

Title: Nature connectedness in adolescents and young adult: a systematic review

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Abstract

Investigating the connection with nature is important to understand how young people approach the environment in which they are included, also investigating the implications of such connection on their well-being. This systematic review aimed to evaluate the psychological and social science literature regarding the connection with nature in adolescents and young adults with the objective to understand how the nature connectedness can influence adolescents and young adults. Following a methodology based on the PRISMA guidelines, through the exploration of different databases, a total of 352 articles were identified, of which 68 articles met the inclusion criteria. For each of them, the characteristics (population typology, design, purpose and main results) are presented. Thematic analysis of the results obtained generated five themes: connection with nature and mental well-being; pro-environmental behavior, sustainability and connection with nature; the role of technology; social connection through connection with nature; and gender differences in connection with nature. The findings suggest how connection with nature could be a good tool to promote the well-being of young people, including social integration in multicultural and urban settings.

Keyword: Nature connectedness, Adolescents, Young adults, Systematic Review

1. Introduction

Migration is a complex and multidimensional phenomenon involving the movement of people from one country to another or within the same country, often driven by economic, political, environmental, or security reasons (O'Reilly, 2022). Migrants commonly face significant challenges during their migration journey, including estrangement from family members, difficulties in adapting to new cultural and linguistic contexts, and experiences of discrimination or marginalization (Olcese et al., 2024a; Rashi Kemmak et al., 2021). These challenges can profoundly impact migrants' psychological and physical well-being, increasing their risk of developing mental disorders such as anxiety, depression, and post-traumatic stress disorder (Rashi Kemmak et al., 2021). To address all these potential problems, some authors highlight the role of connectedness as a protective factor for well-being. For example, Borraccino et al. (2020) emphasise the importance of social connectedness as an element that promotes health and life satisfaction by moderating the effects of environmental stressors.

The concept of connectedness is very broad and general and includes within it the connection to cultural practices, often mediated by environmental factors (Olivos & Clayton, 2017). Specifically, the possibility of maintaining cultural practices related to one's identity can act as a protective factor for health, offering a sense of continuity and stability amidst the upheaval of migration (Olcese et al., 2024b). In this regard, environmental conditions can play a crucial role in either facilitating or hindering the preservation of these cultural identities (Charles-Rodriguez et al., 2023). Actually, access to natural spaces, for example, is essential for continuing traditional activities deeply rooted in specific landscapes, such as agriculture, foraging, or religious rituals (Celik et al., 2023). These practices help migrants maintain a connection to their heritage, fostering resilience and promoting mental well-being (Charles-Rodriguez et al., 2023; Celik et al., 2023).

Adolescence and young adulthood, typically defined as the period between the ages of 12 and 25, are life stages characterized by significant physical, emotional, and social development (Bonnie et al., 2019; Crone & Dahl, 2012). However, the exact definition of this age group can vary, with most studies including individuals as young as 11 or as old as 26 (Defoe et al., 2015). For adolescents and young adults, the stresses associated with migration—such as the struggle to maintain cultural identity, experiences of discrimination, and the challenges of adapting to new environments—can significantly increase their vulnerability to mental health problems (Borho et al., 2023; Borraccino et al., 2020). Research by Borho et al. (2023) shows that migrant adolescents and young adults are more likely to report higher levels of anxiety, depression and

other mental health problems than their non-migrant peers, especially if they experience discrimination, social isolation or difficulties adapting to new cultural environments. Indeed, the authors highlight how, in this context, the preservation of cultural practices and identity can serve as a critical coping mechanism. In this sense, those who manage to maintain their cultural traditions and connect with others who share their background often develop a stronger sense of identity and resilience (Borraccino et al., 2020). This evidence is also supported by Olcese et al. (2024b), who argue that maintaining cultural practices provides continuity and a sense of belonging that can protect against the negative effects of migration on mental health. Therefore, environmental factors can be critical in supporting or hindering the maintenance of these cultural practices. For example, Celik et al. (2023) highlight the importance of access to green spaces and community centres that allow people to gather and continue traditional activities. On the other hand, urban environments with limited opportunities for such activities can contribute to a sense of dislocation and exacerbate feelings of isolation (Bilsborrow, 2022).

Nature connectedness, also known as nature relationship or nature relatedness, refers to an individual's subjective sense of their relationship with nature (Martin et al., 2020; Pritchard et al., 2020); the concept emphasizes the notion that to feel connected to nature is more than simply spending time in nature. To measure nature connectedness quantitatively, the concept has been operationalized in various ways with adult participants, including Connectedness to Nature Scale (Mayer & Frantz, 2004) and Nature Relatedness Scale (Nisbet et al., 2009) and with children, such as the Children's Connection to Nature Index (Cheng & Monroe, 2012) and The Inclusion of Nature in Self Scale (Schultz, 2002).

As highlighted by Arola et al. (2023), there is meta-analytical evidence about the impact of the connection with nature and well-being, although these are essentially focused on the adult population. For instance, interaction with the natural environment has been shown to promote physical health (Mao et al., 2018), enhance mental well-being (Olafsdottir et al., 2020), and foster positive emotional states such as happiness (Capaldi et al., 2014). Spending more time outdoors is associated with increased physical activity, which in turn contributes to overall well-being (Gray et al., 2015) and a reduction in symptoms of depression, anxiety, and stress (Beyer et al., 2014). Additionally, it has been suggested that social cohesion, together with physical activity, is one of the main factors facilitating contact with nature and the consequent improvement in health (Hartig et al., 2014). A recent literature review conducted by Jennings and Bankole (2019) found that access to urban green spaces is correlated with positive outcomes in terms of social cohesion, such as place attachment, social support, sense of belonging, and empowerment. Moreover, the presence of green spaces appears to encourage pro-environmental behaviors among residents, including increased physical activity

(Mytton et al., 2012) and social interaction (Lachowycz & Jones, 2013). Theories of Attention Restoration and Stress Reduction have been proposed to explain the positive effects of nature exposure on well-being (Argyriadis et al., 2024). Attention Restoration Theory (ART) posits that exposure to natural environments can restore attentional capacity, which is depleted by the demands of daily life and the need for directed attention (Kaplan & Kaplan, 1989). According to ART, natural environments possess characteristics such as soft fascination, being away, extent, and compatibility, which promote the restoration of attention (Kaplan & Kaplan, 1989). On the other hand, the Stress Reduction Theory (SRT) suggests that exposure to natural environments can evoke positive emotional responses, leading to a reduction in physiological arousal and stress levels (Argyriadis et al., 2024).

If a growing body of research has highlighted the benefits of exposure to nature on physical, mental, and emotional health, many studies do not specifically consider migrant populations (Charles-Rodriguez et al., 2023). Instead, in their review, the authors found how nature is relevant for the migrant population as participation in natural environments is an experience that can create a bridge between the past and the present, creating new memories that contribute to building a sense of belonging and attachment to the place, cultural continuity and well-being, in line with recent research that has examined the role of exposure to green spaces in the Chinese (Wang et al., 2024) and Albanian migrant population (Kruja et al., 2024), finding how this also contributes to improving life satisfaction. Natural environments can facilitate recovery, positive emotions, socialization, and health-promoting activities, such as physical activity (Charles-Rodriguez et al., 2023). In addition, recent research suggests that participation in nature-based programs can offer the opportunity to change the role of immigrants in host societies, moving from a role of "receivers" to a more active and leadership role (Bessho et al., 2020). Finally, another study of adult migrants by Yang et al. (2020) showed that connecting with nature does not necessarily have a direct relationship with migrants' mental health. On the contrary, there may be a more complex relationship between these variables, e.g. it may be indirectly linked through the reduction of perceived environmental disturbance and the improvement of social cohesion. In this regard, authors have also found that a better perception of green spaces reduces the perception of pollution and noise, thereby improving social cohesion and, indirectly, mental health (Yang et al., 2020).

Arola et al. (2023) tried to bridge the gap with regard to contact with nature and children, finding that this positively influences their well-being. Other research has found that contact with the natural environment can promote cognitive functioning in children and adolescents (Nguyen & Walters, 2024). Some reviews have been conducted on the impact of connecting

with nature in the adolescent population (Moll et al., 2022; Nielsen, 2022; Rowley et al., 2022), highlighting how the link between these two issues tends to be unclear (Cabana et al., 2024). Despite the presence of this evidence, there are some points that could be critical and that make a new review of the literature necessary. Specifically, these reviews focused on the analysis of a few bibliographic databases, being able to take into account only a small number of references. Additionally, although these reviews are recent, as they were all published in 2022, the data collected date back to the period between April and October 2021, therefore not being able to consider these last three years, years in which the scientific literature has been further enriched with research also on the basis of climate evolutions that make it increasingly necessary to pay attention to ecological and natural issues, including environmental sustainability (Štraupaitė, 2023). Furthermore, there is an almost complete lack of literature on contact with nature among young migrant adolescents (Seeland et al., 2019), even though it is recognised that green spaces offer greater potential for social inclusion than elsewhere (Parr, 2007) and that these places are important for promoting multicultural encounters (Glover et al., 2005).

2. Method

This systematic review began with the identification of relevant search terms concerning migrant adolescents and young adults in relation to their connection with nature, in an effort to understand how the scientific literature has investigated the connection with nature in this specific population and what results have been reported. The following terms were then selected: Migrant* OR Immigration OR Refugee* OR Newcomer* AND youth OR adolescen* OR teenager* OR young adult* AND human nature relationship OR nature connectedness OR nature exposure OR connection to nature. These terms were initially identified by the first author and then discussed with the rest of the team to reach agreement on the search criteria. We used several bibliographic databases for the search: ProQuest, Psychology and Behavioral Sciences Collection, PsycArticles, PsycInfo, PubMed, Scopus and Web of Science. However, the search string yielded only one relevant article (Seeland et al., 2009), in which the authors, studying foreign students in Switzerland, found that public urban green spaces play an important role for children and young people in facilitating intercultural contacts and friendships. As it was not possible to conduct a systematic review based on a single article, we decided to broaden the search string by removing the specific reference to migration. This broader approach allowed us to explore how the connection with nature manifests itself and what effects it has on adolescents and young adults in general, regardless of migration status. The expansion of the research string was based on the need to obtain a more comprehensive view of the phenomenon, avoiding limiting the research to a specific subset of the population. This process was essential to

better understand the dynamics of connection with nature and its potential psychological, social and physical benefits for young people, providing a broader picture that can be applied to different populations.

2.1. Research question and aim

Following these considerations, this systematic review was guided by this more general research question: How does the connection with nature influence adolescents and young adults? In an attempt to answer this question, the present study aims to examine how nature connectedness has been investigated in the scientific literature in adolescent and young adult populations, and with what results. This analysis aims to guide future research, particularly in the context of young migrants, as there is a notable lack of studies on nature attachment in this specific population.

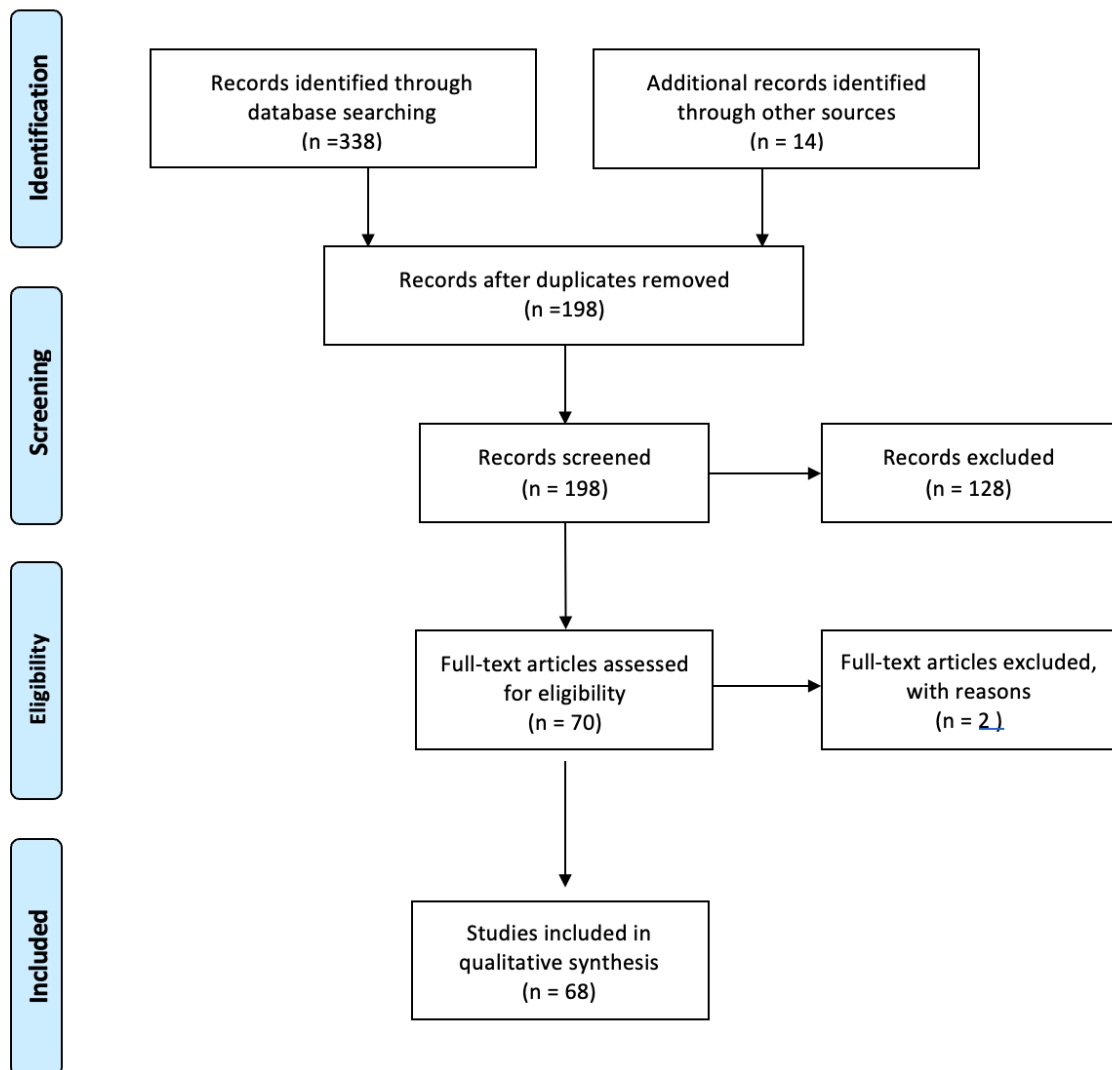
Table 1. Final search string

Terms related to population	Boolean Operator	Terms related to nature
Youth OR adolescen* OR teenager* OR "young adult*"	AND	"Human nature relationship" OR "nature connectedness" OR "nature exposure" OR "connection to nature" OR "connection with nature"

As visible in Table 1, the new search string was as follows youth OR adolescen* OR teenager* OR "young adult*" AND "human nature relationship" OR "nature connectedness" OR "nature exposure" OR "connection to nature" OR "connection with nature". It was run in the same databases considering Title, Abstract and Keyword. Where possible, the search limit was set in the social sciences, in peer reviewed articles, in articles that actually considered the population of interest (adolescents and young adults aged between 11 and 26, so that there was a one-year lag in the age references used). For each of the selected databases, all English language articles up to June 2024 were reviewed and selected.



