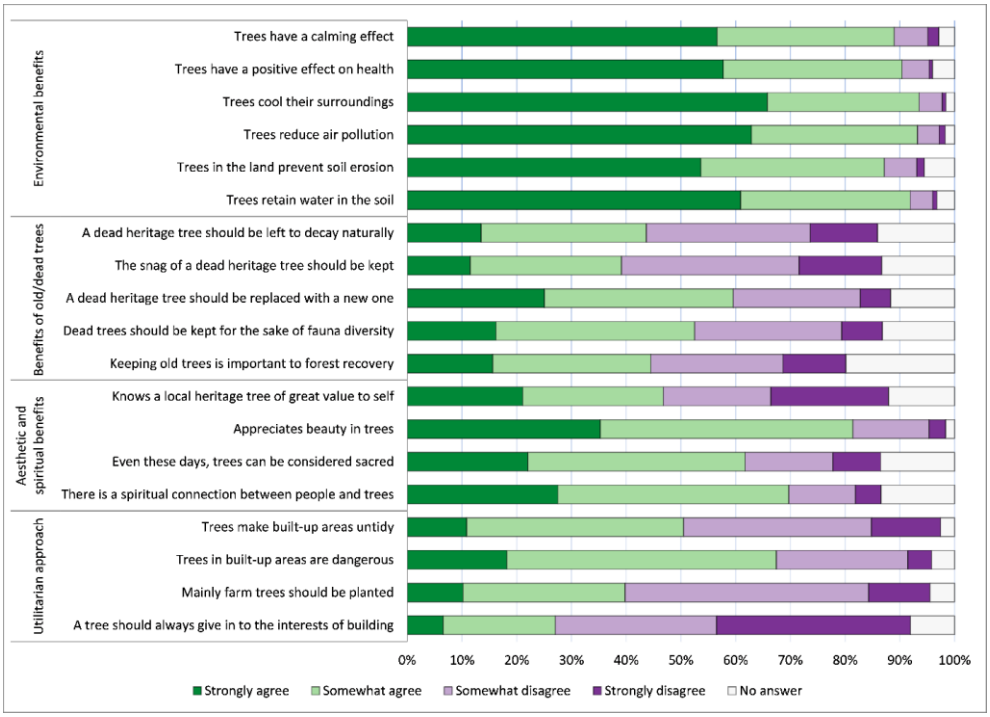
	Factor			
	1	2	3	4
Environmental benefits				
Trees retain water in the soil	0.717			
Trees in the land prevent soil erosion	0.695			
Trees reduce air pollution	0.707			
Trees cool their surroundings	0.714			
Trees have a positive effect on health	0.581			
Trees have a calming effect	0.585			
Benefits of old/dead trees				
Keeping old trees is important to forest recovery		0.622		
Dead trees should be kept for the sake of fauna diversity		0.485		
A dead heritage tree should be replaced with a new one		-0.539		
The snag of a dead heritage tree should be kept		0.619		
A dead heritage tree should be left to decay naturally		0.701		
Utilitarian attitude				
A tree should always give in to the interests of building			0.543	
Mainly farm trees should be planted			0.391	
Trees in built-up areas are dangerous			0.606	
Trees make built-up areas untidy			0.690	
Aesthetic and spiritual benefits				
There is a spiritual connection between people and trees				0.655
Even these days, trees can be considered sacred				0.748
Appreciates beauty in trees				0.498
Knows a local heritage tree of great value to self				0.554
Cronbach's Alpha	0.842	0.763	0.651	0.703

Note: Extraction method – Principal Axis Factoring; rotation method – Direct Oblimin with Kaiser Normalisation. Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.846. Only variables exerting the greatest influence in each factor are showed.

Figure 1 shows the distribution of answers to the statements, which are also sorted by the factors/dimensions they primarily load. The distributions indicate that respondents were most appreciative of selected environmental benefits of trees such as local cooling, water retention, reduced pollution, or preventing soil erosion, as well as to their positive effects on human health. Considerably lower importance was attached to the aesthetic and spiritual benefits of trees. Respondents were little appreciative of other environmental benefits of especially old/dead trees. This can be caused by low awareness of the benefits of old trees to biodiversity or forest recovery. Although trees in built-up areas were perceived as sources of

danger and untidiness, only a minority believed they should always give in to the interests of building. Overall, utilitarian attitudes to trees were the least frequently occurring dimension among the respondents.

