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RESEARCH ARTICLE

Compassion and the perceived rarity of plants can increase plant appreciation

Pavol Prokop[1,2] | **Kristína Belzárová**[3] | **Ivana Tomanová Čergeťová**[4]

[1]Department of Environmental Ecology and Landscape Management, Faculty of Natural Sciences, Comenius University, Bratislava, Slovakia

[2]Institute of Zoology, Slovak Academy of Sciences, Bratislava, Slovakia

[3]Elementary School in Lozorno, Lozorno, Slovakia

[4]Department of Psychology and Pathopsychology, Faculty of Education, Comenius University, Bratislava, Slovakia

Correspondence
Pavol Prokop
Email: pavol.prokop@savba.sk

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Abstract

1. Plants have traditionally been perceived as "less alive" and less attractive than animals, posing challenges for conservation initiatives. Previous efforts to address Plant Awareness Disparity (PAD) mainly focused on cognitive aspects, neglecting the role of the affective domain.
2. In our study involving a sample of Slovak individuals, we explored whether plants evoke compassion similar to that for animals and non-living objects, and whether the perceived rarity of plants influences participants' willingness to pay (WTP).
3. Results showed that withered and water-stressed plants elicited compassion responses comparable to those for abused animals, whereas non-living objects (dilapidated buildings before reconstruction) received significantly lower compassion scores. Participants expressed a lower WTP for plants compared to animals or minerals. The perceived rarity of plants, animals and minerals was positively correlated with the increase in WTP. As predicted, WTP positively correlated with conservation attitudes.
4. Our findings highlight the potential to emphasize the affective domain and rarity in addressing PAD, both in science education lessons and conservation campaigns. This underscores the importance of recognizing and cultivating emotional connections with plants to enhance conservation efforts.

KEYWORDS
compassion towards plants, plant blindness, scarcity and conservation attitudes

1 | INTRODUCTION

Biophilia, a term coined by psychoanalyst Fromm (1964), is a combination of two words from ancient Greek: "bio" means life and philia means "love". Love of life (hereafter biophilia) was later popularized by Wilson (1984). Fromm (1964) conceptualized biophilia as a psychological orientation characterized by an attraction to all living entities and their vitality. Biophilia refers to human affinity towards animals, plants and natural landscapes. Unfortunately, despite the integral role that plants have played in human life throughout history, plants are often heavily neglected by humans. This ignorance and disregard for plants have prompted over two decades of intensive research into human perceptions of them.

Plant Awareness Disparity (PAD), formerly known as plant blindness, is a pervasive phenomenon characterized by the tendency not to notice plants within one's environment, leading to significant consequences for our understanding of the natural world (Burke et al., 2022; Parsley, 2020; Stagg & Dillon, 2022; Wandersee

& Schussler, 1999, 2001). PAD has four components (Parsley et al., 2022): attitude (disliking plants), attention (neglecting the observation of plant life), knowledge (not understanding plant life and its importance in ecosystems) and relative interest (finding plants less interesting than animals). In everyday life, PAD is widespread in the human inclination to overlook the importance of plants to our biosphere and human affairs, often exacerbated by the preference for recalling animal images over plant images due to the latter's lack of immediately observable motion (Richards & Siegler, 1984). Drastic reduction of botanical education (Stroud et al., 2022), synonymity of 'biology' and 'zoology' during the historical development of general biology courses further strengthened an inadequate representation of plants (Nichols, 1919; Stroud et al., 2022; Wandersee & Schussler, 2001). Research indicates that systematically addressing all dimensions of attitudes towards plants—affective, cognitive and behavioural—results in a more robust and enduring impact on attitude change than focusing on a single domain (Fazio & Zanna, 1981).

The implications of PAD extend beyond the classroom, affecting broader perspectives on the importance of plants in ecosystem functioning, environmental sustainability, public health and human survival on Earth (Burke et al., 2022; Parsley, 2020). Plants positively impact stress reduction and mental well-being (Fukano & Soga, 2024; Rozario et al., 2024; Simonienko et al., 2023). The mere exposure to plants and flowers enhances somatic and psychological health, reduces pain, decelerates systolic blood pressure and anxiety (Bratman et al., 2012 for a review) and increases prosocial behaviour (Zhang et al., 2014). To sustain the presence of plants in our lives for a sustainable future, fostering positive emotions towards them can enhance motivation and interact with human cognition (Fredrickson, 2001), ultimately leading to more favourable behaviours that support plant life.

