SZOCIÁLIS SZEMLE
16. évfolyam, 1. szám (2023) *https://doi.org/10.15170/SocRev.2023.16.01.01*

Nature's influence on the development of empathy: An exploratory study

A természet hatása az empátia fejlődésére: Feltáró elemzés

MESA ROSE MATTHEWS & REBEKA JÁVOR

Mesa Rose Matthews: independent researcher; mesapoosie@gmail.com

Matthews, Mesa Rose: *független kutató; mesapoosie@gmail.com*

Rebeka Jávor: University of Pécs, Faculty of Humanities and Social Sciences, Institute of Social Relations, Department of Community and Social Studies; javor.rebeka@pte.hu

Jávor Rebeka: *Pécsi Tudományegyetem, Bölcsészet- és Társadalomtudományi Kar, Társadalmi Kapcsolatok Intézete, Közösségi és Szociális Tanulmányok Tanszék; javor.rebeka@pte.hu*

Abstract
The aim of the study is to examine whether and to what extent nature connectivity directly impacts an individual's level of empathy. The results may suggest a positive correlation, potentially serving as a humanitarian tool in the future. The compiled information regarding the beneficial impact of the natural world on an individual's degree of mental awareness may be relevant in the field of social work due to the increased global demand for adjustments and presence on an emotional level to improve the well-being of society.

Keywords: empathy, environment, nature connectedness, biophilia hypothesis

Absztrakt
A tanulmány célja annak vizsgálata, hogy a természettel való kapcsolat hogyan befolyásolja az empátia kialakulását és működését, amely pozitív összefüggés akár humanitárius eszközként is hasznosítható. Ezek, a természet tudatosságra gyakorolt pozitív hatásáról összegyűjtött információk relevánsak lehetnek a szociális munka területén, hiszen megnövekedett az igény az érzelmi fejlődésre és jelenlétre a társadalom jólétének fejlesztése érdekében.

Kulcsszavak: *empátia, környezet, természettel való kapcsolat, biofília hipotézis*

Introduction

The study focuses on a meta-concept hidden within the shadows of previously published literature discussing the topic of nature and human characteristics, extending into emotional compositions. This vast and multifaceted correlation is collectively compiled today underneath the academic umbrella titled nature connectedness: an area of research focusing on an individual's level of connection with the natural world (Nisbet et al., 2008). The relationship between nature connectedness and particularly an individual's level of empathy is one specific area that is becoming increasingly popular while it presents an abundance of progressive possibilities.

Environmentalists have expressed an interest in this linking of empathy to nature connectivity due to the likelihood that more empathy means more compassion and concern for the preservation of the natural world. For example, an individual who empathetically takes the perspective of a suffering tree will be more concerned regarding harm inflicted on trees, as well as develop an inner commitment to help save them, a concept titled dispositional empathy with nature or DEN (Tam, 2013). A previously unexplored research topic that deserves attention presents itself when a DEN situation is flipped. Does the level of nature connectivity directly impact an individual's level of empathy?

This question is answered by two parts, the first being a thorough literature review examining the theory that nature has a profound effect on the degree of empathy within humans. The second portion of the research explores the results of two cross-examined surveys which validate the information gathered throughout the literature review.

Literature review

Biophilia hypothesis

Living in an age that pulls humankind further from their organic roots and deeper into the land of technology results in changes within societal thinking and action. In accordance with the biophilia hypothesis, humans tend to have an innate drive to live in connection with the natural world (Kellert & Wilson, 1993; Kellert, 1997). As animals live in a balance with nature, the human species has drifted from its organic way of life and become increasingly more distant from the natural world (Bratman et al., 2012). According to the United Nations, in 2018 human beings were recorded primarily as city dwellers, with 55% of the world population living in urban areas (United Nations, 2018). While living in an urban environment does not necessarily mean no internalized love for nature, with respect to the biophilia hypothesis it is understandable that mankind is increasingly becoming more unbalanced (DeVille et al., 2021).

A neurological study discovered that time spent in natural environments activates more of the frontal, temporal and parietal regions of the brain which are linked to an individual's interest and emotional contemplation (Martínez-Soto et al., 2013). From the meta-perspective, there is evidence of people living in urban areas having increased activity of their amygdala, the part of the brain responsible for processing fearful and threatening stimuli (Kim et al., 2010; Kim & Jeong, 2014; Baxter & Croxson, 2012). This suggests that a relationship with nature has the potential to influence the mental composition of an individual. However, the degree to which empathy is directly influenced by natural experiences is still unexplored.

Empathy

Empathy may be described as an emotional ability to experience the mental state of another individual as if feeling the emotions yourself (Borke, 1971; Konrath et al., 2010). This characteristic is regarded as an essential part of maintaining a healthy society since it allows individuals of a population to relate with one another via an inherent sense which permeates past differences in interest and action (Ansbacher, 1991). A 2011 meta-analytical study on the degree of empathy of members adhering to the younger populations signs an alarm that empathy is becoming increasingly uncommon, decreasing by 48 % between 1990 and 2010 (Konrath et al., 2010) This aligns with the rapid 350% increase in technological presence within young adults' daily lives between 1979 and 2009 (Bohn & Short, 2009).

