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"We are a part of nature, and we must care for it": An investigation of co-design and youth experiences in nature-based interventions for wellbeing and environmental stewardship

By

Topaz Lily Shrestha

A Thesis Submitted to The National University of Ireland, Cork

For the Degree of

Doctor of Philosophy

School of Applied Psychology

National University of Ireland, Cork

Ireland

October 2025

Research Supervisors: Dr Zelda Di Blasi, Dr Sarah Foley and Dr Marica Cassarino

Head of School: Prof. Christopher McClusker

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Declaration

This dissertation is the result of research carried out in the School of Applied Psychology from October 2015 to July 2019. This is to certify that the work I am submitting is my own and has not been submitted for another degree, either at University College Cork or elsewhere. All external references and sources are clearly acknowledged and identified within the contents. I have read and understood the regulations of University College Cork concerning plagiarism.

Topaz Lily Shrestha
School of Applied Psychology
University College Cork
October 2025

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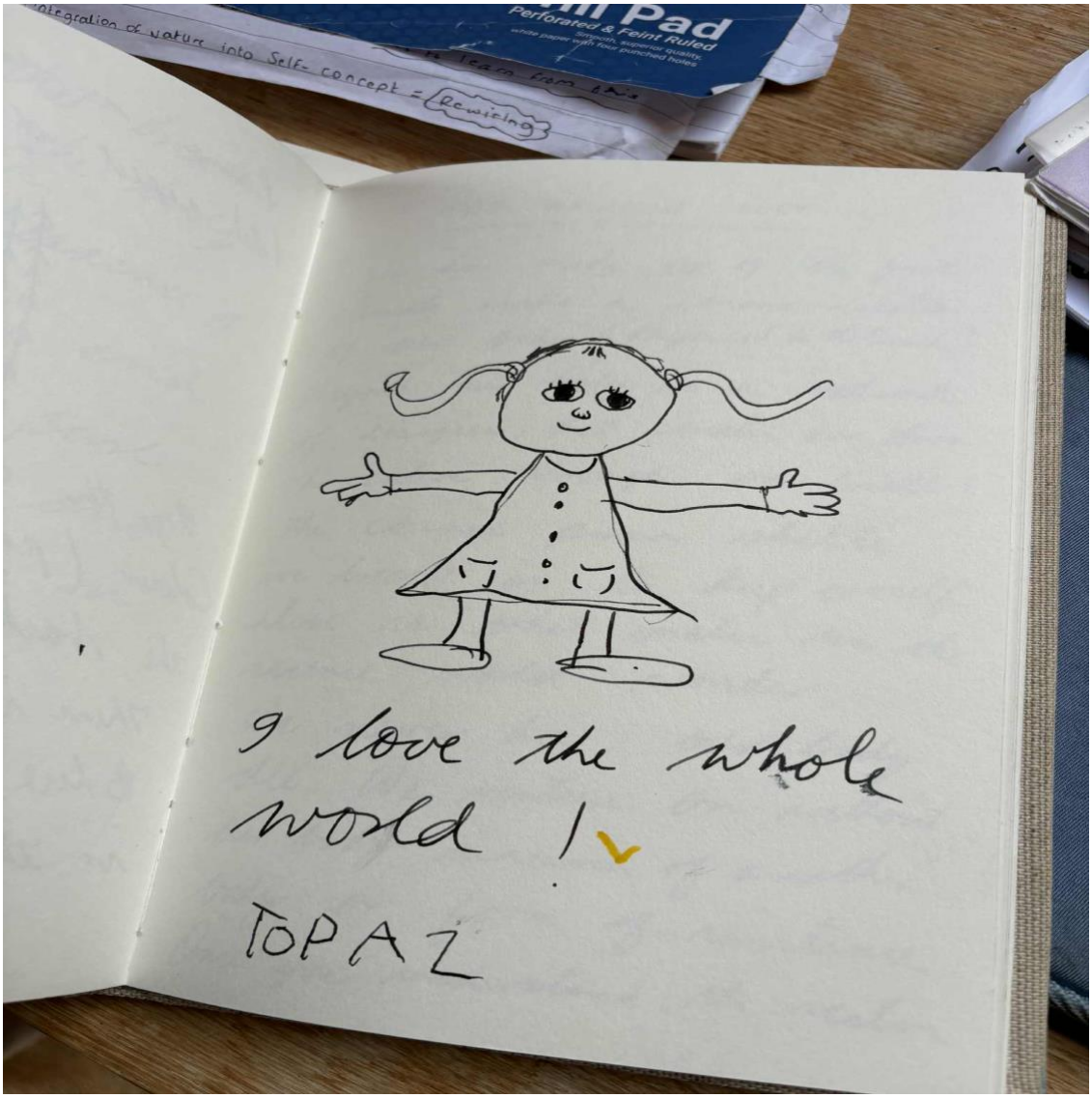
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I include this drawing I made when I was five years old which I came across recently. Apparently, when my dad asked what it meant, I told him, it means "*I love the whole world."* Looking back, I believe this simple expression captures the deep sense of oneness I felt with the world even then — and the very essence of why I do the work I do today.



Publications from this Thesis

Peer-reviewed Journal Articles

Shrestha, T., Chi, C. V. Y., Cassarino, M., Foley, S., & Di Blasi, Z. (2023). Factors influencing the effectiveness of nature-based interventions (NBIs) aimed at improving mental health and wellbeing: Protocol of an umbrella review. *PloS one*, *18*(7), e0273139. DOI: 10.1371/journal.pone.0273139.

Shrestha, T., Chi, C. V. Y., Cassarino, M., Foley, S., & Di Blasi, Z. (2025). Factors influencing the effectiveness of nature-based interventions (NBIs) aimed at improving mental health and wellbeing: An umbrella review. *Environment International*, 109217. DOI: 10.1016/j.envint.2024.08043.

Shrestha, T., Cassarino, M., Foley, S., & Di Blasi, Z. (2025). The natural world around me; a qualitative exploration of young people's relationship to nature and how it relates to their wellbeing and feelings of pro-environmental behaviour. *Journal of Environmental Psychology*, *103*, 102556. DOI: 10.1016/j.jenvp.2025.102556

Contribution of First Author

The above peer-reviewed journal articles are presented as chapters in this thesis. As the first author of all these papers, I carried out the fieldwork, conducted the analysis and led the paper writing and publication process. Co-author contributions are listed in detail in each of the publications.

Abstract

The widespread human disconnection from nature has been identified as a root driver of contemporary crises, including the escalating mental health crisis and environmental emergency. In response, there is an urgent need for evidence-based interventions that strengthen nature connectedness, enhance wellbeing, and cultivate adaptive coping strategies. Emerging research consistently highlights the pivotal role of nature connection in promoting resilience, supporting mental health, and cultivating environmental stewardship for planetary health.

This PhD examined the potential for nature-based interventions (NBIs), defined as structured activities or environmental modifications designed to engage individuals with nature and strengthen nature connectedness, wellbeing, and planetary health.

Study 1 consisted of an umbrella review of 64 systematic reviews and meta-analyses on nature-based interventions, providing a meta-level synthesis of the current evidence base, incorporating assessments of methodological quality and highlighting key factors that influence intervention effectiveness. Findings identified potential barriers and enablers to effectiveness of interventions (e.g. quality of natural environment, perceived safety, social dimensions, practitioner skills and co-design) and underscored the need to focus on young people and incorporate co-design.

Study 2 explored young people's relationships with nature cross-culturally through focus groups (n=24), using reflexive thematic analysis and focusing on its associations with wellbeing and pro-environmental attitudes. The study identified relational, embodied, and meaning-oriented patterns to nature connection, while highlighting barriers such as limited access, safety concerns, reduced intergenerational transmission and the structure of modern life. Findings emphasised the need for interventions that are contextually sensitive and tailored to individual circumstances.

Study 3 Pathways to Nature (PTN) was a transdisciplinary, cross-cultural intervention co-designed with young people and practitioners in Ireland, Spain, Armenia, and Finland (n=60, aged 13–26). The aim of this study was to evaluate the impact of co-designed nature-based interventions, adapted to the unique needs of each cultural context, on youth mental health, nature connectedness, and pro-environmental behaviour. Using a mixed-methods approach, survey data suggested increases in nature connectedness post-intervention, while focus group

analysis identified five key themes: 1) Pathways to Wellbeing, 2) A Shift in Perspective, 3) Changing Habits, 4) The Ripple Effect on Communities, and 5) Challenges and Space for Improvement.

Together, these interconnected studies build on each other to advance conceptual clarity on NBIs, provide cross-cultural insights into youth-nature relationships, and generate applied evidence for co-designed, contextually sensitive interventions. Findings highlight the need to embed nature connection into youth development and planetary health strategies, while pointing to the need for fundamental shifts in worldview towards more ecocentric perspectives.

This thesis makes significant contributions to research, practice, and policy, by demonstrating how NBIs can support youth wellbeing and environmental stewardship, offering actionable insights for intervention design and systemic change.

Chapter 1—Introduction

"Today we are faced with a challenge that calls for a shift in our thinking so that humanity stops threatening its life support system"

— Wangarĩ Maathai

There is growing recognition that our relationship with nature needs repairing. This is linked to the emerging acceptance that the current socioecological crisis is rooted in humanity's disconnection from the natural world. People have become both physically removed and psychologically disconnected from nature, leading to a range of negative consequences for both human wellbeing, and the environment (Richardson, 2025). In 2020, the UN Secretary-General stated that making peace with nature is the defining task of the 21st century. He concluded his speech on the state of the Earth by asserting, "Now is the time to transform humankind's relationship with the natural world" (Guterres, 2020). Reshaping humanity's relationship with the natural world is essential for supporting both human and environmental health i.e. planetary health (Lengieza et al., 2023; Barragan-Jason et al., 2022). Nature-based interventions (NBIs) can respond to this problem by creating needed opportunities for reconnection with nature.

Planetary health refers to the interconnected health of people and the planet; recognising that human wellbeing depends on the wellbeing of Earth's natural systems (Whitmee, 2015). Central to this recognition are urgent calls for a fundamental shift in worldview—from anthropocentrism to ecocentrism (Giusti et al., 2025). Across disciplines, an emerging body of work is beginning to emphasise the critical role of nature connectedness, a subjective sense of inclusion and kinship with the natural world, in enabling this shift and thus sustainable transformation towards a healthier future (Lengieza & Aviste, 2025). Yet, there remains a deficit of practical, applied research that identifies tangible pathways for achieving this shift at scale. Although relational approaches are increasingly recognised as catalysts for transformative change, their benefits and practical applications remain underexplored. Recently, growing attention has been directed toward the potential of Nature-Based Interventions (NBIs) to strengthen nature connectedness, thereby supporting the health of humans and the natural world.

This thesis investigates this potential by synthesising the existing evidence base on NBIs; highlighting how design and practice shape effectiveness and are pivotal in achieving the aforementioned outcomes. It further examines the human–nature relationship, by focusing specifically on young people's relationship to nature. This offers key insight into the foundations and underlying mechanisms of nature connectedness as well as barriers to connection. The decision to focus on young people was informed by several key considerations: Firstly, extensive research demonstrating that the foundations of nature connectedness and nature-based values are established during childhood (Hahn, 2021; Sachs et al., 2022), while adolescence is often marked by a rapid decline in connection to nature—commonly referred to as 'the teenage dip' (Richardson, 2019; van Heel et al., 2023). Further, the current youth mental health crisis (Schweizer et al., 2023), and substantial increase in eco-anxiety (Hickman et al., 2021), underscores the urgent need for scalable interventions to support young people during this uncertain time. Given the many benefits of nature connectedness for young people (Madera et al., 2025), nature-based interventions aimed at cultivating nature connectedness, have the potential for significant impact (Overbey et al., 2023; Obeng et al., 2023). Young people are also uniquely positioned in relation to planetary health: they face heightened vulnerability to ecological crises, hold a central role in shaping future societal values, norms and behaviours, and possess the potential to act as catalysts for long-term environmental stewardship. This relevance has been underscored globally through youth climate and environmental movements, where young people have emerged as powerful advocates acting as the voice of nature itself (Soler-i-Martí et al., 2024). Equally important are the distinctive perspectives that young people bring. Their relational understandings of the world and unique perspective on the current climate emergency make them particularly relevant in advancing the shift towards ecocentric orientations (Giusti et al., 2025; Haswell, 2023). Together, these lines of inquiry inform the development of context-specific, relational, and co-designed interventions for young people, piloted through a cross-cultural study.

This thesis builds on the body of research which seeks to reconnect humanity with nature recognising the importance of this relationship. These opening pages situate this work within the broader context of humanity's disconnection from nature, positioning it against the social, political, and historical forces that have contributed to the current socioecological crisis. I introduce nature connectedness, specifically fostered through nature-based interventions, as a

means of addressing this disconnection. I discuss theory and evidence on the impact of nature disconnection (and connectedness) on human and planetary health, moving on to outline the key aims of this work. In essence, what we contemplate here is more than ecological restoration, it is the restoration of the relationship between people and the natural world.

Setting the Context—A Disconnected Age

Humanity faces a convergence of global crises that raise urgent questions about the future of planetary health and the viability of life on Earth. Climate change accelerates at a catastrophic pace. Biodiversity loss, often termed the sixth mass extinction, threatens ecosystem stability. Pandemics expose our vulnerability while intensive resource extraction continues unabated (Ripple et al., 2024; IPCC, 2023; Masson-Delmotte et al., 2021). Compounding these ecological pressures are significant human conflicts, including genocides, refugee crises, and disputes over resources. Collectively, these phenomena underscore a fundamental dysfunction in our current worldview and our relationship with the natural world. They highlight the fragility of the systems upon which both human and more-than-human life depend. Given these factors, it is unsurprising that we are facing a widespread mental health crisis (WHO, 2025), with young people being particularly vulnerable to this impact (Dooley et al., 2024). My background in history has instilled in me the importance of stepping back and noticing ‘the golden thread’ that underpins cultural and societal experiences and phenomena. A historical perspective invites us to ask what deeper, underlying patterns connect these crises. From this perspective, it becomes clear that many of the crises confronting humanity today are symptomatic of a deeper and more pervasive condition: an epidemic of disconnection. Here, we use 'disconnection' to refer to measurable trends, such as declines in frequent nature contact and time spent outdoors alongside rising screen-based activity and urbanisation that limits everyday access to restorative green/blue spaces (Richardson, 2025; Beery et al., 2023). This disconnection manifests across multiple dimensions—we are disconnected from nature, from each other, and ultimately from ourselves. The widespread negative repercussions of this for planetary health are more prevalent than ever (Beery et al., 2023; Richardson et al., 2023).

This disconnection has profoundly shaped our society, identity, and relationship with the natural world. The unsettling paradox of modern life underpins this; whereby we are

experiencing unprecedented technological advancement and global connection while simultaneously experiencing an epidemic of loneliness (Sachs et al., 2024) and eroding the very ecological foundations of our existence (Hickel, 2020). As the Chair of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) summarises: “the health of ecosystems on which we and all other species depend is deteriorating more rapidly than ever, eroding the very foundations of our economies, livelihoods, food security, health and quality of life worldwide” (UN, 2019). This is not simply a matter of environmental degradation; it reflects a deeper cultural condition in which the dominant global agenda continues to prioritise profit over planet, power over compassion, and exploitation over reciprocity. Disconnection from nature is therefore not merely an individual psychological problem but a collective, institutional, and socio-cultural phenomenon (Beery et al., 2023). It is rooted in and reinforced by ideological orientations, political systems, cultural norms, and systemic structures that deny or obscure human embeddedness within the natural world. This disconnection manifests in multiple forms from the physical distancing from nature through urbanisation to the cultural normalisation of consumerism, the technological mediation of everyday life, and the epistemic frameworks that position nature as an object for exploitation rather than integral to life on Earth (Vidal et al., 2024; Milstein et al., 2023). Across time and cultural contexts, evidence suggests that humans have become progressively alienated from nature, losing sight of the fundamental interdependence between human survival and the health of ecological systems (Richardson 2023; 2025).

Central to this condition is the process of psychological distancing from nature, whereby humans are placed on the top of the pyramid above all other living beings. This distancing has facilitated extractivist worldviews and practices, perpetuating the treatment of nature primarily as a resource or commodity for human exploitation and (mis)use (Hochachka et al., 2025; Hanaček et al., 2024). Historically, this process of psychological distancing and disconnection can be traced to cultural shifts that elevated the human above the more-than-human world (Haas et al., 2021; Thompson & Barton, 1994). The rise of Humanism during the Renaissance progressed human exceptionalism, autonomy, and rationality. While this period expanded individual freedom and scientific progress, it also advanced a worldview in which nature was positioned as an external “it” to be studied, ordered, and exploited (Lyons et al., 2016; Soper, 2000). Additionally, the emphasis on individualism contributed to the erosion of an understanding of

human identity grounded in kinship with, and reciprocal responsibility toward, the natural world. The humanist orientation evolved into an anthropocentric (human-centric) worldview that positioned humanity at the apex of existence, perpetuating hierarchical and extractive relationships with all other beings (Kopnina, 2018; 2019). Anthropocentrism—defined as a worldview which places human beings at the center of moral consideration, valuing nature primarily for its utility to human interests (Thompson & Barton, 1994)—has since shaped modern economies, politics, and critically moral frameworks. The consequences of this worldview have been detrimental (Frantz et al., 2025; Saha, 2025). When nature is reduced to a collection of resources or commodities, widespread destruction and exploitation follows ecosystems become abstract 'resources' to be managed rather than living systems with intrinsic worth. This alienation fosters indifference and an apathetic attitude toward ecological harm, which undermines planetary health. Further, the impact this has had on psychological wellbeing is significant. It has produced what some describe as a crisis of identity, belonging and values (Bock et al., 2024; de Diego-Cordero et al., 2024)—whereby humanity has forgotten its place within the larger web of life, and in so doing has undermined the very conditions of its survival.

Recent research by Professor Miles Richardson (2025) employed a hybrid agent-based model (ABM) to track this decline in our relationship to nature over the past 220 years. Findings indicate a persistent loss in nature connectedness, revealing a troubling global decline of over 60% since 1800. This trend mirrors the diminishing presence of nature-related terms, such as "river," "moss," and "blossom", in literature, capturing the cultural shift away from nature in the last two centuries. Projections suggest that without transformative policy and societal changes, this disconnection will continue. These findings underscore that the decline in nature connectedness is not merely an individual or local phenomenon, but a systemic and culturally embedded process. The parallel between declining engagement with nature and its diminishing presence in literature and cultural discourse indicates that this estrangement operates on both psychological and societal levels, influencing collective perceptions, values, and identities. Over generations, the erosion of everyday interactions with nature diminishes not only ecological literacy but also a sense of belonging to the more-than-human world (Zelenski et al., 2023). Consequently, humanity's estrangement from nature perpetuates a cycle in which environmental degradation is both a driver and an outcome of diminished human–nature relationships, posing significant challenges for advancing environmental stewardship, cultural resilience, and

sustainable societal practices. It is therefore essential to examine the underlying causes of this disconnection to effectively address it.

Extinction of Experience (EoE)

This estrangement from nature is rooted in the *extinction of experience* (EoE) whereby people are becoming less likely to have direct contact with nature (natural environments and their associated wildlife) in their everyday lives. This theory was first put forward by Robert Pyle (1993), who asserted that the loss of everyday contact with nature has resulted in an extinction of experience, which diminishes both personal wellbeing and collective concern for the natural world. This shift extends beyond a mere reduction in engagement or direct contact with the natural world; it reflects something much deeper—an erosion of reciprocity and relationality with nature and the disastrous consequences this has for planetary health (Colléony et al., 2020; Soga & Gaston, 2016). While it is challenging to identify a single cause of humanity's growing alienation from the natural world, scholars widely acknowledge that it emerges from a myriad of factors coalescing. These include the loss of opportunity to engage with nature (e.g., urbanisation, accessibility barriers), the loss of orientation or declining affinity toward the natural environment, and broader cultural-historical dynamics, such as technological advancement and demographic shifts (Richardson et al., 2022; 2025).

Loss of opportunity: Arguably, the core driver of the loss of human–nature interactions is the decline in opportunities to directly experience nature. Global environmental changes, driven by urbanisation and land-use shifts, have reduced opportunities for people to experience nature which has significantly impacted their orientation toward the natural world (Richardson, 2025). Urbanisation has undoubtedly exacerbated this and nature experiences have emerged as a predominant casualty of our rapidly urbanising world (Kageyama et al., 2024; Alcock et al., 2014). Over the past century, a steadily increasing proportion of humanity has concentrated within urban areas, environments largely dominated by artificial infrastructures and often segregated from natural systems and ecological processes (Kageyama et al., 2024). Since 1950, the percentage of the world's population living in 'a relatively nature-impoverished urban milieu' has nearly doubled from 30% to 55% (United Nations, 2018; Capaldi et al., 2015, p.1).

Future projections estimate that by 2050, this figure will increase further to approximately 70% (UN, 2018, 2024; Li, 2022). Notably, nearly 90% of this anticipated growth is expected to occur in the Global South, particularly in Asia and Africa. This trend carries significant socio-environmental implications. Rapid urbanisation in these regions often coincides with insufficient infrastructure, limited access to green spaces, and heightened vulnerability to climate-related disasters (Chen et al., 2022). The amalgamation of dense populations, inadequate urban planning, and environmental degradation can exacerbate health disparities, reduce resilience to extreme weather events, and significantly impact overall wellbeing (Rigolon et al., 2018). Furthermore, the loss of local biodiversity and ecosystems may diminish essential ecosystem services, such as air and water purification, further amplifying the challenges faced by rapidly urbanising communities in the Global South (Li et al., 2024).

This exponential growth in the proportion of people living in urban areas has limited opportunities for engagement with nature in everyday life, diminished nature connectedness and exacerbated the negative effects on mental health and attitudes, and behaviour with regard to the environment. This is reflected in recent research, for example Barragán-Jason et al., (2025) conducted a cross-sectional study in France and Colombia spanning ages 3 to 87 with n=1858. Findings indicate that rising urbanisation and deforestation are associated with reduced human–nature connectedness. The research underscores how physical disconnection from nature due to urban growth undermines opportunities for nature connection and sustainable outcomes, particularly in populations with fewer opportunities for direct nature engagement. Further, research has shown that urbanisation has increased productivity and accelerated economic development (Samadkulov 2024), at the expense of planetary health (Kageyama et al., 2024; Aldana-Domínguez et al. 2022). This trend is further intensified by technological advancements and the proliferation of sedentary lifestyles, with activities such as watching tv, computer gaming, and internet use shaping our daily routines (Nambirajan et al., 2025; Pergams & Zaradic, 2006). Coupled with the frenetic pace of modern life, which encourages overscheduling and micromanagement, these factors substantially diminish opportunities for meaningful engagement with the natural environment (Soga & Gaston, 2016). Consequently, for many people, direct outdoor experiences are increasingly being replaced by virtual or screen-based alternatives (Torjinski & Horwood, 2023; Ballouard et al., 2011).

Loss of orientation: Beyond these direct and physical impacts, urbanisation has shaped our preferences and valuation of nature. This loss of opportunity to connect with nature is further compounded by a decline in individuals' positive orientation toward the natural world, that is, a reduced emotional affinity for nature, which constitutes a critical factor perpetuating the extinction of experience. While access to green spaces (opportunity) has increasingly become a policy priority, orientation toward nature is an equally important determinant of nature engagement (Richardson, 2025). Evidence suggests that this emotional orientation exerts a long-lasting influence on people's relationships with and attitudes toward nature, often equalling or even surpassing the impact of mere opportunity. For example, in Brisbane, Australia, Lin et al. (2014) found that the frequency of people's use of urban green space was driven more by their degree of emotional connectedness to nature rather than the availability of neighborhood green space. Richardson's (2025) exploration of population dynamics over time, highlights the importance of intergenerational transmission of an orientation towards nature connectedness, spotlighting factors such as familial norms, social learning, and cultural practices. This research reveals how demographic shifts and family structures shape nature connectedness across generations. In particular, parental nature connectedness plays a pivotal role in shaping children's orientation toward nature and has been identified as one of the strongest predictors of child nature connectedness, either amplifying or mitigating declines in urban environments (Passmore et al., 2021). Low parental orientation may perpetuate the "extinction of experience" cycle, particularly in contexts where access to natural spaces is limited. These findings highlight that nature connectedness is shaped not only by personal experiences with the environment; but also influenced by social/ familial norms and embedded within cultural contexts. Personal affinity with nature, captured by orientation, describes an essential element of a strong connection to nature (Richardson, 2025). Thereby driving values, attitudes, behaviour and delivering broader benefits for both human and nature's wellbeing (Pritchard et al., 2020; Mackay & Schmitt, 2019). Together, these losses reflect not only diminished direct experience with nature, but also a weakening of orientation, meaning, and moral responsibility toward the natural world.

Colonialism, Capitalism and Equity

It is important to recognise that this extinction of experience and subsequent distancing from nature has not been accidental, but intentional, serving colonial and capitalist agendas that legitimise and profit from the exploitation of the natural world and its resources (Gill, 2024; Hickel, 2020; Merchant, 1980). Colonial worldviews played a central role in reframing nature from a living, relational entity into a commodified resource to be owned and exploited. This ontological shift, advanced by capitalism, entrenched extractive relationships with the natural world by casting it as "other" rather than kin (Ramcilovic-Suominen, 2025; Duggal, 2021). This utilitarian perspective, reframed nature's value around its utility in the accumulation and economic growth and power (Schmeltzer et al., 2022; Hickel, 2020; Erickson, 2020; Moore, 2016; 2017). Through this process, indigenous ecocentric ontologies, grounded in reciprocal, relational ethics with land, water, and non-human life, were systematically marginalised or, in many cases, erased (Longdon, 2025; Fogarty, 2022). Essentially, this involves the uprooting and eradication of an entire relationship with deep implications for human and environmental health (Sène, 2024; Gómez-Barris, 2017). These worldviews which recognise the mutual dependence between humans and nature were supplanted by dominant anthropocentric models that legitimised environmental domination (Jones et al., 2022; Ferdinand, 2021; Fraser 2021). In essence, what is lost extended far beyond physical land—it was an entire way of thinking and being in relation to nature. A way in which the self is understood as part of a greater whole and sustainable ways of existing were naturally entwined within everyday practices (Nenquimo, 2025; Menzies et al., 2024; Topa & Narvaez, 2022; Whyte, 2018; Crook et al., 2018; Kimmerer, 2013).

It is now widely accepted that the European colonial project and capitalism have played a pivotal role in creating the current dominant sociocultural, socioeconomic, and sociopolitical realities—from the way we see and interpret ourselves and the world around us, to the very structures of global institutions. However, colonialism is not a thing of the past or a historical event which has merely passed. Recent work by Ramcilovic-Suominen (2025), highlights how treating colonialism as something that is no longer present and just a part of the Wests' "dark history" is a significant barrier to socioecological justice, transformational change, and liberation. Colonialism has given rise to structures which shape social norms and practices, that

are ultimately harmful to the web of life, the broader living world, and the planet itself, subsequently undermining the wellbeing of all humans, who are intrinsically part of nature. These systems have also generated deep inequities in health and access to nature, shaping who is afforded the opportunity to connect with and benefit from a relationship with nature—a concern examined in the following section.

The expansion of capitalism and colonialism entrenched false narratives of white supremacy and cultural inferiority, legitimising systems of racial domination and dehumanisation that privileged a small minority (Duggal, 2021; Webb & Krasner, 1989; Ramcilovic-Suominen, 2025). These systems continue to operate through selective forms of discrimination, disproportionately impacting communities based on race, class, gender, religion, and geography (Danewid, 2023). The psyche embedded within colonialism and capitalism has shaped our social norms and environments in ways that privilege certain groups while marginalising others, creating systemic inequities in access to nature (Kronenberg, 2025; Layden et al., 2025). As an intentional consequence, marginalised communities, including racialised groups, people with low-income, and those with disabilities, often face structural and social barriers that limit their opportunities to engage with nature (Rigolon et al., 2021; Robinson et al., 2022). These barriers manifest in multiple, interrelated ways. For example, the geographic distribution of green spaces often privileges wealthier, predominantly white neighborhoods, leaving low-income and historically marginalised communities with fewer parks, trails, and general access to nature (Nobles & Moore, 2024). Moreover, economic constraints, such as the cost of transportation, outdoor equipment, or participation in outdoor programs, can further restrict access (Englert et al., 2024). Physical accessibility is another crucial concern due to the fact that many public natural spaces are not designed to accommodate people with mobility challenges or other disabilities, creating exclusionary environments (Kling, 2024). Beyond these structural issues, social and cultural dynamics, such as experiences of discrimination, feelings of unease, or cultural norms around outdoor participation, can further reinforce a sense of alienation from nature (Bergeron, 2024; Jennings et al., 2024; Robinson et al., 2022). The consequences of these inequities are profound, constraining both the psychological and relational benefits of nature connection (Rigolon et al., 2021). Accordingly, healing this disconnect from nature calls for a decolonisation of how we conceptualise and relate to nature.

Consequences of EoE and Disconnection—Personal and Planetary Health

This section examines the psychosocial and physiological consequences of physical and psychological distancing from nature. A substantial body of evidence demonstrates that reduced human-nature interaction has wide-ranging effects on wellbeing, with research showing how this cycle diminishes both psychological wellbeing and pro-environmental behavior (Colléony et al., 2020):

Human Health and Wellbeing: large body of research shows that regular contact with nature benefits psychological, physical and social functioning (Wang et al., 2025), Outcomes include sensory restoration (Ratcliffe et al., 2021), reduced depressive symptoms, enhanced mood (Paredes-Céspedes et al., 2024), and improved quality of life (Bettmann et al., 2025). Nature connectedness has been described as 'a basic psychological right' (Richardson, p. 266, 2023). These benefits are increasingly threatened by rapid urbanisation, environmental degradation, and systemic injustices that limit everyday access to nature. These shifts have prompted widespread academic inquiry into the consequences of diminished human–nature relationships for health and wellbeing. Reduced human-nature interaction is consistently linked to heightened stress, attention fatigue, anxiety, and declines in overall wellbeing (Zhang et al., 2020). During the COVID-19 pandemic, restrictions and "nature deprivation", characterised by reduced access to green space, fewer outdoor experiences, and diminished sensory contact with nature, was linked to significant declines in personal wellbeing, especially in urban populations and those already under psychological strain (Colleony et al., 2022).

These effects go beyond mental distress, affecting a broad spectrum of physiological and social outcomes, with far-reaching and long-term consequences for psychological wellbeing. Limited access to natural environments is associated with higher cortisol levels, elevated blood pressure, impaired immune function, and disrupted sleep patterns (Tomasso et al., 2021; Twohig-Bennett & Jones, 2018). Reduced exposure is also linked to poorer cognitive functioning, creativity, and emotional regulation; capacities crucial for adapting to the stressors of modern life (Nguyen & Walters, 2024; Ríos-Rodríguez et al., 2024; Vella-Brodrick & Gilowska, 2022; Ratcliffe et al., 2022). Socially, the loss of shared green spaces diminishes opportunities for casual and structured social interaction, weakens community cohesion, and can intensify

loneliness (Mitchell et al., 2024; Sachs et al., 2024; Wilson et al., 2024). These spaces often serve as symbolic and cultural meeting points, where individuals and communities form connections, exchange knowledge, and maintain a sense of belonging. When such communal natural areas are removed or degraded, people become increasingly isolated, and feelings of loneliness and social disconnection intensify. This is particularly concerning given robust evidence linking loneliness to mental health outcomes, including elevated anxiety, depression, and stress, as well as poorer overall psychological wellbeing (Hutten et al., 2021), this simultaneous erosion of green spaces and social networks compounds risk. Furthermore, nature deprivation in urban environments can compound the effects of social isolation, creating a dual burden in which both the lack of green space and the erosion of social networks amplify vulnerability to mental health challenges.

These impacts are not equally distributed and consequences are especially pronounced for those facing systemic inequalities in access to nature, highlighting how social and environmental factors intersect to exacerbate vulnerability. Reduced opportunities for stress reduction and physical activity in natural settings directly undermine the emotional wellbeing benefits that typically arise from a strong and consistent relationship with nature (Chang et al., 2024; Nicklett et al., 2024). This has resulted in a critical social equity issue with many people not having opportunities to spend time in nature, and experience the mental health benefits, due to the complex interplay of social, political, historical and environmental injustices (Ibes et al., 2021; Shrestha et al., 2025; White et al., 2023).Accessibility challenges are widespread, highlighting concerns around the availability, convenience, and ‘affordability’ of nature (Rigolon et al., 2021). This reflects the commodification of nature within current society whereby engagement with nature is reserved for certain privileged groups rather than seen as a basic human right and need (Daly et al., 2024; Rousell et al., 2024). This cycle of inequity is further perpetuated by inequitable urban planning, racial segregation and economic disadvantage (Birch et al., 2020; Ibes et al., 2021). It is important to note that accessibility is a complex and layered issue with multiple dimensions of exclusion, and certain groups are disproportionately affected. In particular, some communities face greater vulnerability to exclusion from nature with research highlighting that perceived safety as a key barrier (Raina & Mandal, 2025; Bornioli et al., 2024). For example, people of colour, women, and the LGBTQ+ community often experience significant concerns around discrimination and violence when visiting natural spaces (Te Braak

& van Tienoven, 2025; Redden, 2025; Schinasi & Lawrence, 2024; Collins et al., 2024; Navarrete-Hernandez et al., 2021). Accordingly, nature connection is an issue of justice and health equity, not just a tool for feeling better (Shrestha et al., 2025; Amri et al., 2024; Chilton & Jones, 2020).

Adolescence merits particular attention. This period is characterised by heightened sensitivity to environmental, social, and psychological influences, during which foundational capacities for emotional regulation, resilience, and cognitive functioning are established (Beames et al., 2025). Regular engagement with natural environments, promotes stress recovery, attentional restoration, and adaptive coping skills that are essential for navigating the complex demands of modern life (Nguyen & Walters, 2024; Vella-Brodrick & Gilowska, 2022), While reduced contact with nature among adolescents is linked with higher anxiety, depression and loneliness. (Jackson & Williams, 2021). At the same time, urbanisation, increased digital media use, and fewer opportunities for outdoor play constrain young people's interactions with the natural world. This phenomenon poses a pressing public health concern, as diminished nature has cumulative and long-term consequences for emotional, cognitive, and social development (Richardson et al., 2025; Madera et al., 2025). These challenges are further exacerbated by the reality that young people are growing up in an exceptionally complex and often unpredictable world. They face unprecedented pressures, including rapid technological development that reshapes social dynamics and learning environments, global natural disasters that threaten both immediate safety and long-term security, geopolitical conflicts, and exposure, direct or indirect, to humanitarian crises such as genocide and forced displacement. Such stressors not only compound the psychological vulnerability of adolescents but also heighten the importance of protective factors, including a strong relationship with nature and regular engagement with restorative natural environments are therefore especially salient for young people (Richardson et al., 2025; Madera et al., 2025).

Planetary Health: The implication of this disconnection extends far beyond wellbeing. The loss of interaction with nature not only diminishes benefits relating to health and wellbeing, but also discourages positive emotions, attitudes, and behaviour regarding the environment, thereby reinforcing a self-perpetuating cycle of disaffection from nature (Richardson et al., 2025; Soga & Gaston, 2016). Research reveals that those who are not strongly connected to nature, are less

likely to perceive and value the benefits that a strong relationship with nature brings (Soga & Gaston, 2016) and are less motivated to protect and care for nature (Barrable & Booth, 2020; Frantz & Mayer, 2014; Ives et al., 2018; Martin et al., 2020). Crucially, reduced engagement with natural environments fosters apathy toward environmental protection, carrying profound intergenerational consequences, including diminished empathy for nature and reduced motivation to safeguard it. Unequal access to nature contributes to intergenerational disparities in environmental literacy and engagement by reducing the capacity of marginalised communities to cultivate a meaningful connection to the natural world (Dominiak-Szymańska et al., 2024; Tomasso et al., 2022; OECD, 2024). This has a direct impact on nature connectedness, pro-environmental behaviour and the likelihood to participate in environmental stewardship initiatives (Cacciatore et al., 2025; Arola et al., 2023; Teixeira et al., 2023).

This pattern of disconnection perpetuating environmental indifference can be understood through the established value systems theory. Schwartz's (1992) Theory of Basic Human Values outlines that reduced interaction with nature alters people's attitudes toward the natural world, shaping their values and environmental beliefs (Ünal, et al., 2018; Steg, 2014; 2016), perceived ethical norms, and ultimately their behaviour and willingness to engage in its protection (Guazzini et al., 2025; Duradoni et al., 2025; Soga & Gaston, 2016). Building on this, Social Norms Theory outlines that values, attitudes and ultimately behaviours are shaped by the dominant perceived social norms which in turn shape cultural values (Stern, 1999; Steg, 2016). Consequently, both perceived values and social norms shape nature connectedness and PEB. This loss of engagement with nature not only diminishes the vital beliefs people hold about nature but may also erode public support for pro-nature policies and climate action, thereby exerting a profound influence on the trajectory of our collective future (Gaston & Soga, 2020). As a result, the extinction of experience is now increasingly recognised as one of the most substantial public health concerns (Barragan-Jason, 2023; Shanahan et al., 2015), and a fundamental barrier to tackling global environmental degradation (Barragan-Jason et al., 2022).

When neighbourhoods and institutions (schools, community centres) provide limited, poor-quality, or unsafe access to nature, individuals, particularly children and people from marginalised groups, have fewer formative nature experiences. Lower exposure leads to weaker nature connectedness, which correlates strongly with reduced pro-environmental attitudes, behaviours, and lower likelihood of joining stewardship activities (community gardening,

volunteering, citizen science) (Macias-Zambrano et al., 2024; Chawla, 2020). Research demonstrates that sustained, personal contact with natural environments is essential for cultivating an emotional affinity with nature—an effect that cannot be replicated through occasional or sporadic encounters (Hogg et al., 2024; Neldner et al., 2023; Barragan-Jason, 2023). While brief or sporadic encounters with nature can have some positive effects, such as stress reduction and improved mood, unlike sustained contact, these fleeting experiences are less likely to result in the lasting emotional affinity and deep-seated connectedness to nature that forms through prolonged personal involvement and meaningful engagement (Shrestha et al., 2025; Gu et al., 2023). Research demonstrates that fewer formative experiences in nature during childhood impact affective bonds and environmental identity (Arola et al., 2023; Syropoulos & Markowitz, 2021). Just like any other relationship, a bond with nature requires time and consistent contact to develop, with the benefits of nature connectedness emerging gradually over time. Previous longitudinal research demonstrates that improvements in nature connection—and the associated psychological and health benefits—unfold over many years, reinforcing the idea that transformative outcomes arise through sustained engagement rather than immediate exposure (Harris et al., 2025; Barrable & Booth, 2020). This trajectory is especially concerning in light of the extinction of experience, which has eroded both the opportunities and the temporal space necessary to nurture a meaningful connection with nature. In this context, it becomes essential to explore the cultural, institutional, and historical dynamics that perpetuate our separation from the natural world. By doing so, we can better understand how disconnection fuels ecological crises, and why reconnecting, psychologically, culturally, and institutionally, with the natural world is one of the most urgent challenges of our time.

Exploring the Potential of Ecocentric and Relational Worldviews

Healing this disconnect requires more than conservation or policy reform; it calls for a decolonisation of how we perceive and relate to nature—restoring frameworks of reciprocity, kinship, and compassion that counteract the commodifying logics of colonial-capitalist perspectives (Richardson, 2023; Magan, 2022). In essence, healing our disconnection from nature involves a re-imaginging or ‘re-story-ation’ of our relationship to nature as Kimmerer (2013) suggests. As discussed in the previous sections, it necessitates a critical interrogation of

how historical and current colonial, racialised, and capitalist systems shape who is seen as having the 'right' to connect with nature. Further, addressing the inequities that prevent many from reconnecting with nature requires a multidimensional approach that goes beyond simply creating more green spaces (Rigon et al., 2025). A growing body of research in psychology, and beyond, underscores this need for a transformation in the way we view the world and our place within it by highlighting how many of today's intersecting crises, climate breakdown, biodiversity loss, and widespread psychological distress, are rooted in a crisis of worldview (Lengieza & Aviste, 2025; Barragan-Jason et al., 2022). Fundamentally, the dominant anthropocentric, and ego-centric, paradigm positions humans as separate from, and superior to, the natural world, condoning extractive behaviours and unsustainable development (Strayer & Stoeffler, 2024; Hickel, 2020; Ives et al., 2017). It is therefore essential to critically examine and transform this worldview, placing reciprocity, and interconnectedness at the core of human identity and social systems.

Ecocentric worldviews present an alternative framework that recognises humans as interdependent participants within dynamic socio-ecological systems (Pascaul et al., 2023; Folke et al., 2011). Rooted in ecological principles and an awareness of the symbiotic relationships between humans and the more-than-human world, this perspective is essential moving forward (Shastri, 2013). This worldview emphasises relationality—valuing nature not merely for its instrumental benefits but for its intrinsic worth and its fundamental role in sustaining all life (Chan et al., 2016; Barragán-Jason et al., 2021). As we have previously touched on, such orientations are not new innovations but are deeply rooted in Indigenous worldviews that have long understood humans as part of a web of reciprocal relationships within the natural world (Kimmerer, 2013; Whyte, 2018). Indigenous knowledge systems often frame the land, water, plants, and animals as kin, teachers, or active agents within relational networks (Topa & Narvaez, 2022). Indigenous people, all around the world, worship every component, animate or inanimate, of nature. Additionally, they personify their environments, as they consider all natural objects populating the earth as sentient beings, deserving of compassion and care (Snodgrass & September, 2008). This perspective embeds respect, responsibility, and reciprocity with nature, into cultural practices and governance and has a significant impact on the ways in which they interact with their immediate environment as well as shaping their wider value systems (Menzies et al., 2024). Notably, this worldview stands in direct contrast to dominant Western paradigms

and agendas (Kopnina, 2014; Thompson & Barton, 1994). Therefore, current sustainability challenges, driven by Western overexploitation of nature, need to be considered in the context of the limited Western paradigms, which frequently fail to accurately define or conceptualise nature itself (Jarwar et al., 2024). Ecocentric perspectives can be seen as fundamental to both the restoration and revaluation of these longstanding traditions of ecological wisdom, offering an alternative to the dominant anthropocentric worldviews. By drawing on Indigenous epistemologies, creating spaces for the remaining custodians of this knowledge to share their understanding in ways that are meaningful rather than extractive (Thomas, 2021), and integrating these insights into contemporary environmental psychology, intervention design, practice and policy we can achieve significant transformative change. Just as biodiversity is essential for the functioning of all ecosystems on our planet, cultural diversity is essential for challenging the imposed hegemony shaped by colonial-capitalist systems. Ecocentric worldviews encompass a relational ethic capable of guiding societies toward sustainability, justice, and ecological flourishing (Giusti et al., 2025).

Recent evidence underscores both the urgency and the potential of this worldview shift. Richardson's (2025) recent report serves as ominous window into what has been lost, documenting a substantial decline in nature connectedness over the past two centuries, revealing a generational fracture in human–ecological relationships, and emphasising the urgent need for transformational changes in how we think, feel, and act toward the natural world. As discussed, such disconnection has had profound implications: severely impacting human health and wellbeing (Wang et al., 2025), weakening environmental identity/ literacy (Harris et al., 2025), diminishing stewardship (Beery et al., 2023), and reducing resilience in the face of ecological crises (White et al., 2023). At the same time, the growing recognition of relational environmental values—ways of valuing nature grounded in relationships, care, and responsibility—in driving transformational change (Goodwin et al., 2025; Rierchers et al., 2025; West et al., 2024), suggests a cultural opening for reimagining human–nature relationships. This has the potential to advance justice, sustainability, and planetary health. There is an emerging awareness that it is in fact a 'crisis of values' at the root of climate change, biodiversity loss, and socio-environmental injustices (Giusti et al., 2025). This growing consciousness acknowledges how human–nature relationships, encompassing emotional, cultural, and social dimensions, are pivotal. By recognising the interconnectedness of humans and nature, ecocentric approaches can bridge

diverse worldviews and promote collective action through a sense of belonging and duty towards our shared home (Nerland, 2024). Sustainable human development depends on repositioning humanity within an ecocentric reality—recognising ourselves as one species among many, cooperating with others to sustain life on Earth. Simultaneously, emphasising relational values fosters a deeper connection to the environment, encouraging collective action and resilience in the face of ecological challenges. By nurturing relationships between people and the natural world and creating avenues for (re)connection, we can strengthen both relational and biospheric values with the potential to spark environmental stewardship (Pascaul et al., 2023).

Nature Connectedness

Environmental psychology is the scientific study of the interplay between people and their physical environments, examining how natural and built settings influence human behaviour, wellbeing, and how individuals in turn perceive, shape, and impact these environments (Gifford et al., 2011; Steg et al., 2018). Recent research within environmental psychology highlights how creating opportunities for nature connectedness—the extent to which individuals include nature as part of their identity and experience a sense of emotional and cognitive affiliation with the more-than-human world—offers a promising path forward (Giusti et al., 2025; Lengeiza & Aviste, 2025; Barragan-Jasen et al., 2023; Lengieza & Swim, 2023). The construct of nature connectedness is widely used in environmental psychology and related fields, yet it is operationalised in diverse and sometimes conflicting ways. In the literature, nature connectedness has been measured both as a subjective, experiential phenomenon i.e. a "felt sense" of affinity, belonging, or relational connection with the natural world and as a more reductive, quantitative metric, for example through proxies such as frequency of visits to green or blue spaces, proximity to parks, or measures of urban greenness (Capaldi et al., 2014; Pritchard et al., 2020). This diversity in operationalisation can create significant ambiguity for readers and risks conflating engagement with natural environments (behavioural exposure) with the deeper relational and psychological dimensions of connection. In this thesis, nature connectedness is explicitly conceptualised as a felt, relational sense of connection to the natural world. It encompasses emotional, cognitive, and identity-based dimensions of how individuals experience and relate to nature, rather than simply measuring physical proximity or visitation

frequency. By foregrounding the subjective, experiential aspect of the construct, the research prioritises how young people feel and relate to nature, and how these relational experiences support wellbeing and pro-environmental attitudes.

Conversely, within this thesis, nature disconnection is framed as the fragmentation or weakening of this relational bond. It reflects a diminished sense of engagement, belonging, or affinity with the natural world, underpinned by both the extinction of experience, a cumulative reduction in opportunities for meaningful nature engagement (Pyle, 1993), and broader contextual factors, such as urbanisation, safety concerns, social norms, and structural barriers that limit access to natural environments. Nature disconnection therefore is not merely a lack of time spent outdoors; it represents a disruption in the ongoing, relational processes that foster connection, meaning, and identity formation through nature. By explicitly framing nature connectedness as a felt sense and nature disconnection as its fragmentation, this thesis clarifies the conceptual lens guiding the research. This approach allows for the integration of both psychological and social-contextual perspectives, supporting a nuanced understanding of how young people's relationships with nature are shaped, and how these relationships may be cultivated, restored, or hindered across diverse cultural and environmental contexts.

