

## Article

# Urban Cemeteries as Shared Habitats for People and Nature: Reasons for Visit, Comforting Experiences of Nature, and Preferences for Cultural and Natural Features

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**Abstract:** Cemeteries are globally culturally protected greenspaces in cities that meet different societal needs and often harbor high biodiversity. To harness the potential of cemeteries as urban green infrastructure, stakeholders need to understand why people visit cemeteries and their preferences. We conducted an online survey in Berlin, Germany ( $n = 627$ ) to understand (i) the reasons for cemetery visits; (ii) preferences for cemetery features; (iii) the effect of a dead tree as a wilderness component on preferences for differently managed green areas (wild, meadows, lawns); (iv) preferences of nature elements as comforting experiences; and (v) how reasons for the visit and sociodemographic variables relate to respondents' preferences. The major reasons to visit cemeteries were 'enjoying nature', 'mourning', and 'historical interest' and most preferred cemetery features were 'wildlife', 'solitude', and 'vegetation'. Presenting a dead tree did not modulate preference ratings for green areas that were depicted on photographs. Comforting experiences with nature elements were high overall. The reasons to visit had besides socio-demographic variables predictive potential on pronounced preferences. The results underscore the importance of cemeteries as multidimensional places and indicate tolerance for the inclusion of dead trees as important wildlife habitat. Strategies to develop cemeteries as shared habitats for people and nature should also consider, besides socio-demographic background, the reasons for cemetery visits.

**Keywords:** dead wood; grassland; graveyard; greenspace management; landscape preference; nature experience; sacred sites; spirituality; transcendental experience; urban wilderness; urban forestry



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## 1. Introduction

In many fast-growing cities around the world, pressure on green spaces is increasing [1,2]. At the same time, green areas benefit the health and wellbeing of urban dwellers [3]—services that are increasingly requested to cope with current challenges such as climate change [4–6] or the COVID-19 pandemic [7,8]. Unlike other green spaces in cities, cemeteries are culturally protected "sacred sites" [9,10] that are often located within or close to densely populated areas [11]. As a result, there is growing interest in the potential of cemeteries to complement the urban green infrastructure [11–15]. While the primary purpose of cemeteries is as a burial ground, cemeteries are also public spaces for reflection and recreation, places to enjoy nature and cultural encounters, as well as important historical places for people [9,16–20]. Cemeteries are, therefore, multidimensional places that meet different societal needs [21–23].

To harness the potential of cemeteries for urban green systems, stakeholders need to understand why people visit cemeteries and which natural or cultural features of cemeteries they prefer. Previous studies have demonstrated multifaceted reasons to visit cemeteries [17,24]. Clearly, beyond their function for mourning and commemoration, cemeteries are appreciated as green, recreational urban spaces with unique qualities compared to other greenspaces such as parks [19]. People have been shown to appreciate different features in

cemeteries that can range from natural (e.g., vegetation, old trees, presence of color, and flowers) to cultural and historical (e.g., monuments) as well as the clear physical demarcation of urban cemeteries from the urban environment and a well-managed appearance of cemeteries [16,17,25–27]. While the latter feature may particularly conflict with the role of cemeteries as important places for nature in cities, people might also appreciate different features in cemeteries depending on their reason to visit cemeteries.

Previous studies have demonstrated that cemeteries can harbor a high biological richness including rare and endangered species (see review by Löki et al. [28]). The biodiversity of cemeteries depends on their age and size, their structural heterogeneity, and above all, on the type and intensity of management [29,30]. If certain areas in cemeteries are used or maintained less intensively or even abandoned, a development towards a “novel urban wilderness” may take place, which has been defined by the prevalence of natural processes in the virtual absence of direct human influence [31]. This development, referred to as “rewilding” in rural landscapes [32], can be described as a wilderness gradient, so that different areas in cemeteries can be considered more or less wild than others [31].

Wilderness development in cemeteries ultimately leads to reforestation as shown for old cemeteries in London and Berlin [29,33]. In contrast to intensively maintained urban green spaces, the natural re-vegetation of the sacral landscape allows visitors to experience natural processes. Cemetery visits could thus counteract the increasing loss of human–nature interactions, which has been identified as a growing problem [34]. Therefore, the promotion of wilderness in the urban context has become an important issue in managing and developing urban green spaces [35–37], with the aim to support both human–nature interactions and biodiversity conservation in cities [31].

Less-managed parts of urban greenspaces can provide habitat for many species [38]. This also relates to cemeteries [28]. Dead, standing tree trunks, however, are usually missing in cemeteries although they are particularly important habitat for hundreds of specialized species of fungi and insects that depend on different decomposition stages of deadwood [39–41]. Moreover, the associated cavities provide habitat for bats, woodpeckers, and other cavity dwellers [42,43]. Many of these species are highly endangered as standing, thick deadwood is often scarce in the intensively used rural landscape and often missing in managed forests. Deadwood is a limited resource in urban areas as well [44]. Yet, there is great potential for these important habitats, as wood production in urban green spaces is not economically relevant. This also applies to cemeteries in Berlin, which have a large stock of trees whose lifespan is coming to an end.

Promoting wilderness, including dead trees, in urban green spaces is desirable to support biodiversity conservation and the experience of nature. However, these aims do not always necessarily align with the aesthetic preferences of urban dwellers [45,46]. Ecologically valuable elements in greenspaces that contrast to cultural norms are often perceived as messy [47]. While people generally appreciate living old trees due to a manifold of associated services such as aesthetics or shade provision [19,48], this might not necessarily relate to dead trees. Dead wood has been found to be less preferred in different forest types [48–50]. However, how free-standing dead trees influence preferences for urban green spaces in general and for cemeteries in particular has not yet been studied.

People’s use of green spaces and their preferences of landscape features with regard with biodiversity, naturalness, or wilderness are often related to age, gender, or other socio-demographic factors [36,51–55]. However, it is unclear whether people with divergent reasons to visit a cemetery—e.g., for mourning or for experiencing nature—prefer wilderness elements such as dead trees, or more or less managed cemetery areas, differently.

In early US cemeteries that were designed in the naturalistic English landscape garden style, relationships between landscape features and visitors’ emotions were intentionally addressed in the 19th century. The prototype of such cemeteries, Boston’s Mount Auburn of 1831, provided visitors with a series of sensory experiences to evoke specific emotions, such as the pleasures of melancholy, that met contemporary romantic sensibilities [56]. Previous studies confirmed that natural features can serve as a principal source for people

to "experience a sense of spirituality" [57], and wilderness is a widely recognized source of transcendent emotions [58]. Wonder and awe can be a direct emotional reaction to the direct contact with wilderness as well as a sense of oneness with nature [59,60]. A South African study, for instance, demonstrated the relationship between trees and religious and spiritual experiences [25]. Moreover, the symbolic meaning of plants can matter as shown for *Salvia fruticosa* in cemeteries in Israel, symbolizing the human life cycle in human rites of passage [61], or sacred plants such as *Ficus religiosa* in urban sacred sites in India [62].

There is still little empirical research on the intersection between spirituality and nature in general and in particular about the specific nature features that contribute to spiritual comfort and well-being [63]. Similarly, no studies explicitly investigated the relationships between visitors' religious faith and spiritual wellbeing in relation to nature features in cemeteries although it is well evidenced that religious worldviews can foster meaning, connectedness with nature, and feelings of transcendence [63].

Here, we were interested to understand how different reasons to visit cemeteries and the socio-demographic background of visitors influence their views on cultural and natural features in cemeteries in Berlin, Germany. We conducted an online survey and used manipulated photo stimuli to further test whether the insertion of an old free-standing dead tree as an important wilderness element changes preferences for differently maintained cemetery areas (i.e., intensively managed lawns, less-frequently mowed meadows, and overgrown, wild areas). We also wanted to understand how different natural elements in cemeteries are related to visitors' comforting experiences.

In detail, our specific research questions were:

1. What are the major reasons to visit urban cemeteries in Berlin?
2. What are visitors' preferences for natural and cultural cemetery features?
3. How does an old dead tree as a significant wilderness component modulate preferences for differently managed settings in cemeteries (i.e., lawn, meadow, wild area)?
4. How are different nature elements in cemeteries (i.e., overgrown graves, trees, glades and plants) rated as comforting experiences in cemeteries?
5. How do respondents' reasons to visit and their age, gender, and religious faith relate to their pronounced preferences and ratings?