Fig. 1: Distribution of agreement with individual statements indicating attitudes to trees



Mean indices were calculated (from 0=strongly disagree to 3=strongly agree on 4-point scale) to analyse the ways attitudes to trees are influenced by social conditions, including the respondents' sociodemographic background. Each index equals the mean value of selected items by which a factor is loaded that most (see Table 1 and Figure 1); one missing value was tolerated for each index (two in case of benefits of old/dead trees). Further analysis of mean indices and its relation to visual preferences for landscapes with trees will be shown part "Relationship between attitudes to trees and preferences for the different landscapes with trees".

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Visual preferences for landscapes with trees

In the second part of our study, we examined preferences for various types of landscapes with trees by inviting respondents to evaluate photographs. Seven photographs of distinct types of such landscapes were administered for rating on a four-point scale from "definitely like" to "definitely dislike". The photographs are depicted on the Figure 2 and a graphical representation of the ratings is shown in Figure 3[2]. In both cases, the results are ordered from

[2] Photo authors: Jana Stachová, Daniel Čermák, Petr Petřík

the most strongly preferred tree landscape photograph (definitely like) to the least preferred one.

Our results support the findings of previous studies that dense or decaying woodlands are the least popular (photo 6 and photo 7 in Figure 2). A solitary dead tree (photo 5) received somewhat less negative ratings than dead forest. Moreover, we were able to confirm the preference for tall trees, as an avenue of old trees was more popular than an avenue of young trees (photo 4). As for forest types, little distinction was made between a monoculture of same-aged trees, in other words plantation forest, (photo 3) and a forest of diverse species and ages (photo 2), the latter being preferred by natural scientists and increasingly by foresters: the public gave similar ratings for both types of forests. The highest preferences by far were exhibited by a photograph of an old oak avenue (photo 1), indicating not only the above-mentioned preference for tall trees with taller stems and regular crowns but arguably also attitudes to such trees as cultural and historic heritage.