PRISMA Flow Diagram



2.2. Search strategy

This systematic review was conducted following the Preferred Reporting Items for Systematic reviews and Meta-analyses (PRISMA, Moher et al., 2009) guidelines, as illustrated in Fig. 1. This set of evidence-based items guides investigators in designing, writing, and reporting results of systematic reviews and meta-analyses, to improve their quality and usability by following common parameters. The review process was divided into three stages: title screening, abstract screening and full-text screening. The results of the database searches were downloaded and managed using Zotero, a bibliographic management software that facilitated the organization and tracking of sources throughout the review process.

Using the above string, a total of 338 articles were identified across the various databases. Moreover, experts in the field and other sources (e.g., ResearchGate) were consulted to identify additional relevant records not present in the databases, so 14 potentially relevant articles were included. As can be seen in figure 1, the total number of records found was 352 articles. Subsequently, the database libraries were downloaded and then imported into Zotero to proceed with the next step of abstract analysis.

2.3. Inclusion and Exclusion criteria

The following inclusion criteria were applied in the abstract analysis process: a) we included studies involving adolescents (11-18 years) and young adults (19-26 years); b) we considered studies that examine the connection to nature, exposure to it and the resulting benefits; c) we included both qualitative and quantitative studies, including those with a mixed research design; d) we considered only published in peer-reviewed academic journals and written in English articles to ensure quality and accessibility. The exclusion criteria were: a) studies involving children under 11 years old or adults over 26 years old, as they do not fall within our research focus; b) studies that do not directly address the connection with nature or that focus on non-relevant aspects such as urbanization without contact with nature; c) we excluded reviews, comments, letters to the editor, unpublished theses, and conference proceedings, as well as articles for which the full text could not be obtained; d) studies with significant methodological limitations or low scientific quality; e) studies published in languages other than English. The first and the second authors (FM and MO) independently screened the papers in a double-blind process, assessing their relevance based on titles and abstracts. Papers deemed relevant were read in full. Any disagreements were resolved by the third author (LM).

2.4. Data extraction

The next stage of reading the full texts, only those articles were included which, meeting the inclusion criteria specified above, presented the reference to age clearly and where the results/findings were distinguishable from any other age groups. Thus, a total of 68 articles were included in this systematic review, after removing 2 articles due to the unavailability of full texts. For data extraction, a systematic process was employed to collect key information from each selected publication. The extracted data included details related to the authors and the title of the publication, the year of publication, and comprehensive information about the study population. Special attention was given to the type of population included in the studies, with a specific focus on adolescents and/or young adults. The participants' age, sample size,

and any relevant demographic or contextual details were documented to better understand the study context. Additionally, data were gathered concerning the primary objective of the study and the research design employed (e.g., cross-sectional, longitudinal, experimental, or quasi-experimental studies). The analysis primarily concentrated on outcomes related to the connection with nature, excluding other non-pertinent outcomes. Thus, only results that directly addressed the relationship between exposure to nature and physical, mental, or emotional health outcomes were considered, focusing exclusively on the sample of interest, namely adolescents and/or young adults. Table 2 shows the references, investigated populations, objectives, study design and main findings of each included article.

Table 2. Included studies with characteristics

Authors	Title	Population	Objectives	Study design	Main results
Aruta (2023)	The intergenerational transmission of nature relatedness predicts green purchase intention among Filipino adolescents: Cross-age invariance and the role of social responsibility	Filipino parent-adolescent dyads, N = 449, Adolescents aged between 17-23	The aim was to investigate a serial mediation model demonstrating how social responsibility mediates the intergenerational transmission (from parents to adolescent children) of nature relatedness, and how this transmission influences adolescents' green purchase intention	Quantitative	- Adolescents' connection with nature, as fostered by their parents and mediated by social responsibility, significantly predicts their intention to engage in green purchasing behaviors
Barron & Rugel (2023)	Tolerant greenspaces: Designing urban nature-based solutions that foster social ties and support mental health	Young adults, N not specified, aged between 15-24	The aim was to clarify the specific characteristics of urban greenspaces that appeal to young adults and fulfill their needs for restorative and	Qualitative	- The study highlighted the importance of urban greenspaces in fostering a connection with nature among young adults. It emphasized the need for diverse, secluded, and well-maintained greenspaces to support

	among young adults		socially oriented experiences.		social ties and mental health.
Barton et al., 2016	The Wilderness Expedition: An Effective Life Course Intervention to Improve Young People's Well-Being and Connectedness to Nature	Students, N = 130, aged between 11-18	The aim of this study was to measure the impact of wilderness expeditions on self-esteem (SE) and connectedness to nature (CN) and assess whether benefits varied according to participant and expedition characteristics.	Quantitative	<ul style="list-style-type: none"> - Wilderness expedition leads to increased self-esteem and nature connectedness - Increase in self-esteem was more significant in girls
Bowers et al. (2019)	Urban youth perspectives on the benefits and challenges of outdoor adventure camp	Young adults and youth, predominantly from urban and racial/ethnic minority backgrounds, N = 75, aged between approximately 11-17	The aim was to evaluate the impact of a short-term outdoor adventure camp on youth development outcomes, including connection to nature	Mix method	<ul style="list-style-type: none"> - 49.3% of youth reported a significant increase in their connection to nature after the camp experience, which provided novel and challenging outdoor settings - The adventure camp provided a direct and engaging experience with nature, which helped the participants develop a deeper connection with the environment. The outdoor activities, which included hiking, camping and other challenges in a natural setting, had a positive impact on the way young people perceive and relate to nature - The study also found that young people from ethnic minority and socio-

Bowers et al., 2021	Nature as an Ecological Asset for Positive Youth Development: Empirical Evidence From Rural Communities	Students, N = 587, aged between 11-14	The aim was to explore direct associations between time in nature, connection to nature, and the competence, connection, confidence, character, and caring as well as the “sixth” C of contribution	Quantitative	economically disadvantaged backgrounds particularly benefited from the camp experience, suggesting that such programmes may be particularly effective in promoting well-being and connection with nature in these populations. - Positive youth development positive correlates with time spent in nature and nature connectedness
Browning et al. (2022)	Association between residential greenness during childhood and trait emotional intelligence during young adulthood: A retrospective life course analysis in the United States	College students, N = 297, aged between 18-27	The aim was to examine the relationship between childhood exposure to greenness and emotional intelligence in young adulthood.	Quantitative	- The study found no significant association between greenness exposure and emotional intelligence, indicating that other factors might play a more critical role in developing a connection with nature during young adulthood
Cahn & Duvall (2023)	Nature Contact Linked to Higher Levels of Positive Well-Being	Sample 1: University students, N = 173, aged between 18-25	The aim was to explore whether incidental and intentional nature contact were	Quantitative	- Nature exposure was associated with improvements in vitality and attentional function but did not significantly impact

	in Young Adults During the Pandemic	years. Sample 2: Amazon Mechanical Turk workers, N = 154, aged between 18–25 years.	associated with declines in negative well-being (i.e., anxiety and social isolation) and/or improvements to positive well-being (i.e., vitality and attentional functioning) in young adults during the pandemic		feelings of anxiety and isolation. - Intentional nature contact was particularly beneficial for enhancing vitality and attentional functioning in both samples.
Campbell (2016)	Exploration of Body Image and Connection with Nature Among American Indian Female Adolescents	Adolescent students, N = 14, aged between 12-14	The aim was to gain insight into body image and connection to nature among American Indian female adolescents	Mix method	- Participants experienced an array of outdoor activities and most of the participants claim they have had or have a connection with the nature world and enjoy the outdoors - Participants showed positive body image influenced by cultural identity, with connection to nature providing emotional support.
Cavazos-Arroyo & Sánchez - Lezama (2022)	Explaining green consumption: A cross-cultural study on young adult consumers through a multi-group comparison	Young adults, specifically university students from Mexico, N = 447 and Spain, N = 120, aged 18 - 26 for the Mexican sample, and aged 18 - 25 for the Spanish sample	The aim was to explore and compare the decision to consume green products related to their connection to nature, environmental citizenship, activism, and environmental social identity among young Mexican and Spanish consumers.	Quantitative	- Connection to nature was the only significant predictor of green consumption among young adults in both countries. - Those who felt more connected to nature were more likely to engage in eco-friendly consumption behaviors

Chen & Huo (2023)	Social Interaction Anxiety and Problematic Smartphone Use Among Rural-Urban Adolescents in China: A Moderated-Mediation Model	Junior high school students, N = 840, aged between 12-14	The aim was to explore the relationship between social interaction anxiety and problematic smartphone use among Chinese adolescents, examining the roles of online basic psychological needs satisfaction and nature connectedness, with a focus on rural-urban differences.	Quantitative	<ul style="list-style-type: none"> - Nature connectedness moderated the relationship between online basic psychological needs satisfaction and problematic smartphone use. Specifically, higher nature connectedness was associated with lower problematic smartphone use, suggesting that adolescents with a stronger connection to nature are less likely to develop problematic smartphone use, even when they experience social interaction anxiety. This effect was more pronounced among rural adolescents compared to their urban counterparts.
Dornhof et al. (2019)	Nature relatedness and environmental concern of young people in Ecuador and Germany	High school students from Germany, N = 2,173, and High school students from Ecuador, N = 451, aged between 18-22	The aim was to explore the effects of a nature-based intervention on undergraduate students' connection to nature and well-being.	Quantitative	<ul style="list-style-type: none"> - The intervention increased students' connection to nature, which was associated with improvements in well-being. - The study suggested that nature-based experiences could foster a deeper connection with nature and enhance psychological well-being.
Friedman et al. (2024)	The messy middle: an exploratory study of adolescent environmentalists in North Carolina	Adolescents, N = 9, aged between 12-19	The aim was to explore how adolescents with a strong connection to nature and involvement in environmental education	Qualitative	<ul style="list-style-type: none"> - The study identified three main themes: 1) Optimism and limitations related to individual actions, 2) Environmentalism as more than a phase, and 3) Complex relationships with

			programs experience their connection to nature, environmentalism, and related behaviors.		nature, environmentalism, and technology. The adolescents expressed both positive and negative emotions towards their connection with nature, indicating a complex relationship influenced by their environmental knowledge, personal experiences, and the broader socio-political context.
Gamble et al. (2014)	Not just scenery: viewing nature pictures improves executive attention in older adults	Young adults, N = 26, aged between 18–25.	The aim was to investigate whether viewing nature pictures could improve executive attention in both healthy older adults and young adults, based on the Attention Restoration Theory.	Quantitative	<ul style="list-style-type: none"> - Viewing nature pictures significantly improved executive attention in young adults, while urban pictures did not show such improvement. - This Nature Effect was specific to executive attention and did not influence alerting or orienting attention.
Garcia et al. (2020)	Leisure Time in Natural Environment as a Promoter of Emotional Connection with Nature. An Environmental Study with Teenagers in Pontevedra	Secondary education students, N = 683, aged between 11-18	The aim was to analyze the influence of leisure experiences in natural environments on the emotional connection with nature among secondary education students. The study also examined the role of variables such	Quantitative	<ul style="list-style-type: none"> - Teenagers who spend more leisure time in natural environments have a higher degree of emotional connection with nature. - Students from rural areas showed a stronger connection with nature than those from urban areas. - Female students exhibited a significantly higher emotional connection with nature compared to male students.