The tendency to categorize plants into uniform green masses hampers the appreciation of their unique biological features, contributing to a skewed preference for animals (Amprazis et al., 2021; Balas & Momsen, 2014; Uno, 2009; Wandersee & Schussler, 1999, 2001). Animals are regarded as 'more alive' than plants because plants do not move around, among others (Guerra et al., 2024; Kinchin, 1999; Lindemann-Matthies, 2005; Lubbe & Castillo Alfonzo, 2024; Wandersee, 1986; Yorek et al., 2009). Human preferences for animals are reinforced by a visual perception bias, demonstrated by studies indicating that humans exhibit an attentional blink, detecting animals more efficiently than plants when images in rapid succession are shown (Balas & Momsen, 2014; Kanske et al., 2013; Zani & Low, 2022). However, these results, primarily based on cognitive tests, say little about the human capacity to develop positive emotions towards plants. Evolutionary pressures have favoured empathy and compassion for conspecifics, and the natural affinity to form bonds typical of social mammals has generalized to non-human animals (Serpell, 2015).

Harmful actions towards plants are often judged less severely than those towards animals (Collado & Sorrel, 2019). Differences in moral reasoning about animals further extend to plants, compromising their perception in comparison to autonomous and living beings (Melson, 2013). Miralles et al. (2019) suggested that plants receive less compassion and empathy from humans than animals because they are phylogenetically distant from humans. In contrast, animals are phylogenetically closer. Considering humans' enormous mental capabilities, this does not necessarily preclude their ability to form positive relationships with plants. It is, therefore, necessary to understand and cultivate emotional sensitivities towards plants that facilitate their mutual flourishing.

We define the affective domain as people's emotional and empathetic responses towards plants. Empathy and compassion are related but distinct emotional responses. Empathy is the ability to understand and share the feelings of another (Cuff et al., 2016). It involves perspective-taking and an emotional resonance with the experiences of others. Compassion, defined as a felt response to suffering that involves caring and an authentic desire to ease distress (Goetz et al., 2010), goes a step further than empathy, involving not just understanding but also a desire to alleviate the suffering of others. Compassion has been studied in human–animal relationships, whereas compassion towards plants received very little attention. However, research showed that human-directed compassion and empathy show little difference with compassion and empathy towards animals in adverse situations (Preylo & Arikawa, 2008; Westbury & Neumann, 2008). If compassion is driven by the desire to reduce other's suffering, including non-human animals, it is a promising avenue to increase interspecies compassion, including plants, not only animals.

A prominent factor that enhances interest in plants may be the human natural preference for rare and exceptional objects (John et al., 2018; Leibenstein, 1950). One prominent explanation is that rare objects increase the social status and/ or uniqueness of the object's owner (Fromkin & Snyder, 1980). As an illustration, Gierl and Huettl (2010) discovered that consumers held more favourable attitudes towards conspicuous goods when their scarcity was attributed to a limited supply rather than to a high demand. This is because individuals with possessions in limited supply can signal elevated social status in interpersonal relationships. Rarity also plays a role in human preferences for living organisms: humans show a stronger preference for rare or uncommon organisms (Christie et al., 2006; Hanley et al., 2003; Randler et al., 2023; Slone et al., 1997). Research in this field, however, is constrained to animals. Therefore, it is unclear whether the perceived rarity of plants can enhance people's interest in them.

Researchers made several important attempts to help mitigate at least some of the four components of PAD (Fančovičová & Prokop, 2011; Krosnick et al., 2018; Lohr & Pearson-Mims, 2005; Strgar, 2007; Ward et al., 2014), but their focus has largely been on cognitive domains. Compassion for plants may directly impact the affective component of PAD, while perceived rarity could influence the cognitive and behavioural dimensions.

In this study, we experimentally manipulated visual cues that evoke suffering in plants and compared participants' compassionate responses with those elicited by suffering animals and damaged to non-living objects. The choice to focus on compassion rather than empathy in this context is because compassion can be extended to a broader range of entities, including non-living objects. While it is difficult to empathize with a damaged building or car, as they do not have subjective experiences, one can still feel compassion and a desire to help or restore these inanimate objects. Compassion does not require the same level of emotional resonance as empathy, making it a more suitable construct for comparing responses to living and non-living entities. The focus on compassion, in this case, allows for a broader application beyond just living beings, which is essential for the comparison being made.

We combine standardized questionnaires based on individual ratings of items and self-reported behavioural observations based on visual material. Visual material is rated using a forced-choice paradigm to measure the affective domain in our study. Concerning the latter, we experimentally manipulated visual cues that evoke suffering in plants and compared participants' compassionate responses with those elicited by suffering animals and damaged non-living objects. Furthermore, we manipulate the perceived rarity of plants, animals and non-living objects to explore the cognitive aspects of people's relationships with plants.