Fig. 2: Photographs of landscapes with trees

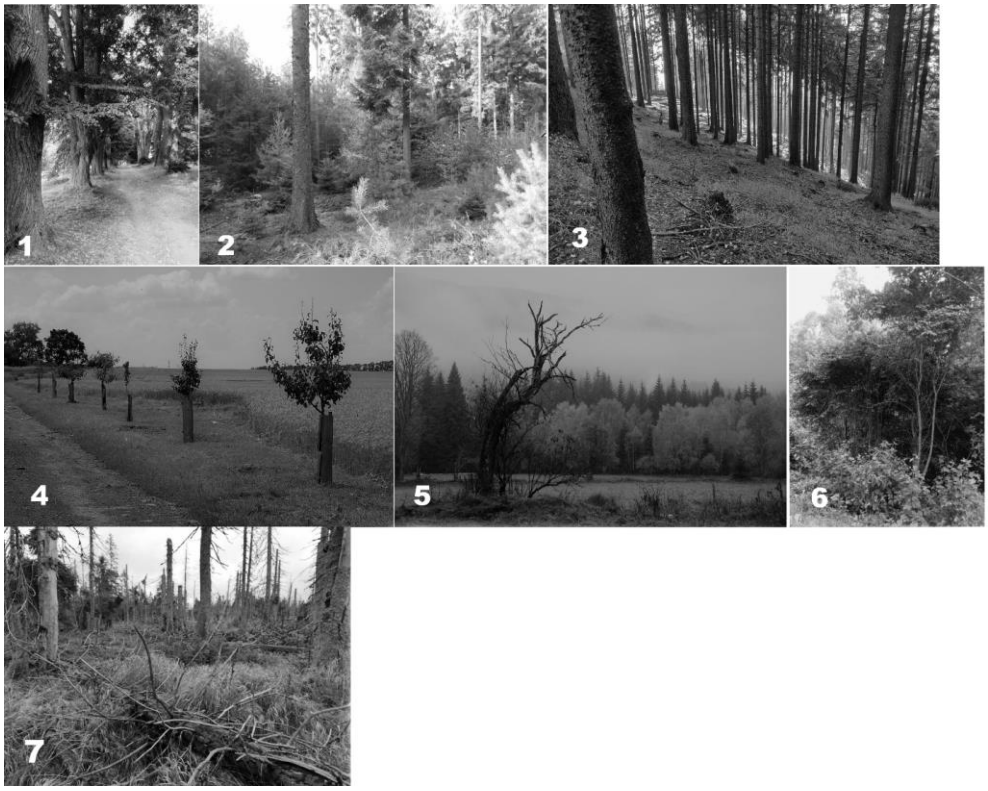
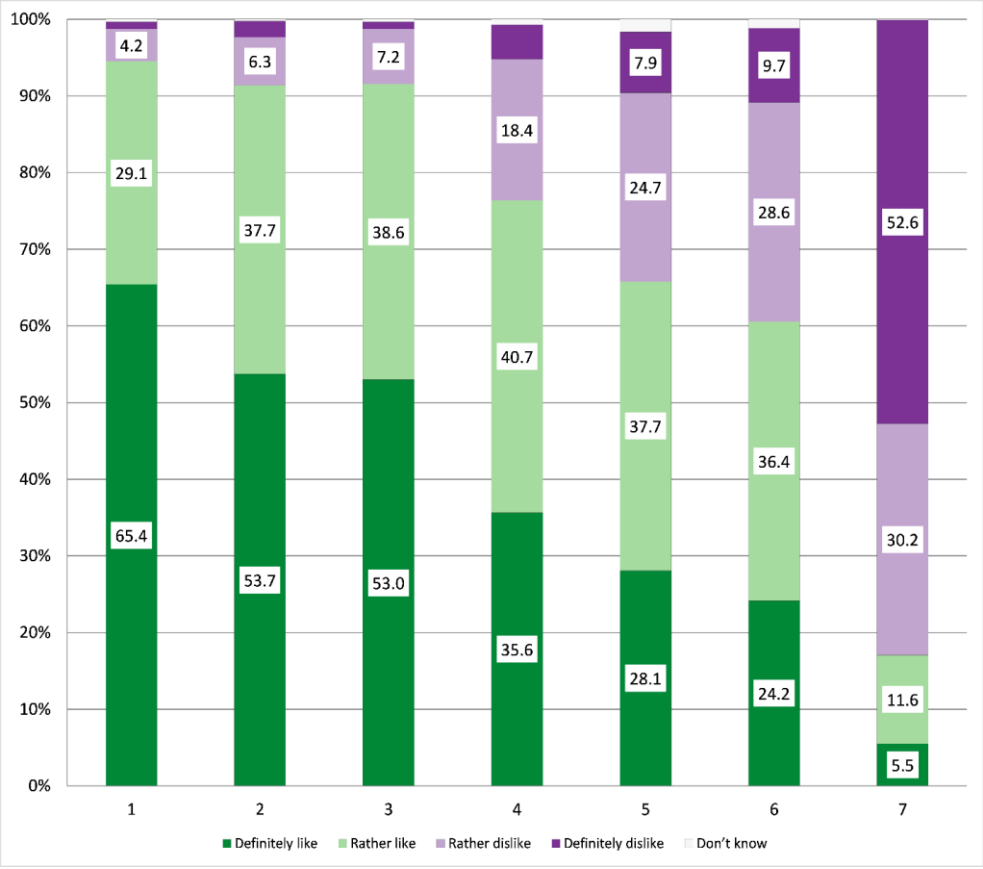


Fig. 3: Perception of the attractiveness of landscapes shown in photographs 1-7



People prefer landscapes with trees that are more organized and less dense. To better understand the qualities associated by respondents with "nicer" landscape, we invited a group of nine expert judges of the Institute of Botany, Czech Academy of Sciences, to assess the above photographed landscapes on eleven different scales indicating selected characteristics (see Table 2). By comparing the order of preferences among our respondents with the expert assessment, we found that respondent preferences were the most strongly associated with the safe–dangerous scale, followed by two semantically closely related scales, tidy–untidy and organized–unorganized. The results indicate that respondents preferred such physical environmental attributes they found safe and transparent, and vice versa.

Table 2: Rank correlation between mean expert assessments on 11-point scales and mean respondent evaluations on a 4-point scale

Scales for expert assessment	Correlation with a 4-point scale from definitely like to definitely dislike
dense × sparse	−.250
young × old	−.357
happy × sad	.393
healthy × diseased	.450
tidy × untidy	.811*
safe × dangerous	.937**
tall × undergrown	.643
natural × artificial	−.643
organized × unorganized	.811*
calming × annoying	.414
friendly × unfriendly	.571

Note: Spearman correlation coefficients shown.

Relationship between attitudes to trees and preferences for the different landscapes with trees

The next step is to verify how much visual preferences of landscapes are related to attitudes to trees and frequency of time spent in natural environments. To verify this we employ logistic regression analysis. Respondents' socio-demographic characteristics were also included as control variables in the model. The descriptive statistics of all employed explanatory variables is shown in Table 3.