People are relating differently to each other as well as themselves, likely because of the timeline of tech time replacing time spent in nature (Louv, 2008). This assumption is supported by the evidence of a negative relation between narcissism and empathy which states that one cancels out the other within an individual's emotional capacity (Watson et al., 1994). According to one of the grandfathers of psychotherapy and personality theory, Alfred Adler, empathy may be observed as a key aspect of constructing connections with the world (Adler, 1998). Such data express the importance of empathy in approaching social problems in joint humanitarian efforts regarding the utilization of networking, resource allocation, broadened understandings, and motivational influences.

Empathy is composed of two unique but interconnected components which were originally distinguished by Scottish Philosopher Adam Smith. He described the first as instinctive sympathy (empathy), an automatic emotional reaction to the emotional experience of others, similar to a cause-and-effect type of response like when a baby cries and someone nearby can recognize that they are experiencing a negative emotion (Decety & Jackson, 2004). Today this is referred to as cognitive empathy or "a rational understanding or ability to take someone's perspective" (Tam, 2013).

Smith described the second as intellectualized sympathy (empathy), a true ability to feel the emotion of the baby rather than just rationalize its emotional state. This component is now referred to as affective or emotional empathy which is when an individual truly feels another's emotional response as if it is their own (Tam, 2013). Affective empathy is the more effective of the two components when addressing humanitarian issues. This is because an individual is more likely to act upon a problem which they feel internally rather than merely as an observer. While cognitive empathy is necessary to the workings of humanitarian aid because it enables people to distinguish the origins of suffering, affective empathy provides the internalized emotional motivation to get an individual up and working on actively reduce the suffering.

A primary reason empathy is beneficial in humanitarian efforts is the empathy-altruism hypothesis. According to the Encyclopaedia of Social Psychology, the empathy-altruism hypothesis represents how "feelings of empathy for another person produce an altruistic motivation to increase that person's welfare" (Baumeister & Vohs, 2007). This means that increasing the rate of empathy helps to increase the number of individualized decisions to make beneficial actions for others. From a social work and societal perspective, this is beneficial to addressing social problems from the bottom up.

Empathy with nature

"… We must begin in empathy by becoming the animals before we can save them" (Sobel, 1996 cit. Tam, 2013, p. 92). This quote encompasses empathy with nature, the ability to step into the metaphorical shoes of the natural world and feel its emotions as one does with members of the human species (Tam, 2013). Berenguer (2007, 2008) examined the effect of empathy on pro-environmental attitudes, behaviours and moral reasoning and concluded that environmental activists exemplify empathy with nature on a daily basis as they let their mirrored pain for the elements of the natural world dictate their actions through motivation and direction. When the perspective of the element is taken, the activists tend to further extend their actions past the specific focus and let the energy extend into multiple areas of the natural environment, resulting in even more humanitarian action.

Emotions present in situations specifically surrounding biodiversity loss and climate change are described as *climate* or *eco-emotions* (González-Hidalgo & Zografos, 2019).

Commonly influencing pro-environmental behavior, eco-emotions are usually thought of as negative emotions such as grief, anxiety, solastalgia (emotional distress caused by environmental change), disgust, shame, and many others as well as additional emotions considered more motivational such as pride and determination (Pihkala, 2022).

While such a link between nature connectedness and empathetic concern has not received an abundance of attention, a correlation has been previously established in earlier research (Zhang et al., 2014). A more extensive area of research is the connection between a lack of nature in relation to an increase of callous and uncaring traits such as narcissism and apathy (Byrd et al., 2012). A study from 2019 found that individuals with a higher connection to nature tend to score lower on psychological assessments examining callous and uncaring traits (Fido & Richardson, 2019).

Research question

Does nature have a positive effect on an individual's degree of empathy, perhaps as a resulting characteristic stemming from a higher degree of nature connectedness? This research study seeks to explore the correlation between nature and empathy.

Materials and methods

Questionnaires

Within the survey, two different measures were applied, alongside a general questions portion which requires the participants to provide information regarding their age, gender, country, etc.

Interpersonal Reactivity Index

The first measure is the Interpersonal Reactivity Index (IRI) created by Mark H. Davis of the University of Texas in 1980. This 28-question survey is designed to measure the level of empathy in adults by using a 5-point Likert Scale (Davis, 1980). The 28 questions are divided into four subgroups to better understand the entirety of an individual's degree of empathy within various social scenarios. These subscales (Davis, 1983), coupled with example questions which are utilized within my research are as follows:

- Perspective Taking (PT) – the tendency to spontaneously adopt the psychological point of view of others *"I try to look at everybody's side of a disagreement before I make a decision"*;
- Fantasy (FS) – taps respondents' tendencies to transpose themselves imaginatively into the feelings and actions of fictitious characters in books, movies, and plays *"After seeing a play or movie, I have felt as though I were one of the characters"*;
- Empathic Concern (EC) – assesses "other-oriented" feelings of sympathy and concern for unfortunate others *"I often have tender, concerned feelings for people less fortunate than me"*;
- Personal Distress (PD) – measures "self-oriented" feelings of personal anxiety and unease in tense interpersonal settings *"I sometimes feel helpless when I am in the middle of a very emotional situation"*.

