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Oppliger, J., Lieberherr, E., Hegetschweiler, K.T. (2019)

**Factors influencing teenagers' recreational forest use in a densely-populated region in
Switzerland**

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Abstract

It is undisputed that frequent forest visits have health benefits and positive developmental influences on adolescents. However, little research has been conducted on teenagers' recreational forest use behavior. This paper examines various factors influencing adolescents' forest visit frequency, including motives and constraints, the forest use during childhood, as well as preferences concerning leisure activities. We conducted a survey in eight different schools in a densely-populated region in Switzerland, with a total of 643 respondents between 13 and 22 years of age. The statistical analysis shows that Swiss teenagers visit forests on average once a month and that for most teenagers, forest only plays a marginal role in their lives. Frequent forest visits during childhood, with parents or unsupervised, are positively associated with more frequent visits as teenagers, as are certain leisure preferences. The frequent use of electronic media was strongly linked to a low forest visitation. The highest proportion of the visit frequency's variance could be explained by the friends' visit frequencies and the perceived boredom during a forest visit. We draw the conclusion that forest visits do not offer enough entertainment for most adolescents, alternative leisure activities are therefore preferred.

Management implications:

This study provides a quantitative analysis of teenagers' recreational forest use, and we highlight factors associated with forest visit frequency. Our results show the importance of childhood visits, differing leisure preferences and the role of perceived boredom, fear and disgust during forest visits. Future management strategies should acknowledge these factors

and attempt to get children to visit woodlands from an early age on, accompanied by their parents, as members of youth groups or unsupervised. Further, managers should strive to make forest visits engaging and entertaining for youth, for example by providing open spaces and possibilities for playing.

Keywords:

Forest visit frequency; adolescents; leisure preferences; outdoor recreation; questionnaire survey at schools

1. Introduction

In today's widely urbanized society, forest visitors benefit from the forest as a place of peace and welcome distraction, its preventive and therapeutic health aspects, and for stress reduction (Bratman, Hamilton, & Daily, 2012; Kaplan, 1995; Shin, Yeoun, Yoo, & Shin, 2010; Sonntag-Öström et al., 2011). Frequent forest visits are, especially with regard to adolescents, proven to contribute to a healthy body development, emotional and mental health as well as general well-being (Mäkinen & Tyrväinen, 2008; Ward-Thompson, Roe, & Travlou, 2007). The wood's natural elements offer teenagers a calming influence and a place for self-reflection (Milligan & Bingley, 2007) and were shown to have a positive sustained effect on well-being and cognitive performance on adolescent pupils (Wallner et al., 2018). However, despite all the positive effects, today's youth spends little time visiting forests and other green spaces (Curry & Brown, 2010; Schwery, 2013; Soga & Gaston, 2016). During childhood, this may be due to parents' attitudes, but as the children get older, this may well be due to shifting leisure preferences. The question arises, how does today's youth actually use forests recreationally, which motives lead to a visit and which constraints prevent it?

Diverse research has been conducted on adults' and children's forest usage (Bell, Simpson, Tyrväinen, Sievänen, & Pröbstl, 2009; Hunziker, von Lindern, Bauer, & Frick, 2012; Ward-Thompson, Aspinall, Bell, & Findlay, 2005). However, the research rarely focuses on teenagers. Especially concerning the motives for visiting the forest and the factors preventing it (constraints), research on adolescents is scarce. Existing research is mostly related to the forest's benefits and the motives leading to a visit, and not to the reasons against a visit (i.e. constraints), whether they are fears, insecurities or perceived boredom (Lovelock, Walters, Jellum, & Thompson-Carr, 2016; Mäkinen & Tyrväinen, 2008). Furthermore, the studies that do exist on teenagers generally focus on the use of urban green spaces like parks or outdoor recreation in general, not specifically on forests (Lekies, Yost, & Rode, 2015; Mäkinen & Tyrväinen, 2008; Ward-Thompson et al., 2007). In this paper, we fill this gap with a quantitative survey on teenagers' recreational forest usage and its influences, motives and constraints.

Accordingly, the aim this paper is to gain insights on teenagers' frequency of forest visits, the childhood's and leisure preferences' influence on it, as well as the motives facilitating and the constraints preventing forest visits. Our research questions were:

- Do teenagers visit the forest and if yes, with which frequency and which are the prevailing activities?

- Which motives encourage and which constraints hinder teenagers to visit forests?
- Which further factors (leisure preferences, forest visit pattern during childhood, socio-demographic factors) influence teenagers' forest visit frequency?

We addressed these questions by conducting a survey with 643 teenagers, aged 13 to 22 years, in eight schools in Zurich and neighboring regions in Switzerland and subsequently performing a quantitative, statistical analysis.

2. Factors influencing teenagers' recreational forest use

2.1 Motives and constraints

Identifying the motives and constraints most prevalent in recent literature served the purpose of better understanding the reasons behind people's decision to visit the forest. Hunziker et al. (2012) found that the general Swiss adult population mainly visits the forest to go for a walk, get exercise, enjoy the forest's tranquility, and to experience nature. Studies focusing on adolescents' recreational forest use, mostly performed in Western Europe, primarily addressed the perceived freedom during a forest visit as a key motive: Teenagers are accordingly intrigued by the woodlands as a place to retreat from adult supervision and where they feel unobserved (Bell, Thompson, & Travlou, 2003; Mäkinen & Tyrväinen, 2008; Ward-Thompson et al., 2005; Ward-Thompson et al., 2007).