Garip et al., 2021	Development and implementation of evaluation resources for a green outdoor educational program	Adolescent students, N = 50, aged between 13-19	as place of residence and gender. The aim was to identify the impact of participating in a Green Spaces, Learning Places program	Mix method	- Experiencing positive feelings in green spaces leads to positive wellbeing
Gasparetto-Higuchi et al. (2023)	The relationship of Amazonian adolescents with natural environments before and during social isolation in the COVID-19 pandemic	Adolescents (N = 277 for the first survey, N = 79 for the second survey), aged between 14 and 19 years	The aim was to investigate the relationship of Amazonian adolescents with natural environments and how this relationship changed during the social isolation caused by the COVID-19 pandemic.	Quantitative	- Adolescents with a strong connection to nature before the pandemic expressed a greater desire to reconnect with nature during the isolation period. - High levels of connection with nature were associated with greater concern for environmental issues, a stronger desire to access natural spaces, and more frequent seeking of nature-related news during the pandemic.
Goh et al. (2023)	Untangling the additive and multiplicative relations between natural scenery exposure and human-animal interaction on affective well-being: Evidence from daily diary studies	Young adults, N = 514, aged between: 19-30	Examine the additive and multiplicative relationships between natural scenery exposure and human-animal interaction on affective well-being (specifically positive affect, negative affect, and stress). The study sought to understand whether these	Quantitative	- There was a significant positive relationship between natural scenery exposure and positive affect at both the within-person and between-person levels. This suggests that individuals reported higher positive affect on days when they were more exposed to natural scenery and that those who generally experienced more natural scenery had higher positive affect overall.

			elements of nature contribute independently to well-being or if their effects are interdependent.		
Gruno & Gibbons (2024)	Nature-Based Physical Activity in Pictures: A Photovoice Unit in (and Beyond) Physical and Health Education	Students in a Physical and Health Education (PHE) class, N = not specified. Aged between 16-18	The aim was to engage students in nature-based physical activity and foster human-nature connectedness using a Photovoice methodology.	Qualitative	<ul style="list-style-type: none"> - The study found that students emphasized a sense of connection not only to nature but also to themselves, their classmates, and their community. The project demonstrated that nature-based physical activity can effectively enhance human-nature connectedness among students.
Gu et al. (2023)	Contact with nature for emotion regulation: the roles of nature connectedness and beauty engagement in urban young adults	Young adults, N = 2097, aged between 18-35 ($M_{age} = 24.01$)	Investigate how self-reported frequency of nature contact is associated with the use of emotion regulation strategies in young adults and explore the mediating role of nature connectedness (psychological connection to nature) and the moderating role of engagement with natural beauty.	Quantitative	<ul style="list-style-type: none"> - Nature connectedness mediated the associations between both direct and indirect nature contact and cognitive reappraisal (an adaptive emotion regulation strategy) as well as expressive suppression (a maladaptive strategy). - Engagement with natural beauty moderated the relationship between direct/indirect nature contact and cognitive reappraisal, as well as the relationship between indirect nature contact and nature connectedness.
Hagen (2024)	Unveiling the Voices: Lived Experiences of	Adolescent girls, N = 7, aged between 13-17	The aim was to examine the lived experiences of adolescent	Qualitative	<ul style="list-style-type: none"> - Connection with nature and animals was a significant theme, with participants describing

	Adolescent Girls With Emotional Disturbance in Special Education		girls with emotional disturbance in special education to improve academic success and graduation rates		how these connections helped them manage their emotional disturbance and provided a sense of calm and safety
Hatala et al., 2020	Land and nature as sources of health and resilience among Indigenous youth in an urban Canadian context: a photovoice exploration	Adolescents and Young adult, N = 28, aged between 16-25	This study explores Indigenous youths' meaning-making processes and engagements with land and nature in an urban Canadian context	Qualitative	- Connection with nature positive was found to be a recurring theme in promoting well-being
Helne (2022)	Voicing relationality: the nature connectedness of young Finnish adults in the promotion of sustainability	Young adults, N = 29, aged between 20-29	The aim was to explore nature connectedness among young Finnish adults and its role in promoting sustainability, especially among those not engaged in employment, education, or training	Qualitative	- The study found that participants had a significant connection with nature, which manifested across six dimensions: material, cognitive, experiential, sensual/emotional, philosophical/spiritual, and compassion, care, and commitment. This connection is critical for well-being and can foster pro-environmental behaviors and sustainability. Participants saw nature as integral to their well-being, which influenced their attitudes towards sustainability.
Hoover (2020)	Children in nature: exploring the	High school students (N = 140), aged 16-19	The aim was to examine the relationship between	Quantitative	- Connection to nature was significantly predicted

	relationship between childhood outdoor experience and environmental stewardship		childhood outdoor experiences and connection to nature, environmental attitudes, and pro-environmental behaviors		by appreciative outdoor activities. - Connection to nature was also a significant predictor of conservation behaviors.
Jackson et al. (2021)	Connection to nature boosts adolescents' mental well-being during the COVID-19 pandemic	Adolescent, N = 624, aged between 11 - 18	The aim was to explore the relationship between connection to nature and mental well-being before and during the COVID-19 pandemic among adolescents in the United States.	Quantitative	- The study found a significant decline in connection to nature during the pandemic, which predicted declines in mental well-being. Connection to nature mediated the relationship between outdoor activity participation and mental well-being. During the pandemic, the direct effect of outdoor activities on mental well-being increased, highlighting the importance of maintaining a connection to nature for adolescents' mental health.
Johnson et al. (2013)	Cultivating youth's capacity to address climate change in Uganda	Ugandan youth, N = 133, aged between 16-24	The aim was to assess the effects of environmental education workshops on youth's environmental knowledge, connection to nature, self-efficacy, and civic attitudes	Mix method	- Before the workshops, many youth had limited understanding and interaction with natural environments. However, by the end of the workshops, participants reported a greater appreciation for the beauty of the forests and a sense of stewardship towards the environment - The workshops' emphasis on experiential learning—such as conducting

Johnson-Pynn et al. (2008)	Students and Scientists Connect with Nature in Uganda, East Africa	Adolescent students, N = 84, aged 16-24 years	The aim was to assess the impact of Environmental Education workshops on connection to nature, self-efficacy, and civic attitudes.	Quantitative	<p>biodiversity assessments, identifying plant and animal species, and reflecting on the importance of forests—was highlighted as a crucial factor in fostering a connection with nature. The direct engagement with nature through these activities allowed participants to form personal, emotional connections to the environment, which were evident in their self-reported experiences.</p> <ul style="list-style-type: none"> - Participants generally reported an increase in their connection to nature after attending the workshops, particularly those who attended longer, three-day workshops. - Participants in the rural setting reported a significant increase in their connection to nature, while those in the urban setting reported a decrease. - Males showed a more substantial increase in connection to nature than females, particularly in the longer workshop format. Females' connection to nature decreased slightly, especially in the rural setting. - After practicing forest bathing,
Keller (2023)	Forest Bathing	High school students, N	The aim was to investigate the	Mix method	

	Increases Adolescent Mental Well-being and Connection to Nature. A Transformative Mixed Methods Study	= 24, aged between 16-18	impact of forest bathing on adolescent mental well-being and their experiences of connectedness to nature		<p>participants showed a statistically significant increase in their connection to nature, as measured by the Connectedness to Nature Scale</p> <ul style="list-style-type: none"> - The increase in connectedness to nature did not significantly change between the first and the third forest bathing sessions, indicating that the most significant change occurs initially - Forest bathing significantly improved participants' connection to nature, which was linked to increased mental well-being and reduced stress - The experience also fostered a sense of responsibility and care for the environment
Krettenauer et al. (2020)	Connectedness with nature and the decline of pro-environmental behavior in adolescence: A comparison of Canada and China	Adolescent, N = 325 Canada, 363 China, aged between 11-21	The present research investigated whether age-related differences in connectedness with nature in adolescence are associated with pro-environmental behavior across two cultures, Canada and China	Quantitative	<ul style="list-style-type: none"> - Adolescence is characterized by a decline in feelings of connectedness with nature, which is often associated with a decrease in pro-environmental behavior. - The study compares Canadian and Chinese adolescents and finds that while both groups show a decrease in connectedness with nature as they age, this decline has a more pronounced effect on pro-environmental behavior in Canada than in China.

**Kretten
auer et
al.
(2024)**

Pro-
environmental
behaviour,
connectedness with
nature, and
the
endorsement
of pro-
environmental
norms in
youth:
Longitudinal
relations

Adolescent
and young
adult, N =
610, aged
between 12-
20

The study was
meant to
investigate
longitudinal
change in pro-
environmental
behaviour from
the early
teenage years
to early
adulthood as it
relates to
changes in
nature
connectedness
and the
endorsement of
pro-
environmental
norms

Quantitative

- In China, the expectation of positive moral emotions (such as pride and satisfaction) from engaging in pro-environmental behavior helps mitigate the decline in pro-environmental actions despite reduced connectedness with nature.
- Pro-environmental behaviour, connectedness with nature and norm endorsement significantly increased in the first two years of the longitudinal study, while this increase levelled off thereafter.
- Cross-lagged panel analyses demonstrated that nature connectedness and endorsement of pro-environmental norms reciprocally predicted pro-environmental behaviour in both cohorts, with one dominant path from pro-environmental behaviour to norm endorsement
- As adolescents and young adults continue to engage in pro-environmental behaviour, they increasingly tend to endorse pro-environmental norms.
- Connectedness with nature and norm

Küçüka ydın (2024)	Understanding Connection to Nature in Turkish Middle School Children: Personal Factors and Nature's Restorative Effect	Students, N = 214, aged between 11- 16 years (Study 1), N = 404, aged between 11- 15 (Study 3)	Adapt and validate the Connection to Nature Index in a Turkish sample (Study 1) and investigate the relationship between connection to nature and psychological health, satisfaction with life, and hope, using a serial mediation model (Study 3)	Quantitativ e	endorsement, by contrast, did not evidence any cross-lagged relationship. - The Connection to Nature Index was validated for use in the Turkish sample, showing good psychometric properties (Study 1) - Connection to nature was found to positively influence psychological health, satisfaction with life, and hope in children, with hope and life satisfaction acting as serial mediators (Study 3)
Larson et al. (2019)	Outdoor Time, Screen Time, and Connection to Nature: Troubling Trends Among Rural Youth?	Rural youth in the USA, N = 543, aged between 11- 18 years	The objective was to examine the relationship between screen time, outdoor time, and connection to nature among rural youth	Quantitativ e	- Increased screen time is associated with a decline in connection to nature, whereas outdoor time enhances this connection, highlighting the tension between digital and natural environments for rural youth.
Lau et al. (2024)	Emotional responses and psychologic al health among young people amid climate change, Fukushima's radioactive water release, and	Young adult, N = 2000, aged between 18- 28 years	The aim was to investigate the impact of multiple global crises on the psychological health of young people, and the roles of media exposure and nature connectedness	Quantitativ e	- The study found that nature connectedness significantly mitigates the negative psychological effects of emotional engagement with global crises such as climate change and the release of radioactive water. Individuals with higher nature connectedness

	wars in Ukraine and the Middle East, and the mediating roles of media exposure and nature connectedness: a cross-national analysis				reported better mental health outcomes despite the distress caused by these crises
Li et al. (2021)	Can residential greenspace exposure improve pain experience? A comparison between physical visit and image viewing	Healthy young adults, N = 24, aged between 19-21	This study aimed to investigate the impact of physical and image-based exposure to greenspaces on pain perception.	Mix method	<ul style="list-style-type: none"> - Both modes of exposure (physical and imaging) to green spaces increased pain tolerance and reduced the intensity of perceived pain. - Physical visits to green spaces had a greater impact than viewing pictures, suggesting that direct experience of nature might be more effective in improving pain perception.
Li et al. (2022)	Nature deficit and senses: Relationships among childhood nature exposure and adulthood sensory profiles, creativity, and nature relatedness.	Chinese university students, N = 691, aged between 18-25 years	The aim was to examine how childhood nature exposure is associated with adulthood sensory profiles and whether these profiles mediate nature relatedness and creativity in adulthood	Experimental - Quantitative	<ul style="list-style-type: none"> - Regarding the relationship between childhood nature exposure and adulthood creativity and nature-relatedness, significant direct paths and indirect paths through low sensory registration were observed. - Results suggested that children who had lower levels of nature exposure grew up to exhibit a high tendency to miss subtle sensory stimuli, and this sensory processing pattern in turn is associated with

Li et al., 2018	Moving beyond the neighborhood: Daily exposure to nature and adolescents' mood	Adolescents, N = 155, aged between 13-19	The aim was to understand the association between exposure to varying concentrations of nature and adolescents' mood	Quantitative	lower levels of affinity to nature and creativity - Exposure to nature is associated with better mood
Liu et al. (2024)	Passive green space exposure leading to lower aggression: The mediating role of sense of security.	Young adult, N = 240, M _{age} = 23.74	The aim was to investigate the effect of passive green space exposure on aggression and the mediating role of a sense of security.	Quantitative	- Exposure to passive green space was associated with lower aggression, with sense of security mediating this relationship.
McEwan et al. (2022)	This Is What the Colour Green Smells Like!': Urban Forest Bathing Improved Adolescent Nature Connection and Wellbeing	Adolescent students, N = 44, aged between 9-17	The aim was to assess whether an urban nature connection intervention could improve adolescents' nature	Quantitative	- Urban forest bathing improved nature connection by 25%, anxiety reduced by 13%, rumination reduced by 44%, and social connection increased by 12%.
Michaelson et al. (2020)	Electronic screen technology use and connection to nature in Canadian adolescents: A mixed methods study	Students, N = 74 qualitative participants aged between 11-18; N = 23,920 quantitative participants, aged between 11-15	The aim was to explore relationships between electronic screen use and connections to nature among Canadian adolescents.	Mix method	- A higher use of electronic screen technology is associated with a lower perception of the importance of nature. Adolescents with higher screen use tended to feel less connected to nature. - Teenagers who disconnected from electronic devices

Minor et al. (2023)	Nature exposure is associated with reduced smartphone use among college students	College students (N=120), aged between 18-24	The aim was to examine the relationship between nature exposure and smartphone use among college students	Quantitative	<p>showed an increased appreciation for nature. This suggests that reducing the amount of time spent on screens may help strengthen the connection with the natural environment.</p> <ul style="list-style-type: none"> - Increased nature exposure is associated with reduced smartphone use, suggesting that nature experiences may help mitigate excessive smartphone usage.
Musitu-Ferrer et al. (2019)	Is school adjustment related to environmental empathy and connectedness to nature?	Adolescents, N = 833, aged between 12-17	The aim was to explore the relationship between school adjustment, environmental empathy, and connectedness to nature.	Quantitative	<ul style="list-style-type: none"> - Adolescents with higher school adjustment showed greater connectedness to nature. - Females generally reported higher connectedness to nature than males.
Neaman et al. (2023)	Unleashing the power of connection: How adolescents' prosocial propensity drives ecological and altruistic behaviours	Adolescents, N = 438, aged between 11-19	The goal of the study was to assess connection to nature, connection to people, and connection to country as mediators of the relationship between prosocial propensity and prosocial behaviours in both the ecological and human domains	Quantitative	<ul style="list-style-type: none"> - the effect of prosocial propensity on ecological behaviour was positively mediated by connection to people and connection to nature, but negatively mediated by connection to country. - For altruistic behaviour, the effect of prosocial propensity was positive via connection to people, nature, and country
Neurohr et al. (2023)	Measuring adolescents' level of	Adolescent student, N =	The aim was to develop a reliable	Quantitative	<ul style="list-style-type: none"> - Adolescents' interest in nature correlates positively

	interest in nature: a promising psychological factor facilitating nature protection	351, $M_{age} = 12.58$	instrument to measure adolescents' interest in nature		with their connection with nature, their intention to preserve nature and engagement in pro-environmental activities in their free time
Piccinini et al., 2018	Outdoor play and nature connectedness as potential correlates of internalized mental health symptoms among Canadian adolescents	Adolescents, $N = 29784$, aged between 11-15	The aim was to explore how environmental exposures, as well as self-perceptions of connectedness with nature, each related to the prevalence of recurrent psychosomatic symptoms.	Quantitative	- Nature connectedness can reduce internalized psychosomatic symptoms, such as depression, irritability, nervousness or trouble falling asleep
Price et al. (2022)	Factors associated with nature connectedness in school-aged children	Students, 7-18years ($N=1872$) Adolescent aged between 11-18 $N =$ non specified	The aim was to identify biological, behavioral and social factors associated with nature connectedness levels	Quantitative	- Self-reported daily screen time was negatively correlated with nature connection
Raleigh (2009)	Childhood nature contact and its effect on adult coping skills	College students, $N = 119$, aged between 18-25	The aim of the study was to explore how childhood exposure to nature affects adult use of natural restorative environments	Mix method	- Positive correlation between childhood nature exposure and the use of natural environments for emotional soothing in adulthood - There were some evidence that individuals who had higher contact with nature as children were more likely to use active coping strategies, such as seeking out natural environments for emotional regulation, rather than passive or

