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Effects of nature contact on children's willingness to conserve animals under rapid urbanization

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ABSTRACT

Wildlife conservation requires public support. Growing evidence has suggested that childhood nature experience plays an essential role in forming one's environmental commitment. Yet, the link between nature contact and children's willingness to conserve wild animals has been examined little, especially for children from developing countries. Here, we conducted a questionnaire survey of school children from 4th to 5th grade and investigated their knowledge, likeability of species, and willingness to conserve wild animals, as well as the associations between nature contact (direct and indirect forms) and these outcomes. A total of 842 students at six primary schools in Nanning, Southern China, participated in the survey. Results showed that children's willingness to conserve wild animals was positively associated with both direct (time spent outdoors) and indirect (watching natural programs or reading natural books) nature contact frequency, their knowledge of species, and their likeability of species. Moreover, children's knowledge and likeability of species were also positively associated with nature contact frequency (direct and indirect forms). Therefore, wildlife conservation would benefit from environmental education and child care policies that enable children to spend time outdoors and learn about nature in multiple ways.

1. Introduction

Human activities have globally degraded various ecosystems, threatening the existence of biodiversity (WWF, 2020). As a result, wildlife conservation requires a positive change in human behavior (Nielsen et al., 2021; Schultz, 2011). Environmental psychologists have suggested that childhood nature experience is essential in forming one's environmental commitment (Chawla, 2007; Evans et al., 2018). Childhood participation with nature appears to influence one's pro-environmental attitudes and behaviors across the life span (Rosa et al., 2018; Wells and Lekies, 2006). Therefore, engaging children with nature-related activities and enhancing their bond with nature might help foster environmentally responsible citizens and support wildlife conservation.

Unfortunately, because of the continuous urbanization process, children are spending less time outdoors and are increasingly disconnected from nature (Larson et al., 2018; Soga et al., 2018; Soga and Gaston, 2016). The loss of nature experience could impair children's well-being, as well as their concern for nature (Chawla, 2015, 2020; Jimenez et al., 2021). The biophilia hypothesis states that human has an innate love of life and living systems (Wilson, 1984). So far, the evidence has suggested that biophilia is learned and experiential (Simaika and Samways, 2010; Soga et al., 2020). Consequently, the loss of nature experience might result in children's indifference to nature because of the widening gap between them and the natural world (Pyle, 1993). If children are continuously away

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from nature, they wouldn't be able to value it or invest in its conservation (Miller, 2005).

Nature contact, sometimes denoted as nature experience, varies by spatial scale, proximity, and the sensory pathway through which nature is experienced (Frumkin et al., 2017; Hartig et al., 2014). For example, nature contact can be identified as direct and indirect ones differing in the presence of natural elements. Direct nature contact includes various nature-related activities such as camping, hiking, or watching birds. Indirect contact could happen without the presence of physical natural elements. It can consist of activities such as watching natural programs, reading natural books, or viewing pictures of nature. In recent years, some studies have investigated the impact of indirect nature contact on children's environmental attitudes. Several research indicated that there is a positive correlation between the two (Duerden and Witt, 2010; Soga et al., 2018). While some research suggested that indirect nature contact did not affect children's environmental attitudes by itself (Braun and Dierkes, 2017; Collado et al., 2020). For example, by comparing the pre-and post-intervention results, a study found that participation in traditional environmental education (i.e., indoor curriculum without direct nature contact) did not affect children's environmental attitudes or behaviors (Collado et al., 2020).