Research on constraints of a forest visit is limited, especially concerning adolescents and children (Lovelock et al., 2016). The most widely-studied constraint regarding teenagers is the perceived fear experienced in the forest, i.e. the fear of getting attacked, robbed, kidnapped or raped (Lekies et al., 2015; Milligan & Bingley, 2007; Ward-Thompson et al., 2004; Ward-Thompson et al., 2007). Bixler and Floyd (1997) also showed that disgust experienced during outdoor activities, defined as the emotional discomfort resulting from unpleasant stimuli, as well as the desire for modern comforts can be major constraints for teenagers in the U.S. Both the perceived fear and disgust of outdoor settings tend, however, to decrease through continuous exposure (Emmons, 1997; see section 2.3).

2.2 Leisure preferences

A further constraint, which could influence teenagers' recreational forest usage, is perceived boredom (Ward-Thompson et al., 2007). There is a lack of literature concerning the relation

between adolescents' experienced boredom during forest visits and their visit patterns. Regarding the possible reasons teenagers get bored in woodlands, Pickhardt (2012) states that the ability to self-entertain has been lost in adolescents, thanks to the constant availability of passive, electronic entertainment. Different studies showed how boredom proneness is linked to high internet use (Chou, Chang, & Yen, 2018; Skues, Williams, Oldmeadow, & Wise, 2016; Wegmann, Ostendorf, & Brand, 2018). This can prove problematic, especially because today's youth spends progressively more time using electronic media (Haug et al., 2015; Mainella, Agate, & Clark, 2011; Rideout, Foehr, & Roberts, 2010; Willemse & Waller, 2016).

The teenagers' preferred leisure activities, as well as their peers' recreational preferences, probably have a significant influence on their forest usage patterns, as they influence where an activity is likely to be performed. It was shown that friends have an important influence on adolescents' leisure preferences and that the friends' activities are strongly linked with their own (Garcia et al., 2017; Torkildsen, 2005). Overall, there's a lack of research on the link between teenagers' leisure preferences and their recreational forest usage.

2.3 Childhood's influence

Another aspect worth examining is the influence of past forest experience during childhood on teenagers' recreational forest use today. Multiple studies have shown that a person's lack of experience with outdoor green space as a child can limit the desire to visit it as a teenager or adult and can therefore lead to a reduced participation in outdoor activities (Asah, Bengston, & Westphal, 2011; Asah, Bengston, Westphal, & Gowan, 2017; Lovelock et al., 2016; O'Brien, 2005; Ward-Thompson et al., 2007). However, most studies do not focus on forests, but on urban green space or nature in general. Further research concerning childhoods' influence would be interesting, especially considering the fact that children today generally spend little time in forests or outdoors generally (Curry & Brown, 2010; Karsten, 2005; Moss, 2012; Schwery, 2013).

Parents strongly influence the time young children spend outdoors. The media's increased coverage of kidnappings, child molestation, rapes, etc. has led to an inflation of the parents' perceived dangers associated with outdoor play (Gill, 2007; Louv, 2008; Mainella et al., 2011). Amongst other factors, the danger of strangers is one of the parents' biggest fears. Together with the other constraints to outdoor activities during childhood, this can lead to what Louv (2008) describes as a "nature deficit". These early experiences in nature are formative and

important for a development of an affinity to nature, as well as for the later well-being, as they help to overcome constraining factors, i.e. fear, disgust or boredom (Chawla, 2006; Cobb, 1959; Humberstone & Stan, 2009; Kellert, 2009; Louv, 2008; Mainella et al., 2011; Moore, 1990).

3. Materials and Methods

3.1 Sample

Data were collected using a questionnaire in German, on paper as well as electronically using Sawtooth Software Lighthouse Studio, Version 9.3.1. We distributed this questionnaire to 18 classes in eight different schools, in the cantons (constituent-states) of Zurich, Aargau and St. Gallen in Switzerland in May 2017. To include different educational levels, we targeted four grammar schools, three secondary schools and one vocational school. The questionnaire was completed by 656 students aged 13-22. With the exclusion of 13 improperly completed questionnaires, this led to the final participant number of 643. All questionnaires were anonymous.

3.2 Dependent variables

We used the teenagers' forest visit frequency (FVF) as the main dependent variable. We measured this using six different questions, which served the purpose of gaining a more detailed insight on teenagers' FVF by using different question types (closed-ended as well as open-ended). Two of those questions inquired how often the participants visited the forest during the summer season (spring, summer and autumn) and during winter, respectively. We based the questions on a 5-point scale, ranging from never to 3-7 times weekly, following Hunziker et al. (2012). The remaining four questions were open-ended and asked how many times participants visited the forest in total during one year, as well as how many times they visited it per month alone, with family or with friends.

In order to gain a single, conclusive and normally distributed dependent variable, an index was created, using the six above-named variables. We transformed variables resulting from the four open-ended questions ($\ln(X+1)$) to reduce positive skew (Field, 2009). We then weighted all variables appropriately (the variable on FVF during spring-autumn was weighted three times more than the variable on FVF during winter, as it covers a time period three times longer). From these transformed variables the arithmetic mean was calculated. This resulted in the dependent variable *FVFindex*.

3.3 Independent variables

We examined four sociodemographic factors as our independent variables: age (determined by participants' year of birth), gender (male/female), area of residence (later grouped into rural/urban according to the Swiss Federal Statistical Office's categorization (BFS, 2017)), as well as the school which they attended.