A considerable body of work, within environmental psychology and beyond has documented a strong link between nature connectedness and positive outcomes for both people and the planet. For example, empirical research shows that cultivating nature connectedness is critical for enhancing human wellbeing (Mellor et al., 2022; Martin et al., 2020), predicting pro-environmental values, (Duradoni et al., 2025), and fostering pro-environmental behaviours (MacKay & Schmitt, 2019). Several meta-analyses have supported this showing that nature connectedness is a reliable predictor of a broad range of sustainable behaviours (Barragan-Jason et al., 2023). Moreover, there are meta-analytically documented links from nature connectedness to numerous forms of wellbeing, including general wellbeing (Barragan-Jason et al., 2022), hedonic wellbeing (Capaldi et al., 2014), and eudaimonic wellbeing (Pritchard et al., 2019). Crucially, nature connectedness is linked to a multitude of beneficial group outcomes, such as pro-sociality (Lengeiza et al., 2021) and social cohesion (Oh et al., 2022). This is encouraging, given the well-established links between social connectedness and psychological wellbeing (Wang et al., 2018), as well as the inherently social and diffuse nature of pro-environmental behaviours (Nash et al., 2019). In other words, connectedness to nature is good for both people

and the planet, making the more interesting question: *'How can we strengthen our relationship to nature?'*

This body of work has prompted widespread global recognition of the importance of nature connectedness within planetary health discourse. For instance, the United Nations identifies nature connectedness as a key component of public health strategies aimed at promoting wellbeing. The UN Environment Programme (UNEP, 2023) emphasises that healthy environments, including access to green spaces and the cultivation of strong relationships with nature, are fundamental to supporting overall mental and physical wellbeing. Further, the decline in nature connectedness is now widely recognised as a root cause of the environmental crisis (UN, 2019; 2024), with the IPBES Transformative Change Assessment (2024) highlighting nature connectedness as a powerful lever for the transformative change required to achieve the 2050 Vision for Biodiversity. Despite growing recognition of its importance, practical strategies to foster nature connectedness remain largely absent from international policy frameworks. For instance, explicit references to nature connectedness and the restoration of human–nature relationships are notably absent from the United Nations Sustainable Development Goals (SDGs). While the SDGs address the symptoms of this disconnection (i.e. environmental degradation and mental health challenges), they overlook the deeper, underlying crisis of relational disconnection between humans and the natural world. Recent criticism of the SDGs highlights that these goals reproduce an anthropocentric bias with nature valued instrumentally, as a resource to pursue human health and economic development, rather than intrinsically, as a co-constitutive partner in sustaining life (Kopnina, 2024; Adelman, 2018). This narrow framing risks obscuring the root causes of ecological breakdown and limiting the potential for transformative, ecocentric approaches that recognise interdependence and reciprocity. Accordingly, the practical strategies for addressing the concerning decline in nature connectedness and integrating opportunities for engagement with nature, through interventions, remain underexplored.

Nature-based Interventions (NBIs)

Emerging work has highlighted the potential for nature-based interventions (NBIs) to foster nature connectedness supporting planetary health; through the promotion of diverse wellbeing

outcomes and and pro-environmental behaviours (Giusti et al., 2025; Richardson, 2023; Zelenski et al., 2023; Sheffield et al., 2022). NBIs are structured activities, programmes, or practices that intentionally engage individuals or communities with natural environments to promote health, wellbeing, and sustainability outcomes (Struthers et al., 2024; Richardson et al., 2022; Shanahan et al., 2019). They are implemented within a wide range of disciplines, from medicine and public health to environmental psychology, occupational therapy and urban planning etc. Examples include green exercise, therapeutic horticulture, forest bathing, outdoor education, environment enhancement and conservation activities, and urban greening initiatives. NBIs have been linked to multifarious benefits for human wellbeing, such as stress reduction (Kaleta et al., 2025), enhanced resilience (White et al., 2023), and improved life satisfaction (Pretty & Barton, 2020). Beyond individual benefits, NBIs hold significant potential in recognising and advancing the symbiotic nature between human and environmental health. By fostering deeper connections with nature, these interventions can encourage pro-environmental behaviours, environmental stewardship, and conservation-oriented actions, thereby contributing to sustainability (Ives et al., 2020; 2023). Importantly, NBIs are particularly powerful because of their potential to cultivate relational values which in turn support the necessary shift from anthropocentric to ecocentric worldviews (Chan et al., 2018). Interventions designed to foster nature connectedness, have been shown to encourage value shifts towards relational orientations aligned with an ecocentric worldview (Lengeiza & Aviste, 2025; Ng et al., 2023; Passmore et al., 2022). In this way, NBIs serve not only as routes to enhancing individual wellbeing but also as transformative mechanisms for aligning human flourishing with the wellbeing of the more-than-human world (Giusti et al., 2025; Singer-Brodowski 2023).

Despite growing evidence of the benefits of nature-based interventions, significant knowledge gaps remain. In particular, there is limited understanding of the underlying mechanisms through which NBIs support psychological wellbeing i.e. the factors which make interventions successful. This includes how contextual factors, such as age, socio-cultural background, urban versus rural settings, type of nature, or prior experiences with nature, shape what works, for whom, and under what circumstances. The barriers which constrain intervention success are also poorly understood. Moreover, the potential of NBIs to foster pro-environmental behaviours and relational values remains underexplored, especially in research with young people, for whom nurturing both wellbeing and environmental stewardship is critically important

(Madera et al., 2025). Fundamentally, for these interventions to be truly transformative, their impact must extend beyond the individual, shaping broader societal values. The transformative potential of interventions depends on how effectively they foster an alignment between individuals' inner worldviews and the external values embedded in prevailing social norms and the structure of communities (Giusti et al., 2025; Ives et al., 2023). In essence, the extent to which people perceive their values being reflected in the world around them. Change happens best when what people feel and believe is supported by the society and environment around them. Achieving this alignment requires designing and evaluating interventions in close consideration of the social, spatial, and cultural contexts of the communities in which they are implemented, ensuring that both individual and collective experiences support lasting ecological and social change (Giusti et al., 2025). By recognising and integrating the diverse ways in which people relate to nature, interventions and policies can become more inclusive, culturally sensitive, and subsequently effective. This can also help to enhance adaptation strategies, making them more applied and contextually sensitive, while empowering communities to actively engage in the transformation process. Thus, exploring interventions that cultivate connection and reciprocity, offers a psychological and cultural pathway toward a more healthy, sustainable and equitable future.

Theoretical Underpinnings of Thesis

The theoretical underpinnings of this thesis are rooted in core evolutionary and cognitive frameworks within Environmental Psychology. Central among these is the Biophilia Hypothesis (Wilson, 1984), which proposes that humans possess an innate affinity for the natural world and derive significant wellbeing benefits through contact with nature. From this perspective, human–nature relationships are understood as evolutionarily adaptive because humans evolved in close interaction with natural environments with both psychological and physiological responses to nature deeply embedded in human biology. Building on this foundation, Stress Reduction Theory (SRT; Ulrich, 1984) suggests that natural environments facilitate physiological and psychological recovery from stress. SRT posits that exposure to non-threatening natural settings activates parasympathetic nervous system responses, reduces physiological arousal, and promotes affective restoration. Building on this, Attention Restoration Theory (ART; Kaplan &

Kaplan, 1989) proposes that exposure to natural environments restores cognitive resources depleted by sustained directed attention. Through qualities such as “soft fascination,” nature enables recovery from mental fatigue and enhances cognitive functioning. Together, these frameworks have provided a robust theoretical basis for understanding why human–nature interactions promote health and wellbeing, and why those who lack regular engagement with nature may be more vulnerable to negative health outcomes (e.g., Pritchard et al., 2020; Shanahan et al., 2015; Hartig, 2024).

Beyond physiological and attentional restoration, contemporary environmental psychology has increasingly emphasised the construct of nature connectedness. Theories of nature connectedness conceptualise this relationship as multidimensional, encompassing affective (gratitude care, awe), cognitive (beliefs, values), experiential (contact and engagement), and identity-based components (Lengeiza & Aviste, 2025; Richardson, 2023). Aforementioned, empirical research demonstrates that higher levels of nature connectedness are associated with improved wellbeing, greater life satisfaction, and stronger pro-environmental attitudes and behaviours. In this way, nature connectedness functions not merely as an outcome of nature exposure, but as a psychological mediator linking human–nature interaction to both mental health and environmental stewardship. Theoretical models of environmental stewardship further propose that individuals who experience a stronger sense of connectedness to nature are more likely to adopt pro-environmental behaviours (Duradoni et al., 2025; MacKay & Schmitt, 2019). This relationship is often explained through identity-based motivation, moral extension toward the natural world, and increased intrinsic valuation of ecological systems. Nature connectedness may therefore operate as a bridging construct between personal wellbeing and planetary health, aligning self-interest with ecological care.

While the Biophilia Hypothesis, Stress Reduction Theory, Attention Restoration Theory, and nature connectedness frameworks have been highly influential, they are not without limitations. A central limitation is their implicit assumption that the benefits of nature are largely uniform and universal. These theories often present nature exposure as inherently beneficial, with limited attention to variability across individuals and contexts. However, the restorative effects of a forest walk, for example, may differ substantially depending on prior experiences, cultural associations, personal preferences, and perceived safety (e.g., Madera et al., 2025; Richardson et al., 2025). For some individuals, dense forests may evoke fear rather than restoration. Similarly,

urban green spaces may provide meaningful refuge for one young person, while feeling unsafe or exclusionary to another. Moreover, dominant frameworks primarily emphasise individual-level psychological and physiological mechanisms. They offer comparatively limited insight into how social, cultural, and structural factors mediate or moderate these effects. Access to high-quality green space, socioeconomic status, intergenerational transmission of nature experiences, community cohesion, and cultural narratives about nature all shape how individuals experience and benefit from nature engagement. Without incorporating these dimensions, theoretical models risk oversimplifying human–nature relationships and overlooking inequities in access and outcomes. There is therefore a pressing need to advance theoretical approaches that move beyond assumptions of universal benefit toward a more context-sensitive understanding of human–nature interactions. Such approaches must consider dynamic interactions between individual characteristics (e.g., developmental stage, identity, prior experiences), environmental quality (e.g., biodiversity, safety, accessibility), and social context (e.g., cultural meanings, peer norms, structural barriers). By integrating these factors, research can better explain why certain populations experience stronger or weaker benefits from nature engagement and guide the design of interventions that are responsive to diverse needs and settings.

To address these limitations, this thesis incorporates the A–B–C model of Behavioural Change (Guagnano et al., 1995; Liao & Yang, 2022) as an integrative framework. The A–B–C model proposes that Behaviour (B) is shaped by the interaction between Attitudes (A) and Contextual factors (C). Considering the relationship between nature and mental health, the A-B-C model outlines how Contextual factors (C)—including accessibility of safe natural environments, cultural meanings attached to nature, time pressures, and social support—shape young people's opportunities to engage with nature and therefore influence whether potential wellbeing benefits are derived. In this way, mental health outcomes are not determined solely by individual attitudes or affinity toward nature, but by the interaction between internal dispositions and external conditions. Similarly, while pro-environmental attitudes and values may predispose individuals toward sustainable action, contextual barriers—such as infrastructure, social norms, economic constraints, and access—can either enable or constrain behavioural expression. This framework is particularly relevant to youth populations. Young people may express strong environmental concern and feel deeply connected to nature yet encounter structural barriers that limit their ability to engage with nature and act consistently with their values. Thus, enhancing

nature connectedness alone may not automatically translate into sustained environmental stewardship. Within this thesis, the A–B–C model is used to move beyond purely psychological explanations of nature–health–behaviour relationships. While nature connectedness is conceptualised as strengthening Attitudes (A), equal emphasis is placed on addressing Context (C). Study 1 identified contextual enablers and barriers to effective NBIs (e.g., environmental quality, safety, practitioner skills, co-design processes). Study 2 illuminated culturally, and socially embedded barriers experienced by young people, including limited access, safety concerns, and modern structural constraints. Building on these insights, Study 3 (Pathways to Nature; PTN) operationalised the A–B–C framework through the co-creation of interventions tailored to local contexts. PTN was centred on enabling young people not only to strengthen their connection with nature (A), but also to identify, navigate, and transform contextual barriers (C) within their communities. Through participatory co-design, youth and practitioners collaboratively developed locally relevant NBIs, fostering agency, social support, and structural alignment. In this way, behaviour change (B), in the form of enhanced environmental stewardship and adaptive coping, was conceptualised as emerging from the dynamic interaction between internal dispositions and external conditions.

Thesis Conception

Recognising the urgent need for interventions that adopt a contextually-sensitive approach to design, support youth wellbeing, foster environmental stewardship, and cultivate ecocentric worldviews, this PhD investigates the potential of nature-based interventions to enhance nature connectedness as a pathway to achieving these outcomes. In doing so, it addresses critical research gaps, integrates transdisciplinary knowledge, and develops an innovative approach to intervention design that advances planetary health.

My passion for this topic is rooted in my personal history and relationship with nature. It began in childhood, shaped by my upbringing in rural Kerry at the base of Carrauntoohil, Ireland's tallest mountain. Irish mythology locates the legend of Tír na nÓg—a realm of natural beauty, eternal youth and abundance—here in the foothills of Carrauntoohil. Growing up in this landscape, I experienced its beauty and abundance firsthand and began to understand why the story is based here. From an early age, I became aware of the profound influence my natural

surroundings had on my mental health, my values, and my emerging sense of responsibility to care for the plants and animals that surrounded me. My place attachment, forged in Kerry, has remained central to my identity. This connection was significantly affected when I left home and moved to the city, to study at University College Cork. Moving from a rural environment to what felt, at the time, like an urban metropolis, was a shock to the system. I felt overwhelmed, overstimulated, and disconnected. Despite Cork's strong sense of community, which I have come to recognise and appreciate, at that stage I experienced the city as suffocating. This was largely due to the fact that, at that time, Cork city was a built-up urban environment and there was a considerable lack of green and blue spaces. I sought daily contact with nature but found it almost impossible to access which significantly affected my health and happiness. I must also add that I often felt unsafe in the few available green spaces, which further limited my ability to connect with nature. This highlights not only the scarcity of natural environments in urban contexts but also the complex layers underpinning 'access' to nature, including perceptions of safety and broader social conditions. Looking back, I recognise that I was grieving the sudden loss of a relationship that had anchored me for my entire life: my relationship with nature. Without it, my sense of inner balance and ability to self-regulate faltered. This loss showed me how deeply unfair it is that access to nature—and a relationship so central to health and wellbeing—can be determined by where one happens to live.

Reflecting on my own privilege, I came to understand how fortunate I was to grow up immersed in nature. This early connection has profoundly shaped my worldview, my values and behaviours. It is this relationship that continually sustains me during periods of struggle and informs my commitment to care for and protect the natural world. I strongly believe it is what has led me to this PhD journey and my passion for reconnecting people back to nature. Importantly, it became clear to me that many others are denied this same opportunity. During my time in Cork, I lived in an area classified as 'disadvantaged' or lower socioeconomic status, where greenspace was scarce and encounters with nature were virtually absent from everyday life. In contrast, visits to wealthier neighbourhoods, such as Blackrock and Sunday's Well, revealed more abundant green spaces, and with them, an almost immediate sense of calm for my nervous system. These inequities struck me as profoundly unjust. In my view, the opportunity to access and build a relationship with nature should be a universal right, yet it is consistently limited by socioeconomic and spatial inequalities, underpinned by historical injustices. Through

this lens, I began to see the broader picture: the extinction of everyday experiences with nature, and the systematic exclusion of certain groups from natural spaces, have contributed to an alienation from nature which underpin the environmental crisis. This disconnection is not only from nature but from ourselves—our recognition that we are part of the natural world. In forgetting this, we have lost sight of our interdependence and our responsibilities.

During my Master's studies in Positive Psychology, I developed a research interest in health interventions, with a particular emphasis on nature-based approaches. As I began to engage with the literature on human–environment interactions, I was struck by the growing body of work linking contact with nature to positive health and wellbeing outcomes. At that time, and increasing exponentially since, there was a surge in research investigating this topic. This work appeared to reflect something I had long intuited—that our relationship with nature is central to human health. However, a lot of this research was coming from disciplines such as medicine, psychology, urban planning etc. with a heavy focus on public health. I found much of this work troubling in its framing. Nature was often positioned as a resource for human benefit, with little recognition that human wellbeing is fundamentally dependent on the health of the planet itself. I didn't have words for it at the time but essentially, the literature was saturated with an anthropocentric, extractive perspective that neglected the reciprocal dimensions of human–nature relationships. While evidence documenting the benefits of nature for human health was abundant, there was a lack of practical guidance on how to foster nature connectedness in ways that could support nature.

Nature-based interventions emerged as an area of inquiry and promising mechanism, yet research in this area remained underexplored and fragmented, with little effort to consolidate evidence into applied practices or scalable strategies. Equally concerning was the neglect of health equity: this research seemed to ignore the glaringly obvious health equity crisis and layers of injustice shaping our relationship to nature from a socioeconomic, race and gender dimension. This inequity resulted in simplistic solutions such as "green prescriptions," which assume access to nature is universal; overlooking the reality that many individuals live in environments devoid of green space and are denied opportunities to build formative relationships with nature during childhood which has a significant impact on derived benefits. These gaps in both framing and practice have deeply shaped the conception of my PhD thesis. My doctoral research is grounded in a conviction formed through lived experience: that everyone should have the opportunity to

build a strong and enduring relationship with nature. Such a relationship underpins planetary health, and restoring it is essential if we are to foster the ecological values and worldview shifts necessary for transformative change.

Thesis Aims and Objectives

The overarching aim of this thesis is to explore how nature-based interventions can foster nature connectedness as a means of enhancing wellbeing and environmental stewardship. This project aims to help people move away from seeing nature as just a resource for humans, toward seeing themselves as part of nature and embedded within the natural world, which has the potential to progress transformative change. This thesis is guided by the following overarching question:

> *How can nature-based interventions be designed and implemented to foster nature connectedness in ways that support wellbeing and environmental stewardship?*

Accordingly, this research is guided by the following objectives:

1. To evaluate the effectiveness of nature-based interventions designed to enhance wellbeing, and to identify and understand the key mechanisms, both barriers and enablers, that influence their effectiveness. This objective also seeks to highlight gaps in current knowledge and to identify priority areas for future research, including specific populations to focus on and approaches to intervention design that may optimize impact.
2. To investigate the diversity of young people's nature-based experiences and their relationships with nature across different cultural and socio-economic contexts. To understand how these relationships influence mental health and environmental identity, and to identify the key barriers that hinder the development of nature connectedness.
3. To integrate research findings into the co-design, implementation, and evaluation of nature-based interventions aimed at enhancing mental health, nature connectedness, and pro-environmental behaviours among young people. This objective seeks to identify

pathways of transformational change that promote youth wellbeing, cultivate environmental stewardship, and foster a shift towards more ecocentric worldviews. It also aims to highlight areas for refinement to inform the development of future interventions and advance best practice in nature-based research.

Structure of the Thesis

This thesis is presented as a series of publications written for journals within the field of Applied Psychology, Public and Environmental Health Sciences. Below I briefly introduce the content and contribution of each chapter:

In chapter 2, I outline the methodological foundations of this PhD which have developed iteratively over an extended period of time throughout the PhD, shaped by the evolving needs and direction of the research. This extended discussion was necessary, as journal publications typically allow only brief explorations of methods, insufficient for articulating the depth of methodological reasoning required in a doctoral thesis. The methodological approach has evolved in response to the findings of the umbrella review, which served as a needs-analysis by synthesising the available evidence, identifying research gaps, and highlighting future directions for intervention design. All methodological choices were intentional and carefully justified in relation to the overarching research questions, while also remaining responsive to the evolving needs-analysis. This chapter details the role of qualitative methodology, youth work methodology, the participatory co-design processes, and the practical ethics and reflexivity integral to the research process.

In chapter 3, I present an umbrella review synthesising existing systematic reviews and meta-analyses of the effectiveness of nature-based interventions for mental health and wellbeing (published as an academic paper in Environment International). The decision to undertake an umbrella review stemmed from the observation that existing evidence on the effectiveness of NBIs was fragmentary and often inconsistent, thereby limiting the translation of research findings into practice. Conceptually, the review contributes by examining how NBIs have been operationalised in the literature, offering a catalogue of intervention types and approaches described across existing publications. Importantly, the review also identified a prevalent

anthropocentric bias in the field, where NBIs were frequently framed as ‘resources’ for human use rather than as part of a reciprocal relationship with the natural world. This problematic framing reinforced our conviction of the need for both a shift in intervention design and a broader transformation towards an ecocentric worldview. The review provides a comprehensive synthesis of the current evidence base and a critical needs-analysis that directly informs the design and direction of the two empirical studies of this PhD (described respectively in Chapters 4 and 5).

Chapter 4 presents the first empirical study, which consisted of a qualitative exploration of young people's relationship to nature and how it relates to their wellbeing and feelings of pro-environmental behaviour (published in the Journal of Environmental Psychology). Building on the umbrella review, which highlighted the importance of understanding the foundations of human–nature relationships and barriers to nature connectedness, we conducted an in-depth qualitative study exploring young people’s experiences of nature. This decision was further informed by the recognised deficit of qualitative research in the field, particularly studies attentive to the personal, lived dimensions of nature experiences. Our decision to focus on young people was informed by several key considerations which I have touched on in this chapter and unpack further in this chapter. In essence, while the umbrella review enabled us to ‘zoom out’ and synthesise the broader evidence base, the first empirical study allowed us to ‘zoom in’ to uncover the nuanced and contextual complexities of young people’s relationships with nature, generating critical insights to inform intervention design.

Chapter 5 presents the second empirical study, which combined qualitative and quantitative methods to evaluate the impact of co-designed nature-based interventions on young people’s nature connectedness, mental health, and pro-environmental attitudes (to be submitted to the People and Nature). This study formed part of a larger multi-disciplinary Key Action 2 (KA2) European youth work project, Pathways to Nature, involving partners in Ireland, Spain, Armenia, and Finland. Drawing on youth work methodology, this project integrated diverse practitioner insights, harnessing both a wealth of experiential knowledge and practical experience. Building on findings from the umbrella review, the qualitative study, and previous collaborations with practitioners, the research adopted an innovative and dynamic participatory co-design approach. This approach ensured that interventions directly addressed the lived realities and tangible needs of young people, while supporting them to act as catalysts for transformative change in their

communities. The paper details the processes and practices developed to support meaningful co-design, including strategies to ensure accessibility and inclusivity, while reflecting critically on the challenges and opportunities inherent to this approach. More broadly, the study provides important insights for intervention design, practice, and policy by demonstrating how NBIs can simultaneously support youth wellbeing, pro-environmental behaviours, and foster relational values and ecocentric orientations.

Finally, Chapter 6 synthesises the overarching findings of the project, discussing their implications for conceptual frameworks, intervention design and considering the potential of ecocentric orientations as a guiding ontological foundation for planetary health strategies. Particular emphasis is placed on how the empirical work addresses calls for strategies to enhance nature connectedness as a means of supporting public health outcomes and fostering urgently needed shifts towards sustainable lifestyles. This chapter includes a critical reflection on the limitations of this research, providing particular insight into the challenges inherent to participatory and co-design approaches. Finally, future directions for research, practice, and broader policy are discussed outlining how nature-based interventions are just one part of an integrated approach towards sustainable transformation.

Note. This thesis draws extensively on youth work philosophy and methodology through close collaboration with youth workers and young people across Europe. Given the central role this approach played in shaping the research design, implementation, and ethos of the project, a brief overview of youth work—what it is, who it serves, and its key benefits—is provided in the text box below:

What's Youth Work?

Youth work is a distinct field of educational and social practice that supports young people's personal, social, and civic development through voluntary, relationship-based engagement. It was given formal statutory recognition in the Youth Work Act 2001, which defines youth work as:

"A planned programme of education designed for the purpose of aiding and enhancing the personal and social development of young people through their voluntary involvement, and which is

complementary to their formal, academic or vocational education and training and provided primarily by voluntary youth work organisations."

Emerging in Europe in the late 19th and early 20th centuries through community, faith-based, and social reform movements, youth work developed as a response to social inequality, urbanisation, and the need to support young people outside formal schooling structures. Today, it is recognised across Europe and internationally as a key mechanism for promoting youth wellbeing, participation, and social inclusion. Youth work typically operates in community-based settings such as youth centres, outreach programmes, cultural organisations, and non-formal education initiatives. Services are commonly funded through a combination of public funding (e.g., local authorities, national governments, EU programmes), charitable foundations, and non-governmental organisations. Many youth work services prioritise supporting "young people with fewer opportunities," including 'at-risk youth' those experiencing social exclusion, economic disadvantage, marginalisation, or mental health challenges. As such, youth work often engages groups who are underrepresented in traditional research contexts. At its core, youth work is grounded in voluntary participation, empowerment, and relational practice. Unlike formal education, it is not curriculum-driven or assessment-focused. Instead, it emphasises trust-building, mutual respect, and creating safe spaces where young people can explore identity, develop skills, and express their perspectives.

A defining feature of youth work is its relational ethos: practitioners consistently stress that meaningful change is built on authentic relationships. Methodologically, youth work draws on non-formal and experiential learning approaches, including creative activities, dialogue, group work, arts-based methods, and community projects. It seeks to foster agency, self-efficacy, resilience, communication skills, and civic engagement. Contemporary European youth policy frameworks, such as the EU Youth Strategy, emphasise active participation, social inclusion, and health equity, positioning youth work as central to enabling young people to shape decisions that affect their lives. Within this thesis, youth work provided both a practical setting and a methodological ethos. Pre-existing relationships between youth workers and young people created a foundation of trust that enabled meaningful participation and co-design. The relational, participatory, and reflexive principles of youth work informed the development of context-sensitive nature-based interventions, ensuring that they were not imposed upon young people but co-created with them in ways that respected local knowledge, lived experience, and diverse social realities. For further reading see 'Opportunities for Youth National Strategy for Youth Work and Related Services.'

Chapter 2—Methodology

This chapter outlines the methodological approaches that guided the design, implementation, and evaluation of my doctoral research. As stated in Chapter 1, addressing this overarching aim of my research necessitates a dynamic, and transdisciplinary approach that facilitates research which is both academically rigorous and responsive to the complex, interconnected challenges of wellbeing, equity, and planetary health. In order to understand both the potential for nature-based interventions to support these outcomes and explore the nuances shaping human nature interactions, I adopted an interdisciplinary and participatory orientation, integrating insights from environmental psychology (Yap & Leow, 2024), positive psychology health intervention frameworks (Seligman et al., 2005), qualitative methodology (Lloyd & Gifford, 2024), youth work methodology, community-based participatory research (CBPR) (Fletcher, 2003), and co-design approaches (Chinsen et al., 2025; Gooding et al., 2025; O'Donnell et al., 2025), underpinned by a relational and ecocentric worldview. This orientation is rooted in a commitment to inclusivity, accessibility, and the co-production of knowledge with young people and community partners. Rather than imposing standardised models, my research aimed to create context-sensitive interventions that are meaningful to diverse communities across varied cultural settings. This required a careful examination of the relational interactions between people and the more-than-human world, with a view to understanding the social, cultural, and ecological contexts which shape these interactions and supporting these moments of recognition further through supportive and inclusive design approaches.

This chapter begins by establishing the philosophical positioning that underpins the research, including the ontological and epistemological assumptions guiding methodological choices. I then introduce the methodological frameworks employed, including umbrella review methodology, qualitative methodology, positive psychology, and with particular emphasis on participatory frameworks such as Community-Based Participatory Research CBPR, and the influence of youth work methodology. Following this, I present a discussion of the ethical considerations that underpinned and guided this research. Finally, this methodology also required a highly reflective and emotionally engaged design process throughout. To illustrate the intersubjective work involved, I provide a reflective perspective at the end of this chapter,

highlighting my learning, positioning, and the process of co-creation with participants throughout the project. In presenting these elements, this chapter demonstrates how the chosen methodology balances academic rigour with community relevance, ensuring that the findings are both theoretically robust and practically impactful.

Philosophical Positioning

The philosophical positioning of this thesis is grounded in a relational ontology, informed by social constructivism, and a participatory epistemology. This orientation reflects both the subject matter of the research and the methodological approaches adopted throughout the thesis. A relational ontology recognises that human wellbeing, identity, and values are co-created through relationships with both humans and the more-than-human world (Kenter & O'Connor, 2022; Walsh et al., 2021). This framing is particularly suited to the aims of the thesis, which seek to explore how nature-based interventions can foster mental health, nature connectedness, environmental stewardship, and shifts towards ecocentric worldviews. Drawing on a relational youth work approach, as well as emerging research within environmental psychology (Lengieza et al., 2023), we consider the growth of the human-nature connection as reflective of the development of interpersonal relationships. Just as relationships with people build progressively, our capacity to connect and relate with nature evolves over time through meaningful nature experiences. Such experiences reinforce the gradual development of specific emotional, social, cognitive and physical competencies that support nature connectedness and align with the shift from anthropocentric to ecocentric worldviews. Further, by foregrounding the interconnectedness of human and ecological systems, relational ontology provides a foundation for examining how context, culture, and environment shape experiences and outcomes. Thus, the ontological positioning of this research is explicitly ecocentric. Rather than treating nature instrumentally, as a backdrop or a resource for human 'use' this project conceptualises humans and nature as co-constitutive, interdependent, and entwined. This worldview challenges anthropocentric framings that dominate health and environmental research by adopting an integrated understanding of planetary health. This positioning is not only philosophical but also practical, shaping the way interventions were designed: with an emphasis on reciprocity, stewardship, and relational connectedness between humans and nature.

The research is also informed by social constructivism (Vygotsky, 1978), which asserts that knowledge and meaning are not fixed but are continually constructed through social interaction, dialogue, and shared cultural frameworks. Subsequently, the meaning and value we assign to nature is not inherent but shaped by our cultural narratives, social contexts, and lived experiences. This lens is particularly useful for understanding human–nature relationships, as it does not assume an inherent 'unbreakable' connection with nature but rather highlights how perceptions of the natural world vary across cultural, generational, and socio-economic contexts (Alves & Vidal, 2023). For example, whether nature is viewed as a resource to be managed and used, a sacred entity, or a partner in sustaining life, is dependent on the social and cultural lenses through which individuals and communities interpret their environment. This stance facilitated the exploration of the real-world lived experiences of young people engaging with nature. Additionally, adopting this perspective strengthened the project's participatory orientation, particularly within studies two and three. For instance, this orientation has encouraged me to recognise that young people and community partners bring diverse, culturally situated ways of knowing and experiencing nature that shape their realities. It also underscores the importance of creating spaces where these perspectives can be shared, understood and integrated into the design of interventions, ensuring that they are contextually relevant and culturally sensitive. Moreover, social constructivism informed the reflexive practice adopted throughout the research, whereby findings were not treated as definitive but were iteratively shared, discussed, and refined in collaboration with partners and participants. For example, insights from youth workers were invaluable in shaping strategies to embed reflexivity within the research process. Several of these specific practices will be outlined later in this chapter. This process ensured that interpretations resonated with participant's lived realities, while also allowing new meanings and understandings of human–nature connection to emerge through dialogue.

Epistemologically, this research is situated within participatory traditions, which challenge conventional hierarchies of knowledge and emphasise the value of lived experience (Kulmala et al., 2024). These traditions rest on the assumption that knowledge is not passively discovered nor produced in isolation by academic researchers, but rather co-created through dialogue, collaboration, and shared reflection. This orientation is particularly relevant when exploring the human–nature relationship, because the ways people understand and interact with the more-than-human world are deeply shaped by cultural narratives, lived contexts, and community practices

(Menzies et al., 2024). By foregrounding inclusivity, this stance recognises that diverse perspectives, particularly those of young people and marginalised groups, are essential in developing a more holistic understanding of how nature connectedness can be fostered. The participatory dimension of this orientation also aligns with the wider project's aim of addressing inequities in access to nature, seeking to amplify voices that are often excluded from dominant discourses in human–environment research (Lloyd & Gifford, 2024). In practice, this meant intentionally creating opportunities for participants to articulate their own meanings, stories, and values in relation to nature, and positioning these accounts as legitimate and valuable forms of knowledge. Adopting this stance required me to remain open, emotionally engaged, and responsive throughout the research process, recognising that my interpretations were always provisional and shaped through interaction. Moreover, I also recognise that the very idea of human-nature disconnection, which underpins this thesis, is embedded within specific ontological frameworks, for example, European-based philosophical traditions (Beery et al., 2023; Todd, 2016). Around the world, particularly within indigenous communities, many ontological orientations do not make a distinction between humans and the more-than-human world (De la Cadena, 2015). The widespread notion of disconnection is largely a legacy of European colonialism, where political domination, re-education programs, cultural hegemony, forced labour, and genocide worked to impose and normalise ontologies that separate humans from nature (Ramcilovic-Suominen, 2025). Acknowledging this colonial origin is essential for understanding how dominant epistemic traditions have produced and continue to reproduce the concept of disconnection.

Methodological Frameworks

In shaping the methodological foundations of this PhD research, I drew on umbrella review methodology (Aromatis, 2015; Papatheodorou, 2019) to critically assess the existing evidence, identify gaps in research and practice, and determine the most appropriate direction for intervention design. I integrated qualitative methods with participatory frameworks, particularly community-based participatory research (CBPR), while also drawing on insights from youth work methodologies and positive psychology. Together, these approaches provided a robust

foundation for the co-design approach adopted in this project, guiding both the process and practice of intervention development:

Umbrella Review Methodology

While conducting my initial literature review, it became clear that the diversity of natural environments and broad applicability of nature-based interventions, across different populations and disciplines, had resulted in significant heterogeneity in intervention design. This led to a proliferation of systematic reviews and meta-analyses, producing a fragmented and mixed evidence base (Wilkie & Davinson, 2021). Given the extensive number of reviews assessing NBIs, it was essential to consolidate the existing evidence base to clarify what was known and, where necessary, make recommendations for integrating these interventions into practice, policy and planning, as well as guiding future research. This resulted in our decision to conduct an umbrella review. Umbrella reviews integrate findings from multiple systematic reviews and meta-analyses rather than primary studies, providing a comprehensive overview of a research area (Fernandez et al., 2025; Harper et al., 2021). By consolidating evidence across specialties, these reviews play a critical role in advancing knowledge, shaping evidence-based practice, and informing policy decisions globally (Shi et al., 2024). They also assess the methodological quality of included studies, ensuring robustness, reproducibility, and high standards of evidence synthesis (Barker et al., 2023). This approach allowed for a comparison of findings across reviews and offered decision-makers an overarching synthesis of the evidence base (Papatheodorou, 2019). Within this umbrella review, narrative synthesis (Popay et al., 2006) was employed to integrate the available evidence, explore patterns across studies, and identify factors influencing the outcomes of NBIs. Narrative synthesis is particularly well-suited for addressing questions about the factors shaping intervention implementation (Khurshid et al., 2021), supporting the contextualised integration of diverse forms of evidence.

The umbrella review approach significantly enhanced the efficiency and rigor of this PhD research, supporting evidence-based practice and facilitating informed decision-making for both intervention design and policy considerations. By synthesising a large and diverse body of research, the approach allowed us to navigate complex and sometimes conflicting findings,

highlight research gaps, and establish priorities for future inquiry. Specifically, the umbrella review provided a summative overview of existing published evidence on nature-based interventions, offering detailed insight into the key barriers and enablers of intervention implementation. This enabled us to identify the underlying mechanisms associated with successful outcomes—such as co-design, fostering social connection, promoting immersive or active engagement, and the importance of the practitioner—which were directly incorporated into the design of our interventions. From a methodological perspective, the review is notable for addressing the unique challenges of conducting an umbrella review, including the development of tailored strategies for synthesising heterogeneous evidence. Further, we detail our use of narrative synthesis to integrate findings across reviews, providing practical insight into the value of this approach, while also incorporating assessments of methodological quality. Furthermore, the approach facilitated a comprehensive understanding of the conceptual underpinnings of NBIs, helping to situate our interventions within a broader theoretical and practical context. The umbrella review also highlighted critical knowledge gaps and methodological considerations, providing a strong foundation to inform future research, guide policymaking, and support evidence-based practice. In this way, it was instrumental in shaping both the strategic and operational elements of the PhD project, ensuring that intervention development was grounded in robust, consolidated evidence while remaining responsive to emerging insights in the field.

Qualitative Methodology

Within this PhD research, I address widespread calls for a movement beyond theory-based de-contextualised approaches within Environmental Psychology (Lloyd & Gifford, 2024; Nielsen et al., 2024); which I will unpack further in Chapter Four. I address this in part, by employing qualitative methodology to explore the human-nature connection within empirical studies two and three. Recognising the bias towards quantitative research within the field and the lack of sensitivity to personal perspectives on nature (Lloyd & Gifford, 2023; Sumner et al., 2020), I have set out to underscore the potential for qualitative studies to add to our understanding of the subjective meaning of nature. By understanding more on the individual level, it may be possible to derive multidimensional perspectives into the mechanisms through which nature supports human health and promotes stewardship. Understanding the complex and

deeply personal/varied relationships between humans and the natural world requires a methodological approach capable of capturing nuance, context, and lived experience. Quantitative approaches have made significant contributions in this field, offering evidence of broad patterns and associations between nature exposure, wellbeing outcomes, and pro-environmental behaviours. However, such approaches often fall short in uncovering the why and how that underpin these relationships. They may measure the presence or absence of 'nature connectedness,' for instance, but sometimes fail to integrate the diverse meanings and experiences that shape this construct across different social, cultural, and ecological contexts (Smith et al., 2021; Sumner et al., 2020). Qualitative methodology is therefore particularly well-suited to this area of inquiry. It allows for the exploration of the relational, affective, and contextual dimensions of human–nature relationships that cannot be adequately captured through quantitative measures alone (Giusti et al., 2019). By illuminating participants' voices and lived-experiences, qualitative methods create space for young people and community members—particularly those whose perspectives are often underrepresented in research—to articulate their own understandings of nature, wellbeing and stewardship. This is especially important given the importance of inclusivity, co-production of knowledge, and the recognition of diverse worldviews embedded within the philosophical positioning of this thesis. Building on this, I integrated a mixed-methods approach in my final study. I believe that analytic tools provide researchers with distinctive lenses that enable them to explore different aspects of the data and that these different methods of analysis may be viewed as complimentary as opposed to mutually exclusive. The combination of methodologies provided us with the ability to generate richer understandings and avoid reductionism. This mixed-methods approach was crucial to understanding how dynamic nature-experiences are perceived by participants, and how individuals' mindsets may impact nature's ability to restore.

Reflexive Thematic Analysis: Within my qualitative orientation, I selected thematic analysis (Braun & Clarke, 2006, 2021) as a particularly useful and insightful method for analysing data. Thematic analysis is flexible, theoretically compatible with the project's participatory and constructivist underpinnings, and well-suited to examining the meanings people attribute to their experiences and relationships. Its strength lies in its ability to identify both patterns of shared experience and points of divergence, while remaining grounded in participants' own language

and perspectives (Čepić et al., 2024). Applied to the study of human–nature relationships, thematic analysis enables the exploration of complex emotional, cultural, symbolic and relational dynamics that shape people's connection, or lack thereof, with nature. For example, within my research it has allowed for exploration of the complex barriers to connection alongside positive experiences of awe, gratitude, belonging, and relational care. By structuring these narratives into themes, the analysis provides a coherent yet nuanced account of the mechanisms underlying nature connectedness and its relationship to wellbeing and environmental stewardship. Moreover, thematic analysis is iterative and reflexive, aligning with the participatory ethos of this project. In my final study, a phenomenological lens was adopted while coding transcripts. Phenomenology recognises humans as embedded within the wider natural world. This perspective moves away from the goal-orientated pursuit of scientific objectivity and focuses on a holistic worldview rejecting the separation between humans and nature (Merleau-Ponty, 1962; Richardson, 2023). I will outline my specific approach to thematic analysis, including approaches to member checking, ensuring accuracy of findings, and practices of reflexivity in Chapter Four and Five.

Positive Psychology Methodology

The influence of positive psychology is evident throughout this research. As a field, positive psychology emphasises the exploration and promotion of human flourishing and wellbeing, moving beyond deficit-oriented models that focus exclusively on illness or dysfunction (Seligman, 2004; 2010; Keyes, 2002). Human flourishing is defined as a state of optimal wellbeing in which an individual experiences positive emotion, engagement, meaningful relationships, a sense of purpose or meaning, and accomplishment. Flourishing goes beyond the absence of mental illness, encompassing both personal fulfillment and the capacity to contribute positively to others and society (Seligman, 2011). Yet, something which caused me unease while undertaking my Masters in positive psychology was the reality that human flourishing cannot be meaningfully understood in isolation from environmental flourishing: there is, in essence, no human wellbeing without nature's wellbeing. Accordingly, I began to explore this research topic while integrating insight from positive psychology. As a direct result, this research extends this framework of 'flourishing' to recognise that human flourishing is fundamentally entangled with

ecological health, a perspective that challenges the anthropocentric boundaries of traditional positive psychology.

Within this project, the theoretical framework of Positive Psychology Interventions (PPIs) informed both the design and evaluation of nature-based interventions, positioning the research at the interface of individual wellbeing and collective ecological sustainability. A particular focus was placed on the role of meaningful affective experiences—including awe, gratitude, curiosity, nostalgia, empathy, and a sense of meaning or purpose in life—in strengthening nature connectedness. These experiences not only support individual wellbeing but also foster broader orientations towards care and responsibility for nature. In this regard, the research engages with both dimensions of positive psychology: 'doing good,' expressed through pro-environmental behaviours, and 'feeling good,' understood as the wellbeing outcomes of deepening connections with nature. PPIs and particularly the significance of meaningful savouring activities (Macaulay et al., 2024; Smith et al., 2014), directly informed the design of the nature-based interventions developed within this research. The umbrella review underscored the importance of savouring, mindful engagement, and immersive experiences in nature as central mechanisms for enhancing intervention effectiveness. This built on existing positive psychology research highlighting the role of savouring in promoting wellbeing (Smith et al., 2014) and informed the intervention design within the Pathways to Nature Study (Empirical Study Three). Within the design of interventions, I drew on canonical research into value systems (Park & Peterson, 2008), as well as the significance of constructs such as gratitude, empathy, resilience, and hope in shaping behaviour and meaning making (Basit et al., 2024; Chawla, 2020). Additionally, key theoretical models—such as Person–Activity Fit Theory (Lyubomirsky, 2008; Lyubomirsky & Layous, 2013), which emphasises the alignment between intervention and individual values, and Broaden-and-Build Theory (Fredrickson, 2004), which describes how positive emotions expand thought–action repertoires and build psychological resources—provided an essential foundation for understanding how nature-based experiences contribute to both wellbeing and engagement in stewardship. Crucially, the ethos of positive psychology resonates with underpinning philosophies of both youth work and CPBR. All three position individuals as experts within their own world while prioritising values-based, empowerment-focused approaches that seek to cultivate potential, foster resilience, and create supportive and healthy environments in which people can flourish (Pantazidis, Pechtelidis, 2025; Balkaya-Ince et al., 2024).

Community-Based Participatory Research (CBPR) and Co-design Methodology

Community-Based Participatory Research (CBPR) has informed both the philosophical orientation and practical implementation of this work. CBPR is a collaborative approach to research which involves partners equally throughout the research process, integrating their knowledge and mobilising action to address disparities and achieve social change (Collins et al., 2018; Wallerstein & Duran, 2010). Its ultimate aim is to foster positive, transformative, and sustainable change with, and for communities. It has evolved from the principles of action research (Lewin, 1939), emphasising equitable partnerships between researchers and community stakeholders across all phases of research, from design through dissemination (Fletcher, 2003). This approach seeks to challenge traditional hierarchies in research by valuing local knowledge, lived experience, and recognising communities as co-producers of knowledge rather than passive subjects. The guiding principles of CBPR revolve around the importance of mutual respect, relationship-building, trust, co-learning, and shared decision-making (Israel et al., 2019; Wallerstein et al., 2018). These principles have directly shaped the design and delivery of this research. Another key strength of CBPR is its iterative, dynamic nature. Knowledge is generated and refined through ongoing cycles of dialogue, reflection, and action (Wallerstein et al., 2017). This was operationalised within my research through member-checking with participants and partners, regular feedback sessions, observations on practice, and innovative participatory activities designed with insight from both young people and practitioners. The implementation of CBPR also calls important attention to power dynamics and inclusivity within the research relationship (Amauchi et al., 2022; Fletcher, 2024).

This methodological approach was particularly well-suited to the aims of this research, which sought not only to generate academic insights but also to deliver meaningful, context-sensitive interventions that respond to the needs and priorities of young people and their communities. The emphasis on co-creation of knowledge and considering community partners *as experts within their own world* was a crucial aspect guiding the orientation of my PhD research. This approach acknowledged that meaningful and contextually relevant knowledge cannot be generated without valuing the lived experiences, perspectives, and insights of those directly engaged with the phenomena under study (Singh et al., 2025). For example, in Study Two, a qualitative

exploration of young people's relationship with nature, the objective was to gain a deeper understanding of how young people perceive, understand, and engage with the natural world. This focus went beyond identifying whether or not they felt connected, seeking instead to illuminate the nuanced meanings, barriers, and opportunities that shape such connections. By drawing on CBPR principles and positioning young people as experts in their own lived realities, the study revealed dimensions of nature connectedness that might otherwise remain obscured by top-down, researcher-driven approaches. These insights proved invaluable in guiding subsequent stages of the research, particularly in shaping intervention design, ensuring that our methods were not only evidence-based but also responsive to the actual needs, values, and priorities of young people themselves. In this way, the co-creative ethos not only enhanced the richness of the data but also contributed to the development and orientation of the subsequent work.

Additionally, the conception of the final study (Pathways to Nature) came from our community partners, who had also identified rising mental health struggles among young people, and e the positive impact of nature connection. These practitioner insights were reinforced by the perspectives of young people gathered through our in-depth qualitative work where young participants not only echoed the importance of nature in supporting their wellbeing but also articulated the barriers that limited their access to and engagement with natural environments. Together, these contributions underscored the need for interventions that explicitly address barriers while fostering opportunities for meaningful and sustained nature connection. Rather than imposing a predetermined model for nature-based interventions, the PTN project adopted a co-design approach, whereby interventions were collaboratively developed and adapted to reflect the cultural, social, and ecological contexts of participating youth and countries. Drawing on CBPR, the project positioned young people, youth workers, and community partners as co-creators of interventions rather than passive subjects that the interventions were 'happening to.' This epistemological stance not only disrupts hierarchical modes of knowledge production but also ensures that the findings are grounded in the lived realities, needs, and priorities of those most directly affected. By embedding CBPR principles and co-design methodology, this research aimed to ensure that interventions were not only evidence-based but also contextually relevant to the communities in which they were developed. By leveraging CBPR, this approach to intervention design acknowledges that sustainable transformation requires more than individual behaviour change; it calls for collective action rooted in community values, relationships, and

agency. In sum, CBPR and co-design were not supplementary techniques but rather foundational methodological underpinnings which have shaped this research and the subsequent evidence outputs. They enabled the project to bridge the gap between theory and practice, generating interventions that were both academically robust and socially meaningful, while foregrounding the voices of those most directly affected by the intersecting challenges of youth mental health and ecological crisis.

Youth Work Methodology

Finally, my ongoing work and collaboration with youth workers throughout this PhD have shaped not only my research but also provided invaluable insights and wisdom for life more broadly. For instance, a key lesson has been the importance of building relationships as the foundation for meaningful work and lasting impact. Youth workers consistently emphasise that relationships grounded in trust, respect, and understanding are pivotal. Essentially, it is our ways of being—how we are and how we act toward others—that holds the greatest significance. As one of the youth workers I collaborated with summarises: *"It's not about what you do; it's about how you are that people will remember. People will always remember how you treat them."* The pre-existing relationships between youth workers and the young people, along with the trust and understanding developed over time, were an integral foundation element of this research. These relationships provided a strong foundation for the work we undertook, grounded in genuine connection and a mutual desire to support one another. Crucially, the insights gained from this relational approach is very valuable considering my overarching research question of restoring and rebuilding our relationship to the natural world. The practical approaches to relationship building gained from the youth worker approach were invaluable here. Building such relationships requires significant time and effort, something that researchers often feel unwilling or unable to prioritise in the pressure for timely outputs. However, I believe that for research to avoid being extractive or tokenistic, focusing on these foundational relationships is essential.

Building on this relational disposition, youth work methodology has played a central role in shaping the ethos, design, and implementation of empirical studies two and three. At its core, youth work is guided by principles of empowerment, participation, inclusion, and respect for the lived experiences of young people (Hofmann-van de Poll, 2024; Klatt, 2020; Jeffs, 2018). Youth

workers' emphasis on relational practice, means that trust, mutual respect, and ongoing dialogue are prioritised as the foundation for meaningful engagement (Coburn, 2011). These principles align closely with the guiding ethos of CPBR and the participatory orientation of the thesis, which sought to ensure that intervention design was guided by young people. This orientation and methodology shaped the research process by highlighting the importance of creating safe, inclusive, and youth-friendly spaces where participants felt comfortable to share their perspectives and co-develop ideas for interventions. In practical terms, this meant learning from both youth workers and young people and allowing them to shape the research process in ways that were accessible, inclusive and most importantly fun. This involved incorporating creative, experiential, and non-formal learning methods—such as storytelling, group activities, photo-elicitation, embodied practice, and arts-based practices—that resonate with youth work traditions and support diverse modes of expression beyond purely verbal accounts (Ord, 2007).

