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Childhood experience in forest recreation practices: Evidence from nine European countries

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ABSTRACT

This study examines the role of childhood experience in forest recreational practices at adulthood. It investigates the effect of visitation frequency and type of settlement during childhood on frequency of visits at adulthood and analyses variations in nine European countries including Austria, Czech Republic, Switzerland, Germany, Denmark, France, Poland, Slovakia, and UK. The data are collected through a representative online survey and results are based on a generalized ordered logit model in which frequency of forest visits is considered as an ordered categorical variable. Childhood experience is found to be a significant factor determining frequency of forest visits at adulthood. In addition, current residential settlement, distance to the nearest forest, and other socioeconomic factors influence frequency of forest visits. The study findings show the importance of forest accessibility to children for a development of better recreational habits that support active mobility, sustainability and healthy lifestyles.

1. Introduction

Many studies indicate how children's contact with nature, such as forests, could improve their psychological wellbeing and cognitive skills (see Bjork et al., 2008; Fuller et al., 2007; McCurdy et al., 2010; Miller, 2005; Wilson, 2003). Limited time spent by children outdoors, and particularly in nature areas, may result in restricted use of nature amenities during their adulthood and lead to adverse health effects (Coon et al., 2011; Jacobs et al., 2008; Thompson et al., 2008). This problem emerges since, nowadays, children are spending less time in nature and semi-nature areas (Godbey, 2009; Kong, 2000; Skår and Krogh, 2009; Valentine and McKendrick, 1997). Access to modern social media technology and indoor playing equipment on the one hand and parental fear to allow their children for unsupervised playing opportunities on the other, have reduced children's time to be spent in nature areas (see Fjørtoft, 2001; Godbey, 2009; McCurdy et al., 2010). According to Larson et al. (2011), interest in internet or messaging,

watching or playing video games, DVDs or TV, and listening to music have become the most important reasons for children not to spend leisure time outdoors.

Recently, Pamela et al. (2016) elaborate how childhood nature exposure is related to adulthood mental wellbeing through fostering nature exposure in adulthood. According to Bixler et al. (2002) children playing in nature areas could develop better exploring skills and sense of autonomy; and such experiences are long lasting and can create stronger emotional attachment to nature areas in adulthood. Olds (1989) explains that adults' recollections of healing places are rooted in their childhood outdoor experiences. All in all, the association between recreational experience in nature and effects on health is well documented (Dalton et al., 2016; James et al., 2016; Zhang et al., 2017), nonetheless to the causality pathways which are still debatable (Lachowycz and Jones, 2013).

Outdoor recreation has been found to significantly affect individuals' environmental behaviours and attitudes in general (Berns

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and Simpson, 2009; Michael and Gary, 2010; Teisl and O'Brien, 2003; Theodori et al., 1998). For instance, Rosa et al. (2018) show how childhood nature experience has a long-lasting effect on adulthood pro-environmental behaviour. Similarly, Cleary et al. (2018) point out how childhood experience could influence one's nature connectedness in general. Furthermore, some studies outline how a strong connection with nature during childhood could foster individuals' positive attitudes towards the intrinsic values of nature (see Bell et al., 2003; Lohr and Pearson-Mims, 2000, 2005).

Regarding the childhood-adulthood association in nature recreation, Bixler et al. (2002) elaborate how recreational activities in adulthood are influenced by the outdoor experience during childhood. According to Asah et al. (2011), participation in nature-based recreation during childhood reinforces motivation and mitigates constraints of outdoor recreation in adulthood. Similarly, McFarlane et al. (1998) show that when children are more experienced with nature areas, they also tend to appreciate more natural and less managed recreational sites in their adulthood. In addition, experienced nature recreationists are found to prefer difficult and challenging routes. Wells and Lekies (2006) confirm similar recreational behaviour being observed among adolescents, i.e. those who had more opportunity playing in wilderness areas during childhood are more likely to prefer wildland walking paths and are more tolerant to the lack of modern recreational facilities. Through conducting in-depth interviews, Lovelock et al. (2016) underline the significance of childhood nature recreation experience in fostering enduring participation at adulthood.

Childhood outdoor experience is also a good predictor of the frequency of forest recreational visits in adulthood, as shown in Thompson et al. (2008). More frequent forest visitors are found to be those who had already been frequent visitors in their childhood. Less frequent visitors were those who had none or limited outdoor recreational experience during childhood. Similarly, Acharya et al. (2009) found the frequency of visits to a wilderness area in adulthood being determined by past wilderness experience. According to Acharya et al. (2009) and Nawas and Platt (1965), the impact of childhood experience on the recreational habits later in life can be described through nostalgic behaviour. Acharya et al. (2009) show nostalgia being one of the main determinants of visitation frequency to wilderness areas.