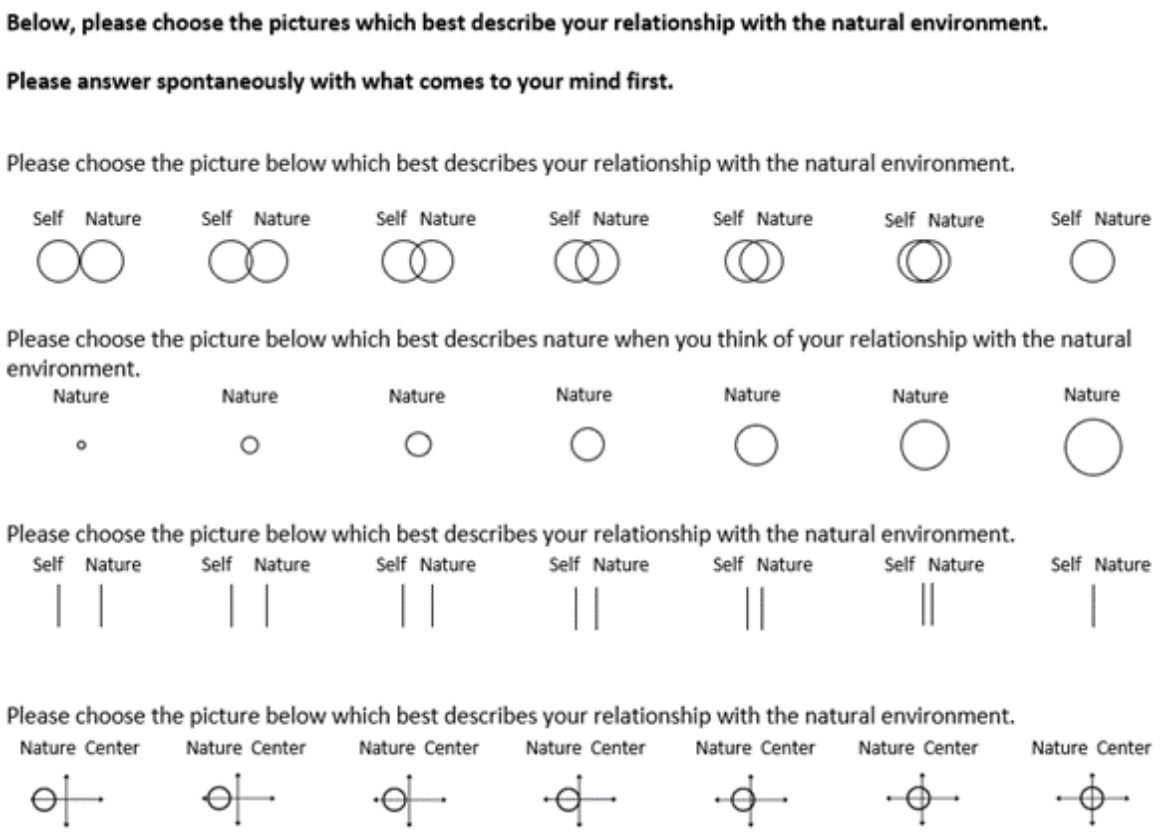
The PT and FS subscales examine the more cognitive empathetic qualities on a slightly superficial level with questions determining the level the participant can understand how others feel. The EC and PD subscales observe the affective (emotional) empathetic qualities with more earnest questions that dig deeper into how much the participant can feel the emotions of others rather than just understand them.

Extended Inclusion of Nature in Self Scale

The second measure is the Extended Inclusion of Nature in Self Scale (EINS) developed by Christian Martin at the National University of Ireland in 2016 (Martin & Czellar, 2016). This four-question survey is unique in comparison to most of the other assessments seen in the scientific community because it relies entirely on the surveyor's literal visualization of themselves in relation to nature (Koivisto & Grassini, 2022). The EINS questions which will be used during the survey is as follows:

Figure 1

Extended version of the Inclusion of Nature in Self scale



(Martin & Czellar 2016, p. 186)

While the four questions appear very similar, they are distinguished by unique representational identifiers that each participant may rationalize specifically to their identity. Question 1 analyses the internal *overlap* an individual feels that nature has on their life while the focus of Question 2 is reframed into the *size* of nature's presence within their life. Question 3 aims to determine how much *distance* an individual puts between themselves and nature while Question 4 describes how *central* of an aspect nature is within an individual's life. Utilizing a

quadrilateral self-evaluation helps to illustrate a more comprehensive understanding of an individual's connection with nature.