Another key influence of youth work methodology is its focus on recognising and amplifying the self-efficacy and agency of young people. Rather than treating them as a homogenous group or framing them solely in terms of deficits (e.g., mental health challenges), the project recognised young people as resourceful actors with valuable insights into their own lives, communities, and relationships with nature (Sercombe, 2010). This perspective was particularly important in ensuring that interventions were responsive to the needs, interests, and priorities identified by young participants themselves. The philosophical underpinning of youth work i.e. valuing young people's voices, fostering inclusivity, and promoting social justice, have shaped our work. Crucially, the population sample originating from collaborating with youth centres, in both Studies Two and Three, has allowed us to address calls for foundational research to understand the layered dimensions of young people's relationship to nature; specifically calls for exploration of multi-ethnic and disadvantaged youth's experiences. Our partner youth centres focus on supporting "young people with fewer opportunities," such as those experiencing social exclusion, disadvantage, or marginalisation. Traditionally, research on older youth tends to focus on university populations due to their accessibility to researchers, leaving these groups underrepresented (Liprini & Coetzee, 2017; Shrestha et al., 2021). Further, by working with a cross-cultural sample in both studies, the research acknowledged the diversity of cultural, geographic, socio-economic, and ecological contexts in which young people's relationships with nature are situated. Youth work methodology provided a framework for navigating these

differences respectfully, ensuring that interventions were not imposed but co-created in ways that honoured local knowledge and practices (Pantazidis & Pechtelidis, 2025; Davies, 2005). Finally, the emphasis on critical reflection within youth work shaped my role as a researcher throughout this process. Youth work demands not only practical skill in engagement but also a reflexive awareness of power dynamics, positionality, and the potential for tokenism in participatory projects. This aligns closely with reflexive qualitative research and thus further supported our approach to analysis. This reflexive stance was embedded in the project design and analysis, ensuring that young people's contributions shaped findings and that their involvement went beyond symbolic participation. In sum, youth work methodology provided a lens for fostering genuine collaboration with young people.

Methodological Robustness and Ethics

Given the emerging and novel nature of umbrella reviews as a methodological approach, particular attention was paid to ensuring methodological robustness throughout our process. To mitigate potential sources of bias in synthesising evidence from existing systematic reviews, we engaged in critical reflection on the unique methodological challenges inherent in conducting an umbrella review—such as overlapping primary studies, variable review quality, and differences in review scope and reporting standards. In response, we developed a systematic and transparent strategy to address these challenges, informed by established methodological guidance (Campbell et al., 2020; Lunny et al., 2017; Lunny et al., 2018). This reflective and iterative process was essential in maintaining rigour and credibility in the synthesis of evidence, ensuring that the conclusions drawn were both valid and contextually meaningful. The specific strategies employed to enhance methodological robustness and manage the complexities of review-level synthesis are outlined in detail in Chapter 3, Section 2.4.

Further, ethical considerations formed a critical foundation for the design and implementation of Empirical Studies 2 and 3. Given that these phases of the research directly involved children and young people, groups often considered vulnerable within research contexts (Alderson & Morrow, 2020), careful attention was given to ensuring that all stages of the research upheld the highest ethical standards. This was not only a procedural necessity but also a moral and relational

commitment to safeguarding participants' wellbeing and autonomy throughout the research process. Ethical reflection extended beyond formal ethics approval to include the everyday ethics of conducting participatory and youth-centred research—such as navigating power dynamics, ensuring meaningful consent and assent, and creating inclusive, supportive spaces where young people could safely share their perspectives. These ethical principles and practices underpin the empirical work presented in Chapters 4 and 5 and were integral to maintaining the integrity and authenticity of the research process.

Ethical approval was sought and achieved for study design, data collection and participant recruitment, from the Social Research Ethics Committee (SREC), University College Cork. We sought further permission from the partner youth centres, management, parental guardians and young people themselves. All partner youth centres have unique rigorous ethical procedures in place, in line with the country-specific requirements, which we adhered to for the purpose of this research. As this study includes vulnerable populations i.e. children and young people under the age of 18 years, we were required to carry out the 'relevant work' to comply with ethical practice as defined by the National Vetting Bureau. Accordingly, this project required official Garda Vetting through UCC, and a separate Garda vetting process as outlined by the requirements of the partner youth services. This research was conducted in compliance with the UCC Child Safeguarding Statement, which sets out the legal requirements under the Children First Act (2015).

While the formal ethical consent process was a key initial concern, the everyday ethics of working with vulnerable populations, such as young people, and designing a research programme that is sensitive to their wide range of abilities and needs was a constantly evolving and reassessed aspect of the research (Aldridge, 2024). The ethical framework underpinning this research was guided by the principles of respect, inclusivity, and reciprocity. Given the participatory and cross-cultural nature of the project, ethical considerations extended beyond procedural requirements to encompass reflexive, relational, and contextual dimensions of research practice. Accordingly, the following framework of ethical study design has been employed:

Safeguarding and Informed Consent: As a portion of the participants were under the age of 18, informed consent was obtained from both the young person partaking in the study and the parental guardian of the individual. All materials were translated into the appropriate languages

and presented in clear, age-appropriate language. Consent was framed as an ongoing process rather than a one-time event, allowing participants to revisit their involvement and withdraw at any stage without consequence. Safeguarding procedures were developed in collaboration with youth workers and adhered to the legal frameworks of each partner country. Adult facilitators had all undergone Garda vetting, were trained in child protection and support protocols, and clear referral pathways were established for participants who might require additional support.

Inclusivity and Accessibility: Central to the ethos of this research was the principle of inclusivity. Efforts were made to ensure that participants from diverse cultural, socio-economic, and linguistic backgrounds were able to engage meaningfully. Rigorous translation processes were undertaken, and multiple forms of communication were used to ensure that all young people could share their perspectives and experiences. For example, participatory workshops incorporated creative and experiential methods—such as drawing, storytelling, photo-elicitation, theatre, and outdoor activities—to enable multiple forms of expression and reduce barriers linked to literacy or confidence in verbal communication. Specific case study examples illustrating this in practice will be given in the subsequent section.

Participatory Ethics and Power Dynamics: Traditional research risks positioning young people as passive subjects (Ibes et al., 2021). To counter this, the project adopted a participatory ethic that sought to minimise power imbalances and promote youth agency as outlined as our methodological frameworks (CBPR and youth work methodology). Young people were invited to co-design the research from ideation through to dissemination, contribute to data interpretation through member-checking, and played a crucial role in dissemination of research. In particular, in Study Three where young participants shared their experiences as the 'Pathways to Nature Youth Conference 2025.' This participatory approach aligns with CBPR principles of shared decision-making and collective ownership, ensuring that research outputs were not only about participants but also created with them.

Reflexivity and Cross-Cultural Contexts: Conducting research across a myriad of culturally distinct countries necessitated ongoing reflexivity regarding researcher positionality, assumptions, and cultural sensitivities (As outlined in my reflections on reflexivity at the end of this chapter). Regular consultation with youth workers and local community partners supported contextually appropriate adaptations to methods. Further, consultation with the young people themselves allowed for the culturally sensitive adaptation of research material and subsequently

the interventions in Study Three. Power dynamics between researchers, practitioners, and young people were critically examined, with strategies such as rotating facilitation roles, youth-led discussions, and collaborative evaluation processes employed to foster equitable participation.

Confidentiality and Data Protection: All data were anonymised, with pseudonyms used in transcripts and testimonials. Digital data were stored on encrypted servers in compliance with the General Data Protection Regulation (GDPR) of UCC. As our research is partially conducted on the internet we utilised and adhered to the UCC policy for conducting internet research. Care was taken when reporting findings to avoid identifying individuals or small groups, particularly in smaller rural communities where anonymity can be challenging to maintain.

Ethical Commitment to Impact: Finally, this research recognised the ethical responsibility to ensure that findings would generate tangible benefits for participants and their communities. Positive ethics were considered throughout the ideation, design and implementation of this research. Changes in our natural environment affect everyone and any work towards addressing the environmental crises by restoring our relationship with nature is highly beneficial for all life on Earth. Further, this research provided individuals with personal reflections on their relationship to nature and how this connection can benefit their wellbeing and encourage their motivation to engage in action to protect and care for nature. It was anticipated that the social connections, community and sense of belonging that come from involvement in work, would be a positive experience for the young people. This process may have helped to empower people to feel more motivated in the fight against the climate/ biodiversity-crisis (Pihkala, 2020; Niceforo, 2020). Lastly, by producing both an academic thesis as well as user-friendly guide/manuals and other visual dissemination material, we sought to democratise access to knowledge and provide resources that could support future practice. This commitment to accessibility reflects the project's guiding values of equity and inclusivity, while also ensuring that research outcomes contribute to positive and sustainable change.

Reflexivity

Importantly, this methodological journey was not only technical but also deeply reflective and emotionally engaged. As a researcher, I was not positioned outside of the process but was

continually shaped by my interactions with young people, practitioners, and community partners. Holding space for diverse voices, often from groups who have been historically marginalised in both research and environmental decision-making (Lloyd & Gifford, 2024), required ongoing reflexivity about my own assumptions, values, and positionality. The process demanded attentiveness, humility, and emotional investment, which became as integral to the methodology as the formal frameworks and tools employed. Reflective practice is also fundamental to co-design processes and allowed me to critically assess my role in the research in terms of positioning others, advancing the work and portraying a clear and practical research output (Karcher et al., 2024; Olmos-Vega et al., 2023). This reflective approach was employed throughout the data analysis phase of my research, in which I critically analysed my reflections on practice. While this reflexivity held clear academic value, it also became a crucial part of my personal development, especially in shaping how I made sense of the human–nature relationship.

Taking a reflective stance throughout the research process has allowed me to examine my own positionality. I became increasingly aware of my growing affinity for the youth workers and young people I collaborated with, alongside the sense of responsibility I felt to ensure that our work produced tangible, positive outcomes within their lives. Further, my background, upbringing, and relationship with nature inevitably shaped the values, assumptions, and decisions embedded in this research. For example, being raised in a rural setting surrounded by nature has fostered a strong sense of connectedness and appreciation for the natural world. Throughout my research journey I have had to continually check my assumptions, particularly the belief that nature holds inherent meaning for everyone. This reflection is especially relevant in the context of the extinction of experience, where many young people are growing up without close contact with nature, and therefore may not share the same sense of connection or benefit in the same ways. I have come to understand the pivotal perspective of being cognisant of a person's unique context. Essentially, we all experience nature differently; what is empowering for some may be irrelevant, or even disempowering, for others. My background in positive psychology, with its emphasis on individual differences, has supported me in holding this awareness when interpreting findings. Additionally, my prior personal experiences in education and the workplace have reinforced the significance of viewing young people as agents and experts in their own lives.

This reflexive approach also required a conscious awareness of power dynamics, particularly when working across differences in age, gender, cultures, languages, and socio-economic contexts. A key source of learning for me on this topic came from being a member of the project management team within the Pathways to Nature project (Empirical Study Three). I was struck by the way the youth worker team engaged with their partners and the young people. Through this experience, I came to realise that Equality, Diversity, and Inclusion (EDI) is not achieved simply by meeting quotas or ensuring representation of certain 'minority groups.' Rather, it is something you echo through your ways of being, the practices you adopt; how you treat people inside and outside of the working relationship. This team modelled genuine inclusivity; age and gender did not determine whose voice mattered. Witnessing this in practice made me reflect deeply on my own approach, and it has inspired me to think more carefully about how I can contribute to spaces where people feel genuinely heard and respected. Regular journaling and ongoing dialogue with my supervisory team provided essential support for my process of reflexivity throughout the research. These practices offered structured space to critically examine my assumptions, decisions, and emotional responses, deepening my awareness of how my positionality shaped the research process. My supervisory team have modelled genuine inclusivity from the beginning, ensuring that all voices were valued equally, which reinforced a collaborative and reflective research culture. In addition, strategies such as continuous dialogue with community partners, and member-checking with participants helped to minimise researcher bias and enhance the robustness of the findings. This combination of personal reflection and team dialogue was instrumental in fostering thoughtful, ethically conscious, and reflexive practice throughout the project. By engaging with partners and young people in on-going cycles of feedback and co-design, the project embraced a dynamic process in which methodological choices were adapted and refined collaboratively. Furthermore, considering insights from scholars who explore historical privilege and equity, regarding nature connection throughout my research journey has supported this perpetual process of reflexivity (Jones & Segal, 2018; Kimmerer, 2013).

My practice of reflexivity became particularly significant when working with complex and deeply emotional topics such as the climate crisis and biodiversity loss, alongside young people's experiences of eco-anxiety and the pervasive injustices embedded within our systems. At times, I found myself overwhelmed; experiencing moments of deep anxiety about the state of the planet,

uncertainty of the future, and sadness for young people who shared similar feelings with me. Engaging in reflective practice provided a way to sit with these feelings, acknowledge their weight, and consider how they were influencing both my perspective as a researcher and my sense of self. In this way, reflection was not just an academic exercise but a personal coping strategy, enabling me to navigate the emotional demands of the research and to transform feelings of despair into a deeper motivation for meaningful engagement, necessary change and crucially hope. As echoed in some of my core findings, it was also my experience that social connection, community, and a sense of unity were powerful antidotes to feelings of anxiety and hopelessness. Coming together with others to do something meaningful with my research, not only supported my wellbeing throughout the research journey but also reinforced the importance of collective action in responding to these global challenges we face. I found it deeply reassuring and motivating to connect with people from across the world who shared my values and were working towards a shared goal. Additionally, it has been profoundly meaningful to work with, and get to know such inspiring young people, whose passion and commitment have been a driving force behind this research. This has been a significant source of hope for me as I reflect on and contemplate the future. This has not been merely a one-off research partnership; it has fostered friendships and deep connections that I hope to have for the rest of my life.

Chapter 3—Study One Umbrella Review[1]

Factors influencing the effectiveness of nature-based interventions (NBIs) aimed at improving mental health and wellbeing

Abstract

Several systematic reviews support nature–based interventions (NBIs) as a mechanism of enhancing mental health and wellbeing. However, the available evidence for the effectiveness of these interventions is fragmentary and mixed. The heterogeneity of existing evidence and significant fragmentation of knowledge within the field make it difficult to draw firm conclusions regarding the effectiveness of NBIs. This can only limit the development of interventions to support personal and planetary wellbeing, potentially resulting in ineffective and ill–targeted investment decisions. These concerns have hindered the translation of research evidence into practice and guidelines are urgently required to assist researchers, practitioners and policymakers in developing interventions to promote environmental stewardship and meet the health needs of diverse communities. A higher-order or meta-level synthesis is required to make sense of this evidence. This umbrella review synthesises evidence on the barriers and enablers to nature–based interventions through a summative review of existing published systematic reviews and meta-analyses. A systematic search in PsycINFO, PubMed, Greenfile, Web of Science, Embase, Scopus, Academic Search Complete (EBSCO), Environment Complete (EBSCO), Cochrane Library, CINAHL, Health Policy Reference Centre and Google Scholar was performed. This is a mixed method review, and systematic reviews with both quantitative and qualitative data synthesis were included. 64 systematic reviews were included in the synthesis. The descriptive data, extracted from each study, forms an overview of the characteristics of available evidence on nature-based interventions. A narrative synthesis is used to present the potential factors influencing the outcomes of NBIs. The risk of bias of the systematic reviews was assessed using a 16-item Assessment of Multiple Systematic Reviews 2 (AMSTAR2)

[1] This chapter has been published as two published papers in peer-reviewed journals: Environment International and the protocol for this review published in PloS one.

checklist. Directions for future research, potential quality needs and recommendations for future research, policymaking, and practice are discussed.

Graphical Abstract:



Introduction

Nature's restorative influence on our health and wellbeing is supported by a vast body of empirical evidence (Barragan-Jason et al., 2023; Corazon et al., 2019; White et al., 2021; White et al., 2023). This prior research outlines the numerous benefits of engagement with natural environments for physical, psychological and emotional wellbeing. Accordingly, it is a considerable public health concern that urbanisation, environmental degradation, and the structure of modern society have fractured our relationship to the natural world. There is a pervasive narrative that modern-urbanized lifestyles have eroded healthy human relationships with nature resulting in an indifferent attitude towards environmental exploitation and a multitude of health issues (Harper et al., 2021; Konijnendijk, 2023). The health of ecosystems in which we and all other species depend is deteriorating more rapidly than ever. We are eroding the very foundations of our economies, livelihoods, food security, health and quality of life worldwide (IPBES). Undoubtedly, many of us are physically and psychologically disconnected from nature, and this psychological distancing has implications for both personal and planetary wellbeing. Recently, promoting the therapeutic value of nature has been a topic of growing interest across health promotion and treatment fields (Smalley et al., 2022; White et al., 2023). Modern science is beginning to acknowledge what ancient and Indigenous cultures have always known – human and environmental health are deeply interconnected and our relationship to nature can support, enhance, and restore our health and wellbeing.

Nature-based Interventions (NBIs)

The wider recognition of nature connection as a powerful health promotion technique has resulted in significant interdisciplinary interest in the potential for 'nature–based interventions' (NBIs) to support human health. NBIs are intentional programmes, activities and strategies recognising nature–human kinship. These interventions aim to enhance wellbeing by engaging people in nature–based experiences (Pretty & Barton, 2020; Shanahan et al., 2019; Volpe et al., 2021). They can be broadly categorised into those that alter the environment in which people live, work, recreate, learn and heal (for example, the development of parks in cities or gardens in

hospitals through biophilic design) and those that change behaviour (engaging people through organized programmes such as ecotherapy, green exercise programmes etc.) (Shanahan et al., 2019). These interventions can be formulated around green space, blue space, or an combination of both and considerable variety exists in practice and type. Using the health promotion/ promotion/disease prevention pyramid analogy (Frieden, 2010) (White et al., 2023) state that NBIs can occur at the primary, secondary, and tertiary prevention levels. With primary prevention acting at a population level, rather than targeting specific groups, and habitually involving physical/infrastructural changes e.g. urban greening, parks, greenways etc. Conversely, secondary prevention interventions focus on at-risk populations, attempting to increase nature contact, and/or promoting a deeper psychological connection to the natural world through programmes such as forest bathing (Kotera et al., 2022) allotment/community gardening (Chris Genter et al., 2015) and wilderness therapies (Kraft & Cornelius-White, 2020). Lastly, tertiary prevention interventions are tailored to individuals with existing physical and/or mental health issues (e.g. cancer, cardiovascular disease, depression), integrating elements of nature contact into standard medical and psychological treatments. See (White et al., 2023) for a detailed description.

Reviewing the evidence on NBIs

The rise of interest in nature-based solutions has resulted in a rapid increase in primary studies being conducted to evaluate the efficacy of nature–based interventions. As a response to the accumulating literature in the field, a multitude of systematic reviews and meta-analyses have been performed to synthesize this evidence (Britton et al., 2020; Coventry et al., 2021; S. Grassini, 2022; Trøstrup et al., 2019). Considering the extensive number of reviews assessing NBIs, it is crucial to take stock of the existing evidence base to consolidate our understanding and, where required, make recommendations to support the integration of these interventions into public health and planning and guide future research (Papatheodorou, 2019). In recent years, the emergence of umbrella reviews has provided a valuable strategy for organizing and assessing a wide range of review-level evidence (Aromataris et al., 2015; Harper et al., 2021; Papatheodorou, 2019). An umbrella review synthesises evidence from multiple systematic

reviews—with or without meta-analysis— providing an overview of findings and enabling the systematic assessment of this type of synthesized evidence (Pollock et al., 2020). The approach is progressively used in public health research, to gauge what is known about a topic, allowing the findings of separate reviews to be compared and contrasted and subsequently providing decision-makers in healthcare with an overall synthesis of the body of information (Papatheodorou, 2019). The diversity of nature itself and universal application of NBIs to different populations has resulted in significant heterogeneity of intervention design (Wilkie & Davinson, 2021). Furthermore, vague intervention descriptions and a lack of theoretical frameworks guiding NBI design has mitigated our critical appraisal of these interventions (Smith et al., 2021; White et al., 2023). The exponentially increasing number of systematic reviews in the nature-health field are often cautious in drawing conclusions due to issues of study comparability and quality. There is considerable fragmentation of knowledge within the field and previous studies highlight evidence gaps concerning the various factors that influence intervention outcomes (Shanahan et al., 2019; Van den Bosch & Sang, 2017; White et al., 2023). This can only limit the development of interventions, potentially resulting in ineffective and ill–targeted investment decisions. These concerns have hindered the translation of research evidence into practice and guidelines are urgently required to assist policymakers in developing interventions to promote environmental stewardship and meet the health needs of diverse communities.

Systematic reviews in environmental health research vary considerably in their methodology and quality (Sutton et al., 2021). Therefore, an umbrella review is instrumental for evaluating and consolidating inconsistencies across systematic review findings and methodologies. Extensive scoping searches revealed the vast and growing body of systematic reviews on NBIs. Additionally, conflicting findings regarding nature-based interventions have been reported across previous systematic reviews (Shanahan et al., 2019). Based on this, authors recognised the need for a higher-order or meta-level synthesis to make sense of this evidence. To justify the need for our review during scoping, authors aimed to identify whether similar or overlapping work already exists on the topic (including the consideration of other evidence synthesis methods such as scoping reviews and systematic evidence maps). Where there were overlapping reviews, we systematically identified and evaluated the strengths and weaknesses of these reviews to identify

knowledge gaps within the area. Preceding overviews involving the relationship between nature contact and health (See Supplemental Material S1: Scoping searches for related overviews) considered either a broad range of environmental exposures—not focusing specifically on NBIs (Dick et al., 2020; Hossain et al., 2020; Yang et al., 2021) or focused on only one specific type of NBI (e.g. nature-based outdoor therapy, garden-based therapy, greenspace or green walls (Cardinali et al., 2023; Collins et al., 2020; Harper et al., 2021; Skelton et al., 2020). Further, many of these reviews focused on broad outcomes of public health, reducing health inequalities and climate change mitigation rather than specifically exploring mental health and wellbeing (Cheng et al., 2023; McGowan et al., 2021; Van den Bosch & Sang, 2017; Wilkie & Davinson, 2021; Yang et al., 2021). Lastly, none of these umbrella reviews explicitly explored the various factors influencing the effectiveness of NBIs using a systematic approach. By focusing specifically on NBIs and their impact on mental health and wellbeing outcomes, we aim to evaluate the distinct factors influencing the effectiveness of these interventions to provide user-friendly, practical guidelines summarising existing evidence and guiding both research and practice.

Operationalisation of NBI

Many existing reviews of NBIs define nature contact using geographical metrics such as the amount of green or blue space present in any given area (e.g., number of parks with access to greenery, lakes, beaches, woodlands etc.) (Garrett et al., 2023; Van den Bosch & Sang, 2017; White et al., 2023). A fundamental limitation of such metrics is that they assume exposure revolves around geographic proximity without considering whether nearby nature was actually visited, of good quality, or whether it was accessible (e.g. long travel distance, near a busy road crossing) (Holland et al., 2021; Wilkie & Davinson, 2021). Accordingly, researchers are being called to broaden their definition of contact with nature and explore different types of natural settings and their characteristics (Houlden et al., 2018; Van den Bosch & Sang, 2017). The extent to which nature can enhance wellbeing depends on diverse features of contact experiences, for example, temporal, interactional, interpersonal, and intrapersonal dimensions (Nguyen et al., 2021; White et al., 2023). To address this, the current review focused on NBIs

where ‘nature-based’ encompasses what Bloomfield (2017) refers to as “time spent in places defined as rich in natural beauty and biodiversity” (p. 82). This includes both biodiverse, unregulated, wild nature lacking human involvement and publicly accessible, managed urban green spaces or blues paces (e.g., parks, gardens/allotments, and artificial lakes/reservoirs) (Taylor & Hochuli, 2017).

Review objectives

The primary objective of this mixed-method umbrella review is to investigate the factors influencing the effectiveness of nature–based interventions, aimed at enhancing mental health and wellbeing. Therefore, our research question is: “What are the factors influencing the effectiveness of nature-based interventions?” We aimed to do this by providing a summative overview of existing published evidence on nature-based interventions, gaining particular insight into the barriers and enablers to NBIs. Drawing on the PICO framework for outlining our review objectives and knowledge goal the key elements of this research question correspond to the study population of adults and children of all ages and genders with or without mental and/or physical health illnesses, nature-based interventions involving contact with *real* nature, in the context of health promotion, where mental health and wellbeing indices are the explicit outcomes of interest. Accordingly, our specific objectives were to identify:

1. What nature–based interventions (NBIs) are available
2. What factors support engagement in and implementation of NBIs
3. What are the potential barriers to the involvement in and subsequent benefit of these interventions
4. What are the guidelines for future research and policy planning

Table 1. PICOS statement for the review objectives and eligibility criteria PICOS statement for the review objectives.

	Criteria	As defined in present review	Relevance to review question
P	Population	Any population of participants exposed to any form of nature-based intervention (NBI)	Knowledge goal is to explore factors influencing NBIs – Broad population inclusion criteria offers the most insight into our review objectives
I	Intervention	Nature-based interventions: Programmes, activities or strategies that aim to engage people in nature–based experiences with the specific intention of improving health and wellbeing outcomes	This review adopted a comprehensive definition of nature exposure which captures different types of natural environments and characteristics. In line with knowledge goal, NBIs must focus on mental health and wellbeing outcomes
C	Context	Health Promotion	One of the key objectives of this review is to enhance the knowledge base regarding the potential for NBIs to support health promotion on a global scale
O	Outcome	All recognised measures of mental health and wellbeing	Our specific focus is on health promotion in terms of improved mental health and wellbeing

S	Study design	Systematic reviews and *meta*-analyses only	Drawing on the highest level of available published evidence to provide a summative overview of factors influencing the effectiveness of NBIs
P	Population	SRs which include any population of participants, with or without mental and/or physical health illnesses, exposed to any form of nature-based intervention for any duration. No age, sex or race/ ethnicity exclusion criteria	The approach to NBIs has a wide/ diverse range of study populations. Applying a broad population inclusion criteria offers the most applicability and generalizability with regard to our research question
I	Intervention	SRs which investigate nature-based interventions: Any NBI focused on *real,* rather than simulated or virtual nature, and exposure to green and blue spaces.	In order to adopt a comprehensive definition of nature exposure the current review adopted this broad focus on NBIs – Involving exposure to *real* nature, blue/ green spaces or assessing contact with *actual* nature-based interventions as it aligned with our review objectives
C	Context	Health Promotion	Outcomes of interest are mental health and wellbeing. Accordingly, health promotion is our context of interest for this review
O	Outcome	Eligible primary outcomes included any recognised measure of mental health and wellbeing	Focusing specifically on mental health/ wellbeing indices allows the assessment of a more homogenous

		assessed using self-reported and/ or objective measures	set of outcomes, and further enables increased analytical depth
S	Study design	Systematic reviews and *meta*-analyses only	This is an umbrella review focused on solely systematic reviews. Non-systematic reviews are not comparable to standards of systematic reviews and thus not considered

Our overarching goal is to provide a comprehensive and detailed synthesis of the growing evidence on NBIs. We hope to provide insight into the conceptual underpinnings linked to factors that influence the effectiveness of nature-based interventions to enhance our understanding of this phenomena. This umbrella review will identify existing critical knowledge, gaps in knowledge and potential quality needs to offer recommendations for future research, policymaking, and practice. Such research is crucial to tackling health inequalities and addressing issues around health equity and environmental justice.

Methods

Design Protocol registration

This umbrella review was developed according to the Joanna Briggs Institute (JBI) methodology for umbrella reviews, which provides guidelines specific for synthesizing the findings from multiple reviews (Aromataris et al., 2020; Aromataris et al., 2015). Additionally, the review follows the methodology described by (Smith et al., 2011) which outlines the procedure for conducting reviews of systematic reviews for healthcare interventions.

This umbrella review adheres to the Preferred Reporting Items for Overviews of Reviews (PRIOR) guidelines, specifically developed for umbrella reviews (Gates et al., 2022) (Supplemental Material S1: PRIOR checklist), and a protocol for the review was published elsewhere (Shrestha et al., 2023). The review was registered with the International Prospective Register of Systematic Reviews (PROSPERO) (registration number CRD42022329179).

In this umbrella review, there are some deviations from the published protocol. For example, our initial protocol proposed the potential approach of grouping evidence according to focus and methodology (qualitative or quantitative reviews) and splitting the findings into sister papers, separated by quantitative and qualitative evidence; however, given the heterogeneity of the studies included, we decided not to split the review in terms of methodology. Upon assessing the data, we determined that the evidence did not support this approach and such a divide was ultimately not feasible. Further, we determined such an approach would not provide any distinct benefits to the evidence synthesis.

Search Strategy

A structured search was conducted to identify all available systematic reviews on the topic. A systematic search of the following twelve electronic databases was completed from database inception to 26th May 2022: PubMed, PsycINFO, Web of Science, Scopus, Academic Search Complete (EBSCO), Environment Complete (EBSCO), Greenfile, Health Policy Reference Centre, Cochrane Library, Embase, CINAHL and Google Scholar. There was no date limit placed on the search. The search strategy aimed to find peer-reviewed systematic reviews, with or without meta-analyses, of nature–based interventions (NBIs) where improving mental health and wellbeing is a distinct objective.

The systematic search was developed with the Faculty Librarian, using an iterative process, and following in-depth guidelines (Chandler et al., 2019; McGowan et al., 2016). The comprehensiveness and sensitivity of the proposed search strategy was pilot tested against benchmark papers/seed references to maximise the specificity and sensitivity of the search string.

22 candidate references were identified through preliminary scoping searches in PubMed, Embase and Academic Search Complete (See Appendices S2: Candidate References Identified). Pubmed has been identified as one of the databases with the highest inclusion rate of systematic reviews so this search engine was particularly relevant for preliminary scoping (Goossen et al., 2020). As our study design of interest was systematic reviews, we developed a search query for identifying SRs based on current guidance for attaining maximum sensitivity in identifying SRs (Atkinson et al., 2015; Lefebvre et al., 2017; Navarro-Ruan & Haynes, 2022). Candidate references were analysed to identify the most common terms and keywords. The most relevant and recurrent terms, as well as terms used in searches of identified SRs and relevant umbrella reviews, were used to develop the search strategy. Additionally, the selection of search terms was informed by existing theory and research defining nature–based interventions. The SearchRefiner tool from the Systematic Review Accelerator website was used to pilot the sensitivity and specificity of our search strategy (Scells & Zuccon, 2018). The proposed search query was entered along with the PubMed IDs of the candidate systematic reviews, and using the resulting output, we determined whether the search strategy would locate all 22 references, and whether all included search terms were necessary. Scoping searches and the development of the search strategy was undertaken by TS and the faculty librarian, in consultation with ZDB, SF and MC.

Our final search strategy included terms relating to (i) Intervention: nature–based interventions/green or blue spaces and (ii) Outcome: mental health and wellbeing outcomes which were combined with (iii) Study design: systematic review OR meta-analysis and searched for in title, abstract, and keywords. All search strategies, applied to the aforementioned databases, incorporated exploded controlled vocabulary terms and text words, using Boolean operators. Field tags were used to search in the title, abstract and keywords. Databases were searched to identify relevant literature as per the objective of this review. The search terms for nature–based interventions/green or blue spaces and mental health/wellbeing outcomes and our study design of interest were combined with the Boolean AND; within each group, the Boolean OR was used. Supplementary searches were conducted on the search engine Google Scholar to identify additional references. We highlight that such searches are merely supplemental, as there is limited understanding of how search results are produced on these search engines, compared to

electronic databases. Aiming for as complete coverage as possible, the search was widened, beyond the protocol, by manually screening candidate articles' reference lists to identify additional relevant records. The detailed search strategy, developed by the full research team in consultation with a Faculty Librarian, is available in (Supplementary Material S2).

Inclusion and exclusion criteria

Inclusion and exclusion criteria were based on the Cochrane guidelines for what constitutes a systematic review, and the Assessing Methodological Quality of Systematic Reviews-2 tool (AMSTAR 2) for the quality assessment of systematic reviews (Shea et al., 2017). For example, inclusion criteria were restricted to studies with defined search terms and inclusion criteria as these criteria are core components of a high-quality systematic review. This umbrella review included systematic reviews, with or without meta-analysis, which investigated the impact of nature–based intervention (NBI) on mental health and wellbeing. Evidence from both quantitative, qualitative and mixed methods systematic reviews was included. The decision to include both quantitative and qualitative evidence was based on the commitment to provide an extensive and accurate summary of the existing evidence of NBIs. Within the sphere of public health, qualitative evidence can provide particular insight into values and preferences for health interventions (Harder et al., 2015). Thus, this body of evidence is crucial to intervention design. We did not apply any restriction in study design for the primary studies included in systematic reviews. The rationale behind this decision is that the field largely consists of non-randomized trials, and the exclusion of systematic reviews which include non-RCT studies may have resulted in an incomplete synthesis of findings (Corazon et al., 2019).

Searches were limited to peer-reviewed English-language publications. Grey literature defined as "information produced on all levels of government, academia, business and industry in electronic and print formats not controlled by commercial publishing" (Bonato, 2018) i.e. conference proceedings, dissertations, policy documents etc. was excluded for a combination of reasons. Firstly, preliminary searches highlighted the substantial body of literature published on NBIs. After consultation with the research team, we deemed an attempt to synthesise all findings to be arbitrary and outside the scope of this review. Accordingly, we decided to focus on

published systematic reviews. Searches were limited to peer-reviewed publications because SRs are typically published in academic peer-reviewed journals. Secondly, the decision to include solely peer-reviewed studies was based on our commitment to provide a synthesis of high-quality evidence which has gone through a meticulous and rigorous review process (Aromataris et al., 2015; Papatheodorou, 2019). The choice to include only English-language publications was the result of limited resources and the language constraints of our review team. While we acknowledge that the decision to exclude grey literature and studies not published in English has resulted in relevant literature being overlooked – we ultimately decided that limiting the parameters of our review would provide a more insightful and targeted overview of findings, particularly given the extensive, and growing, body of evidence published in the area. The following are the detailed inclusion and exclusion criteria in line with PICOS (population, intervention, context, outcome, and study design) guidelines. A concise tabular representation of eligibility criteria and rationale regarding our review objectives and research question is provided in Table 1.

Participants

In this review, we included any population who were exposed to any form of nature-based intervention (as defined below) for any duration. Reviews reporting on the general population of healthy participants (children, adolescents, adults) of any age, sex, and race/ ethnicity were considered for inclusion. Additionally, populations of individuals with or without mental and/or physical health illnesses e.g. depression, anxiety, obesity, cancer etc. were included.

Interventions

In this umbrella review, nature-based interventions (NBIs) are defined as programmes, activities or strategies that aim to engage people in nature–based experiences with the specific intention of improving health and wellbeing outcomes (Shanahan et al., 2019). This review included any systematic review focused on *real* rather than simulated or virtual nature–based interventions and exposure to green and blue spaces. ‘Real nature’ was defined as a broad range of green and blue spaces and landscapes in the indoor and outdoor environment. This includes green/blue spaces,

indoor nature, or real nature views (e.g., window views) (van den Bogerd et al., 2020). In order to adopt a comprehensive definition of nature exposure which captures different types of natural environments and their characteristics, the current review focused on NBIs which included exposure to both 'wild'/unregulated natural environments which have minimal human involvement and managed/man-made green and blue spaces such as urban parks, ponds, garden allotments etc. Additionally, we included NBIs which focus on biophilic design for example, green walls and roofs in cities etc. and the overall incorporation of nature into infrastructure. It was a requirement that all included studies assess NBIs which integrate explicit and purposeful nature contact, incorporating blue or green space through direct nature exposure to an actual natural setting (e.g., walking in nature/ being in a park, urban nature exposure, community gardening, etc.). Interventions which examined the effects of artificial nature, virtual/simulated nature, animal therapy, animal interventions or nature sounds were excluded from this review.

Context

As the aim of this review is not concerned with the effectiveness of interventions, but rather a broader conceptual question, we do not focus on comparators within our review. Rather we consider the C of the PICO framework as the context of NBIs. The context of nature-based interventions was required to be within the health promotion sphere– focusing on contact with *real* natural environments. It was required that all included interventions must have the promotion of mental health and wellbeing outcomes as an explicit aim (i.e., programmes that solely aim to connect people with nature without the objective of also delivering health and wellbeing benefits will be excluded).

Outcomes

All systematic reviews which assess the mental health and wellbeing impacts experienced by individuals following active participation in NBIs were included. Mental health, as defined by the World Health Organization (WHO), is "a state of wellbeing in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and

fruitfully, and is able to make a contribution to his or her community" (Organization, 2014). Wellbeing encompasses positive emotions and mood, the absence of negative emotions, satisfaction with life, fulfillment, and positive functioning (Diener, 2000; La Placa et al., 2013). Eligible primary outcomes included any recognised measure of mental health and wellbeing assessed using self-reported and objective measures. Outcomes can be defined as the psychological effects of NBIs related to mental health and wellbeing (e.g., life satisfaction, quality of life, vitality, stress, anxiety, exhaustion, burnout, and depression). The outcomes can be categorized as: (i) mental health indices, (ii) restoration and recovery, (iii) executive functioning/cognitive ability, (iv) work and life satisfaction, and (v) psychophysiological indicators of psychological wellbeing (e.g., cortisol levels). Includable qualitative evidence was in the form of themes, metaphors and concepts relating to the meaning, experience and perceived effects of nature–based interventions and any factors that help or hinder their success, e.g., direct quotes, and author analysis of qualitative findings.

Study design

Evidence from both quantitative, qualitative and mixed methods systematic reviews were included.

Strategy for addressing unique challenges of an umbrella review

To mitigate bias in our synthesis of the evidence from SRs, we reflected on the unique challenges faced when conducting a review of reviews (ROR) and constructed a strategy to address various scenarios unique to umbrella reviews (Campbell et al., 2020; Lunny et al., 2017, 2018).

- Lack of alignment between our review and systematic review research question/objectives: Included SRs had a range of varying review questions distinct to that of this study. Also, studies sometimes evaluated outcomes that were outside of the scope

of this review. To address this we undertook targeted data extraction, evaluation, and synthesis, focusing exclusively on findings relevant to our objectives.

- Deficit of systematic conduct of reviews: SRs may have inconsistent methods for evaluating the evidence. Accordingly, we included only reviews we considered "systematic", based on rigorous guidelines outlined in section 2.3.

- Transparency in reporting of methods: Serious shortcomings in reviews that utilise narrative synthesis have been identified. The most concerning issue is a lack of transparent description of the methods used. To address these concerns, we followed the guidance by the Synthesis Without Meta-Analysis (SWiM) guidelines (Campbell et al., 2020) and the ENTREQ guidance for qualitative evidence synthesis (Tong et al., 2012). Additionally, we have provided a detailed description of our approach to narrative synthesis in section 2.8.2.

- Addressing overlap of primary studies across systematic reviews: Due to the magnitude of studies included in this review and because of the lack of alignment between our research question and SRs research questions we did not evaluate the overlap of primary studies in the reviews. Previous umbrella reviews use the corrected covered area (CCA) (Pieper et al., 2014). We are aware that this is an inherent issue in umbrella reviews and highlight that overlap may have resulted in overrepresentation in reporting of review characteristics/ factors. We discuss this further in our limitations section (Lunny et al., 2021).

- How to address heterogeneous/discordant results, interpretations and conclusions across included studies: Any discordant findings across SRs were explicitly identified within our review. Causes of such discrepancies were evaluated by considering the systematic review methodology and any potential bias/ inadequate reporting. Narrative synthesis was instrumental in helping us to address and summarise such discrepancies.

- Inconsistent/discrepant or missing data across systematic reviews: Where we encountered missing or discrepant data we contacted the authors of systematic reviews to clarify – if we were not satisfied with the rationale for such issues the study was removed from our umbrella review

- Methodological limitations of systematic reviews: The AMSTAR2 Tool was used to systematically assess the risk of bias in included SRs. A detailed summary of this process is described below.

Data selection

All records identified were downloaded into the reference manager EndNote 20 software (Thomson Reuters, Toronto, Ontario, Canada). The identified literature was screened for duplicates. A two-stage screening process was completed independently by two researchers (TS and CVYC); Title and abstract screening was followed by full text-screening. Any irrelevant systematic reviews, which did not meet the inclusion criteria were removed. Interrater reliability (IRR) was reported at all three stages of screening and data extraction to ensure consistency and clarity (Belur et al., 2021). This was conducted independently by two (TS and CVYC). Interrater agreement was 0.88. Any disagreements between the research team were resolved by discussion or the involvement of a third reviewer (ZDB) until consensus was reached. Disagreements were recorded and are available upon request. The screening process is outlined in the PRISMA flowchart (Supplemental Material S3).

Data extraction

The following descriptive data was extracted: author, year of publication, country of origin, type of review (i.e., systematic review with meta-analysis versus systematic review without meta-analysis), population of interest, health outcome(s), setting/context, number of articles included, number of databases searched, date range of database searching, publication date range, quality assessment tool used, method of synthesis used and key findings. An ad hoc data extraction tool was developed to extract potential factors which affect the outcomes of nature-based

interventions to facilitate the narrative synthesis (Supplemental Material S4). Where necessary, we attempted to contact study authors to identify or clarify missing or ambiguous information.

Quality appraisal

Two independent researchers (TS and CVYC) assessed the methodological quality of included systematic reviews and meta-analyses using the AMSTAR 2 tool, a 16-item checklist used to critically rate the quality of an individual systematic review as high, moderate, low and critically low (Shea et al., 2017). The AMSTAR2 is a validated and widely used instrument for evaluating the quality of systematic reviews of both randomized and nonrandomized trials of health interventions. Six items 2, 4, 7, 9, 11, 13, (namely, protocol registration, adequacy of search strategy, risk-of-bias assessment, appropriateness of meta-analytical methods, use of risk of bias during interpretation, and assessment of publication bias) are identified as critical domains. The AMSTAR 2 tool has been updated to facilitate a more detailed assessment of systematic reviews that include both randomized and non-randomized studies of healthcare interventions. Disagreements were resolved by the involvement of a third researcher (ZDB) to reach a consensus.

The different domains of the AMSTAR 2 tool were operationalized using the supplementary guidance which provides additional advice on how to make judgements (See Supplementary Material S7 and Appendix 1 of the AMSTAR 2 tool (Shea et al., 2017). However, in the context of this review, there were specific considerations inherent to the review design and research field. For example, this is a mixed-method review and randomized studies need to be assessed differently from non-randomized studies, with regard to risk of bias and confounding. The predominantly observational nature of available evidence in this field means that a different approach is required for identifying and addressing potential confounding/ biases because of key differences in study design compared to experimental studies. Accordingly, included SRs methods were evaluated on a case-by-case basis. Further methodological weaknesses inherent to assessing evidence related to environmental exposures have been identified (Michel et al., 2024), specifically related to assessing internal validity and a lack of transparent critical appraisal methodologies. Because systematic review methodologies were primarily developed for clinical

trials, their appropriateness for evaluating evidence from observational/ public health, and how these methods can effectively be adapted, has been debated.

Data synthesis

Descriptive data

The strategy for data synthesis consisted of firstly extracting the descriptive data from each review, which forms an overview of the available evidence on study characteristics. We presented our findings through tables to describe the characteristics of the included SRs i.e. countries publishing on the topic, the classification of interventions used, types of outcomes reported etc. This provides a comprehensive summary of the available evidence on NBIs, giving particular insight into methodological approaches to interventions and quality of available evidence. This provides an overview of research patterns and trends in the field to further inform research and practice.

Narrative synthesis

Narrative synthesis, following the framework outlined by Popay et al., (2006) was used to explore patterns of findings across studies and present the potential factors influencing outcomes of NBIs. Given the number and heterogeneity of included studies, structured narrative synthesis and thematic synthesis were developed to synthesise the key findings in an accessible format. Narrative synthesis provides a systematic process for combining the findings of multiple studies. Further, as highlighted by Popay et al., (2006) this approach is particularly suited to addressing questions about the factors shaping the implementation of interventions. Accordingly, we decided this was the most appropriate approach to address our review objectives and overarching research question. Narrative synthesis supports the contextualized integration of diverse forms of evidence helping researchers to understand the phenomenon of interest. The approach is especially suited to reviews of complex interventions such as NBIs. This allowed for a more in-depth consideration of all factors affecting intervention delivery and allowed us to explore the

relationship between reported enablers and barriers. Our exact approach to narrative synthesis is outlined below:

Narrative synthesis was conducted by primary researcher TS, in consultation with the wider research team (ZDB, SF, MC and CVYC). Our synthesis was based on Popay et al., (2006) general framework for narrative synthesis outlining four main elements to the narrative synthesis process: 1) Developing a theory of how the intervention works, why and for whom 2) Developing a preliminary synthesis of findings of included studies 3) Exploring relationships in the data 4) Assessing the robustness of the synthesis. The evidence provided by the systematic reviews was extracted electronically from the results, discussion and conclusion sections of included studies using and ad hoc extraction tool. Data was extracted with the particular lens focus on factors influencing the effectiveness of interventions as per the objectives of this review. A thematic synthesis was developed to identify recurring patterns across reviews, by using textual description, and summarise these factors under distinct headings. Findings were synthesized narratively by developing key themes related to enablers and barriers of interventions. The synthesis was an iterative process which involved the full research team to ensure coherence and adequacy of the themes. Patterns in the findings were explored by creating tables of extracted evidence and features of the data both within and across the reviews. The socio-ecological lens to human nature connectedness was used as a framework to synthesize the evidence and guide analysis (Balázsi et al., 2019; Fischer et al., 2015). The synthesis was sensitive to factors which may affect the impact on wellbeing, such as the demographics of participants, the context of the activities, and the implementation and specifics of the interventions. Popay et al., (2006) guidelines facilitated reflection on how the process of narrative synthesis can be made more systematic and transparent and how bias introduced by the evidence itself as a result of methodological limitations in the included SRs) and/or by decisions made by reviewers can be minimised. This procedure for addressing the challenges and considerations inherent to narrative synthesis was considered throughout the analysis (Lisy & Porritt, 2016). The transparency and consistency of methodology was guided by the Synthesis Without Meta-Analysis (SWIM) guidelines (Campbell et al., 2020) and the ENTREQ guidance for qualitative evidence synthesis (Tong et al., 2012). The narrative synthesis thematic analysis framework can be found in the supplementary material S8.

Meta-analysis was not possible due the heterogeneity of study populations, intervention type and plurality of disciplinary origins of these interventions. As the review considers one type of "intervention" (nature–based), but of varying composition (e.g. ecotherapy, green infrastructure, or blue environments), and the effect on several different health outcomes, we considered the challenge of dissecting each included review, extracting the results from each study, and the amalgamation of results, to be of insubstantial value given the likelihood for inaccurate statistical power and potentially misleading results (Brok et al., 2008). Additionally, broad inclusion criteria for review study design (eg, quantitative and qualitative), prevented the quantitative pooling of syntheses.

Certainty assessment

Grading the quality of a body of evidence has become an integral part of research practice and policy development. However, there are a range of challenges inherent to certainty assessment in this research field which we have encountered during the conduct of this umbrella review. Notably, there is no official guidance on evidence grading in umbrella reviews (Lunny et al., 2017; Michel et al., 2023; Sadoyu et al., 2022). The majority of available guidance for umbrella reviews recommends using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach, however, without any official criteria on how to apply GRADE within the context of an umbrella review this is challenging (Gates et al., 2020). Secondly, grading the quality of the body of evidence has only become an essential part of the systematic review process in recent years. This criteria was added to the revised Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines in 2020. Many of the included SRs in this review were conducted before 2020 when this process was not mandatory or common practice leading to a deficit of evidence grading. Evidence-grading approaches were developed predominantly for clinical questions. However, our review contains a diversity of disciplinary backgrounds. The field of environmental and public health, including research on nature-based interventions, is affected by characteristics that may complicate the critical evaluation of primary studies and bodies of evidence:

1. GRADE works well for meta-analyses of effectiveness (Yousefifard & Shafiee, 2023), which is not suited to our umbrella review as we neither conducted a meta-analysis nor explore the effectiveness of interventions. Rather we aim to explore the conceptual underpinnings linked to factors that influence the effectiveness of nature-based interventions to enhance our understanding of this phenomenon. We attempt to address this conceptual question by carrying out this meta-level synthesis rather than commenting on effectiveness. Our broad review aims/design and the conceptual framework of our overarching research question impeded us from adhering to the official GRADE criteria. Additionally, the inclusion of both quantitative and qualitative SRs limited us from using guidelines for rating the certainty in evidence in the absence of a single estimate of effect (Murad et al., 2017).