These previous studies outline the importance of childhood experience in outdoor recreational practices at adulthood, commonly in a qualitative explanation. Thompson et al. (2008) showed the childhood experience being significant in determining adults' frequency of outdoor recreation in green spaces. Based on a correlation analysis, and ignoring predictors, the study revealed that visitation frequency in adulthood is positively correlated with recreation frequency during childhood.

Therefore, the present study contributes to this body of literature by analysing the childhood-adulthood relationship in forest recreation, exploring more predictive variables and covering many countries. The main objective of the study is to analyse the role of childhood experience (along with other covariates) in determining the frequency of forest visits. The study is conducted using survey data from nine European countries including Austria, Czech Republic, Denmark, France, Germany, Poland, Slovakia, Switzerland, and United Kingdom. It aims to address three research questions: 1) How does childhood forest experience (i.e. frequency of visits and/or type of residential settlement during childhood) influence the frequency of forest visits at adulthood? 2) What is the role of other determinants of forest visitation frequency? and 3) To what extent does adulthood frequency of forest visitation varies among the nine European countries? It is hypothesised that childhood forest experience plays a significant role in determining the level of forest visitation frequency at adulthood. Likewise, people who have grown up in rural areas tend to have a higher frequency of

Table 1
Number of respondents and response rate in each country.

	Valid observations		Excluded	
	number	(%)	Non-visitors (%)	Speeders (%)
Austria (AT)	1000	72	13	4
Switzerland (CH)	1001	72	10	3
Czech Republic (CZ)	883	63	12	5
Germany (DE)	1003	61	24	6
Denmark (DK)	1000	53	14	8
France (FR)	1012	38	24	4
Poland (PL)	1008	85	9	4
Slovakia (SK)	885	62	17	3
United Kingdom (UK)	1001	21	22	26

visits and, that individuals currently living in rural areas are more likely to visit forests more frequently.

2. Materials and methods

2.1. Survey and sampling strategy

The source of data for the present study is a web-based questionnaire survey conducted in nine European countries. The survey has been undertaken from January to February 2017 by professional survey companies operating in the respective countries, using a self-interviewing survey mode. The main purpose of the survey was to analyse preferences for different attributes of forest sites in these countries. A central part of this questionnaire is built around questions regarding current forest recreation practices and childhood experiences.

The surveying companies in the respective countries selected adult respondents from their online pool of respondents. The companies followed a 'quota-based' sample selection procedure that ensured representativeness in terms of gender, age, and education. The sample size containing 'all finished' interviews was about 1000 respondents per country after screening out respondents who were defined as 'speeders' and who had not visited any forest during 12 months prior to the survey, referred as *non-visitors*. The 'speeders' were those respondents who answered the whole questionnaire in less than 10 min. Considering the number of respondents who started viewing the questions, i.e. clicking on the survey link, the valid response rates were above 40% in all countries except France and UK. Invalid observations included speeders, people not visiting forests, people screened out as their quota was full, or they exited the survey before answering all questions. From the total of 26,111 individuals who started the questionnaire, 4610 (18%) were screened out and excluded for a representative 'quota' fill, 5021 (19%) did not finish the questionnaire, 2964 (11%) were identified as speeders, and another 4723 (18%) were excluded since they had not visited any forest for 12 months before the survey. The percentage of non-visitors varies from 9% (Poland) to 24% (both in Germany and France) (see Table 1). The final cleaned sample consists of 8793 valid observations.

2.2. Model specification

Frequency of forest visits in adulthood during the last 12 months was treated as a categorical variable with three levels: at least once a year (less frequent), at least once a month (frequent), or at least once a week (more frequent). Hence, an ordered logit model was employed to examine the likelihood of a forest visitor to be part of a higher category of visitation frequency. As mentioned before, the explanatory variables

are childhood experience, current residence area, distance to the nearest forest (among the recently visited forests), and other socio-demographic variables including age, gender, education, household income, and children under 18. The childhood forest experience is represented by two variables: frequency of visits during childhood and type of residential area in childhood.