Gathering data and sampling strategy

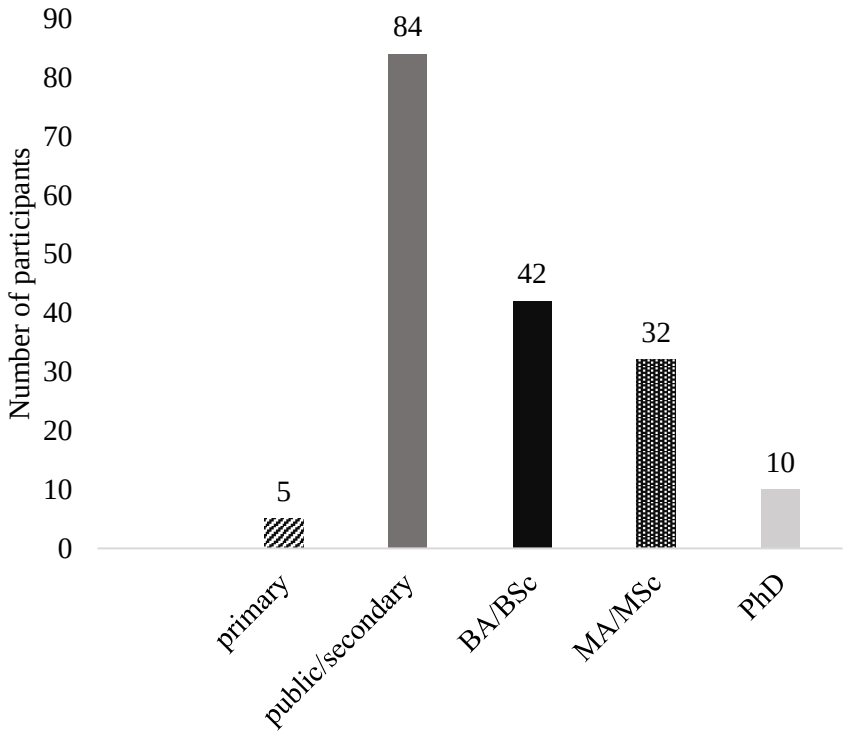
The collection period of the survey responses lasted approximately five months to obtain the significant number of responses necessary to properly validate the survey results. Email was the primary platform from which the assessment could be accessed while the survey itself was available as a Google Form. An email containing links to the surveys as well as general information regarding the research, the disclosure of the participants' rights and the description of their privacy protections were included.

Sample

Our sample included 173 participants, 122 females (70,5%), 46 males (26,6%), 4 nonbinary (2,3%) and 1 transgender (0,6%) individual; age range 15 and 81 (*M=33.13; SD=15.98*). Nearly half of the whole sample have attended higher education: BA/BSc 42 (24,3%), MA/MSc 32 (18,5%), Ph.D. 10 (5,8%); the other half of them participated in public/secondary education 84 (48,6%); and 5 (2,9%) who attended primary school as shown in Figure 2 below.

Figure 2

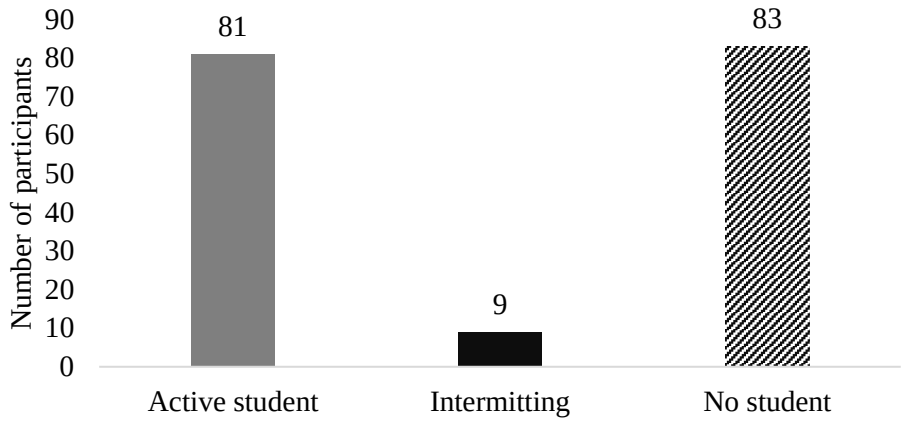
Different educational backgrounds



Half of the whole sample is an active student (46,8%), 5,2% is intermitting the studies, and the other half is no longer a student (48%) (see Figure 3).