We assessed participants' forest usage during childhood by asking 18 questions, most of which used statements and a 5-point scale ranging from "Does not apply at all" to "Fully applies". We asked participants about the forest's importance during their childhood, past visit frequency, how freely they explored the forest, if they remember it in a positive or negative way, their parents' attitude towards it and if the parents banned forest visits, as well as if respondents participated in organized activities (e.g. scouts and other youth groups, forest play groups, forest kindergarten) as children.

We asked 31 questions about the adolescents' leisure preferences. These focused on the specific leisure activities and their frequencies. Questions included: "How often do you... meet friends / ... do sports / ... watch series, movies or videos online (Netflix, YouTube, or similar)?" Answers were given on a 5-point scale ("never", "seldom", "from time to time", "often", "very often"). In addition, the survey asked where the teenagers mostly perform these activities (at home, in parks, in the forest, ...). Finally, one question asked about the participants' friends' FVF.

We incorporated recurring topics from the literature review concerning motives and constraints (i.e. freedom, social aspects, enjoyment of nature, fear, disgust, boredom; see section 2) into 27 statements. 12 statements described why the participants choose to visit the forest, and 15 why they may be averse to visiting. For all these statements we used the 5-point answer scale ("Does not apply at all" to "Fully applies").

3.4 Data analysis

We conducted the statistical analysis using IBM SPSS version 24. We carried out factor analyses on each independent variable group; leisure preferences, childhood, motives and constraints. Principal axis factoring was used as extraction method, Varimax / Quartimax as

rotation method. Leisure preferences were thus reduced to the six underlying factors *Electronic / Relax* (watching series / movies / videos online, spending time on the internet, gaming, relaxing), *Sport* (playing sports, going to sport events), *Social* (meeting friends, going to clubs / bars), *Creative / Intellectual* (playing music, reading, studying / doing homework), *Family* (spending time with family, shopping, watching TV), and *Pets / Walking* (spending time with pets, going for a walk) (Appendix A).

The variables concerning childhood influence were reduced to the five factors: *Visit with Parents* (frequent visits with parents, parents like forest visits, positive memories, unorganized visits, visits with supervision), *Ban / Fear Parents* (parents' fear in the past & today, forest ban in the past & today), *Unsupervised Exploration* (visits without supervision, off the path exploration), *Youth Group* (member of youth group in the past & today) and *Visit School* (visits with school) (Appendix B). The different motives were reduced to the three factors *Freedom* (smoking / drinking / marijuana, being unobserved, being able to make noise, do drugs, no rules), *Contemplative* (enjoy nature, tranquility, health benefits, spend time with family) and *Social* (spending time with friends, girlfriend / boyfriend, having fun) (Appendix C), while the constraints were reduced to the three factors *Fear* (fear of getting lost, being attacked, dogs, weird people and accidents), *Disgust* (ticks, mosquitos / insects) and *Boredom* (friends don't visit, boredom, full leisure time) (Appendix D). The constraining variables fear of poisonous plants and of diseases scored high factor loadings with both factors *Fear* and *Disgust*.

We used independent-samples t-tests to test for differences of FVF between socio-demographic groups (e.g. genders). We assessed the correlation between different variables and factors using Pearson's correlation coefficient. In total, 40 Pearson correlation and 9 t-tests were conducted. Considering the high number of tests, the Bonferroni correction (Dunn, 1961) was applied to adapt the significance level to $p = 0.05/49 = 0.001$.

To examine associations between the independent variables and teenagers' forest visit frequency (*FVFindex*), we used a stepwise multiple linear regression. Variables with p -values < 0.05 were considered statistically significant and were therefore included into the regression (removal with p -value > 0.10). The following independent variables were examined: age, all factors resulting from the factor analyses (leisure preferences, childhood's influence, motives and constraints), friends' FVF, and school type.

4. Results

4.1 Demographics

Out of the surveyed 643 adolescents, 280 (44%) were male, 363 (56%) were female. The participants' mean age was 16.6 years. Seventy-two percent of respondents were between the ages of 15 and 18, the youngest participant was 13, the oldest 22. Most pupils lived in urban areas (73%), the smaller part lived in rural or suburban areas (26%).

4.2 Visit frequency

In response to our first research question concerning the forest visit frequency of teenagers, we saw that almost half (45%) of the participants visit the forest less than once a month or never during spring to autumn (Table 1). Concerning winter, those two answers cumulate to 68%. Only a minority visit the forest more than once a week (22% during spring-autumn, 11% during winter).

Table 1 Adolescents' forest visit frequency, n=643

How often do you visit the forest during...?	Forest visit frequency, %				
	Never	Less than once a month	1-3 times a month	1-2 times a week	3-7 times a week
spring-autumn	10.4	34.5	32.5	17.0	5.6
winter	31.6	36.5	20.5	8.6	2.8

In response to an open-ended question asking how often they visited the forest per year, 50% answered they visit less than 13 times a year (median). Most frequently forest visits occurred with friends (mean = 1.92 times per month), second frequently alone (mean = 1.77 times per month) and the least with family (mean = 1.72 times per month). Fifty-one percent never visit the forest alone and 12% never visit the forest at all.

4.3 Motives and constraints

The results concerning our second research question on motives encouraging and constraints hindering teenagers to visit forests, show that participants mainly go to the forest for contemplative or related reasons, like experiencing nature, enjoying the tranquility or doing something for their health (Fig. 1). Having fun and spending time with family and friends

(social reasons), are important as well. Conversely, the least mentioned reasons for forest visits are consuming drugs and smoking / drinking / marijuana. Perceived freedom (being unobserved, no rules) was also ranked rather unimportant.