Respondents were asked to state the frequency of forest visits during their childhood and during the last 12 months before undertaking the survey, separately in an interval set of categories. As people might interpret the meaning of forest differently, especially when dealing with respondents from several different countries, the term ‘forests’ was described to include woodlands but not urban parks. In addition, they were asked to tell the type of residential area where they had lived in most of their childhood (until the age of 11); and sideways, they were asked to tell the type of settlement they are currently living in. The residential areas were categorized as a rural area with less than 3000 inhabitants, a town with 20–100 thousand inhabitants or a city with more than 100 thousand inhabitants. Distance to the nearest forest was calculated from coordinate points where respondents pinpointed on a google-map. Then the Euclidian distance was calculated from the coordinate points between the respondents’ residential area and the forest sites they had been visiting during the last 12 months. Respondents were also asked to indicate their level of education and household income from drop-down categories.

Frequency of forest visits during childhood was coded as a categorical variable - the same way as the dependent variable. The residence area was also coded as a dummy variable representing ‘rural’ being grown up in a settlement of less than 3000 inhabitants; or ‘urban’ otherwise. Some numeric variables (distance to the nearest forest, and number of children) were also coded as dummies for a better model fit. ‘Age’ was considered in its continuous (linear) measurement. Level of education and income were also re-categorised into meaningful classes. Notice that income was asked in a categorical set-up of the same number of classes with different income levels and currencies across respective countries. However, the re-categorisation into four levels (i.e. ‘low income’, ‘middle income’, ‘high income’, and ‘refused’) would more-or-less reflect similar income grouping disclosing respondents’ income differences across the countries.

The frequency of forest visits at adulthood is specified as a function of the childhood experience and other explanatory variables. The dependent variable, ‘frequency of forest visits’, being a categorical variable could be analysed either by an ‘interval regression’ or an ‘ordinal data modelling’ approach. The visitation frequency intervals were not always determined specifically, cf ‘almost every day’ and the interval regression model fit was weak. This leads to employ the ordinal data modelling approach - after transforming the responses into ordered outcomes (see Appendix A). As noted above, the ordered outcomes were labelled as ‘more frequent’, ‘frequent’, and ‘less frequent’ corresponding to the frequency of visits at least once a week, once a month, or once a year, respectively. The exact number of annual forest visits in adulthood was not known to the analyst and was thus considered as latent (unobserved) variable.

Therefore, the unobserved frequency of visits (y_n^*) of individual n can be formulated as:

$$y_n^* = X_n \beta + \varepsilon_n \tag{1}$$

X is a row vector of the explanatory variables and ε_n is an error term which could be assumed with logistic or normal distributions. The observed frequency of forest visits (y_n) takes one of the three ordered values given by:

$$y_n = \begin{cases} 1 = \textit{less frequent} & \text{if } y_n^* < \alpha_1 \\ 2 = \textit{frequent} & \text{if } \alpha_1 < y_n^* < \alpha_2 \\ 3 = \textit{more frequent} & \text{if } y_n^* > \alpha_2 \end{cases} \tag{2}$$

where α_1 and α_2 are to-be-estimated cut off points. That means the possible outcomes are determined based on the likelihood of the latent variable being less than (or greater than) these cut off points. With an assumption of a logistic distribution of ε_n , a generalized ordered logit model was estimated using the functional form (Williams, 2006):

$$P(y_n > j) = \frac{\exp^{(\alpha + X_n \beta_j)}}{1 + \exp^{(\alpha + X_n \beta_j)}} \tag{3}$$

The generalized ordered logit model is employed to account for the different β_j (slopes) of the categories, j . This model is recommended when the parallel odds ratio assumption (where β_s are taken to be the same in comparing each pair of categories) is violated in the simple ordered logit modelling (Williams, 2006). The test for the parallel odds ratio (Long and Freese, 2001; Wolfe and Gould, 1998) confirms the assumption being violated. The approximate likelihood-ratio test of proportionality of odds across response categories has a chi-square value = 96.68 (with $df = 15$). As a result, the generalized ordered logit model is estimated with partial proportional odds ratio, i.e. by allowing same β_s for the categories of variables that do not violate the parallel odds ratio assumption.

3. Results and discussion

3.1. Descriptive statistics

Looking at the frequency of forest visits in the 12 months before the survey, 41% of the respondents were categorized as *less frequent*, 40% as *frequent*, and 19% as *more frequent*. The majority in each country except France and UK can be considered as frequent visitors. More than half of the respondents in France and UK are categorized as less frequent visitors. During childhood, about 74% of the respondents had the opportunity to visit forests at least once a month. However, some variations across the different countries are observed. For instance, in countries like France, Poland, Slovakia, and UK, the proportion of respondents categorised as less frequent visitors during their childhood is more than 40% while it is less than 35% in countries like Austria and Switzerland.