Reihana et al. (2023)	Indigitization: Technology as a mode for conservation sustainability and knowledge transfer in indigenous New Zealand communities.	Māori and Polynesian youth in New Zealand; N = 122, aged between 11-18	Explore the use of virtual reality and graphic novels as tools for transferring indigenous ecological knowledge and fostering a connection to nature among youth.	Qualitative	avoidant coping strategies. However, there was no clear correlation between nature contact and the development of low trait anxiety in adulthood, indicating that while nature contact influences coping strategies, it does not necessarily mitigate anxiety - Virtual reality and graphic novels tools were effective in transferring ecological knowledge and enhancing connection to nature among youth.
Rodríguez-Díaz et al. (2022)	The Future of Rurality: Place Attachment among Young Inhabitants of Two Rural Communities of Mediterranean Central Chile	Young inhabitants of two rural communities in central Chile; N = 90, aged between 13-24	Identify the factors influencing young people living in two rural agricultural communities in central Chile to stay in or leave the countryside	Quantitative	- Higher satisfaction with community, connection to nature, and social valuation of rural livelihoods positively influence the likelihood of young people staying in the countryside
Rosa et al. (2018)	Nature experiences and adults' self-reported pro-environmental behaviors: The role of connectedne	Young adult, N = 224, M _{age} = 23.64	This study explores whether nature experiences lead to self-reported pro-environmental behaviors and whether this	Quantitative	- Greater contact with nature during childhood is associated with greater contact with nature as an adult, which, in turn, is positively associated with connectedness to nature and pro

	ss to nature and childhood nature experiences		relation is mediated by connectedness to nature		environmental behaviors
Rosa et al. (2023)	Gender differences in connection to nature, outdoor preferences, and nature-based recreation among college students in Brazil and the United States	Undergraduate students, N = 207, aged between 18-24	Examine the associations among connection to nature, recreation setting preferences, and nature-based recreation participation	Quantitative	- young adults with stronger connection to nature have a greater preference for outdoor environments to recreate and that these preferences are associated with more frequent participation in Nature-based recreation - Women were more connected to nature and tended to prefer outdoor environments to recreate
Rose et al. (2018)	Promoting adolescent health and well-being through outdoor youth programs: Results from a multisite Australian study	Adolescent student, N = 160, M _{age} = 15	The purpose of the study was to examine the extent to which participation in structured outdoor programs is associated with improvements in adolescent health and well-being	Quantitative	- Structured outdoor programs may have a beneficial effect on well-being - No changes were found on measure of nature connectedness
Scopelliti et al. (2022)	My parents taught... green was my growth! the role of intergenerational transmission of ecological values in young adults' pro-environment	Young adult, N = 175, aged between 18-30	The aim was to detect what are the predictors of pro-environmental behaviors	Quantitative	- The importance of the emotional connection with nature and environmental identity in predicting Pro Environmental Behaviors has clearly emerged

	al behaviors and their psychosocial mechanisms				
Seeland et al. (2009)	Making friends in Zurich's urban forests and parks: The role of public green space for social inclusion of youths from different cultures	Students and young adults, including immigrants, N = 437, aged between 11-17	The aim was to analyze the role of urban green spaces in facilitating social inclusion among Swiss and immigrant youths	Quantitative	<ul style="list-style-type: none"> - The study found that urban green spaces, such as parks and urban forests, play a crucial role in the social inclusion of young people, especially those from migrant backgrounds. These spaces offer opportunities to meet, socialise and form friendships between young people of different cultural backgrounds. - It has been observed that young Swiss use urban forests more frequently than their immigrant peers, suggesting a variation in connection with nature based on cultural background. This could be due to different cultural habits, accessibility of spaces, or different perceptions of the value of natural environments - Outdoor activities, such as football and other forms of play in parks, have been identified as the main means by which young people form friendships and develop social networks.
Severin et al. (2023)	Impact of the citizen science	Secondary school students, N	The aim was to explore educational	Quantitative	<ul style="list-style-type: none"> - The project led to higher pro-environmental

	project COLLECT on ocean literacy and well-being within a north/west African and south-east Asian context	= 410, aged between 14-18	and behavioral impacts of citizen science projects		behavioral intentions for students in Benin and Ghana and higher well-being and nature connectedness for students in Benin
Swami et al. (2018)	Exposure to natural environments, and photographs of natural environments, promotes more positive body image. Body Image, 24, 82-94	Young adult, N = 43, aged between 18-25	The aim was to understand the impact of nature exposure on body image through 5 study. Only one involved young adult	Quantitative	<ul style="list-style-type: none"> - When participants viewed images of nature, there was an elevation in their state body appreciation - No corresponding elevation was found when the same participants viewed images of built environments.
Tseng & Wang, 2020	Understanding Taiwanese adolescents' connections with nature: rethinking conventional definitions and scales for environmental education	N = 10, aged between 17-18		Qualitative	<ul style="list-style-type: none"> - Nature connection promotes positive feelings and emotions and psychological restoration
Uhlman et al. (2022)	Nature relatedness, connections to food and wellbeing in Australian adolescents	Adolescent students, N = 59, aged between 11-18	This study seeks to understand Australian adolescents' connections to nature and their food, and how these relate to their overall sense of wellbeing	Mix-method	<ul style="list-style-type: none"> - Most adolescents considered that food connected them with nature - Urban students were less likely than rural students to state specifically that food comes from nature

van Heel et al. (2023)	Heroes for nature: understanding childhood nature experiences in motivating action for nature	Young adults who are dedicated to acting for nature, N = 20, aged between 18-25	this study aimed to find patterns in life experiences that contribute to their relationship with nature and drive their action for nature	Qualitative	<ul style="list-style-type: none"> - In early adolescence, engagement with nature takes flight after moments of wonder, significant life experiences, or encounters with like-minded peers. - Some interviewees experienced a temporary lack of interest in nature during puberty.
van Heezik et al. (2021)	Relationships between childhood experience of nature and green/blue space use, landscape preferences, connection with nature and pro-environmental behavior	Young adults, N = 282, aged between 18-25	The aim was to determine if early exposure to nature influences young adult interactions with natural environments and their engagement in behaviors that benefit the environment	Quantitative	<ul style="list-style-type: none"> - The study found only a weak association between child nature experience and the willingness to engage in pro-environmental behaviors, as well as weak positive associations with participants' awareness of biodiversity and the benefits of nature for well-being.
Wang & Huo (2022)	Effect of materialism on pro-environmental behavior among youth in China: the role of nature connectedness	Undergraduate student, N = 277, aged between 18-24	The aim was to explore the effect of materialistic values on pro-environmental behavior among youth and the mediated role of nature connectedness between materialistic values and pro-environmental behavior	Quantitative	<ul style="list-style-type: none"> - The negative impact of high materialistic values on pro-environmental behavior decreased with the increase of nature connectedness, further supporting the mediating role of nature connectedness - L'esposizione alla natura (tramite immagini o video) ha dimostrato di aumentare la connessione con la natura e, di conseguenza, il comportamento pro-ambientale, anche in

Wang et al. (2019)	Green space and serious psychological distress among adults and teens: A population-based study in California	N = 4538, aged between 12-17	The aim was to study the beneficial effect of green space on mental health among teen	Quantitative	<p>individui con alti livelli di materialismo</p> <ul style="list-style-type: none"> - Surrounding greenness significantly predicted decreased odds of serious psychological distress in teens
Wang et al. (2024)	Harnessing the power of nature exposure to mitigate adolescents' Internet addiction: A chain mediation model	Adolescent students, N = 1469, aged between 13-16	The present study examined the relationship between nature exposure and Internet addiction and investigated the mediating roles of anthropomorphism of nature and awe	Quantitative	<ul style="list-style-type: none"> - Mediation analyses indicated that awe partially mediated the relationship between nature exposure and adolescents' Internet addiction. - The anthropomorphism of nature and awe served as sequential mediating roles in the relationship between nature exposure and adolescents' Internet addiction.
Wiens et al., 2021	Enhancing adolescent girls' well-being in the arctic — finding what motivates spending time in nature	N = 117, aged between 13-16	The aim was to describe what motivates adolescent girls in the Arctic to spend time in nature	Qualitative	<ul style="list-style-type: none"> - Wanting to have pleasant emotions, the possibility of participating in activities and a desire to feel better are the main reason to spend time in nature
Williams et al. (2021)	Classroom-based citizen science: impacts on students' science identity, nature connectedness	Students, N = 367, aged between 12-17	This study explored changes in nature connectedness after a science project	Quantitative	<ul style="list-style-type: none"> - The project had no meaningful impacts on science identity or nature connectedness

Windhorst & Williams, 2015	<p>ss, and curricular knowledge</p> <p>Growing Up, Naturally: The Mental Health Legacy of Early Nature Affiliation</p>	<p>N = 308, aged between 18-24</p>	<p>The study aimed to examine the associations between connection with nature, positive natural experiences in childhood, and mental health, and to compare the childhood experiences of students with different levels of connection to nature.</p>	<p>Quantitative</p>	<ul style="list-style-type: none"> - Positive correlation between nature connectedness and positive childhood nature experiences - Nature connectedness had weak correlation with emotional and psychological well-being
Wright & Collings (2023)	<p>Conceptual meanings of permanency : photovoice with care-experienced youth</p>	<p>Care-experienced young, N = 11, aged between 16-25</p>	<p>The aim was to understand the perspective of young people about connection with nature using research methods such as Photovoice</p>	<p>Qualitative</p>	<ul style="list-style-type: none"> - Nature as constancy and metaphor suggested an internal sense of security and strategies to feel grounded by connecting with nature
Yeung & Yu (2022)	<p>Cognitive-emotional benefits of weekly exposure to nature: A Taiwanese study on young adults</p>	<p>Young adult, N = 48 (24 indoors and 24 outdoors in urban greenspace), 21 years old</p>	<p>The study explores whether the outdoor group surpasses the indoor group in cognitive and emotional well-being and nature connectedness</p>	<p>Quantitative</p>	<ul style="list-style-type: none"> - For sessions two, three, and four and one month post-test, the outdoor group's connectedness to nature was significantly higher than pre-test. - Both groups yielded similar results in decreased depression, anxiety, and stress, but a significantly higher number of outdoor group participants had employed nature exposure for coping

Zhang et al. (2017)	Push and pull factors determine adolescents' intentions of participation in nature observation: Reconnecting local students with nature in China	Adolescent student, N = 340, aged between 11-17	A wildlife observation toolbox was provided to students to encourage participation in nature observation clubs	Mix method (questionnaire and follow-up interviews)	with stress or emotions after the program - Nature connectedness and previous nature experiences were significant "push" factors for participation intention in nature clubs -
Zhang et al. (2024)	Unraveling the longitudinal relationships between connectedness to nature, depressive symptoms, and learning burnout in adolescents	Adolescent students, N = 1092, aged between 12-16	The study investigated mediated pathways, reverse mediated pathways, and reciprocal pathways between connectedness to nature, depressive symptoms, and adolescent learning burnout via a half-longitudinal analysis	Quantitative	- Connectedness to nature can serve as a positive resource to alleviate the levels of depressive symptoms among adolescents and thereby decrease learning burnout. - The protective effect of connectedness to nature was smaller, and the decreasing effect of learning burnout on connectedness to nature was stronger than the alleviating effect of connectedness to nature on learning burnout.

3. Results

The studies were published between 2008 and 2024. The majority of the studies are quantitative (approximately 67%). There are also some qualitative studies (17%) and mixed-method studies that combine both approaches (16%). The academic fields covered mostly included psychology. The analysed studies were mainly conducted on local US populations and many involved urban or rural youth, often from minority or disadvantaged backgrounds. Some studies have also compared populations from different countries (e.g. Mexico and Spain,

Germany, Turkey, Ecuador, etc). Migrant populations were mainly represented in studies focusing on urban environments, such as green spaces in Zurich. Additionally, the studies primarily focus on adolescents (60%), while those that consider young adults are fewer (40%).

We used a narrative approach to synthesize the data extracted from the studies analysed. Thematic analysis was then used to derive themes from the findings of the selected studies. All authors actively participated in defining and naming these themes. We identified the following five themes: 1) connection to nature and mental well-being; 2) pro-environmental behaviour, sustainability and connection to nature; 3) role of technology; 4) social connectedness through connection to nature; 5) gender differences in connection to nature.

Generally, greater connectedness to nature has often been found to be associated with positive outcomes, such as improved mental health, increased pro-environmental behaviour and sustainable attitudes, reduced problematic use of digital technologies and better social connection. Finally, there are some gender differences that have been highlighted by some studies.