Fig. 1 Adolescent's motives for visiting the forest. Participants rated the importance of each item on a scale from 1-5 (1=does not apply at all, 5=fully applies), $n = 643$. Mean values are shown.

As for constraints, i.e. reasons not to visit the forest, the respondents mentioned their already fully-booked leisure time, followed by the arguments that their friends do not visit forests and the perceived boredom when visiting forests (Fig. 2). The former two constraints are the only ones with a mean agreement score above neutral (3). Teenagers also frequently indicated ticks, mosquitos, other insects, i.e. disgust related reasons, for not visiting the forest. Finally, the respondents mentioned fear of accidents, of getting attacked, of getting lost and of poisonous plants the least. Even though the scores of fear- and disgust-related constraints average low, 42% of participants said at least one applies or fully applies.

Fig. 2 Factors preventing adolescents from visiting the forest (constraints). Participants rated the importance of each item on a scale from 1-5 (1=does not apply at all, 5= fully applies), $n = 643$. Mean values are shown.

4.4 Leisure activities in general

In terms of the activities filling the teenagers' leisure time and preventing forest visits (our third research question) we found the following: Participants' most frequent leisure activities are watching series / movies / videos online, followed by meeting friends, relaxing, doing sports, browsing the internet, studying / doing homework, and spending time with their family (Fig. 3). Least named is visiting a youth center. These activities are mostly carried out at home or at a friend's home. Respondents mentioned the forest least as a place for leisure activities. They also said that their friends do not visit the forest frequently, only 10% said their friends visit the forest often or very often.

The analysis indicates a strong correlation between participants FVF (*FVFindex*) and their friends' FVF (Pearson correlation: $r = 0.497$, $n = 642$, $p < 0.001$). A positive correlation could also be found between the constraint factor *Boredom* and the leisure activity *watching series / movies / videos online* ($r = 0.211$, $n = 643$, $p < 0.001$).

Fig. 3 Frequency with which adolescents perform various leisure activities. Each participant rated the frequency of each activity on a scale from 1-5. Results are sorted by mean ratings, $n = 643$.

4.5 Childhood

When we asked participants whether the forest played an important role during their childhood, 80% said it had played an important or rather important role. A majority (73%) stated they visited the forest more frequently or far more frequently during their childhood than today. A large part (59%) mentioned that they never or seldom were in forests unsupervised as children, though most participants said they visited forests from time to time, often or even very often in company (91%). Sixty percent of participants stated that their parents were either not or just slightly afraid if their children played in the forest in the past. However, 42% were forbidden to visit forests at one point in the past and 8% are still forbidden to go to the forest even as teenagers. Both these last two variables are negatively correlated with age (ban today: $r = -0.158$, $n = 643$, $p < 0.001$, ban past $r = -0.145$, $n = 642$, $p < 0.001$). An examination of the influence of organized forest activities on the future forest use revealed a correlation between *FVFindex* and the participation in youth groups (e.g. scouts) today ($r = 0.266$, $n = 643$, $p < 0.001$) or in the past ($r = 0.165$, $n = 643$, $p < 0.001$). However, no significant correlation was found between the current FVF and the past participation in a forest kindergarten / playgroup ($r = 0.065$, $n = 643$, $p = 0.102$) or visits with the school ($r = -0.001$, $n = 643$, $p = 0.983$).

Significant correlations were, additionally, found between different childhood factors and the motive, constraint and leisure factors. The factor *Fear*, for example, is negatively correlated

with the factor *Visit with Parents* ($r = -0.137$, $n = 640$, $p < 0.001$) as well as *Unsupervised Exploration* ($r = -0.193$, $n = 640$, $p < 0.001$) and strongly positively with *Ban / Fear Parents* ($r = 0.411$, $n = 640$, $p < 0.001$). This means, teenagers who spent a lot of time in the forest with their parents or unsupervised experience less fear now, those whose parents fear the forest themselves and banned them from visiting it experience far more fear. The same is true for the factor *Disgust*, which is negatively correlated with *Visit with Parents* ($r = -0.325$, $n = 640$, $p < 0.001$), *Unsupervised Exploration* ($r = -0.080$, $n = 640$, $p < 0.001$) and positively with *Ban / Fear Parents* ($r = 0.155$, $n = 640$, $p < 0.001$) too. The factor *Boredom* was negatively associated with the factors *Visit with Parents* ($r = -0.328$, $n = 640$, $p < 0.001$), *Unsupervised Exploration* ($r = -0.154$, $n = 640$, $p < 0.001$) and *Youth Group* ($r = -0.174$, $n = 640$, $p < 0.001$). Finally, teenagers who visited the forest frequently with their parents in the past (factor *Visit with Parents*) are now less prone to use electronic media during their leisure time (factor *Electronic / Relax*, $r = -0.216$, $n = 640$, $p < 0.001$). No relevant correlations were found between the factor *Visit School* and the constraint or motive factors.