A growing body of research suggests that knowledge and the likeability of wildlife (i.e., like or dislike a specific species) play an important role in predicting one's conservation attitudes (Jacobs et al., 2012; Liordos et al., 2018). For example, a study conducted with primary school students indicated that students were inclined to conserve arthropods with the knowledge of arthropod's role in ecosystems (Cornelisse and Sagasta, 2018). Individuals' willingness to donate for conservation was found strongly correlated with their preference toward specific species (Martín-López et al., 2007). Accordingly, some studies have included knowledge and the likeability of species as explanatory variables to understand how nature contact affects people's attitudes toward wildlife and its conservation (Hosaka et al., 2017; Mohamad Muslim et al., 2018; Torkar et al., 2010). For example, a study from China indicated that nature contact positively affected children's willingness to conserve wild animals by enhancing their biophilia and reducing their biophobia (Zhang et al., 2014). Moreover, a study from Japan indicated that both direct and indirect nature contact were positively associated with children's willingness to conserve biodiversity, mediated by their affective attitudes toward wildlife species (Soga et al., 2016). When investigating the relationships between nature contact and knowledge of species, the results varied between studies. In many cases, frequent nature interactions were positively related with children's knowledge of species (Fančovičová and Prokop, 2011; Randler, 2010; Sampaio et al., 2018). For example, a study of urban children revealed that contact with an urban forest granted greater knowledge of the native animals (Sampaio et al., 2018). Similarly, a study from German indicated that both the frequency of walking in nature and reading books/journals about animals were correlated with species knowledge (Randler, 2010). While sometimes nature interactions fail to improve children's knowledge of wildlife as well (Mulder et al., 2009). Regarding the relationship between knowledge of species and conservation attitudes, there are also variations between studies. Many studies indicated a positive correlation between knowledge of species and conservation attitudes (Liordos et al., 2018; Torkar et al., 2010), but some suggested that this relationship differed among specific species (Prokop and Tunnicliffe, 2008).

Despite consistent evidence suggesting a positive link between direct nature contact and pro-environmental actions, the relation between indirect nature contact and one's conservation attitudes has been examined little, especially for children from developing countries (Soga et al., 2016). Furthermore, the processes behind this relation are still unclear. Thus, this study aimed to investigate the link between nature contact (direct and indirect forms) and children's willingness to conserve wild animals, as well as to understand the potential effects of species knowledge and likeability in this relationship. We focused on locally common animals in the current study because children can frequently encounter these animals when interacting with nature and their attitudes to this group of animals are more likely affected by nature interactions (for a similar approach, see Cornelisse and Sagasta, 2018; Soga et al., 2016). By conducting a questionnaire survey of elementary school students, we examined the following hypotheses: 1) children's willingness to conserve wild animals was positively associated with frequent nature contact (direct and indirect), knowledge of species, and the likeability of species; 2) the knowledge of species was positively associated with frequent nature contact; 3) the likeability of species was also positively associated with frequent nature contact. The gender difference in children's willingness to conserve wild animals was also considered because people's attitudes toward animals differed between genders (Kellert and Berry, 1987). We expected that such knowledge would help to inform effective decision-making and motivate positive actions in wildlife conservation.

2. Methodology

2.1. Participants and procedure

The questionnaire survey was conducted in Nanning, the capital of Guangxi Zhuang Autonomous Region, Southern China (108°22 'E, 22°48' N). Currently, the city is undergoing rapid urbanization. By 2019, Nanning had an urban population of 2,414,700 people (60.7 % of the city's total population) and covered 9947 ha, of which 865 ha were urban areas. Compared to 2014, the urban population of Nanning has risen by 19.3 %, and the metropolitan area has grown by 2.9 % (Guangxi Statistical Bureau, 2019). As a result, greenspace coverage of the city is 34.3 % in urban areas but varies between districts (Nanning Statistical Bureau, 2020). Students from 4th to 5th grade of six primary schools within different city regions participated in the survey. Children's participation was first certified and approved by principals within each school and then consented by themselves before surveys. No identifiable information was required on the survey. Therefore, neither formal ethics approval nor written consent from parents was required. In May 2021, a total number of 842 valid responses were collected.

The survey was conducted via structured questionnaires within each class (approximately 45 min) under the supervision of the same researcher. We gave a standardized oral introduction of the project in addition to the written instructions on the questionnaire. Students' answers to items of each species were filled by themselves after viewing the animal pictures on digital screens.

2.2. Questionnaire design

We designed a questionnaire addressing the following topics: 1) children's nature contact frequency (direct and indirect forms), 2) the knowledge of species, 3) the likeability of species, 4) and the willingness to conserve wild animals (see details in Appendix A).

We selected 24 locally common species in Nanning, differing in physical size, evoked emotions, and trophic and taxonomic positions to understand children's attitudes toward conserving wild animals. Our final dataset included six insects, two arachnids, two amphibians, four reptiles, six birds, and four mammals (Appendix B).

2.3. Measures of direct and indirect nature contact frequency

Direct nature contact (time spent outdoors) was measured on two items: 1) children's weekly spent hours in school green spaces over the last year, 2) children's weekly spent hours in other green spaces (e.g., community parks, forest parks) over the last year, both items were assessed based on children's self-report. Two items were then combined to indicate children's direct nature contact frequency.