3.1. Connecting with nature and mental well-being

Several studies have shown a positive association between connection to nature and mental well-being in adolescents and young adults. Specifically, Jackson et al. (2021) found that adolescents who maintained a strong connection to nature during the COVID-19 pandemic experienced improvements in mental well-being, with this connection mediating the relationship between outdoor activities and well-being. Similarly, Keller (2023) has shown that practices such as 'forest bathing' - which refers to a healing technique that restores the physical and psychological health of the human body through sensory stimulation when the body is exposed to a forest environment (Li, 2010) - significantly increases the connection to nature and consequently mental well-being in high school students. Furthermore, Liu et al. (2024) showed that passive exposure to green spaces can also have important effects on young adults, for example, by reducing aggression and thus increasing their sense of security. Piccininni et al. (2018) also showed that connection to nature can reduce internalizing psychosomatic symptoms, such as depression, irritability, and nervousness, in adolescents. Other studies have confirmed the link between connection to nature and improved mental well-being, although not all findings were consistent. McEwan et al. (2022) found that urban 'forest bathing' improved attachment to nature by 25% and reduced anxiety by 13% in adolescents. Goh et al. (2023) reported that exposure to natural environments is associated with increased positive affect, while Garip et al. (2021) highlighted that positive feelings experienced in green spaces improve adolescents' overall well-being. On the contrary Cahn and Duvall (2023) found that exposure to nature improved vitality and attentional functioning in young adults but did not find significant effects on reducing anxiety and isolation. Similarly, Windhorst &

Williams (2015), examining the mental legacy of early connections with nature, found a positive correlation between childhood nature experiences and adult connections with nature, while nature connectedness was found to have weak correlation with emotional and psychological well-being. Some studies have highlighted the link between the first experiences in contact with nature and their implications for the future. In this regard, Hoover (2020) showed that childhood exposure to nature is positively correlated with the use of natural environments for emotional comfort in adulthood. Finally, Helne (2022) explored the relationship between connection to nature and well-being among Finnish young adults and found that this connection is manifested in several dimensions, including material, cognitive, experiential and spiritual aspects, and is fundamental to well-being and the promotion of sustainability.

3.2. Pro-environmental behaviour, sustainability and nature connectedness

Connectedness to nature has often been linked to the development of pro-environmental behaviour in adolescents and young adults. Specifically, Scopelliti et al. (2022) identified emotional attachment to nature and environmental identity as significant predictors of pro-environmental behaviour in young adults. Similarly, Krettenauer et al. (2024) demonstrated that connection to nature and adherence to pro-environmental norms influence pro-environmental behaviour in adolescents and young adults. Bowers et al. (2019) found that urban adolescents from socioeconomically disadvantaged backgrounds, developed deeper connections to nature and pro-environmental behaviours after participating in outdoor adventure camps, highlighting the importance of contact with natural environments. Additionally, Krettenauer et al. (2020) highlighted that adolescence is often characterized by a decrease in connectedness to nature, which results in a decrease in pro-environmental behavior. However, in China, the expectation of positive moral emotions (such as pride and satisfaction) derived from pro-environmental behavior helped mitigate this reduction, emphasizing the influence of cultural factors on this relationship. Johnson et al. (2013) found that environmental education increased nature connectedness and pro-environmental behaviour among Ugandan youth, highlighting the importance of experiential learning. Moreover, studies, such as Rosa et al. (2023), have shown that young adults with greater nature connectedness tend to prefer natural environments for recreation, which is associated with more frequent participation in nature-based activities. Li et al. (2022) and Rosa et al. (2018) examined how childhood exposure to nature can influence the relationship with creativity and connection with future nature, thus creating a link between early experiences in contact with nature and pro-environmental behaviour in adulthood. Wang and Huo (2022) examined how materialistic values can influence pro-environmental behavior in

adolescents and found that a stronger connection to nature can mitigate the negative effects of materialism.

Furthermore, given the recent focus on sustainability issues, Helne (2022) investigated how connection to nature promotes sustainability and pro-environmental behavior in young Finnish adults, confirming that a deep connection to nature can promote sustainable pro-environmental behavior. Similarly, Neaman et al. (2023) explored how adolescents' pro-social tendencies influence ecological and altruistic behaviours, noting that nature contact positively mediates this relationship. Finally, Lau et al. (2024) examined young people's emotional responses and psychological health to global crises such as climate change, war, and radioactive water spills, highlighting the role of contact with nature in mitigating negative psychological effects and highlighting how sustainability initiatives are central to well-being.

3.3. The role of technology

The rise of technology has posed significant challenges to maintaining a strong connection with nature among adolescents and young adults. Several studies have examined the impact of technology use on contact with nature. Michaelson et al. (2020) conducted a study of Canadian adolescents that examined digital technology use in relation to the perceived importance of connecting with nature. The authors found that adolescents with greater use of digital technologies (e.g. social media or video games) reported a significantly lower sense of connection with nature, while those who disconnected from electronic devices showed a greater appreciation for nature. Similarly, Larson et al. (2019) examined the relationship between outdoor time, screen time, and connection to nature among adolescents living in more rural areas of the United States. Again, the study found that more screen time was associated with less nature connection, while more time spent outdoors strengthened this relationship. Another study by Minor et al. (2023) examined the relationship between exposure to nature and smartphone use among college students. The study found that greater exposure to nature was associated with reduced smartphone use, suggesting that nature experiences may help mitigate excessive smartphone use. From an innovative perspective, Reihana et al. (2023) explored the use of virtual reality and comics as tools to transfer indigenous ecological knowledge and promote a connection to nature among young Māori and Polynesians in New Zealand. The study showed that these technological tools were effective in promoting a connection to nature, suggesting that technology can also be used creatively to promote a connection to the natural environment, especially in specific educational and cultural contexts. Furthermore, Gasparetto-Higuchi et al. (2023) found that during the pandemic, a time when, due to COVID-related social restrictions, the use of technologies has exponentially increased, adolescents with a strong connection to nature expressed a

greater desire to reconnect with nature and associated this connection with greater concern about environmental issues.

3.4. Social connectedness through nature connectedness

The studies included in this review highlight how green spaces and nature experiences can facilitate social connectedness, contributing not only to individual well-being but also to social cohesion and inclusion. In this regard, Barron and Rugel (2023) highlighted that urban green spaces, when designed to be accessible, diverse and well maintained, play a crucial role in supporting social interactions among young adults, facilitating experiences of rest and emotional connection. In particular, green space characteristics such as the presence of quiet and secluded areas were found to be essential in meeting young people's needs for safe places to socialize and find emotional comfort. Similarly, the study by Seeland et al. (2009) showed how urban forests and parks can serve as meeting places where young people from different cultural backgrounds, including those from immigrant families, can develop new friendships and feel included in the community. Another important example is provided by Gruno and Gibbons (2024), who examined the impact of outdoor physical activity as part of an educational programme, highlighting how such activities not only promote a connection with the natural environment, but also strengthen the sense of community and cohesion among participants. The authors highlight how this effect was particularly evident in educational contexts where nature was used as a tool to promote physical and mental well-being and strengthen social bonds among young people. Additionally, Hatala et al. (2020) explored the role of connection to land and nature in promoting resilience and well-being among Indigenous youth in an urban Canadian context. Using a photovoice methodology, the study demonstrated that the interaction with nature can help build a sense of shared identity and strengthen social bonds within Indigenous communities, demonstrating the value of nature as a supporter of mental health and collective resilience. Finally, the study by Johnson et al. (2013) showed that environmental education workshops not only increase environmental awareness and connection to nature among Ugandan youth, but also improve their ability to act as active citizens in their communities. As posited by authors, this effect is particularly strong among youth who participate in experiential learning in natural environments, where direct interaction with nature helps to build strong social networks based on shared values and a common commitment to environmental protection.

3.5. Gender differences in nature connectedness

The literature review has shown that there may be gender differences in the relationship between nature connection and adolescence and early adulthood. Several studies have found that females tend to experience a stronger connection to nature than males, which appears to positively influence their pro-environmental behaviours, perceptions of well-being, and preferences for outdoor activities. Musitu-Ferrer et al. (2019) examined the relationship between school adjustment, environmental empathy and connection to nature in adolescents and found that women generally had a stronger connection to nature than men. Similarly, Rosa et al. (2023) examined gender differences in connection with nature, preferences for outdoor recreation activities, and participation in these activities among college students in Brazil and the United States. In their study, the authors found that women were more connected to nature than men and tended to prefer outdoor environments for recreational activities, which in turn led to more frequent participation in nature-based recreational activities. Campbell (2016) examined body image and nature connectedness among American Indian adolescent girls. The study found that nature connection provided significant emotional support and positively influenced their body image, particularly among adolescent girls. Nature connection was closely linked to their cultural identity, highlighting a distinctive aspect of women's experiences with nature. Küçükaydın (2024) studied nature connection among adolescent students in Turkey, focusing on personal factors and the effects of nature on psychological well-being. The author found that nature connection had a positive effect on boys' psychological health, life satisfaction and hope, but with a more pronounced tendency for girls than for boys. Garcia et al. (2020) found that female secondary school students aged 11-18 had a significantly stronger emotional connection to nature than their male counterparts. This finding was particularly evident among students from rural areas, suggesting that girls may derive greater emotional benefits from their connection to nature than boys. Furthermore, Rosa et al. (2018) found that in young adults, connection to nature was associated with pro-environmental behaviour, with females showing a greater propensity to engage in environmentally responsible behaviours than males. Finally, Swami et al. (2018) explored the effects of exposure to natural environments and images of natural environments on body image in young adults and found that female participants reported a significant increase in body self-esteem after viewing images of nature, whereas this effect was not as evident in male participants.

Discussion

This study is the more recent integrated review of the relationship between connection to nature and various psychosocial outcomes among adolescents and young adults by highlighting the multifaceted benefits of connection to nature and identifying the specific areas where these

connections are most evident. In this sense, this review is an important starting point for future research on this topic, also in view of the fact that the focus was on contact with nature in the migrant population, but that this area has been little explored in the literature.

The positive association between connection to nature and mental well-being, as evidenced by studies such as Jackson et al. (2021) and Keller (2023), is consistent with research works (Bratman et al., 2024) in which the therapeutic effect of nature on mental health is highlighted. These findings are particularly relevant in the context of global stressors such as the COVID-19 pandemic, where the role of nature as a buffer against mental health challenges has been widely recognised (Lee et al., 2023). The practice of ‘forest bathing’ and other immersive experiences in nature have been shown to improve psychological well-being, reducing symptoms of anxiety and depression, while promoting a sense of vitality and attention functioning (McEwan et al., 2022). However, the literature also suggests that the benefits of connection to nature are not uniform across contexts. For example, while Cahn and Duvall (2023) found improvements in vitality and attentional functioning, they did not observe significant reductions in anxiety and isolation, indicating that individual differences and environmental factors may modulate these effects (Bowler et al., 2010). This variability underlines the need for a deeper understanding of how different populations engage with nature and how these interactions can be optimised for mental health benefits.

The results also highlight the well-established relationship between connection to nature and pro-environmental behaviour in adolescents and young adults. Studies consistently show that emotional attachment to nature and environmental identity are strong predictors of pro-environmental behaviour (Scopelliti et al., 2022), reinforcing the findings of Krettenauer et al. (2024), who demonstrated the reciprocal influence between connection to nature and pro-environmental norms. Interestingly, the influence of nature connection on pro-environmental behaviors seems to be mediated by cultural factors. Studies conducted in China (Krettenauer et al., 2020) have shown that positive moral expectations resulting from pro-environmental behaviors can help maintain environmental commitment during adolescence, despite a natural decline in nature connection in this stage of life. Furthermore, early contact with nature in childhood appears to have a lasting impact on the propensity for sustainable behaviour in adulthood, suggesting that early experiences are crucial for the development of a strong environmental identity (Li et al., 2022), a deeper contact with nature (Hoover, 2020) and more sustainable attitudes (Helne, 2022). These findings are supported by other research that highlights how environmental identity is constructed through personal experiences with nature, positively influencing pro-environmental behaviour and more sustainable attitudes, and how

this can have direct implications for mental health and well-being (Mackay et al., 2021). Furthermore, these links are particularly important as pro-environmental behaviors are often linked to better place attachment (for a review, Daryanto & Song, 2021), which plays a vital role in building a sense of community (Bow & Buys, 2003), and in improving the psychological well-being of the migrant population, including young people (Albers et al., 2021; Charles-Rodriguez et al., 2023).

The impact of technology on adolescents' and young adults' connection with nature is another area that emerged from this review. Several studies have highlighted the negative correlation between technology use and connection with nature (Larson et al., 2019; Michaelson et al., 2020). The results of these studies suggest that when adolescents reduce the amount of time they spend in front of screens, they report a significantly greater appreciation of the natural environment. This finding is consistent with the so-called nature deficit disorder, which suggests that excessive indoor activity and technological distractions contribute to a decline in children's engagement with nature (Alvarez et al., 2022; Louv, 2008). However, the relationship between technology use and connectedness to nature appears to be reciprocal (Minor et al., 2023), suggesting that experiences in nature may help to mitigate the over-reliance on technology that is often associated with a more sedentary lifestyle that is less focused on exploring the natural environment (for a review, see Oswald et al., 2020). Innovative ways of using technology to promote this connection have also been explored (Reihana et al., 2023). In particular, the use of tools such as virtual reality to disseminate ecological knowledge can strengthen the connection with the natural environment. This is in line with other research showing that the use of immersive technologies can increase environmental awareness and stimulate interest in nature, especially among young people (Markowitz et al., 2018). Finally, the study by Gasparetto-Higuchi et al. (2023) during the pandemic highlighted that despite the increased use of technology due to social restrictions, young people who already had a strong connection with nature tended to express a greater desire to reconnect with it, linking this connection to a greater concern for environmental issues. This tendency could be explained by Attention Restoration Theory, which argues precisely how nature can enhance attention span and psychological well-being (Kaplan & Kaplan, 1989), elements that came under pressure during the pandemic (Hawke et al., 2022).

The results of the systematic review highlight the fundamental role that green spaces and nature experiences play in fostering social connection, contributing not only to individual well-being, but also to social cohesion and inclusion, also considering the challenges young people face at this stage of their lives, characterised by the transition from the micro-family system to the wider social system (Crone & Dahl, 2012). These findings are particularly relevant as the literature has highlighted the link between social connectedness and a sense of community (Vora & Kinney, 2014), and young people's psychological well-being (Jose et al., 2012), indicating how these factors are associated with

each other. It has also been highlighted how connection with nature can be an element that favours intercultural processes, facilitating sociability among people with a migrant background (Seeland et al., 2019). In light of the initial theme of this review, namely the study of contact with nature in migrant populations, this result is particularly relevant, as it highlights how forms of contact with nature - such as outdoor sports (Gruno & Gibbons, 2024) - can help overcome linguistic and cultural barriers, promoting interculturality and the possibility of putting down roots in the host country (Seeland et al., 2019). Furthermore, these bonds can also have important implications in terms of a sense of community, which is one of the most protective elements against experiences of discrimination in the migrant population (García-Cid et al., 2020).