Figure 3

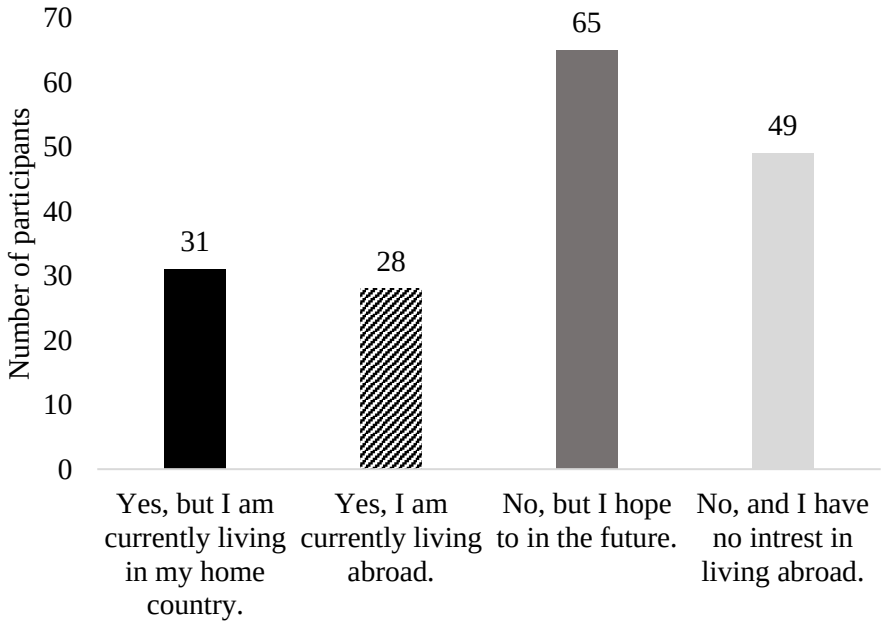
Students status



The largest percentage of our sample have not lived abroad before for at least six months, but they hope to in the future (37,6%), 28,3% do not even have interest in living abroad; 17,9% have already lived abroad, but they are currently living in their home country, and 16,2% are currently living abroad (see Figure 4).

Figure 4

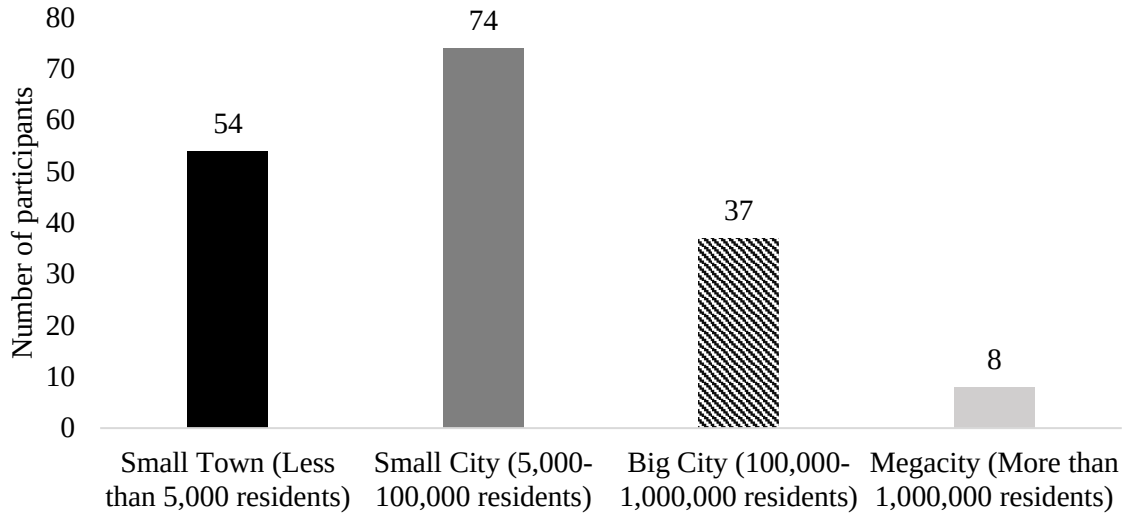
Living abroad for at least 6 months



The largest percentage of our sample spent the majority of their childhood in small cities (5,000-100,000 residents) (42,8%), 31,2% in small towns (Less than 5,000 residents), 21,4% in big cities (100,000-1,000,000 residents) and 4,6% from megacities (More than 1,000,000 residents) (see Figure 5).

Figure 5

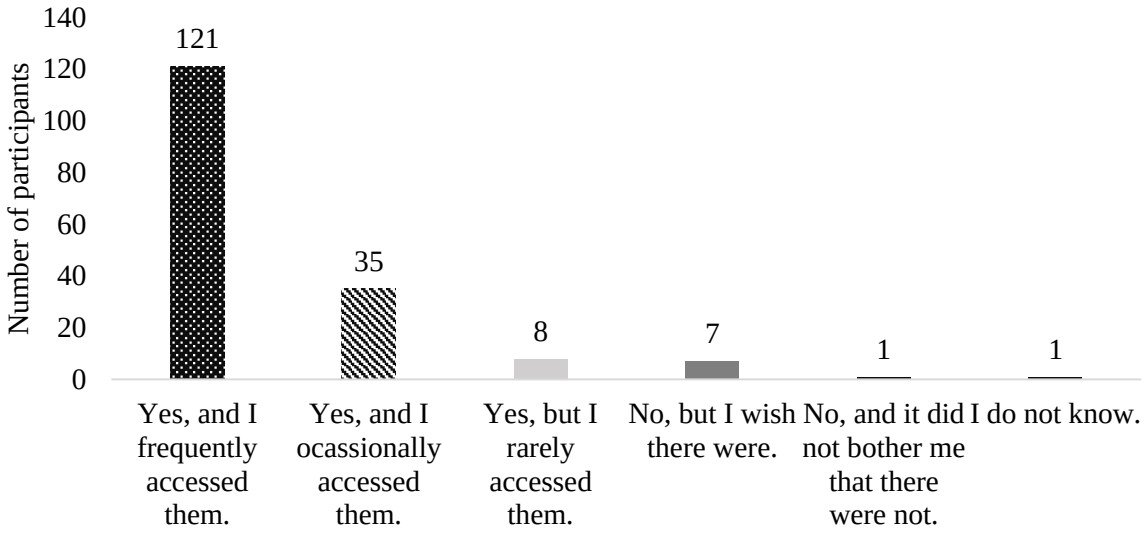
Living environment in childhood



Most of the participants had natural environments and/or green spaces available to them throughout their childhood and they frequently accessed them (69,9%), 20,2% had natural environments and/or green spaces available and they accessed them occasionally, 4,6% had natural environments available but they rarely accessed them, 4% did not have available natural environments but they wish they did, 0,6% did not have available natural environments and did not care, and 0,6% do not know whether they had it or not (see Figure 6).