2. There is often a scarcity of RCTs, for public health interventions like NBIs. This has resulted in challenges when applying GRADE to the field of environmental public health. The predominantly observational nature of available primary studies in this field means that, due to fundamental differences in study design compared to experimental studies, a different approach is required for identifying and addressing potential confounding and other biases (Michel et al., 2024; Rooney et al., 2014). Further, issues related to intervention exposure assessments are often a challenge in NBIs and specifically in observational vs. experimental studies, where exposures are sometimes not controlled by the researcher. Subsequently, control groups may have been exposed to some form of NBI (i.e. exposure to the outdoors or physical activity) within their daily lives leading to potential confounding bias. However, both the default ranking of experimental studies above observational studies and the tendency to rate primary studies based on how well they imitate a “hypothetical target RCT” have been criticised (Michel et al., 2024; Pearce & Vandenbroucke, 2023; Rothman, 2014). Further, there are issues around validity, suggesting that for several public health questions GRADE assessments of evidence quality might be biased/underestimate the true quality of the evidence (Boon et al., 2021; Harder et al., 2015).

3. Lastly, highly heterogeneous and dynamic intervention approaches and study designs that define nature-based public health interventions further impede the grading process. The universality of NBIs and their application to many diverse population groups, across varied settings and within different disciplines has resulted in significant heterogeneity of included studies further hindering certainty assessment.

This underscores the need for conceptual advances and practical guidance in the application of GRADE within public health contexts. With this in mind, we draw on the Project on a Framework for Rating Evidence in Public Health (PRECEPT) guidance (Harder et al., 2015; Harder et al., 2017) and the relevant conclusions to consider the certainty of our evidence. However, we note that this framework has a particular focus on infectious disease prevention and control. Thus, some of the considerations are not relevant to our review. PRECEPT defines a methodology for evaluating and grading evidence in public health. The four domains that the methodology rates evidence on were not relevant here due to their focus on infectious disease. However, elements of the guiding framework for certainty assessment within SRs were incorporated to judge evidence in the current review. There are four steps recommended to SRs here: 1) identify the relevant questions, 2) perform the systematic review, 3) apply an evidence grading system and document results and 4) prepare an evidence summary. Included SR's adherence to these 4 steps informed our certainty assessment. For a detailed overview of these 4 steps see Supplemental Material S9. We also consider the relevant dimensions of GRADE (listed below) during analysis and synthesis to further comment on the certainty of our evidence:

- Risk of bias: Risk of bias in the systematic reviews was assessed using the AMSTAR2 tool, as described in section 2.7. and the research team's observations on the body of evidence.

- Publication bias: We considered SRs reporting on publication bias, recorded during the quality appraisal process, and potential implications for the certainty of evidence.

- Indirectness of evidence: Indirectness exists when there are substantial differences between the PICO assessed in the systematic reviews and umbrella review question. To

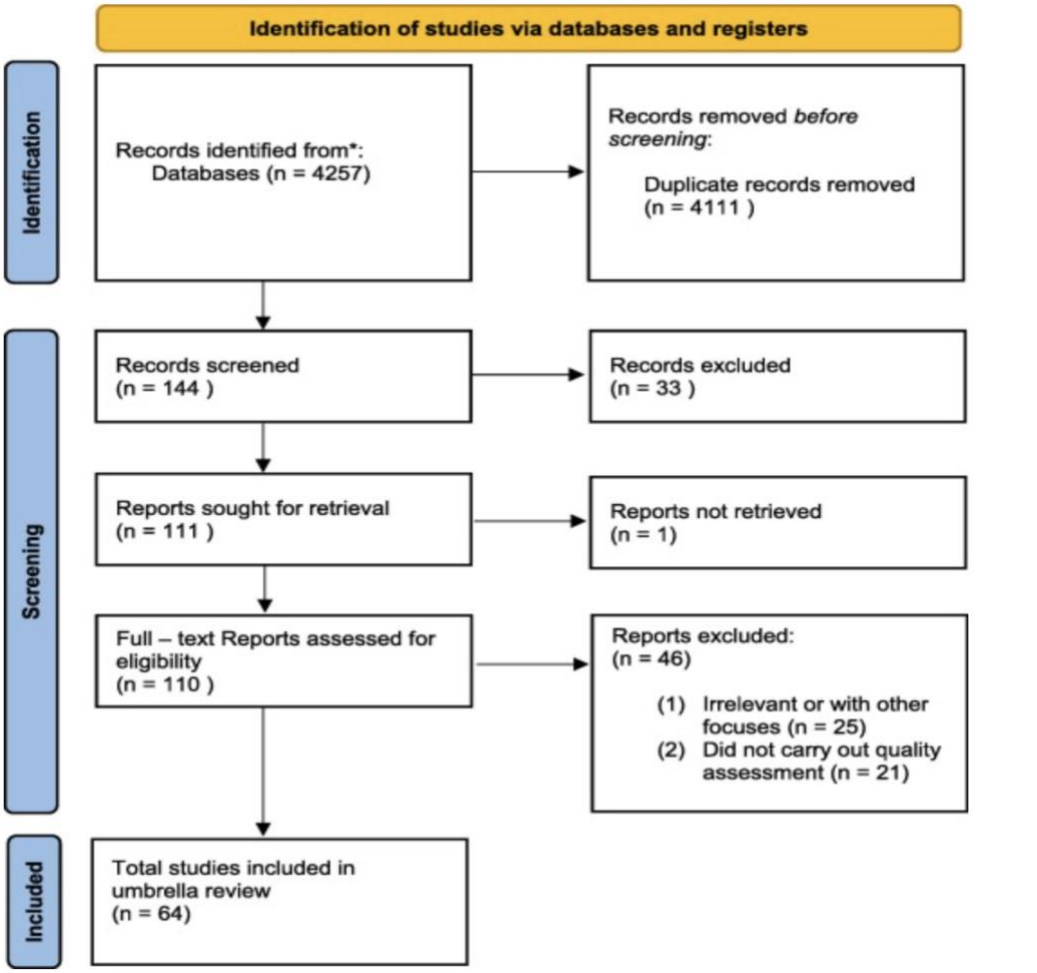
address this we undertook targeted data extraction, evaluation, and synthesis, focusing exclusively on findings relevant to our objectives.

Results

Systematic review retrieval

As shown in Figure 1 PRISMA flow chart, the initial search identified 4,257 records. After removing duplicates, the titles and abstracts of 144 systematic reviews were manually screened and 34 studies were subsequently excluded at the title and abstract screening stage. We reviewed the full text of 110 studies, 46 of which were excluded, reasons for exclusion listed in Figure 1. Finally, 64 studies were included in the narrative synthesis.

Figure 1. PRISMA Flow Chart



Characteristics of included systematic reviews

Included systematic reviews were published between 2010 and 2022, and they comprised studies conducted between 1988 and 2022. 45 (approximately 70%) of the included studies have been published since 2019, reflecting the recent surge in interest in NBIs. The majority of studies were conducted in Europe, followed by East Asia. 19 out of 64 included SRs performed a meta-analysis of data. Nature-based interventions were diverse in type and varied in disciplinary origin. Health promotion, public health and urban planning were the most dominant disciplines represented. Remaining SRs came from a range of disciplines including occupational therapy, clinical psychology, occupational health psychology, biodiversity management and environmental stewardship/conservation. Interventions were largely heterogeneous but can be

broadly categorized into those that change the environment (SRs examining the impact of urban green/ blue space i.e. public parks, street trees, green roofs etc.) or interventions which change the individual's behavior (i.e. forest bathing, nature-based therapy, green exercise etc.). With regard to these types of interventions forest-bathing/therapy or shinrin-yoku, horticultural therapy (HT), community/allotment gardening were the most reviewed followed by green exercise, nature walking groups and wilderness experiences. Two reviews looked at interventions focused on conservation activity (EECA) (Husk et al., 2016; Lovell et al., 2015). Table S3 in the Appendices, outlines the characteristics of the included studies in alphabetical order.

Quality Assessment

The methodological quality of the systematic reviews included in this umbrella review is shown in Table S4 (Appendices). Many of the included SRs failed to meet the seven critical domains of the AMSTAR2 checklist, with 35 (approx 55%) of the SRs being categorized as "low" methodological quality and 12 (approx 19%) as "critically low." This may be linked to the diversity of disciplines and backgrounds from which these SRs originate. With various disciplines following criteria which do not align well with the requirements of the AMSTAR 2 tool. Weaknesses in the critical items included: SRs not stating prior design or registered protocol, not justifying reasons for exclusion of studies, 10 (approx 16%) did not use a satisfactory tool to address the risk of bias in the individual studies and approximately 32% of studies, that performed meta-analyses did not conduct an adequate investigation of publication bias. The Newcastle–Ottawa Scale (NOS) and the Cochrane Risk of Bias (RoB 2) were the most commonly cited tools. Further, reviews modified/ tailored the selected tools themselves or cited preceding SRs who used modified approaches when justifying their quality appraisal. The last three critical domains related to meta-analysis and were difficult to evaluate since most (70%) of the included systematic reviews did not perform a meta-analysis. Weaknesses in the noncritical items included: authors not using components of PICO to frame their research question and inclusion criteria, authors not performing data extraction in duplicate, authors not reporting sources of funding for the studies included in the SRs, and SRs not reporting conflicts of interest. A more detailed overview of our assessment, including responses to each signaling question within each domain are provided in the supplemental materials (see Appendices Table S7: Responses to each question of the AMSTAR 2 tool).

Figure 2. Summary Plot of AMSTAR 2 Quality Assessment Results

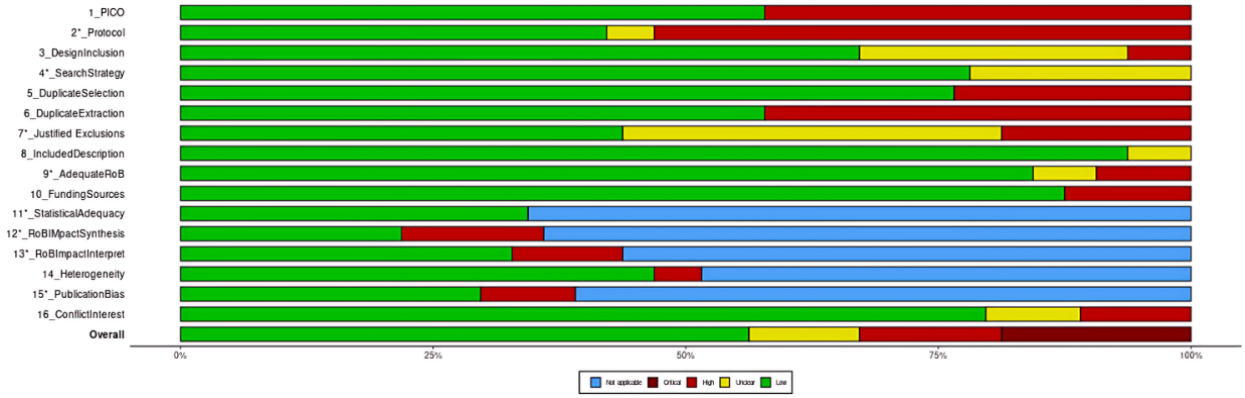
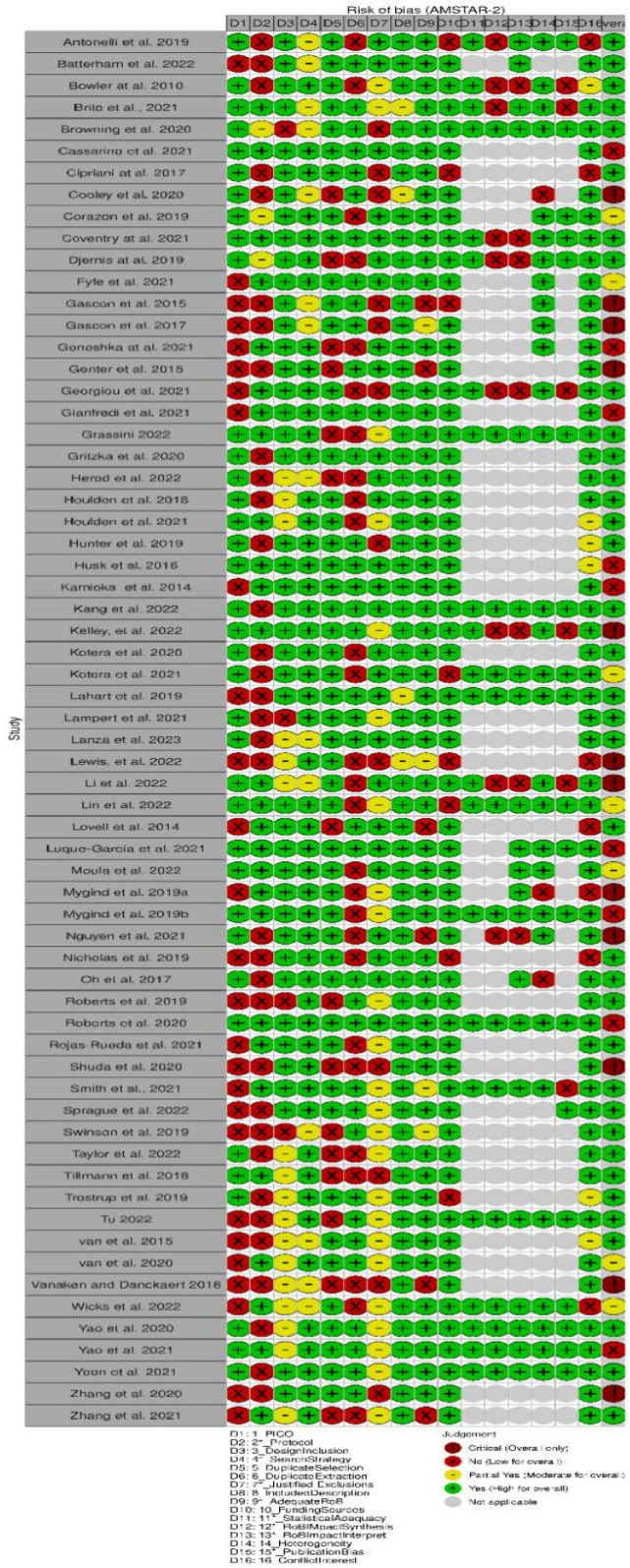


Figure 3. Traffic Plot of AMSTAR 2 Quality Assessment Results



Certainty Assessment

We assessed the robustness of our synthesis by considering the overall quality of evidence for drawing conclusions, discussing the results, and engaging in critical reflection. Important limitations within the evidence base are presented and discussed:

- Risk of bias: As aforementioned, approximately 19% of SRs did not use a satisfactory tool to address the risk of bias in individual studies. Further potential sources of bias were identified across reviews. For example, limitations in systematic search strategies, e.g., searching only 2-3 databases (Appendices Table S6) or issues regarding the search terms, restrictions on considered data sources (e.g., not including unpublished studies which may have been relevant), and issues regarding the synthesis of evidence. These factors and their potential to increase the risk of bias should be considered when interpreting the findings of this umbrella review.

- Publication bias: As shown in our AMSTAR 2 assessment, a large number of included SRs (approx 43%), that performed a quantitative synthesis, did not carry out an adequate investigation of publication bias and discuss its likely impact on the results of the review. The underlying tendency to selectively publish small positive studies and selectively report results, may be compounded by potential lower methodological quality of small studies, and increased clinical heterogeneity in population subgroups (Nüesch et al., 2010). The deficit of reviews assessing these factors and their impact on publication bias affects the certainty of our findings. However, it must be noted that it only makes sense to conduct such publication bias tests when 10+ studies are available. Additionally, the role of searching grey literature in reducing publication bias must be considered.

- Certainty assessment/ evidence grading: Very few systematic reviews utilised formal grading systems to rate the body of evidence. Where SRs did undertake evidence grading, the Grading of Recommendations, Assessment, Development, and Evaluations (GRADE) framework and the Newcastle Ottawa Scale (NOS) were the most frequently used approaches. We highlight that neither of these frameworks were developed specifically

for this field and SRs employing these frameworks made multiple modifications/ adaptations to the original criteria. Subsequently, the identified approaches were highly heterogeneous in both their comprehensiveness and their applicability to nature-based interventions which limits our ability to draw firm conclusions on the certainty of evidence. We conclude that establishing the wider use of more appropriate evidence grading methods is crucial for both strengthening systematic review methodologies and for the development and implementation of environmental public health policies.

- Indirectness of evidence: Although we aimed to mitigate this by undertaking targeted data extraction etc. potential divergence between our research question and included SRs research questions may have affected our findings. The majority of reviews focused broadly on the impact of a certain NBI on mental health outcomes however, some reviews focused more specifically on a certain outcome or dimension of interest (Labib et al., 2020; Ru Zhang et al., 2021) potentially impacting the directness of evidence.

Narrative Synthesis

What follows is a narrative synthesis identifying patterns across SRs and the key factors influencing the outcomes of nature-based interventions. Extracted data was synthesized narratively by developing central factors or themes related to the enablers and barriers of NBIs as detailed in section 2.8.2. A synthesis of the literature showed that factors could be grouped under eight main headings with some of the factors having sub-themes as represented in Figure 1: 1) Immersive experiences and active engagement, 2) Social dimensions, 3) Physical activity (PA), 4) Duration/frequency of and adherence to intervention, 5) Target population and individual differences, 6) Quality of natural environment, 7) Practitioner/facilitator skills and approach, and 8) Co-design.

Table 2. 8 Factors influencing the effectiveness of nature-based interventions (NBIs)

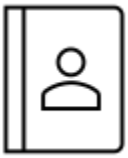
Factors	Description
1. Immersive Experiences & Active Engagement 	Importance of immersive experiences and active engagement with the natural environment (including savouring, mindfulness, and full body involvement) for wellbeing outcomes
2. Social Dimensions 	Interventions incorporating social interaction are more effective in promoting wellbeing. e.g. community-led interventions result in social contact which benefits sense of social identity, community, civic engagement, and reinforcement of sense of self as connected to nature
3. Physical Activity (PA) 	The moderating role of physical activity (PA) in NBIs. Interventions incorporating PA are particularly effective in enhancing wellbeing outcomes e.g. green exercise, green walking groups, community gardening etc.

4. Duration/Frequency and Adherence to Intervention



Duration, frequency and adherence to an intervention affect wellbeing outcomes. Evidence suggests that interventions which are more immersive in design (e.g. horticultural therapy (HT), forest bathing etc.) require a longer time span for participants to fully engage and subsequently benefit

5. Target Population & Individual Differences

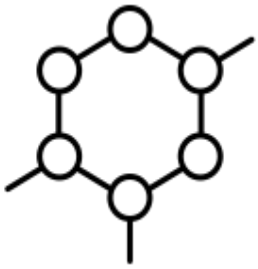


Socio-demographic factors such as age, gender, culture, socio-economic status (SES), baseline mental health, and trait nature-connectedness have a significant impact on wellbeing outcomes. Many of reviews emphasis the moderating role of the type of population group, their unique context and individual differences

6. Quality of Natural Environment



Factors such as the type of nature, biodiversity levels, accessibility and safety contribute to the 'perceived quality' of a natural environment. "Perceived quality" is any attribute that can affect willingness to visit a space, including intrinsic characteristics, features (vegetation,

	amenities), conditions (maintenance) or user perception of its quality
7. Practitioner/Facilitator Skills & Approach 	Influence of practitioner capability, skills, approach, and professional confidence on intervention outcomes e.g. facilitators' interaction styles, knowledge of natural environments/ wilderness context, first aid ability etc.
8. Co-design of Interventions 	Importance of participatory and co-design processes. Interventions which are co-designed in a collaborative process are more targeted and effective. Involving individuals in the planning and implementation of NBIs has the potential to improve practitioner confidence, participant satisfaction, adherence and wellbeing outcomes

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1) Immersive experiences & active engagement

Evidence across systematic reviews draws distinctions between active and passive engagement with nature and suggests the importance of immersive nature experiences for intervention design. Active engagement with the natural environment (including savoring, mindfulness, and full body involvement) appears to significantly impact the effectiveness of interventions. In their review, (Mygind et al., 2019) focused specifically on immersive nature experiences and defined them as those which have an 'emphasis on the experience of closeness to nature during the activity.' Both (Heród et al., 2022) and (van den Bogerd et al., 2020) identified two key types of intervention, i.e. passive or active people–nature interactions. Active engagement was found to be more beneficial. The later review found that high active use (physical activity) of campus green space was strongly linked to students' happiness, quality of life and stress levels with associations between passive use (mere exposure) and outcomes of wellbeing being much smaller. (Cooley et al., 2020) distinguish between low, moderate and high intensity engagement with nature. Exploring outdoor nature-based therapy, they differentiate between the 'active approach' - with nature viewed as a third person in the therapy relationship vs the 'passive approach' - with nature as merely a backdrop to therapy. Findings suggested that the active approach can provide the space for nature to be a powerful mediator in the client-practitioner relationship.

Reviewing the effects of short-term exposure to natural environments on depressive mood, (Roberts et al., 2019) suggest that active exposure such as walking or doing an activity in nature may be more effective than passive engagement. (Coventry et al., 2021) state that forest and wilderness therapies with an emphasis on *immersion* in nature are more effective in reducing depressive mood than mere exposure to nature. The wellbeing benefits of environmental enhancement and conservation activities seem to be strongly connected to the immersive state these activities evoke; whereby participants derive a strong sense of meaning from this active engagement (Husk et al., 2016). Both (Moula et al., 2022) and (Djernis et al., 2019) argue that bodily involvement with the environment and engaging the senses is crucial in nature-based therapy, as it reinforces the memory of experiences in nature, and subsequently prolongs and reaffirms the therapeutic effect. Similar findings in reviews on allotment gardening/ horticulture therapy, detail how participants who spent more time actively working on their allotment reported increased wellbeing in comparison to those who used it for passive relaxation (C. Genter et al., 2015; Heród et al., 2022; Kamioka et al., 2014). (Gritzka et al., 2020) found that nature savoring - mindful appreciation of natural elements - was the only workplace NBI that

demonstrated an exclusively significant finding by enhancing employee wellbeing. This mindful engagement and deep connection to nature promotes the recovery process by providing the space to become aware of the inner self (Kang et al., 2022). Alluding to the importance of immersive experiences, (Swinson et al., 2020) state that wellbeing benefits may not occur when the intervention design is less conducive to exploring the natural environment. They suggest that practitioners should incorporate this active engagement into intervention design. Active and immersive interventions may be defined by experiences in nature that have a social dimension or incorporate physical activity.

2) Social Dimensions

Many of the systematic reviews highlighted the impact of social connection as a moderator in the nature-wellbeing relationship (Batterham et al., 2022; Browning et al., 2020; M. Gascon et al., 2017; Kotera et al., 2021). This suggests that interventions which combine nature engagement with social interaction may be more effective in promoting wellbeing (Simone Grassini, 2022; Taylor et al., 2022). (Heród et al., 2022) found that over half of the 35 studies in their review showed improvement in social connections after nature-based interventions and emphasized this as a potential pathway to improved wellbeing. Moreover, (Lovell et al., 2014) reported that each study in their review drew links between the social contact, gained through participation in NBIs, and wellbeing. This is further supported in the reporting of (Coventry et al., 2021; Georgiou et al., 2021; Heród et al., 2022; Luque-García et al., 2022; A. Roberts et al., 2020). (Cassarino et al., 2021) found that urban regeneration through community-led actions increased social capital, sense of community, civic engagement which in turn positively influenced wellbeing indices. Highlighting the element of perceived safety, (Wicks et al., 2022) state that the presence of others might offer greater feelings of safety or reassurance in natural areas that could otherwise feel secluded or unsafe. In their systematic review on allotment gardening (Chris Genter et al., 2015) highlighted that the majority of gardening interventions were delivered in groups and that gardening undertaken in community groups was significantly associated with higher levels of nature connection and subjective wellbeing than observed in individual or home gardeners. This finding was reinforced by other systematic reviews on community gardening and horticulture therapy (Lampert et al., 2021; Lin et al., 2021). Lastly,

(Husk et al., 2016) found that NBIs focused on environmental enhancement and conservation activities (EECA) result in social contact which benefits an individuals' sense of social identity in terms of our shared place on Earth, and relates to belonging, environmentalism, and reinforcement of a sense of self as connected to nature.

3) Physical Activity (PA)

Engagement with nature is often hypothesized to benefit human health by encouraging physical activity (PA), accordingly, 15 of the included systematic reviews have explored this topic. Both (Lovell et al., 2014) and (van den Berg et al., 2015) state that physical activity is likely to be one of the key mechanisms by which NBIs benefit wellbeing. In their review, on the wellbeing benefits of green exercise, (Kelley et al., 2022) highlight evidence suggesting that PA results in greater wellbeing regardless of context. This emphasizes the moderating role of PA in NBIs. Exploring the effects of nature walks on depression, (Kotera et al., 2021) emphasize that it may be the act of walking rather than the natural environment which is important for depression. In their review on nature-based exercise, (Brito et al., 2022) allude to the existence of a synergistic relationship between the benefits of exercising and the benefits of interacting with the natural environment. Focusing on environmental enhancement and conservation, (Husk et al., 2016) found that such activities provide opportunities for physical activity which subsequently benefits mental health. Furthermore, PA in combination with social connection is suggested to be a moderator in the nature-wellbeing correlation. For example, green walking groups which combine social interaction with physical movement are found to be particularly effective in enhancing wellbeing outcomes (Swinson et al., 2020).

Many of the reviews allude to the fact that the incorporation of physical activity in intervention design can enhance NBI success and wellbeing outcomes. In their review on forest bathing (shinrin-yoku), (Antonelli et al., 2019) state that it is possible that the performance of light physical activity could have contributed to the reduction of stress levels and subsequent increase in wellbeing seen across studies. (Cooley et al., 2020) highlight that the physical movement involved in nature-based therapy helps practitioners to connect with clients psychologically. Many of the reviews, focusing on exposure to green space, suggest that the opportunity to perform physical activity is one of the key mechanisms explaining the mental health benefits attributed to green spaces (Gianfredi et al., 2021; R. Zhang et al., 2021). (Gascon

et al., 2015) observed that reduced psychological distress associated with living near green spaces occurred mainly in individuals who were physically active. Moreover, evidence suggests that the benefits obtained from urban green spaces may be the result of the physical activity and social interactions they promote (Luque-García et al., 2022; Taylor et al., 2022).

4) Duration/Frequency and adherence to Intervention

Across systematic reviews, there is evidence to suggest that the duration, frequency and adherence to an intervention affects wellbeing outcomes (Oh et al., 2017; Sprague et al., 2022; W. Yao et al., 2021). Evidence suggests that interventions which are more immersive in design require a longer time span for participants to fully engage and subsequently benefit (L. Mygind et al., 2019; Trostrup et al., 2019). For example, longer program durations seem to be more effective for interventions such as horticultural therapy (HT) and forest bathing. In (Tu, 2022) meta-analysis of horticultural therapy the duration of programs varied significantly from two weeks to one year with some evidence indicating that HT program duration may require more than four weeks to affect mental health outcomes due to familiarization with the horticultural activities and practitioners. Similarly, in their meta-analysis on forest therapy, (Yeon et al., 2021) found that the longer intervention time, the greater the effect on anxiety and depression. Specifically, the effect size for depression was largest when the intervention duration was more than 120 min, followed by 3 hours being more effective than 1 hour. (Coventry et al., 2021) found that positive mental health effects were observed for gardening interventions, especially for interventions delivered in groups and that lasted for 12 weeks or more. This further emphasizes the benefit of NBIs with a social dimension and may highlight the need for a longer duration of time in such interventions - in order to develop a sense of familiarity and connection with fellow gardeners/practitioners.

Contrastingly, shorter durations seem to be more effective for NBIs which involve exercise i.e. nature walking groups and green exercise. Findings from (Wicks et al., 2022) review, on the benefits of outdoor physical activity, suggested that shorter exercise sessions were associated with larger positive effect sizes for both anxiety and negative affect. In (Coventry et al., 2021) green exercise meta-analysis the most effective interventions were delivered in groups for between 20 and 50 minutes highlighting the efficacy of a shorter duration for such interventions.

Reviewing the impact of nature walks on anxiety and depression, (Kotera et al., 2021) found that walking duration has an important effect on both outcomes. (Lanza-León et al., 2021) found that the frequency and duration of visits to green space are protective factors directly linked to mental health. Findings indicate that frequent use of green space is significantly positively associated with higher levels of self-esteem, life satisfaction and subjective happiness. However, there was no evidence to suggest that longer sessions in nature led to better outcomes. In contrast, even as little as two sessions found improvements in nature connectedness and enhanced wellbeing. Lastly, (Browning et al., 2020) emphasize that low levels of adherence challenge the effectiveness of interventions. They highlight that NBIs such as forest bathing and park prescriptions were found to have low levels of patient adherence which directly affects outcomes.

5) Target Population - Individual Differences

The influence of the target population and their individual differences on intervention outcomes was arguably the most pervasive factor across systematic reviews. Variables related to socio-demographic factors such as gender, age, culture, trait nature-connectedness and socio-economic status (SES) are found to have a significant impact on wellbeing outcomes. With many of the reviews emphasizing the moderating role of the type of population group (M. Gascon et al., 2017; Houlden et al., 2021; Roberts et al., 2019). These are categorised below:

Base-line mental health of participants: In terms of participant characteristics, various reviews highlighted the potential that NBIs may be most effective on people with pre-existing mental health issues rather than 'healthy' participants. For example, (Antonelli et al., 2019) suggested that the cortisol-lowering effect of forest bathing may be more pronounced among individuals facing a stressful period (students during an exam period). Similar assertions were made in (Yeon et al., 2021) review of forest-bathing. Additionally, (Corazon et al., 2019) state that there might be a need to induce a stressor to detect significant physiological differences in participants.

Trait Nature-Connectedness: The trait nature connectedness has emerged as a correlate of psychological wellbeing and accordingly may moderate the effects of an intervention. Evidence from reviews suggested that individuals who have higher levels of this trait may be more likely to benefit from exposure to nature due to the personal meaning they hold for the Natural World

(Coventry et al., 2021; Gritzka et al., 2020; Swinson et al., 2020). Furthermore, the development of nature-connectedness may be linked to cultural origins. For example, people who are in a culture that accords with nature's healing influence may have higher levels of nature connectedness and subsequently derive greater benefits (Kotera et al., 2021). In their review of nature-based counseling, (Lewis et al., 2022) emphasise the importance of the personal meaning people hold for nature as a determinant of mental health outcomes. Reflection on the client's unique relationship to nature allows counselors to incorporate nature engagement in an individualized capacity which is tailored to the needs of the client. For example, (Cooley et al., 2020) review on nature-based therapy found that the incorporation of nature into therapy was habitually determined via person-centered considerations such as clients demonstrating an affinity to natural spaces. They suggest that this subjective connectedness to nature may have influenced wellbeing outcomes. Importantly, (Moula et al., 2022) assert that this trait may cause a "nature-positive bias" which skews results.

Age & gender: Various reviews emphasize that nature affects health in different ways and with different benefits based on population's age and sex (Hunter et al., 2019; van den Berg et al., 2015). In their review, (Nguyen et al., 2021) found that health benefits were observed when the environment type facilitated age and gender-appropriate physical activities in nature. For example, middle-aged adults preferred built facilities with paved paths for exercising whereas young adults prefer areas with open grounds for adventurous, athletic activities like hiking, trail-running or mountain biking. (Vanaken & Danckaerts, 2018) found that green space exposure seems to be correlated with children's and adolescents' mental health in varying ways depending on their developmental level. In children, the availability of a private garden and a shorter distance from their residential address to a green space seems to be beneficial. Whereas for adolescents, correlations with mental health are found more consistently with average greenness in the surrounding neighborhood and with the quality of green spaces, suggesting that this age group benefits not from the closest green space, but from green spaces of their choice, indicative of their growing autonomy. Highlighting the influence of age on intervention selection, (Nicholas et al., 2019) states that horticultural therapy (HT) with 'wander garden usage' was found to be most effective for older people with dementia, with all studies reporting positive effects on agitation. In regards to gender differences, (van den Berg et al., 2015) found that men seem to benefit more from green space in their living environment than women due to

constraints of perceived safety. Reviewing the effects of forest-bathing on anxiety, (Kotera et al., 2021) highlight gender as a potential moderator finding that greater proportions of females were associated with larger effects. Similarly, (Trostrup et al., 2019) found that female cancer patients were more likely to participate in and benefit from nature-based rehabilitation interventions than males.

Socioeconomic Status (SES): One of the most widely mentioned factors across systematic reviews was the moderating role of socioeconomic status. People with low income or living in socioeconomically deprived areas face issues of green/blue space access. This lack of contact with restorative natural resources is a social determinant of health inequities (Batterham et al., 2022; Buckland & Pojani, 2023; Georgiou et al., 2021; White et al., 2023). (Zhang et al., 2020) highlight how issues of access and equity are of major concern and emphasize that socioeconomic status is one of the main confounding sources between adolescents' mental health and green space. Their review found that young people from disadvantaged families reside in areas with a lower quantity and quality of green space and have poorer wellbeing. Similarly, (Batterham et al., 2022) and (Lanza-León et al., 2021) found that people with low income tended to have poorer mental health outcomes which are exacerbated by insufficient access to nature and its potential as a restorative environment. (Georgiou et al., 2021) highlight how blue space benefits and use are not equally distributed among people of different SES. Their review found that people with higher income and education were more likely to access blue spaces, while those with lower income faced issues of blue space access or availability. Supporting this further, both (Gianfredi et al., 2021) and (Luque-García et al., 2022) allude to the fact that available urban greenspace is often dilapidated and poorly maintained, with vandalized or dangerous areas.

Evidence suggests that nature contact benefits are stronger for people from socio-economically disadvantaged backgrounds (Gascon et al., 2015; Mireia Gascon et al., 2017; Smith et al., 2021; van den Berg et al., 2015). Two reviews (Chris Genter et al., 2015; Shuda et al., 2020) link this reoccurring finding to differences in wealth/resources and the contrast effect between living and natural environments. Higher SES individuals are more likely to have more options for accessing nature beyond their locality, potentially with higher restorative quality, and thus these groups are less reliant on their local greenspace. For example, in their review exploring the effects of allotment gardening, (Chris Genter et al., 2015) found that gardeners from high deprivation areas reported lower stress levels than those from low deprivation areas.

They mention the fact that the contrast between home and allotment environments for people from high-deprivation areas may contribute to this phenomenon. Furthermore, (Shuda et al., 2020) found that there appeared to be a more beneficial effect of green space interventions on people from lower socioeconomic areas across studies. They emphasize that differences in wealth may be a confounding variable here; wealthier individuals may be able to supplement lack of green/blue space in their urban environment by traveling to natural environments, or through private landscapes and gardens. Importantly, (Vanaken & Danckaerts, 2018) remind us of the fact that the links between socioeconomic status and access to nature are not consistent across different countries and cultures. They emphasize that in some cities/countries green space is spread out equally between the strata of socioeconomic status or ethnic background, such as in the city of Barcelona, Spain. Whereas in other countries, inequalities do exist, e.g. Scotland where individuals from lower socioeconomic groups are less likely to have private gardens or access to a public park.

Cultural differences: The synthesis of findings highlight that perceptions of nature differ cross-culturally and various socio-cultural differences and climatic factors may promote or hinder engagement with nature (Batterham et al., 2022; Bowler et al., 2010; Kotera et al., 2021; van den Berg et al., 2015; Vanaken & Danckaerts, 2018; White et al., 2023). Many of the reviews state that the variation in effect between continents, countries, and climatic regions makes ethnicity and culture a potential moderator in the nature-wellbeing relationship (Bowler et al., 2010; Kotera et al., 2021; van den Berg et al., 2015; Yeon et al., 2021). (Smith et al., 2021) draw attention to the fact that socio-cultural differences and various climatic factors may promote or impede the use of urban blue spaces. Reviewing the wellbeing effects of forest-bathing, (Kotera et al., 2021) found that benefits were greater for Asian and particularly Japanese participants. They emphasize that perceptions of nature differ cross-culturally and state that findings may be linked to the fact that people who are in a culture that accords with nature's healing influence may derive greater benefits from shinrin-yoku (e.g. Shintoism). (Taylor et al., 2022) suggest that there are also individual preferences at play. For example, forest bathing on a warm (but not too hot) day might have more appeal, and therefore greater positive impact. Ultimately, they allude to the fact that variation in individual temperature preferences and tolerances can be traced back to by regional and cultural norms.

6) Quality of natural environment

This review identified a wealth of review-level evidence linking the 'quality' of a natural space to intervention outcomes. Factors such as the type of nature, biodiversity levels, accessibility, perceived safety and maintenance contribute to perceived quality of a natural environment.

In 2015, (van den Berg et al., 2015) and colleagues highlighted an important knowledge gap regarding the relationship between quality of green space and health. They found that almost all of the 32 identified longitudinal and cross-sectional studies in their review focused on the quantity of green space in the living environment with very few studies exploring the quality and perceived satisfaction with greenspaces. Nearly a decade on and this knowledge gap remains largely unexplored. In their review, (Fyfe-Johnson et al., 2021) state that a consistent limitation is that researchers exploring nature exposure do not measure access to, quality of, or actual use of parks and green/ blue spaces. Other reviews support this stating that mere urban greenspace presence is not enough to achieve the desired health outcomes and important elements such as access, amenities, maintenance, security and user satisfaction also need to be considered (Gianfredi et al., 2021; Sprague et al., 2022). Many reviews emphasize the importance of considering the quality of natural environments for estimating their potential as a clinical intervention tool and evidence suggests that the mental health benefits resulting from nature exposure vary significantly by perceived quality (Mireia Gascon et al., 2017; S. Grassini, 2022; Gritzka et al., 2020; Ru Zhang et al., 2021). Where reviews have investigated this knowledge gap they find strong links between quality and wellbeing outcomes. For instance in their review, (Nguyen et al., 2021) define "perceived quality" as any attribute that can affect willingness to use a space, including but not limited to intrinsic characteristics (size or patterns), features (vegetation, facilities or amenities), conditions (maintenance or safety) or user perception of its usefulness or quality. They found that all studies examining quality demonstrate positive associations between green space's perceived quality with health. Below, we further discuss different factors contributing to the quality of a natural environment:

Type of natural environment/ biodiversity: Various reviews link the type of natural environment to perceived quality (Geneshka et al., 2021; Anna Roberts et al., 2020; W. Yao et al., 2021; Zhang et al., 2020). These reviews show variation in wellbeing outcomes based on the

type of natural environment. Environmental features highlighted include perceived biodiversity, vegetation structure, exposure to tree canopy, green vs "blue space" (eg, water features), season, leaf shape and colour, and management of/ infrastructure on the site (Bowler et al., 2010; Fyfe-Johnson et al., 2021; Kotera et al., 2021).Throughout the reviews, biodiversity is emphasized as important and environments which support a diverse range of flora and fauna are suggested to have more benefits for human health (Nguyen et al., 2021; Yeon et al., 2021; Zhang et al., 2020). Trends in the type of natural environments which are most beneficial have been observed across systematic reviews. Characteristics such a space being Wild (undeveloped, no visible human impact), Lush (biodiversity) and Spacious (large cohesive areas) are linked to high quality (Houlden et al., 2021; Houlden et al., 2018; Zhang et al., 2020). In their review, (Nguyen et al., 2021) found that some environment types were more likely to provide wellbeing benefits than others. People who spent time outdoors reported greater mental restoration following visits to rural green space and coastal locations in comparison to urban green space. Green spaces perceived as being more "natural," such as national parks, protected areas or bushlands, provided greater benefits. The review found that a combination of habitat, plant, bird and insect biodiversity resulted in restorative effects, but each biodiversity component alone did not. Spaces described as simple, peaceful and quiet areas with no urban noise pollution, with tree canopy and, crucially, 'away' or 'other' to usual environments appear frequently (Simone Grassini, 2022; Kang et al., 2022; Lovell et al., 2014; Luque-García et al., 2022; Moula et al., 2022; van den Bogerd et al., 2020). Urban greenspace might provide additional stresses, such as traffic, which do not feature in a natural environment (Swinson et al., 2020). Certain factors such as a lack of cleanliness and amenities are commonly reported in the literature, due to their negative influence on the use of green and blue spaces (Luque-García et al., 2022; Moula et al., 2022; Smith et al., 2021). In their meta-analysis, (W. Yao et al., 2021) assessed whether effect sizes differed based on the type of natural and built environment, and found that biodiverse areas (effect size = 0.654) and forests (effect size = 0.682) had a greater effect on positive emotion. The findings suggested considerable moderation, with exposure to wild natural environments being more effective at decreasing negative affect than exposure to the managed natural environments.

Perceived Safety: Perceptions of safety and security are recognised as defining features linked to the quality of a natural space. In their review of greenspace quality and health, (Nguyen

et al., 2021) found that the safety of green space was associated with better quality of life and reduced psychological distress. Similarly, (Cassarino et al., 2021) found that the mental health benefits derived from green spaces were associated less with the quantity of space available and more with the perceived safety and quality of the space, especially for women and low-income communities. This review calls attention to gender differences in perceived safety with women's experiences of safety and security typically related to design features associated with natural surveillance, such as landscaping, lighting and maintenance. Correspondingly, (van den Berg et al., 2015) found that women and men perceive and utilize green space in different ways, with women's use of green space being heavily influenced by the quality and perceived safety of green spaces in comparison to men's use. The presence of dense shrubs and tree cover is often equated to lower safety and security which subsequently reduces the restorative benefits of parks (Li et al., 2022; Nguyen et al., 2021; Wicks et al., 2022). (Luque-García et al., 2022) assert that built-greenness offers easier opportunities for engagement than natural greenness, due to the fact that it has been designed to actively encourage exposure to nature, and generally, tends to be easy to access, reasonably well-lit and well maintained. They argue that these characteristics help community members to view such spaces as safer. However, evidence from (Djernis et al., 2019) review suggests that individuals prefer natural environments that are wild/untouched and provide a variety of species but are still experienced as safe. Here, we see how perceived safety can be a barrier to engagement with wild and biodiverse environments - which may have additional wellbeing benefits (Houlden et al., 2021; Lovell et al., 2014; Moula et al., 2022; Nguyen et al., 2021).

Concerning outdoor nature-based therapy, (Cooley et al., 2020) state that the unpredictability of nature makes it difficult for practitioners to maintain structured boundaries and raises concerns for the safety of patients. They emphasise that many practitioners find it difficult to maintain ethical practice guidelines, in terms of beneficence (do good) and non-maleficence (do no harm) due to the physicality of the outdoors. They stress the importance of finding the appropriate type of outdoor environment which is conducive to therapy and the participant's safety needs. (Anna Roberts et al., 2020) highlight how extenuating factors can shape perceptions of safety. Evidence in their review linked the negative experiences that some participants had in nature to the influence of parental anxiety and the media in portraying natural spaces such as woodland as dangerous places where people are unsafe. (Cooley et al., 2020)

provide solutions to improve perceived safety and security. For example, completing a risk assessment prior to the intervention can mitigate risk. Also, being aware of professional limits of competence and knowing when to seek external guidance from trained professionals is key. For instance, in this review some practitioners worked alongside outdoor pursuit instructors when incorporating more adventurous activities into their therapy process.

Accessibility Many of the reviews highlighted accessibility issues resulting in a widespread call for policymakers to direct efforts at tackling inequalities in access to nature (Gianfredi et al., 2021; van den Bogerd et al., 2020; Zhang et al., 2020). Accessibility encapsulates access and proximity to high quality natural spaces. More specifically, it is linked to inequalities with access to nature for specific groups such as individuals with lower SES, minority groups and those with disabilities (i.e. mobility disabilities). In their review, (Simone Grassini, 2022) raised concerns around the availability, convenience, and affordability of nature. (Fyfe-Johnson et al., 2021) highlights the disparity in access to nature with some communities deprived largely because of historical environmental injustices that resulted in an imbalance in access to natural environments. In relation to proximity, they found that nature exposure had the most significant impact on children's health when green space was near the child's home or school, highlighting the importance of easy access to nature. Reviewing the links between greenspace and mental health, (Houlden et al., 2018) found that access to the highest level of greenspace (i.e. perceived neighbourhood greenness, terciles) was correlated to better mental health. They argue that greenspace accessibility should be measured more concretely, using individual travel distances and spatial methods of analysis, to enhance our understanding of how greenspaces should be designed and incorporated into environments.

(Kotera et al., 2021) call attention to the paradox of equity issues stating that often a key benefit identified for nature-based therapies is that they are free and publicly accessible, in principle. However, they emphasize that currently nature is not equally accessible to everyone. (Lanza-León et al., 2021) link various environmental characteristics such as rurality and whether an area is deprived to accessibility. Evidence from their review suggests that individuals who do not have accessible outdoor spaces are more likely to show anxiety symptoms. (Li et al., 2022) suggest that exercise in wild environments might have some advantages over exercise in urban greenspaces. However, accessibility and intensity of natural environments may counteract this. For instance, a wild forest without satisfactory pedestrian facilities reduces the pleasure of

walking. Focusing specifically on Latin America, (Rojas-Rueda et al., 2021) call attention to environmental health inequalities for people with mobility disabilities, those from low-income families and, socially deprived populations. They assert that health evidence on these populations could help optimize land use and built environment policies to reduce environmental health inequalities. Spotlighting both geographical and financial concerns for green walking groups, (Swinson et al., 2020) highlight that some groups may not have access to rural natural spaces because of geography or cost. Access to natural spaces is habitually measured using metrics of distance i.e. distance to the nearest park, green space or public open space (Mireia Gascon et al., 2017). However, few studies have considered the layered dimension of accessibility asking questions such as is the space safe/functional and are there other issues around access for instance, a busy road crossing.

7) Practitioner/Facilitator skills and approach

The influence of practitioner skills, approach and professional confidence on intervention outcomes was mentioned in seven reviews. Although, not all reviews assessed interventions which had a practitioner (e.g. reviews looking at the impact of green/blue space on health) this is a factor worth highlighting. (Kamioka et al., 2014) state that facilitators' interaction styles and their knowledge of natural areas appear to affect NBI outcomes. Findings from (Cipriani et al., 2017) review, on horticulture therapy, suggest that practitioners' professional confidence may have an impact on intervention outcomes. Similarly, in (Cooley et al., 2020) review of outdoor therapy they emphasized that practitioners reported a need for professional confidence and assurance to overcome the sense of professional 'othering' or alienation due to providing a therapeutic activity that challenges the habitual perception of how and where therapy is offered. Practitioners' knowledge of the natural environment and preparation for the intervention are crucial factors that relate to the sense of confidence; with components such as "knowledge of the chosen wilderness context" and "first aid" being cited as concerns throughout the review. Both (S. Grassini, 2022) and (Heród et al., 2022) allude to the impact of practitioner capability and their chosen intervention approach as a key determinant of intervention success. Additionally, (Lovell et al., 2014) maintain that how the facilitator chooses to structure the intervention is very significant. Reviewing arts-based NBIs in schools, (Moula et al., 2022) observed that teachers

often lacked confidence in delivering interventions in an outdoor setting and that this affected the health and wellbeing outcomes. They suggest that this lack of confidence could be linked to the time constraints that prohibit teachers from investing time and effort in the design and implementation of such interventions. This underscores the need for sufficient time allocation and support to implement NBIs.

8) Co-design of interventions

Evidence across systematic reviews suggests that interventions should be co-designed in a collaborative process involving the individual participants/patient, outdoor experts and the facilitator. Many of the included reviews highlight the importance of participatory and co-design processes that involve individuals in the planning and implementation of NBIs; outlining the fact that this has the potential to improve practitioner confidence, participant satisfaction, adherence and wellbeing outcomes (Cassarino et al., 2021; Gritzka et al., 2020; Smith et al., 2021). We see this across reviews whether it be co-design in the planning of green/blue spaces or the conceptualisation of a specific NBI adapted to an individual. Some studies in this review did engage such expertise (Simone Grassini, 2022; Heród et al., 2022). For example, in (Cooley et al., 2020) review of outdoor-based therapy some practitioners worked alongside outdoor pursuit instructors when incorporating more adventurous activities into their therapy process. They emphasized how this boosted practitioner confidence and intervention success. In their review of workplace NBIs, (Gritzka et al., 2020) found that participation in the planning and formulation of the intervention predicted higher commitment during the intervention period, and subsequently positively influenced intervention outcomes. They suggest that investigations into the feasibility of the intervention should be carried out prior to conducting the actual NBI. For instance, an online survey exploring the perceived feasibility of the proposed intervention can gauge individuals' perceptions and actively involve participants in the design process. This reflective premeditation on participants' needs and hopes during intervention design is central to the success of NBIs.