Several studies have highlighted a gender difference in relation to the bond with nature, particularly in favor of women (Campbell, 2016; Garcia et al., 2020; Küçükaydın, 2024; Musitu-Ferrer et al., 2019; Rosa et al., 2023; Swami et al., 2018), which seems to indicate a greater sensitivity and predisposition to the natural environment in girls (Rosa et al., 2018, 2023). For example, Musitu-Ferrer et al. (2019) demonstrated that adolescent girls show greater environmental empathy and bonding with nature, which aligns with the idea that women, in general, are often socialized to be more caring and empathetic towards the surrounding environment (McDonald & Kanske, 2023). However, there appears to be disagreement in the literature regarding this gender differentiation, with some recent research (e.g. Carrizales et al., 2023) not supporting relevant gender differences for example in relation to pro-social behaviors. Findings from Campbell's (2016) study highlight the importance of connecting with nature in supporting positive body image, particularly among adolescent girls. The relationship between nature and body image suggests that nature can act as a source of emotional support and cultural affirmation. This is particularly relevant in the context of community psychology, as the positive influence of nature on body image can be seen as a reflection of how natural environments provide a non-judgmental and inclusive space that promotes self-acceptance and resilience, contributing to individual well-being and, in turn, the well-being of the community as a whole (Cheng & Monroe, 2012). In other words, these findings highlight how connection to nature can act as an important factor in shaping gendered experiences and behaviours, with wider implications for community health and resilience. Therefore, as community psychology emphasises the importance of ecological approaches to health and well-being, these findings suggest that nature-based and gender-sensitive programmes could enhance community interventions, thereby promoting both individual and collective resilience (Coventry et al., 2021) and creating environments that promote well-being and social inclusion (Hartig, 2021).

This review is an important starting point for future research in the context of migration to clarify, through empirical studies, the relationship between nature connection and the young migrant population, also in light of the scarcity of evidence on the subject and the strong link that seems to exist between nature connection and the field of community psychology, which is interested in promoting well-being and mental health within communities, including the most vulnerable and marginalised groups.

However, there are some limitations to this study. First, only English language articles were reviewed, excluding other non-English language evidence. Expanding the study to include articles in other languages might broaden the scope of the current observations. Another controversial issue is the difficult definition of the age range that best represents adolescents and young adults. Although much of the literature considers the age range between 11 and 26 years (Defoe et al., 2015), there are other studies and meta-analytic evidence that consider young adults, for example, as those younger than 40 years (e.g. Lozano-Blasco et al., 2020). Finally, one of the main limitations of the review is that the initial research on nature connectedness among migrant adolescents and young adults yielded only one relevant article, making it necessary to extend the search to include studies on adolescents and young adults in general. One limitation is that the results cannot be directly generalised to the migrant population. At the same time, however, identifying this gap in the literature is an important strength of the systematic review, which can therefore guide further research on this topic. Indeed, given the limited number of studies available on young migrants, future research should focus on how the connection with nature influences the psychological, social and environmental well-being of this population. Studies that focus on different migration experiences, considering factors such as time spent in the host country, language and socio-economic conditions, would be particularly useful to better understand this relationship.

Conclusion

This systematic review highlights how contact with nature promotes psychological well-being, pro-environmental behaviour, social connectedness and sustainability in adolescents and young adults. Although specific studies on young migrants are very limited, the findings suggest that nature can play a key role in helping young people cope with the challenges of growing up. In this context, more research on this topic may be an effective way to support migrants' adaptation and integration. Indeed, these issues are particularly relevant for the migrant youth population, as they can facilitate the processes of integration, adaptation and construction of a new identity, while at the same time providing a sense of belonging and attachment to the host community. On the one hand, migration can reduce this attachment due to the distance from the natural context of the country of origin, economic difficulties and the urbanization that often characterizes the places of arrival. However, contact with new forms of landscape can stimulate a renewed sense of connection with nature, which, as the literature points out, can act as a bridge between the past and the present, helping migrant adolescents and young adults to forge new bonds and a sense of belonging to their new reality, as well as experiencing greater agency. Therefore, future research is encouraged to delve deeper into the experiences of migrants and other underrepresented groups, helping to develop inclusive and sustainable programmes that harness the power of nature to improve community well-being.

References

- Albers, T., Ariccio, S., Weiss, L. A., Dessi, F., & Bonaiuto, M. (2021). The role of place attachment in promoting refugees' well-being and resettlement: A literature review. *International journal of environmental research and public health*, 18(21), 11021. <https://doi.org/10.3390/ijerph182111021>
- Alvarez, E. N., Garcia, A., & Le, P. (2022). A review of Nature Deficit Disorder (NDD) and its disproportionate impacts on Latinx populations. *Environmental Development*, 43, 100732. <https://doi.org/10.1016/j.envdev.2022.100732>
- Argyriadis, A., Kopanakis, E., Koutras, P., Louvaris, K., Mammi, A. Z., Psychogiou, M., Katsarou, D., Vieira, I., Drakopoulou, O., & Argyriadii, A. (2024). The Impact of Outdoor in Nature Mindfulness on the Mental Well-being of Children and Adolescents. A Mental Health and Cross-cultural Approach. *Materia socio-medica*, 36(1), 73–76. <https://doi.org/10.5455/msm.2024.36.73-76>
- Arola, T., Aulake, M., Ott, A., Lindholm, M., Kouvonen, P., Virtanen, P., & Paloniemi, R. (2023). The impacts of nature connectedness on children's well-being: Systematic literature review. *Journal of Environmental Psychology*, 85, 101913. <https://doi.org/10.1016/j.jenvp.2022.101913>
- Aruta, J. J. B. R. (2023). The intergenerational transmission of nature relatedness predicts green purchase intention among Filipino adolescents: Cross-age invariance and the role of social responsibility. *Current Psychology*, 42(9), 7297-7308. <https://doi.org/10.1007/s12144-021-02087-7>
- Barron, S., & Rugel, E. J. (2023). Tolerant greenspaces: Designing urban nature-based solutions that foster social ties and support mental health among young adults. *Environmental Science & Policy*, 139, 1-10. <https://doi.org/10.1016/j.envsci.2022.10.005>
- Barton, J., Bragg, R., Pretty, J., Roberts, J., & Wood, C. (2016). The Wilderness Expedition: An Effective Life Course Intervention to Improve Young People's Well-Being and Connectedness to Nature. *Journal of Experiential Education*, 39(1), 59-72. <https://doi.org/10.1177/1053825915626933>
- Bessho, A., Terada, T., & Yokohari, M. (2020). Immigrants' "role shift" for sustainable urban communities: a case study of Toronto's multiethnic community farm. *Sustainability*, 12(19), 8283. <https://doi.org/10.3390/su12198283>

- Beyer, K. M., Kaltenbach, A., Szabo, A., Bogar, S., Nieto, F. J., & Malecki, K. M. (2014). Exposure to neighborhood green space and mental health: evidence from the survey of the health of Wisconsin. *International journal of environmental research and public health*, *11*(3), 3453-3472. <https://doi.org/10.3390/ijerph110303453>
- Bilsborrow, R. E. (2002). Migration, population change, and the rural environment. *Environmental change and security project Report*, *8*(1), 69-84.
- Bonnie, R. J., Backes, E. P., Alegria, M., Diaz, A., & Brindis, C. D. (2019). Fulfilling the promise of adolescence: realizing opportunity for all youth. *Journal of Adolescent Health*, *65*(4), 440-442.
- Borho, A., Morawa, E., Schug, C., & Erim, Y. (2023). Perceived post-migration discrimination: the perspective of adolescents with migration background. *European Child & Adolescent Psychiatry*, *32*(12), 2427-2438. <https://doi.org/10.1007/s00787-022-02084-6>
- Borraccino, A., Berchiolla, P., Dalmaso, P., Sciannameo, V., Vieno, A., Lazzeri, G., Charrier, L., & Lemma, P. (2020). Connectedness as a protective factor in immigrant youth: results from the Health Behaviours in School-aged Children (HBSC) Italian study. *International journal of public health*, *65*(3), 303–312. <https://doi.org/10.1007/s00038-020-01355-w>
- Bow, V., & Buys, E. (2003). Sense of community and place attachment: The natural environment plays a vital role in developing a sense of community. In *Social change in the 21st century 2003 conference refereed proceedings* (pp. 1-18). Centre for Social Change Research, School of Humanities and Human Services QUT.
- Bowers, E. P., Larson, L. R., & Parry, B. J. (2021). Nature as an ecological asset for positive youth development: Empirical evidence from rural communities. *Frontiers in psychology*, *12*, 688574. <https://doi.org/10.3389/fpsyg.2021.688574>
- Bowers, E. P., Larson, L. R., & Sandoval, A. M. (2019). Urban youth perspectives on the benefits and challenges of outdoor adventure camp. *Journal of Youth Development*, *14*(4), 122-143. <https://doi.org/10.5195/jyd.2019.809>
- Bratman, G. N., Mehta, A., Olvera-Alvarez, H., Spink, K. M., Levy, C., White, M. P., Kubzansky, L. D., & Gross, J. J. (2024). Associations of nature contact with emotional ill-being and well-being: the role of emotion regulation. *Cognition and Emotion*, *38*(5), 748–767. <https://doi.org/10.1080/02699931.2024.2316199>
- Browning, M. H., Li, D., White, M. P., Bratman, G. N., Becker, D., & Benfield, J. A. (2022). Association between residential greenness during childhood and trait emotional intelligence

during young adulthood: A retrospective life course analysis in the United States. *Health & Place*, 74, 102755. <https://doi.org/10.1016/j.healthplace.2022.102755>

Cabana, D., Pinna, S., Farina, S., Grech, D., Barbieri, N., & Guala, I. (2024). Coastal cultural ecosystem services and adolescents' subjective well-being. *Ambio*, 1-13. <https://doi.org/10.1007/s13280-024-02043-2>

Cahn, P. R., & Duvall, J. (2023). Nature Contact Linked to Higher Levels of Positive Well-Being in Young Adults During the Pandemic. *Ecopsychology*, 15(4), 340-353. <https://doi.org/10.1089/eco.2022.0059>

Campbell, H. Y. (2016). *Exploration of Body Image and Connection with Nature Among American Indian Female Adolescents*. Prescott College.

Capaldi, C. A., Dopko, R. L., & Zelenski, J. M. (2014). The relationship between nature connectedness and happiness: A meta-analysis. *Frontiers in psychology*, 5, 92737. <https://doi.org/10.3389/fpsyg.2014.00976>

Carrizales, A., Gülseven, Z., & Lannegrand, L. (2023). The mediating role of empathy in the links between relationships with three socialisation agents and adolescents' prosocial behaviours. *Journal of Social and Personal Relationships*, 40(9), 2855-2877. <https://doi.org/10.1177/02654075221099652>

Cavazos-Arroyo, J., & Sánchez-Lezama, A. P. (2022). Explaining green consumption: A cross-cultural study on young adult consumers through a multi-group comparison. *Estudios Gerenciales*, 38(162), 69-81. <https://doi.org/10.18046/j.estger.2022.162.4701>

Çelik, O., Çetiner, S., Abdallah, İ., & Udemba, E. N. (2023). Environmental implication of international migration on high-and middle-income countries: A comparative analysis. *Energy & Environment*, 0958305X231167464. <https://doi.org/10.1177/0958305X231167464>

Charles-Rodriguez, U., Venegas de la Torre, M. D., Hecker, V., Laing, R. A., & Larouche, R. (2023). The relationship between nature and immigrants' integration, wellbeing and physical activity: a scoping review. *Journal of immigrant and minority health*, 25(1), 190-218. <https://doi.org/10.1007/s10903-022-01339-3>

Chen, Y., & Huo, Y. (2023). Social Interaction Anxiety and Problematic Smartphone Use Among Rural-Urban Adolescents in China: A Moderated Moderated-Mediation Model. *Youth & Society*, 55(4), 686-707. <https://doi.org/10.1177/0044118X221126548>

- Cheng, J. C.-H., & Monroe, M. C. (2012). Connection to Nature: Children's Affective Attitude Toward Nature. *Environment and Behavior*, 44(1), 31-49. <https://doi.org/10.1177/0013916510385082>
- Coventry, P. A., Brown, J. E., Pervin, J., Brabyn, S., Pateman, R., Breedvelt, J., Gilbody, S., Stancliffe, R., McEachan, R., & White, P. L. (2021). Nature-based outdoor activities for mental and physical health: Systematic review and meta-analysis. *SSM-population health*, 16, 100934. <https://doi.org/10.1016/j.ssmph.2021.100934>.
- Crone, E. A., & Dahl, R. E. (2012). Understanding adolescence as a period of social-affective engagement and goal flexibility. *Nature reviews neuroscience*, 13(9), 636-650. <https://doi.org/10.1038/nrn3313>
- Daryanto, A., & Song, Z. (2021). A meta-analysis of the relationship between place attachment and pro-environmental behaviour. *Journal of Business Research*, 123, 208-219. <https://doi.org/10.1016/j.jbusres.2020.09.045>
- Defoe, I. N., Dubas, J. S., Figner, B., & van Aken, M. A. G. (2015). A meta-analysis on age differences in risky decision making: Adolescents versus children and adults. *Psychological Bulletin*, 141(1), 48-84. <https://doi.org/10.1037/a0038088>
- Dornhoff, M., Sothmann, J. N., Fiebelkorn, F., & Menzel, S. (2019). Nature relatedness and environmental concern of young people in Ecuador and Germany. *Frontiers in psychology*, 10, 453. <https://doi.org/10.3389/fpsyg.2019.00453>
- Friedman, S., Morrison, S. A., & Todd, L. (2024). The messy middle: an exploratory study of adolescent environmentalists in North Carolina. *Environmental Education Research*, 30(9), 1604-1618. <https://doi.org/10.1080/13504622.2024.2342935>
- Gamble, K. R., Howard, J. H., Jr, & Howard, D. V. (2014). Not just scenery: viewing nature pictures improves executive attention in older adults. *Experimental aging research*, 40(5), 513-530. <https://doi.org/10.1080/0361073X.2014.956618>
- García-Cid, A., Gómez-Jacinto, L., Hombrados-Mendieta, I., Millán-Franco, M., & Moscato, G. (2020). Discrimination and psychosocial well-being of migrants in Spain: The moderating role of sense of community. *Frontiers in Psychology*, 11, 2235. <https://doi.org/10.3389/fpsyg.2020.02235>