We anticipated that participants visit urban cemeteries for different reasons. We expected that people who visit cemeteries to enjoy nature would prefer natural features and wild areas in cemeteries more than people who visit cemeteries for mourning or historical interest. We further expected that the presence of a dead old tree as a wilderness element would not influence preferences for the wild area, but more so for green areas that are intensively managed. Moreover, we anticipated that natural elements would provide comforting experiences for visitors and that this would be influenced by religious faith and reason to visit cemeteries. This deeper insight into the relationships between different cemetery visitors and the different natural elements in cemeteries can support urban planners and designers in developing cemeteries as important components of the urban green infrastructure.

## 2. Materials and Methods

### 2.1. Study Area

Berlin is the largest city in Germany, with 3.8 million inhabitants in 2021, within a total area of 891 km<sup>2</sup>. About 60% of the city is developed with built-up areas and streets, while the remaining 40% is covered by green or blue spaces in 2020, including forests (18%) and parks (7%) [64].

Berlin has 224 cemeteries that are distributed all over the urban area and within its administrative borders covering 1167 ha in total [65]. Most of Berlin's cemeteries are designed in a park style with tree allées, tree clumps and glades, and include areas with lawns or meadows. Due to changing burial practices, the use of some cemeteries for burials is decreasing, and in some parts, natural processes have been allowed to proceed with

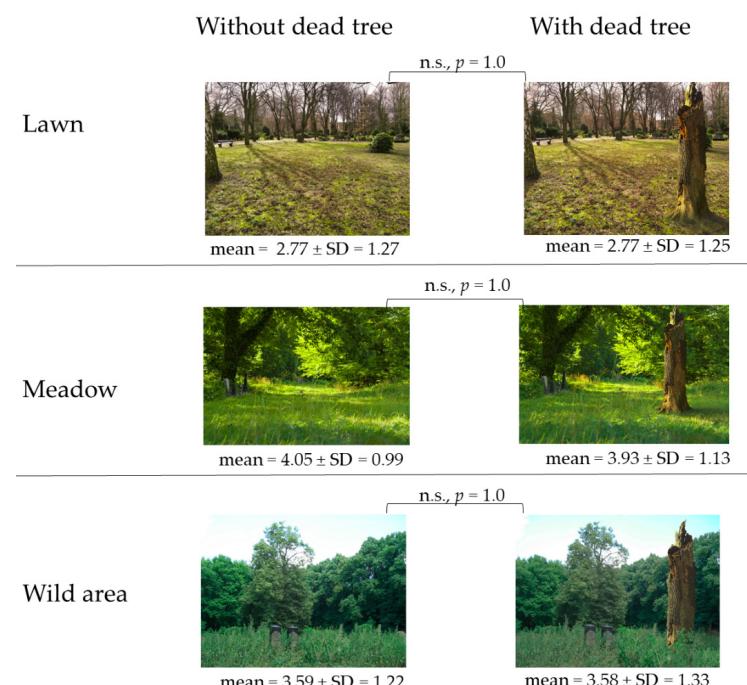
limited management interference. High biological richness has been shown early on for Berlin cemeteries [66], and more recently also for an old rewilded cemetery [29].

## 2.2. Survey Distribution

An online questionnaire was created using the online tool “LamaPoll” (Lamano GmbH & Co. KG™, Berlin, Germany) and distributed among participants from varying socio-demographic backgrounds in Berlin and the surrounding federal state of Brandenburg. To cover respondents from varying socio-demographic backgrounds, we approached 955 randomly selected institutions in Berlin and Brandenburg through internet research. The addressed institutions covered largely in equal parts sports, elderly people homes, urban gardening initiatives, and cultural associations, adapting the approach from Fischer et al. [53]. We asked the institutions ( $n = 955$ ) to distribute the survey through their email distribution lists or their social media channels. Following a snowball sampling method [67], we further asked the contacted institutions and persons from our own environment to forward the survey link to other people in their professional or personal environment. The survey was accessible for one month from 1 to 29 June 2020, and we sent a reminder email to the institutions after two weeks.

## 2.3. Development of the Survey Instrument

The questionnaire was separated in five sections and addressed (i) reasons to visit cemeteries, (ii) 13 items to ask participants’ preferences for natural and structural features in cemeteries (Table 1), (iii) photo stimuli showing differently managed cemetery areas with and without a free-standing dead tree, (iv) five items to measure comforting experiences in cemeteries, and (v) socio-demographic variables (Table 1). We also asked for the zip code of current residence to ensure that only responses from participants who were currently living in Berlin and the adjacent federal state of Brandenburg were included in the analysis. We limited the study to Berlin and its wider surroundings (i.e., Brandenburg) to ensure a familiarity of the participants with the regional cemetery types.



**Figure 1.** Average preference rating and standard deviation (SD) for differently managed cemetery spaces (lawn, meadow, wild area) without (left) and with (right) an inserted dead tree (n.s. = not significant).

**Table 1.** Tabular summary of the response variables that were used in the questionnaire.

Response Variable	Question	Items	Answer Options
Cemetery characteristics	<i>How important are you the following cemetery characteristics in cemeteries in Berlin? (Please rate on a scale from "not important at all" to "very important"</i>	(1) quietness, (2) nature sounds (e.g., bird sounds, leaf rustling, burbling of water), (3) animals (e.g., squirrel, bird), (4) old trees, (5) wild-flowers, (6) hedges, (7) wild areas, (8) lawn, (9) shadow, (10) buildings for prayer (e.g., chapels), (11) monuments, (12) few people, and (13) social meeting point	1 = not important at all 2 = somewhat important 3 = neutral 4 = mostly important 5 = very important
Preferences for green areas: lawn, meadows, wild area	<i>How much do you like each green area on a cemetery? (Please take your time to have a look at each photo and rate afterwards how much you like the nature scenario on a cemetery depicted on each photo)</i> <i>Photo stimuli see Figure 1</i>		1 = not at all 2 = a little 3 = moderate 4 = mostly 5 = very much
Predictor variable			
Reason to visit a cemetery	<i>What are your reasons to visit cemeteries? (Even if you have not been on a cemetery in the past twelve months, please try to indicate the reasons that are most applicable. Multiple answers are possible)</i>	(1) mourning/remembrance (e.g., taking care of a grave, going on a funeral, following a ritual, sense of duty to visit a grave), (2) enjoying nature (e.g., observing animals and plants, listening to nature sounds, breathing fresh air), (3) relaxation (e.g., reflecting, sitting on a bench, taking time for oneself, resting, reading), (4) social interactions (e.g., having conversations, feeling connected with other cemetery visitors, greeting each other), (4) historical interest (e.g., visiting sepultures and monuments, reading epitaphs), (5) doing sports (e.g., going for a run, yoga), (6) dog walking, (7) crossing (e.g., short cut), (8) going for a walk, (9) other (open response)	Multiple answers were possible
Comforting experiences of nature in a cemetery	<i>What feelings does a visit to a cemetery activate in you? Please rate on a scale from "not at all" to "very much". Even if you don't go to cemeteries, please try to think about how you would feel if you go on a cemetery</i>	Old trees help me to cope with my grief When I stand in a clearing/glade of a cemetery, I feel hope Overgrown grave sites bring me close to the cycle of life Some plant species have a symbolic meaning for me	1 = not at all 2 = a little 3 = moderate 4 = mostly 5 = very much
Age	<i>Respondents' age</i>		— years NA—no answer
Gender	<i>Respondents' gender</i>		Female Male Diverse NA—no answer

### 2.3.1. Photo Stimuli

In our survey, each of the photo stimuli showed one green area scenario that was related to a different level of management, namely a frequently cut lawn, a less intensively managed meadow, and an overgrown wild area (Figure 1). These reflect a wilderness gradient and were selected since they are typical of cemeteries in Berlin—apart from intensively maintained grave fields, which were not the focus of our interest. To measure the influence of a key wilderness element on people's preferences, we showed the same scenarios with and without the same inserted free-standing dead old tree depicted on the right side of each photo stimuli. We did not explicitly name the dead old tree that was shown in the stimuli to avoid influencing the responses by possible negative connotations of terms that were related to dead wood. Moreover, since such dead tree trunks do not occur in Berlin cemeteries to our knowledge, it is, therefore, unlikely that the respondents generally related the questions about old trees to the dead tree trunk that was inserted in the stimuli.