More than half of the respondents indicated that their current residence is in rural settlements. A total of 61% of the respondents had lived in a rural settlement during their childhood. For 48% of the

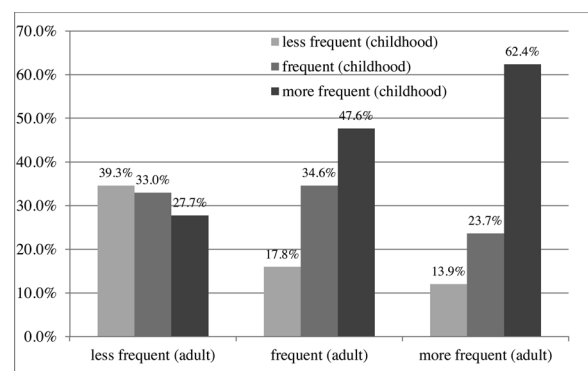


Fig. 1. Frequency of visits as a child and as an adult.
 Note: Category “more frequent” denotes to at least one forest visit per week during childhood and adulthood, respectively, “frequent” describes behaviour with one visit a month but up to 3 visits a month, while “less frequent” means 2–4 times a year including “never visited a forest” during childhood and less than 10 times a year as an adult. Perhaps the categories of “never visited a forest” and “2–4 times a year” during childhood may describe different behaviour. However, only 3% of the respondents replied “never visited a forest” and that is too small to analyse it separately. It is also noticed that the correlation and estimation results considering these two categories separately was not essentially different from the results using the merged category.

Table 2
Estimation results of the generalized ordered logit model.

Variable	Visits in adulthood: Once a month or more often (more frequent or frequent) compared to once a year (less frequent)			Visits in adulthood: Once a week (more frequent) compared to once a month or less often (frequent or less frequent)		
	Coefficient	SE	P-value	Coefficient	SE	P-value
<i>Visits in childhood</i>						
Frequent	0.768***	0.059	0.000	0.370***	0.089	0.000
More frequent	1.465***	0.060	0.000	1.244***	0.081	0.000
<i>Residential area</i>						
Rural area in childhood	-0.062	0.051	0.226	-0.251***	0.064	0.000
Rural area in adulthood	0.326***	0.050	0.000	0.529***	0.062	0.000
Distance to the nearest forest in adulthood	-0.572***	0.046	0.000	-0.695***	0.059	0.000
Male	0.094**	0.047	0.044	-0.036	0.057	0.526
Age	-0.002	0.002	0.273	0.007***	0.002	0.001
<i>Level of education</i>						
Vocational training	0.133**	0.057	0.020	-0.021	0.068	0.752
University level studies	0.123**	0.060	0.039	-0.084	0.074	0.257
<i>Net monthly income</i>						
Middle income	0.155**	0.062	0.012	0.002	0.075	0.983
High income	0.160**	0.062	0.010	-0.005	0.074	0.942
Income refused	0.189***	0.070	0.006	-0.070	0.085	0.407
Having children under18	-0.103**	0.046	0.026	-0.103**	0.046	0.026
Constant	-0.444***	0.107	0.000	-2.220***	0.139	0.000
Final log likelihood	-8611.949					
Pseudo R ²	0.068					
Number of observations	8793					

*** And ** show the 1% and 5% significance levels respectively.

Category “more frequent” denotes at least one forest visit per week, “frequent” means 1–3 visits a month, “less frequent” means less than one visits a month (during childhood) or less than 10 times a year in adulthood.

respondents, the calculated Euclidean distance to the nearest visited forests is above 5 km from their residence (see Appendix B for more information on responses).

The statistics on the frequency of forest visits presented in Fig. 1, illustrates how forest recreational practices of the respondents are associated with their recreational experiences in childhood. Considering all nine countries, 62% of the respondents who are categorized as *more frequent* visitors, based on the last 12 months, were *more frequent* visitors in their childhood (i.e., had visited forests at least once a week). In addition, 48% of the respondents who are categorized as *frequent* visitors (visiting forests at least once a month) were those who had visited forests at least once a week during childhood. In general, respondents who are categorized as *more frequent* in childhood accounts for a larger proportion of those categorized as *frequent* or *more frequent* visitors now at adulthood. Notice also that about 72% of respondents who are categorized as *less frequent* visitors as adults are those who are categorized as *less frequent* or *frequent* visitors in childhood. Similar statistics are also observed for each country cases. In almost all the countries, more than 50% of those categorised as *more frequent* visitors are also identified as *more frequent* visitors in childhood. In Austria, Switzerland, Czech Republic, and Slovakia this proportion becomes even higher than 70%.