Many reviews emphasize that co-designing public green/blue spaces with community members can enhance perceived safety and that continued maintenance is key to uphold this sentiment of security. Reviewing the impact of transformations in the urban environment on

wellbeing, (Cassarino et al., 2021) highlight the importance of involving the local community in urban planning and transformations in green infrastructure. The grassroot, community-led interventions described in this review were successful in empowering a sense of both agency and belonging among the most vulnerable residents, particularly those from a low socioeconomic background. Such approaches built upon the empowerment of citizens can have co-benefits such as social cohesion in the community and civic engagement. Similarly, (Hunter et al., 2019) urge urban planners to engage local communities in the design process to ensure that their needs are incorporated into the natural space. This collaborative process, which is sensitive to the requirements of the residents, can encourage community members to take ownership for the urban green spaces, promoting its future management and maintenance. Findings from (Hunter et al., 2019) review outlined that collaborative urban green space interventions can have a significant effect on improved perceptions of safety and in turn park usage. Lastly, reviewing the impact of greenspace on adolescents mental health, (Zhang et al., 2020) urge policy makers and urban designers to take young people's views into account when designing these spaces. They state that rather than merely providing survey questions, adolescents should actively participate in the design process with the support of emerging technologies. Such approaches can be linked back to developing social connections and may have co-benefits which include youth development, sense of belonging, improved self-identity, enhanced self-efficacy to engage in civic processes, and forming the foundations of environmental stewardship.

Discussion

This umbrella review aimed to provide a summative overview of existing evidence on nature–based interventions to address the overarching research question: *What are the factors influencing the effectiveness of nature-based interventions?* In the following section, we summarise the key findings of the review and discuss implications for intervention design. We highlight limitations and gaps in research with recommendations for future research, practice and policy.

Summary of key findings

This umbrella review included a total of 64 systematic reviews (19 with meta-analyses) published up to 2022. The majority of SRs have been published since 2019, reflecting the recent proliferation of interest in NBIs. The reviews included in this synthesis were highly heterogeneous in terms of intervention type, target population and methodology. Further, they were varied in disciplinary origin, with assorted approaches to NBIs. We note a strong research tradition in Europe and East Asia which may reflect a governmental interest in the importance of nature connectedness which has permeated research priorities. Health promotion, public health and urban planning are the most recurrent disciplines publishing in the area. The universal application of NBIs to different groups and the diversity of nature itself has led to significant heterogeneity of intervention designs. Accordingly, interventions were diverse in type but can be broadly categorized into those that change the environment (SRs examining the impact of urban green/ blue space i.e. public parks, street trees, biodiverse environments, biophilic design etc.) or interventions which change behaviour (i.e. actively engaging an individual or group with nature through a structured activity).

The current umbrella review demonstrated evidence to support NBIs for mental health and wellbeing. There was particularly strong evidence for interventions including immersive experiences (e.g. horticultural therapy and forest bathing); active engagement, social interactions and co-design. Collective evidence across reviews suggests the importance of immersive nature experiences for intervention effectiveness (Coventry et al., 2021; Moula et al., 2022; Lærke Mygind et al., 2019). These experiences can be characterized by active engagement with the natural environment and full bodily involvement. Linked to this, the level of physical activity in an intervention was associated with active engagement. A clear narrative across reviews was that physical activity is a potential moderator of the nature-wellbeing relationship (Brito et al., 2022; Cooley et al., 2020; Kotera et al., 2021).

Findings suggest that interventions that combine nature engagement with social interaction are more effective in promoting wellbeing (Batterham et al., 2022; Browning et al., 2020; Mireia Gascon et al., 2017; Kotera et al., 2021). NBIs can be a pathway to increased social support/social cohesion and can foster a sense of community and civic engagement which positively contributes to mental health. This finding is particularly interesting in light of White et al., (2023) integrative theoretical framework proposing the theory of Nature-based Biopsychosocial Resilience (NBRT). This theory suggests that interventions which promote

nature-based social contact through community initiatives or shared activities, such as social gardening (Litt et al., 2023), can improve psychological wellbeing by boosting social-ecological resilience. Furthermore, Dong and Geng's (2023) exploration of conservation of resources theory suggests that interventions combatting the impact of nature deficit on mental health may be implemented by focusing on social capital. These combined findings have implications for intervention design and support the development of interventions which incorporate these dimensions. Examples of such interventions, identified across reviews, are community gardening and horticulture therapy (Lampert et al., 2021; Lin et al., 2021), green walking groups (Swinson et al., 2020) and NBIs focused on environmental enhancement and conservation activities (EECA) (Husk et al., 2016).

Although the heterogeneity of research design makes it difficult to draw firm conclusions, findings suggest that the type of nature is highly influential and biodiverse environments are suggested to have more benefits for human health. Moreover, socio-demographic factors such as age, gender, culture, socio-economic status (SES) and trait nature-connectedness were found to have a significant impact on intervention outcomes. Multiple SRs emphasize that nature affects health in varying ways and with unique benefits based on the individual differences and context (Hunter et al., 2019; Nicholas et al., 2019; van den Berg et al., 2015; W. F. Yao et al., 2021). Further, evidence from this review suggests that nature contact benefits are stronger for people from socio-economically disadvantaged backgrounds (Gascon et al., 2015; Mireia Gascon et al., 2017; Smith et al., 2021; van den Berg et al., 2015). This so-called 'equigenic' effect has been reported in other studies (Moran et al., 2021; Rigolon et al., 2021; Wang et al., 2022). Two reviews (Chris Genter et al., 2015; Shuda et al., 2020) link this reoccurring finding to differences in wealth/resources and the contrast effect between living and natural environments. This aligns with Rigolon et al., (2021) study where they hypothesize that disadvantaged groups experience stronger protective effects from green space because of their greater dependency on proximate nature, as they often lack access to other health-promoting resources. However, it is important to recognise that the links between socioeconomic status and access to nature are not consistent across countries/cultures and inequalities in nature contact may not be universal when considered at a country level. A recent country level analysis, revealed that in Austria there is little evidence of socio-economic inequalities in residential green/blue space at the whole country level (Fian et al., 2023). In some cities access to nature is equally distributed between the strata of

socioeconomic status whereas in other countries stark inequalities do exist (Vanaken & Danckaerts, 2018).

Recommendations for practice and policy

The following factors should be considered when designing interventions and specific recommendations for practitioners and policymakers are outlined below:

1. Findings from this review provide particularly strong evidence for the development of interventions which are immersive, involve active engagement (i.e. physical activity), incorporate social interactions and are co-designed through participatory processes.
2. Consideration of the specific target population and their individual differences during intervention design is crucial. Socio-demographic factors such as age, gender, culture, socio-economic status (SES) and trait nature-connectedness should be assessed. Practitioners must consider the significance of context and having an environment which facilitates age, gender and culturally appropriate activities in nature.
3. The significant heterogeneity of intervention design limits our ability to draw firm conclusions on the optimal intervention duration or frequency. However, there is some evidence to suggest that interventions which are more immersive in design require a longer time span for participants to fully engage and benefit.
4. The promotion of equitable access to nature and implementation of NBIs in socio-economically disadvantaged areas can reduce existing health inequalities. Policymakers and practitioners must focus on bridging equity gaps in access to nature and involving marginalized communities in the design process.
5. The quality of natural environments and factors such as the type of nature, biodiversity levels, accessibility, and perceived safety should be considered when designing interventions. Findings suggest biodiverse environments are suggested to have more benefits for human health. This is highly concerning against the backdrop of rapid biodiversity loss and the depletion of natural resources which further underscores the urgent need for society to restore and regenerate its human-nature relationships.

Accordingly, environments which support a diverse range of flora and fauna should be prioritized in intervention design.

6. Summative evidence emphasizes that the perception of safety and security is a widespread barrier to NBIs. This is particularly true for women and our review highlights gender differences in perceived safety. This should be taken into account when designing both interventions and public green/blue spaces. The merits of gender-sensitive urban planning are supported by the literature, particularly concerning the wellbeing benefits derived from perceived safety (Cassarino et al., 2021; Navarrete-Hernandez et al., 2021; Rišová & Madajová, 2020). Optimizing the conditions of space and understanding what makes an environment safe, inclusive, and welcoming (without losing valuable biodiversity) should be prioritized in future practice and policies.
7. We call for governmental policies that aim to protect and enhance the quality of natural spaces, particularly in low SES communities. To facilitate this, better nature protection, management and practical design approaches are required to protect rare and vulnerable habits and species. The rewilding of cities and integration of biodiverse habitats into urban environments can support this. Many existing reviews of NBIs use metrics such as green/blue space quantity to define nature exposure (Houlden et al., 2021; Van den Bosch & Sang, 2017). An inherent limitation of these metrics is that they assume exposure revolves around geographic proximity without considering whether nearby nature was actually used, of good quality, or accessible (Holland et al., 2021; Wilkie & Davinson, 2021). Since the quality of an environment appears to be more relevant to people's health, policymakers should pay attention to the aforementioned attributes of quality rather than only considering quantity. Relevant evaluation indicators of the quality of nature should be developed and incorporated into NBI design and urban planning policies.
8. This review revealed that participatory and co-design processes that involve individuals in the planning and implementation of NBIs should be prioritized in future practice. Co-created interventions can lead to more sustained outcomes and evidence across reviews reveals that by tailoring interventions to the specific individual or community they are more targeted and subsequently more effective. Some researchers (Britton et al., 2020; Cassarino et al., 2021; Delbaere et al., 2024; Nguyen et al., 2021) have emphasized the

need to actively involve diverse minority and marginalized groups in the co-design process. This would play a key role in addressing equity issues/ health disparities and will stimulate wider policy adaptations. Recently, Delbaere et al., (2024) proposed a 'Gender, Inclusion and Diversity Framework' for the development of inclusive Nature-Based Solutions. Such frameworks can be instrumental in supporting the co-design process.

9. Given the complex social, political, environmental and economic dynamics that are at play, the delivery of NBIs requires both a transdisciplinary and multisector (government, non-governmental organisations, academic, private sector) approach. We propose participatory co-design processes as potential mechanisms for supporting this. These are important elements which have been under-explored.

Implications for future research

Included systematic reviews were mostly carried out in high-income countries where, habitually, the natural world presents few challenges and threats. Thus, findings only reflect relatively industrialized nations which further underscores the need for research in low-middle-income nations where there may be cultural differences which affect intervention design (Britton et al., 2020; White et al., 2020). Across reviews, there is a pervasive call for research in specific regions such as rapidly urbanizing African and Asian countries (Vanaken & Danckaerts, 2018) and for a focus on specific population groups, such as young populations of Indigenous people (Batterham et al., 2022). Notably absent were studies from Africa, the Middle East, Latin America, and South Asia. These regions are disproportionately affected by the climate crisis (Diffey et al., 2022; Hickman, 2020) and could stand to benefit from nature-based interventions which have the potential to support personal and planetary wellbeing. Of note, is the fact that the term 'nature exposure' is often used interchangeably to describe both interventions which change behaviour and those that alter the environment (Browning et al., 2020; Gianfredi et al., 2021; Luque-García et al., 2022). We argue that this broad terminology makes it difficult to distinguish between different varieties of NBIs and their subsequent impact on wellbeing. Further, vague intervention descriptions and an absence of theoretical frameworks guiding NBI design has limited the critical appraisal of these interventions. Previous researchers (Britton et al., 2020; Harper et al., 2021) have alluded to the absence of a common language for nature-based

providers, whereby conceptual ambiguity of central terms precipitates a lack of coherence across nature and health research, policy, and practice. Future studies should focus on developing a common terminology for categorizing and differentiating between interventions.

There is an inclination to report only the 'positive interactions' in nature across the field, however, this review also revealed the potential for negative experiences in nature and the need to assess potential risks, particularly for vulnerable groups. The field is dominated by self-referred subjects, who may have higher levels of nature-connectedness. This can lead to a potential "nature-positive" bias which skews results. Many studies record nature-connectedness as an outcome of interest but moving forward the implications of varying levels of this trait for intervention outcomes must be discussed (Gray & Birrell, 2015; Moula et al., 2022) We noticed an inclination to focus on short-term outcomes in nature-based interventions. Longitudinal studies exploring the types of interventions that lead to substantial and sustained benefits could increase the public recognition of NBIs and subsequently support their inclusion in national and international policy. Given our finding that the type and 'quality' of natural environments is important for intervention outcomes, the evidence base would benefit from future research exploring different characteristics of natural environments such as biodiversity levels, wildlife and vegetation density etc. (Beute et al., 2023).

NBIs are part of a wider conversation around race, class, privilege and health equity. Evidence from the included reviews makes the deficit of studies examining the impact of nature exposure on marginalized communities, such as low-income and racially/ethnically minorities, blatantly obvious. Future research must focus on amplifying such voices. Lastly, while carrying out this review, we noticed a widespread tendency to view nature as a 'resource' that society is capitalizing on for human benefit. This is reflected in the accepted terminology with phrases such as 'social prescribing,' 'the optimal *dose* of nature,' and nature as a 'health promotion *tool.*' Such terminology commodifies and over-medicalises the natural world. In recent years, nature more broadly has been positioned as a healer with unidirectional benefit leading to an anthropocentric bias (Barragan-Jason et al., 2023; Prescott et al., 2022). This paradoxical approach to health promotion, which fails to recognise the interconnection between human and environmental health, will exacerbate our current disconnect from the natural world and the pervasive 'extractivism' we see worldwide (Gómez-Barris, 2017; Hickel, 2020; Kotzé & French, 2018). Such framing is particularly concerning because language not only describes but also

shapes cultural norms (Kuang & Bicchieri, 2024), potentially reinforcing anthropocentric and utilitarian approaches to the natural world. Such positioning contributes to widespread ecological degradation and limits the capacity for individuals to cultivate relational values. NBIs must address the immense pressure that Earth's ecosystems face and the growing disconnect from our natural surroundings. We urge researchers, policymakers and practitioners in the area to adopt an ecocentric, socioecological approach to intervention design—which acknowledges our symbiotic relationship with the Earth.

Strengths and limitations of the review

To our knowledge, this is the first umbrella review to rigorously investigate the barriers and enablers to nature-based interventions. Further, we evaluated evidence on mental health outcomes, which is considered a priority in public health, and makes our review relevant to policymakers and stakeholders developing strategies to improve health promotion policies. The review provides a comprehensive "tertiary-level" synthesis that summarizes the evidence on NBIs using a pooled sample of systematic reviews and meta-analyses. We recognised the need for a tertiary-level synthesis to make sense of the literature, consolidate the evidence and better inform research, practice and policy. Second, we carried out an extensive search of twelve international databases to identify relevant systematic reviews. The methodological quality of included studies was assessed with the AMSTAR2 checklist. This provided a critical appraisal for the current evidence, identified gaps and limitations of the existing literature, and provided guidance for future systematic reviews.

Authors assessed the emerging properties of the overall body of evidence to determine how much certainty or confidence should be attributed to the synthesis of results. During the certainty assessment process, it was evident that there are some inherent limitations which must be considered when appraising our findings. The quality assessment indicated that most of the included systematic reviews had one or more limitations in their methodology, which may be linked to the diversity of disciplines and backgrounds from which these SRs originate. We observed that the methodological quality was poor with 73% of included studies being categorized as "low" or "critically low." Most SRs performed narrative synthesis rather than meta-analyses preventing our ability to comment on the effectiveness of interventions. More than

half of the reviews did not report a priori registered protocol, which might have increased the risk of sampling, selection, and within-study bias. Additionally, many SRs did not perform data extraction in duplicate, which disrupts the accuracy of the extracted data and approximately 16% did not use a satisfactory tool to address the risk of bias in the individual studies. Further, approximately 32% of the SRs, that performed a quantitative synthesis, did not carry out an adequate investigation of publication bias and discuss its likely impact on the results of the review. Further, the significant heterogeneity among the included studies could lead to bias in the results. Numerous systematic reviews cited preceding reviews to justify their approach to quality assessment. This suggests a "propagated" methods adoption, whereby review authors use preceding reviews for guidance, potentially resulting in the use of inappropriate methods.

However, it is important to highlight that AMSTAR2 is a blunt instrument, with studies undergoing an automatic downgrade if they do not satisfy one of the "critical domains", which may not be suited to reviews containing a diversity of disciplines such as this (Sacre et al., 2023). Although AMSTAR 2 is designed to assess the quality of SRs including both RCT and non-RCT design, the underlying issues within specific reviews are often highly complex, and subject to varying interpretations, particularly when judgments are made across a wide spectrum of interventions like in the present review. Our use of the tool in particular calls attention to the conversation around the need to first define appropriateness in varied review contexts. Nonetheless, these compounded issues may have resulted in potential risk of bias potentially affecting the quality of synthesized evidence. Due to the significant heterogeneity of included studies (i.e. populations, intervention approach, outcomes) and magnitude of evidence we did not evaluate the impact of study overlap on our synthesis. We acknowledge that overlap may have resulted in overrepresentation in reporting of review characteristics and factors. Further limitations include the use of a search filter restricted to publications in English, which may have resulted in the underrepresentation of non-English speaking researchers publishing on the topic. We were also limited by the broad scope of our phenomenon of interest, "NBIs" which are diverse in range. As such, we did not aim to identify specific interventions and their effectiveness but to evaluate narratively the universal barriers and enablers to interventions present in existing literature. Our synthesis included reviews up until September 2022, due to the volume of reviews and project restrictions. However, given the rapid pace at which reviews are being published in the area, it is possible that new evidence has emerged that may further inform

the recommendations made in this work. Lastly, there was a deficit of studies which conducted a certainty assessment for grading the overall evidence in their review which affected our overarching certainty assessment. This may be linked to the fact that this procedure has only become integral in 2020 – as outlined by the revised PRISMA guidelines. Further, certain aspects of existing approaches, including the clinical origins of such frameworks and the aforementioned default ranking of evidence from randomized controlled trials (RCT) above evidence from observational studies, have previously been criticized in the context of public health. We conclude that establishing the wider use of more appropriate evidence grading methods is crucial for both strengthening systematic review methodologies and for the development and implementation of public health policies.

Conclusion

The rapid proliferation of nature-based interventions threatens to out-pace the potential for meaningful and effective strategies for personal and planetary health. Interventions are diverse in type, study population and setting leading to significant heterogeneity. Further, NBIs are subject to the complex interplay of social, political, historical and environmental factors. Subsequently, a contextually sensitive approach, considering various individual differences and contextual factors, is required. Findings spotlight the international call for policymakers to direct efforts at tackling inequalities in access to nature. This is of special interest for health equity and environmental justice. Furthermore, participatory and co-design processes that involve individuals in the planning and implementation of NBIs should be prioritized in future research and practice.

Chapter 4—Study Two: Qualitative Study[2]

The Natural World Around Me; A qualitative exploration of young people's relationship to nature and how it relates to their wellbeing and sentiment of pro-environmental behaviour

Abstract

There is a deficit of qualitative research which aims to understand young people's experiences and relationship to nature. Drawing on youth work methodology, this interdisciplinary study employed an exploratory qualitative approach to understand how young people's relationship with nature influences their wellbeing and sentiment of pro-environmental behaviour. Three focus groups were conducted with 21 young people, aged 12-26, from diverse cultural backgrounds. Thematic analysis resulted in four dominant themes: 1) the foundations of our relationship to nature; 2) pathways to wellbeing; 3) barriers to nature connection and 4) nature connection in the face of climate and ecological crisis. This study spotlights the significance of nature connectedness in supporting youth mental health and laying the foundation for environmental stewardship. Findings extend previous theoretical perspectives suggesting a unique relationship between young people and nature with distinctive ecocentric roots. Understanding this relationship has the potential to unite activity from health services to environmental policy and beyond, ultimately benefiting both human and ecological wellbeing. Implications for research policy and practice are discussed.

[2] This chapter has been published in peer-reviewed journals The Journal of Environmental Psychology, Volume 18, Issue 4.



Graphical Abstract: Visual representation of nature connection by one of the young people. This is a drawing that one of the participants created during the focus group while they were reflecting on the discussion. This was unpromoted, and the participant created the drawing of their own free will and shared it with the researcher post-focus group. They communicated that the image captures the contrast between urban and natural environments and their unique relationship to nature – whereby nature connection is a source of calm for them. We believe this encapsulates some of the overarching findings of this paper. Additionally, this speaks to the diversity of communication styles and the need to facilitate and support varied communication styles outside of solely verbal communication. The drawing is being shared with the permission of the creator. We have received assent and consent from both the participant and their parental guardian to present their signed and dated drawing.

Introduction

Youth mental health in light of the climate and environmental crisis

Worldwide, young people are experiencing unprecedented levels of substandard mental health. There are a number of influencing factors, but one which there is increasing evidence of is the climate and environmental crisis (Diffey et al., 2022; Charlson et al., 2021; Hickman, 2020). The current youth mental health crisis (Schweizer et al., 2023), coupled with the knowledge that mental illnesses typically begin during youth Kessler et al., (2005) emphasises the importance of evidence-based interventions to promote wellbeing and foster coping mechanisms against the global crises we face. The climate, ecological and mental health crises are interlinked with evidence suggesting that our fractured relationship with nature contributes to these global challenges (Hickel, 2020; Whitburn et al., 2020). Despite the evident links between human and planetary health, these domains have often been treated independently rather than holistically (Benoit et al., 2022; Hickman et al., 2021).

During adolescence, youth mental health is subjected to a range of negative pressures, including conformity, digital technology, social media and bullying (Blakemore, 2019; Tillman et al., 2018). Overarching structural factors are highly influential here, with mental illness being found to be higher among youth living in low-income families (Gutman & Schoon, 2015), among those with refugee backgrounds (Lustig et al., 2004; Silove et al., 2017) and among ethnic minorities/ marginalised groups (Ibes et al., 2021; McManus et al., 2009). Further, a shortage of health resources and mental health professionals directed at youth mental health worldwide (McGorry et al., 2022) shifts much of the responsibility in providing support to wider society or the individuals themselves. Research has shown that the climate crisis evokes a myriad of feelings and mental health impacts for young people – with varied responses ranging from indifference to deep ecological grief (Charlson et al., 2021; Clayton, 2020; Diffey et al., 2022; Pihkala, 2019; Wullenkord & Reese, 2021). A person's ability to cope with the emotions that the crisis induces can influence their capacity to contribute to necessary activism, mitigation or adaptation efforts (Capstick et al., 2022; Hickman, 2020; Van Valkengoed & Steg, 2019). With the recent proliferation of climate/eco-anxiety, a natural way of responding to a collapsing world,

it is evident that young people are struggling (Gunasiri et al., 2022; Pereira & Freire, 2021). This calls for new and innovative ways of thinking and resourcing in order to support coping with the range of climate-related emotions.

Such negative wellbeing experiences may be explained by the fact that the climate crisis, coupled with increasing urbanisation and environmental degradation, is causing a disconnection from nature. Further, adolescence is a time where we see a rapid depletion in young people's relationship to nature, often referred to as 'the teenage dip' (Richardson, 2019, 2023; van Heel et al., 2023). The sentiment of oneness with nature is known as 'nature connectedness.' Richardson (2023) defines nature connectedness as 'a realisation of our shared place in nature, which affects our being – how we experience the world here and now.' This is important as research demonstrates a consistent positive trend between nature connectedness, improved wellbeing outcomes (Hossain et al., 2020; White et al., 2021) and pro-environmental behaviour (PEB) (Mackay & Schmitt, 2019; Martin et al., 2020). These benefits have seen nature connectedness referred to as a basic psychological need. Specifically, feeling strongly connected to nature is associated with a range of cognitive, psychological, and physiological health benefits for young people (Birch et al., 2020; Cassarino et al., 2021; Chawla, 2015; Fyfe-Johnson et al., 2021; Moula et al., 2022; Norwood et al., 2019). Nature-based experiences have been distinguished as a buffer for stress in both rural (Wells & Evans, 2003) and urban (Corraliza et al., 2012) youth and time in nature can also foster resilience when faced with traumatic events (Touloumakos & Barrable, 2020). Moreover, research to date suggests that nature connectedness is one of the key predictors of pro-environmental behaviour and, subsequently, climate change action (Frantz & Mayer, 2014; Ives et al., 2018; Mackay & Schmitt, 2019; Martin et al., 2020; van Heel et al., 2023; Whitburn et al., 2020). Studies on children and young people indicate that this relationship begins before adulthood and is strengthened through sustained contact with nature into adolescence and adulthood (Hahn, 2021; Krettenauer et al., 2020; Sachs et al., 2022). Further, research on nature connectedness and values emphasises that early childhood engagement with nature can shape our value systems, potentially leading to altruistic and biospheric values (Martin & Czellar, 2017; Oh et al., 2021; Rosa et al., 2018). This highlights the importance of supporting youth to develop a strong relationship with the Natural World.

‘A deficit framework’

Recently, there has been widespread debates focusing on young people as disinterested and disconnected from nature with research in the field dominated by reports of how little children spend time in nature (Charles & Louv, 2009; Charles & Wheeler, 2012; Hughes et al., 2019); RSPB, 2013). These debates result in a sentiment of blame being placed on young people rather than addressing the complex cultural/societal dynamics at play. This is an over-simplification of the story causing young people to feel unwarranted guilt which needs to be positioned alongside the global narrative of young people as ‘eco-saviours’ with responsibility placed on youth, who may be unprepared or unsupported by adults, and the active concern which has been demonstrated globally in youth environment and climate strikes (Fisher & Nasrin, 2021; Soler-i-Martí et al., 2024). An emerging argument within the literature identifies the framing of children and young people's relationships with nature around ‘a deficit model’ as the root of this issue (Birch et al., 2020; Louv, 2008). This is part of a larger societal trend toward oversimplifying youth’s relationship with nature. Birch et al., (2020) state that this deficit model typically has three parts: First, a public framing of youth as having a deficit of knowledge about nature (Balmford et al., 2002; Lisewski-Hobson & Watkins, 2019). Secondly, they are seen as caring less about the environment (Reis, 2020) with children and young people feared to feel less responsibility than previous generations. Yet, it is hoped that they will develop pro-environmental behaviours – with little support or change in systemic structures which have caused this issue (Bowers et al., 2021; Chawla, 2015; Richardson, 2019, 2023). Third, the perceived deficit of ‘natural childhoods’ which is often attributed to technological distractions (Louv, 2008). An acceptance of nature deficit disorder risks a problematic framing of young people themselves as needing improvement while deeper structural, cultural and societal dynamics are overlooked. Critics of ‘nature-deficit disorder’ have started to emerge, stating that it creates uniformity and homogeneity among young people's experiences of nature (Birch et al., 2020; Malone, 2016, 2017) and fails to acknowledge the nuances in nature experience. Additionally, much of the research concerning young people’s perceptions of nature is retrospective—research on adults' understanding of nature drawn from their childhoods (Chawla, 2007; van Heel et al., 2023; Fägerstam, 2012). Work with older youth has to some extent, omitted diversity of youth experience by primarily working with university students employing

quantitative measures and failing to explore multi-ethnic, disadvantaged youth experiences. (Liprini & Coetzee, 2017; Shrestha et al., 2021). At a foundational level, more research is needed to understand the layered dimensions of young people's relationship to nature.

Need for interdisciplinary qualitative research

Within the field of Environmental Psychology, there has been debate on how best to address these issues. This conversation has uprooted a pervasive feeling that "psychology is falling short of its potential" in addressing the environmental crisis (Lloyd & Gifford, 2024; Nielsen, Clayton, et al., 2021; Nielsen, Cologna, et al., 2021). With critics challenging the current conceptual, theoretical, and methodological approaches, within Environmental Psychology, and calling for a move 'beyond theory-based, decontextualized approaches' (Nielsen et al., 2024), increased cultural diversity in the field (Tam & Milfont, 2020) and a greater focus on interdisciplinary collaboration (Nielsen et al., 2024; Nielsen, Cologna, et al., 2021). Recently, Lloyd and Gifford, (2024) emphasised the significance of interdisciplinary qualitative research in addressing such criticisms. They suggest that the integration of such methods will answer the call for methodologically-diverse, solutions-focused research, to address the complexity of environmentally-significant behaviour. The predominant focus on quantitative methodology within the discipline underscores this issue (Smith et al., 2021; Bowers et al., 2021; Bratman et al., 2019; Smith et al., 2021). While quantitative methods can provide valuable statistical insights, they often overlook the nuanced and subjective experiences of young people, making them less effective for capturing the complexities of their relationships with nature. Sumner et al. (2020) call attention to the lack of sensitivity to personal perspectives on nature and highlight that sustained qualitative research will help us to conceptualise young peoples' lived experiences of nature. Particularly, the personal, emotional, cultural and symbolic significance of natural environments (Foley & Kistemann, 2015; Smith et al., 2021). Further, there is a lack of interdisciplinary collaboration on the topic (Lloyd & Gifford, 2024; Schusler & Krasny, 2010), where findings drawn from the public health sphere, environmental psychology, and other fields of research are seldom integrated with insights from practitioners who have a wealth of experiential knowledge. Accordingly, the current interdisciplinary/cross-sectoral project incorporates insight from youth workers drawing on a Positive Youth Development (PYD)

perspective (Bowers et al., 2021; Mainella et al., 2011). The PYD approach is particularly relevant given its emphasis on the strengths, potential and differences of young people, rather than focusing on a deficit-model (Bowers et al., 2021; Chawla, 2015). This makes it well-suited for exploring idiosyncratic environmental perceptions. Only when we are equipped with a better understanding of the meaning young people attach to nature can we begin to understand their connection or lack thereof to nature.

The current study

The aim of this study was to qualitatively explore young people's relationship to nature, through the lens of the youth work strength-based approach—Positive Youth Development (PYD). We address the deficit of interdisciplinary qualitative research by collaborating with youth workers and employing a robust methodology to understand – how young people from diverse backgrounds perceive, experience and make sense of nature and what makes them want to protect it. Our guiding research question is: *How does young people's relationship to nature influence their mental health and sentiment of pro-environmental behaviour?* Our approach revolves around the significance of recognising individual differences in relation to human-nature connection. Considering widespread social and health inequalities, we explore different experiences of nature as narrated by young people of different ages, and ethnic/cultural and SES backgrounds – spotlighting the importance of context.

Methods

Design

This exploratory qualitative study used focus groups to examine young people's accounts of their relationship with nature. Focus groups are a particularly effective mechanism of data collection when working with vulnerable groups, e.g. children/young people and can be used to create a safe peer environment while helping to avoid some of the power imbalances in the researcher-participant relationship (Adler et al., 2019). This allowed young people to expand on

how/if this connection affects their mental health and feelings of pro-environmental behaviour. Our study draws on a community-based participatory research (CBPR) approach (Satcher, 2005) to support engagement with a diversity of young people including 'seldom heard' young people with fewer opportunities. CBPR is a collaborative research approach that actively and equitably involves community members in the research process (Baum, 2016; Collins et al., 2018; Fletcher, 2003). This study is part of a larger multi-disciplinary Key Action 2 (KA2) European youth work project, and it was conducted in partnership with a community youth centre in the southeast of Ireland. As is the relational theme in this work, our collaboration with youth workers began through an existing connection with Waterford and South Tipperary Community Youth Service (WSTCYS). The youth workers approached our research team with a potential research question and needs analysis grounded in years of frontline experience. At its core, this reflects the ethos of participatory research—community partners identifying real-world challenges and working with researchers to develop meaningful responses. From here, I visited WSTCYS, or 'Woodstown' as those who know and cherish it refer to it, in a volunteer capacity during a week-long training course (See Figure 4).The youth centre has a particular focus on addressing the needs of young people experiencing marginalisation, disadvantage and social exclusion. Both the youth workers and young people were seen as co-researchers in the research process and shaped the design of this study. Our intersectoral (university, practitioner and community service agency) and interdisciplinary (ecopsychology, environmental/health psychology, environmental educators, forestry conservationists and youth workers) research team enhanced the design of this study by integrating a range of divergent perspectives. Ethics review and approval were provided for this study (Approval references 2023-064).

Figure 4. Woodstown Youth Centre



Participants

Participants were recruited using purposive sampling through the research team's preexisting involvement with the youth centre. This recruitment method allowed for a sample of young participants who represented a range of ethnic, cultural and socioeconomic backgrounds who were availing of the youth service. Recruitment and contact with potential participants was facilitated by our collaborators at the youth centre. During the recruitment process, potential participants were informed that a research study, exploring nature connection, was being conducted and that participation would be voluntary. Those interested in participating were provided with further details in an information sheet and consent/assent forms for participation. Participation in this study was open to young people (children, teenagers and young adults) ranging in age from 12 to 26 years of age – there were no restrictions on gender. Exclusion criteria included being younger than 12 years of age or older than 26 years of age. In the case of participants under the age of 18, informed assent was obtained from participants and informed consent was provided from the parent/guardian.

In total, 21 young people (9 women/girls and 12 men/boys), ranging in age from 12-26, were recruited. An interesting dimension of this project is the variation in the cultural backgrounds of participants. A selection of the young people were recruited during an international youth exchange, organised by the youth centre in collaboration with Erasmus +. Additionally, participants were recruited through the youth centres involvement with Comhairle na nÓg – The Irish Youth Council. 7 were members of Comhairle na nÓg and 14 were young people on the Erasmus + youth exchange. The young people came from an array of different countries and backgrounds. Namely Ireland, Armenia, Czechia, Cyprus, Romania, Scotland and Pakistan. A translator was required for one of the Armenian participants (Hasmig). A fellow Armenian participant (Nazani) acted as translator during the focus group. All participants were given pseudonyms. Information presented in Table 3.

Table 3. Participants by pseudonym, gender, age, country and route to the project. N = 21

Pseudonym	Gender	Age	Country	Route
Saoirse	F	13	Ireland	Comhairle na nÓg (Irish Youth Council)
Habbib	M	19	Pakistan	Erasmus + Youth Exchange
Arshak	M	18	Armenia	Erasmus + Youth Exchange
David	M	16	Cyprus	Erasmus + Youth Exchange

Ruairí	M	17	Ireland	Comhairle na nÓg (Irish Youth Council)
Nazani	F	22	Armenia	Erasmus + Youth Exchange
Lily	F	12	Ireland	Comhairle na nÓg (Irish Youth Council)
Dean	M	19	Ireland	Member of WSTCYS
Aran	M	20	Scotland/ Ireland	Member of WSTCYS
Arev	F	21	Armenia	Erasmus + Youth Exchange
Tamara	F	15	Ireland	Comhairle na nÓg (Irish Youth Council)
Hasmig	M	21	Armenia	Erasmus + Youth Exchange
Eros	M	25	Cyprus	Erasmus + Youth Exchange

Ghazar	M	26	Armenia	Erasmus + Youth Exchange
Safi	F	21	Ireland	Comhairle na nÓg (Irish Youth Council)
Ali	F	15	Ireland	Comhairle na nÓg (Irish Youth Council)
Kyle	M	17	Irish	Member of WSTCYS
Loukas	M	24	Cyprus	Erasmus + Youth Exchange
Conor	M	20	Irish	Member of WSTCYS
Maeve	F	16	Romania/ Ireland	Comhairle na nÓg (Irish Youth Council)
Maahi	F	18	Armenia	Erasmus + Youth Exchange

F = Female; M = Male

Focus Groups

Three separate focus groups were carried out for the purpose of this study. The focus groups were conducted by the primary researcher (First Author), who had no previous contact with the young people or direct ties to the youth centre. Focus groups were audio-recorded. Focus groups were conducted in groups of 6–8 young people, and each focus group lasted for approximately 2 hours. A focus group schedule was developed in line with guidance on conducting focus groups with vulnerable populations (Colin Gibson et al., 2020; Gibson, 2012). The development of the focus group schedule was a collaborative process involving our multidisciplinary team and included piloting the questions on young people to gauge comprehension. All questions were open-ended, phrased in simplistic language and focused on encouraging participants to reflect on their relationship to nature and consider its impact on their wellbeing and attitudes towards (See Appendix II).

Acknowledging the diverse communication styles and needs of youth, participants were given the opportunity to write down their answers to any questions they did not feel like sharing in the group setting. These reflections were shared with the researcher post-focus group. Two languages were spoken within the focus groups – English and Armenian. While English was the primary language used to conduct the focus groups, a translator was required for one of the Armenian participants (Hasmig). A fellow Armenian participant (Nazani) acted as a translator during the focus group. Nazani translated the questions from English into Armenian for Hasmig and then translated Hasmig's answers, given in Armenian, back into English for the researcher. Cognisant of the power dynamics inherent to the translations process, we ensured that Nazani was instructed to give word-for-word translations of Hasmig's answers and allow time for him to reflect and expand on these answers where needed. Both participants knew each other before the Erasmus + exchange. Thus, there was a pre-existing level of trust and rapport. A detailed summary of the schedule can be found in the Supplementary Material (Appendix II).

Photo Speak

Further recognising the diversity of communication styles and needs, we used Photo Speak to facilitate group discussion in each focus group. Photo Speak is a photo-elicitation technique which differs from PhotoVoice as the researcher provides the images rather than the participants taking their own photographs (Shaw, 2021). The foundation of photo-elicitation is the idea of inserting one or more photographs into a research interview (Bigante, 2010; Harper, 2002) to generate verbal discussion (Kyololo et al., 2023). This approach involves participants choosing a photo to describe their answer to a question or perspective on a topic. The official Photo Speak deck used in these focus groups was developed by an Irish organisation 'Partners in Faith.' Photos were provided by the researcher from the Photo Speak deck and placed on the floor, in the centre of the focus group, so participants could walk around and select an image in response to each question (See Fig. 5). This was optional and presented to participants as such. The methodology has been informed by the value of narrative research (Andrews et al., 2013), giving participants ways of communicating events, emotions and experiences through not just speech but also visual media (Tolia-Kelly & Rose, 2012). A multi-modal approach to data collection acknowledges the diversity of young people and how they see the world.

Figure 5. Visual representation of Photo Speak



Data Analysis

Data analysis consisted of a reflexive thematic analysis (TA) and examination of the chosen Photo Speak images. A reflexive thematic analysis approach was identified as the most appropriate analytical method for this study due to its theoretical flexibility and adaptability to multiple contexts (Braun & Clarke, 2006, 2019). This approach offered in-depth, multi-dimensional insight into complex human-nature relationships. TA is a functional method for working within a 'participatory research paradigm' whereby the participants are viewed as collaborators (Braun & Clarke, 2019).

This study followed the six stages outlined by Braun and Clarke for reflexive TA (2006):

1. *Familiarisation*: The interviewing researcher (first author) listened to each audiotape multiple times, noting initial ideas and supporting familiarisation with the data. Interviews were transcribed using an orthographic approach. This process supports the meticulous interaction with the data which allows the researcher to deepen familiarity with the data.
2. *Coding:* An ad hoc data extraction sheet was developed to support analysis (See Supplemental Material). Primary researcher coded data using an inductive latent approach. Each transcript was re-read systematically to identify initial codes, the most basic element of data relevant to the research question (Boyatzis, 1998). This involved reading over initial codes, while simultaneously reading the transcripts, questioning and comparing ideas to identify similarities and/or inconsistencies. The process supported consistency of coding, cross-classification of themes, reflexive thinking and resulted in richer conceptual analysis.
3. *Developing candidate themes:* Meaningful patterns in the codes, relating to the research question, were identified and codes were organized into prospective candidate themes and subthemes. Coding and identification of themes was a collaborative process involving all four authors, consistent with a consensual qualitative research (CQR) analysis (Hill et al., 2005).

4. *Review themes:* Themes were refined and checked for coherence and data within each theme was reviewed for cohesiveness within themes and delineation between themes. Several meetings with all researchers facilitated this process. Considering that variation in TA often occurs at the point of theme development and revision (Hill et al., 2005; Mauthner et al., 1998) subsequent team meetings involved an iterative process of cross-analysis of overarching themes and subthemes. Original transcripts were reviewed to ensure that resulting themes were representative of the data.
5. *Define:* A thematic map of themes and subthemes was developed with theme names officially defined. This process was also conducted collaboratively between researchers until consensus was met.
6. Produce report - All participants are provided with pseudonyms (See Table 1).

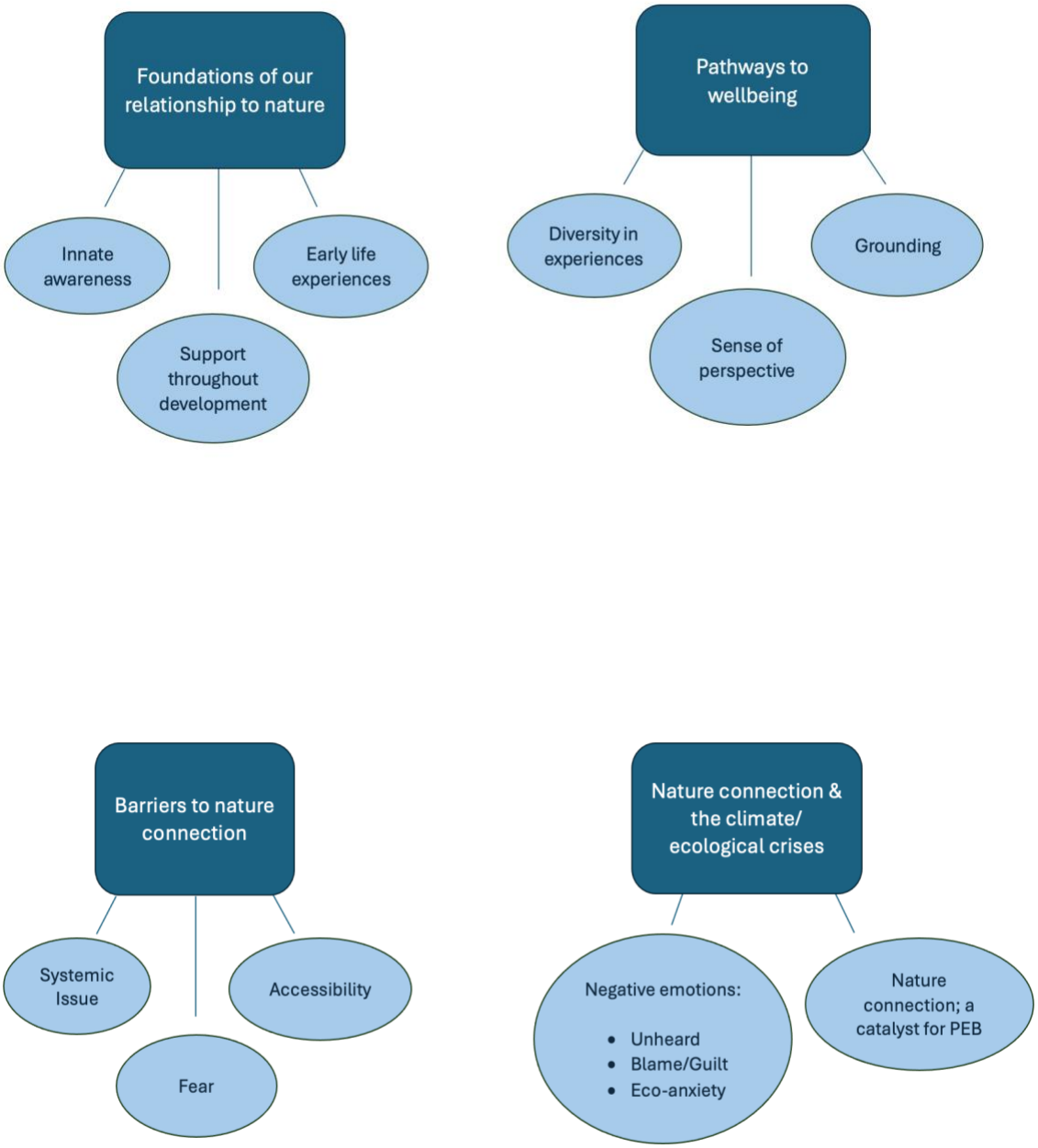
Reflexivity

The authors acknowledge that they have their own relationships with nature, informed by individual experiences and were cognisant of this when designing the study and engaging with the data. Authors practised reflexivity throughout the research process to ensure that their own judgements did not overpower participants' perspectives. The guiding frameworks of CBPR, PYD and the use of Photo Speak allowed participants to share their experiences and supported processes of reflexivity. This research process emphasises that the researchers were also learning from the participants, who challenged and enriched their perspectives on nature connection. The authors also acknowledge that individuals experience nature differently, and what might be empowering for some could be disempowering for others. In what follows, the authors sought to integrate the voices of young people and allow their stories of nature-connection to speak for themselves.

Results

The exploration of young people's relationship to nature and its impact on mental health and pro-environmental behaviour resulted in four overarching themes: 1) the foundations of our relationship to nature; 2) pathways to wellbeing; 3) barriers to nature connection and 4) nature connection in the face of climate and ecological crisis. Each theme has further sub-themes which provide structure to the findings. In this section, themes are outlined with reference to the participant's direct quotations and further exploration of the underlying narratives which highlight subtle nuances contained within each theme. Figure 6 provides a schematic representation of the overarching themes and sub-themes.

Figure 6. Schematic representation of 4 themes and sub-themes



1) The foundations of our relationship to Nature

This theme outlines the beginnings or roots of participants' relationship to nature and explores how this connection evolves over the life course. Participants describe their first experiences in the natural world and expand on the different individuals, structures, and systems that support nature connectedness. The overarching theme is the result of the subtle interaction of three sub-themes which are explored:

Innate awareness

Many of the young people spoke about having an innate bond to the natural world from a young age and the reciprocal relationship between humans and nature. Some of the participants used the word 'connection' to illustrate this intrinsic feeling. Arev described how for her this awareness was present from a very young age:

> "For me, I think we have a connection with nature from the beginning of our lives…It is something that is part of us." (Arev, 21, Armenia)

Participants described how the awareness of this interconnectedness allows them to reflect on their place within the larger ecological context. Tamara explained how her understanding of this has resulted in a recognition of the interdependence between all life on Earth:

> "I think how interconnected and interdependent everything is, like birds depend on trees, we depend on trees, trees depend on us…and it's just kind of like we can't separate it into different things because we all rely on everything." (Tamara, 15, Ireland)

Interestingly, participants' understanding of the symbiotic relationship between humans and nature was often linked to a sense of duty to protect nature, as described by two participants in the following quotes:

> "For me, nature is everything that surrounds us and we are a part of nature and we must care about it. Nature is a very important part of our lives." (Arshak, 18, Armenia)

> "Nature depends on us. It is our home and to protect it gives us a future… It's much more important…It's not only the calmness, it's much more than that. It's bigger, it gives us everything." (Loukas, 24, Cyprus)

This is interesting in terms of young people being innately relational and viewing the World through the lens of reciprocal or interconnected relationships. Further, this provided insight into how this perspective can lead to an awareness of the impact of our behaviour within the wider ecosystem.

In contrast to the intrinsic awareness, felt from a young age, some of the participants spoke about how this understanding manifested later in life. They describe this as a sudden moment of consciousness or recognition that all life is interwoven. Safi describes this moment of awareness which is characterised by awe and followed by a deeper understanding that nature and humans share the trait of aliveness:

> "I don't really think anyone introduces you to nature. I think you just kind of become conscious of it at one point. I think of course you can learn about it in school and in your family and you know that's grass that's a field but it kind of comes one day when you're like wow! This is alive." (Safi, 21, Ireland)

Early life experiences

An important dimension of this theme is the potential for early life experiences to form the foundation for our relationship with nature. Participants emphasise the significance of immersion in nature from a young age and structures such as the family unit, school and specific

programmes as crucial to nature connectedness. For example, Hasmig who grew up in a rural village in Armenia, directly links this to the cultivation of his connection to nature:

> "He lives in a village and because of that he has always been connected to nature. There wasn't a particular person who said this is nature, he just grew up with it and had that consciousness." (Hasmig, 21, Armenia, translated by Nanzini)

Participants emphasised the crucial role of family support and encouragement in shaping their early connection to nature. Many directly linked their bond with nature to childhood experiences facilitated by family, often forming vivid, emotional core memories:

> "I think nature was part of my life from the beginning. For example, I have a grandma and family who live in a small village in Cyprus and I was always surrounded by nature… I always remember the nice big park where I used to play as a child so it was always part of my life… It was an early connection to nature and that was the foundation." (Eros, 25, Cyprus)

Immersive interactions with nature, defined by contact with and affinity for animals and plants, is also emphasised as a significant part of these early experiences in nature. Maeve recalls the combination of support from their family and interaction with flora/fauna as pivotal memories :

> "I'd say a lot of it was family. My dad is from a very small village in Romania so it's very rural and every summer I'd be out there picking vegetables, checking on the hens every day, chopping the wood and my family were always just in the garden…We just had so much time outdoors…I grew up absolutely loving animals. That was a big thing for me." (Maeve, 16, Romania/Ireland)

Many of the participants highlight a specific family member who introduced them to nature. They attributed their connection to nature with encouragement from this individual. For example, Nazini (22, Armenia) says "My grandfather used to go for hikes and he took me a lot when I was 7 or 6 years old." Additionally, Ali (15, Ireland) links her relationship to nature to: "just being

outside when I was younger with my dad. We would go on walks and he would teach me about the flowers."