We considered the following aspects in editing the photo stimuli to reduce other potentially influencing factors: All the photos showed the respective dead tree from a similar angle and all other potentially distracting natural or anthropogenic elements were deleted from the photos. The original photos were taken by the authors from cemeteries in Berlin and edited in Adobe Photoshop™.

### 2.3.2. Reason for Cemetery Visit

Based on previous research on cemetery visits [17,24], we provided nine options where the participants could select the reasons why they visit cemeteries (Table 1). We also provided an "other" option where the participants could enter a reason to visit cemeteries which we did not provide as an option. Each participant could give more than one reason and we emphasized in this section that the participants could indicate the reasons that would be most applicable even if they have not visited a cemetery in the past twelve months.

### 2.3.3. Cemetery Features

We selected thirteen cemetery features that were mostly derived from the literature that we considered to be relevant for cemeteries in Berlin. These cemetery characteristics included: quietness and few other people (e.g., silence and calm atmosphere) [17,19,25,27], mature trees [17,25], sounds of nature (e.g., bird songs) [17], shady places [48], and monuments [16,17,23]. We also added features focusing on vegetation [26] such as wild-flowers, hedges, wild areas, lawns, and meadows. Lastly, we added buildings for prayers (e.g., chapels), social meeting places, and also seeing animals. The participants were asked to rate on a scale from 1 (not important at all) to 5 (very important) how much they considered each characteristic to be important to an urban cemetery in Berlin. We added that people should fill out this section even if they do not visit cemeteries but to imagine what they would consider as to be important.

### 2.3.4. Preferences for Differently Maintained Green Areas and Wilderness Element

Wild areas are developing in cities that can be seen along gradients of naturalness and ecological novelty [31]. To investigate how people perceive different green areas differing in their level of wilderness, we provided three different photo stimuli showing a gradient of wilderness: a mown lawn, a meadow with wild-flowers, and a completely wild area without any clear visible management or human presence.

Independently from the wilderness level but dependent on the management, dead trees can be part of green areas in cemeteries. To measure the effect of a dead tree as a wilderness element on preferences for the three differently maintained green areas, we added an image of a free-standing dead tree to each photo. We chose this wilderness element because of its high importance as habitat for many taxa of animals and fungi—and because of the many mature trees in Berlin's cemeteries which are expected to die off in the

near future. As a final set of photo stimuli, we had six photo stimuli: three green areas, each with and without the dead tree. For each photo, we asked the participants their preferences on a scale from 1 (do not like at all) to 5 (like it very much).

### 2.3.5. Comforting Experiences with Nature Elements in Cemeteries

Based on the previous literature that investigated how people experience comfort in cemeteries or with nature elements [16,25,61,68,69], we developed four items: (i) old trees help me to cope with my grief given that older trees are generally larger than younger ones and the relationship between large trees and grief, (ii) when I stand in a clearing/glade of a cemetery I feel hope, (iii) overgrown grave sites bring me close to the cycle of life, and (iv) some plant species have a symbolic meaning for me. People could rate on a scale from 1 (do not agree at all) to 5 (completely agree) how much they agreed with each item.

### 2.3.6. Socio-Demographic Variables

Sociodemographic variables were addressed in the questionnaire (Table 1) to gain a better understanding about the background of the study sample, i.e., age and gender. We also included religious faith as a predictor variable (three options: not faithful, moderately faithful, and very faithful) since faith has been shown to influence the perception and use of urban cemeteries, including grieving processes in cemeteries [16,25,69].

### 2.3.7. Pre-Test

The questionnaire was pre-tested with  $n = 11$  respondents from different socio-demographic backgrounds, i.e., with people that were different in age (from 23 to 58 years), gender (5 males and 6 females), and occupation (6 students and 5 employees). The pre-tests were carried out in April 2020 as cognitive interviews, each with a length of up to 1.5 h following Fischer et al. [53]. The pre-test led to slight adaptations of the questionnaire for the final version (Table 1). We ensured that the questionnaire could be completed within approximately 15 min.

## 2.4. Statistical Analysis

To measure the reason for cemetery visits, we summed up all the responses and calculated the relative frequency for each of the offered reasons. The open field ‘other’ resulted in 73 responses. Of these, 29% were for professional reasons (e.g., work-related), so that these reasons were grouped into occupation, resulting in a total of ten items for cemetery visit reason.

To reveal the importance of overarching characters of cemeteries, we undertook a principal component analysis (PCA). The PCA analyses with the thirteen cemetery features that are shown in Table 1 yielded five components, explaining 71.0% of the data. Next, we conducted an exploratory factor analyses (EFA) with varimax rotation (Table A1) to eliminate items that did not load above 0.40 within the five cemetery characteristic components. Here, the cemetery characteristic “social meeting point” did load below 0.40 and was hence excluded from further analyses.

To compare the preferences for the shown three green areas (lawn, meadow, wild) with and without the dead tree, we applied pairwise Wilcox tests (unpaired, Bonferroni correction). Since we did not find differences between the preferences for the same green area with and without the dead tree, we combined all the pronounced preferences for the same green area type to calculate the general preferences for the lawn, the meadow, and the overgrown wild area. We again applied pairwise Wilcox tests (unpaired, Bonferroni correction) to compare between the preferences for the three green areas, now ratings of stimuli with and without dead tree combined, and also to compare between the preferences for the five overarching cemetery characteristics which had been identified by the PCA analyses.

To calculate the predictive potential of the most common reasons to visit a cemetery that were related to nature, mourning and historical interest, and of the respondents’ age, gender, and religious faith on preferences for green areas and cemetery characteristics,

we applied generalized linear mixed models (GLMs) with a quasi-Poisson distribution. We also applied interaction terms between age and gender to avoid stereotypes and to account for e.g., older versus younger women, but did not find significant interactions. Consequently, we included these variables as separate fixed factors in our models.

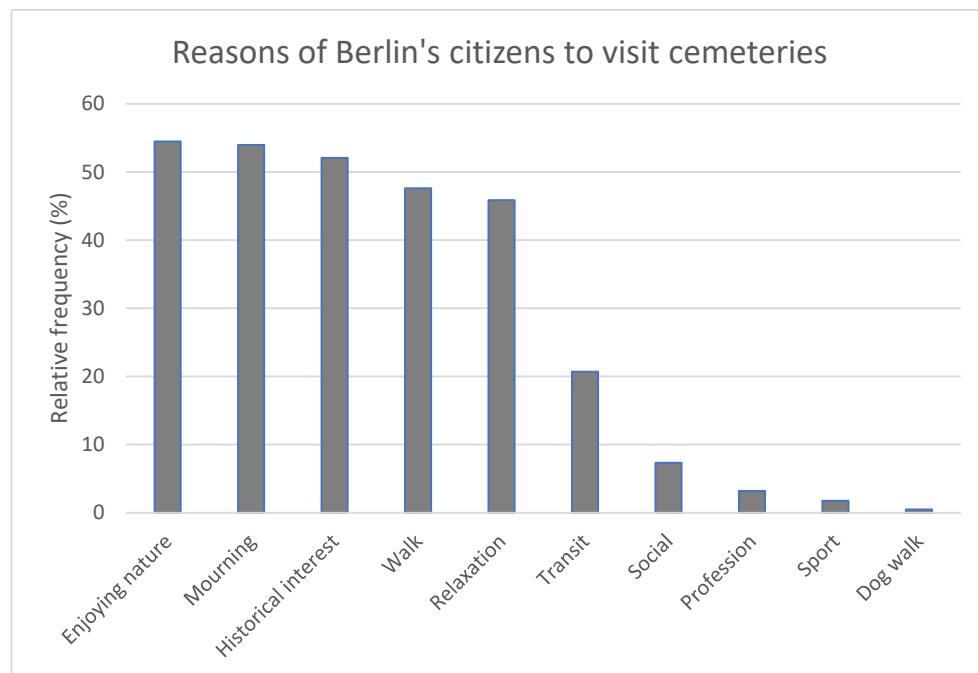
### 3. Results

#### 3.1. Survey Sample

In total, 796 participants started the survey of which we only included participants who finished the questionnaire and entered their postal code to Berlin or Brandenburg, leading into a total of  $n = 627$  (79%). The participants' age ranged from 18 to over 75 years with the average age of 42.8 years. Most participants (59%) were female, followed by male (38%) and participants of diverse genders (3%). A total of 54% of the participants rated themselves as not faithful, 25% as moderately, and 21% as very faithful (with <0.1% gave no response to this question). The vast majority (95%) of the participants were born in Germany; 97% lived in Berlin, and 3% in the surrounding federal state of Brandenburg.