Indirect nature contact was confirmed according to the frequency of watching natural programs or reading natural books over the past year. Responses were scored on a four-point scale (1 = never, 2 = seldom, 3 = sometimes, 4 = often). This item was dichotomized when fitting the models to enable comparability across groups. Responses of never or seldom were scored as 0 for infrequent contact, whereas responses of sometimes or often were scored as 1 for frequent contact.

2.4. Measures of knowledge, likeability, and willingness

Three questions representing basic facts about the species' biology measured knowledge of each species. Respondents were required to report honestly to each question ('Yes, I know.' or 'No, I don't.'). Each question counts for one point. Therefore, the knowledge score of each species ranged from 0 to 3 (students answered 'Yes, I know.' for none to three questions).

The likeability of species was assessed by asking respondents, 'Do you like this animal?'. Responses were scored on a five-point scale (− 2 = strongly dislike, − 1 = dislike, 0 = not sure, 1 = like, 2 = strongly like).

Willingness to conserve wild animals was assessed by asking respondents, 'Are you willing to protect this animal?'. Responses were scored on a five-point scale (− 2 = strongly unwilling, − 1 = unwilling, 0 = not sure, 1 = willing, 2 = strongly willing).

2.5. Data analysis

All analysises were applied using R 4.0.5 (R Core Team, 2021). To examine the relationships between nature contact and willingness to conserve wild animals, a linear mixed-effects model (LMM) was applied using the 'lmer' function in the 'lme4' package (Bates et al., 2015). In the model, children's willingness to conserve wild animals was used as a response variable. Nature contact frequency (direct and indirect), knowledge of species, and the likeability of species were used as explanatory variables. Gender was also included as an explanatory variable to control for its potential confounding effects. The school and species were fitted as the random effects to exclude the confounding factors associated with schools (e.g., the school locations, the school, and its neighboring green space coverage) and animal species (e.g., children's emotions to certain species such as spider phobia). Significance of the random effects was analyzed using the 'ranova' function in the 'lmerTest' package (Kuznetsova et al., 2017).

To examine whether nature contact was associated with knowledge and likeability of species, two LMMs were fitted with knowledge of species and the likeability of species as response variables, respectively. For each model, nature contact frequency (direct and indirect) and gender were fitted as explanatory variables, and the school and species were fitted as the random effects.

As well as for the overall 24 species, we also applied LMMs for different groups of animals to understand the influencing factors of children's conservation attitudes toward various species. We grouped the 24 wild animals based on their knowledge, likeability, and willingness scores, using the hierarchical cluster technique with the Average linkage method. The cluster analysis was performed using the 'hclust' function, and the number of clusters was determined using the 'NbClust' package (Charrad et al., 2014).

3. Results

3.1. Direct and indirect nature contact frequency in children's daily life

Children's direct nature contact (time spent outdoors) was 5.43 ± 0.16 (mean ± se) hours of the total green spaces, of which 2.40 ± 0.09 h were spent in school green space, the other 3.15 ± 0.11 h were spent in other green spaces (Appendix C). Though girls tended to spend more time in visiting both school and the other green spaces, the differences were not significant between genders (ANOVA, $F = 0.108$, $p = 0.743$ for total greenness; $F = 0.182$, $p = 0.67$ for school greenness; $F = 0.403$, $p = 0.526$ for the other greenness). For indirect nature contact (natural programs watching and/or natural books reading), most respondents (84.3 %) reported often or sometimes watching natural programs or reading natural books (Appendix D). Only 2.8 % of the respondents reported never doing such things. Again, there was no difference between genders in indirect contact frequency ($F = 1.098$, $p = 0.295$).

3.2. Effects of nature contact on knowledge, likeability, and willingness

The results of LMMs indicated that willingness to conserve wild animals was positively associated with the direct nature contact frequency ($p = 0.006$), indirect nature contact frequency ($p < 0.001$), knowledge of species ($p < 0.001$), and the likeability of species ($p < 0.001$) (Table 1). Moreover, the knowledge of species was positively associated with both direct ($p < 0.001$) and indirect ($p < 0.001$) nature contact frequency (Table 1). The likeability of species was also positively associated with the direct ($p = 0.015$) and indirect ($p < 0.001$) nature contact frequency (Table 1). Girls showed higher scores in willingness to conserve wild animals than boys ($p < 0.001$).