Correlation of explanatory variables was computed to show how the attitudes to trees, frequency of time spent in natural environments and socio-demographic characteristics are related (Table 4). We can identify certain significant relationships between attitudes to trees. Environmental benefits of trees show medium correlation with aesthetic and spiritual benefits and week correlation with benefits of old/dead trees. Environmental benefits were also negatively related to utilitarian benefits. Aesthetic and spiritual benefits shows weak positive correlation with benefits of old/dead trees and very weak negative correlation with utilitarian benefits. Only very weak, but significant, correlations were identified among other variables. The most significant one is educational attainment, which is associated with three out of four mean indices of attitudes to trees.

Table 3: Descriptive statistics of explanatory variables

Explanatory variables	Definition	Mean	SD	Min	Max
Gender	0 = male; 1 = female	0,52	0,500	0	1
Age	Age of respondents in years	47,22	17,395	15	96
Educational attainment	1 = basic; 2 = vocational; 3 = secondary; 4 = college graduate	2,63	0,949	1	4
Municipal population size (inhabitants)	1 = 0-799; 2 = 800-1.999; 3 =2.000-4.999; 4 = 5.000-14.999; 5 = 15.000-29.999;6 = 30.000-79.999; 7 = 80.000-999.999; 8 = more than 1 million (Prague)	4,87	2,170	1	7
Frequency of time spent in natural environments	From 1 = almost never to 5= almost everyday (5-point scale)	3,24	1,043	1	5
Environmental importance of trees	Mean index	2,53	0,482	0,5	3
Importance of old/dead trees	Mean index	1,46	0,663	0	3
Aesthetic and spiritual values	Mean index	1,89	0,668	0	3
Utilitarian approach	Mean index	1,44	0,597	0	3

Table 4: Correlation matrix of explanatory variables

	Gender	Age	Educational attainment	Municipal population size (inhabitants)	Freq. of time spent in natural environments	Environmental benefits of trees	Benefits of old/dead trees	Aesthetic and spiritual benefits	Utilitarian attitude
Gender									
Age	0.004								
Educational attainment	0.031	0.111**							
Municipal population size (inhabitants)	0.011	-0.004	0.158**						
Frequency of time spent in natural environments	0.059	-0.037	0.067*	-0.162**					
Environmental benefits of trees	0.043	0.120**	0.107**	0.023	0.063				
Benefits of old/dead trees	-0.055	-0.037	0.081*	0.095**	0.032	0.241**			
Aesthetic and spiritual benefits	0.128**	0.136**	0.063	-0.105**	0.176**	0.405**	0.333**		
Utilitarian attitude	-0.062	-0.033	-0.118**	-0.054	0.013	-0.255**	-0.049	-0.185**	

Logistic regression models were employed to examine how visual preferences were associated with sociodemographic factors and by the above-identified attitudes to trees and the frequency of time spent in natural environments (see Table 5). Dependent variables on four-point scale were recoded to binary variables like/dislike landscapes with trees.

How are visual preferences for landscapes associated with attitudes to trees and other variables? The respondents' sociodemographic background played a rather marginal role in their visual preferences, with a few isolated effects of gender, education, or municipality size. It turns out that the evaluations of and preferences for a wilderness or wilderness-like landscape do not always grow with educational attainment, as other research evidence shows (see van den Berg & van Winsum-Westra, 2010; Buijs *et al*, 2009; Lindemann-Matthies *et al*., 2010; Stachová, 2018).

However, interesting associations were found in the case of attitudes to trees. The strongest relationship was observed with both perceived environmental benefits of trees and as well as with the benefits of old/dead trees. As recognition for the ecological benefits of trees grows, so does the popularity of old and young tree alleys and production forests (Photos 1-4). In other words, those accentuating the environmental benefits of trees simultaneously preferred ordered and transparent tree landscapes over dense forests with continuous canopies and dead trees. In contrast, those appreciating old/dead trees were less likely to prefer landscapes shown on Photos 1, 3, and 4 (examples of organized landscape). A completely opposite situation occurred in the case of Photos 5–7, with a naturally regenerating or dense forest or with dead trees, which were significantly less liked by people who appreciated the benefits of old/dead trees. People recognizing the environmental benefits of trees preferred Photo 7 less often.