4.6 Different socio-demographic groups

Comparing different sociodemographic groups regarding their FVF revealed several differences. Female participants ($n=363$) visited the forest more frequently compared to male participants ($n = 280$) (*FVFindex* mean = 2.1 vs 1.8, $t = 3.805$, $df = 641$, $p < 0.001$). The median for answers to the open-ended question, how many times they visit the forest during a year, was double for females (20 times a year) than for males (10 times a year). Significant gender-specific differences could also be found concerning the constraint factors *Fear* ($t = -3.869$, $n = 630$, $p < 0.001$), *Boredom* ($t = 3.649$, $n = 640$, $p < 0.001$) and the motive factor *Contemplative* ($t = -3.982$, $n = 641$, $p < 0.001$). Thus, female participants stated that they experience more fear and less boredom when visiting forests, and that they rather visit it for contemplative reasons. During childhood, girls more often visited forests with their parents ($t = -3.426$, $n = 639$, $p < 0.001$), however, they were also more frequently forbidden to visit the forest alone ($t = -4.711$, $n = 639$, $p < 0.001$) and explored them less often on their own than boys ($t = 2.149$, $n = 639$, $p < 0.001$). Older participants also visited the forest more frequently (Pearson correlation: $r = 0.136$, $n = 643$, $p = 0.002$). Teenagers living in rural / suburban areas visited forests more often than those living in larger cities ($t = 4.472$, $n = 635$, $p < 0.001$). They further mentioned the constraint variable *forest too far away* less often ($t = -2.523$, $n = 635$, $p = 0.012$), although this result is not within the corrected significance level.

4.7 Predictors of forest visit frequency

In order to identify the factors that predict the dependent variable *FVFindex* best, a multiple linear regression was performed (Table 2). Tests to display issues with multicollinearity showed variance inflation factors (VIF) between 1.054 and 1.424 with the independent factors, which are well in range to proceed the analysis (Field, 2009). We found the variable *FVF friends*, explaining 24.7% of the variance in forest visit frequency, to be the most important factor, followed by the constraint factor *Boredom*, explaining an additional 8.1% of variance. The childhood factor *Visit with Parents* and the leisure factor *Pets / Walking* explained another 4.4% and 3.2% of variance respectively. These four factors were the strongest predictors for participants' forest visit frequency. Teenagers were thus more likely to visit the forest frequently, if their friends visited it often, if they frequently had been to the forest with their parents during their childhood, if they spent their leisure time with pets and went for walks. However, perceived boredom in the forest prevented teenagers from regular visits. To a lesser extent, five more factors explained variance in FVF. The feeling of disgust might prevent teenagers from visiting the forest (explaining additional 1.5% of variance). Frequent visits were also less likely if the adolescents' parents were afraid of the forest or even forbade them from visiting it (additional 1% of variance), if participants spent their leisure time using electronic media, relaxing, watching TV (another 1% of variance) or spent time with their family (additional 0.3% of variance). Unsupervised exploration of the forest in the participants' childhood on the contrary, increased FVF (explaining an additional 0.5% of variance).

Table 2 Multiple linear regression showing the association between predictors (leisure preferences, childhood, motives, constraints, friends' FVF) and the dependent variable *FVFindex*, n = 643

	β	t	p	cum. R ²
Constant		17.242	0.000	0.000
FVF friends	0.226	6.444	0.000	0.247
Constraint Factor Boredom	-0.208	-5.954	0.000	0.328
Childhood Factor Visit with Parents	0.177	5.233	0.000	0.372
Leisure Factor Pets / Walking	0.226	7.195	0.000	0.404
Constraint Factor Disgust	-0.089	-2.730	0.007	0.419
Childhood Factor Ban / Fear Parents	-0.097	-3.204	0.001	0.429
Leisure Factor Electronic / Relax	-0.110	-3.563	0.000	0.439
Childhood Factor Unsupervised Exploration	0.072	2.379	0.018	0.444
Leisure Factor Family	-0.071	-2.208	0.028	0.448

β = standardized regression coefficient, t = obtained *t*-value, p = p-value, cum. R² = cumulative adjusted R Square, F(9,628) = 58.401, p < 0.001, R² = 0.448

4.8 Activities in the forest

Figure 4 shows the different activities teenagers do in the forest. The activity performed by most participants was *having a picnic / BBQ* (59%), followed by *going for a walk* (51%), *jogging* (48%), and *making a fire* (48%). Less than 40% of respondents visited the forest to *go for a hike* (39%), *meet friends* (38%), or *go cycling* (35%). Least mentioned activities were *Nordic walking* (0.6%), *geocaching* (4%), and *picking berries / mushrooms* (5%).

Fig. 4 Activities adolescents carry out in the forest, responses of $n = 643$ pupils are shown. Numbers next to bars indicate the number of responses, multiple answers were possible.

5. Discussion

5.1 Visit frequency and activities in the forest

Regarding the frequency with which Swiss teenagers visit the forest (our first research question), we found that on average the visit frequency is low (13 = median), while a large proportion of Swiss adults visits the forest 1-2 times a week (Hunziker et al., 2012). Depending on the season, between a tenth to a third answered that they never visit the forest. A French study may help to explain this low visit frequency as being due to the teenagers' position in life – they are too old to join their parents and they have no children of their own yet. Visiting the forest is seen as a family activity that is reinforced by the parents and therefore not attractive to teenagers (Dobré & Granet, 2007). These low numbers are also in line with recent research,

stating that children and adolescents these days tend to visit forest less often than during past decades (Karsten, 2005; Louv, 2008; Moss, 2012; Schwery, 2013). However, some teenagers still visit the forest quite often (around one fifth said that they visit the forest at least once a week during warmer seasons), mainly to have a picnic or go for a walk, go jogging, hiking or cycling, or to meet friends and build a fire.