The association between the levels of frequencies during childhood and adulthood is supported by a chi-square test, rejecting the hypothesis of no correlation between the frequency categories. The correlation between the frequency of visits in childhood and adulthood is found to be significant (chi-square with four degrees of freedom = 841.64, $p = 0.000$) with a weak strength (Cramer's $V = 0.22$).

3.2. Estimation results

The estimation results of the generalized ordered logit model are presented in two columns to compare coefficients of variables for the pairs of categories of the dependent variable. In general, frequency of forest visits in childhood, current residence in a rural area, and distance to the nearest forest significantly explain the likelihood of being in a higher category of forest visitation frequency as an adult (Table 2).

Respondents labelled as ‘*frequent*’ or ‘*more frequent*’ forest visitors in childhood are more likely to be on a higher level of visitation frequency as adults, the effect being slightly reduced for the highest level. For instance, being a *more frequent* visitor compared to a *less frequent* visitor in childhood significantly increases the probability of being a *more frequent* or *frequent* visitor at adulthood. A more frequent visitor in childhood is also more likely to be a more frequent visitor in adulthood – but notice the difference between 1.465 and 1.244. The effect of currently living in a rural settlement can be explained in the same manner – it has positive impact on the probability of being on a higher frequency of visit category. In contrast, respondents who reported being grown up in a rural area settlement are less likely to be on the highest level of visitation frequency as adults.

The results show that the frequency of forest visits is strongly associated with childhood experiences. The main hypothesis that the frequencies of recreational visits in adulthood are positively influenced by visitation frequencies experienced during childhood is confirmed. In this regard, the finding of this study is consistent with the study by Thompson et al. (2008) who elaborated on the childhood factor as a determinant of the frequency of greenspace recreation in adulthood. Moreover, the results reveal a strong positive association between the

Table 3
Marginal effects of selected explanatory variables.

Variables	Visits in adulthood: Once a month or more often (more frequent or frequent) compared to once a year (less frequent)			Visits in adulthood: Once a week (more frequent) compared to once a month or less often (frequent or less frequent)		
	Coefficient	SE	P-value	Coefficient	SE	P-value
<i>Visits in childhood</i>						
Frequent	0.121***	0.015	0.000	0.055***	0.014	0.000
More frequent	0.141***	0.014	0.000	0.189***	0.013	0.000
<i>Residential area</i>						
Rural area in childhood	0.022*	0.012	0.081	-0.036***	0.009	0.000
Rural area in adulthood	0.004	0.012	0.760	0.074***	0.009	0.000
Distance to the nearest forest in adulthood	-0.038***	0.011	0.001	-0.098***	0.008	0.000

*** And * show the 1% and 5% significance levels respectively.

type of current residential area and the level of forest visitation frequency. People who are living in rural settlements are more likely to be in a higher category of visitation frequency. Previously, Acharya et al. (2009) indicated that adult individuals who grew up in rural areas (and moved to big cities at adulthood) are more frequent visitors of wilderness areas than who grew up in urban settlements. In the present study, a model was estimated using a variable similarly defined as in Acharya et al. (2009), i.e. using a dummy variable describing people who grew up in a rural area and currently living in a city, but that does not change the result and conclusion. Therefore, in this regard, this finding of the present study does not seem to be consistent with the previous study.

Similarly, the Euclidean distance is negatively associated with the probability of being in a higher category, i.e. distance to the nearest forest being farther than 5 km decreases the likelihood of being on a higher level of visitation frequency. Distance becomes more restrictive for the probability of being in the highest category. Nearby access to nature areas increases the frequency of recreational activities – which is well-documented in studies estimating demand for outdoor recreation as a function of travel costs (e.g. Mayer and Woltering, 2018) – and may also lead to higher levels of physical activities and better health (see Bjork et al., 2008; Olds, 1989). Therefore, in this regard, the estimation result is consistent with previous findings. Note that the variable was defined as a dummy indicating the Euclidean distance between residential locations and the nearest visited forest being farther than 5 km. Initially, it was calculated from the coordinate points based on pinpointed locations on a map tool in the questionnaire and the calculated distance may not represent the route used by the visitor. More importantly, the respondents may fail to properly pinpoint on the locations as investigated in Agimass et al. (2018). Hence, it is expected that the dummy coding is a robust indicator of distance which was also confirmed by an improved model fit using the dummy coding of the distance.