We hypothesize that plants may not be perceived merely as non-living objects if compassion is triggered by suffering in plants. Instead, this opens avenues for research exploring emotional affinity towards plants to address PAD. Additionally, we manipulated the perceived rarity of plants to investigate whether the rarity itself could enhance participant's interest in plants. The same experimental manipulation was applied to animals and non-living objects to ensure that rare plants are either exceptionally prioritized or not compared to common ones. Presenting plants as rare rather than ordinary can enhance their perceived value, offering a potential avenue to alleviate PAD. Participant's nature connectedness was also examined to show whether preferences for plants could easily be explained by this variable rather than by experimental manipulations. We also investigated the potential correlation between the perceived value of plants and animals, as measured by willingness to pay (WTP), and conservation attitudes, measured by willingness to protect them. In addition, we also investigated whether real, unmanipulated rarity of animals and plants could influence their perceived value.

The primary objective of this study is to investigate the compassionate responses elicited by suffering in plants compared to animals and non-living objects. We are also examining how perceived rarity influences participants' interest in plants. This research aims to enhance understanding of emotional connections with plants and their potential implications for conservation efforts.

2 | METHODS

2.1 | Participants

The participants were $N=201$ Slovaks (157 women) between ages 15 and 65 years of age (mean = 34.7, SE = 0.73). Participants reported residing in all eight regions into which Slovakia is administratively divided. The majority of participants were from the Bratislava region ($N=61$, 30.35%), followed by the Žilina region ($N=34$, 16.91%) and the Trnava region ($N=23$, 11.44%). Most of participants (67%) were young adults aged 20 and 40 years. All participants were recruited through social networking sites, predominantly Facebook (7400 followers) and Instagram (31,000 followers) owned by the third author. Her social networks are focused mainly on mental health. Initially contacted participants were asked to further recruit volunteers from among their acquaintances, utilizing the snowball-sampling technique (Goodman, 1961). The age distribution and the female-biased ratio among our participants correspond to that of the population of Slovak Facebook users (Kowal et al., 2020). We invited individuals to participate voluntarily in our research project without disclosing specific hypotheses.

Because it was not possible to ask participants whether they are willing to protect minerals, as they are not formally protected like living organisms, we ran an additional survey to address the predicted association between WTP and conservation attitudes. The participants were $N=61$ Slovaks (38 women) between ages 16 and 58 years of age (mean = 32.7, SE = 1.45). Participants reported residing at seven out of eight regions into which Slovakia is administratively divided. The majority of participants were from the Bratislava region ($N=33$, 54.1%), followed by the Nitra region ($N=8$, 13.11%) and the Trnava region (N = 8, 13.11%). Most of participants (59%) were young adults aged 20 and 40 years. The majority of participants were first-grade psychology students from a mid-sized university in Slovakia.

All participants provided their informed consent at the beginning of the questionnaire. This research was approved by the Ethical Committee of Faculty of Natural Sciences, Comenius University (certificate no. ECH 19034).

2.2 | Research instruments

2.2.1 | Rarity

Whether the participants value the rarity of plants, animals and non-living objects was examined with 12 pictures downloaded from Google (see Supporting Information for full version of the questionnaire). To standardize the pictures, the background was removed, and the picture size was always the same. Each picture contained only one object. We used plants with flowers because they are attractive to people (Fančovičová et al., 2022; Hůla & Flegr, 2016). Two mammals and two birds were used as examples of animals because these taxa belong to most preferred by people (e.g., Fančovičová et al., 2021; Prokop & Randler, 2018). Finally, minerals were chosen as examples of non-living objects because they are attractive to people, and their value considerably varies (Altingoz et al., 2019). Four pictures represented each category (plants, animals, non-living objects). Two of the four pictures represented rare plants, and two pictures represented common plants, animals, or non-living objects (Table 1). Each picture contained brief information regarding the object's status (This plant/animal/gemstone is rare/common). Participants were asked how much they would be WTP for each object following Sundie et al. (2011): "Compared to the average human of your age, please indicate how much money you would want to spend on ______." Responses were provided on a 7-point scale (1 = much less than the average human, 4 = about average, 7 = much more than the average human). Summed scores for each category (hereafter treatment) were used for statistical analyses. The same procedure was repeated after participants filled out further parts of the questionnaire (below), but each picture presented as rare was now shown as common and vice versa. Cronbach alpha calculated for the first and the second rounds was high ($\alpha = 0.92$ and 0.94, respectively). All pictures in the first and second rounds were presented in random order.