3.3. Subgroup analysis

The mean scores indicated that children's knowledge, likeability of species, and willingness to conserve wild animals were distinct among species. With hierarchical cluster analysis based on knowledge, likeability, and willingness scores, 24 species were classified into four main groups: Cluster 1 (Little Egret, Common Kingfisher, Red-bellied Tree Squirrel), Cluster 2 (Crested Goshawk, Collared Scops Owl, Asian Swallowtail, Common Blackbird, Cabbage White, Common Moorhen, Chinese Mantis, Oriental Garden Lizard, Spot-legged Tree Frog, Asian Grass Lizard, Common Shrew, Stick Insect, Brown Rat, Chinese Ratsnake, Fruit Bat, Dung Beetle), Cluster 3 (Chinese Cobra), Cluster 4 (Large Green Chafer Beetle, Cane Spider, Asian Common Toad, Giant Golden Orb Weaver) (Fig. 1). Cluster 1 included three species that children were familiar with, fond of, and willing to protect. Cluster 2 included 16 species that received middle levels of knowledge, likeability, and willingness scores. Cluster 3 included one species that children were familiar with but unwilling to protect. Finally, cluster 4 included four species that received low levels of knowledge, likeability, and willingness scores.

The LMMs fitted within each animal group showed that children's willingness to conserve wild animals was positively associated with indirect nature contact, knowledge of species, and the likeability of species (Table 2). Among Cluster 2 and Cluster 4, willingness was also positively associated with the direct nature contact frequency. In addition, girls showed higher willingness scores to conserve species for each animal group.

4. Discussion

Our results demonstrated that children's willingness to conserve wild animals was positively associated with both direct and indirect nature contact frequency, knowledge of species, and the likeability of species. Direct nature interactions have often been considered as an essential way to build children's connection with and care for nature (Cheng and Monroe, 2012; Mayer and Frantz, 2004; Nisbet et al., 2009). The current study has supported this positive relation in wildlife conservation scenarios (i.e., children who spent more time outdoors showed a higher willingness to conserve wild animals). Moreover, the identified positive correlation between indirect nature experience and willingness to conserve wild animals suggested that vicarious experiences such as reading natural books and/or watching natural programs may also encourage positive conservation attitudes (Soga et al., 2016). Therefore, environmental education and policies that enable children to spend time outdoors and learn about wildlife in multiple ways (e.g., experiential learning in the natural environment) would likely benefit wildlife conservation from the human dimension (Cheryl et al., 2018).

Knowledge and the likeability of species are considered two important predictors of people's attitudes toward wildlife and their support for its conservation (Jacobs et al., 2012; Lundberg et al., 2019; Wilson and Tisdell, 2005). This study has found a positive correlation between the increases in knowledge of species and a higher willingness to conserve them as well as a positive correlation between the likeability of species and a higher willingness to conserve them, a finding similar to other studies (Liordos et al., 2018,

Table 1
Parameter estimates and *P*-values for three linear mixed-effects models.

Response variables	Explanatory variables	Estimate	± SE	t value	P
Willingness to conserve wild animals	Schools (random intercepts)				< 0.001
	Species (random intercepts)				< 0.001
	Gender (Boys/Girls)	-0.239	0.034	-7.058	**< 0.001**
	Direct nature contact	0.011	0.004	2.739	**0.006**
	Indirect nature contact (frequent/infrequent)	0.217	0.046	4.748	**< 0.001**
	Knowledge of species	0.111	0.006	17.803	**< 0.001**
	Likeability of species	0.821	0.005	151.813	**< 0.001**
Knowledge of species	Schools (random intercepts)				< 0.001
	Species (random intercepts)				< 0.001
	Gender (Boys/Girls)	-0.123	0.045	-2.69	0.07
	Direct nature contact	0.033	0.005	6.19	**< 0.001**
	Indirect nature contact (frequent/infrequent)	0.823	0.061	13.472	**< 0.001**
Likeability of species	Schools (random intercepts)				< 0.001
	Species (random intercepts)				< 0.001
	Gender (Boys/Girls)	-0.083	0.051	-1.64	0.101
	Direct nature contact	0.015	0.006	2.436	0.015
	Indirect nature contact (frequent/infrequent)	0.885	0.071	12.499	**< 0.001**