#### 3.2. Reasons for Cemetery Visits

In total, 627 participants provided 1875 answers as about major reasons for visiting a cemetery, with an average of three reasons per participant (Figure 2). The three most frequent reasons for visiting were given by more than half of the participants and were enjoying nature (57%), mourning/memory (54%), and historical interest (52%). Slightly less than one in two gave the reasons for visiting as going for a walk (48%) and relaxation (46%) (Figure 2). One in five said they use cemeteries to walk through (20%), and fewer than 10% of the participants cited the reasons for visiting as social interaction (7%), profession (3%), sports activity (2%), and walking the dog (<1%).



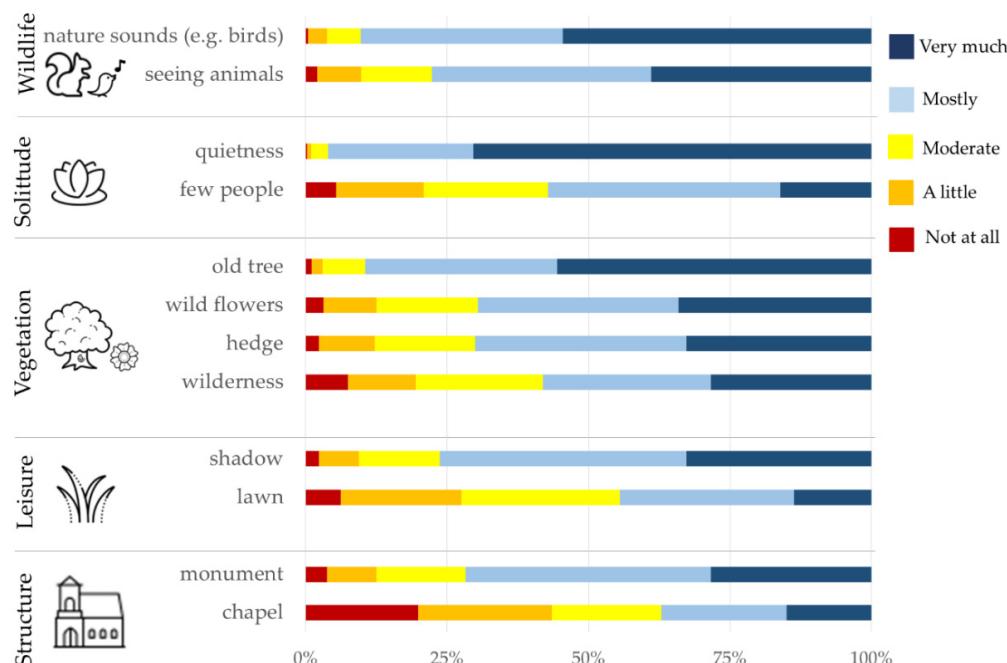
**Figure 2.** Relative frequency of the most common reasons of participants ( $n = 627$ ) to visit cemeteries in Berlin. Due to possible multiple responses, 1875 answers were generated.

Older people visited cemeteries more for mourning (Pearson's Chi-squared test,  $\chi^2 = 17.69$ ,  $df = 4$ ,  $p = 0.001$ ) and for historical interest (Pearson's Chi-squared test,  $\chi^2 = 17.47$ ,  $df = 4$ ,  $p = 0.002$ ) than younger ones. In relation to gender, women visited cemeteries more to enjoy nature (Pearson's Chi-squared test,  $\chi^2 = 10.28$ ,  $df = 2$ ,  $p = 0.006$ ) and for mourning (Pearson's Chi-squared test,  $\chi^2 = 6.12$ ,  $df = 2$ ,  $p = 0.047$ )

than men. In contrast, there was no significant relationship between gender and historical interest (Pearson's Chi-squared test,  $\chi^2 = 0.21$ , df = 2,  $p = 0.90$ ) and age and reason to visit cemeteries for enjoying nature (Pearson's Chi-squared test,  $\chi^2 = 6.29$ , df = 4,  $p = 0.18$ ).

### 3.3. Preferences for Natural and Cultural Cemetery Characteristics

There were five overarching cemetery characteristics that were identified and differed in their relevance to the respondents (Figures 3 and 4, Table A1). These five components which we address as overarching cemetery characteristics were named as 'wildlife' (included two items: seeing animals and 'nature' sounds such as bird sounds); 'solitude' (two items: few people, quietness); 'vegetation' (four items: old trees, wilderness, hedge, wild-flowers); 'leisure' (two items: shadow; lawn); and 'structure' (two items: monument, chapel) (Figure 3). Quietness, nature sounds (e.g., bird songs), and old trees most often received the most extreme rating 'very much' as important; in contrast to chapel which most often received the rating of 'not at all' important (Figure 3).

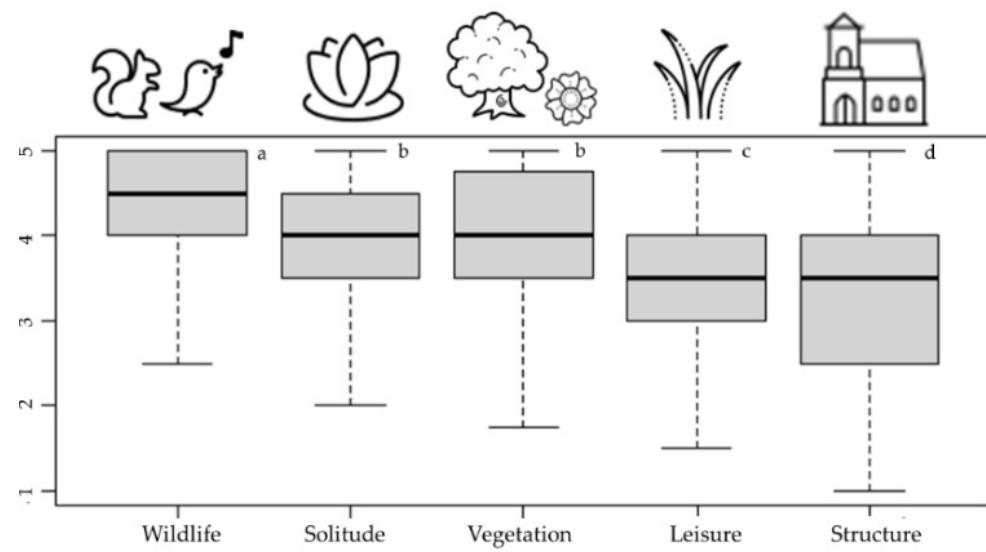


**Figure 3.** Items within each cemetery characteristic category (from most to least preferred). Procentual rating of importance per item from 1 (red = 'not at all') to 5 (blue = 'very much').

Comparing preferences for the five overarching cemetery features, we found significant differences ( $p < 0.001$ , Wilcoxon rank sum test with Bonferroni correction); except between vegetation and solitude (Figure 4). The respondents' preferences were highest for wildlife (mean = 4.23, SD  $\pm$  0.82, median = 4.5), followed by solitude (mean = 4.06, SD  $\pm$  0.7, median = 4.0), and vegetation (mean = 3.94, SD  $\pm$  0.83, median = 4.0), leisure (mean = 3.61, SD  $\pm$  0.86, median = 3.5), and structure (mean = 3.36, SD  $\pm$  1.0, median = 3.5).