Furthermore, the probability of being in a higher category of visitation frequency increases with male respondents, individuals with higher levels of education, and those in middle- or higher-income groups. However, these socioeconomic variables do not significantly determine the likelihood of being in the highest category. Age of the respondent is the other factor positively related to the likelihood of being in the highest frequency of visits category. On the other hand, having children increases the probability of being on the lower level of visitation frequency.

The estimation results also reveal cross-country fixed effects being

significant, supporting the variations illustrated in the descriptive statistics. The same generalized ordered logit model was estimated controlling for cross-country fixed effects, considering UK as a reference (note that most of the UK visitors are categorized as ‘less frequent’ visitors). In this case, all country dummies, except for Slovakia, are significant and positive (see estimation results reported in Appendix C). That means, respondents in other countries are more likely to be on a higher level of visitation frequency compared to the UK respondents. All countries included in this study, except UK and Denmark, have a forest cover of more than 30% of the total land area (“THE WORLD BANK data,” 2017) and this could perhaps be linked to the accessibility of forests which can contribute to the positive effect of the ‘country-index’ fixed effects taking UK as a reference. It is worth to mention that a different result could be obtained by changing this reference category.

The cross-country variation could be attributable to different factors which this study does not consider. Perhaps, it could be related to the differences in forest cover of the countries, recreational accessibility – where all aspects may not be captured by the distance variable, forest land entitlement, recreational access policies, availability of recreational facilities, or different cultural associations with forests (see Bell et al., 2009a,b, 2007; Edwards et al., 2012; Pröbstl et al., 2010).

Marginal effects of selected significant variables are also estimated with results reported in Table 3. Higher levels of visitation frequency in childhood positively influence the probability of a person being in a higher category of frequency of visits as an adult. For instance, the probability of a person being in a higher category than the less frequent category increases by 14%, given the person was a more frequent visitor in childhood; the effect of other variables being constant at their mean values. This probability becomes 19% for the person to be in the highest level of frequency. The variables reflecting the types of residential areas in adulthood and in childhood have significant marginal effects only for the highest category of visitation frequency. A person currently living in a rural settlement is 8% more likely to be a *more frequent* visitor. In contrast, a person who has grown up in such areas in childhood will be 4% less likely to be on the highest level of visitation frequency. Similarly, the probability of a person being in a higher category decreases when distance to the nearest forest is farther than 5 km; e.g. the probability of being in the highest category reduces by 10%, other variables being fixed at the means.

Finally, a limitation of this study is that the analysis of the long-term impacts of childhood experience is based on remembered childhood forest recreational practices asked in an online survey. Remembering childhood experience might be difficult for many people and perhaps

could be one of the reasons for ignoring such a factor in many studies on outdoor recreation (Asah et al., 2011; Thompson et al., 2008; Wells and Lekies, 2006). It might also be demanding for the respondents to clearly state their childhood experience in a concise way, i.e. reporting the visitation frequency from recreational experiences passed over several years or even decades. The preferred approach for more reliable analysis would be using longitudinal data on life path experiences (Asah et al., 2011). However, longitudinal data regarding respondents' outdoor experiences are hardly available. Thus, the retrospective approach becomes a feasible option to examine the childhood experiences affecting adulthood behaviours (Chawla, 2009; Kals et al., 1999).

In contrast to such a limitation, studies have shown that outdoor experiences in childhood could be vividly remembered at adulthood (see Asah et al., 2011; Bell et al., 2003; Lohr and Pearson-Mims, 2000; Sebba, 1991). For instance, Sebba (1991) has indicated that natural features from outdoor experiences are the predominantly remembered significant places in one's life. Furthermore, she explained how adults' memory could be maintained as a central childhood experience from a child's sensory perception.

"...one can conclude that the request to recall an environment significant in childhood seemed to be a request to pinpoint a place that stirred up their original recreation as children." (Sebba, 1991 p. 407)

Therefore, it is believed that the self-reported remembered childhood experiences were fairly measured and the results could not be biased by such a limitation.