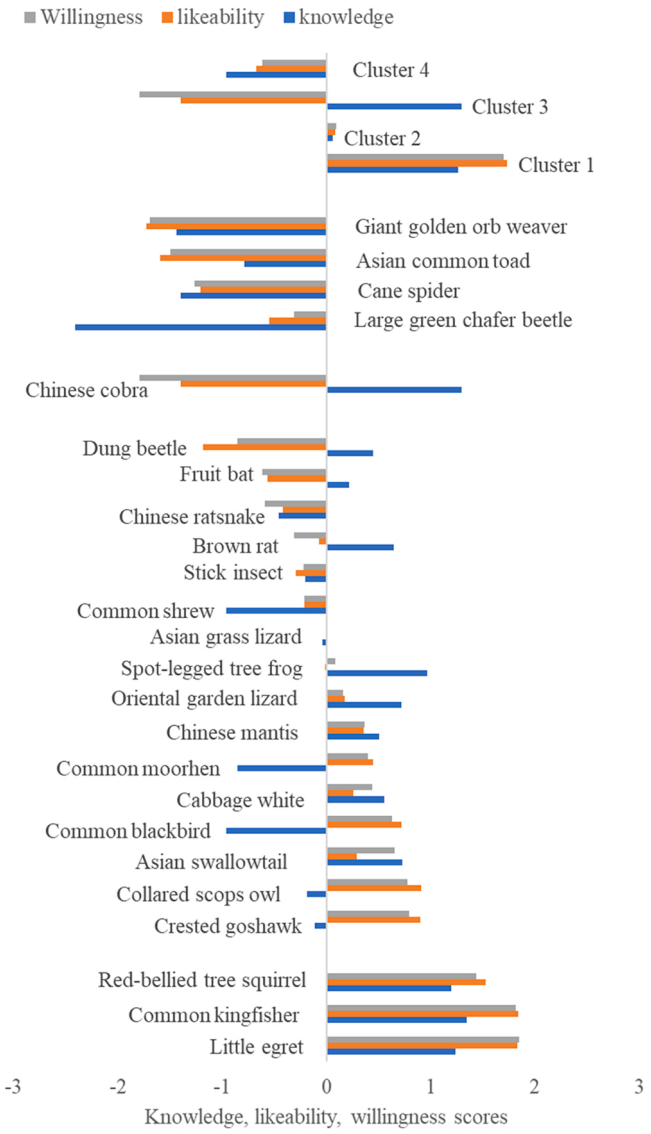

Fig. 1. Respondents' knowledge, likeability, and willingness scores (standardized values) for 24 species and four clusters (averaged values). Species classification (Cluster 1–4) were based on hierarchical cluster analysis (see also Appendix E).

2020). Furthermore, we have also confirmed positive relationships between nature contact (direct and indirect) and children's knowledge of species, and nature contact and children's likeability of species. Thus, frequent nature contact was also likely to interact with positive conservation attitudes indirectly. Our results highlighted the importance of nature interactions in forming and fostering positive attitudes toward nature and conservation as precious research (Chawla, 2007; Cheng and Monroe, 2012). Therefore, urban planning policies should be dedicated to creating nature-rich cities to benefit people and nature.

Results of the cluster analysis indicated that direct nature interactions are not always related to children's willingness to support species conservation. This difference among animal groups could happen for distinct reasons. As for species in Cluster 1, the non-significant correlation between direct nature contact and willingness could be due to children's high willingness to conserve these animals. As for Cluster 3 (Chinese Cobra), the non-significant correlation might result from children's fear of snakes (Isbell, 2006; Prokop et al., 2009). As frequent nature interactions are likely to lead to a higher chance of encountering a serpent, children who spent more time outdoors may not wish for such encounters. Thus, when addressing specific species conservation, species-related traits and people's emotions should be considered (e.g., snake phobia, spider phobia) for better conservation outcomes (Prokop and Randler, 2018; Prokop and Tunnicliffe, 2008). Despite this, engaging children with nature-related activities still would benefit most species.

Gender has been indicated as an important factor in predicting people's attitudes to wildlife and its conservation (Teel and Manfredo, 2010; Zinn and Pierce, 2002). In this study, we found that female students had a higher willingness to conserve wild animals than males. This might be explained by the gender difference in attitudes toward wild animals. Generally, females tend to hold a

Table 2
Parameter estimates and *P*-values for linear mixed-effects models fitted within each cluster.