- García, R. M., Villar, M. B. C., & Crespo, L. V. (2020). Leisure Time in Natural Environment as a Promoter of Emotional Connection with Nature. An Environmental Study with Teenagers in Pontevedra (Galicia-Spain).
- Garip, G., Richardson, M., Tinkler, A., Glover, S., & Rees, A. (2020). Development and implementation of evaluation resources for a green outdoor educational program. *The Journal of Environmental Education*, 52(1), 25–39. <https://doi.org/10.1080/00958964.2020.1845588>
- Gasparetto-Higuchi, M.-I., Teixeira-Paz, D., Ferrari-Justulin-Zacarias, E., & Vilar-de-Almeida, R. (2023). The relationship of Amazonian adolescents with natural environments before and during social isolation in the COVID-19 pandemic (La relación de los adolescentes del Amazonas con los entornos naturales antes y después del aislamiento social en la pandemia de COVID-19). *PsyEcology*, 14(1), 1-19. <https://doi.org/10.1080/21711976.2022.2139896>
- Glover, T. D., Parry, D. C., & Shinew, K. J. (2005). Building Relationships, Accessing Resources: Mobilizing Social Capital in Community Garden Contexts. *Journal of Leisure Research*, 37(4), 450–474. <https://doi.org/10.1080/00222216.2005.11950062>
- Goh, A. Y., Chia, S. M., Majeed, N. M., Chen, N. R., & Hartanto, A. (2023). Untangling the additive and multiplicative relations between natural scenery exposure and human–animal interaction on affective well-being: Evidence from daily diary studies. *Sustainability*, 15(4), 2910. <https://doi.org/10.3390/su15042910>
- Gray, C., Gibbons, R., Larouche, R., Sandseter, E. B. H., Bienenstock, A., Brussoni, M., Chabot, G., Herrington, S., Janssen, I., Pickett, W., Power, M., Stanger, N., Sampson, M., & Tremblay, M. S. (2015). What is the relationship between outdoor time and physical activity, sedentary behaviour, and physical fitness in children? A systematic review. *International journal of environmental research and public health*, 12(6), 6455-6474. <https://doi.org/10.3390/ijerph120606455>
- Gruno, J., & Gibbons, S. (2024). Nature-Based Physical Activity in Pictures: A Photovoice Unit in (and Beyond) Physical and Health Education. *LEARNing Landscapes*, 17(1), 109-124. <https://doi.org/10.36510/learnland.v17i1.1123>
- Gu, X., Zheng, H., & Tse, C. S. (2023). Contact with nature for emotion regulation: the roles of nature connectedness and beauty engagement in urban young adults. *Scientific Reports*, 13(1), 21377. <https://doi.org/10.1038/s41598-023-48756-4>

- Hagen, J. R. (2024). *Unveiling the Voices: Lived Experiences of Adolescent Girls With Emotional Disturbance in Special Education* (Doctoral dissertation, Lesley University).
- Hartig, T. (2021). Restoration in nature: Beyond the conventional narrative. *Nature and psychology: Biological, cognitive, developmental, and social pathways to well-being*, 89-151. https://doi.org/10.1007/978-3-030-69020-5_5
- Hartig, T., Mitchell, R., De Vries, S., & Frumkin, H. (2014). Nature and health. *Annual review of public health*, 35(1), 207-228. <https://doi.org/10.1146/annurev-publhealth-032013-182443>
- Hatala, A. R., Njeze, C., Morton, D., Pearl, T., & Bird-Naytowhow, K. (2020). Land and nature as sources of health and resilience among Indigenous youth in an urban Canadian context: A photovoice exploration. *BMC Public Health*, 20, 1-14. <https://doi.org/10.1186/s12889-020-08647-z>
- Hawke, L. D., Nguyen, A. T., Ski, C. F., Thompson, D. R., Ma, C., & Castle, D. (2022). Interventions for mental health, cognition, and psychological wellbeing in long COVID: a systematic review of registered trials. *Psychological medicine*, 52(13), 2426-2440. <https://doi.org/10.1017/S0033291722002203>
- Helne, T. (2022). Voicing relationality: the nature connectedness of young Finnish adults in the promotion of sustainability. *Sustainability: Science, Practice and Policy*, 18(1), 531–543. <https://doi.org/10.1080/15487733.2022.2097507>
- Hoover, K. S. (2020). Children in nature: exploring the relationship between childhood outdoor experience and environmental stewardship. *Environmental Education Research*, 27(6), 894–910. <https://doi.org/10.1080/13504622.2020.1856790>
- Jackson, S. B., Stevenson, K. T., Larson, L. R., Peterson, M. N., & Seekamp, E. (2021). Connection to nature boosts adolescents' mental well-being during the COVID-19 pandemic. *Sustainability*, 13(21), 12297. <https://doi.org/10.3390/su132112297>
- Jennings, V., & Bamkole, O. (2019). The relationship between social cohesion and urban green space: An avenue for health promotion. *International journal of environmental research and public health*, 16(3), 452. <https://doi.org/10.3390/ijerph16030452>
- Johnson-Pynn, J. S., Johnson, L. R., Kityo, R., & Lugumya, D. (2008). Students and Scientists Connect with Nature in Uganda, East Africa. *International Journal of Environmental & Science Education*, 3(3). [doi:10.12973/ijese.2014.217a](https://doi.org/10.12973/ijese.2014.217a)

- Johnson, L. R., Johnson-Pynn, J. S., Lugumya, D. L., Kityo, R., & Drescher, C. F. (2013). Cultivating youth's capacity to address climate change in Uganda. *International Perspectives in Psychology*, 2(1), 29-44. <https://doi.org/10.1037/a0031053>
- Jose, P. E., Ryan, N., & Pryor, J. (2012). Does social connectedness promote a greater sense of well-being in adolescence over time?. *Journal of research on adolescence*, 22(2), 235-251. <https://doi.org/10.1111/j.1532-7795.2012.00783.x>
- Kaplan, R., & Kaplan, S. (1989). *The experience of nature: A psychological perspective*. Cambridge University Press.
- Keller, J. (2023). *Forest Bathing Increases Adolescent Mental Well-being and Connection to Nature. A Transformative Mixed Methods Study* (Doctoral dissertation, Antioch University).
- Krettenauer, T., Lefebvre, J. P., & Goddeeris, H. (2024). Pro-environmental behaviour, connectedness with nature, and the endorsement of pro-environmental norms in youth: Longitudinal relations. *Journal of Environmental Psychology*, 94, 102256. <https://doi.org/10.1016/j.jenvp.2024.102256>
- Krettenauer, T., Wang, W., Jia, F., & Yao, Y. (2020). Connectedness with nature and the decline of pro-environmental behavior in adolescence: A comparison of Canada and China. *Journal of Environmental Psychology*, 71, 101348. <https://doi.org/10.1016/j.jenvp.2019.101348>
- Kruja, S., Braçe, O., Kokthi, E., & Cumbreira, M. G. (2024). The Role of Urban Green Spaces on Life Satisfaction and Migration Willingness in Tirana, Albania. *Human Ecology*, 1-13. <https://doi.org/10.1007/s10745-024-00511-7>
- Küçükaydın, M. A. (2024). Understanding Connection to Nature in Turkish Middle School Children: Personal Factors and Nature's Restorative Effect. *Journal of Environmental Psychology*, 102393. <https://doi.org/10.1016/j.jenvp.2024.102393>
- Lachowycz, K., & Jones, A. P. (2013). Towards a better understanding of the relationship between greenspace and health: Development of a theoretical framework. *Landscape and urban planning*, 118, 62-69. <https://doi.org/10.1016/j.landurbplan.2012.10.012>
- Larson, L. R., Szczytko, R., Bowers, E. P., Stephens, L. E., Stevenson, K. T., & Floyd, M. F. (2019). Outdoor Time, Screen Time, and Connection to Nature: Troubling Trends Among Rural Youth? *Environment and Behavior*, 51(8), 966-991. <https://doi.org/10.1177/0013916518806686>

- Lau, S. S., Fong, J. W., van Rijsbergen, N., McGuire, L., Ho, C. C., Cheng, M. C., & Tse, D. (2024). Emotional responses and psychological health among young people amid climate change, Fukushima's radioactive water release, and wars in Ukraine and the Middle East, and the mediating roles of media exposure and nature connectedness: a cross-national analysis. *The Lancet Planetary Health*, 8(6), e365-e377. [https://doi.org/10.1016/S2542-5196\(24\)00097-4](https://doi.org/10.1016/S2542-5196(24)00097-4)
- Lee, K. O., Mai, K. M., & Park, S. (2023). Green space accessibility helps buffer declined mental health during the COVID-19 pandemic: evidence from big data in the United Kingdom. *Nature Mental Health*, 1(2), 124-134. <https://doi.org/10.1038/s44220-023-00018-y>
- Li, D., Deal, B., Zhou, X., Slavenas, M., & Sullivan, W. C. (2018). Moving beyond the neighborhood: Daily exposure to nature and adolescents' mood. *Landscape and urban planning*, 173, 33-43. <https://doi.org/10.1016/j.landurbplan.2018.01.009>
- Li, D., Zhai, Y., Chang, P. J., Merrill, J., Browning, M. H., & Sullivan, W. C. (2022). Nature deficit and senses: Relationships among childhood nature exposure and adulthood sensory profiles, creativity, and nature relatedness. *Landscape and Urban Planning*, 226, 104489. <https://doi.org/10.1016/j.landurbplan.2022.104489>
- Li, H., Zhang, X., Bi, S., Cao, Y., & Zhang, G. (2021). Can residential greenspace exposure improve pain experience? A comparison between physical visit and image viewing. In *Healthcare* (Vol. 9, No. 7, p. 918). MDPI. <https://doi.org/10.3390/healthcare9070918>
- Li, Q. (2010). Effect of forest bathing trips on human immune function. *Environmental health and preventive medicine*, 15, 9-17. <https://doi.org/10.1007/s12199-008-0068-3>
- Liu, J., Liu, S., Sun, X., Meng, Y., & Yang, Z. (2024). Passive green space exposure leading to lower aggression: The mediating role of sense of control. *Aggressive behavior*, 50(3), e22158. <https://doi.org/10.1002/ab.22158>
- Louv, R. (2008). *Last child in the woods: Saving our children from nature-deficit disorder*. Algonquin books.
- Lozano-Blasco, R., Robres, A. Q., & Sánchez, A. S. (2022). Internet addiction in young adults: A meta-analysis and systematic review. *Computers in Human Behavior*, 130, 107201. <https://doi.org/10.1016/j.chb.2022.107201>
- Mackay, C. M., Schmitt, M. T., Lutz, A. E., & Mendel, J. (2021). Recent developments in the social identity approach to the psychology of climate change. *Current Opinion in Psychology*, 42, 95-101. <https://doi.org/10.1016/j.copsyc.2021.04.009>

- Mao, G. X., Cao, Y. B., Yan, Y. A. N. G., Chen, Z. M., Dong, J. H., Chen, S. S., ... & Wang, G. F. (2018). Additive benefits of twice forest bathing trips in elderly patients with chronic heart failure. *Biomedical and environmental sciences*, *31*(2), 159-162. DOI: [10.3967/bes2018.020](https://doi.org/10.3967/bes2018.020)
- Markowitz, D. M., Laha, R., Perone, B. P., Pea, R. D., & Bailenson, J. N. (2018). Immersive virtual reality field trips facilitate learning about climate change. *Frontiers in psychology*, *9*, 2364. <https://doi.org/10.3389/fpsyg.2018.02364>
- Martin, L., White, M. P., Hunt, A., Richardson, M., Pahl, S., & Burt, J. (2020). Nature contact, nature connectedness and associations with health, wellbeing and pro-environmental behaviours. *Journal of environmental psychology*, *68*, 101389. DOI: [10.1016/j.jenvp.2020.101389](https://doi.org/10.1016/j.jenvp.2020.101389)
- Mayer, F. S., & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of environmental psychology*, *24*(4), 503-515. <https://doi.org/10.1016/j.jenvp.2004.10.001>
- McDonald, B., & Kanske, P. (2023). Gender differences in empathy, compassion, and prosocial donations, but not theory of mind in a naturalistic social task. *Scientific Reports*, *13*(1), 20748. <https://doi.org/10.1038/s41598-023-47747-9>
- McEwan, K., Potter, V., Kotera, Y., Jackson, J. E., & Greaves, S. (2022). 'This Is What the Colour Green Smells Like!': Urban Forest Bathing Improved Adolescent Nature Connection and Wellbeing. *International Journal of Environmental Research and Public Health*, *19*(23), 15594. <https://doi.org/10.3390/ijerph192315594>
- Michaelson, V., King, N., Janssen, I., Lawal, S., & Pickett, W. (2020). Electronic screen technology use and connection to nature in Canadian adolescents: A mixed methods study. *Canadian Journal of Public Health*, *111*, 502-514. <https://doi.org/10.17269/s41997-019-00289-y>
- Minor, K., Glavind, K. L., Schwartz, A. J., Danforth, C. M., Lehmann, S., & Bjerre-Nielsen, A. (2023). Nature Exposure is Associated With Reduced Smartphone Use. *Environment and Behavior*, *55*(3), 103-139. <https://doi.org/10.1177/00139165231167165>
- Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Annals of Internal Medicine*, *151*(4), 264–269. <https://doi.org/10.7326/0003-4819-151-4-200908180-00135>
- Moise, R. K., Meca, A., Schwartz, S. J., Unger, J. B., Lorenzo-Blanco, E. I., Ángel Cano, M., Szapocznik, J., Piña-Watson, B., Des Rosiers, S. E., Baezconde-Garbanati, L., Soto, D. W.,