Figure 6

Natural environments and/or green spaces available throughout childhood



Results

IBM SPSS Statistics 26.0 was used, and Pearson Correlation test was applied to identify the association between the components of empathy, the believed relationship with the natural environment and the demographic variables.

Components of empathy and the believed relationship with the natural environment

The most convincing result can be seen with Empathic concern: it has a positive correlation with Picture 1–Overlap; with Picture 2–Size; with Picture 3–Distance and with Picture 4–Central as well. This means that the higher the empathy component, the closer the individual values their relationship with nature.

On the other hand, Personal distress was negatively correlated with Picture 1–Overlap; with Picture 3–Distance and with Picture 4–Central, which means that the higher the Personal distress, the weaker the individual evaluates their relationship with nature, and vice versa. The stronger the relationship is, the individual will experience less distress.

There is no association between the other empathy components and the believed relationship with the natural environment (see Table 1).

Table 1

Correlations between the components of empathy and the believed relationship with the natural environment

	Picture 1		**Picture 2**		**Picture 3**		**Picture 4**	
	r	**p**	**r**	**p**	**r**	**p**	**r**	**p**
Perspective-taking	**.169**	**.03***	.117	.13(n.s.)	.090	.24 (n.s.)	.140	.07 (n.s.)
Fantasy	-.045	.55 (n.s.)	-.022	.77 (n.s.)	**-.181**	**.02***	-.103	.18 (n.s.)
Empathic concern	**.240**	**.001****	**.188**	**.01***	**.152**	**.04***	**.249**	**.001****
Personal distress	**-.189**	**.01***	-.086	.26 (n.s.)	**-.211**	**.005****	**-.153**	**.04***

*Sig. *p<.05, **p<.01*

Demographic variables and the components of empathy

We also examined the relationship between demographic variables and the components of empathy. The most crucial result is that Available natural environments/green spaces correlated positively with Empathic concern, suggesting that the more time a person spent in nature as a child, the more Empathic concern increases.

There is no correlation between the other demographic variables and the components of empathy (see Table 2).

Table 2

Correlations between the components of empathy and the demographic variables

	Perspective-taking		**Fantasy**		**Empathic concern**		**Personal distress**	
	r	**p**	**r**	**p**	**r**	**p**	**r**	**p**
Age	-.110	.15 (n.s.)	**-.327**	**.000****	.012	.88 (n.s.)	**-.160**	**.03***
Gender	-.084	.27 (n.s.)	**.171**	**.02***	.099	.19 (n.s.)	**.262**	**.001****
Education	.073	.34 (n.s.)	**.248**	**.001****	.047	.54 (n.s.)	-.024	.75 (n.s.)
Living abroad	.028	.71 (n.s.)	.049	.52 (n.s.)	-.067	.38 (n.s.)	-.010	.90 (n.s.)
Living environment	.049	.52 (n.s.)	.020	.80 (n.s.)	-.014	.86 (n.s.)	.020	.79 (n.s.)
Available green spaces	-.056	.46 (n.s.)	.026	.73 (n.s.)	**.171**	**.02***	.034	.66 (n.s.)

*Sig. *p<.05, **p<.01*

Discussion

The study's primary purpose was to answer the question: Does the level of nature connectivity directly impact an individual's level of empathy? Based on the results it can be seen that within this sample of respondents, empathy – and affective empathy in particular – is correlated with a higher degree of nature connectedness.

This is expressed when comparing the results of Davis's Interpersonal Reactivity Index (IRI) to Martin's Extended Inclusion of Nature in Self Scale (EINS). We can determine that the positive correlation relates to affective empathy because the most significant findings expressed an increase of the Empathic Concern (EC) subgroup which assesses "other-oriented" feelings of sympathy and concern for unfortunate others. This data show that when an individual has a higher degree of nature connectivity, they also express higher emotional awareness and internalized empathy for others.

Simultaneously there was a negative correlation of Personal Distress (PD) which measures "self-oriented" feelings of personal anxiety and unease in tense interpersonal settings. Individuals who scored lower on the EINS scale, describing themselves as less connected to nature, tended to have higher rates of Personal Distress. This correlation was also true when individuals with high EINS scores showed low PD. This expresses that participants are likely to feel more distress because they are lacking a connection to the natural environment around them which may lead them to feel less protected within certain areas of the world, for example, in a city. When they have a stronger connection to nature they may feel as if there is more of a safety net around them which allows for the development of more positive emotions such as empathy.