Response variable	Clusters	Explanatory variables	Estimate	± SE	t value	P
Willingness to conserve wild animals	Cluster 1	Schools (random intercepts)				0.332
		Species (random intercepts)				0.621
		Gender (Boys/Girls)	-0.083	0.023	-3.558	**< 0.001**
		Direct nature contact	0.003	0.003	1.256	0.209
		Indirect nature contact (frequent/infrequent)	0.098	0.031	3.159	**0.002**
		Knowledge of species	0.052	0.015	3.354	**< 0.001**
		Likeability of species	0.668	0.015	45.672	**< 0.001**
	Cluster 2	Schools (random intercepts)				< 0.001
		Species (random intercepts)				< 0.001
		Gender (Boys/Girls)	-0.128	0.015	-8.614	**< 0.001**
		Direct nature contact	0.006	0.002	3.695	**< 0.001**
		Indirect nature contact (frequent/infrequent)	0.199	0.020	9.777	**< 0.001**
		Knowledge of species	0.073	0.008	9.253	**< 0.001**
		Likeability of species	0.662	0.007	98.935	**< 0.001**
	Cluster 3	Schools (random intercepts)				1
		Gender (Boys/Girls)	-0.228	0.083	-2.738	**0.006**
		Direct nature contact	0.013	0.010	1.346	0.179
		Indirect nature contact (frequent/infrequent)	0.227	0.114	1.987	**0.047**
		Knowledge of species	0.144	0.049	2.927	**0.004**
		Likeability of species	0.707	0.028	24.973	**< 0.001**
	Cluster 4	Schools (random intercepts)				0.002
		Species (random intercepts)				0.043
		Gender (Boys/Girls)	-0.202	0.035	-5.835	**< 0.001**
		Direct nature contact	0.012	0.004	2.923	**0.004**
		Indirect nature contact (frequent/infrequent)	0.247	0.047	5.206	**< 0.001**
		Knowledge of species	0.069	0.016	4.272	**< 0.001**
		Likeability of species	0.694	0.015	46.758	**< 0.001**

greater concern for animal welfare, and they are more wildlife protection-oriented than males (Kellert, 1984; Kellert and Berry, 1987).

While we found a positive correlation between nature contact and willingness to conserve wildlife of children in Southern China, before it could be extended to other settings, studies in different population groups and within distinct cultures should be applied for generalization. Also, there are limitations of the current study and future works would benefit by addressing these shortcomings. First, the scale and instruments we used here are not standardized measures. For example, we used the weekly outdoor time as an indicator of direct nature contact, while some research suggested that other factors such as the intensity of nature interactions and the specific activities children engaged in may also impact their attitudes toward nature and conservation (Collado et al., 2015). Therefore, further work would benefit from including factors like types of nature-based activities and intensity of nature contact to understand what kind of nature experiences and how frequent nature contact is enough to foster positive conservation attitudes. Also, studies that apply different measurements and scales are needed to confirm the relationships we tested. Second, we only measured children's willingness to conserve wild animals in the current study. Previous research suggested that people's willingness and behavior are connected but can be affected by various factors such as personal skills, habits, and perceived costs and benefits (Heimlich and Ardoin, 2008; Steg and Vlek, 2009). Thus, studying the effect of nature contact on personal conservation behaviors would further benefit conservation efforts. Third, this study only tested the correlations between nature contact and willingness to conserve wild animals. More elaborate tests of the causal direction would help to improve our understanding of the effects of nature contact on conservation attitudes.

5. Conclusion

In summary, the present study investigated the relationship between nature contact and children's willingness to conserve wild animals as well as the potential effects of their knowledge and likeability of species in this relation. Results indicated that both direct and indirect nature contact were positively associated with children's willingness to conserve wild animals. The knowledge of species and the likeability of species were also positively associated with willingness to conserve them. These findings suggested that it is important to foster environmentally responsible citizens, engaging children with nature-related activities and enhancing their knowledge and likeability of species in multiple ways. Urban planning and development policies should be dedicated to creating nature-rich cities that include parks and forests for the benefit of people and nature, especially when the world is undergoing rapid urbanization (Cheryl et al., 2018).

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability

Data will be made available on request.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.gecco.2022.e02278.

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