This controversy is also reflected in results from on-site surveys and visitor counting. While Rusterholz et al (1999) found that the percentage of forest visitors between 15-20 years of age was indeed low compared to other age groups in an urban forest in Northwestern Switzerland, Kleiber (2006) counted the least visitors in the age group of 21-30 years. However, consideration of activities reveals a more differentiated picture. Rusterholz & Baur (2003) showed that the age distribution of visitors varied largely between forest areas. In one area close to the forest edge, 23% of the respondents were younger than 20 years old and prevailing activities consisted of jogging and picnicking, whereas in two other forest areas the percentage of young visitors amounted to only 5% and 11% and activities were dominated by walking.

A comparison with the activities of the general Swiss adult population (Hunziker et al., 2012) shows that ‘going for a walk’ was the most frequent adult activity in the forest, while it was named second by the participants of our study. A rather big discrepancy with the Hunziker et al. (2012) study, in which the average age was 52 years, was found with the activities *jogging* and *having a picnic / BBQ*, which were both named more often by teenagers in our survey (6% vs. 48% for *jogging* and 9% vs. 59% for *having a picnic / BBQ*). Having a picnic or a BBQ in the forest is a long Swiss tradition and Swiss teenagers often use fire places as a meeting point for social activities in the evenings (Hegetschweiler, Rusterholz, & Baur, 2007, Hegetschweiler, personal communication, November 2018).

5.2 Motives and constraints

Using a stepwise multiple linear regression, we were able to show that the most significant predictors for forest visit frequency were the friends’ visit frequency, the childhood’s forest usage, especially visits with parents, the perceived boredom in the forest and leisure preferences (*Pets / Walking*).

Contemplative and health-related reasons for visiting the forest were named most in the survey. The enjoyment of nature, its beauty and tranquility were frequently named as key motives. In a qualitative study, Ensinger et al. (2012) postulated that these motives might not be very relevant for participants during their adolescence, that they, however, were aware that they would be

seeking peace and quiet in the forest during their future adult lives. Participants seek woodlands as a place for fun with friends and family, seldom for the perceived freedom. The latter is not quite in line with recent literature, which presents the forest as an important space that teenagers can make their own and be themselves, unobserved (Bell et al., 2009; Ward-Thompson et al., 2005; Ward-Thompson et al., 2007; Weber, 2010). Children and adolescents could have more freedom to roam in Switzerland compared to other countries, or have different needs for independence. For example, 75% of the children in Switzerland walk to kindergarten and school, often on their own or in groups from the age of 5 or 6 years onwards, compared to 50% in Germany and 30-40% in the U.K. and the U.S (Leybold-Johnson, 2017).

Our findings suggest that one of the major reasons teenagers rarely visit the forest are contrasting leisure preferences. Most notable in this context is the use of electronic media, which is strongly linked with fewer forest visits (cf. Stafford, Welden, & Bruyere, 2018). They are also positively correlated with higher perceived boredom in the forest, which implies that the woodlands are not stimulating enough, possibly through a loss of the ability to actively self-entertain through constant use of electronic media (Pickhardt, 2012). These findings are in line with recent research, stating a higher use of electronic media over time with teenagers (Haug et al., 2015; Mainella et al., 2011; Rideout et al., 2010).

Our findings also cohere with recent research stating that activities like going for a walk, spending time with pets, exercise, as well as intellectual / creative activities like studying, reading, playing music are all associated with a higher forest visit frequency (Stafford, Welden, & Bruyere, 2018). Our highest predictor for FVF is the friends' forest visit frequency, which again links with recent research showing that leisure preferences and the use of public spaces are strongly influenced by friends (Garcia et al., 2017; Höglhammer et al., 2018; Torkildsen, 2005), as peer pressure can be a key driver during adolescence concerning outdoor recreation (Lovelock et al., 2016).

With only a fifth of our respondents fearing getting robbed, kidnapped and/or lost, fear seems to be less problematic to our participants, than literature suggests (cf. Lekies et al., 2015; Milligan & Bingley, 2007; Ward-Thompson et al., 2007; Wild-Eck, 2001). Our findings are in line with research showing that a way to prevent fear and disgust experienced in the forest is visiting it as a child and getting familiarized with the unfamiliar space (Burgess, 1996; Emmons, 1997; Milligan & Bingley, 2007; Ward-Thompson et al., 2004). We found significant

correlations between the two factors *Fear* and *Disgust* and the frequency of forest visits with parents, participation in youth groups and unorganized visits during childhood. However, we found no such correlations with school visits. Female participants stated higher levels of fear and disgust when visiting forests, yet, their visit frequency is higher nonetheless. Hence, it seems that other factors influence the forest visit frequency more strongly. As Bixler and Floyd (1997) state, disgust sensitivity is linked with the desire for modern comforts, which could be of importance here as well, though it was not tested for.