2.3 | General compassion questionnaire

General compassion was examined with a 16-item compassion questionnaire developed by Pommier et al. (2020). Items were rated on a scale from 1 (almost never) to 5 (almost always). Five negatively worded items were scored in reverse order. For example, I pay careful attention when other people talk to me about their troubles; I like to be there for others in times of difficulty. The reliability of the scale was acceptable (Cronbach $\alpha = 0.78$). High scores mean high general compassion for other people. Confirmatory factor analysis (CFA) was conducted to assess the factor structure of the General Compassion Questionnaire (GCQ) and to examine the extent to which the items align with the theoretical framework proposed by Pommier et al. (2020). The four domains suggested by Pommier et al. (2020) served as the basis for the latent variable model in this analysis. These domains include Kindness, Common humanity, Mindfullnes and Indiference. The CFA model was specified accordingly, with each observed item loaded onto its respective latent factor based on the theoretical considerations of Pommier et al. (2020).

TABLE 1 List of plants, animals and gemstones used in the experiment.

Category	Rare	Common
Plants	*Dendrophylax lindedenii*	*Vanilla planifolia*
	Franklinia alatamaha	*Stewartia pseudocamellia*
Animals	*Panthera pardus orientalis*	*Puma concolor*
	Limosa haemastica	*Calidris pygmaea*
Gemstones	Kyawthiut	Tourmaline
	Grandidierite	Haematite

2.4 | Compassion towards plants, animals and non-living objects

A total of 12 pairs of pictures showing plants, animals and non-living objects (four pairs per treatment) were prepared by authors or downloaded from Google. We intended to show objects varying in perceived level of compassion. Each pair of plants were shown in a way that the same plant was photographed before (probably low compassion) and after water stress (probably high compassion) (Figure 1). Photographs of these species were used: *Spathiphyllum* sp., *Brugmansia arborea*, *Strobilanthes alternata* and *Capsicum annuum*. Water stress was defined here as the unavailability of water until the leaves of the plant wilted. Animals could not be manipulated in the same way, so we downloaded photographs of the same individuals of abused (probably high compassion) and cured dogs (probably low compassion).

Regarding non-living objects, we used pictures of dilapidated buildings before (probably high compassion) and after reconstruction (probably low compassion). Participants were asked to choose two pictures arousing greater compassion using the forced-choice method. Pictures which should arouse high compassion were given 1 point, while preference for low compassion was given 0 points. The reliability level was acceptable (Cronbach $\alpha = 0.71$).

2.5 | Nature relatedness

Nature relatedness was examined with six items rated on a 7-point Likert scale ranging from 1 (strongly agree) to 7 (strongly disagree)

FIGURE 1 An example of ordinary (left) and water-stressed (right) *Spathiphyllum* sp. used as visual stimuli to investigate compassion.

adopted from Nisbet and Zelenski (2013). For example, I take notice of wildlife wherever I am; I feel very connected to all living things and the earth. The scale showed high reliability (Cronbach $\alpha=0.84$). High scores mean high relatedness to nature.

To address the link between WTP and conservation attitudes with $N=61$ participants, we used the four pictures of plants and four pictures of animals described above, examining the effect of rarity. Pictures of minerals were not included, because it is impossible to examine conservation attitudes towards them, at least in the same sense as conservation attitudes towards living organisms. Participants were asked how much they would be WTP for each randomly presented animal and plant on a 7-point scale. Information about the conservation status of presented animals and plants were not provided. Following item was used to address participants' conservation attitudes: "Do you think that this species should be protected by laws?" following Prokop and Fančovičová (2013). Responses were recorded on a 5-point scale (1 = not necessary to protect, 5 = extremely important its protection). The reliability of the WTP scale and the conservation attitudes scale was high (Cronbach $\alpha=0.91$ and 0.77, respectively).

2.6 | Statistical analyses

The study employed a within-subjects design, so all participants saw all questions and visual stimuli. WTP scores were categorized as ordinal and defined as the dependent variable in the Generalized Mixed Model (GMM) (Jamieson, 2004). Categorical predictors were treatment, rarity (whether the picture was presented as rare or common) and participant sex. Continuous predictors were age and mean scores from the General Compassion scale and Nature Relatedness scale. Participant ID was treated as a random effect, and rarity was defined as a repeated measure. Compassion was examined with the GMM, where the preference for compassion pictures was defined as the binomial dependent variable. Treatment and sex were categorical predictors, and age, mean scores from the General compassion scale and Nature relatedness scale were continuous predictors. Participant ID was treated as a random effect. Non-significant interactions were removed from the models. The CFA model fit was evaluated using multiple fit indices, including the Root Mean Square Error of Approximation (RMSEA), the Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI). These indices were chosen to assess how well the proposed model fit the observed data. All analyses were performed with Gamlj_3 in Jamovi (The Jamovi Project, 2024).