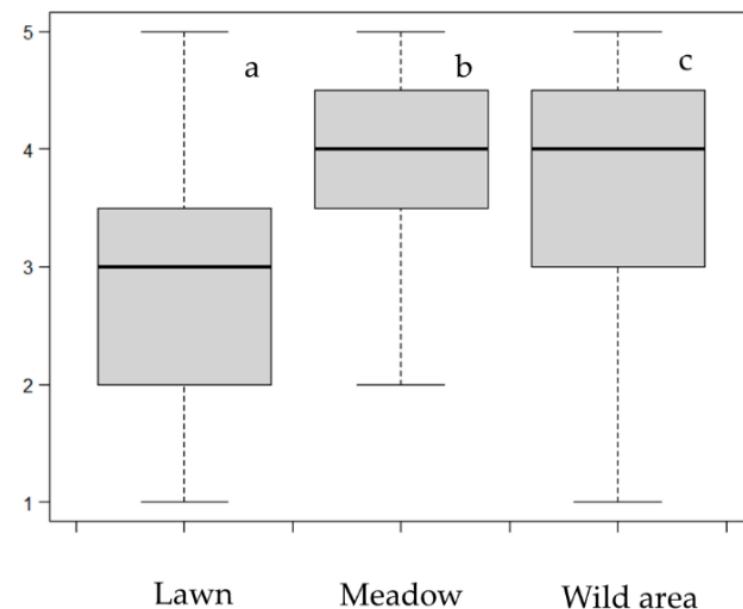
### 3.4. Preferences for Green Spaces with and without the Dead Tree

Photo stimuli with and without a dead tree did not differ significantly (Wilcoxon rank sum test with Bonferroni correction,  $p = 1.0$ , Figure 1). In detail, people rated photos that showed the same maintained green area similarly; irrespective of whether a dead tree was shown on it or not.



**Figure 4.** Preferences for five overarching cemetery characteristics (wildlife, solitude, vegetation, leisure, and structure) that were rated by participants ( $n = 627$ ). Scale of 1 ('not at all') to 5 ('very much'). Significant differences indicated with different letters at the level  $p < 0.001$ .

The preference ratings for the three green spaces (averaged ratings for photo stimuli with/without dead wood), however, differed significantly (Wilcoxon rank sum test with Bonferroni correction,  $p > 0.001$ , Figure 5). The respondents preferred the meadow (mean =  $3.99 \pm SD 0.82$ ) significantly more than the wild area (mean =  $3.59 \pm SD 1.14$ ). The lawn (mean =  $2.77 \pm SD 1.07$ , averaged ratings) was the least preferred green space type in cemeteries.

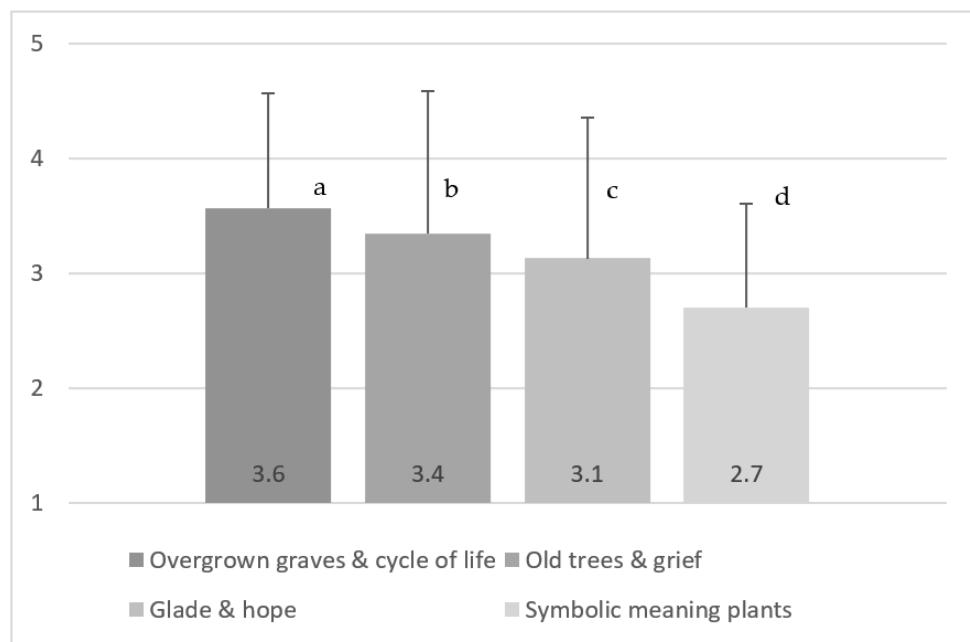


**Figure 5.** Preference ratings for lawn, meadow, and wild area with ratings of paired photo stimuli (with and without the dead tree) combined ( $n = 627$ ). Different letters indicate significant differences at the  $p < 0.001$  level. Scale of 1 ('do not like at all') to 5 ('like very much').

### 3.5. Comforting Experiences of Nature in Cemeteries

Comforting experiences in cemeteries that are linked to vegetation were overall rated high (Figure 6). The participants rated highest the item 'overgrown grave sites bring me close to the cycle of life' (mean =  $3.6 \pm 1.2$ ) followed by the item that 'old trees help me to

cope with my grief' (mean =  $3.4 \pm 1.3$ ) and 'when I stand in a clearing/glade of a cemetery, I feel hope' (mean =  $3.1 \pm 1.2$ ). The least although still moderately rated, was the item 'some plant species have a symbolic meaning for me' (mean =  $2.7 \pm 1.2$ ).



**Figure 6.** Comforting experiences of nature in cemeteries of the participants ( $n = 627$ ). Different letters indicate significant differences at the  $p < 0.01$  level (a, b and a, c) and at the  $p < 0.001$  level (a, d and b, d).

### 3.6. Predictors of Preference Patterns

Reasons to visit cemeteries and the respondents' age, gender, and religious faith were significantly related to the pronounced preferences for cemetery features, different green areas, and to the respondents' comforting experiences of nature (Table 2).

When people visited cemeteries to enjoy nature, they appreciated the four cemetery features nature, leisure, solitude, and wildlife, but not the structure characteristics (Table 2). They further showed high preferences for meadows and wild areas. In contrast, people who visited cemeteries to mourn showed appreciation for structure (chapels and monuments), but not for nature characteristics. They further did not pronounce high preferences for wild areas and meadows. The reason to visit cemeteries for historical interest was positively associated with a high appreciation for structural features and low preferences for wild areas.

The older participants appreciated nature, structure, and wildlife features more but preferred lawns and wild areas less than younger ones (Table 2). There was a negative association between participants above 75 years old and appreciating solitude in cemeteries. In relation to gender, men showed lower preferences for leisure, vegetation, and wildlife features as well as for the green area types meadows and wild areas than women. Religious faith showed positive predictive potential on the appreciation of structural features and lawn, but participants who rated themselves as faithful did not show high appreciation for meadows.

**Table 2.** The predictive potential of different reasons of cemetery visits and of the respondents' sociodemographic factors on preferences for cemetery features and for differently managed green areas. Significant results shown in bold with *p*-values (\* *p* < 0.05; \*\* *p* < 0.01; \*\*\* *p* < 0.001).