Sustained support throughout development

This sub-theme emphasises the need for ongoing engagement with nature through adolescence and adulthood at a time where their relationship to nature typically comes under pressure. The significance of external support, such as the school curriculum, programmes/initiatives and the power of youth work, to reinforce nature connectedness is crucial. Tamara alludes to the dynamic essence of her relationship to nature and how it is dependent on continual engagement and support throughout the different developmental stages:

> **"**I think it (nature connection) kind of developed at different stages… through primary school – like my primary school was a Green Flag primary school so there was a heavy emphasis on recycling and being kind to nature and then it has just developed over the years. Even recently with Comhairle (youth council) I think I've been the most connected to nature I have ever been…So like your knowledge of it continually develops over your life." (Tamara, 15, Ireland)

Some of the participants mentioned how involvement in the local youth centre supported them to cultivate a relationship to nature. These young people identify specific youth workers who introduced them to nature and ignited the subsequent affinity. This speaks to the power of one person to make a key impact on a young person's life and act as the catalyst for a lifetime of nature connectedness. Kyle (17, Ireland) spoke about feeling "void towards nature" in his early years. He recalled the significance of two youth workers introducing him to nature through visits to local natural environments. Similarly, Conor identified one youth worker as the specific individual who supported the development of his relationship to nature later in life:

> "Darren (youth worker) would have been one of the people who really encouraged me to spend time in nature." (Conor, 20, Ireland)

2) Pathways to Wellbeing

Diversity in experiences

This theme highlights the significance of individual differences when considering the links between nature connection and wellbeing. Our analysis revealed that there is a diverse range of mechanisms leading to improved wellbeing which are inherently specific to the individual and their context. For example, for Aran nature contact is all about adrenaline and seeking adventure. Accordingly, this leads to feelings of vitality, zest and freedom:

> "Nature for me is a bit of an adrenaline rush…I live my life on the edge – if it's dangerous I like it. When you get the thrill and the rush you can't leave it off. I feel free. Basically, being out in nature helps to let go of all of the worries of life…it makes me feel more alive" (Aran, 20, Scotland/Ireland)

For others, nature offers an entirely different experience, one of calm, reflection, and peace, as demonstrated by Habib and Nazani:

> "It's like a calm place to clear your mind to relax…It helps me calm down and reflect" (Habib, 19, Pakistan)

> "For me nature is mainly connecting with yourself. It gives you the space to go inwards, reflect and connect with yourself." (Nazani, 22, Armenia)

Conversely, Kyle's experience highlights that not everyone feels connected or at ease in nature, further demonstrating the complexity of individual reactions to the natural world. He explains how he can't relax in nature which leads to feelings of apathy towards the natural world:

> "I feel like I can't relax in nature and I've tried sitting down and being still but I can't….That's probably why I don't care about nature as much because it's just there." (Kyle, 17, Ireland)

Nature as a Grounding Experience

Participants spoke about how spending time in nature allows them to notice the intricate details of the natural world, drawing their attention to the present moment while simultaneously distracting them from the worries of everyday life. They expanded on this to explain how this allows them to be more mindful of their internal world, grappling with problems, processing emotions and ultimately leading to a sense of calm:

> "Nature is feeling at peace. So in nature I feel calm and like I can be alone with my thoughts and find a lot of ways to solve my problems and reflect. I think when I have a lot of questions and problems nature helps me breathe and process it all." (Maahi, 18, Armenia)

Both Nazani and Sarah use Photo Speak images to symbolise this sense of calm and describe how they envision nature as connection to the self:

> "So I chose this picture (Figure 7) because I think there is a huge sense of connection and for me nature means connection. It's not only us connecting with nature and whatever surrounds us but it's the connection within ourselves… So I think the environment lets you disconnect and reconnect." (Nazani, 22, Armenia)



Figure 7. Photo Speak image selected by Nazani. Images from official Photo Speak deck provided by 'Partners in Faith' Organisation based in Ireland.

> “I think nature feels like this picture (Figure 8), just the boat on its own because to me it looks serene and just peaceful... I feel as if I was the boat, just nobody else around me, just me with my own thoughts in nature – I think that’s what it’s like to me I just feel at peace.” (Saoirse, 13 Ireland)

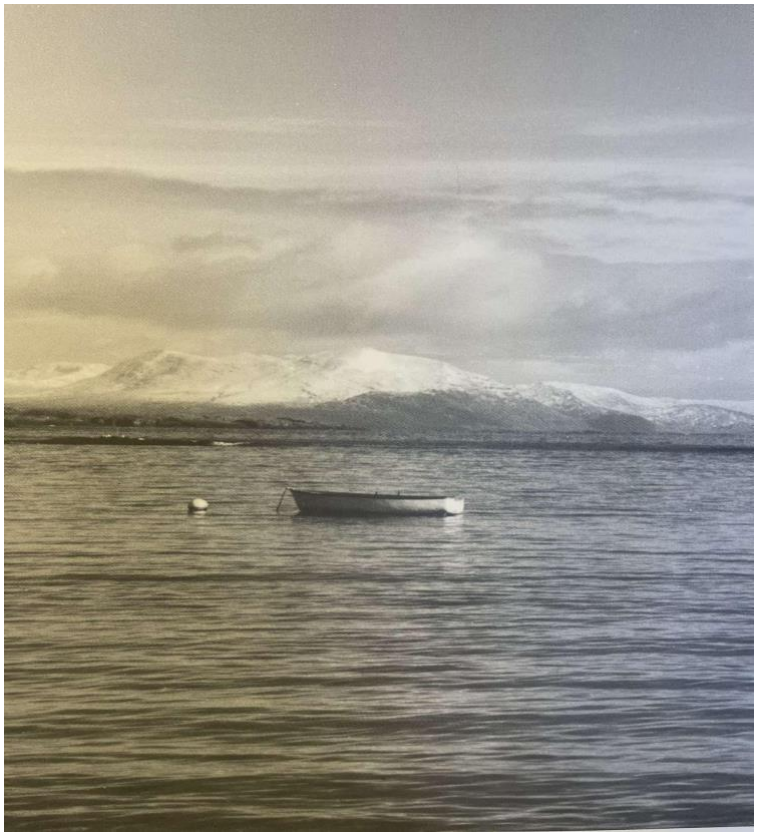


Fig. 8. Photo Speak image selected by Saoirse. Images provided from official Photo Speak deck provided by ‘Partners in Faith’ Organisation based in Ireland.

Here we see how the Photo Speak images act as a spark to conversation supporting participants to explain their feelings in nature by anchoring them to an image.

Sense of perspective

The final element of this theme is the sense of perspective that participants experience in nature. This sub-theme was pervasive across focus groups and captured participants' sense of awe in the face of the vastness of the natural world. Reference was made to participants'

comparative size in relation to nature. Maahi explains how, when immersed in nature she feels small which results in feeling like she is part of a greater living system:

> "I chose this picture (Figure 9) because when I go out in nature it reminds me of how tiny I am and nature is so big. So if you see in the picture nature is bigger than the kid and I feel tiny and like I have the strength of nature. It helps me to realise how big this world is and puts things in place. It helps to process other problems and get some insight."
> (Maahi, 18, Armenia



Fig. 9. Photo Speak image selected by Maahi. Images provided from official Photo Speak deck provided by 'Partners in Faith' Organisation based in Ireland.

Interestingly, participants often reflected on this experience of reduced importance, in comparison to nature, as having a positive impact on their mental health. Maeve uses the metaphor of the expansive sky and ocean to illustrate the feelings of awe, wonder, gratitude and tranquillity she feels when witnessing these elements of nature:

> " Like even leaving the shop I look up at the sky and I swear I probably look like that and even when I'm staring out at the ocean. It's like you have stars in your eyes, you 're just captivated by it." (Maeve, 16, Ireland/Romania)

Lastly, the sense of gratitude following immersion in nature is a significant element of this sub-theme. This is linked to an awareness that human life is inextricably interconnected with nature – which relates to our first theme. Arev reflects on how the sense of perspective, experienced in nature, can lead to feelings of vitality and a reminder of an appreciation for life:

> "I feel recharged and relaxed, like everything around you continually grows and is alive reminding me that I'm alive." (Arev, 21, Armenia)

3) Barriers to Nature Connection

Participants provided insight into the range of psychological and/or structural/systemic factors that hinder their relationship to nature, with evident variations in experiences across different cultural contexts. This theme includes three sub themes: a systemic issue – the structure of modern life; accessibility; and fear.

A systemic issue – the structure of modern life

Many young people spoke about the structure of modern life as a systemic barrier to nature connectedness. Independent of country of residence, participants highlighted a lack of time as a barrier to engagement with nature as well as a failure to prioritise immersive nature experiences. This sentiment of a deficit of time, and the resulting sense of urgency, was pervasive across young people's testaments. Safi encapsulates this feeling:

> "I think the way our systems are set up, we leave at 9 am and get back when it's dark so there is no time to actually be in nature…It's not really built into our daily systems." (Safi, 21, Ireland)

Participants went on to describe a society obsessed with ‘growth’ and ‘progress’ which leaves little room for slowing down and tapping into meaningful experiences that serve as a reminder of our interdependence with nature. Tamara reflects on the past, through the medium of poetry, contrasting it to the individualistic and disconnected present world which is dominated by progress for progress's sake. She alludes to the need for a wider paradigm shift which alters our social norms and narratives around priorities:

> “I think at the end of the day it all links back to Capitalism and this sort of individualism and growth and we need to take a step back and slow down and realise we can incorporate nature more often … Like I’m studying Yeats at the moment in English and you can see there was such a strong emphasis on nature and it being beautiful and I think Ireland has kind of lost that connection to nature. Like we’re called the Emerald Isle but you go to Dublin or any city or town and it’s just grey. ” (Tamara, 15, Ireland)

Nazini highlights how a lack of work-life balance is the key determinant of diminished nature connection:

> “It’s like work comes first, study comes first, everything comes first before our own wellbeing…99% of the time I find myself focusing on things for work and university and most of the time I neglect my peace… I think that is the main reason that stops me spending time in nature.” (Nazani, 22, Armenia)

These reflections reveal how the systems shaping modern life—whether through education, work, or societal expectations—create a significant gap between young people and nature, which requires structural changes.

Accessibility

Ghazar used the symbolic image of a wall (Figure 10) to personify the growing disconnection from the natural world resulting from urbanisation and inequitable urban planning. This is linked to our second subtheme which focuses on issues around accessibility and equitable access to nature:

> "The real nature for me is far from my city and I need to take a 2 hour train to get there… And that makes it harder for me. Maybe it's because of our lifestyle in Yerevan…there's not much nature and people are getting much more urbanised and going far from the nature…and that's so sad because… it's hard to access it in the city." (Ghazar, 26, Armenia)



Fig. 10. Photo Speak image selected by Ghazar. Images provided from official Photo Speak deck provided by 'Partners in Faith' Organisation based in Ireland.

When asked about accessing nature, Loukas (24, Cyprus) stated that "It's too expensive." Similarly, Arshak (18, Armenia) mentioned that the proximity and cost of reaching nature is a barrier for him: "I can't go back to my village and see nature. If you want to visit beautiful nature you have to drive 1 or 2 hours and it costs money." Here we see how socio-economic inequalities can exacerbate nature disconnect:

Throughout participants' accounts, safety and security are recognised as defining features of an accessible environment. Some participants explained that they are within close proximity to nature but that it is not necessarily an environment they feel safe in. Importantly, they underscore

the fact that they feel unsafe on the journey to reach such natural spaces. Tamara referenced the danger of busy roads and a car-centric society:

> "I was hit by a car with my dog when I was trying to walk to the nature park and the car just wouldn't slow down…and like even to get to other places that have nature you're dependent on a car…So I think that the infrastructure based around nature is just really inaccessible." (Tamara, 15, Ireland)

Similarly, Ali alluded to the fact that perceived safety is a key concern of hers while trying to access nature:

> "I have some (nature) near me but if I want to walk I have to go through built up estates…and I don't really feel safe." (Ali, 15, Ireland)

We see how issues around accessibility, safety and fear of the unknown converge for someone like Eros who has a mobility disability that impairs his walking ability:

> "To be honest for me most of the time it's the fear of the unknown and the *accessibility* of the place you know because of my disability. I start to think what if it's not accessible or easy for me to walk." (Eros, 25, Cyprus)

Eros mentioned that focus groups, like the present one, can provide insight into the complex barriers which prevent people with disabilities from interacting with nature. He highlights that such research would support equitable access to nature while emphasizing that nature's wellbeing must be kept as a priority within such conversations.

Fear of…

The final barrier to nature connection is fear which links to previous concerns over safety. Fear in natural environments can manifest itself in diverse ways and there were a range of varied experiences across participants' accounts. Negative experiences in nature can heighten such

fears. Participants often spoke about nature 'demanding respect' and 'the power of nature' which can be a source of fear:

> " Nature can be powerful; humans can get hurt, they can die." (Loukas, 24, Cyprus)

> "I feel like if ever I'm in a field with a particularly big mammal like a cow… it feels overbearing as if at any point this thing could completely tear through me but also in that sense it has this sort of beauty to it like this is something that you need to respect" (Ruairí, 17, Ireland)

Fear of the unknown was a significant aspect of this subtheme. Many of the young people have grown up in urban settings. This lack of familiarity can result in unease, in the face of the unknown, whereby not having many positive experiences in nature can lead to apprehensiveness to engage. This can potentially manifest itself as apathy towards nature. For example, Kyle (17, Ireland) explained that he feels "empty towards nature" and doesn't have any strong feelings having not "grown up in nature." Tamara described how her urban upbringing and subsequent lack of exposure to nature may have resulted in a fear of spiders:

> "I think spiders are a huge thing for me because logically I see them and I understand ya you play a role in the environment…but like I see one in the field or in my bedroom and I'm immediately taken aback. I think it's just some sort of aversion to them…I think part of it is because I've grown up in urban areas my entire life so it's a lack of exposure to it that's kind of like causing it." (Tamara, 15, Ireland)

She then went on to speak about her father's fear of spiders and various instances where she has witnessed his unease. This links to another aspect of this sub-theme which is inherited parental fear. This dimension speaks to the social norms and narratives we can absorb during our development. Sentiments such as 'nature is dangerous' or 'nature isn't my place' can be adopted throughout childhood and adolescence. Aran explains how his mother's fear of nature and tendency to worry is a barrier:

> **“**For me it’s my mum she is the ultimate worrier – she worries constantly about me. If I’m going anywhere she’s always thinking about the worst-case scenario. Anything bad that could happen she thinks it’ll happen. She doesn’t see nature as a safe space.” (Aran, 20, Scotland/Ireland)

4) Nature connection in the face of climate and ecological crisis

The final theme explores the links between nature connection and environmental stewardship. This theme consists of two sub-themes: negative emotions; and nature connection, a catalyst for pro-environmental behaviour.

Negative emotions

Many young people spoke about the diversity of negative emotions they experience in response to the climate and ecological crises. Participants report feeling ‘unheard’ or ‘not listened to’ in conversations around the climate crisis. They describe having a tokenistic say on matters that will ultimately go on to shape their lives. For example, both Maeve and Ali reflect on these feelings of being ignored by those in positions of power:

> “I know the government has all these summits now but from what we’ve seen it feels more bark and no bite like nothing ever seems to be put into practice. They say they’ll do that and this but where is it? They have all this power but where is it going and where can we actually see this change in the real world?” (Maeve, 16, Romania/Ireland)

> “We had a talk with an MEP (Member of European Parliament) in School and I asked her a question and she completely skirted around it and avoided it. It feels like they don’t care what we have to say” (Ali, 15, Ireland)

Participants also expressed feeling a lot of unwarranted blame and guilt as individuals – when in reality they feel that the crisis is the result of a broken system. They assert that there has been a

manipulation of the individuals' role, in addressing the climate crisis, to divert away from the actual systemic cause. Ruairí explains how he is highly cautious of narratives that shift the blame onto the individual instead of systems and corporations:

> "I can't really divert my eyes away from the fact that it is a Capitalist problem. That there is a system in place that allows these companies to exploit all of the environmental resources, they put all the guilt on us…I think that we all have a role to play but the role we have to play has been manipulated.." (Ruairí, 17, Ireland)

Lastly, participants communicate a sentiment of pervasive eco-anxiety; characterised by feelings of helplessness and hopelessness which ultimately leads to deep overwhelm in the face of the crisis. Kyle (17, Ireland) summarises this sense of panic in relation to a fatalistic lack of time: "There's too much time wasted like we should have started years ago but we didn't and I feel like there's not enough time." Participants explained how the overload of information can lead to overstimulation amplifying distress. Tamara speaks about this experience of overwhelm which results in what she refers to as 'shut down':

> "Personally, I do have a lot of climate anxiety like anytime I see a tweet about it or it spoken about in the news my anxiety spikes and I freak out about it…I think for me when I see news stories I do just shut down and I have a lot of environmental terminology muted on twitter because if I see it I'll just spiral…It also does make you feel hopeless." (Tamara, 15, Ireland)

Similarly, Maeve highlights how the oversaturation of information can lead to eco-anxiety and touches on the influential role of individual differences in relation to how we cope with the influx of information:

> "But you almost don't want it to play on your mind all the time because it gives you anxiety. The anxiety can spike out of nowhere because we have a lot of information thrown at us constantly…and it's very dependent on how a person deals with that and processes that information." (Maeve,16, Romania/Ireland)

Nature connection; a catalyst for pro-environmental behaviour

The final sub-theme revolves around the potential for nature connection to act as a powerful catalyst for pro-environmental behaviour (PEB). Participant's accounts highlight how active engagement and immersion in nature can tap into biospheric values by evoking an intrinsic urge to protect the natural world. We explored this innate feeling in the first theme, here we expand on its links to PEB. Additionally, in the second theme we outlined pathways to wellbeing experienced through nature connection. Here, we suggest that the specific pathways of gratitude and a sense of perspective are unique routes to PEB. Ruairí explained how connecting with nature and experiencing the many benefits, derived from this connection, leads to a powerful sense of gratitude and urge to protect:

> "When I'm in nature I gain an appreciation… – I see this is what we want to protect and rightly so because I'm in awe of it. It's the only place really where I can feel truly free… I think it definitely encourages that behaviour to protect it when you're out there experiencing it." (Ruairí, 17, Ireland)

Linked to the potential for nature connection to evoke innate and deep-rooted sentiments of PEB, Ruairí referred to a 'dormant' feeling inside all of us that our busy lifestyles prevent us from tapping into:

> "Nature brings a sort of dormant feeling inside of us that we can't access because we're constantly busy ... and there is that dormant feeling inside of us inherently to protect the environment… and when we're in that environment it spurs us on a lot easier than if we're not."

Participants expanded on this to explain how witnessing environmental degradation first-hand can lead to consciousness about the urgency of the crisis:

> "You could be at the beach and you might see a seagull picking up a piece of plastic and you think to yourself well that plastic shouldn't be there for the seagull to pick up so I

> think seeing things first-hand makes you see that something has to be done." (Sarah, 15, Ireland)

Here we see how feeling strongly connected to nature and noticing its diminished state can lead to an awareness and sense of duty to restore, conserve and protect.

Lastly, it is important to emphasise that nature connection does not automatically translate to environmental action. There are a range of individual differences and contextual factors which are highly influential here. For example, for Safi nature is a place of refuge where she can escape omnipresent narratives on the climate crisis. She spoke about the need to compartmentalise and keep her relationship to nature separate from thoughts of the climate crisis:

> "No, because I try to separate those feelings because nature makes me happy and global warming makes me sad and so I don't want to combine them.
> (Safi, 21, Ireland)

Further, this may call attention to the protective impact of nature connection as a means of healthy escapism while grappling with an omnipresent global crisis. In essence, our relationship with nature may provide a safe space to decompress and detach from overwhelming emotions, coming back with a renewed sense of vitality and hope.

Discussion

This study aimed to understand how young people's relationship with nature affects their mental health and attitudes towards pro-environmental behaviour. We qualitatively explored young people's environmental perceptions drawing on Community-based Participatory Research and a Positive Youth Development (PYD) perspective. The discussion is organised below, reflecting on how our findings might respond to matters of youth mental health and climate action. Recommendations for research, practice and policy are discussed:

Summary of findings

Findings provided insight into young people's unique perspective on nature connectedness; centred around relationality. Participants demonstrated a more relational understanding of nature, explaining how they feel an intrinsic connection towards the natural world and an understanding of the interconnection between personal and planetary wellbeing. This innate connection is bolstered by early experiences and continual contact throughout their development. The influence of the family unit was crucial here with family members playing a pivotal role in encouraging engagement and allowing young people the autonomy to explore nature. This reinforces previous research highlighting the importance of such support in both laying the foundation for nature connectedness and in forming value systems which inform environmental stewardship (Van Heel et al., 2023; Beery et al., 2020; Stanley et al., 2018; Oh et al., 2021). Our findings speak to ongoing conversation spotlighting equity issues around nature connection (White et al., 2023; Ibes et al., 2021). During their development, many young people do not have opportunities to spend time in nature due to the complex interplay of social, political, historical and environmental injustices. For these individuals, support throughout development, in the form of specific initiatives and programmes delivered through formal and informal education (i.e. targeted youth work programmes) is crucial. Youth work can have a powerful impact by supporting the development of nature connectedness later in life. Whereby, a youth worker can act as a mediator between the young person and nature – introducing them to the natural world and showing them that this is 'their' space too.

Many participants explained how engagement with nature has a grounding effect, supporting emotional regulation; by anchoring them in the present moment, providing them the space to reflect and process their emotions. This relates to frameworks of restoration and stress reduction (Ulrich et al., 2023) outlining how nature provides an emotional sanctuary or place of refuge from the stress of day-to-day life. However, the potential for this pathway to buffer against anxiety induced by the climate crisis is yet to be fully realised. This speaks to research from the COVID-19 pandemic which emphasised nature connection as an integral buffer to some of the psychological distress experienced globally during this time (Labib et al., 2022; Jackson et al., 2021). Essentially, nature connectedness may act as a support, facilitating emotional regulation, and allowing individuals to process the range of emotions evoked by the climate crisis. Moreover, some young people explained how they feel a deep sense of connection/community while in natural environments. This further reinforces the ability of nature connectedness to support society – with the importance of community, intergenerational collaboration and a unified response cited as some of the crucial needs in addressing the climate crisis (Diffey et al., 2022; Haworth et al., 2022). This is also interesting in light of White et al., (2023) theory of Nature-based Biopsychosocial Resilience (NBRT) which suggests that nature-based social contact can improve psychological wellbeing by boosting social-ecological resilience.

Our findings highlight a range of external, systemic, and psychological barriers that limit the ability to develop a strong relationship to nature. For example, inequitable urban planning, racial segregation, marginalisation and economic disadvantage all impede nature connection (Birch et al., 2020; Ibes et al., 2021). For many, accessibility issues are widespread. Numerous participants highlighted concerns around the availability, convenience, and ‘affordability’ of nature. This alludes to the commodification of nature within current society. Whereby, nature connection is reserved for certain privileged groups rather than seen as a basic human right and need (Daly et al., 2024; Rousell et al., 2024). Further, young people's accounts revealed the layered nature of accessibility, particularly, the dimension of perceived safety and inherent sex/gender differences. Some young female participants stated that they have access to nature but don't feel safe visiting such environments. This highlights the need to explore gender differences to mitigate potential equity issues (Cassarino et al., 2021; Navarrete-Hernandez et al., 2021; Rišová & Madajová, 2020). Recently, Bornioli et al., (2024) have explored this topic by identifying various gender-related and certain sex-related factors which can affect aspects of person-greenspaces

interactions. Linked to this, fear of the unknown was referenced by participants as a barrier. Partially due to urbanised childhoods, nature is an unfamiliar environment for many young people which leads to a reluctance to engage and potential apathy towards nature (Shekari et al., 2024; Beery et al., 2020; Oh et al., 2021). In recent decades, we have seen a rise in extra surveillance on children due to stranger danger campaigns and a growing concern over safety (Francis et al., 2017). This has resulted in a movement indoors and away from nature (Beery et al., 2023). Furthermore, the media's frequent portrayal of nature as something rare/unusual, and sometimes distressing, can lead to both intrinsic fear and a feeling of being 'other' than nature which is exacerbated by urban lifestyles and a lack of contact (Freeman & Jarvis, 2013). This is also rooted in a wider cultural shift away from nature (Hickel, 2020; Richardson, 2023). Many participants alluded to a lack of time and prioritisation of nature connection within our current lifestyles which spotlights a deeper systemic issue whereby nature connection is not valued by society.

Findings reveal the diversity of emotions that young people are experiencing in response to the climate crisis – all culminating in a pervasive feeling of overwhelm. Our analysis highlights that responses and coping mechanisms are linked to the young person's individual differences, specific context and feelings of nature connectedness. Moreover, some participants reported a need to compartmentalise, separating their relationship with nature from the environmental crisis. This supports research on self-protective strategies in response to the threat of climate change (Wullenkord & Reese, 2021) and underscores the importance of understanding such mechanisms and the conditions under which they arise to support people to cope proactively, maintain psychological health and work towards mitigating the crisis (Charlson et al., 2021; Clayton, 2020; Diffey et al., 2022; Pihkala, 2019; Van Valkengoed & Steg, 2019). Interestingly, nature connection may provide a form of healthy escapism for youth grappling with varied climate-related emotions and deep overwhelm – by allowing them to draw on this relationship, take refuge in nature and return with a renewed sense of vitality, motivation and hope. This suggests that interventions to support youth in coping and taking action should be supported by research which is sensitive to individual and contextual factors and programmes designed to promote nature connection.

Lastly, findings emphasise the potential for nature connectedness to be a powerful catalyst for pro-environmental behaviour. Participants' accounts revealed that having a strong

relationship with nature can encourage necessary activism, mitigation and adaptation behaviours by tapping into innate biospheric values and laying the foundation for sustained environmental stewardship. This supports growing research outlining that nature connectedness is one of the strongest predictors of PEB (Barragan-Jason et al., 2021; Shekari et al., 2024; van Heel et al., 2023), and points to a potential 'feedback loop' whereby engaging in pro-nature behaviours may connect people to nature more strongly which in turn fuels PEB (Richardson et al., 2020). Recently, the Irish government held its first Children and Young People's Assembly on Biodiversity Loss (2023), whose findings fed into the concurrent Citizens' Assembly on Biodiversity Loss. Many of the children who participated in the assembly initially expressed having feelings of climate/eco-anxiety; however, having participated in developing the recommendations to the government and their 58 Calls to Action, they reported more positive attitudes linked with "having done something", improvements in 'nature connectedness' and a renewed sense of hope. This speaks to the potential feedback loop. However, it is important to note that our findings are based on what the young people said they felt or thought about, but not necessarily what they said they ∗will∗ do. Thus, it captures the intention to engage in PEB rather than action. Future research should explore tangible action taken in terms of PEB and its correlates to nature connection. Of particular novel interest is our finding that the 'sense of perspective' that nature connectedness evokes, specifically feelings of gratitude and a sense of 'oneness' with nature, is a unique pathway leading to PEB. Whereby connecting with nature can shift us out of an egocentric perspective, eliciting feelings of awe, respect, unity and a sense of duty, which can form the basis for pro-nature behaviours. Participants suggested that feeling connected to nature was more than a relationship with nature, rather, they communicated that they were 'part of nature.' This emphasises the importance of connectedness with nature beyond simply having contact with nature but rather to the point of integration of nature into the self-concept (Schultz, 2002), and the need to focus on the quality of our relationship i.e. 'moments rather than minutes' in nature (Richardson, 2023).

Implications for future research

More research is needed to understand the full conceptualisation of young people's relationship to nature. Particularly, focusing on individual differences and contextual factors which impact

nature connectedness. The predominance of WEIRD cultures—Western, Educated, Industrialised, Rich and Democratic, within this research field is problematic. Much of the research published on the human-nature relationship is carried out in high-income countries where, habitually, the natural world presents few challenges and threats (Birch et al., 2020; Ibes et al., 2021; White et al., 2020). Thus, findings and subsequent policies are influenced by the worldviews of the Global North which privileges a certain perspective on nature connection. Additionally, this has concerning implications for research on climate change, since the crisis is rooted in the economic systems, lifestyles, and ideologies of these cultures (Kühn & Bobeth, 2022; Atwoli et al., 2022). This highlights the need for studies on nature connectedness in low-middle income nations where there may be stark cultural differences and needs. We call for research in specific regions such as rapidly urbanising African and Asian countries (Vanaken & Danckaerts, 2018), the Middle East and Latin America (White et al., 2020). These regions are disproportionately affected by the climate crisis (Diffey et al., 2022; Hickman, 2020) and could stand to benefit from evidence-based interventions to support personal and planetary wellbeing. Our findings emphasise how individual differences, such as cultural context, impact our relationship to nature underscoring the necessity to explore varied experiences and narratives. Further, we call attention to the value of focusing on specific population groups, such as Indigenous peoples and youth (Batterham et al., 2022; Redvers et al., 2024). Emerging evidence suggests that an understanding of Indigenous knowledge and culture, more widely, could assist in the transformation of worldviews needed for a sustainable future (Niigaaniin & MacNeil 2022; Kimmerer, 2013).

Research should aim to understand how youth from culturally and economically diverse backgrounds perceive, experience and make sense of nature to conceptualise their ability to cope with and willingness to take action in the face of the climate crisis (Barragan-Jason et al., 2022). While these perceptions are context-specific, they can provide insight into potential routes to nature connectedness and climate action. Our findings shed particular light on the need to explore the mechanisms promoting nature connectedness among such populations and the varied barriers to nature connection. Namely, negative experiences such as fear, equity issues and the varied rationale for low levels of nature connectedness (White et al., 2020). Qualitative methodologies have a great deal to add to our understanding here by bringing nuanced

understanding (Edwards, 2022), generating theory where none exists (Montesanti et al., 2021), and moving beyond deductive de-contextualised research (Lloyd & Gifford, 2024; Nielsen et al., 2024). Qualitative inquiry also offers a more culturally sensitive way to conduct environmental psychology which can help to empower and provide real-world benefits to marginalised communities (Montesanti et al., 2021; Haugestad et al., 2021). We suggest that adopting a phenomenological lens could be particularly relevant to this area of research. Phenomenology recognises humans as embedded within the wider natural world. This perspective moves away from the goal-orientated pursuit of scientific objectivity and focuses on a holistic worldview rejecting the separation between humans and nature (Merleau-Ponty, 1962; Richardson, 2023). Thus, inquiry through this lens may support an understanding of how we can encourage the necessary paradigm shift, where we see ourselves as part of nature, which is central to a sustainable future (Stevens, 2010; Rabinowitz et al., 2018). n our study, one of the participants drew a powerful image representing their attitude to nature. This finding underscores the importance of enabling creative, non-verbal forms of expression to facilitate a diversity of communication styles/needs and highlight the complex and personal relationships individuals have with nature.

Implications for practice and policy

This study provides important direction for local initiatives and broader policies:

1. Given the importance of nature connectedness for youth mental health and pro-environmental behaviour, nature-based interventions (NBIs) aimed at fostering this trait amongst young people should be prioritised. While traditional interventions focus on education and environmental knowledge (Barragan-Jason et al., 2021), research shows a weak link between environmental knowledge and behaviour (Otto & Pensini, 2017; Schultz and Tabanico, 2007; Barrable and Booth, 2020). This indicates that focusing solely on education is not the best route to ecological behaviour. Our work suggests that interventions should focus on immersive experiences and active engagement with nature; characterised by observation, noticing, exploration and mindfulness. This could foster a deeper relationship and help to close the ‘connectedness-action gap’ (Barbett, 2021;

Richardson, 2023; Russell et al., 2017). This approach addresses the root cause—disconnection from nature—rather than simply a lack of knowledge.

2. Interdisciplinary approaches to intervention design and the incorporation of community-led, participatory and co-design processes is crucial. Drawing on the expertise of practitioners (teachers, environmental educators, outdoor facilitators, environmental psychologists, youth-workers etc.) who have a wealth of experiential knowledge will support the integration of nature connectedness into mainstream society. Further, this multi-sector approach will help to actively involve minority/marginalised groups in the co-creation process; supporting nature connectedness within populations who are often classified as 'low-users' of nature. This would play a key role in addressing health disparities and will stimulate wider policy adaptations.
3. Many youth are disproportionately excluded from easily accessible, high-quality and safe health-promoting nature opportunities which has resulted in a critical social equity issue. Concerns around the economic, spatial and psychological (perceived safety) barriers to accessing nature are prevalent. Policymakers and practitioners must focus on bridging equity gaps to reduce existing health inequalities. We call for governmental policies that aim to protect and enhance the quality of natural spaces, and support interventions aimed at reconnection, particularly in low SES/marginalised communities. To facilitate this, better nature conservation, rewilding, integration of biodiverse habitats into urban environments and practical design approaches are required to ensure that everyone has the chance to develop a relationship to nature. For such populations, youth work can be highly influential in laying the foundations for psychological health and pro-nature values. This should be reflected in governmental funding for such sectors.
4. The young people's voices heard in this research underscore the need for systemic change/ a new zeitgeist – "A change in the way we see the World and our place within it" (Tamara, 15). Children and young people's unique understanding of the World through lenses which are innately relational is a key component of this. Understanding their perspective of the intrinsic interconnection between human and environmental health is crucial. Policy can support this shift by adopting a One Health or ecocentric perspective, which similarly recognises the interconnection between personal and planetary wellbeing (Richardson et al., 2017; Rabinowitz et al., 2018; Stevens, 2010; Lerner & Berg, 2017).

Further, this would encourage a movement away from the widespread extractivism we see across public policy; where nature is often framed as a health 'resource' to be used for human benefit rather than recognising the reciprocal relationship. It is promising to see global institutions, such as the UN, adopting a One Health perspective and focusing on reconnection (UN, 2021). However, central to this is local and wider policy developments – prioritising nature connectedness by allowing time and space for connection and building this into our daily systems (educational, political, social and cultural). Further, interventions should incorporate philosophies which have a deep interface with this ecocentric perspective e.g. Ecology, Indigenous knowledge and the Buddhist concept of Dharma (Khoshoo, 1999; Niigaaniin & MacNeill, 2022; Wall Kimmerer, 2013). This paradigm shift is key to uniting human and nature's wellbeing, an essential step towards a sustainable future.

5. Finally, meaningful intergenerational collaboration is crucial to addressing both the mental health and climate crises (Diffey et al., 2022; Walker & van Holstein, 2024). The movement towards 'post-paternalism'– beyond young people having a tokenistic say and towards incorporating their insight into policy and supporting them to contribute fully to addressing the climate crisis is promising (Daly et al., 2024). Addressing the financial, educational and mental health support barriers preventing involvement and providing meaningful climate-related opportunities is key (Hamilton, 2022; Spajic et al., 2019).

Strengths and limitations

Answering the call for qualitative research, increased participant diversity and interdisciplinary collaboration, this work provides rich and meaningful insight into young people's relationship with nature. Our collaboration with the youth workers has been highly influential in terms of moving away from theory-based de-contextualised approaches (Lloyd & Gifford, 2024) and towards a recognition of individual differences and contextual sensitivity in the human-nature relationship. While focus groups are a valuable method of qualitative exploration, findings represent the perspective and experiences of 21 individuals and their own personal connection to nature. Moreover, all, except one, of the participants are from the Global North thus capturing a certain perspective of nature connectedness. Further qualitative enquiry

into youth from the Global South's relationship to nature will provide insight into the multifaceted dimensions of our connection to the Natural World.

Conclusion

This study supports the assertion that nature connectedness is a basic human right; spotlighting its links to mental health and pro-environmental behaviour. Accordingly, the complex systemic barriers, hindering nature connectedness, must be addressed to ensure everyone has the right to develop a relationship with nature. Importantly, our work speaks to the significance of children and young people's unique philosophies on nature connectedness. Their perspective centred around relationality and an ecocentric worldview, is integral on our journey towards a sustainable future.

Chapter 5—Study Three: Pathways to Nature (PTN)[3]
Co-developing and Evaluating Nature-Based Interventions to Support Youth Wellbeing and Environmental Stewardship

Abstract

Considering the growing youth mental health crisis, there is an urgent need for evidence-based interventions that support young people's wellbeing. Previous research highlights the significance of nature connection in supporting wellbeing and promoting related outcomes such as environmental stewardship. Drawing on youth work methodology, this cross-cultural and interdisciplinary study employed a mixed-method approach to evaluate a pilot nature-based intervention, Pathways to Nature (PTN), on youth mental health, nature connectedness and pro-environmental behaviour. Using a mixed-method design, the study was conducted across four European countries: Ireland, Spain, Armenia, and Finland. A total of 60 young participants (aged 13–26) engaged in the PTN intervention. Quantitative data was collected via online surveys administered at baseline and post-intervention, while qualitative data was gathered through post-intervention focus groups held in each country (n = 24 participants in total). Descriptive analysis of the survey data indicated increased levels of nature connectedness following participation. Thematic analysis of focus group discussions identified five key themes: 1) Pathways to Wellbeing, 2) A Shift in Perspective, 3) Changing Habits, 4) The Ripple Effect on Communities, and 5) Challenges and Space for Improvement. Findings highlight the potential for nature-based interventions to support youth mental health and lay the foundation for environmental stewardship. The study highlights the need for systemic and environmental changes that embed nature connection as a core component of youth development and planetary health strategies. Implications for intervention design, practice and policy are discussed.

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Introduction

Young people today are subjected to a range of stressors and negative pressures which often culminates in a pervasive sense of overwhelm (Shrestha et al., 2024; Schweizer et al., 2023). Moreover, with the consequences of anthropogenic climate change more prevalent than ever, climate distress is becoming widespread amongst youth (Williams et al., 2023). On top of this, increasing levels of urbanisation and societal sophistication have put a burden on young people's mental resources (Blakemore, 2019; Tillman et al., 2018). These unprecedented challenges, coupled with the knowledge that most mental illnesses emerge during adolescence (Kessler et al., 2005), underscore the urgent need for evidence-based interventions to help young people navigate the crises they face, while fostering community, resilience, and enabling them to thrive rather than merely survive.

Youth mental health and global climate distress

Mental illness is the leading threat to the health and wellbeing of young people (McGorry & Mei, 2018; McGorry et al., 2022), affecting more than 50% by the age of 25 (McGorry & Mei, 2018). Suboptimal mental health is widespread among youth, with conditions such as anxiety, depression, and psychological distress accounting for 45% of the total disease burden in individuals aged 10-24 years (Gore et al., 2011). Recent longitudinal research, spanning all six populated continents, highlights a worrying ‘flourishing age gradient’ and reveals that young people are not doing as well as they used to be (VanderWeele et al., 2025). Given challenging social and economic conditions, it's tough being a young person trying to navigate today's world. While causes are likely diverse, mental health concerns with young people are undoubtedly on the rise. Adolescence and the transition to adulthood represent a critical and developmentally sensitive period, during which mental health challenges can significantly disrupt key milestones, including identity and relationship formation, educational and career progression, financial independence, and the development of autonomy and self-efficacy. Despite the high level of need and the potential for early intervention to yield substantial benefits, young people face significant barriers to timely and effective mental health care (Uhlhaas et al., 2023). A global shortage of health resources directed at youth (McGorry et al., 2022), and a lack of funding for

important supports such as youth services (Liang et al., 2020), shifts the majority of responsibility to the individuals themselves. Structural inequalities further exacerbate these challenges, with higher rates of mental illness observed among youth from low-income backgrounds (Gutman et al., 2015), marginalised ethnic minorities (Ibes et al., 2021), and refugee populations (Silove et al., 2017). Additionally, these groups are disproportionately affected by the climate crisis and its subsequent mental health impacts (Sharpe & Davison, 2022). These compounding factors increase the risk for chronic psychiatric consequences.

Young people are generally more vulnerable to the effects of climate change, as they are exposed to its consequences earlier in life, during a critical stage of development, and for a greater portion of their lifespan (Schweizer et al., 2023). Accordingly, climate change can contribute to emotional stressors pertinent for youth, including existential anxiety and uncertainty about the future (Karaliuniene et al., 2022; Williams et al., 2024). Research indicates that the climate crisis elicits a wide range of emotional and mental health responses among youth, varying from apathy to profound ecological grief (Brosch, 2025; Diffey et al., 2022; Pihkala, 2020). The terms eco-anxiety, climate anxiety, climate grief, and solastalgia are often used interchangeably in the literature to describe “a chronic fear of environmental doom” (Wortzel, 2024). The broader concept of ‘climate distress’ serves as an umbrella term encompassing the various negative emotions associated with climate change (Cianconi et al., 2023). This must be considered in the context of a global narrative which portrays young people as "eco-saviors," (Wullenkord & Reese, 2021), and young people’s widespread concern which is demonstrated through global youth-led environmental and climate strikes (Soler-i-Martí et al., 2024). However, without adequate systemic and emotional support, youth risk burnout as they take on the role of ‘spokesperson for the Earth’ and navigate the immense pressure of climate activism (Budziszewska & Głód, 2021). Further, an individual’s ability to cope with climate emotions can significantly influence their capacity to navigate daily life and engage in essential activism, mitigation, or adaptation efforts (Capstick et al., 2022; van Valkengoed & Steg, 2019). With the increasing prevalence of eco-anxiety among young people—a natural response to a rapidly changing world—it is clear that youth are struggling (Gunasiri et al., 2022). This underscores the need for innovative approaches and resources to help them navigate mental health struggles and process the range of climate-related emotions. In their recent review of pediatric climate distress, Wortzel et al., (2024) highlight the lack of effective programs to

support youth climate distress and promote wellbeing. Moreover, very few nature-based programs, centred around fostering connection and a deep bond with nature, were identified. This is surprising given extensive evidence highlighting the potential for nature connectedness to enhance mental health while supporting coping/ resilience and encouraging pro-environmental behaviour (PEB).

Nature connectedness, wellbeing and PEB

The concept of connectedness to nature has a long history in ecology, ecopsychology and preceding this – has deep roots in ancient and indigenous cultures (Kimmerer, 2013; Redvers, 2024). Nature connectedness can be defined as a sense of belonging to the natural world (Mayer & Frantz, 2004), or as Richardson (2023, p.112) defines it 'a realisation of our shared place in nature, which affects our being, how we experience the world here and now.' This sentiment of oneness with nature is linked to various benefits for both personal and planetary health (Richardson, 2023). Research from the last two decades suggests that nature connection is significantly associated with domains of wellbeing including happiness (Barragan-Jason et al., 2022), vitality (Capaldi et al., 2014), and eudaimonic wellbeing (Pritchard et al., 2020). Accordingly, this positive relationship to nature is associated with a range of psychological health benefits for young people and may help to address mental health concerns (Barrera-Hernández et al., 2020; Jackson et al., 2021). Two recent systematic reviews have outlined the significant association between nature connectedness and wellbeing in children and adolescents (Arola et al., 2023; Barrable et al., 2024). Moreover, engagement with nature and nature-based experiences have been identified as a protective factor against stress for both urban (Corraliza et al., 2012) and rural youth (Wells & Evans, 2003), while also fostering resilience in the face of traumatic events (Touloumakos & Barrable, 2020). This is interesting, considering the potential for nature connectedness to be a source of refuge for young people navigating today's world and the climate crisis (Shrestha, Cassarino, et al., 2025). However, this is concerning given evidence revealing that adolescence is a period marked by a significant decline in young people's connection to nature, commonly referred to as 'the teenage dip' (Neldner et al., 2023; Richardson, 2019; van Heel et al., 2024). Studies have revealed that while levels of nature connectedness are high in younger children, they have declined by the middle of the teenage

years (Chawla, 2020; Hughes et al., 2019). This ‘dip’ may be explained for a variety of reasons with research outlining how the trajectory of nature connectedness seems to decline around the age that children start school (Price et al., 2022). This could be attributed to the increased emphasis on social relationships, societal pressure to conform and fit in socially (Richardson, 2019). This is a period where children form social relationships and develop an identity, with increased focus on the individual rather than collective identity, which may conflict with a close connection with nature as priorities change. Further, the school environment, with increased academic pressure and expectations leading to a distinct feeling of having ‘a lack of time’ (Shrestha, Cassarino, et al., 2025) exacerbates this. Lastly, this is a period when we see increased screen time for young people and digital technology monopolises attention hindering the ability to get out and connect (Michaelson et al., 2020). Which may be linked back to the strong focus on social relationships in adolescence, and the opportunities to develop and reinforce these through the use of social media (Price et al., 2022). Lastly, increasing urbanisation and systemic health inequities have limited young people’s access to nature, thereby impeding their capacity to form meaningful connections with nature (Ibes et al., 2021). Recent research on youth perceptions of greenspaces highlights concerns related to safety, exclusion, and a perceived prioritisation of parks for younger children—factors that contribute to reduced green space engagement during a critical developmental period (Whitten, 2025).

Considering the benefits of nature connectedness for planetary health, research to date suggests that feeling strongly connected to nature is one of the key predictors of pro-environmental behaviour e.g. recycling, decreased meat consumption, pro-nature conservation behaviour etc. (Frantz & Mayer, 2014; Ives et al., 2018; Mackay & Schmitt, 2019; Martin et al., 2020). If people feel a sense of oneness with nature, they tend to see nature as intrinsically valuable—valuable in and of itself rather than for any benefits or resources it might offer. Thus, they may perceive threats to the natural world as more serious than people who do not feel connected (Mackay & Schmitt, 2019). This heightened awareness can, in turn, motivate efforts to address and mitigate threats through PEB and climate action (Barragan-Jason et al., 2022).

Early childhood experiences in nature are significant, with research on morality and moral concern highlighting that children distinguish how much they care about entities from their levels of liking and knowing about them (Neldner et al., 2023). Retrospective studies have shown that adults committed to taking care of the environment attribute their pro-

environmentalism mainly to positive childhood experiences in nature (Evans et al., 2018; Hogg et al., 2024). Direct contact with nature throughout childhood is associated with a stronger interest in and emotional affinity towards nature (Collado et al., 2013), awareness about the importance of nature (Otto & Pensini, 2017), pro-ecological beliefs (Evans et al., 2018), and a sense of duty towards the environment (Collado & Sorrel, 2019; van Heel et al., 2024). Research on value systems suggests that childhood experiences in nature can influence our core values, fostering altruistic and biospheric perspectives (Oh et al., 2021; Rosa et al., 2018). Importantly, nature connectedness has been found to be an even stronger determinant of pro-environmental and ecological behaviours in youth than environmental knowledge (Anderson & Krettenauer, 2021; Barrable & Booth, 2020; Otto & Pensini, 2017; Schultz & Tabanico, 2007). Despite this, nature connection is not prioritised within many modern societies and is not a common feature of environmental education (EE) (Barragan-Jason et al., 2022; van Heel et al., 2024). EE has traditionally focused on providing knowledge of how and why we need to behave pro-environmentally (Rickinson, 2001; Wals et al., 2017). While educational programmes have a role to play in increasing "ecological literacy" (Pitman & Daniels, 2020), research highlights that simply increasing knowledge about conservation and environmental issues does not necessarily lead to behaviour change (Otto & Pensini, 2017; Price et al., 2022; Steg & Vlek, 2009). Recently, this approach to environmental education has faced criticism for being top-down and impersonal (Barragan-Jason et al., 2022), leading to widespread calls for more innovative and learner-centered methods (Walker et al., 2025). Interventions designed to channel our affinity towards nature into tangible action for the environment can help to close the 'connectedness-action gap' (Richardson, 2023). Furthermore, research highlights a potential 'feedback loop' whereby engaging in pro-nature behaviours may connect people to nature more strongly which subsequently fuels PEB (Richardson & Hamlin, 2021; Shrestha, Cassarino, et al., 2025). This emphasises the importance of supporting young people to cultivate a deep connection with nature and underscores the need for nature-based interventions to facilitate this process.