4. Conclusion

Literature analysing the determinants of forest recreation is huge. However, there have been much less studies aiming specifically at the role of forest recreational practices during childhood in one's adulthood forest recreational behaviour. Those few previous studies have found that when children are more experienced with nature areas, they also more appreciate natural and less managed recreational sites, prefer wildland walking paths, and share positive attitudes towards the intrinsic values of nature in their adulthood. Also, outdoor experience in childhood has been found to be associated with higher visitation frequency of forests in adulthood and in fact those who had already been frequent visitors in their childhood, are more frequent visitors of forests in their adulthood. This study is contributing in several aspects to the existing literature. It has examined the childhood-adulthood forest visit frequency in a multi-country setting. Interviewing more than 8000 people in representative samples from nine European countries with nearly 300 million inhabitants including the most populous EU-countries (except for Italy) we found a major part (62%) of more frequent forest visitors in adulthood were indeed also more frequent forest visitors in their childhood. The effect of being a more frequent forest visitor in childhood on visitation frequency in adulthood is much stronger than the effect of other factors (such as living in urban areas, education attainment, or income level). Our results also show a potential lifecycle effect that is unfortunately negative; while being older increases the frequency of forest visits, having children younger than 18 decreases rather than increases this frequency. Motivating parents of younger children to visit forests more frequently may result in a long-lasting effect, affecting forest recreation behaviour across generations.

In this way, the study has wider implications for decision makers in forest management and land use planning in general. The findings highlight the importance of forests for recreational services especially in urban areas, and hence contribute to urban land use planning and

management decisions. The latter should consider the importance of forest accessibility as type of residential settlement and distance to the nearest forest play a crucial role in determining visitation frequency. "A tree must be bent while it is young" implies a popular saying. This holds true for people's connection with nature and especially forests which needs to be established already during childhood. These insights seem especially relevant today considering children who are lacking access and unsupervised play in nature areas such as forests for reasons mentioned in the introduction. Stakeholders at various levels, i.e. government institutions, teachers at day-care, kindergartens and schools, and of course parents can play a crucial role in increasing children's opportunity to play outdoors. Therefore, in addition to the contribution to the existing literature gap in outdoor recreation research, the findings can inform a wide range of actors in managing and designing strategies for children's recreational access to forests.

Thus, investments in children's forest recreation/edutainment programs may pay off years or even decades later through more healthy lifestyles of adults, more inclination towards more sustainable consumption patterns which in turn benefit public health costs and improve society's environmental footprint. In practice, protected areas with significant forest cover, especially those located in the surroundings of urban areas (like many German nature parks for instance), could ideally deal with this task of establishing children's contact with forests in early years, for example during school fieldtrips, weekend or holiday camps. Peri-urban wildlife parks providing possibilities to watch and even get in physical contact with animals or forest-based playgrounds with picnic facilities for families could also serve as means of motivating families in urban areas to visit forests which otherwise might be perceived as rather boring and not very entertaining by children used to the entertainment and distractions of today's electronic leisure devices.

Furthermore, this contribution also paves the way for future research. Due to an already lengthy and quite complex questionnaire, the differing forest cultures in the nine survey countries were not taken into account. In this way, for instance, it remains an open question as to how forest definitions vary in the perceptions of the respondents from these nine countries, which collective importance for the societies forests and forest recreation have and in how far this influences the forest visitation frequencies which vary considerably between the nine countries. Also, the rural-urban dichotomy requires in-depth research as the definition and demarcation of rural areas is much more complex than our rough distinction between settlements with less and more than 3000 inhabitants. In addition, the European centred perspective of this study could be complemented by comparisons on the global scale with, for example, the North, Central and South American, Southeast Asian and African contexts where the availability, accessibility and structure of forests for recreation vary considerably, but also the outdoor recreation habits, the role of forests in it as well as the educational approaches, i.e. whether children are allowed to play on their own in forests.

While the researchers have not explicitly assessed the link between access to forests and pro-environmental attitudes and behaviour, they know from other studies that the experiences with nature in childhood can be important for forming attitudes and behaviour in adulthood. Therefore, in future research, it is important to disentangle the effect of childhood access to nature, social factors (e.g. parents' use of and attitude towards outdoor recreation) and adulthood recreational use of nature. This could involve qualitative and more extensive in-depth interviews about the recreational socialization of respondents, their actual recreational practices and its development over the respondents' lifecycle. Future research should also investigate to which degree childhood experiences influence not only preferences for outdoor

recreation in adulthood but also the choices of residence. If individuals with strong preferences for outdoor recreation are more likely to choose a residence close to nature the impact of childhood experiences will also have an indirect effect on nature use through the choice of residence. All these insights are important for evaluating the long-term impact of policies increasing access to outdoor recreation in nature areas.