In interpreting the above evidence on attitudes to trees, particularly the very high assessments of their environmental, spiritual and aesthetic benefits, one must bear in mind the ambiguous ways people relate to nature and landscape. Attitudes to nature and landscape are not always reflected in real behaviour, and people may have somewhat limited knowledge of some related concepts. And it is in the light of research evidence about superficial knowledge of some environmental concepts or terms that we must interpret some seemingly widespread biocentric attitudes in the Czech public. For example, a public opinion survey showed that 19 % of Czechs are very much and 59 % moderately interested in the state of Czech landscape (STEM, 2020). Moreover, research shows that most people in Czechia hold biocentric attitudes, including rather or definitely supporting the assertion that plants and animals have the same right to life as people (83 %) or perceiving man as a part of nature and subject to its laws (78 %). Only a minority agree with anthropocentric attitudes such that people have the right to altering their natural environment in line with their needs (20 %) or that people are destined to rule nature (12 %). This, however, does not mean that all those people translate their attitudes into adequate concrete actions; studies demonstrate a disconnect between real behaviour and reported attitudes (Krajhanzl *et al*., 2018).

Table 5: Logistic regression results

	1		2		3		4		5		6		7	
Explanatory Variables	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2
	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)
Gender	-0.254 (0.310)	-0.388 (0.341)	0.507* (0.249)	0.485 (0.265)	-0.103 (0.243)	-0.262 (0.260)	-0.115 (0.169)	-0.194 (0.180)	-0.064 (0.153)	-0.037 (0.159)	0.257 (0.151)	0.227 (0.156)	0.035 (0.183)	0.113 (0.193)
Age	0.014 (0.009)	0.009 (0.010)	-0.011 (0.007)	-0.018* (0.008)	-0.002 (0.007)	-0.007 (0.008)	0.005 (0.005)	-0.001 (0.005)	-0.002 (0.004)	-0.002 (0.005)	-0.001 (0.004)	-0.001 (0.005)	-0.001 (0.005)	0.004 (0.006)
Educational attainment	-0.238 (0.166)	-0.415* (0.183)	0.343* (0.135)	0.265 (0.144)	-0.213 (0.133)	-0.338* (0.142)	0.212* (0.091)	0.166 (0.096)	0.134 (0.083)	0.102 (0.086)	0.170* (0.082)	0.094 (0.084)	0.017 (0.098)	0.007 (0.103)
Municipal population size	-0.013 (0.070)	0.027 (0.081)	-0.292*** (0.064)	-0.290*** (0.070)	-0.077 (0.057)	-0.024 (0.062)	-0.084* (0.040)	-0.081 (0.043)	0.007 (0.036)	-0.011 (0.037)	-0.028 (0.035)	-0.013 (0.037)	0.099* (0.043)	0.082 (0.046)
Frequency of time spent in natural environments		-0.081 (0.172)		0.021 (0.127)		0.177 (0.127)		-0.172 (0.089)		-0.086 (0.077)		0.225** (0.076)		0.105 (0.096)
Environmental importance of trees		2.044*** (0.329)		1.346*** (0.259)		1.332*** (0.254)		1.110*** (0.191)		0.267 (0.174)		0.215 (0.172)		-0.862*** (0.208)
Importance of old/dead trees		-0.870** (0.321)		-0.145 (0.220)		-0.719** (0.227)		-0.319* (0.152)		0.507*** (0.130)		0.316* (0.127)		1.221*** (0.181)
Aesthetic and spiritual values		0.358 (0.304)		0.370 (0.223)		0.623** (0.224)		0.293 (0.158)		-0.063 (0.142)		0.082 (0.138)		-0.293 (0.170)
Utilitarian approach		-0.262 (0.301)		0.095 (0.244)		0.172 (0.235)		-0.209 (0.157)		-0.148 (0.138)		-0.248 (0.137)		-0.001 (0.165)
Nagelkerke pseudo R^2	0.018	0.231	0.083	0.200	0.016	0.163	0.020	0.136	0.006	0.051	0.013	0.067	0.012	0.138
Omnibus test	0.294	0.000	0.000	0.000	0.223	0.000	0.033	0.000	0.523	0.000	0.121	0.000	0.204	0.000

The results of our analyses also correspond with a lot of research evidence that most people studied are clearly highly appreciative of the presence of trees in both urban and open rural landscapes. Our results, in accordance with various above mentioned studies, demonstrated that people generally attach importance not only to environmental, aesthetic and utilitarian meanings of trees but also to other, less tangible qualities such as the spiritual benefits of trees. The minority of people who attach lesser environmental, aesthetic and spiritual importance to trees is more often recruited from the categories of young people; lower educational attainment in case of environmental benefits; and also men in case of aesthetic and spiritual benefits. Members of the Czech public especially appreciate the environmental benefits of trees, which means they are well aware of some environmental aspects of trees such as local cooling, water retention, reducing pollution or erosion prevention, and they also highly appreciate the individual health effects of trees. Our data also reveals that those more supportive of the environmental significance of trees were also more likely to agree with planting trees, especially on urban streets and in rural landscapes, but also on playgrounds, along roads, near buildings, etc. One can assume that the environmental significance of trees, as represented by statements in our battery, is an utilitarian attitude of sorts and to some extent an anthropocentric one: just as people can exploit trees for timber or fruit, so can they use them to improve their environment.