3 | RESULTS

The descriptive characteristics of the data obtained from the questionnaires are shown in Table 2.

TABLE 2 Descriptive characteristics of scores from research instruments ($N=201$).

	Mean ± SE	Range
General Compassion Questionnaire	3.91 ± 0.03	2.19–4.81
Nature connectedness	4.88 ± 0.09	1.83–7.0
Compassion for plants	3.85 ± 0.05	0–4
Compassion for animals	3.95 ± 0.02	2–5
Compassion for buildings	3.02 ± 0.07	0–4
Round 1		
WTP for plants	3.15 ± 0.10	1–7
WTP for animals	3.42 ± 0.12	1–7
WTP for minerals	3.53 ± 0.10	1–7
Round 2		
WTP for plants	3.05 ± 0.11	1–7
WTP for animals	3.41 ± 0.12	1–7
WTP for minerals	3.46 ± 0.11	1–7

Abbreviation: WTP, willingness to pay.

3.1 | Compassion for plants

Treatment (Plant/Animal/Non-living objects) significantly influenced compassion preferences (Table 3). Pair-wise comparisons showed significant differences, suggesting that compassion was highest for the Animal category, followed by Plants and Non-living objects (Figure 2). Sex differences were not significant (estimate = 0.013, Table 3). Both men (mean = 0.97, SE = 0.009) and women (mean = 0.97, SE = 0.006) were almost identical in their compassion preferences. Regarding continuous predictors, neither age, nor relatedness to nature or general compassion influenced the results (Table 3). Considering interaction terms, Treatment × General compassion suggests that the general compassion score tended to be associated with the preference of compassion for animals and plants but not with buildings. The interaction between General compassion × Sex indicates that women who exhibited higher levels of general compassion preferred pictures of wilted plants, abused dogs and dilapidated buildings before reconstruction more than women with lower levels of general compassion. However, no similar trend was found for men. Further statistical details can be found in Tables S1–S4.

3.2 | Rarity

Generalized Mixed Model showed that plants, animals and minerals presented as rare received higher WTP scores than those presented as common (Figure 3). The participants were more willing to pay for minerals, followed by animals and plants (all $p<0.001$). Men (mean = 7.04, SE = 0.21) scored higher WTP than women (mean = 6.57, SE = 0.21). Participants scoring higher on the nature relatedness scale also scored more on WTP for plants, animals and minerals than those who scored less on the nature relatedness scale. These results were significantly and positively influenced by the participant's age and general compassion score (Table 4). A significant interaction term between variables (Treatment × Rarity) suggests that while the WTP for rare minerals was significantly higher than for rare animals, followed by rare plants (all $p < 0.001$). Common minerals received a similar WTP score as common animals ($p = 0.48$). Common plants were less valued than common animals and minerals (both $p < 0.001$). Further statistical details can be found in Tables S5–S8.

TABLE 3 Results of GMM on compassion preferences ($N = 201$).

	Wald χ^2	df	*p*
Treatment	159.68	2	<0.001
Sex	0.002	1	0.964
Age	0.71	1	0.398
General compassion	3.09	1	0.079
Nature relatedness	1.78	1	0.183
Treatment × general compassion	13.48	2	0.001
Sex × general compassion	4.66	1	0.031

Abbreviation: GMM, Generalized Mixed Model.

3.3 | CFA of general compassion questionnaire

Confirmatory factor analysis supported the theoretical General Compassion Factors for all four domains used. The model had an acceptable fit with a RMSEA of 0.08 and a SRMSR of 0.062. A CFI of 0.884 and a TLI of 0.858 also indicated an acceptable fit (Hu & Bentler, 1999).