5.3 Childhood

Recent research has shown that recreational forest usage during childhood and the parents' attitude towards forests can influence today's usage and the personal attitude towards the forest (Asah et al., 2011; Asah et al., 2017; Cobb, 1959; Gill, 2007; Lovelock et al., 2016; Moore, 1990; Ward-Thompson, Aspinall, & Montarzino, 2008). Our results allow similar conclusions, by connecting past experiences in the forest with today's forest use. As seen in the stepwise multiple linear regression model, one of the strongest predictors of today's forest visit frequency is the number of past visits with parents. The parents' preferences towards woodlands turned out to be especially important with regard to teenagers' visit frequency. In line with the literature, we assume the parents' attitudes were passed on to their children and their perceived fear and disgust were reduced through frequent visits (cf. Burgess, 1996; Emmons, 1997; Ward-Thompson et al., 2007). The latter can also be achieved by independent forest play (Gill, 2007; Milligan & Bingley, 2007), which is presumably why we saw a strong association between the frequency of past unsupervised forest visits and today's visit frequency. However, different studies revealed increasing parental fears concerning their children's independent outdoor play (Gill, 2007; Louv, 2008; Lovelock et al., 2016; Mainella et al., 2011). This is supported by our results, as we were able to show that parents indeed fear for their children when they visit forests. Those parental fears and forest bans were strong predictors of participants' current forest visit frequency, showing that they have a lasting influence. This is in line with previous research by Aitken (1994) who states that parental fears and insecurities can prevent possibly important experiences concerning independence. Sullivan (2006) noted that a pervasive safety culture is also prevalent in outdoor education, which hinders pupils' pleasure and enjoyment. This could be one of the reasons behind the non-existence of a correlation between past forest visits with schools and our participants' current FVF. As Wang, Ang, Teo-Koh, and Kahlid (2004) highlighted, young adolescents should not be forced into outdoor education programs but rather be given a meaningful rationale for participation. Nonetheless, it has been shown that

visits to forests organized by schools have a positive influence on the children's physical and social skills, self-confidence and concentration (O'Brien & Murray, 2007), even if it does not motivate them to visit the forest voluntarily outside school hours as teenagers.

5.4 Limitations

A methodological challenge we were faced with was the survey's limitation to eight schools from three regions, with the main part of participants attending higher educational levels. A disproportionate share of participants lives in urban regions. In this study, it was not possible to determine the distance of the residential site of each pupil to the nearest accessible forest, which might have an influence on forest visit frequency. However, 69% of the Swiss population can reach the nearest forest on foot within 5-10 minutes (Hunziker et al., 2012) and this should apply to teenagers as well.

A distortion could also have arisen due to the different questionnaire formats, as some pupils filled it out in class, distributed by their teacher, and pupils from two schools voluntarily at home. The study did reveal differences between schools (Oppliger, 2017), but it was not possible for us to determine the exact reasons for these differences, as there might be several more reasons than just the questionnaire format. Furthermore, the questionnaire contained some sensitive questions such as consuming marihuana and other drugs in the forest, which might not have been answered truly, especially in the presence of teachers. Moreover, the number of forest visits named by participants might be questioned, as self-estimation tends to be too high.

6. Conclusion

The objective of this study was to investigate teenagers' recreational forest use in a densely-populated part of Switzerland and to identify influencing factors, including the forest visits during childhood, leisure preferences, motives to visit the forest as well as constraining factors. Based on a survey of adolescents in a densely-populated region of Switzerland, this study demonstrates that a majority of teenagers does not visit the forest frequently compared to adults. These findings are counterintuitive given the positive effects of forest visits on health, physical development or stress reduction noted in the literature (Mäkinen & Tyrväinen, 2008; Milligan & Bingley, 2007; Ward-Thompson et al., 2007). Understanding the underlying motives leading to and constraints preventing forest visits is necessary for the development of methods to get adolescents to engage with nature.

This article contributes to a nascent yet growing body of literature on constraints and motives of a forest visit by adolescents (Lovelock et al., 2016). We make a particular contribution by focusing on forests, which, in comparison to urban green spaces like parks or outdoor recreation, remain understudied (Lekies, Yost, & Rode, 2015; Mäkinen & Tyrväinen, 2008; Ward-Thompson et al., 2007). In the age of digitalization, we add salient knowledge to the growing evidence on the role that electronic media play in constraining teenagers to self-entertain and engage with nature, as we found widespread use of electronic media and perceived boredom to be a key constraint for a forest visit (Pickhardt, 2012; Haug et al., 2015; Mainella et al., 2011; Rideout et al., 2010). Conversely, we contribute to studies showing the motives and other positive influencing factors for a forest visit. In line with the existing literature, we show the importance of childhood on fostering motives and overcoming constraints of a forest visit (Asah et al., 2017; Emmons, 1997; Lovelock et al., 2016; Ward-Thompson et al., 2007). Furthermore, we find that friends have an important influence on visit patterns and on adolescents' leisure preferences, which in turn affect forest visits. Hereby, we contribute to the evidence showing the important influence of friends, regardless of the actual activity (Garcia et al., 2017; Torkildsen, 2005).

Future management strategies to enhance adolescents' forest use should focus on encouraging children to visit forests from an early age on, without making it mandatory. Our results demonstrate how strongly past woodland visits with parents, unsupervised forest exploration and participation in youth groups are associated with the future visit frequency. Free play seems to be one of the key factors to reduce perceived fear, disgust and boredom and should therefore be encouraged. However, further research could be conducted on the reasons behind the fears and how they could be prevented, as there currently is not much research available (Milligan & Bingley, 2007). Furthermore, to truly capture the influence of past forest visit patterns on later recreational forest usage, a long-term study would be appropriate in order to investigate if people who did not visit forests as teenagers do so later on, as adults.

One way to promote play in woodlands is, how Pröbstl, Wirth, Elands, and Bell (2010) suggest, to set up formal and informal recreational facilities, which enhance youth's physical and mental development more strongly, compared to urban playgrounds. Boredom experienced in forests appears to be of particular significance, which forest managers should take into account. To get more teenagers to engage in forest recreation, leisure programs offering engaging forest activities such as youth groups should be sustained and promoted.