Another example which proves a relational connection is the resulting data of the comparison between the available green spaces to an individual's degree of empathy and nature connectedness. Individuals who had higher access to such spaces tended to score higher on the EINS which illuminates the fact that empathy may be increased due to the amount of time spent in nature throughout a lifetime. However, participants scored lower on the IRI which, as previously mentioned, may be because those who grew up close to nature take their relationship with nature for granted and rather than see themselves as aligned with nature, understand nature as a stable entity which is constantly there but does not necessarily induce active acknowledgement. Such an assumption is inconclusive without further research but shows that this data does not necessarily contradict the hypothesis of the study.

Relevance for social work

The evidence collected is beneficial to several areas of social work due to its broad range of application. School social workers may suggest planting more trees on school property or to utilize more natural spaces during fieldtrips in an attempt to reduce bullying. A 2002 study supports this assumption with data proving that outdoor programs may increase interpersonal skills and improve relationships among children (Kellert, 2002). Community social workers may work with local governments to establish nature reserves around communities to reduce crime. This is supported by recorded police records showing crime being reduced by 52% in public housing areas that are highly vegetated thank those with little to no vegetation (Kuo & Sullivan, 2001). Social workers involved in large scale legislative reformations can encourage countries to make the preservation of natural spaces a key point in policy as a way to increase the general wellbeing of the individuals within their municipalities. In addition to the positive effects resulting from higher rates of empathy, researcher Hannah Cohen-Cline from Portland

Oregon's Providence Health and Services states that "being around nature makes people feel better mentally. This has important policy implications" (Gilbert, 2016, p. S56).

When evidence is given to a simple yet fruitful correlation between nature and empathy, in addition the previous research of supportive data, the image of nature as an entire entity can evolve into a lasting societal resource rather than a short-term monetary one. In today's era, nature is no longer a physical resource of mere tangible things but also a psychological resource that can better humankind in a multitude of ways. The opportunities such data present can help tackle the social issues shaking our world from its emotional foundations while simultaneously protecting the planet as well.

Limitations and direction for further research

The responses from the survey participants are slightly skewed to a specific demographic, particularly university students with an international background, with more than two-thirds being women. This sample cannot be called representative.

However, the country of origin, age, race, language, and other characteristics of the participants were still recorded to show a correlation, and lack thereof, which deem them worthy of further exploration in future research.

Conclusion

The information gathered from both the peer-review and the completed surveys were cross examined and evidently supports the hypothesis that nature does positively impact the degree of empathy within an individual. As the biophilia hypothesis states that humans have an innate tendency to connect with nature, it is understandable that less time in nature has negative effects on an individual's emotional composition. In a world where the forests are continually getting smaller and the inhabitants are becoming more distant from one another, such findings come at a crucial time. This information can help humanitarians consider how nature in its entirety may be used as a tool in school, work, and community settings as well as several other areas within the social work sector, such as working with children in need of care. In a contemporary attempt to solve the numerous social issues which are present in all countries, mankind may turn to the natural world for assistance in approaching the core of the problems by means of increased empathy.

References

Adler, A. (1998). *Understanding human nature.* Hazelden.

Ansbacher, H. L. (1991). The concept of social interest. *Individual Psychology: Journal of Adlerian Theory, Research & Practice, 47*(1), 28–46.

Baxter, M. G., & Croxson, P. L. (2012). Facing the role of the amygdala in emotional information processing. *Proceedings of the National Academy of Sciences, 109*(52), 21180–21181. https://doi.org/10.1073/pnas.1219167110

Baumeister, R. F., & Vohs, K. D. (2007). *Encyclopedia of Social Psychology.* Sage. https://doi.org/10.4135/9781412956253

Berenguer, J. (2007). The effect of empathy in proenvironmental attitudes and behaviors. *Environment and Behavior, 39*(2), 269–283. https://doi.org/10.1177/0013916506292937

Berenguer, J. (2008). The effect of empathy in environmental moral reasoning. *Environment and Behavior*, *42*(1), 110–134. https://doi.org/10.1177/0013916508325892

Bohn, R. E., & Short, J. E. (2009). *How much information? 2009 report on American consumers.* Global Information Industry Center.

Borke, H. (1971). Interpersonal perception of young children: Egocentrism or empathy? *Developmental Psychology, 5*(2), 263–269. https://doi.org/10.1037/h0031267

Bratman, G. N., Hamilton, J. P., & Daily, G. C. (2012). The impacts of nature experience on human cognitive function and mental health. *Annals of the New York Academy of Sciences, 1249*(1), 118–136. https://doi.org/10.1111/j.1749-6632.2011.06400.x

Byrd, A. L., Kahn, R. E., & Pardini, D. A. (2012). A validation of the inventory of callous-unemotional traits in a community sample of young adult males. *Journal of Psychopathology and Behavioral Assessment, 35*(1), 20–34. https://doi.org/10.1007/s10862-012-9315-4

Davis, M. H. (1980). *Interpersonal Reactivity Index.* PsycTESTS Dataset. https://doi.org/10.1037/t01093-000

Davis, M. H. (1983). Measuring individual differences in empathy: Evidence for a multidimensional approach. *Journal of Personality and Social Psychology, 44*(1), 113–126. https://doi.org/10.1037/0022-3514.44.1.113