3.4 | The association between WTP and conservation attitudes

If the effect of rarity was not considered, GMM revealed that participants showed equal WTP for both plants and animals (Table 5). Conservation attitudes score ranged between 1 and 5 (mean = 3.73, SE = 0.05). Individuals with higher scores on the conservation attitudes scale demonstrated a greater WTP for plants and animals compared to those with lower scores. Notably, the factors of real, unmanipulated rarity, participants' sex (Table 6), and age did not

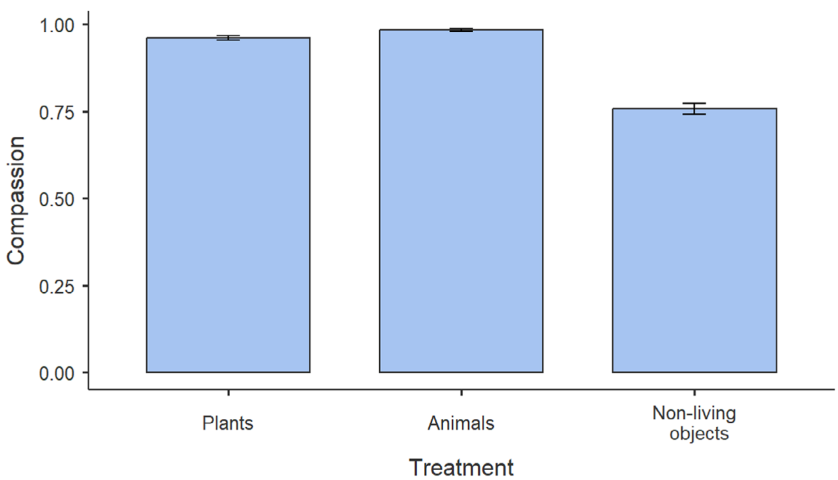

FIGURE 2 Differences in preference for compassion of plants, animals and non-living objects. Post-hoc comparisons in Generalized Mixed Model showed that all differences are significant (all $p < 0.001$).

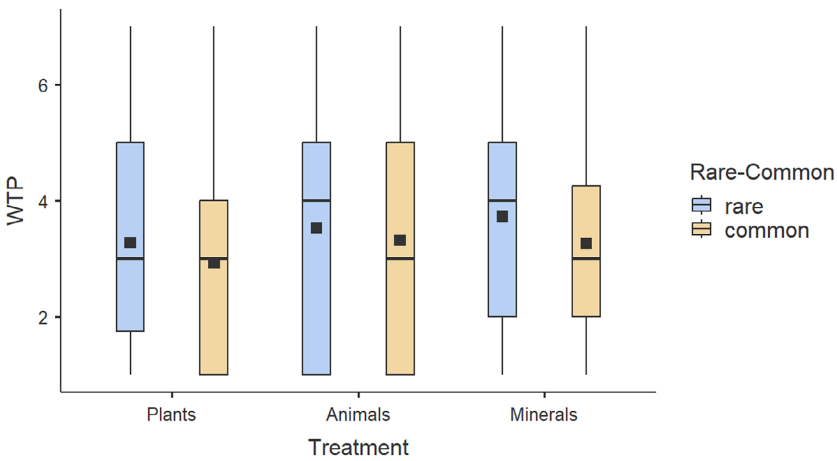

FIGURE 3 Differences in preference for rarity in plants, animals and minerals. Box plots represent medians (lines), means (squares), 25th and 75th percentiles, minimum and maximum values. Differences between rare and common objects were significant ($p < 0.001$). WTP, willingness to pay.

TABLE 4 Results of GMM on willingness to pay for plants, animals and minerals ($N=201$).

	Wald χ^2	df	*p*
Treatment	17427.48	2	<0.001
Rare/common	10839.51	1	<0.001
Sex	25442.58	1	<0.001
Age	4.41	1	0.03
General compassion	4221.72	1	<0.001
Nature relatedness	4308.45	1	<0.001
Treatment × rare/common	1614.97	2	<0.001

Abbreviation: GMM, Generalized Mixed Model.

TABLE 5 Results of GMM on willingness to pay for plants and animals ($N=61$).

	Wald χ^2	df	*p*
Treatment	1.63	1	0.2
Rare/common	0.001	1	0.98
Sex	0.29	1	0.59
Age	3.18	1	0.07
Conservation attitudes	122.75	1	<0.001

Abbreviation: GMM, Generalized Mixed Model.

TABLE 6 Descriptive characteristics of WTP for rare and common plants and animals ($N=61$).

Treatment	Rare	Common
WTP for plants	3.65 ± 0.15	3.49 ± 0.15
WTP for animals	3.86 ± 0.17	3.93 ± 0.17
Men	3.8 ± 0.2	3.74 ± 0.2
Women	3.72 ± 0.14	3.69 ± 0.13

Abbreviation: WTP, willingness to pay.

exert a significant influence on WTP. Further statistical details can be found in Tables S9–S12.