Compared to attitudes in the environmental dimension, the respondents attach relatively little importance to other environmental benefits such as the significance of old/dead trees in facilitating biodiversity or forest renewal. One can infer that the wider society is not yet sufficiently informed about the environmental benefits of old/dead trees. We have to ask if an individual's attitude to old/dead trees might represent special knowledge and a more in-depth understanding of the importance of trees and natural processes overall.

Most respondents attach importance to the aesthetic and spiritual benefits of trees, valuing their beauty and spiritual significance. Yet fewer than one in two respondents know a concrete tree in their area that they value in this sense. The result suggests that many people think about trees theoretically, not based on lived experience of trees. A support for the aesthetic and spiritual benefits of trees decreases with population size of municipality and increases with educational attainment and age. This support is also more often connected with women. As for the utilitarian attitude to trees, people do perceive trees in built-up areas as sources of danger and untidiness, but only a minority believes that they should always give in to the interests of building. Only one if five respondents, then, agree that trees should primarily provide direct utility (timber, fruit). A support for the statements in this dimension increases as education declines.

CONCLUSIONS

To summarize the effects of sociodemographic background on perceived significance of trees, it is education, in line with expectations, that proves to be the strongest factor. While low-educated people best appreciate the utilitarian benefits of trees, appreciation of the environmental, grows with education. College graduates, of all educational groups, are the most likely to value benefits of old/dead trees. In our opinion, this partly reflects the popularization effort of the academic community undertaken in the context of debating climate change and the adaptation/mitigation potential of landscape management. Gender is significant in the spiritual and aesthetic dimension, which is accentuated by women. The environmental benefits of trees as well as the spiritual and aesthetic dimension are the least appreciated by the youngest age categories and the level of appreciation is growing with age.

In line with assumptions, the visual landscape preferences lean towards safe, organized, and transparent landscapes with trees. The most popular tree landscape photographs of those presented are ones showing human involvement, avenues, or regular tree plantations. The least popular are landscapes left to natural processes as much as possible, as represented by photographs of dense or decaying woodlands. These results should be treated with some caution because people's evaluations of unknown landscapes are not informed by familiarity or place attachment. Presumably, when people have intimate knowledge of a landscape, they evaluate it in different terms than a photo-questionnaire. Yet these results certainly suggest a general trend in visual evaluations of landscapes.

Visual preferences for landscapes in our models were only weakly associated with sociodemographic background. While there are some isolated effects of gender, education, or municipality size, no clear trend can be discerned. Still, interesting associations were found in the case of attitudes to trees. People who appreciate the environmental benefits of trees are more likely to prefer transparent and organized landscapes with trees, whereas the more specific environmental attitude appreciating old/dead trees is reflected in higher preferences for wilderness-like landscapes. Therefore, we can conclude that the positive assessment of the widely known environmental functions of trees does not lead to the preference for close-to-nature (wilderness-like) forms of the tree landscape. Preference for these forms of landscape is connected only with the appreciation of the benefits of old/dead trees.

From the social scientific perspective, trees are symbolic places in our landscapes, ones that bear, as demonstrated by the present study, different meanings in different social groups, as reflected in tree landscape preferences as well. People appreciate the environmental, aesthetic and spiritual benefits of trees as long as the trees in the landscape are managed and organized by people and comply with the requirements of a safe "cultural" landscape. Despite the above-mentioned biocentric attitudes in the Czech public, landscapes that fit human demands are more socially acceptable than wilderness-like landscapes, in which natural processes such as death and decay are left to run their course. Yet both attitudes to trees and visual preferences seem to be susceptible to awareness raising and education strategies. People who prefer organized landscapes associate healthy and managed trees therein with the important and relatively well-known environmental benefits such as cooling or water retention. Nevertheless, it is only after fully acknowledging the environmental significance of old/dead trees that such woodlands become appreciated visually as well, or vice versa.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in Czech Social Science Data Archive at http://doi.org/10.14473/V2009b.

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