	Cemetery Features					Green Areas		
	Leisure	Vegetation	Solitude	Structure	Wildlife	Lawn	Meadow	Wild
<b>Visit reason</b>								
Enjoy nature	<b>0.04 ± 0.02 *</b> <i>p</i> = 0.03	<b>0.11 ± 0.02 ***</b> <i>p</i> < 0.001	<b>0.05 ± 0.01 **</b> <i>p</i> = 0.002	<b>-0.07 ± 0.02 **</b> <i>p</i> = 0.005	<b>0.13 ± 0.02***</b> <i>p</i> < 0.001	-0.02 ± 0.03	<b>0.10 ± 0.02 ***</b> <i>p</i> < 0.001	<b>0.07 ± 0.03 **</b> <i>p</i> = 0.008
Mourning	-0.03 ± 0.02	<b>-0.06 ± 0.02 ***</b> <i>p</i> < 0.001	0.003 ± 0.01	<b>0.11 ± 0.02 ***</b> <i>p</i> < 0.001	-0.01 ± 0.02	0.008 ± 0.03	<b>-0.03 ± 0.02 *</b> <i>p</i> = 0.04	<b>-0.12 ± 0.03 ***</b> <i>p</i> < 0.001
Historical interest	-0.02 ± 0.02 <i>p</i> = 0.40	-0.02 ± 0.02 <i>p</i> = 0.26	-0.002 ± 0.01 <i>p</i> = 0.91	<b>0.18 ± 0.02 ***</b> <i>p</i> < 0.001	-0.01 ± 0.02 <i>p</i> = 0.60	-0.02 ± 0.03 <i>p</i> = 0.50	-0.003 ± 0.02 <i>p</i> = 0.85	<b>-0.06 ± 0.03 *</b> <i>p</i> = 0.03
<b>Age</b>								
(reference [18–24]) 25–39	0.0002 ± 0.04 <i>p</i> = 1.00	<b>0.09 ± 0.03 **</b> <i>p</i> = 0.004	-0.003 ± 0.02 <i>p</i> = 0.91	0.02 ± 0.04 <i>p</i> = 0.58	<b>0.06 ± 0.03 *</b> <i>p</i> = 0.02	-0.01 ± 0.05	0.05 ± 0.03 <i>p</i> = 0.10	0.07 ± 0.05 <i>p</i> = 0.10
40–64	0.04 ± 0.03 <i>p</i> = 0.23	<b>0.12 ± 0.03 **</b> <i>p</i> < 0.001	0.03 ± 0.02 <i>p</i> = 0.21	<b>0.12 ± 0.04 **</b> <i>p</i> = 0.002	<b>0.10 ± 0.03 **</b> <i>p</i> < 0.001	-0.08 ± 0.05 <i>p</i> = 0.11	0.0003 ± 0.03 <i>p</i> = 0.99	0.06 ± 0.04 <i>p</i> = 0.17
65–74	0.09 ± 0.05 <i>p</i> = 0.06	<b>0.10 ± 0.04 *</b> <i>p</i> = 0.02	-0.02 ± 0.03 <i>p</i> = 0.56	<b>0.12 ± 0.06 *</b> <i>p</i> = 0.03	<b>0.11 ± 0.04 **</b> <i>p</i> = 0.003	<b>-0.32 ± 0.08 ***</b> <i>p</i> < 0.001	-0.07 ± 0.0	0.05 ± 0.06 <i>p</i> = 0.45
>75	<b>-0.17 ± 0.07 *</b> <i>p</i> = 0.02	-0.08 ± 0.06 <i>p</i> = 0.19	<b>-0.11 ± 0.05 *</b> <i>p</i> = 0.03	<b>0.17 ± 0.07 *</b> <i>p</i> = 0.02	-0.06 ± 0.06 <i>p</i> = 0.31	-0.15 ± 0.11 <i>p</i> = 0.20	<b>-0.17 ± 0.06 **</b> <i>p</i> = 0.004	<b>-0.29 ± 0.10 **</b> <i>p</i> = 0.005
<b>Gender</b>								
(men compared to women)	<b>-0.05 ± 0.02 *</b> <i>p</i> = 0.01	<b>-0.07 ± 0.02 ***</b> <i>p</i> < 0.001	-0.02 ± 0.01 <i>p</i> = 0.23	0.04 ± 0.02 <i>p</i> = 0.08	<b>-0.06 ± 0.02 ***</b> <i>p</i> < 0.001	0.04 ± 0.03 <i>p</i> = 0.26	<b>-0.05 ± 0.02 **</b> <i>p</i> = 0.002	<b>-0.07 ± 0.03 *</b> <i>p</i> = 0.01
<b>Religious faith</b>								
(compared to not faithful)								
Moderately	0.04 ± 0.02 <i>p</i> = 0.10	-0.01 ± 0.02 <i>p</i> = 0.57	0.02 ± 0.02 <i>p</i> = 0.20	<b>0.10 ± 0.03 ***</b> <i>p</i> < 0.001	-0.01 ± 0.02 <i>p</i> = 0.44	<b>0.10 ± 0.04 **</b> <i>p</i> = 0.001	-0.03 ± 0.02 <i>p</i> = 0.10	-0.03 ± 0.03 <i>p</i> = 0.35
Very	-0.007 ± 0.03 <i>p</i> = 0.80	-0.03 ± 0.02 <i>p</i> = 0.19	-0.03 ± 0.02 <i>p</i> = 0.19	<b>0.16 ± 0.03 ***</b> <i>p</i> < 0.001	-0.005 ± 0.02 <i>p</i> = 0.83	0.06 ± 0.04 <i>p</i> = 0.16	<b>-0.06 ± 0.02 **</b> <i>p</i> = 0.005	-0.06 ± 0.04 <i>p</i> = 0.11

The reason to visit a cemetery to enjoy nature was a positive predictor for all the comforting nature experience items (Table 3). The reason to visit a cemetery for mourning was positively related to the item 'old trees help me to cope with my grief'; whereas the reason to visit cemeteries for historical interest was positively related to the item 'overgrown grave sites bring me close to the cycle of life'.

**Table 3.** Predictive potential of reason of cemetery visit and the sociodemographic factors of the respondents on comforting nature experiences shown in Figure 6. Significant results shown in bold with *p*-values (\* *p* < 0.05; \*\* *p* < 0.01; \*\*\* *p* < 0.001).

	Overgrown Graves and Cycle	Old Trees and Grief	Glade and Hope	Symbolic Meaning Plants
<b>Visit reason</b>				
Nature	<b>0.15 ± 0.03 ***</b> <i>p</i> < 0.001	<b>0.07 ± 0.03 *</b> <i>p</i> = 0.02	<b>0.08 ± 0.03 *</b> <i>p</i> = 0.01	<b>0.15 ± 0.04 ***</b> <i>p</i> < 0.001
Mourning	-0.03 ± 0.03 <i>p</i> = 0.23	<b>0.07 ± 0.03 *</b> <i>p</i> = 0.03	0.03 ± 0.03 <i>p</i> = 0.37	0.05 ± 0.04 <i>p</i> = 0.16
Historical interest	<b>0.06 ± 0.03 *</b> <i>p</i> = 0.03	0.005 ± 0.03 <i>p</i> = 0.87	-0.02 ± 0.03 <i>p</i> = 0.50	0.05 ± 0.04 <i>p</i> = 0.20
<b>Age</b> (reference 18–24)				
25–39	<b>0.11 ± 0.05 *</b> <i>p</i> = 0.03	0.04 ± 0.05 <i>p</i> = 0.52	-0.001 ± 0.05 <i>p</i> = 0.98	<b>0.16 ± 0.07 *</b> <i>p</i> = 0.02
40–64	<b>0.12 ± 0.05 *</b> <i>p</i> = 0.02	<b>0.12 ± 0.05 *</b> <i>p</i> = 0.03	0.03 ± 0.05 <i>p</i> = 0.57	<b>0.19 ± 0.07 **</b> <i>p</i> = 0.005
65–74	0.12 ± 0.07 <i>p</i> = 0.08	0.12 ± 0.07 <i>p</i> = 0.10	0.08 ± 0.07 <i>p</i> = 0.31	<b>0.32 ± 0.09 ***</b> <i>p</i> < 0.001
>75	-0.16 ± 0.11 <i>p</i> = 0.12	0.04 ± 0.11 <i>p</i> = 0.67	-0.15 ± 0.11 <i>p</i> = 0.17	-0.02 ± 0.13 <i>p</i> = 0.89
<b>Gender</b>				
(men compared to women)	<b>-0.10 ± 0.03 **</b> <i>p</i> = 0.001	<b>-0.16 ± 0.03 ***</b> <i>p</i> < 0.001	<b>-0.16 ± 0.03 ***</b> <i>p</i> < 0.001	-0.007 ± 0.04 <i>p</i> = 0.85
<b>Religious faith</b>				
(compared to not faithful)				
Moderately	0.01 ± 0.03 <i>p</i> = 0.72	<b>0.09 ± 0.04 *</b> <i>p</i> = 0.02	<b>0.11 ± 0.04 **</b> <i>p</i> = 0.005	<b>0.13 ± 0.05 **</b> <i>p</i> = 0.005
Very	0.002 ± 0.04 <i>p</i> = 0.96	0.07 ± 0.04 <i>p</i> = 0.10	<b>0.13 ± 0.04 **</b> <i>p</i> = 0.001	0.08 ± 0.05 <i>p</i> = 0.12

Moderate religious faith showed predictive potential for three items: 'old trees help me to cope with my grief', 'when I stand in a clearing/glade of a cemetery, I feel hope', and 'some plant species have a symbolic meaning for me'; whereas a self-assessed 'very faithful' had predictive potential on 'when I stand in a clearing/glade of a cemetery, I feel hope'. Participants within the age range 40–64 rated higher the items 'overgrown graves', 'old trees', and 'symbolic meaning of plants'; participants in the age range 65–74 rated also high the item about 'symbolic meaning of plants'. As for gender, men expressed lower appreciation for three comforting experiences than women.