- Pattarroyo, M., Villamar, J. A., & Lizzi, K. M. (2019). The use of cultural identity in predicting health lifestyle behaviors in Latinx immigrant adolescents. *Cultural Diversity & Ethnic Minority Psychology, 25*(3), 371–378. <https://doi.org/10.1037/cdp0000229>
- Moll, A., Collado, S., Staats, H., & Corraliza, J. A. (2022). Restorative effects of exposure to nature on children and adolescents: A systematic review. *Journal of Environmental Psychology, 84*, 101884. <https://doi.org/10.1016/j.jenvp.2022.101884>
- Musitu-Ferrer, D., Esteban-Ibañez, M., León-Moreno, C., & García, O. F. (2019). Is school adjustment related to environmental empathy and connectedness to nature?. *Psychosocial Intervention, 28*(2), 101-110. <https://doi.org/10.5093/pi2019a8>
- Mytton, O. T., Townsend, N., Rutter, H., & Foster, C. (2012). Green space and physical activity: an observational study using Health Survey for England data. *Health & place, 18*(5), 1034-1041. <https://doi.org/10.1016/j.healthplace.2012.06.003>
- Neaman, A., Montero, E., Pensini, P., Burnham, E., Castro, M., Ermakov, D. S., & Navarro-Villaruel, C. (2023). Unleashing the power of connection: How adolescents' prosocial propensity drives ecological and altruistic behaviours. *Sustainability, 15*(10), 8070. <https://doi.org/10.3390/su15108070>
- Neurohr, A. L., Pasch, N., Otto, S., & Möller, A. (2023). Measuring adolescents' level of interest in nature: a promising psychological factor facilitating nature protection. *Frontiers in Psychology, 14*, 1186557. <https://doi.org/10.3389/fpsyg.2023.1186557>
- Nguyen, L., & Walters, J. (2024). Benefits of Nature Exposure on Cognitive Functioning in Children and Adolescents: A Systematic Review and Meta-Analysis. *Journal of Environmental Psychology, 102336*. <https://doi.org/10.1016/j.jenvp.2024.102336>
- Nielsen, E. (2022). *The Association Between Natural Features and Momentary Psychological Wellbeing: Do Individual Characteristics Make a Difference?*. University of Exeter (United Kingdom).
- Nisbet, E.K., Zelenski, J.M., & Murphy, S.A. (2009). The nature relatedness scale: Linking individuals' connection with nature to environmental concern and behavior. *Environment and Behavior, 41*(5), 715-740. [10.1177/0013916508318748](https://doi.org/10.1177/0013916508318748)
- O'reilly, K. (2022). Migration theories: A critical overview. *Routledge handbook of immigration and refugee studies*, 3-12.

- Olafsdottir, G., Cloke, P., Schulz, A., Van Dyck, Z., Eysteinnsson, T., Thorleifsdottir, B., & Vögele, C. (2020). Health benefits of walking in nature: A randomized controlled study under conditions of real-life stress. *Environment and Behavior*, *52*(3), 248-274. <https://doi.org/10.1177/0013916518800798>
- Olcese, M., Cardinali, P., Madera, F., Camilleri, A. P., & Migliorini, L. (2024a). Migration and community resilience: A scoping review. *International Journal of Intercultural Relations*, *98*, 101924. <https://doi.org/10.1016/j.ijintrel.2023.101924>
- Olcese, M., Madera, F., Cardinali, P., Serafini, G., & Migliorini, L. (2024b). The role of community resilience as a protective factor in coping with mental disorders in a sample of psychiatric migrants. *Frontiers in Psychiatry*, *15*, 1430688. <https://doi.org/10.3389/fpsyt.2024.1430688>
- Olivos, P., & Clayton, S. (2017). Self, nature and well-being: Sense of connectedness and environmental identity for quality of life. *Handbook of environmental psychology and quality of life research*, 107-126.
- Oswald, T. K., Rumbold, A. R., Kedzior, S. G., & Moore, V. M. (2020). Psychological impacts of “screen time” and “green time” for children and adolescents: A systematic scoping review. *PloS one*, *15*(9), e0237725. <https://doi.org/10.1371/journal.pone.0237725>
- Parr, H. (2007). Mental Health, Nature Work, and Social Inclusion. *Environment and Planning D: Society and Space*, *25*(3), 537-561. <https://doi.org/10.1068/d67j>
- Piccininni, C., Michaelson, V., Janssen, I., & Pickett, W. (2018). Outdoor play and nature connectedness as potential correlates of internalized mental health symptoms among Canadian adolescents. *Preventive Medicine*, *112*, 168-175. <https://doi.org/10.1016/j.ypmed.2018.04.020>
- Price, E., Maguire, S., Firth, C., Lumber, R., Richardson, M., & Young, R. (2022). Factors associated with nature connectedness in school-aged children. *Current Research in Ecological and Social Psychology*, *3*, 100037. <https://doi.org/10.1016/j.cresp.2022.100037>
- Pritchard, A., Richardson, M., Sheffield, D., & McEwan, K. (2020). The relationship between nature connectedness and eudaimonic well-being: A meta-analysis. *Journal of happiness studies*, *21*, 1145-1167. <https://doi.org/10.1007/s10902-019-00118-6>
- Raleigh, M. J. (2009). *Childhood nature contact and its effect on adult coping skills*. Antioch University New England.

- Rashki Kemmak, A., Nargesi, S., & Saniee, N. (2021). Social Determinant of Mental Health in Immigrants and Refugees: A Systematic Review. *Medical journal of the Islamic Republic of Iran*, 35, 196. <https://doi.org/10.47176/mjiri.35.196>
- Reihana, K. R., Wehi, P. M., Pomare-Peita, M., Harcourt, N., Ellis, J. I., & Murray, J. M. (2023). Indigitization: Technology as a mode for conservation sustainability and knowledge transfer in indigenous New Zealand communities. *Biological Conservation*, 285, 110237. <https://doi.org/10.1016/j.biocon.2023.110237>
- Rodríguez-Díaz, P., Almuna, R., Marchant, C., Heinz, S., Lebuy, R., Celis-Diez, J. L., & Díaz-Siefer, P. (2022). The Future of Rurality: Place Attachment among Young Inhabitants of Two Rural Communities of Mediterranean Central Chile. *Sustainability*, 14(1), 546. <https://doi.org/10.3390/su14010546>
- Rosa, C. D., Larson, L. R., Collado, S., Cloutier, S., & Profice, C. C. (2023). Gender differences in connection to nature, outdoor preferences, and nature-based recreation among college students in Brazil and the United States. *Leisure Sciences*, 45(2), 135-155. <https://doi.org/10.1080/01490400.2020.1800538>
- Rosa, C. D., Profice, C. C., & Collado, S. (2018). Nature experiences and adults' self-reported pro-environmental behaviors: The role of connectedness to nature and childhood nature experiences. *Frontiers in psychology*, 9, 1055. <https://doi.org/10.3389/fpsyg.2018.01055>
- Rose, L., Williams, I. R., Olsson, C. A., & Allen, N. B. (2018). Promoting adolescent health and well-being through outdoor youth programs: Results from a multisite Australian study. *Journal of Outdoor Recreation, Education, and Leadership*, 10(1). <https://doi.org/10.18666/JOREL-2018-V10-I1-8087>
- Rowley, M., Topciu, R., & Owens, M. (2022). A systematic review of mechanisms underpinning psychological change following nature exposure in an adolescent population. *International Journal of Environmental Research and Public Health*, 19(19), 12649. <https://doi.org/10.3390/ijerph191912649>
- Schultz, P. W. (2002). Inclusion with nature: the psychology of human–nature relations. *Psychology of sustainable development/Kluwer Academic Publishers*.
- Scopelliti, M., Barni, D., & Rinallo, E. (2022). My parents taught... green was my growth! the role of intergenerational transmission of ecological values in young adults' pro-environmental

behaviors and their psychosocial mechanisms. *International Journal of Environmental Research and Public Health*, 19(3), 1670. <https://doi.org/10.3390/ijerph19031670>

Seeland, K., Dübendorfer, S., & Hansmann, R. (2009). Making friends in Zurich's urban forests and parks: The role of public green space for social inclusion of youths from different cultures. *Forest Policy and Economics*, 11(1), 10-17. <https://doi.org/10.1016/j.forpol.2008.07.005>

Severin, M. I., Akpetou, L. K., Annasawmy, P., Asuquo, F. E., Beckman, F., Benomar, M., Jaya-Ram, A., Malouli, M., Mees, J., Monteiro, I., Ndwiga, J., Neves Silva, P., Nubi, O. A., Sim, Y. K., Sohoul, Z., Shau-Hwai, A. T., Woo, S. P., Zizah, S., Buysse, A., Raes, F., Krug, L. A., Seeyave, S., Everaert, G., Mahu, E., & Catarino, A. I. (2023). Impact of the citizen science project COLLECT on ocean literacy and well-being within a north/west African and south-east Asian context. *Frontiers in Psychology*, 14. <https://doi.org/10.3389/fpsyg.2023.1130596>

Štraupaitė, S. (2023). Developing the Ecological Citizenship of Older Adolescents. In *IOP Conference Series: Earth and Environmental Science* (Vol. 1185, No. 1, p. 012035). IOP Publishing. DOI:10.1088/1755-1315/1185/1/012035

Swami, V., Barron, D., & Furnham, A. (2018). Exposure to natural environments, and photographs of natural environments, promotes more positive body image. *Body Image*, 24, 82-94. <https://doi.org/10.1016/j.bodyim.2017.12.006>

Tseng, Y. C., & Wang, S. M. (2020). Understanding Taiwanese adolescents' connections with nature: Rethinking conventional definitions and scales for environmental education. *Environmental Education Research*, 26(1), 115-129. <https://doi.org/10.1080/13504622.2019.1668354>

Uhlmann, K., Ross, H., Buckley, L., & Lin, B. B. (2022). Nature relatedness, connections to food and wellbeing in Australian adolescents. *Journal of Environmental Psychology*, 84, 101888. <https://doi.org/10.1016/j.jenvp.2022.101888>

van Heel, B. F., van den Born, R. J., & Aarts, N. (2023). Heroes for nature: understanding childhood nature experiences in motivating action for nature. *Journal of Environmental Planning and Management*, 1-20. <https://doi.org/10.1080/09640568.2023.2281875>

van Heezik, Y., Freeman, C., Falloon, A., Buttery, Y., & Heyzer, A. (2021). Relationships between childhood experience of nature and green/blue space use, landscape preferences, connection with nature and pro-environmental behavior. *Landscape and Urban Planning*, 213, 104135. <https://doi.org/10.1016/j.landurbplan.2021.104135>

- Vora, R. S., & Kinney, M. N. (2014). Connectedness, sense of community, and academic satisfaction in a novel community campus medical education model. *Academic Medicine*, 89(1), 182-187. DOI: [10.1097/ACM.0000000000000072](https://doi.org/10.1097/ACM.0000000000000072)
- Wang, B., Zhao, B., Han, C., Tang, Y., & Jin, C. (2024). Harnessing the power of nature exposure to mitigate adolescents' Internet addiction: A chain mediation model. *British Journal of Developmental Psychology*. <https://doi.org/10.1111/bjdp.12516>
- Wang, J., & Huo, Y. (2022). Effect of materialism on pro-environmental behavior among youth in China: the role of nature connectedness. *Frontiers in Psychology*, 13, 794816. <https://doi.org/10.3389/fpsyg.2022.794816>
- Wang, P., Meng, Y. Y., Lam, V., & Ponce, N. (2019). Green space and serious psychological distress among adults and teens: A population-based study in California. *Health & place*, 56, 184-190. <https://doi.org/10.1016/j.healthplace.2019.02.002>
- Wang, Z., Cheng, H., Li, Z., Gou, F., & Zhai, W. (2024). Can green space exposure enhance the health of rural migrants in Wuhan, China? An exploration of the multidimensional roles of place attachment. *Urban Forestry & Urban Greening*, 93, 128228. <https://doi.org/10.1016/j.ufug.2024.128228>
- Wiens, V., Soronen, K., Kyngäs, H., & Pölkki, T. (2021). Enhancing adolescent Girls' well-being in the arctic—finding what motivates spending time in nature. *International Journal of Environmental Research and Public Health*, 18(4), 2052. <https://doi.org/10.3390/ijerph18042052>
- Williams, K. A., Hall, T. E., & O'Connell, K. (2021). Classroom-based citizen science: impacts on students' science identity, nature connectedness, and curricular knowledge. *Environmental Education Research*, 27(7), 1037-1053. <https://doi.org/10.1080/13504622.2021.1927990>
- Windhorst, E., & Williams, A. (2015). Growing up, naturally: The mental health legacy of early nature affiliation. *Ecopsychology*, 7(3), 115-125. <https://doi.org/10.1089/eco.2015.0040>
- Wright, A. C., & Collings, S. (2023). Conceptual meanings of permanency: photovoice with care-experienced youth. *Journal of Youth Studies*, 1-18. <https://doi.org/10.1080/13676261.2023.2261862>
- Yang, M., Dijst, M., Faber, J., & Helbich, M. (2020). Using structural equation modeling to examine pathways between perceived residential green space and mental health among internal migrants in China. *Environmental Research*, 183, 109121. <https://doi.org/10.1016/j.envres.2020.109121>

- Yeung, Y. Y., & Yu, C. P. (2022). Cognitive-emotional benefits of weekly exposure to nature: A Taiwanese study on young adults. *Sustainability*, *14*(13), 7828. <https://doi.org/10.3390/su14137828>
- Zhang, R., Chen, H., Liu, L., Wang, F., & Yang, Z. (2024). Unraveling the longitudinal relationships between connectedness to nature, depressive symptoms, and learning burnout in adolescents. *Journal of Adolescence*. <https://doi.org/10.1002/jad.12330>
- Zhang, W., Williams, S. J., Wang, X., & Chen, J. (2017). Push and pull factors determine adolescents' intentions of participation in nature observation: Reconnecting local students with nature in China. *Applied Environmental Education & Communication*, *16*(4), 247-261. <https://doi.org/10.1080/1533015X.2017.1333053>