4 | DISCUSSION

This study investigated the interest in plants by means of compassionate preferences and perceived rarity. Using an experimental approach, we found that plants trigger compassion responses like those of animals and that their perceived rarity the WTP of participants. Our results suggest that plants are an integral part of human affinity towards nature (biophilia); however, the absence of sensitive, emotional measures may have hindered the discovery of people's preferences.

Compassion for plants was very similarly to that for animals, whereas compassion for non-living objects received much lower scores. It, therefore, seems that people consider plants and animals as moral objects that are live and experience pain (Collado & Sorrel, 2019). From our view, compassion for plants extends traditional elicitors like watching another person receive painful shocks or watching films about handicapped or malnourished children and others (for review, see Goetz et al., 2010). Also, this study extends previously known associations between compassion for animals and humans (Preylo & Arikawa, 2008; Westbury & Neumann, 2008). Because humans perceive nature to have a moral standing (Collado & Sorrel, 2019), plants have serious potential to elicit compassionate behaviours. Children may not consider plants alive, primarily because they lack the movement seen in animals (Kinchin, 1999; Richards & Siegler, 1984, 1986). However, our study focused on older participants, who are expected to have more developed concepts of living organisms. If people consider plants to be alive, then it explains why they feel more compassion for plant than for buildings. Considering that moral judgements and empathy are related to pro-environmental behaviour (Krettenauer, 2017), it is likely that individuals who exhibit greater sensitivity to water-stressed plants also engage in environmentally friendly behaviour. Future research should explore how people's interactions with indoor and outdoor plants impact their moral transgressions, specifically actions that harm plants.

Rarity should be a significant driver of people's interest in the conservation of living organisms (Christie et al., 2006; Hanley et al., 2003; Randler et al., 2023; Slone et al., 1997; Tryjanowski et al., 2024). Consistently with this expectation, we showed that plants presented as rare received higher WTP scores than plants presented as common. However, previous research in this field used observational rather than experimental methods, which cannot precisely examine people's preferences for living organisms. For instance, rare species can also be conspicuously attractive and large (observational approach), which can easily confound the interpretation of results. Here, we used a controlled experimental approach in which participants were shown the same species (rare and common in nature) presented as common and rare. Considering that the rarity effect also occurred in animals (marginally significantly) and in minerals, it is unlikely that other unknown variables did confound the results. Plants received significantly lower WTP scores than animals and minerals, which corroborates previous research about the inferiority of plants on the animacy spectrum (Amprazis et al., 2021; Balding & Williams, 2016; New et al., 2007; Parsley, 2020; Prokop et al., 2022; Trompenaars et al., 2021; Wandersee & Schussler, 1999, 2001). Animal movement, their phylogenetic closeness with humans (Miralles et al., 2019) and the well-known value of certain minerals (Altingoz et al., 2019) probably supported WTP. The rarity of the plants contributed significantly to their WTP, suggesting that this variable can be used to mitigate PAD. However, plants received lower WTP than animals and minerals, suggesting that people do not perceive plants as valuable.

We used aesthetically appealing plants and animals (e.g., plants with flowers, charismatic mammals) to elicit participants' compassionate responses and WTP. The aesthetic value of species is strongly associated with people's willingness to protect beautiful animals (Castillo-Huitrón et al., 2020; Landová et al., 2018; Lipták et al., 2023; Prokop & Fančovičová, 2013). Therefore, we hypothesize that the aesthetic appeal of plants and animals could also enhance compassion and perceived rarity. While these speculations require additional research, it is crucial to ensure that conservation efforts encompass less appealing species that play vital roles in maintaining ecological balance. By addressing both the aesthetic preferences and the emotional responses associated with different species, conservationists can foster a more inclusive approach that benefits human interactions with nature.

The main effect of general compassion showed no significant influence on participants' compassionate preferences or WTP. However, general compassion significantly triggered the preference for compassion for animals and plants but not for buildings. This result is significant because it further suggests that compassion for plants is close to compassion for animals but not for non-living objects. Plants are, therefore, perceived as living things rather than lifeless objects, which further supports the biophilia hypothesis (Kellert & Wilson, 1993). Shapes of plants can visually be confused as either animals or minerals (Schmidt et al., 2017), but when the affective domain is considered, compassion for plants prevails compared with compassion for non-living objects.