#### 4. Discussion

How cemeteries can be further developed as multifunctional components of the urban green infrastructure is a current topic of urban planning and design. Moreover, there is increasing pressure on the future urban cemeteries with the alteration of burial cultures and decommission of urban cemeteries. Hence, an understanding of the ecological, but also spiritual values of nature elements in cemeteries is crucial to avoid losses due to cemetery transformation [70].

As societal needs and aesthetics do not necessarily align with ecological benefits and biodiversity conservation [45,71], it is of great interest to urban planners and greenspace managers to understand how people from different backgrounds view the natural features of cemeteries for promoting wilderness elements in urban environments.

From previous cemetery studies, we know that urban dwellers visit cemeteries for different reasons, and that different features of cemeteries, particularly trees, maintenance, care, and restorative qualities that are linked to, for example, the sense of being away from the city, are appreciated (e.g., [17,25–27]). Our study takes this a few steps further by illuminating how preferences for differently maintained green spaces and natural and cultural features of cemeteries are related to reasons for visiting. In addition, we test to what extent the insertion of a dead tree as a wilderness element into photo stimuli of differently maintained green spaces in cemeteries influences their evaluation. Lastly, we also demonstrate the importance of comforting experiences that are derived from nature elements in cemeteries; similarly related to reasons for visiting a cemetery.

The major findings of our study were:

- Participants who visited cemeteries for different reasons varied in their preferences for cemetery characteristics, differently maintained green areas, and comforting experiences with natural elements.
- Participants appreciated predominantly cemetery features that were related to wildlife and vegetation and least preferred the most intensively maintained area, with the lawn.
- The presence of a dead tree as wilderness element on our photo stimuli did not affect preferences of any of the differently managed cemetery spaces.
- Religious faith showed, besides other socio-demographic factors, predictive potential on these patterns.

##### 4.1. Major Reasons to Visit Urban Cemeteries

The participants in our study mostly visited cemeteries to enjoy nature, to mourn, and to meet their historical interest. Comparing these reasons with the reasons to visit urban parks, urban cemeteries have a contrasting role in the urban green infrastructure in Berlin. A study in Berlin and four other European cities revealed physical activities such as walking or practicing sports as most preferred, and nature-related activities as least preferred park uses [54]. Sports and dog walking played only a very small role as visit reasons in our survey. In fact, while these activities are not necessarily conventional activities in cemeteries, jogging is an important activity in cemeteries in Malmö, Sweden [72] as is dog walking in cemeteries in Oslo, Norway [24]. A social desirability bias cannot be ruled out in our online survey (i.e., responding in a manner that will be viewed favorably by others) since these activities are less conventional activities in cemeteries. However, more likely is that there exists different use patterns in Berlin's cemeteries compared to the use of cemeteries

in other geographic and cultural contexts and that these activities are just considered to be less conventional in urban cemeteries and consequently less done.

Enjoying nature was the most frequently mentioned reason to visit cemeteries in Berlin whereas in Scandinavian studies visiting graves or on crossing were major reasons [17,19,73]. This might reflect distinctive characteristics of Berlin's cemeteries which are usually densely vegetated, often with wild parts, and harbor a high biological richness [29,66]. These sites thus allow experiencing nature in densely populated neighborhoods. At the same time, most cemeteries in Berlin's center are classified as garden monuments, with a wealth of historical structures, including more than 800 graves of honor with celebrities such as Theodor Fontane, Grimm Brothers, or Georg Wilhelm Friedrich Hegel. Berlin's cemeteries thus provide the opportunity to enjoy nature and culture together; two components that have high restorative potential [17]. Our results underpin the multifunctional roles of urban cemeteries, i.e., as burial grounds, but also places for other recreational activities. Clearly, urban cemeteries in Berlin are more than just parks as also shown in Scandinavia [19]. However, the major reasons to visit cemeteries in Berlin seem to differ to the reasons to visit cemeteries in Scandinavia and possibly beyond. Comparative studies among cemeteries in different cultural contexts could be a next step to shed light on the multifunctional roles of urban cemeteries in different cultures and geographic contexts.

#### 4.2. Natural Features Are Most Preferred but this Depends on the Visit Reason and Socio-Demographics

Our approach identified preferences for a suite of natural and cultural cemetery features and explored their relationship with the participants' socio-demographic background and their motivation to visit cemeteries. Wildlife (hearing and seeing animals) was the most appreciated cemetery feature, followed by solitude (e.g., quietness) and vegetation (e.g., old trees, wild-flowers). These features were particularly appreciated by people who visit cemeteries for nature reasons, older people, and women. Nature sounds, in particular bird songs and calls [74], but also from other animal taxa as orthopteran sounds [75] are the type of natural sounds that are associated with perceived stress recovery and attention restoration in different cultural contexts. It is likely that the cemetery feature hearing animals and quietness are connected. Clearly, nature sounds can be more heard with lower surrounding noise, but nature sounds in combination with sights of vegetation can also mitigate how people perceive surrounding noise [76]. Along these lines, Nordh et al. [17] showed that people experienced the surrounding traffic noise in cemeteries quieter than the actual decibel level on-site. The researchers showed in this context also the pleasure of hearing bird songs in cemeteries [17].

Our study is to our knowledge the first study that shows also the appreciation for seeing wildlife in cemeteries. These results reveal an interesting, yet still unexplored research direction for urban cemeteries given that wildlife-inspired awe and wonder can foster transcendental and spiritual experiences and well-being [63]. The appreciation for (old) trees was expected given their aesthetics and shade provision [19,48]. That the appreciation for vegetation increased with the age of the participants could be related to the associated ecosystem services that are particularly relevant for the elderly. Shade provision in old parks has been shown to benefit older people [77] which are particularly vulnerable to hotter conditions in urban areas [78,79].

Visitors who go in cemeteries to mourn and older people appreciated structure features; as did participants who rated themselves as faithful, although that seems obvious (e.g., buildings for prayers). While it seems that visitors who go in cemeteries to mourn and visitors who go in cemeteries to enjoy nature, appreciate opposite features (i.e., vegetation and structure), we see here an opportunity to meet different needs in urban cemeteries with differently maintained areas with nature (including meadows and wild areas) and structure (graves and monuments).

#### 4.3. Indicated Tolerance for Dead Trees as Wilderness Element

Enhancing wilderness elements in urban greenspaces is a promising approach to support biodiversity conservation and a range of social functions in cities [31,80]. We thus tested whether the presence of a dead tree, a key wildness element, changes preferences for differently maintained cemetery areas. Surprisingly, the participants rated the tree pairs of photo stimuli with and without a dead tree similarly. This was unexpected because wilderness elements that were related to dead wood were found to be less liked in other landscape settings [49,81]. Dead trees are often associated with safety issues [81], and the dead tree could be perceived as hazard issue for visitors in our study as well. Our study thus suggests that the integration of dead tree stems is at least tolerated in urban cemeteries. This has important management implications because dead trees provide important habitats for many taxa including fungi, flora, and fauna (e.g., bats and birds), including endangered species [39–41]. At the same time dead tree trunks should be included in regular controls for standing stability to exclude hazard issues.

#### 4.4. Preferences for Differently Maintained Green Areas

In cemeteries in Berlin, differently vegetated areas are usually associated with the gravesites, ranging from intensively maintained lawns to meadows and to wild areas on abandoned parts of cemeteries. Previous studies revealed that the fascination of the beauty of cemeteries was driven by flowers, trees, graves, but also the level of maintenance and general order [17]. Our study illustrates significant differences in preferences among differently vegetated—and maintained—green environments of cemeteries. The participants preferred meadows to wild areas and the latter to lawns. These preferences were significantly related to the participants' background. People who mentioned that they visit cemeteries for nature experiences showed high preferences for meadows and wild areas, but these areas were less preferred by visitors who go in to cemeteries to mourn, older (>75 years) and male participants. Religious faith provided mixed results on preferences—as in studies from different cultural and geographic contexts. In a South African study, nature-related preferences were shown to differ between religious affiliations [25], differently from a Lebanese study where no differences of preferences in cemeteries was found between religious backgrounds [26].