Decety, J., & Jackson, P. L. (2004). The functional architecture of human empathy. *Behavioral and Cognitive Neuroscience Reviews, 3*(2), 71–100. https://doi.org/10.1177/1534582304267187

DeVille, N. V., Tomasso, L. P., Stoddard, O. P., Wilt, G. E., Horton, T. H., Wolf, K. L., Brymer, E., Kahn, P. H., & James, P. (2021). Time spent in nature is associated with increased pro-environmental attitudes and behaviors. *International Journal of Environmental Research and Public Health, 18*(14), 7498. https://doi.org/10.3390/ijerph18147498

Fido, D., & Richardson, M. (2019). Empathy mediates the relationship between nature connectedness and both callous and uncaring traits. *Ecopsychology, 11*(2), 130–137. https://doi.org/10.1089/eco.2018.0071

Gilbert, N. (2016). Green space: A natural high. *Nature, 531*(7594), S56–S57. https://doi.org/10.1038/531s56a

González-Hidalgo, M., & Zografos, C. (2020). Emotions, power, and environmental conflict: Expanding the 'emotional turn' in political ecology. *Progress in Human Geography, 44*(2), 235–255. https://doi.org/10.1177/0309132518824644

Kellert, S. R. (1997). *Kinship to mastery: Biophilia in human evolution and development*. Island Press.

Kellert, S. R., & Wilson, E. O. (1993). The biophilia hypothesis, Stephen R. Kellert and Edward O. Wilson. 1993. Island Press, Washington, DC. 484 pages. ISBN: 1-55963-148-1. $27.50. *Bulletin of Science, Technology & Society, 15*(1), 52–53. https://doi.org/10.1177/027046769501500125

Kellert, S. R. (2002). Experiencing nature: Affective, cognitive, and evaluative development in children. In P. H. Kahn Jr., & S. R. Kellert (Eds.), *Children and nature: Psychological, sociocultural, and evolutionary investigations* (pp. 117–151). MIT Press.

Kim, G. W., & Jeong, G. W. (2014). Brain activation patterns associated with the human comfortability of residential environments. *NeuroReport, 25*(12), 915–920. https://doi.org/10.1097/wnr.0000000000000205

Kim, T. H., Jeong, G. W., Baek, H. S., Kim, G. W., Sundaram, T., Kang, H. K., Lee, S. W., Kim, H. J., & Song, J. K. (2010). Human brain activation in response to visual stimulation with rural and urban scenery pictures: A functional magnetic resonance imaging study. *Science of the Total Environment, 408*(12), 2600–2607. https://doi.org/10.1016/j.scitotenv.2010.02.025

Koivisto, M., & Grassini, S. (2022). Affective responses to urban but not to natural scenes depend on inter-individual differences in childhood nature exposure. *Journal of Environmental Psychology, 82*, 101840. https://doi.org/10.1016/j.jenvp.2022.101840

Konrath, S. H., O'Brien, E. H., & Hsing, C. (2010). Changes in dispositional empathy in American college students over time: A meta-analysis. *Personality and Social Psychology Review, 15*(2), 180–198. https://doi.org/10.1177/1088868310377395

Kuo, F. E., & Sullivan, W. C. (2001). Environment and crime in the inner city: Does vegetation reduce crime? *Environment and Behavior, 33*(3), 343–367. https://doi.org/10.1177/0013916501333002

Louv, R. (2008). *Last child in the woods: Saving our children from nature-deficit disorder*. Algonquin Books of Chapel Hill.

Martin, C., & Czellar, S. (2016). The extended inclusion of nature in self scale. *Journal of Environmental Psychology, 47,* 181–194. https://doi.org/10.1016/j.jenvp.2016.05.006

Martínez-Soto, J., Gonzales-Santos, L., Pasaye, E., & Barrios, F. A. (2013). Exploration of neural correlates of restorative environment exposure through functional magnetic resonance. *Intelligent Buildings International, 5*(sup1), 10–28. https://doi.org/10.1080/17508975.2013.807765

Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2008). The nature relatedness scale. *Environment and Behavior, 41*(5), 715–740. https://doi.org/10.1177/0013916508318748

Pihkala, P. (2022). Toward a taxonomy of climate emotions. *Frontiers in Climate, 3*, 738154. https://doi.org/10.3389/fclim.2021.738154

Tam, K. P. (2013). Dispositional empathy with nature. *Journal of Environmental Psychology, 35*, 92–104. https://doi.org/10.1016/j.jenvp.2013.05.004

United Nations. (2018). World urbanization prospects – population division. https://population.un.org/wup/Publications/%20Files/WUP2018-Report.pdf%20

Watson, P. J., Biderman, M. D., & Sawrie, S. M. (1994). Empathy, sex role orientation, and narcissism. *Sex Roles, 30*(9–10), 701–723. https://doi.org/10.1007/bf01544671

Zhang, J. W., Piff, P. K., Iyer, R., Koleva, S., & Keltner, D. (2014). An occasion for unselfing: Beautiful nature leads to prosociality. *Journal of Environmental Psychology, 37*, 61–72. https://doi.org/10.1016/j.jenvp.2013.11.008