The correlation between the Nature relatedness scale and General compassion scale with WTP for plants, animals and minerals suggests a connection between individuals' personal values and their economic decisions regarding these entities. In our view, individuals who value nature and demonstrate compassion can view animals, minerals and plants not just as commodities, but as entities deserving respect, care and protection, as suggested by the biophilia hypothesis. Furthermore, supporting enthusiasm for nature-related hobbies, such as promoting pet ownership and houseplant care, can enhance the quality of life through active interactions with plants. This engagement fosters a deeper appreciation for nature and increases the moral value placed on the natural world.

5 | LIMITATION

Pictures of dogs were chosen to examine the preferences for compassion towards animals. Because dogs, as companion animals, are highly preferred by people, this might explain why compassion for animals received a higher score than compassion for plants. In the future, it is necessary to include a diverse range of plant and animal species to confirm that the preferences for compassion are not limited to a few plant species and dogs. The position and quality of pictures of abused and cured animals should also be standardized. We also did not measure the intensity of compassionate reactions, which would produce deeper insights into differences in perception between animals and plants. Another limitation is the reliance on self-reports obtained from a sample of Slovak people and the rating of the same pictures as rare and common. Although a strong advantage of the within-subject design is that it controls for individual differences between participants, participants might, in theory, be aware of the research goals. Further research should investigate the psychometric properties of compassion preferences and rarity, including examining their reliability and validity with data from larger and more diverse samples using a between-subject design.

5.1 | Implications for practice and policy

The results of our research have broad potential for practice and policy:

1. By building emotional connections with plants, such as compassion for their well-being, students may develop a stronger appreciation for plant life. This can be achieved through activities focused on the similarities between plants and animals and the negative impacts of environmental stressors (e.g., drought) on plant health.
2. While previous efforts have primarily aimed at enhancing plant knowledge, our study suggests that appealing to emotions, such as compassion, can also serve as an effective strategy for addressing Plant Awareness Disparity (PAD). Conservation campaigns should consider integrating cognitive and emotional elements to maximize their impact.
3. Science teachers can leverage the "plant parenting" concept, which involves fostering an emotional connection with plants through nurturing and observing their growth, changes and development as living organisms (Burke et al., 2022). A potential outcome of these activities is the increased popularity of houseplant cultivation and gardening. Highlighting certain plant species' unique and threatened status could increase public support and engagement in conservation efforts.
4. Given the positive correlation between perceived rarity and WTP for plant conservation, policymakers should prioritize the protection of rare and threatened plant species. This could involve designating protected areas, implementing stricter regulations, or incentivizing private landowners to conserve rare plant populations. Additionally, rare plants should be more prominently featured in social networks, television programmes and other media platforms to raise public awareness and appreciation for their conservation needs.

6 | CONCLUSION

Water-stressed plants generate compassionate responses comparable to abused animals. Conservation campaigns could potentially benefit from considering peoples' WTP for rare plants in addition to common ones. Greater emphasis on the affective domain when people interact with plants and increased interest in rare plants could be instrumental in mitigating PAD and encouraging conservation efforts. We hope that this research will encourage science teachers to sensitize their students to the fragile lives of plants, which require our protection and care and are equally important as all living entities on this planet. The findings encourage a re-evaluation of the perceived value of plants and underscore their potential role in eliciting compassionate behaviours for better human–plant relationships and, ultimately, for a sustainable future.

AUTHOR CONTRIBUTIONS

Pavol Prokop conceived the ideas with feedback from Kristína Belzárová and Ivana Tomanová Čergeťová; Pavol Prokop designed the methodology with feedback from all authors; all authors collected and prepared the data; Pavol Prokop analysed the data; all authors contributed to interpreting the results; Pavol Prokop wrote the first draft; all authors reviewed and commented on the draft manuscript and gave final approval for publication.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no competing interests.

DATA AVAILABILITY STATEMENT

The processed dataset used for the analysis is available at DOI: 10.6084/m9.figshare.27629904.

ORCID

Pavol Prokop https://orcid.org/0000-0003-2016-7468

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

Data S1. Questionnaire.

Table S1. Model fit based on comparison of the conditional models (random and fixed effects).

Table S2. Additonal indices.

Table S3. Parameter estimates (fixed coefficients).

Table S4. Random components and intraclass correlations (ICC).

Table S5. Model fit based on comparison of the conditional models (random and fixed effects).

Table S6. Additonal indices.

Table S7. Parameter estimates (fixed coefficients).

Table S8. Random components and intraclass correlations (ICC).

Table S9. Model fit based on comparison of the conditional models (random and fixed effects).

Table S10. Additonal indices.

Table S11. Parameter estimates (fixed coefficients).

Table S12. Random components and intraclass correlations (ICC).

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