The high appreciation for meadows reinforces earlier findings about the attractiveness of this vegetation type in urban parks [52,82]. The development phase of the meadow and the associated flowering aspect are important for the attractiveness of meadows compared to lawns. In an English study, richly flowering meadows were clearly preferred to lawns [82]. In a pan-European study showing a low-flowering late-summer aspect of meadows, however, participants slightly preferred lawns over meadows [83]. Therefore, it is a surprising result that the moderately flower-rich cemetery setting with meadows was clearly preferred over lawns. This suggests a preference for less intensely maintained green cemetery areas in Berlin. However, we could not determine a possibly confounding influence of the different tree configurations in the photo stimuli for lawns and meadows.

The high appreciation for wild areas might appear first as a contradiction to studies from Oslo, Norway [17]; Beirut, Lebanon [26]; and London, UK [16] in which visitors appreciate cemeteries with tidy appearance, that are well-managed, and with visible stewardship, since stewardship and care indicate human presence [45] and safety [84] while dense vegetation can evoke fear of crime [85]. However, the appreciation for wild areas was mostly driven by the reason to visit cemeteries for nature experiences.

Hence, similar as for the cemetery features (vegetation and structure), visit reasons need to be taken into account and clearly, there is no 'one size fits all' management strategy for green areas on urban cemeteries. In other words, while visitors who go to cemeteries to mourn or because of historical interest might appreciate wild areas less, these wild areas are appreciated by visitors who go to cemeteries to experience nature. Also, it is unclear whether the fairly high rating for wild areas was influenced by the COVID-19 pandemic. The survey took place three months into the pandemic, a period that has been found to

influence preferences for green areas [86]. In any case, higher levels of urban wilderness that can be accepted by city dwellers can help to counteract the increasing alienation from nature and also create additional habitat for animal and plant species.

#### 4.5. Appreciation of Comforting Experiences in Cemeteries

Understanding the link between biodiversity and spiritual experiences and well-being is still a fairly understudied, yet crucial topic [63]. While cemeteries are acknowledged to contribute to cultural ecosystem services through spirituality and religion [87] and that urban sacred sites provide important ecosystem services in enhancing spiritual satisfaction [25], little is known about the specific factors that drive these benefits. We found that the item ‘overgrown graves bring me close the cycle of life’ had the highest ratings followed by the item ‘old trees help me to cope with my grief’. Both items include plants and a comforting experience that is acknowledged to occur in cemeteries (e.g., reflecting on life [17]). People who visited cemeteries for nature reasons were positively associated with all four items that might be a reflection about their connection with natural elements.

The more surprising findings were that people who visit cemeteries for mourning were positively associated with comfort in their grief that they experience from old trees. The item focusing on old trees was also related to religious faith and aligns with previous studies. De Lacy and Shackleton [25] found that the presence of deciduous trees would remind the faithful that their life would also come to an end with leaves being away over winter but would also remind them about the spiritual afterlife with the re-sprout of deciduous trees in spring. De Lacy and Shackleton [25] also showed a positive relationship between spiritual satisfaction and the basal area of woody plants; indicating that large trees might be more important than having many trees. Along these lines in relation to trees, Williams and Harvey [88] investigated how different qualities of forests influence spiritual experiences. They found that people who visit forests associated tall trees, extensive views, or high waterfalls with spiritual feelings of insignificance and humility whereas settings with more open characters fostered feelings of connectedness and belonging. Hence, our findings also show the importance of old trees in cemeteries and their role to provide comfort for people who visit cemeteries to mourn as well as for natural reasons.

Also surprising in this context was that people who visit cemeteries for historical interest were positively associated with the item that overgrown graves bring them closer to the cycle of life. This expands on Nordh et al.’s [17] findings that people who visit cemeteries for historical interest appreciate the experience and reflection on past times; in this case reflected in the ‘cycle of life’. Women were more associated with all four items and religious faith showed predictive potential on three of the four items. Interestingly, people who rated themselves as moderately faithful showed the strongest relationship with the comforting items. This can indicate that people who consider themselves strongly associated with a religion could require other or additional features for comforting experiences. While transcendental and spiritual experiences in relation to biodiversity are influenced by cultural beliefs and the practices of people [63], we did not explicitly ask for participants’ beliefs or religious affiliation.

The topic of biodiversity and spiritual health and well-being is gaining increasing interest given the potential of spirituality for restoration [63,89]. Cemeteries provide the ideal place to explore this link between biodiversity and spiritual health and well-being. Cemeteries are ‘green lungs’—places where people can get a mental break from their everyday life [17]. Cemetery visits can also foster spirituality [17] and spiritual values and taboos that are associated with sacred natural sites can help to preserve biodiversity through, for instance, protecting natural vegetation that is dedicated to local deities, protecting old growth forests and tree species, and maintaining greater habitat heterogeneity due to sacred grottos and water sources (see review by Irvine et al. [63]). Hence, besides the positive effect of biodiversity on spiritual health and well-being, there is also a feedback loop since spirituality can also positively influence biodiversity conservation. Our study shows that it

is not nature per se that benefits humans, but that it is useful to understand which natural elements in particular contribute to spiritual health and well-being.

## 5. Conclusions

Cemeteries are culturally protected sacred sites in cities globally that meet different societal needs and often harbor high biodiversity. To harness the potential of cemeteries as urban green infrastructure, stakeholders need to understand why people visit cemeteries and which features of cemeteries they prefer. Clearly, while natural features were the most preferred features of Berlin's cemeteries, the preferences were influenced by visit reason and socio-demographic factors. These results show that urban planners and cemetery managers have the possibility to address different societal needs in urban cemeteries while contributing to the conservation of urban fauna and flora. As we show, people visit cemeteries for different reasons and this mediates their preferences for green areas, cemetery features, and even how they benefit from comforting experience with nature.

We argue that developing cemeteries for biodiversity and people at the same time is possible by complementing areas where cultural structures (e.g., burial fields, monuments, chapel) prevail with areas where biodiversity can flourish with natural elements. The evidence that the participants in our study seem to tolerate the presence of an old, dead tree in differently maintained green spaces suggests a promising way to achieve a higher level of wilderness in all parts of a cemetery. As in other cases, it is worth combining urban wilderness promotion with the establishment of 'orderly frames' providing 'cues to care' in wilder parts of urban greenspaces [47]. A generally raised wilderness level can meet with acceptance if information is provided about the associated benefits for nature [83].

Urban cemeteries provide the potential to maintain and foster urban flora and fauna [28] and we show in our study how people in Berlin appreciate this nature in cemeteries. Further investigating the link between biodiversity and psychological and/or spiritual well-being and comfort that people have in visual or auditory experiences or other senses with nature elements in cemeteries would provide an interesting future avenue to explore.

Instead of a 'one size fits all' strategy for the entire cemetery area, our study supports an approach to meet different needs by developing differently maintained sections for people, which in turn supports different components of biodiversity. We conclude that considering people with different preferences and reasons to visit is a promising way to promote urban cemeteries as shared habitats for people and nature.

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**Institutional Review Board Statement:** There were no institutional requirements for ethical clearance. However, the survey was undertaken in accordance with the General Data Protection Regulation (GDPR) of the European Union. A consent form was provided to participants ensuring their anonymity, information about the general aim of the study, data that will be collected, contact and that there would be no disadvantages for participants if they resign from the study at any stage of their participation. Participants had to agree to this consent form before they could start the survey.

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** The data is made available at Harvard Dataverse (<https://doi.org/10.7910/DVN/FVNOA1> accessed on 12 July 2022).

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**Conflicts of Interest:** The authors declare no conflict of interest.

## Appendix A

**Table A1.** Overarching cemetery features that were derived from an exploratory factor analysis (EFA) with varimax rotation. The standardized loadings (pattern matrix) are based upon correlation matrix.

	Nature (Component 1)	Wildlife (Component 2)	Structure (Component 3)	Leisure (Component 4)	Solitude (Component 5)
Wild flowers	0.73				
Hedge	0.68				
Wilderness	0.62				
Old tree	0.61				
Nature sounds		0.68			
Wildlife		0.66			
Chapel			0.72		
Monument			0.51		
Lawn				0.53	
Shadow				0.44	
Quietness					0.55
Few people					0.48

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