Declaration of Competing Interest

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Appendix A. Relabelling the categories of frequency of forest visitation in childhood and adulthood

Categories of visit frequency used in the questionnaire		Categories or ‘Levels’ of frequency for analysis
Childhood forest visits	Adulthood forest visits	
1. More than 2 times per week	1. Almost every day	More frequent (1 – 7 times a week)
2. Two times per week	2. 3–4 times a week	
3. Once a week	3. 1–2 times a week	Frequent (1 – 3 times a month)
4. 2–3 times a month	4. 2–3 times a month	
5. Once a month	5. Once a month	Less frequent (1 – 10 times a year)
6. 2-4 times a year	6. 5–10 times a year	
7. Never visited	7. 2–4 times a year	
	8. Once a year	

Appendix B. Responses per category of the variables across countries (in percent)

Variables	AT	CH	CZ	DE	DK	FR	PL	SK	UK	All
<i>Frequency in adulthood</i>										
Less frequent	34	26	38	36	39	50	41	42	58	41
Frequent	44	45	40	44	39	35	42	41	32	40
More frequent	22	29	22	20	22	15	17	17	10	19
<i>Frequency in childhood</i>										
Less frequent	15	11	16	20	35	37	37	17	42	26
Frequent	31	32	33	32	34	35	30	32	29	32
More frequent	54	57	51	49	32	27	34	52	29	42
<i>Residential area</i>										
Rural area in childhood	62	76	63	55	62	63	53	70	48	61
Rural area in adulthood	52	71	57	45	55	57	41	61	43	54
Distance to nearest forest > 5 km	43	30	42	52	34	62	54	45	68	48
Female	50	50	51	49	50	50	51	51	49	50
<i>Level of education</i>										
Primary school	5	5	6	4	28	1	6	4	3	7
Secondary school	36	12	27	19	11	17	10	33	24	20
Vocational	30	53	42	48	27	28	65	43	17	39
Undergraduate	12	17	7	10	23	40	19	5	13	18
Postgraduate	17	13	18	19	10	14	0	15	43	17
<i>Net monthly income</i>										
Low income	71	37	25	22	35	33	17	21	22	32
Middle income	4	26	22	27	21	37	38	21	30	25
High income	1	12	38	35	25	26	29	43	33	26
Income refused	25	25	15	16	19	4	16	14	15	17
Has children under 18	28	26	35	27	23	38	36	41	27	31

Appendix C. Estimation results from the generalized ordered logit model with country fixed effects

Variables	Visits in adulthood: Once a month or more often (more frequent or frequent) compared to once a year (less frequent)			Visits in adulthood: Once a week (more frequent) compared to once a month or less often (frequent or less frequent)		
	Coefficient	SE	P-value	Coefficient	SE	P-value
<i>Visit frequency in childhood</i>						
Frequent	0.733***	0.060	0.000	0.335***	0.089	0.000
More frequent	1.413***	0.062	0.000	1.201***	0.082	0.000
<i>Residential area</i>						
Rural area in childhood	-0.061	0.052	0.240	-0.266***	0.064	0.000
Rural area in adulthood	0.328***	0.051	0.000	0.531***	0.063	0.000
Distance to the nearest forest	-0.512***	0.047	0.000	-0.637***	0.059	0.000
Male	0.085*	0.047	0.069	-0.038	0.057	0.502
Age	-5.16E ⁻⁰⁵	0.002	0.975	0.008***	0.002	0.000
<i>Level of education</i>						
Vocational training	0.069	0.059	0.241	-0.097	0.069	0.161
Undergraduate or postgraduate	0.148**	0.061	0.016	-0.088	0.075	0.239
<i>Net monthly income</i>						
Middle income	0.229***	0.065	0.000	0.021	0.079	0.793
High income	0.273***	0.066	0.000	0.061	0.080	0.444
Income refused	0.180**	0.071	0.011	-0.095	0.086	0.266
Having children under 18	-0.073	0.047	0.117	-0.073	0.047	0.117
<i>Country fixed effects (reference = UK)</i>						
Austria	0.708***	0.101	0.000	0.513***	0.112	0.000
Switzerland	0.788***	0.094	0.000	0.788***	0.094	0.000
Czech Republic	0.401***	0.094	0.000	0.401***	0.094	0.000
Germany	0.549***	0.091	0.000	0.549***	0.091	0.000
Denmark	0.601***	0.090	0.000	0.601***	0.090	0.000
France	0.294***	0.091	0.001	0.294***	0.091	0.001
Poland	0.619***	0.093	0.000	0.619***	0.093	0.000
Slovakia	0.173*	0.095	0.069	0.173*	0.095	0.069
Constant	-1.014***	0.129	0.000	-2.711***	0.156	0.000
Final log likelihood	-8549.945					
Pseudo R ²	0.075					
Number of observations	8793					

***, ** and * show the 1%, 5% and 10% significance levels respectively.

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