Nature-based Interventions (NBIs) currently

Given the many benefits of nature connectedness, it can be considered a fundamental psychological need (Richardson et al., 2020). Despite this, there is a scarcity of nature-based

interventions aimed at cultivating nature connectedness as a means of enhancing youth mental health and PEB (Wortzel, 2024). Such interventions have the potential to support wellbeing, ameliorate climate distress and motivate pro-nature behaviours. Further, NBIs can help address health equity issues. This is crucial given the predominant focus on specific populations within the field (White et al., 2021) and lack of interventions aimed at youth from low-income, culturally diverse, and marginalised communities (Rishbeth et al., 2022). These young people are often labeled as 'low users' of nature, despite their limited access being driven by global health inequalities and systemic barriers to engagement (Birch et al., 2020; Ibes et al., 2021). For example, inequitable urban planning, economic disadvantage, marginalisation and racial segregation limit access to nature (Byerly Flint et al., 2022; Rigolon et al., 2021). Accordingly, many youth face disproportionate barriers to accessing safe, high-quality, and health-promoting nature experiences, creating a significant social equity issue. This is tied to the commodification of nature in modern society, where nature connection is often reserved for privileged groups rather than recognised as a fundamental human right and psychological need (Rousell et al., 2024; Shrestha, Cassarino, et al., 2025). Furthermore, the societal tendency to frame young people's relationship with nature around a 'deficit model' (Birch et al., 2020; Louv, 2008) overlooks the structural and systemic barriers to nature connection. This problematic narrative wrongly attributes blame to young people, labeling them as 'disinterested' or 'disconnected' from nature, while ignoring the deeper structural, cultural, and societal factors that shape their access and engagement (Bowers et al., 2021; Chawla, 2020). There is an expectation that youth will adopt pro-environmental behaviors and step into the role of eco-saviors – with little support or change in systemic structures which hinder their relationship to nature (Bornioli et al., 2024; Diffey et al., 2022).

Recent research suggests that interventions focused on volunteering, environment enhancement and conservation activities can be particularly effective in supporting youth mental health and stewardship (Laurence & Smyth, 2023; McNamara et al., 2019). Furhtermore, the importance of an ecocentric approach, which honours the multidimensional benefits of nature connection, has been emphasised, to counter the anthropocentric bias (Barragan-Jason et al., 2022; Prescott et al., 2022; Shrestha, Cassarino, et al., 2025). This perspective has criticised the widespread tendency to commodify nature, treating it as a 'resource' for human benefit and highlighted how many NBIs are thinly veiled, claiming to align with the One Health approach

(UN, 2021) but, in reality, perpetuate extractivist perspectives (Rabinowitz et al., 2018). This paradoxical approach to health promotion fails to recognise the interdependence between human and environmental health and must be addressed (Hickel, 2020). A recent umbrella review, synthesising evidence from 64 systematic reviews, calls for nature-based interventions which address these economic, spatial and psychological barriers to nature connection (Shrestha, Chi, et al., 2025). Findings from this review provide particularly strong evidence for interventions which are immersive, involve active engagement, incorporate social interactions and are co-designed through participatory processes. Evidence across included SRs revealed that tailoring interventions to the specific needs of an individual or community can enhance effectiveness and lead to more sustained outcomes. This aligns with previous research emphasizing the importance of actively involving diverse population groups in the co-design of interventions (Britton et al., 2020; Cassarino et al., 2021; Delbaere et al., 2024). Recent calls have highlighted the need for research using mixed-methods approaches to explore human-nature connection (Lloyd & Gifford, 2024; Price et al., 2022). Further, the deficit of intersectoral collaboration (Schusler & Krasny, 2010) means that findings drawn from the public health sphere, environmental psychology, and other fields of research are rarely integrated with insights from practitioners who have a wealth of experiential knowledge. There is a critical need for increased methodological diversity, cross-sectoral/ transdisciplinary, and intergenerational collaboration on this topic (Nielsen et al., 2024; Walker et al., 2025). This study aimed to address these gaps in the literature by adopting a mixed methods and cross sectoral methodology and using the following frameworks to guide our approach to intervention design:

Five Pathways to Nature Framework

This project draws on Richardson and Butler's (2022) Nature Connection Handbook which outlines the 'Five Pathways to Nature Connection' (Lumber et al., 2017) as an overarching framework to design NBIs. The five pathways to nature connection – Senses, Beauty, Emotion, Meaning and Compassion – present five unique types of relationship with nature or 'pathways' to nature connectedness (Richardson et al., 2020). The framework serves as a typology of activities that provide a robust methodological approach for fostering a deeper relationship with nature. The flexible and creative design can be adapted to a range of contexts making it

particularly suited to this cross-cultural study. Additionally, this framework is particularly useful for answering calls for immersive and co-designed NBIs (Shrestha et al., 2025). Interventions informed by the pathways typically encourage specific forms of active engagement, shifting away from traditional relationships based on control, utility, knowledge, and fear (Richardson et al., 2020; IPBES, 2019). Thus, supporting an ecocentric approach to intervention design. The pathways to nature connectedness serve as a vital framework for delivering solutions toward a new relationship with nature. These pathways hold significant societal relevance and offer solutions across various leverage points to strengthen human–nature connections.

Youth Work Methodology

The study is informed by youth work methodology to tailor interventions to individual participants and their unique context. This methodology aligns with the guiding frameworks of the European Youth Strategy (EYS) and European Youth Goals (Hofmann-van de Poll, 2024; Klatt, 2020). These frameworks uphold the principles of active participation, social inclusion and health equity. The EU Youth Strategy focuses on working with young people to identify their needs, supports social and civic engagement and aims to ensure that all young people have the necessary resources to take part in society (Hofmann-van de Poll, 2024). Accordingly, the project draws on a post-paternalistic lens (Daly et al., 2024) – Moving beyond young people having a tokenistic say in policy and towards incorporating their insight in meaningful ways. Harnessing youth work methodologies, this study aimed to cultivate the Seven Proximal Outcomes (Department of Children and Youth Affairs, 2014) within young people as a pathway to improved wellbeing and environmental stewardship. The seven proximal outcomes: communication skills, confidence and agency, planning and problem solving, relationships, creativity and imagination, resilience and determination, and emotional intelligence, can be seen as foundational for psychological health and the ability to engage in action for nature. This incorporates the A-B-C model of pro-environmental behaviour by addressing ‘C’ – the contextual barriers to PEB and supporting young people to navigate these barriers, See (Guagnano et al., 1995) and (Liao & Yang, 2022) for a detailed summary of the A-B-C model). PTN is centered around enabling young people to develop and apply these outcomes through the co-creation of nature-based interventions tailored to their communities.

Study Objectives

Building on previous work, the current study aimed to address several gaps in the literature and widespread calls for a shift "beyond theory-based, decontextualized approaches" (Lloyd & Gifford, 2024, p.1; Nielsen et al., 2024), increased cultural diversity (Tam & Milfont, 2020) and a greater focus on interdisciplinary collaboration within the field (Nielsen et al., 2024; Walker etal., 2024 Nielsen, Cologna, et al., 2021). Our cross-cultural team, partnering Ireland, Spain, Armenia and Finland, was guided by young people to develop interventions which were adapted to the specific needs of each individual community and cultural context. We address the deficit of interdisciplinary mixed-methods research by integrating our knowledge and employing a mixed-methodology to understand how young people from culturally and economically diverse backgrounds connect with nature, the barriers to connection and what makes them want to protect it. Importantly, intervention design was shaped by an ecocentric, relational and socioecological approach which acknowledges the deep interconnection between human and environmental health. The main motivation for the project was the observation, made by partner youth work organisations, on the marked decrease in youth mental health over the period of 2020 – 2023 when access to outside (whether in nature or otherwise) was curtailed.

Our primary objective within this study was the evaluation of co-designed nature-based interventions on youth wellbeing, nature connectedness and environmental stewardship. The study was therefore positioned principally as an intervention evaluation rather than as a formal investigation of the co-design process itself. We sought to integrate our diverse expertise to answer the overarching research question: *How can nature connection support youth wellbeing and environmental stewardship?* Considering widespread health and social inequalities, we explore the impact of nature connection as narrated by young people of different ages, ethnic/cultural and socioeconomic status (SES) backgrounds – to better inform research, policy and practice. While co-design was central to the ethos and implementation of the intervention, it functioned as the methodological approach underpinning the Pathways to Nature (PTN) programme rather than the primary object of analysis. That said, the co-design process generated rich insights that warrant more focused examination. As such, a separate, sister paper may be developed to explore and evaluate the co-design methodology in greater depth.

Note.

We acknowledge that psychological wellbeing and mental health are related but distinct constructs; this study does not equate changes in wellbeing with clinical changes in mental health. While the broader framing of the paper engages with youth mental health, the outcome measure selected for the intervention study was the Personal Wellbeing Index – School Children (PWI-SC). This decision was informed by methodological, ethical, and practical considerations, and was made in alignment with the needs and objectives of our youth work partners navigating across multiple European contexts. Specifically, the research was conducted across diverse cultural settings, languages, and varying learning abilities. The PWI-SC was selected because it is a brief, accessible, strengths-based measure that is developmentally appropriate for young people and relatively easy to translate and administer across different contexts. Its focus on subjective wellbeing domains (e.g., relationships, safety, future security) made it suitable for community-based youth settings, where the project aimed to promote positive development rather than assess clinical measures of mental health. Importantly, the decision not to use a clinical mental health measure was also ethically informed. The intervention was designed as a promotive and preventative programme rather than a clinical treatment. Administering measures of depression, anxiety, or psychological distress in non-clinical youth work settings, particularly across multiple cultural contexts, would have raised additional safeguarding, referral, and interpretation considerations that were beyond the scope and infrastructure of the project. The PWI-SC therefore aligned more closely with the project's aim, which centred on empowerment, participation, and strengths-based development. The focus of this research was on promoting psychological wellbeing as a preventative and protective factor to help alleviate mental health concerns, rather than on assessing or treating clinical symptomatology. We acknowledge the limitations of using a wellbeing measure as a proxy for clinical mental health outcomes. While subjective wellbeing is closely related to mental health, it does not directly measure psychological distress or symptom reduction. Therefore, conclusions regarding mental health impacts are framed cautiously, and the thesis highlights the need for future research employing validated clinical measures to draw stronger inferences about changes in mental health outcomes.

Methods

Design

This is a mixed-methods study which incorporated a pre-post within-subjects assessment employing both an online survey, completed at baseline and post-intervention, and follow up in-depth qualitative focus group completed post-intervention. The study is part of a larger multi-disciplinary Key Action 2 (KA2) European youth work project and was conducted in partnership with four countries. Pathways to Nature (PTN), brought together a cross-sectoral and intergenerational team of youth workers, environmental educators, conservationists, environmental/health psychologists and young people with the aim of developing a programme to support nature connectedness. All partner youth centres and environmental organisations have a particular focus on addressing the needs of young people experiencing marginalisation, disadvantage and social exclusion. This study draws on a community-based participatory research (CBPR) approach (Satcher, 2005), as well as Creswell and Plano Clark's (2018) mixed methods participatory social justice design, to support engagement with a diversity of young people including 'seldom heard' young people with fewer opportunities. CBPR is a collaborative research approach that actively and equitably involves community members in the research process (Collins et al., 2018). Creswell and Plano Clark's (2018) framework applies mixed-methods research to a participatory or social justice perspective.

These approaches support the involvement of participants in the research process with the objective of fostering meaningful change in individuals, communities and systems. Accordingly, co-design was central to this project and the design was guided by co-design principles. Co-design can be defined as "active collaboration between stakeholders in designing solutions to a prespecified problem." (Vargas et al. 2022, p.2.). This process helped to uphold genuine partnership, ongoing collaboration, and mutual learning. It prioritised reciprocity and respect for diversity, ensuring that young people from a wide range of backgrounds were meaningfully involved throughout the process (Greenhalgh et al. 2016). Much of this practice is inherent to youth work which is underpinned by relationship building, mutual trust, respect and considering the young person 'as experts within their own world.' Accordingly, the youth work philosophy and methodology guided the approach to design - this relational and values-based approach became an important methodological influence, shaping not only how we co-designed interventions but also how the research team engaged with participants throughout the research process. The Pathways to Nature framework and resulting NBIs were collaboratively co-

designed with young people as the guiding voice. Both the youth workers and young people shaped the design of this study and were considered co-researchers in the research process. Ethics review and approval for this study were provided by the SREC committee at University College Cork (UCC) in June 2024 (Approval reference 2024-095).

Partner Countries

The four partner countries, Ireland, Armenia, Spain and Finland, represent a range of geographical, climatic, economic, social, and developmental contexts. This diversity was intentional, as the aim was to explore the different needs of young people across varied settings and contexts. By doing so, we sought to gain insights into both the similarities and differences related to health equity and nature connectedness, as well as the potential of NBIs to provide support.

Participants

A total of 60 participants, aged between 13 and 26 years, took part in the study, with the majority identifying as female (60%). Participation in this study was open to young people (children, teenagers and young adults) ranging in age from 12-26 years of age. There were no restrictions on gender. All participants were members of the partner youth organisations as per the inclusion criteria. Participants were recruited using purposive sampling within each partner youth centre. This recruitment method allowed for a sample of young people who represented a range of ethnic, cultural and socioeconomic backgrounds and helped to access voices and experiences heard less frequently in this area of research (Shrestha et al., 2025). Recruitment and contact with potential participants were facilitated by the youth workers in each country. During the recruitment process, potential participants were told about the Pathways to Nature project and subsequent time commitment of one year. Participants were informed that a research study, exploring the impact of the project on participants, was being conducted within the wider project and that participation would be voluntary. Those interested in participating were provided with further details in an information sheet and subsequent Q&A with the youth workers. Consent/assent forms were given to participants upon their recruitment into the study. In the case of participants under the age of 18, informed assent was obtained from participants, and

informed consent was provided from the parent/guardian. See Appendix III, Supplementary Material S5 for participant vignettes - developed collaboratively with youth workers.

Description of the Intervention

The Pathways to Nature project employed a grassroots approach, supporting young people to design and implement nature-based interventions (NBIs) within their respective countries. The ultimate goal of interventions was to act for nature, supporting local biodiversity and communities. The ideation and planning of these NBIs was entirely youth-led, with youth workers providing guidance and facilitation as needed. As aforementioned, the intervention draws on the five pathways to nature framework (Richardson & Butler, 2022), adapting it for practical implementation while integrating the expertise of our cross-sectoral team. Grounded in youth work methodologies, this approach was intentionally designed to foster development of the seven proximal outcomes (Department of Children and Youth Affairs, 2014). Participants were provided with funding and support to develop three NBIs in each partner country, guided by their national youth worker teams. These interventions were tailored to address the specific needs of the local nature and communities. Importantly, this project focused on an ecocentric approach i.e. keeping nature's needs central (Shrestha et al., 2025) and promoting pro-nature behaviours. The project was developed with the vision that the PTN framework could be implemented internationally in the future, serving as a foundational framework that could be adapted to suit the unique cultural context/needs of other countries. With this in mind, the PTN team designed a year-long program to pilot the framework. The program was conducted from May 2024 to August 2025 across all partner countries. See following Figures 11 and 12 for overview of young person's journey through the project, measurement timepoints and summary of twelve NBIs across partner countries (subsequent page):

Figure 11. Young Person's Journey through the Project and Measurement Timepoints

Figure 12. Overview of 12 Nature-Based Interventions/ Initiatives (NBIs) across countries

Young Persons PTN Journey



January—March 2024

Youth Participant Recruitment

July—December 2024

Participation in PTN Training Events



Creation, Presentation and Approval of Planned Nature-based Initiatives (NBIs)



September 2024—May 2025

Mobilising Community & Implementation of Nature-based Initiatives



August 2025

Presentation of completed NBIs to Project Peers at Nature Celebration Youth Exchange in Finland



November 2025

Planning & Preparation of Youth Participation Conference



November 2025

Hosting Conference, Presentation of NBIs & Call to Action

Measurement Timepoints

July December 2024

Baseline measurements taken at National Training courses (T1)

March— April 2025

Post-intervention measurements taken (T2)

March—April 2025

Focus Groups

NATURE-BASED INTERVENTIONS

IRELAND



THE ELM TREE PROJECT

The Elm Tree Project, led by four teens in Clonmel, Co. Tipperary, united community members to transform green spaces near a local youth centre. Over nine months, they planted native trees and wildflowers, having an environmental impact while fostering cross-generational collaboration, inclusion, and a deeper respect for nature.



NATIVE SHELTERBELT AT FOOTBALL CLUB

A group of young people and volunteers led a nature-based initiative to restore biodiversity in response to green space loss from housing developments. They planted 1,100 native trees at their local football club. They designed this NBI to reclaim space for biodiversity and create a green haven for current and future community members.



REGENERATION OF YOUTH CENTRE

Between February and June 2025, 11 young people transformed their youth centre in Abbeylands into a vibrant community green space. Through clean-up, planting, and community volunteering, they turned what was once a neglected area into a source of pride. The project fostered a sense of belonging and place-attachment within the community.

ARMENIA



TREE-PLANTING IN KORNIDZOR

Participants in the border village of Kornidzor engaged 50 people from surrounding areas to plant over 1,000 trees. The initiative fostered healing and intergenerational connection in a community shaped by past hardship. Trees planted near memorials now stand as powerful symbols of resilience, unity, and environmental renewal.



GENERATIONS FOR GREEN AND CLEAN TAVUSH

Youth in Tavush led a NBI involving clean-ups and tree planting, A crucial and forward-looking aspect of the initiative was the involvement of six local kindergartens to model ecological behaviour and instil a love for nature in children from a very early age. Notably, teachers in partner kindergartens have continued this iniative highlighting it's sustained impact.



TREE-PLANTING AND COMMUNITY EVENT PARPI

In Parpi village, a NBI united participants from Yerevan, Artsakh, and the local community to plant trees and restore green spaces. The initiative fostered connection, and inclusion—especially for displaced individuals. With shared purpose and teamwork the day became a powerful symbol of renewal, resilience, and togetherness.

NATURE-BASED INTERVENTIONS

FINLAND



NATURE CONNECTION WORKSHOPS

In Finland, participant's NBIs fostered social connection, especially among migrants, addressing isolation through shared outdoor experiences. Young people led workshops including winter photography and a guided nature trail. These activities deepened connections to nature and community, promoting inclusion, cultural exchange, and environmental awareness.



WE TOGETHER—FINDING BELONGING THROUGH NATURE

The "We Together" project brought 15 young migrants to Lapland's natural landscapes, offering a safe space to build connection and belonging. Through activities like hiking, meditation, and art, participants found routes to connecting with Finnish nature, cultural exchange, and emotional support with nature as a unifying force.



RECYCLING INFRASTRUCTURE AND AWARENESS CAMPAIGN

Recognising inadequate recycling infrastructure at their high school, young people in Kuopio partnered with the school to develop the necessary infrastructure. They launched an awareness campaign, engaging fellow students and promoting proper recycling practices, fostering a more environmentally responsible school community.

SPAIN



NEST BOXES FOR KESTRELS IN MURCIA

Young people in Murcia worked with an environmental organisation to conserve vulnerable birds, focusing on the lesser kestrel. They replaced 40 outdated nest boxes in Guadalentín Valley and installed new boxes in Sierra Espuña, supporting bird populations and fostering youth leadership in regional conservation efforts across diverse ecosystems.



REVITALISATION OF GREEN SPACE IN ALGUAZAS

In Alguazas ten youths led the restoration of the neglected Parque La Pinada, launching awareness campaigns in local high-schools and mobilising over 100 volunteers. With support from the municipality, they cleaned the area and rehabilitated local biodiversity—transforming the park into a vibrant, inclusive space through collective action.



BIODIVERSITY RESTORATION IN ALGUAZAS

Young people in Alguazas led a follow-up NBI, planting 50 new trees to support ecological recovery. With help from the local community and mayor, the project secured long-term maintenance and sustainability. It showcases how youth-led action can inspire collective commitment to environmental and community wellbeing.

Data Collection & Measures

Qualitative Methodology

Focus Groups

Four focus groups were conducted in March-April 2025, one in each partner country. Focus groups were facilitated by the youth worker team. Each focus group was led by a youth worker who had supported the participants throughout the development of the NBIs. This approach leveraged the shared experiences and trust between the youth workers and participants, encouraging open and honest discussions. Additionally, having youth workers facilitate the focus groups allowed discussions to be conducted in the native language of each country, mitigating potential language barriers and promoting accessibility. In Finland, two separate focus groups were conducted - One in Finnish and one in English. This was to facilitate participants who were from refugee backgrounds and were most comfortable answering in English. Youth workers received specific training in January 2025, prior to conducting the focus groups. This in-person, three-day training, developed by the primary researcher/first author in collaboration with the project management team, covered qualitative methodology and best practices for conducting focus groups, particularly with young people. Focus group data was translated and transcribed by the youth workers who had received training. See below for a detailed summary of the translation process.

Focus groups were audio-recorded, with a second youth worker present to take notes and oversee the recording process. Each focus group included six participants, totaling 24 young people across the four countries, with sessions lasting approximately two hours. Participants were randomly selected from the broader sample using stratified sampling (ensuring representation of two participants from each of the three NBIs in each country). The focus group schedule was developed collaboratively by the multidisciplinary team, guided by best practices for working with vulnerable populations (Gibson et al., 2020; Gibson, 2012). Questions were open-ended and designed to encourage participants to reflect on their experiences, the project's impact on their wellbeing, nature connection and attitudes toward pro-environmental behavior (See Supplemental Material S1). Interactive activities using the Illustrated Inclusion of Nature in

Self Scale (IINS) (Kleespies et al., 2021) and the Climate Emotions Wheel (Pihkala, 2022) were incorporated to support the exploration of these topics.

Nature connectedness: During the focus group, nature connectedness was assessed using the Illustrated Inclusion of Nature in Self Scale (IINS) (Kleespies et al., 2021). This scale measures the extent to which a person perceives nature as part of their identity using seven options depicted as Venn diagrams. The illustrated format is particularly suited to children and adolescents, who often resonate with imagery and interpret the world in more abstract and symbolic ways than they are typically given credit for (Dumontheil, 2014; Allen & Armitage, 2017). In this study, the IINS was incorporated as an interactive activity within the focus groups. Based on guidance from our youth work partners, it was determined that this approach would help participants engage with the complex concept of nature connectedness. To facilitate this, the scale was transformed into an activity using large foam mats, each representing one of the seven dimensions of nature connectedness. Participants were invited to respond to the question, *"Where on this scale would you place yourself in terms of your connection to nature?"* by physically positioning themselves on one of the options. This interactive approach fostered discussion on abstract aspects of nature connectedness and encouraged reflections on the project's impact on nature connectedness and its potential links to pro-environmental behaviour.

Climate Emotions & Pro-Environmental Behaviour: The Climate Emotions Wheel (Pihkala, 2022) was used to explore participants' climate-related emotions and their attitudes toward pro-environmental behavior within the focus group. This visual tool is designed to help participants identify and articulate their emotional responses to climate change. The wheel includes core emotions such as fear, anger, hope, and sadness, as well as their intensities and variations, presented in a circular format with gradients or color-coded sections. This format encourages participants to reflect on their emotional states in connection to climate issues, promoting a deeper understanding of the psychological and emotional impacts of climate change. The Climate Emotions Wheel was also incorporated as an interactive activity during the focus groups. Participants were invited to engage with the wheel and were asked to personify nature by responding to prompts such as, *"If nature could speak, what would it say or how would it feel?"* They could draw on the emotions represented in the wheel for inspiration. Recognising the sensitivity of the topic, this method facilitated an open and supportive discussion of the complexities surrounding climate-related emotions.

Translation process of Focus Group Data

Given that English was not the primary language of most participants, it was crucial that all participants could answer in their preferred language to uphold the project's values of inclusivity and accessibility. Accordingly, focus groups were conducted in the language of each country and English where preferred (e.g. for some of the Finnish participants who came from other countries). The translation process was facilitated by the research team (psychologists, youth workers and young people) in collaboration with language/ translation experts in each country. This was a rigorous and meticulous process guided by existing guidelines on cross-cultural translation (Cruchinho et al., 2024; Valūnaitė Oleškevičienė et al., 2018). To ensure accuracy, clarity, and cultural fidelity, the translation process involved several steps:

1. **Back-translation:** Translated transcripts were independently back-translated into the original language by a second translator (Kowal, 2014; Tyupa, 2011) to identify any discrepancies, ambiguous phrasing, or culturally specific expressions that might have been lost in translation.
2. **Collaborative review:** The research team, including psychologists, youth workers, and young people, collaboratively reviewed the transcripts to ensure that the translations reflected the intended meaning, tone, and nuance of participants' original contributions.
3. **Cross-validation with field notes:** A second youth worker, present during each focus group, provided insights from their observational field notes to ensure that the translations accurately captured the participants' intended meaning and maintained consistency with what young people actually expressed during the discussion. This was particularly important for interpreting subtle expressions, humour, or culturally embedded references.

This process not only safeguarded the fidelity and integrity of the data, but also supported intercultural learning across partner countries. It enabled the research team to integrate diverse linguistic and cultural perspectives while ensuring that participants' voices were authentically represented in the analysis. By combining local expertise, youth worker insight, and rigorous

translation methodology, the study maintained both methodological robustness and cultural sensitivity in capturing young people's experiences of nature connection.

Quantitative Methodology

Pre-post Survey

Participants completed an online survey at the start and at the end of the intervention, which was developed in Qualtrics XM. The measures included in the survey were translated by the team into the different languages of the participating countries. Participants were given the option to answer the survey in English or in their own language. The survey included the following measures:

Subjective Wellbeing (SWB): Participants' subjective wellbeing was measured using the Personal Wellbeing Index-School Children (PWI-SC) (Cummins & Lau, 2023). Pre- and post-intervention measures of the PWI-SC were collected using an online survey hosted on Qualtrics. The PWI- SC is a specialist version of the Personal Wellbeing Index-Adult (PWI-A), designed for use with school-age children and adolescents. While it retains the core structure of the adult version, the PWI-SC has been reworded and simplified to align with the cognitive and developmental needs of younger individuals. Unlike the adult scale, which asks questions of 'satisfaction', items on the PWI-SC require that respondents indicate their level of 'happiness' with each domain (Cummins & Lau, 2005). The scale asks respondents to rate their happiness across seven life domains: standard of living, health, life achievement, personal relationships, personal safety, community connectedness, and future security. An optional item evaluating overall life satisfaction ("How happy are you with your life as a whole?") was included, bringing the total number of domains to eight. Responses were rated on a 0–10 Likert scale, with 0 representing "not at all happy" and 10 representing "very, very happy." In line with research supporting the use of visual analogue scales with children and adolescents (Berghmans et al., 2017; Melvin et al., 2018), we adapted the PWI-SC by incorporating smiley/sad face illustrations. A red sad face represented a score of 0, while a green smiley face represented a score of 10 (See Supplementary Material S2). A reliability test was conducted to evaluate the

internal consistency of the PWI-SC pre and post-intervention. The Cronbach's alpha was = 0.868 pre, and = 0.904 post, which indicates high internal consistency in alignment with previous literature (Tomyn and Cummins 2011). Additionally, its cross-cultural applicability is supported by multiple studies confirming its reliability, validity, and measurement invariance across different cultural contexts (Tomyn et al., 2020; Singh et al., 2015; Jovanović, Veljko et al., 2019). While the PWI-SC has been translated and validated for cross-cultural use in many countries, there were no available translations of the scale in Armenian, Finnish, and Spanish. To uphold the project's values of inclusivity and accessibility, our team undertook the translation process of the PWI-SC into the aforementioned languages. The translations have been published on the official Australian Centre on Quality of Life (ACQol) website, enhancing the scale's accessibility and its use with a diverse range of young people across different countries. (For a detailed summary of the translation process see Supplementary Material S1).

Nature Connectedness: Nature connectedness was recorded using a self-report single-item question 'How strongly connected to nature do you feel?' on 0-5 likert scale with the question where 0 (Not at all connected) 5 (Very strongly connected). This single-item approach is supported by scholarship validating concise measures of nature connectedness (e.g., see Richardson et al., 2019 'Nature Connection Index'). This measure was supported by the use of the Illustrated Inclusion of Nature in Self Scale (IINS) in the focus groups.

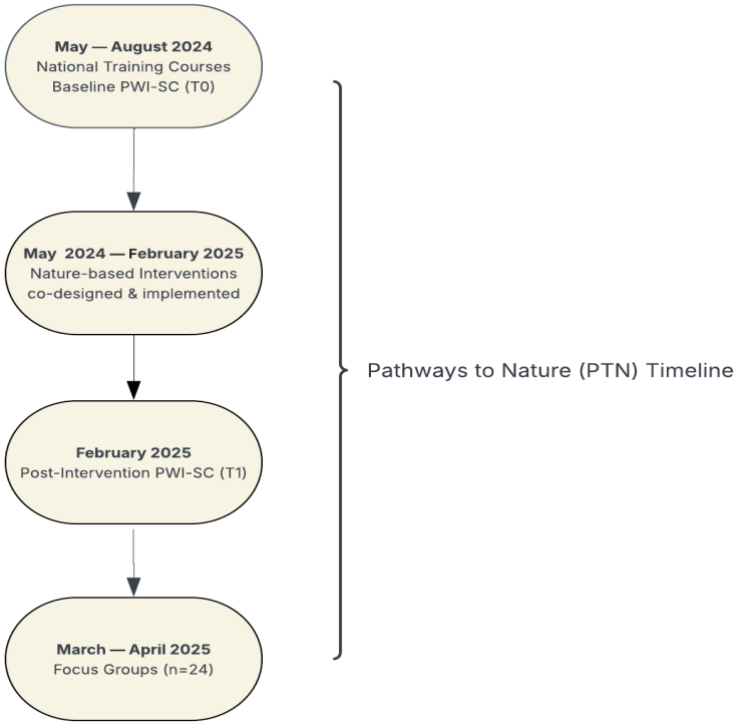
Socio-demographics: Participants age, gender, country of residence and level of urbanity was recorded in the online survey.

Procedure/timeline for wider project

1. In May 2024, the project commenced with a week-long national training course held in each partner country, engaging 15–20 participants per country. The training introduced participants to the 5 Pathways to Nature framework and the concept of Nature-Based Interventions. Baseline (T0) measurements of wellbeing, using the Personal Wellbeing Index-School Children (PWI-SC) (Cummins & Lau, 2023), were collected at the start of each training course using an online survey.

2. Over the subsequent 10 months, May 2024–February 2025, each national group co-designed and developed three NBIs tailored to the specific needs of their local region, biodiversity and community.
3. Regular project management meetings were conducted with all partners to track the progress of the NBIs/project and assess how best to support participants.
4. Although the NBIs evolved as ongoing community initiatives, by February 2025, the interventions were complete, and post-measurements of wellbeing (PWI-SC) (T1) were collected. This time point was chosen as participants were finished with implementing their NBIs, were fully immersed in the project and had time to reflect on the impact of the interventions. Making it a key time to take the post-intervention measurement.
5. From March-April 2025, qualitative focus groups were conducted with five-six participants from each country (24 participants in total). Focus groups were led by the youth worker team in each partner country. The purpose of the focus groups was to provide insight into the impact of the project on participants as narrated by the young people themselves. These focus groups aimed to shed light on the experience of being involved in PTN and provide insight into the layers and nuances of the project.
6. When all interventions were complete (August 2025) informal sharing circles and a project closing survey was implemented to allow participants to provide feedback and ensure all voices/experiences were heard, valued and reflected upon within our findings.

Fig 13. Procedure/ Timeline for PTN Intervention



Data Analysis

Qualitative Analysis

A reflexive thematic analysis (TA) was used to analyse the qualitative data from the focus group transcripts. TA was selected as the most suitable analytical approach for this study due to its theoretical flexibility and adaptability to multiple contexts (Braun & Clarke, 2006, 2019). The analysis followed the six stages outlined by Braun and Clarke for reflexive TA (2006). TA is a functional method for working within a 'participatory research paradigm' (Braun & Clarke, 2019), making it suited to the design of this study. The youth workers who facilitated the focus groups transcribed and translated the data into English, after which the primary researcher (TS) conducted the TA in collaboration with the wider research team. Several team meetings were held throughout the analysis to review emerging themes and ensure they accurately represented the data. The youth workers who facilitated the focus provided key insight during this iterative process of cross-analysis. This approach allowed for meticulous interaction with the data, reflexive thinking and resulted in richer conceptual analysis. To ensure the quality of analysis, member checking was conducted, where findings were shared with participants to confirm their

accuracy and clarify that the resulting themes reflected their experiences and perspectives. The approach to member checking was collaboratively designed with youth workers to share findings with participants and engage them in a creative and supportive way so they felt free to share and/ or contradict findings. Through this collaborative research process, participants challenged and enriched our perspectives of human-nature relationships e.g. challenging the assumption of an intrinsic affiliation towards nature.

Quantitative Analysis

Descriptive statistics were used to examine distributions of wellbeing and nature connectedness at pre- and post-intervention, as well as to examine variations for these variables across country, age, gender, and level of urbanity. The PWI-SC data was found to deviate from normality, displaying negative skewness (skewness = -1.237) and a kurtosis of 1.702. A 5% trimmed mean (7.39), compared to the original mean (7.26), indicated the presence of outliers, though these did not appear to significantly impact the overall distribution. Similarly, the NC data was not normally distributed, showing a kurtosis of -0.718. The Shapiro-Wilk test for both datasets yielded significant results ($p < .001$), further confirming non-normal distribution. Given these results, non-parametric tests were used for subsequent analyses. Due to a technical error in setting up the survey, we could not match participant data pre- and post-intervention, and thus the two timepoints were treated as independent groups for the purpose of the analysis. Specifically:

- Kruskal-Wallis tests were conducted to assess differences in PWI-SC and NC scores across country and level of urbanity (pre- and post-intervention).
- Mann-Whitney U tests were used to explore differences in PWI-SC and NC across gender (pre- and post-intervention), and to assess pre- to post-intervention differences for both PWI-SC and NC.
- Spearman's Rho correlations were used to examine associations between age and both outcome measures (PWI-SC and NC, pre- and post-intervention), as well as to explore the relationship between PWI-SC and NC scores.
- Reliability analyses were conducted for both the PWI-SC and NC scales to assess internal consistency.

Results

Quantitative Results

Sample Characteristics

The final survey sample comprised 60 valid responses for the pre-intervention phase and 55 valid responses for the post-intervention phase. Tables 1 and 2 below provide the characteristics of survey respondents for pre- and post-intervention. The sample reflected considerable cultural and ethnic diversity, engaging young people from a range of backgrounds beyond the four partner countries. This was particularly evident in Finland, where several participants were from migrant or refugee backgrounds. Participants self-identified their nationalities as originating from a variety of countries and regions, including Sudan, Zambia, the Democratic Republic of Congo, Afghanistan, Pakistan, Nepal, Nicaragua, Russia, and Ukraine.

Table 4. Demographic characteristics of survey respondents' pre-intervention

Variable	Group	n	%
Country	Armenia	14	23.33%
	Finland	14	23.33%
	Ireland	16	26.67%
	Spain	16	26.67%

Level of Urbanity	Countryside	5	7.69%
	Village	11	16.92%
	Town	25	38.46%
	City	23	35.39%
Gender	Male	22	33.85%
	Female	39	60.00%

Variable	**Mean**	**sd**
Age	17.68	3.13
PWI-SC	71.87	16.26
NC	3.34	1.05

*PWI-SC is Personal Wellbeing-Index School Children. NC is Nature Connectedness

Table 5. Demographic characteristics of survey respondents' post-intervention

Variable	**Group**	**n**	**%**
Country	Armenia	15	27.27%
	Finland	11	20.00%
	Ireland	15	27.27%
	Spain	14	25.46%

Level of Urbanity	Countryside	3	5.45%
	Village	7	12.73%
	Town	17	30.91%
	City	28	50.91%
Gender	Male	19	34.55%
	Female	31	56.36%

Variable	**Mean**	**sd**
Age	17.65	2.70
PWI-SC	74.60	15.15
NC	3.71	0.83

* PWI-SC is Personal Wellbeing-Index School Children. NC is Nature Connectedness

Variations in Wellbeing

***Wellbeing pre- and post-intervention*:** A Mann-Whitney U Test found that there was no statistically significant difference in wellbeing scores between participants in the pre-intervention group (*Md* = 75.7, n = 65) and those in the post-intervention group (*Md* = 77.1, n = 55), *U* = 1970.50, *z* = 9.65, *p* = .335, *r* = 0.88.

Wellbeing and Country: All participating countries reported average to high levels of wellbeing at the pre-intervention stage, in line with previously published cross-cultural benchmarks (Tomyn et al., 2020; Jovanović, Veljko et al., 2019). Among them, Spain had the highest median wellbeing score (*Md* = 78.60), followed by Armenia (*Md* = 74.30), Ireland (*Md* = 72.90), and Finland (*Md* = 72.85). At the post-intervention stage, the median wellbeing scores increased in all countries except Ireland, which remained unchanged. Armenia reported the highest post-

intervention median (*Md* = 81.40), followed by Spain (*Md* = 80.00), Finland (*Md* = 78.60), and Ireland (*Md* = 72.90).

Wellbeing and Age: A Spearman's Rho correlation indicated a small negative correlation between age (Md = 17.00, IQR = 4) and wellbeing scores pre-intervention (Md = 77.10, IQR = 20), rho = -.274, n = 65, p < .05, with higher age being associated with lower wellbeing scores. However, the variables only share 7.51% of their variance, and the correlation is classified as small (r < .30).

Wellbeing and Gender: A Mann-Whitney U Test revealed a statistically significant difference in wellbeing scores between males and females' post-intervention, *U* = 398.50, z = 2.08, p = .037, r = 0.29. Females' PWI-SC scores (Md = 81.40, n = 31) were significantly higher than males (Md = 70.00, n = 19), however, the effect size is considered small (r < 0.3).

Table 6. Variations in PWI-SC scores in pre-intervention sample (n = 65)

Variable	**Group**	**n (%)**	**Median**	***U* / *H* / *rho***	***p***
Country	Armenia	14 (21.54%)	74.30	*H*(3) = 1.964	0.580
	Finland	20 (30.77%)	72.85		
	Ireland	16 (24.61%)	72.90		
	Spain	15 (23.08%)	78.60		
Level of Urbanity	Countryside	5 (7.69%)	78.60	*H*(3) = 1.642	0.650
	Village	11 (16.92%)	75.70		
	Town	25 (38.46%)	74.30		
	City	23 (35.39%)	72.90		
Gender	Male	22 (33.85%)	76.40	*U* = 373	0.40

	Female	39 (60.00%)	74.30		
Age	N/A	65 (100%)	77.10	*rho* = -.274	.027*

* Correlation is significant at the 0.05 level (two-tailed)

Table 7. Variations in PWI-SC scores in post-intervention sample (n = 55)

Variable	**Group**	**n (%)**	**Median**	***U* / *H* / *rho***	***p***
Country	Armenia	15 (27.27%)	81.40	*H*(3) = 1.764	.623
	Finland	11 (20.00%)	78.60		
	Ireland	15 (27.27%)	72.90		
	Spain	14 (25.46%)	80.00		
Level of Urbanity	Countryside	3 (5.45%)	74.30	*H*(3) = .625	.891
	Village	7 (12.73%)	78.60		
	Town	17 (30.91%)	80.00		
	City	28 (50.91%)	73.60		
Gender	Male	19 (34.55%)	70.00	*U* = 398.50	.037*
	Female	31 (56.36%)	81.40		
Age	N/A	55 (100%)	77.10	*rho* = -.245	.071

*Statistically significant difference in PWI-SC scores between males and females (at the 0.05 level)

Nature Connectedness (NC)

***NC Pre- and Post-intervention*:** A Mann-Whitney U Test revealed that there was a statistically significant difference in nature connectedness scores between participants in the pre-intervention group (Md = 3.00, n = 65) and those in the post-intervention group (Md = 4.00, n = 55), U = 2154.00, z = 2.023, p = .043, r = 0.18.

***NC and Country*:** A Kruskal-Wallis test indicated a statistically significant difference in nature connectedness across the four different countries of participation pre-intervention, $H(3) = 8.275$, p = .042. Post-hoc pairwise comparisons showed that participants from Armenia (Md = 4, IQR = 2) had significantly higher levels of nature connectedness than participants from Spain (Md = 3, IQR = 1). However, country of participation only accounts for 5.37% of variance in nature connectedness (eta3(H) = .0537).

NC and Age: Spearman's Rho correlation indicated a small positive correlation between the age of participants (Md = 17, IQR = 5) and nature connectedness pre-intervention. (Md = 3, IQR = 1), rho = .271, n = 65, p <.05, with higher age being associated with higher levels of nature connectedness. However, the variables only share 7.34% of their variance, and the correlation is considered small (rho < .3). The same relationship was found post-intervention except slightly stronger with a medium positive correlation. However, the variables only share 9.34% of their variance.

Table 8. Variations in NC scores in pre-intervention sample (n = 65)

Variable	Group	n (%)	Median	*U* / *H* / *rho*	*p*
Country	Armenia	14 (21.54%)	4.00	$H(3) = 8.275$	.042*
	Finland	20 (30.77%)	3.00		
	Ireland	16 (24.61%)	3.00		

	Spain	15 (23.08%)	3.00		
Level of Urbanity	Countryside	5 (7.69%)	4.00	$H(3) = 2.409$	.492
	Village	11 (16.92%)	3.00		
	Town	25 (38.46%)	4.00		
	City	23 (35.39%)	3.00		
Gender	Male	22 (33.85%)	3.00	$U = 446$	.790
	Female	39 (60.00%)	3.00		
Age	N/A	65 (100%)	3.00	*rho* = .271	.029**

*Post-hoc comparisons with Bonferroni adjustments found a statistically significant difference (at the 0.05 level) in NC between Armenia and Spain

**Correlation is significant at the 0.05 level (two-tailed)

Table 9. Variations in NC scores in post-intervention sample (n = 55)

Variable	**Group**	**n (%)**	**Median**	***U* / *H* / *rho***	***p***
Country	Armenia	15 (27.27%)	4.00	$H(3) = 8.10$	.044
	Finland	11 (20.00%)	3.00		
	Ireland	15 (27.27%)	3.00		
	Spain	14 (25.46%)	3.00		

Level of Urbanity	Countryside	3 (5.45%)	3.00	$H(3) = 1.507$	.681
	Village	7 (12.73%)	4.00		
	Town	17 (30.91%)	3.00		
	City	28 (50.91%)	4.00		
Gender	Male	19 (34.55%)	3.00	$U = 380.50$	.064
	Female	31 (56.36%)	4.00		
Age	N/A	55 (100%)	4.00	*rho* = .312	.02*

*Correlation is significant at the 0.05 level

Note: while a Kruskal-Wallis test indicated a statistically significant difference in median NC scores between countries, post-hoc comparisons with Bonferroni adjustments did not find any statistically significant differences between groups.

Qualitative Results—Thematic Analysis

The qualitative analysis offered valuable insight into participants' first-hand experiences of the *Pathways to Nature* project, revealing the depth and complexity of its impact. Thematic analysis of focus group transcripts resulted in five overarching themes: 1) Pathways to Wellbeing, 2) A Shift in Perspective, 3) Changing Habits, 4) The Ripple Effect on Communities, and 5) Challenges and Space for Improvement. Sub-themes were identified for themes one and two. This section outlines the key themes using participant quotes and narrative insights to illustrate shifts in attitudes, behaviours, and social dynamics. Figure 2 outlines the five themes and maps the relationships between themes and sub-themes, highlighting both individual and community-level impacts of the intervention.

Fig 14. Schematic representation of five themes:

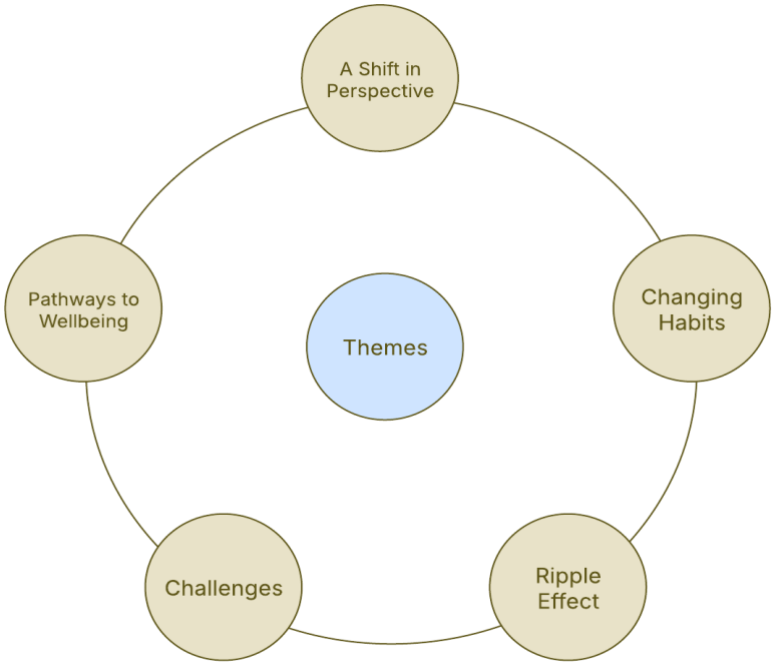


Fig 15. Schematic representation of two themes with sub-themes:

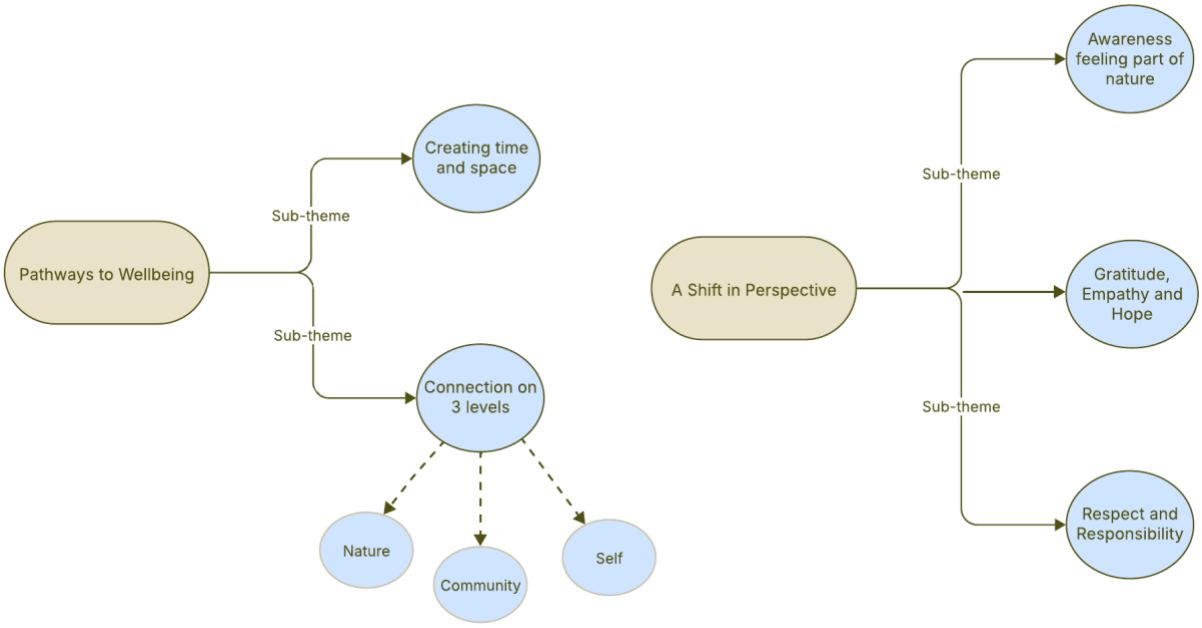


Table 10. Participants by pseudonym, gender, age and country N = 24.