Such measures might enable combatting the current “nature deficit” (Louv, 2008) and promote a healthier and environmentally friendlier society.

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Vitae

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Appendix

Appendix A Factor analysis with rotated (Quartimax) factor loadings of leisure preferences

Variables in questionnaire	Resulting factors with factor loadings					
	Electronic	Sport	Social	Creative /	Family	Pets /
	/ Relax			Intellectual		Walking
Series / movies / videos online	.649	-.099	.073	-.034	.047	.029
Relaxing	.575	-.278	.081	.031	.060	-.106
Internet	.559	.005	.098	-.174	.144	.059
Gaming	.471	.184	-.343	-.324	-.037	.022
Sport event	-.046	.699	.114	-.049	.143	-.022
Sport	-.127	.687	.108	.039	.065	-.015
Bars / clubs	.129	.162	.701	-.171	-.128	-.023
Meeting friends	.077	.150	.522	-.054	.144	.108
Reading	-.039	-.038	-.118	.581	-.032	.190
Learning	-.072	.212	.012	.456	.070	.034
Playing music	-.080	-.093	-.043	.366	.009	.082
Shopping	.145	-.036	.462	-.017	.607	.128
Spending time with family	.010	.169	-.011	.295	.516	.067
Watching TV	.221	.150	-.050	-.089	.460	.077
Going for a walk	-.029	-.022	.065	.252	.219	.588
Spending time with pets	.002	.035	-.011	.052	-.081	.395
Youth center	.023	-.005	.051	.039	.081	.271
Working	-.073	.235	.207	.032	.015	.156
Eigenvalues	1.417	1.295	1.210	1.017	1.004	0.699
% variance explained	7.875	7.193	6.722	5.649	5.577	3.882

Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy: 0.673.

Bartlett's test of sphericity: $\chi^2(153) = 1730.40$, $p < 0.001$.

Appendix B Factor analysis with rotated (Quartimax) factor loadings of childhood's forest experience

Variables in questionnaire	Resulting factors with factor loadings				
	Visit with	Ban / Fear	Unsupervised	Youth	Visit School
	Parents	Parents	Exploration	Group	
Frequent visits with parents	.808	-.087	-.009	.059	.078
Parents like forest visits	.667	-.112	.029	.071	-.079
Positive memories	.629	-.010	.293	.080	.123
Unorganized visit	.560	-.055	.293	.030	.140
With supervision	.480	.048	-.130	-.018	.284
Parents fear in the past	-.145	.612	-.005	-.071	.029
Parents fear today	-.083	.791	-.016	-.045	-.012
Forest ban in the past	-.111	.516	-.454	-.002	.015
Forest ban today	-.084	.475	-.122	-.036	.005
Without supervision	.146	-.145	.722	.091	-.003
Off the path	.326	-.139	.514	.030	.117
Youth group past	.105	-.091	.031	.768	.007
Youth group member	.137	-.078	.075	.566	-.025
School forest visit	.113	-.012	-.011	-.036	.641
Forest kindergarten	.117	.026	.133	.024	.220
Without fear	.383	-.272	.300	-.018	-.007
Negative memories	-.185	.095	.018	-.031	.111
Eigenvalues	2.449	1.656	1.311	0.947	0.615
% variance explained	14.406	9.74	7.713	5.568	3.617

Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy: 0.776.

Bartlett's test of sphericity: $\chi^2(136) = 2465.51$, $p < 0.001$.

Appendix C Factor analysis with rotated (Varimax) factor loadings of motives

Variables in questionnaire	Resulting factors with factor loadings		
	Freedom	Contemplative	Social
Smoking/drinking/marijuana	.724	-.141	.135
Unobserved	.721	.048	.219
Noise	.608	.002	.314
Drugs	.586	-.076	.020
No rules	.550	.169	.205
Nature	-.016	.752	.108
Tranquility	.009	.724	.068
Health	.012	.591	.104
Time with family	-.055	.477	.164
Friends	.276	.139	.796
Fun	.178	.395	.544
Girlfriend / boyfriend	.221	.149	.532
Eigenvalues	2.220	1.920	1.474
% variance explained	18.503	15.999	12.286

Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy: 0.796.

Bartlett's test of sphericity: $\chi^2(66) = 2395.40$, $p < 0.001$.

Appendix D Factor analysis with rotated (Varimax) factor loadings of constraints

Variables in questionnaire	Resulting factors with factor loadings		
	Fear	Disgust	Boredom
Fear of getting lost	.752	.129	.168
Fear of an attack	.671	.164	.051
Fear of accidents	.631	.455	.071
Fear of dogs	.534	.189	.102
Weird people	.518	.314	.152
Poisonous plants	.572	.506	.009
Diseases	.551	.624	.059
Ticks	.310	.704	.182
Mosquitos / insects	.249	.691	.278
Forest too far away	.130	.079	.329
Friends don't visit	.072	.144	.631
Boredom	.088	.363	.592
Full leisure time	.012	-.023	.586
Hay fever	.159	.135	.086
Loneliness	.378	.436	.309
Forest too far away	.130	.079	.329
Eigenvalues	2.953	2.371	1.486
% variance explained	19.687	15.804	9.908

Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy: 0.885.

Bartlett's test of sphericity: $\chi^2(105) = 3805.77$, $p < 0.001$.