Pseudonym	Gender	Age	Country
P1	W/G	16	Ireland
P2	W/G	16	Ireland
P3	W/G	16	Ireland
P4	M/B	14	Ireland
P5	M/B	14	Ireland

P6	W/G	22	Armenia
P7	M/B	23	Armenia
P8	W/G	20	Armenia
P9	W/G	19	Armenia
P10	W/G	17	Armenia
P11	W/G	21	Armenia
P12	W/G	15	Spain
P13	W/G	16	Spain
P14	W/G	16	Spain
P15	M/B	15	Spain
P16	M/B	15	Spain
P17	W/G	21	Finland
P18	M/B	22	Finland
P19	W/G	23	Finland
P20	W/G	16	Finland
P21	W/G	16	Finland

P22	W/G	16	Finland
P23	W/G	20	Finland
P24	W/G	27	Finland

W/G = Woman/Girl; M/B = Man/Boy

1) Pathways to Wellbeing

This theme examines the various ways in which the project contributed to participants' wellbeing through two sub-themes:

Creating time and space

Participants described how being involved in the project allowed them to create time for nature connection, which significantly enhanced their wellbeing:

> "Regarding the project, I realised that sometimes you need to *slow down* and stop to really enjoy nature, because it's good for your mental health." (P17 G/F 21 Finland)

The week-long national training course, held in each partner country, was spotlighted as a pivotal experience:

> "Well, the beginning of the project, living together, how we experienced it, and how we connected with the organization. We really enjoyed that week of training." (P5 G/F 16 Spain)
>
> "I loved the week when we went out to Woodstown (training course) and did all the activities." (P4 B/M 14 Ireland)

> "It made me feel happy. Like whatever was on my mind just got pushed to the side and I was really present that week we were in Woodstown." (P2 G/F 16 Ireland)

Many contrasted the immersive setting with urban life, describing it as "liberating" and "a break from everyday life" (FG3). The intentional creation of time and space for connection fostered feelings of calm and peace, which participants largely attributed to the natural environment and the contrast to their habitual urban settings. When asked why he felt a sense of ease during the week, Participant X explained:"Because I was in an isolated area in the middle of nature, far from the city." (P4 B/M 15 Spain)

Armenian participants, many displaced from rural areas, described a physical longing for nature and shared how the project helped them realise this:

> "Now that I live in the city, I physically feel like I don't get enough connection with nature, and I constantly try to restore that bond. I get sick more often, I feel a certain fatigue...and that's how I realise my connection with nature has weakened. That noise of the city, it's not pleasant for me and it's not something I'm used to as well. This project showed me that" (P3 G/F 20 Armenia).

Others reflected on the need to protect and prioritise nature connection: "Now I also understand that there's still room to get even closer to nature. I feel that need for connection when I've been in the city for a long time without nature and I realise I truly *need* it." (P6 G/F 21 Armenia)

Participants linked their experience of the project to childhood eliciting feelings of calm and peacefulness:

> "The project has helped me a lot to get back to that feeling of *childhood*. When you have the opportunity to explore, to feel everything around you…*it was probably the only week where I felt really happy*…Basically, I got in touch with nature in a very deep way after many years, and it was beautiful" (P19 G/F 23 Finland).

Similarly, participant 17 describes how the project evoked this nostalgia and reminded her of the importance of prioritising this relationship:

> **“**It really brought me back to that state of *childhood* when you had *time* for it…It reminded me how much I liked it (nature), how much I want to go back to that time, and that you can always find at least 5 minutes a day in your schedule.” (P17 G/F 21 Finland)

Participants reflected on the importance of equitable access to nature, emphasising how structured opportunities like this project can help overcome barriers. As one participant put it: “Creating more *time* is helpful and activities like this allow you to unite with nature. Because, really, in an urban environment it's not so easy to do that.” (P17 G/F 21 Finland)

Spotlighting the significance of accessibility and being in close proximity to nature Participant 6, Armenia states: “I think it’s important to be physically close to nature. That would make it easier to preserve that connection in the long run.” (P6 G/F 21 Armenia). A participant from Finland, noted how her view of nature shifted through the project, explaining how she previously viewed nature as “something expensive, distant, unattainable and exclusive” and highlighted the importance of “being able to participate” in such projects. (P24 16 G/F Finland)

Connection on three levels: nature, community and self

The project created space for meaningful connection on three interconnected levels —nature, community, and self—each contributing to participants’ overall wellbeing. Participant 19 (23 G/F Finland) captured these entwined layers: “It was cool to finally be alone with nature, but also in a nice community and to think about myself, finally listen to myself.”

Nature

The project fostered a deep connection to nature, which participants described as calming and emotionally uplifting: “It made me feel more connected to nature…I felt calm and relaxed.” (P4 B/M 15 Spain)

Participant 24 spoke about this tranquility and shared how the experience and environment evoked powerful emotions she had not felt in a long time, due to her struggle with depression:

> “There were also moments of tranquillity... I want to say that, because I'm depressed, the feeling of emotion is kind of missing. And this trip, it was just so very vivid. It's been

quite a long time since I've felt, or experienced such pure emotions…It was probably the only week where I felt really happy." (Participant 24 16 G/F Finland)

Nature was seen as a supportive environment for connecting with one another. One participant shared: "I felt very comfortable. Especially with strangers. I've never felt like that. And being outside and going on walks helped us all get along…Seeing that nature can bring people together and connect us." (P2 G/F 16 Ireland). Participants described nature as a space where they could feel grounded, and truly themselves: Participant 3 FG2 "It's home, it's a place where you can feel yourself." "I feel more relaxed around nature. Like I can be myself." (P1 G/F 16 Ireland). Highlighting individual differences and unique benefits, participants reflected on how the project enabled personally meaningful experiences: **"**By being close to nature through this project, each of us received exactly what we needed in that moment. We all took away something different…I felt genuinely happy during those days" (P4 G/F 19 Armenia). Expanding on this, participant 6 describes how each person was supported to find their unique *pathway to nature* and find new ways of connecting to nature: "It's very individual. Each person experienced it differently, and it comes from deep inside. I'd say it was successful—because most people feel that this connection was strengthened and even formed in new ways." (P6 G/F 22 Armenia)

Community

The project fostered strong interpersonal connections, cultivating a sense of belonging and community. Participants emphasised nature's role in facilitating ease, openness, and authentic interactions. For many, group connections were among the most impactful aspects of the project: "It's a good experience for all of us, and we made new friends. I just loved being around people my own age." (P5 14 B/M Ireland) "This was one of the best programs I participated in…I met amazing people, and our connection continues to this day." (P7 23 B/M)

Many participants described feeling part of something bigger. For example, Irish participants shared: "I felt in a team. Like a sense of belonging. We all kind of looked out for each other." (P3 16 G/F Ireland) Similarly, participants from Armenia share that they felt "a sense of belonging and calm" (P6 22 G/F Armenia) and report feeling at ease despite being in an unknown environment: "Even though I was far from home …I still felt like I was in a very

comforting atmosphere." (P9 19 G/F Aremenia) For participants in Finland, this was particularly significant as many came from migrant backgrounds. The project's ability to foster social cohesion was particularly impactful for these young participants, offering a sense of unity and inclusion after moving to a different country. Participant 21 shared: "Being an international student is really hard to be honest. You feel lonely at times... this project has helped me to express my emotions…now when I feel that life is going down, I remind myself of the project." (P21 27 G/F Finland) She reflects on how their NBI fostered a sense of cohesion and belonging among participants from varied cultural backgrounds:

> "There were really diverse backgrounds of participants. We were all from different countries and participants had an equal opportunity to enjoy nature… It really brought unity. I believe that it has brought me very close as an outsider from a different country—to be part of this community."

The ability to sustain these connections and ensure their longevity was identified as a key strength of this project: "I've participated in a lot of programs, but it's always been the same for me, I'd go, take part, and then that was it. There was no ongoing bond. This is the first programme where the connection has lasted for a long time… where I've stayed in touch with people long-term, and it's actually really cool." (P6 22 G/F Armenia) Participant 9 reflects on how through connecting with other people she was able to discover more about herself: I met and got to know new people, and the more new people I meet, the more I'm able to discover myself." (P9 19 G/F Armenia) This links directly to the last element of this theme.

Self

Lastly, the project deepened participants' sense of connection to the self, encouraging self-awareness and reflection that positively impacted wellbeing. Through their involvement, many spoke of developing greater self-confidence, self-worth, personal efficacy, and an increased belief in their own capabilities:

> "It was a really nice journey and not just with nature, but also connecting with yourself…I feel like I have gained a kind of emotional confidence in myself which I will carry on forever." (P21 27 G/F Finland)

Participant 19 explains how the project has supported her to feel authentically herself and cultivate greater self-compassion: **"**I've become less judgmental toward myself. Not just in nature, but overall, especially after this programme. I can say I'm more *me* now." (P9 19 G/F Armenia) Others spoke about increased agency: "The most fundamental realisation was that I can always change the quality of my life…and as much as our surroundings can influence us, ultimately *we* decide…It gave me the sense that I *have a choice*, and I can choose what I want in life." (P6 22 G/F Armenia)

Learning new skills, engaging in activities they never imagined themselves doing, and going to new places emerged as a core driver of participants' confidence and sense of empowerment:

> "It's a good experience for all of us…I couldn't believe the activities we were doing like planting trees. I never thought I would do something like that. Going places you've never been before." (P5 14 B/M Ireland)
>
> G3: "Learning how to do things. I never had to plant a tree before, and now I have. I learned how to use a shovel, which makes me feel more capable." (P3 16 G/F Ireland)
>
> Participant 1 "I now know how to sharpen a stake properly. I think that's the most useful skill in life." (P17 21 G/F Finland)

Participant 3 referred to valuable skills such as planning and problem-solving which she developed while working on interventions: "Planning of the NBI was good. Planning is a good skill to have in your life…It's a skill you're gonna need for any job in the future. There were some obstacles with our NBI. It was frustrating and annoying but it was good to be able to navigate around it…Problem-solving. It's teaching us life skills." (P3 16 G/F Ireland)

For those with limited English, the opportunity to practice the language built confidence: **"**Speaking English for me. I had never dared to do it before with anyone, so there I spoke some English for the first time." (P22 16 G/F Finland) **"**When I had to speak English there, it wasn't such a big hurdle anymore." (P19 23 G/F Finland)

Beyond practical skills, participants shared that the project also equipped them with emotional regulation tools which have become part of their everyday lives: “The most exciting part was the emotional mapping, because I learned to manage my emotions myself…That became kind of ingrained in me, and now every time I gather with friends or any group, we have this habit of reflecting on the day.” (P10 17 G/F Armenia) Similarly, Participant 9 describes how these tools have helped her to have more compassion towards others:“Through our end-of-day reflections, I’ve realised I started approaching people with less judgment and more empathy…That’s been the biggest change for me.” Participant 19 reflects on the project’s transformative impact, emphasizing its positive effect on self-worth and identity. She highlights the vital role of the youth workers in fostering these connections—something many young people echoed with gratitude. Crucially, her words capture a renewed sense of hope for the future:

> “I can say that the project definitely had a positive impact. It was probably one of the first times I went to a kind of camp with other people, where I enjoyed it. Where I was able to be open and socialise with people… And this project gave me some *hope.* It seems to me that not everything is lost, and I have a million opportunities to see the world and the main thing is not to lose hope. The *people* who are involved in the project, they showed me that I am not a bad person and maybe even interesting and it was an eye-opener for me. It was probably the first time that people gave me positive feedback about me as a person.” (P19 23 G/F Finland)

2) A Shift in Perspective

Many participants experienced a shift in how they relate to nature. This theme, pervasive across focus groups and central to the impact of the project, unfolded across three interconnected sub-themes: A heightened awareness of nature, empathy and gratitude, and a growing responsibility to care for the environment. Participants frequently described this transformation: “I’ve learned *a different way* of seeing nature.” (P13 16 G/F Spain) “I believe that this project helped those who participated in it to *see something more* in nature.” (P19 23 G/F Finland)

Awareness and feeling part of nature

Engagement in the project deepened participants' connection to nature and sharpened their awareness: "I feel more aware of and connected to nature since I've been on the project…I have noticed that I'm now more aware of nature. It was neglected and went unnoticed. I didn't even notice it". (P16 15 B/M Spain) "You start paying more attention—not just sitting and thinking about it, but actually noticing everything more deeply." (P8 20 G/F Armenia) A participant from Ireland shares how linking positive emotions and experiences to engagement with nature has changed her perception of the natural world: "We were out in nature, and we were happy and when you think back to that you remember 'oh I was happy out there' and it changes the way you feel about nature then." (P2 16 G/F Ireland)

Awe-inspiring, such as seeing the Northern Lights, reinforced a sense of unity and oneness with nature: "We were very close to nature, almost like part of it. It was really amazing." This growing connection fostered a new ecological identity:

> "I now believe that I'm part of nature. And I should be empathetic towards it. And be more mindful and conscious about how it's going to affect me. And the impact I'm having on nature which I have to be aware of. We should not consider ourselves separate from nature." (P21 27 G/F Finland)

An Armenian participant spoke about their realisation of our interdependence with nature and alludes to this transformation of self-concept as part of a greater whole: **"**Thanks to the project, I became much more aware. I started to truly realize my place in nature. I've always known I'm a part of it, but now I really *feel* it. I feel how every action I take has a direct impact on nature—and on the future too." (P9 19 G/F Armenia) Similarly, when asked what her main takeaway from the project was, participant 10 shared: **'**That we are also a part of nature, and just as much as we depend on nature, nature also depends on us…The main idea for me was that the more we help nature, the more we're helping ourselves at the same time." (P10 17 G/F Armenia) As illustrated in these participants' accounts, the sense of oneness with nature can serve as the foundation for a more empathetic, compassionate, and conscious approach to caring for the natural world—an idea that connects directly to our second sub-theme.

Gratitude, Empathy and Hope

This sub-theme highlights how deepening the connection with nature can foster feelings of interconnectedness, which in turn give rise to emotions of empathy, gratitude, and hope—key components of pro-environmental behaviour. Through taking action to care for their local environment participants experienced this gratitude and empathy:

> "We did so many activities to connect with nature…and all of that made us *appreciate nature more***."** (P14 16 G/F Spain)
>
> B2: "I feel *empathy* because I've established a bond with nature since I've been on the project, and that makes me feel good." (P16 15 B/M Spain)
>
> "I like being outside more, and I feel more *appreciation* for nature now." (P3 16 G/F Ireland)
>
> "I now *appreciate* nature more, and treat everything—nature and life in general—with more care." (P8 20 G/F Armenia)

This shift in perspective toward a more empathetic and compassionate outlook is marked by a movement away from viewing nature solely as a resource for human use or as a scenic backdrop, to a more conscious consideration of nature's needs: "I think I've started to think more about nature. In the sense that you used to just enjoy its beauty, but now you're thinking about its needs. Now you're really paying attention to it." (P17 21 G/F Finland)

The question that resonated most with participants across the focus groups was one that invited them to harness this empathy by stepping into nature's shoes: *'If nature could speak, what would it say?'* The act of personifying nature enabled participants to articulate their evolving perspective and express a deeper understanding of nature's needs. Participants used the climate emotions wheel to identify a series of powerful emotions including: loss, shame, disappointment, overwhelm, anger, despair, loneliness, fear, panic, betrayal, anxiety, powerlessness, gratitude and hope. Speaking to the underlying mechanisms of this empathy, participants often described nature's feelings by drawing parallels to their own—expressing how they might feel in similar circumstances:

> "Frustration. Because I know if I was nature, say if I was the grass, I wouldn't want bags of crisps being thrown at me when people are done eating them and littering." (P1 16 G/F Ireland)

> "If I were in nature's place, I'd definitely be in a state of depression because of everything that's going on." (P9 19 G/F Armenia)
>
> "I think nature would scream betrayal to us. We are betraying nature in so many ways." (P21 27 G/F Finland)

This question reflects participants' acknowledgement of nature's animacy, and signifies a broader shift toward viewing nature as worthy of respect and care. Participant 6's suggestion that nature has mental health highlights this changing perspective: "I think right now nature is in a really stressed-out state. I imagine that if nature had the opportunity to see a therapist, the therapist would make a lot of money—nature would be a long-term client…Overall, I'd say the state of nature is very bad at the moment. If you look at what's happening in different parts of the world—natural disasters—I think those are nature's way of breaking down, of lashing out because it simply can't handle it anymore" (P6 22 G/F Armenia).

They also spoke to the diversity and depth of emotions experienced by both nature and humanity in the face of the climate and biodiversity crises, highlighting a shared sense of urgency and resilience: "It would probably feel anxiety and hope at the same time. Anxiety because it doesn't know where the future is heading. But hope because it hopes for a good future" (P24 16 G/F Finland). Importantly, participants connected their involvement in the project with positive emotions such as hope and empowerment. They imagined that nature would experience these uplifting emotions when humans take meaningful action on its behalf:

> "It would probably say positive things when we were doing our nature-based initiatives and when people are taking care of the place around them…Because when people are doing positive things in nature, if I was nature it might feel that there is still hope for people to stop doing damage" (P2 16 G/F Ireland).

Participants reflected on how this empathy and gratitude encouraged their acceptance and appreciation of the 'other' and supported them to recognise the value of diverse perspectives: **"**Through this programme, I didn't just learn to love nature but I learned how people can love in completely different ways. And not only people who share our culture or nationality; there were people from different countries, and I saw their ways of connecting…It created such a beautiful

mix—one that allows you to take a little from here and there, and find your own way of loving nature too." (P6 22 G/F Armenia)

Respect and Duty 'Stepping into the bigger picture'

The final sub-theme builds on the earlier expressions of empathy and gratitude, revealing that many participants developed a deep respect for nature and a strong sense of responsibility to protect and care for the environment. This was one of the most significant impacts of the project, consistently reflected across participants' accounts. Participant 14 speaks about "enjoying nature in a healthier way." She expands on this to state: "What I've noticed is the visibility of the importance of nature and that it *deserves* it. We entertain ourselves with it, but *we also have to know how to take care of it* and how to treat it. Nature needs, well, it *deserves***,** good care and good deeds toward it. And that we look at it in a good way, the way it looks at us." (P14 16 G/F Spain) Her shift in language from 'needs' to 'deserves' reflects a deeper transformation in perspective—one that recognises nature as inherently worthy of respect and care. She suggests that we should take a leaf out of nature's book and strive to treat it with the same generosity and kindness that it shows us. This is echoed in Armenian participants' reflections outlining their deepened sense of responsibility and desire to take action: "The project brought me closer to nature, because when I was in nature before, I didn't realize what we were given and its importance…how important it is to protect it. The project helped me understand and truly grasp all of that." (P11 21 G/F Armenia)

Participants shared that the project offered a tangible way to actively support nature—something which is urgently needed in the face of the climate crisis and the sense of helplessness it can evoke. For them, it marked a shift from concern to meaningful action: "During the project, I helped nature for the first time—by helping organize the tree planting. Before this, I'd never participated in a programme where I felt like I was directly helping nature." (P10 17 G/F Armenia) Through the *compassion* pathway and their active involvement in implementing interventions, participants developed a deeper understanding of the effort required to care for nature. This hands-on experience fostered greater respect, awareness, and appreciation. As one Irish participant who took part in the tree planting of a shelterbelt explained:

> "You have more respect...like when you're walking around in the park and you see new trees and new plants. You understand that people really put effort into those rather than just walking past. You understand the work that goes into it, and you notice and appreciate things more." (P2 16 G/F Ireland)

This respect for nature and sense of responsibility led to a deeper understanding of nature's needs, alongside a growing recognition that meaningful environmental protection depends on changes in human behaviour. When asked what nature needs, participants emphasized:

> "I think what nature needs is compassion. So that *people* respect it." (P19 23 G/F Finland)
>
> "More recognition and people to care."(P2 16 G/F Ireland)
>
> "More people like us. People who care about nature." (P15 15 B/M Spain)
>
> "I think nature needs to be valued. Very few people truly appreciate the role it plays in our lives." (P9 19 G/F Armenia)

Participants 17 summarises this call to shift human attitudes and behaviours and emphasizes the need for humanity to recognize the impermanence and fragility of our ecosystems and move into the future cognisant of this:

> "People take a lot, give little back and in the past, unfortunately, have not cared about the consequences. It's leading to the destruction of what we have now. *Nature needs* understanding. Understanding that it is not eternal. You also need to take care of it…if you cut down trees, new ones will not appear in a day. If you take away these resources, new ones will not appear." (P17 21 G/F Finland)

This highlights how participants are situating themselves within the broader environmental context—placing themselves within the picture—and recognising humanity's responsibility to take action. Participant 17 links this newfound respect for nature back to her budding connection to the natural world. She speaks about enjoying nature "with a respectful attitude…without leaving rubbish, or anything behind" and states that it is rooted in "the greater feeling of uniting with nature." Participant 21 reflects on how the project served as a reminder of her cultural and spiritual roots, where nature is revered as sacred. She describes a renewed connection to this belief, emphasising that the project reignited her appreciation for experiencing and honouring the natural world: "In my culture we consider nature as our god, always. And I think we cannot keep

losing that essence of it. I think through this project I was reminded that I have to go out and enjoy every part of it. So my respect for nature has increased." Similarly, Participant 21: states: "When I joined this project it reminded me how important it is to connect with nature, how beautiful it is and why we have to save it. We need this kind of project in each country." (P21 27 G/F Finland) Importantly, participants reflected on how their sense of environmental responsibility has expanded—shifting from a local focus to a more global perspective. This broadening perspective is essential for fostering the kind of collective action needed to address the climate crisis.

> "That sense of responsibility has expanded. It's no longer just about protecting your immediate surroundings—it's more global now. For example, I used to think only in terms of my home, then I started thinking about all of Armenia, and now it's the entire planet…So yes, my thinking has become more global." (P8 20 G/F Armenia)

Participants emphasise the importance of the *emotions* pathways to nature; sharing how experiencing these profound emotions of gratitude, empathy, hope, respect and duty deepened their connection to nature and can be the route towards engaging in action to protect and care for the natural world. As participant 6 and 9 reflect: "It feels like the *emotions* themselves are what brought us closer to nature, helped us stop polluting it, made us love it more. I think they've had a positive impact and deepened our connection to nature." (P11 21 G/F Armenia) Similarly Participant 9 says: "Thanks to these *emotions*, we've become closer to nature, and through that, we've discovered more about ourselves—we feel more whole." (19 G/F Armenia) This connects directly to our third theme, which explores how these emotions can serve as a catalyst for tangible changes in habits.

3) Changing Habits

Participants elaborated on this perspective, describing how their renewed respect and sense of duty has translated into concrete changes in their daily habits and behaviours as a direct result of their involvement in the project:

> "Now, I think more about the consequences of my actions. If I see something dirty in nature, I try to clean it up." (P12 15 G/F Spain)
>
> "Well, with all the activities we did in nature, I realized that it's very important to take care of it. For example, if I see trash on the ground now, it makes me sad and I always try to pick it up." (P13 16 G/F Spain)
>
> "I help my aunty with gardening. This project makes me want to do that more." (P2 16 G/F Ireland)

They attribute these changes in their habits and behaviour to a deeper connection with nature, increased awareness, and a greater appreciation for the effort required to care for the natural environment. An Irish participant reflects on how participating in the project, specifically being involved in litter picking, has enhanced her understanding of the importance of stewardship and inspired her to change her waste disposal habits:

> "Yeah I actually have been thinking that since the project, sometimes before I was like 'oh there's no bin I'll just throw it on the ground.' But now I just keep it in my pocket till I find a bin. Because we went around litter picking and we saw the amount of stuff…it's not good for the environment."(P2 16 G/F Ireland)

Participant 14 echoes a similar sentiment highlighting how gaining knowledge through the project was influential: "We've learned a basic knowledge base through the project about how to take care of nature…now we take better care of our environment." (P14 16 G/F Spain)The use of 'we' reflects a sense of group cohesion and collective identity.

Importantly, participants express a strong desire and commitment to continue work on their NBIs and stay engaged with the project into the future. This is linked to a sense of ownership and duty to maintain the work they have started which is crucial for the long term success of interventions. When asked about the future, many express a motivation to continue working on their NBIs: "Finishing the initiative we're preparing because I think it's really something good for our immediate surroundings." (P16 15 B/M Spain) The young people spotlight the potential for former participants to become active facilitators of change, ensuring the initiative remains dynamic, inclusive, and far-reaching:

> "Continuous learning and development is the most important foundation…I believe maintaining that ongoing presence in this space, constantly reinforcing the idea that we love nature—is what helps us not forget. Just saying, 'This group of people loves nature,' and stopping there—it doesn't feel enough to me. For me, this feels like a mission. That's why having continuity in such programmes is essential. Not just with the same group every time, but involving new people in new ways. Because those who've already been through this phase are now ready to help expand and deepen the reach." (P6 22 G/F Armenia)

The participants also shared how their involvement in the project has sparked a desire to learn more and explore different avenues for environmental stewardship. Looking towards the future, participants voiced a clear commitment to deepening their understanding of nature and exploring environmental efforts happening globally:

> "I hope to participate in future projects, keep in touch with all the people I met through this project, and continue to learn about other ecosystems." (P12 15 G/F Spain)
>
> "Within the project, I developed a strong desire to take part in more volunteer activities… Even something like awareness-raising among young people or kids—if there's an opportunity to volunteer, run a seminar, or explain things to children, I'd gladly do it." (P11 21 G/F Armenia)
>
> "I'm interested to see what else we could do next and what other people might suggest we could do." (P1 16 G/F Ireland)

Their contemplation of the future is vital for ensuring sustained action post-project. Participants express a desire to step into a leadership role, developing their own initiatives: "If the opportunity arises, I'd love to organize a project like this myself someday. That would be really cool." (P8 20 G/F Armenia) They also speak about wanting to share what they have learned with others: "I want to pass on the values I gained from this project to the people I meet" (P9 19 G/F Armenia) and a desire to have a more global impact: "Maybe now we could do something more meaningful and on a larger scale. If there's an opportunity to make a bigger, more global impact. And when you see others doing harm, say something. Speak up and explain *why* it's not okay." (P6 22 G/F Armenia) Notably, participants spoke about a newfound ability to advocate on behalf of nature as a result of involvement in the project: "Before the programme, I

of course did not pollute and was careful with nature as much as I could. But after the programme, *I now also speak up.* I reprimand others who litter or act disrespectfully toward nature. I didn't do that before." (P9 19 G/F Armenia) This sense of responsibility reflects how the project has empowered young people to embody the change they wish to see in the world, linking directly to our final theme exploring the broader ripple effect it has set in motion.

4) The Ripple Effect

This theme captures how the initiative's impact extended beyond individual participants to influence families, peers, and wider communities. Participants described how their involvement sparked conversations and actions among others, deepening collective awareness and engagement with environmental issues. A participant from Spain, shared how creating birdhouses inspired her parents to take an active interest in the project, leading to meaningful discussions about nature in their home:

> "For example, my parents. I told them about the initiative. At first, they told me they would come along but wouldn't participate, but then they took part in the activities there and became very involved. It has given them knowledge and generated interest. Now my father is more interested in birdhouses, and now at home we talk more about that and about nature." (P12 15 G/F Spain)

In parallel, Participant X describes the impact of her involvement in the project on her group of friends inspiring them to volunteer as well as sparking her younger sisters interest:

> "Among my circle of friends, everyone knew I was participating in a project at the time. A few even asked if they could join as volunteers—and they did. That's how I contributed to the community. And now, even my little sisters have started paying more attention to environmental issues. They've become interested, and they've told me that if anything like this happens in our community, they definitely want to be involved." (P8 20 G/F Armenia)

Similarly, Y from Finland describes how she shared what she learned during the training course with her friends, which led them to change their own habits: “And after going through our training, well, I shared with my friends some of the things that I learnt there. And, actually, we started to pay more attention to taking care of nature, sorting rubbish, which before we didn’t. So really, this kind of training affects not only the participant, but also their environment, their friends, their family and so on.” (P17 21 G/F Finland)

As demonstrated in these first three accounts, this ripple effect was the direct result of participants' commitment to raising awareness and actively engaging their communities. Participants amplified the impact by engaging institutions which are already embedded in the community such as secondary schools, kindergartens and local football clubs. Spanish participants describe visiting two local secondary schools, where they engaged over a thousand students. They explained how this outreach sparked interest and support, inspiring many students to volunteer with their intervention: “We’ve carried out an initiative, we’ve spoken with schools, we’ve involved people…The students at the schools were paying attention and were interested in the project and in being part of the initiative with us. I think there are more of us to improve it, and I think it’s going to have a very positive impact, because together we’ll be able to do a little better.” (P14 16 G/F Spain). Similarly, participants from Armenia collaborated with six local kindergartens to nurture an early appreciation for nature among young children. Their intervention aimed to instill lasting environmental values through modelling positive actions and direct involvement. This also speaks to the longevity of such interventions, as their approach has influenced teachers who are now independently continuing the initiative. As one participant reflected: **“**Our goal was to foster a love for nature…starting from an early age, so they would grow up caring for their surroundings .... So, at a community level, I believe we reached all six kindergartens. And right now, those children are being educated by their teachers to care for and water the trees that were planted.” (P6 22 G/F Armenia) Building on this, participant X touches on the importance of modelling behaviours and being action-orientated, rather than merely explaining why others should care:“I think we can pass on these values not only through words but through our actions. For example, my circle of friends now shares the same values—we agree that we shouldn’t pollute, and instead we should care for the environment. When younger kids in our surroundings see that, they try to follow our example.” (P9 19 G/F Armenia)

Considering the project's role in fostering sustained community engagement and collaboration, participant 15 notes how raising awareness and enlisting the support of local community members can ensure the long-term success of these interventions: "We hope it will have a great impact on the local wildlife. And as for the social impact, if our initiative helps raise awareness about caring for small reptiles, they will continue to use the watering trough for a longer time." (P15 15 B/M Spain) An Armenian participant highlights how for her, witnessing not only the environmental impact but also the growing engagement of others has been a crucial source of encouragement. When asked what keeps her committed to the project, she reflected: "Seeing that your efforts are making a difference. Not only in nature, but in people as well. Seeing people start to get involved…Because you can keep going and fighting for something, but there comes a moment when you might lose hope if you feel like nothing is changing." (P8 20 G/F Armenia)

Notably, participants share how they have now started to work on their own initiatives outside the scope of this project which encapsulates this ripple effect. One participant from Armenia described how her experience with PTN motivated her to advocate for change within her community, specifically by lobbying her local municipality to address an ongoing waste management issue:

> "I live in Marash, where there are a lot of stray dogs. The garbage bins are left open, and the dogs come, drag things out, and spread trash everywhere…We gathered over 100 signatures across the community and forced them (the municipality) to bring in and install proper containers." (P7 23 B/M Armenia)

Similarly, participant 17 shared that they are now planning their own nature-connection event, inspired by the project. This demonstrates the project's spillover effect—planting the seeds for future initiatives: "And at this point, we were organising an event to make people appreciate the beauty of nature and encourage them not to destroy it." (P17 21 G/F Finland)

5) Challenges and Spaces for Improvement

Lastly, we share several challenges encountered within PTN, as described by the young participants in their evaluation of the project. We offer these insights in the hope that they will inform and support the design of future interventions. These challenges highlight important

considerations for co-design processes, particularly the nuances of accommodating individual differences and preferences. Being mindful of these complexities is essential when co-creating effective and inclusive interventions:

Weather

Some participants noted that the weather and the time of year presented significant barriers to their development of the interventions. This was especially relevant for participants in Finland, where the intervention took place during the Winter and early Spring due to scheduling constraints faced by the youth worker team. Finnish Winters are known for their harsh conditions, which was a significant challenge for young people participating in outdoor activities. As Participant 17 observed, carefully considering the time of year and seasonal conditions is crucial when encouraging young people to engage with nature. Additionally, they call attention to the importance of having the right clothes/ gear when spending time in nature. Warmer months—such as Spring and Summer—may be more appropriate for introducing those with limited prior experience of the outdoors, as these seasons offer more comfortable and inviting conditions for exploration and connection:

> "Must be the time of year…Winter is a little bit of a boundary for me…Here, we are reminded that we live in Finland, so it is like that…It was already cold. I know there is no such thing as the wrong weather, there are wrong clothes. But if it were summertime, it would be much nicer." (21 G/F Finland)

Similarly, Participant 3 reflected on the particularly harsh Winter during the intervention period, noting that her connection to nature tends to feel stronger during the Summer months when conditions are more favourable: "In the Summer the relationship is much better than in the dark Winter. And this Winter has been extra dark because there hasn't been much snow." (P19 23 G/F Finland) Participant 2 expands on this to share how the weather during the training course acted as a barrier to nature connection in this instance:

> "It was *bad weather* most of the time. So, well, we were kind of sitting indoors and probably didn't feel much connection with nature." (P18 22 B/M Finland)

This highlights the importance of carefully considering seasonal timing in each region when planning and implementing interventions, particularly in cross-cultural contexts. It also

emphasises the need to account for the diverse backgrounds and experiences of participants—not all were familiar with the realities of Finnish Winters. Many participants in the Finnish cohort were recent migrants from other countries and had limited experience with Winter conditions or engaging with nature during this season. For some of these young people, learning how to connect with nature in the context of a Finnish Winter became an important and valuable part of the intervention. As one participant from Nepal shared: "For me coming from a really different environment to the nature of Finland is hard. And this is really new, this Nordic weather. So anything I'm doing with nature in this project is helpful." (P21 27 G/F Finland)

Structure and Consistency

While the flexible structure of the programme was designed to give participants the time and space to engage meaningfully and to encourage youth to take the lead, one young participant shared that the absence of a more structured routine caused them anxiety. This underscores the importance of acknowledging individual differences and needs when designing such programmes. It also highlights the value of providing regular opportunities for participants to offer feedback throughout the intervention, allowing concerns to be addressed and potential anxieties to be mitigated early on. This consideration becomes especially important when young people are placed in unfamiliar environments, surrounded by new people and away from home. For example, the aforementioned participant noted that not receiving the schedule or plan for the training course in advance was a significant source of stress:

> "For me, the issue was that I didn't have the schedule in advance. I really like writing everything down—what's supposed to happen, how it's supposed to go…I like to know what to expect each day. That information wasn't provided ahead of time…and that was stressful for me." (P6 22 G/F Armenia)

Participants from other groups reported that having a daily schedule provided ahead of time helped them feel more prepared and at ease. They also emphasised that facilitators regularly checking in and attentively listening to their needs played a crucial role in making them feel heard and valued throughout the process: "The programme was very well prepared. Every day

there were some interesting activities, adventures, but also, they (youth workers) listened to us, what we wanted." (P17 21 G/F Finland)

In connection with the structure of the programme, participants called attention to the importance of consistent communication and regular contact to ensure success of the interventions. Participants from Ireland shared that greater consistency in meet-ups and check-ins during the ideation and planning stages would have improved the project. They expressed a need and preference for more regular opportunities to connect and reflect as the intervention developed and transitioned into a reality:"I think we should have met up more…You're not going to get anywhere if you're not meeting up on a regular basis." (P1 16 G/F Ireland) Participant 2 echoed this sentiment, emphasising that commitment and consistency, particularly the regular attendance of other participants at meetings, is crucial. She felt that inconsistent participation posed a significant barrier to achieving their goals. Additionally, she highlighted several other challenges that impacted the outcome, including difficulties in obtaining permission to implement the intervention which disrupted the process and affected the final results:"We weren't making any progress in our meetings. Some people were not coming to the meetings so not everyone is on the same page. And then if we couldn't get permission we'd have to change our plans. All of the groups meeting up more often would be better." (P2 16 G/F Ireland) Aligned with the themes of consistency and momentum, participants expressed a strong desire to keep momentum with their interventions, stay engaged and be involved in future projects. This presents a challenge given limited project funding cycles and underscores the need to plan for long-term sustainability when you are engaging young people and asking them to invest time and energy in such projects.

Preferences in Practice and Individual Differences

Highlighting the importance of recognising individual differences and preferences when working with diverse groups and responding to a wide range of needs, we observed varying responses to the tools and techniques used throughout the project. For instance, a participant from Armenia expressed that they found the interactive Inclusion of Nature in Self Scale (IINS) limiting, noting that they felt social pressure to stand where their peers positioned themselves, rather than where they personally felt most aligned:"Honestly, I just stood there because that's

where most people were. That map feels limiting to me. I don't like being told to quantify things so precisely, because what I chose today—I know for sure I'd choose something completely different tomorrow." (P6 22 G/F Armenia) This was a particularly insightful observation, as many other young participants described the activity as engaging and immersive, appreciating the opportunity to take part in an embodied exercise and to be physically active during the focus group. This contrast serves as a reminder not to assume that the majority experience reflects the needs or feelings of all.

It is important to recognise that individual differences and preferences deeply influence young people's relationships with nature and their ability to connect. Consequently, not all participants felt a renewed sense of connectedness to nature after involvement in the project. For example, when explaining his chosen position on the Inclusion of Nature in Self (IINS) scale, participant 4 from Ireland stated: "I don't feel connected to nature at all – zero." (P4 14 B/M Ireland) Despite this, it is promising to see that he expressed optimism about the possibility of strengthening his connection with nature in the future: "Maybe after Finland (Youth Exchange) I'll feel more connected to nature and come to stand in a different spot." Additionally, not all participants reported an increased desire to spend long amounts of time in nature. For some, the comfort came from knowing they could return to their habitual environment. Participant 6 expressed that they preferred urban settings, explaining that nature felt calming only because the experience was temporary. They even found city noise more soothing than extended time in nature: "Yes, it (nature) calms me—but it's the feeling of knowing that I won't be staying there for long that calms me…And when I'm done…I know I'll go back home. I don't want to stay long. I think that in the city, with the noise I am calmer than in nature, even if I go to nature, I don't want to stay long." (P6 22 G/F Armenia) This perspective underscores the importance of recognizing that not everyone has an inherent connection to nature or will experience its benefits in the same way.

Discussion

This study aimed to examine the impact of co-designed nature-based interventions, involving sixty young people across four countries, on youth wellbeing, nature connectedness, and environmental stewardship. A mixed-methods approach was used to explore how young people from culturally and economically diverse backgrounds engage with nature, including the potential benefits they experience, the obstacles they face, and what motivates them to protect the natural world. The discussion that follows considers these findings in relation to youth mental health, health equity, and climate action, offering targeted recommendations for intervention design, practice, and policy development.

Summary of key findings

Wellbeing—Qualitative data provided deep insights into participants' experiences, revealing how the project supported various dimensions of wellbeing through connection on three interconnected levels: nature, community, and self. Crucially, previous research outlines how these interrelated levels of connection can support adaptive responses in the face of ecological change (Macaulay et al., 2023), supporting people to navigate the diversity of climate-related emotions and creating healthier relationships with self, others, and nature. By implementing co-design processes and collaborating with local practitioners who understood the unique contexts of the young people, interventions were culturally sensitive and tailored to their specific needs. In their reporting, the young people associated taking part in the NBI with increased happiness, social connection, self-confidence, personal agency, and hope for the future. Wellbeing benefits were deeply rooted in the project's intentional creation of time and space. The immersive training course week was particularly effective, offering a stark contrast to participants' fast-paced, predominantly urban, lives and underscoring the importance of reconnecting. This is especially significant given that many participants identified the structure of modern, urbanised life as a systemic barrier to nature connection—a concern echoed in existing literature (Richardson, 2025; Ibes et al., 2021). These findings highlight the potential of such interventions to address broader systemic issues, particularly around accessibility and equity, by intentionally

providing inclusive opportunities to engage with nature and experience the benefits of this relationship.

The programmes' focus on nature connection acted as a catalyst to other forms of connection—fostering social interactions as well as a deeper understanding of oneself. Through this, the programme cultivated self-awareness, strong interpersonal bonds and a sense of belonging. The role of nature as a safe and supportive environment, conducive to this, was consistently highlighted by participants. The social dimension was among the most impactful aspects of the programme supporting previous work which highlights that successful interventions tend to have a core social element (Shrestha et al., 2025; Giusti et al., 2018). The ability to foster social cohesion, through the project, was particularly impactful for participants from migrant backgrounds, offering a sense of unity, inclusion and acceptance. Building on this, participants shared that involvement in the project encouraged a recognition of the value of cultural and individual diversity. This speaks to the role nature-based interventions can play in bridging cultural and social divides (Cho et al., 2024). Recent research examining the effects of a one-week immersive nature camp on youth with psychological needs, reported similar results indicating improved social connections, interpersonal skills, and reduced loneliness (Nagi et al., 2025). Further, our findings underscore the importance of creating opportunities for lasting relationships. Participants shared that a key strength of the project was the ability to sustain these connections beyond the programme itself, reinforcing the longevity of wellbeing outcomes and connection to nature.

Notably, the involvement in PTN encouraged reflection and self-awareness that contributed meaningfully to participants' wellbeing. Many participants reported experiencing increased self-confidence, compassion, self-worth, and personal agency in their own lives as a result of involvement in the project and acting for nature. This aligns with previous research which suggests that volunteering and civic engagement can positively contribute to young people's wellbeing. For example, findings from the Growing Up in Ireland (GUI) study revealed that 20-year-olds who volunteer report higher life satisfaction and self-confidence (2023) and support the argument that volunteering offers a protective effect on mental health, especially for those from socially disadvantaged backgrounds. Participant's accounts reflect the programme's capacity to nurture the seven proximal outcomes central to youth development (Department of Children and Youth Affairs, 2014), highlighting its value not only as a wellbeing intervention,

but also as a support for personal and social development. Engaging in new experiences, whether learning new skills, visiting new places, or stepping outside their comfort zones, were key drivers of this personal growth—significantly enhancing participants' sense of empowerment and perceived capability. Supporting this, a national survey in Ireland, conducted by Amárach, showed that more than half of respondents (young adults) who learned a new skill reported a boost in confidence (92%) and improvements in mental and physical wellbeing (88%) (Department of Further and Higher Education, Research, Innovation and Science, 2023). Further, our analysis suggests that the programme equipped participants with emotional regulation strategies, including mindfulness and reflective practices, which they report incorporating into their daily routines to support sustained wellbeing.

Participants emphasised the influential role that the youth workers and facilitators played in supporting these wellbeing outcomes throughout the project. The integration of practitioners' diverse knowledge, expertise and practical experience was an invaluable aspect of this project. Their practices, outlooks, and educational strategies are directly based upon a holistic understanding of young people and their approach, rooted in inclusivity, relationship-building, and deep reflection, was central to creating a supportive and meaningful experience for participants. While specific techniques and exercises supported these outcomes, it was ultimately the facilitators' way of being that made the greatest impact. As one youth worker summarises, *"It's not about what you do, it's about how you are."* This highlights the crucial role of practitioners not only in introducing young people to nature, but also in nurturing social cohesion and guiding self-reflection through their presence, attitude, and relational approach. This is reflected in previous work (Shrestha et al., 2025; 2025) as well as other literature which outlines the significance of the involvement of mentors—'persons, such as teachers, experts or relatives, who are capable of inspiring, encouraging, or leading the nature experience' (Giusti et al., 2018, p.7). Recent work highlights the significance of the youth work approach for the wider education system stating that "embedding youth work in schools can serve as a catalyst for educational transformation, cultivating more democratic, sustainable, and supportive learning environments' (Pantazidis & Pechtelidis, 2025, p.1.).

While wellbeing changes did not reach statistical significance, the pre-post analysis of scores on the PWI-SC indicated an upward trend in wellbeing across all participant groups, with the exception of those in Ireland, whose scores remained stable. The quantitative analysis revealed

that older participants reported lower levels of wellbeing both pre and post-intervention. This finding aligns with the recent longitudinal data from the *Global Flourishing Study*, which highlights a troubling rise in mental health challenges among young adults worldwide. Prompting authors of this report to conclude that this specific cohort 'are not doing as well as they used to be' (VanderWeele et al., 2025, p.646). While the causes are likely multifaceted, our qualitative findings suggest that one contributing factor may be the diminishing connection to nature, coupled with increasing societal pressures to conform to fast-paced, urbanised lifestyles—trends that leave many young people vulnerable to the negative impacts on their health and wellbeing. This is reflected in participants' narrative accounts where many associated the transition into adulthood with an unavoidable movement away from nature and toward high-pressure urbanised settings. Participants spoke about the negative impacts of this, describing feelings of exhaustion, illness, and a growing sense of disconnection from the natural world. This is reflected in previous research outlining the *extinction of experience* (EoE) due to loss of opportunity to connect with nature (urbanisation, reduced opportunities to engage etc.), loss of orientation (decline in affinity to nature), and cultural/ historical context (technological & demographic influences) (Richardson et al., 2022; 2025). With research revealing how this cycle diminishes both wellbeing and pro-environmental behavior (Colléony et al., 2020). These reflections raise important questions about the dominant cultural norms shaping modern life. They highlight the need to reconsider why access to nature, and the time and space to meaningfully connect, is not more deeply embedded in the design of our cities and societal structures.

Quantitative findings suggest potential gender-based differences in individuals' relationships with nature and the benefits derived from nature engagement, with girls/women reporting higher levels of nature connectedness and higher levels of wellbeing than men/boys following the intervention. This is interesting in light of previous research showing that women often report higher nature connectedness, stronger pro-environmental attitudes, and greater emotional and health-related gains through nature connection (Macias-Zambrano et al., 2024; Grabowska-Chenczke et al., 2022). Qualitative findings provided nuanced insights into gendered patterns of engagement, with female participants often articulating more explicitly the project's impact on their wellbeing and relationship with nature. In contrast, one male participant remarked that he "doesn't feel connected to nature at all" after the programme. However, this may reflect broader

gendered differences in communication styles (Tannen, 1990; Kilby, 2023). Observations from youth workers suggest that while male participants may be less likely to verbally express enhanced wellbeing or nature connectedness, these outcomes are often evidenced through behavioural shifts and tangible changes in daily habits. This may be linked to Socialisation Theory (Echavarren, 2023), which posits that women are often socialised to be nurturing and cooperative and subsequently are more predisposed to express care toward nature—a theory often reinforced by ecofeminist discourse suggesting an intrinsic connection between women and nature (Siegel, 2024). This underscores the need for sensitivity to these gender-based differences within intervention design.

Nature connectedness—The analysis conveyed that participants experienced a shift in perspective during the project signifying an evolving relationship with the natural world, characterised by a heightened awareness of nature, deeper empathy and gratitude for nature and a newfound sense of respect and responsibility to protect the environment. Central to this is the sense of oneness with nature—whereby participants report transitioning from a sense of separation to feeling 'part of' and embedded within the natural world. This felt sense of connectedness and belonging represents a core outcome of the project. It suggests the integration of nature into their self-concept (Schultz, 2002), whereby the self is understood as part of a greater whole, emphasising the interconnectedness of all life. In alignment with this, quantitative findings reveal significantly higher nature connectedness scores post-intervention than pre-. Participants reported a more relational or reciprocal view of planetary health, moving away from a utilitarian perspective, where nature is seen merely as a resource for human use, toward a more holistic understanding that recognises the mutual dependence of humans and nature. This shift also brought with it a more conscious consideration of nature's intrinsic value—its rights, needs, and worth beyond any material benefit it may provide. This suggests the potential of such interventions to support a shift in worldview from an anthropocentric (human-centered) toward a more ecocentric (nature-centered) perspective (Frantz et al., 2025). This is promising, given that recent research has identified this shift in worldview as crucial to transitioning into a more sustainable lifestyles and enacting authentic behaviour change (Giusti et al., 2025; Balunde et al., 2019). This emerging orientation closely aligns with Indigenous worldviews, which embody mutual respect, kinship, reciprocity and interdependence (a.k.a. relational values)—values that, as highlighted in previous research, are central to transforming our relationship with the natural

world and safeguarding it into the future (Nenquimo, 2025; Menzies et al., 2024; Topa & Narvaez, 2022). These insights underscore the potential of NBIs to serve as powerful catalysts for this essential shift in perspective, helping to reframe sustainability from a human-centered model to one rooted in Earth-centered kinships. As identified by previous work, foundational shifts in cognition and ontology are critical for initiating and sustaining transformative change across other domains of society (Orr & Burch, 2025).

Importantly, our analysis sheds light on the underlying mechanisms leading to this shift in perspective spotlighting potential routes to achieve this. Participants identified three specific pathways to nature, *beauty, emotions* and *compassion* (Lumber et al., 2017), as particularly central to this evolving perspective. Firstly, experiences in nature, particularly moments that evoke awe and reverence, were suggested to inspire this sense of unity and interconnectedness. This aligns with previous research highlighting patterns between awe-evoking experiences and ecological behaviour (Løvoll &Sæther, et al., 2020), and the mediating role of nature connectedness (Yang et al., 2018). Secondly, participants emphasise the importance of the *emotions* pathway to nature; sharing how they experienced emotions of gratitude and empathy during the project and that this ultimately deepened their connection to nature. Existing literature underscores the importance of these specific emotions for nature connectedness (Chen et al., 2022; Tam, 2013). Participants demonstrated an understanding of nature's needs and were able to express these through the personification of nature in the focus group. This speaks to what Kimmerer (2013) refers to as *'the grammar of animacy'* denoting how participants have gained increased moral concern and responsibility through recognition of nature as a collection of living beings with inherent rights and worthy of our care. The importance of moral concern in forming the root of pro-environmental behaviour has been highlighted within recent work (Neldner et al., 2022). Additionally, through the *compassion* pathway, and their active involvement in NBIs to protect and care for nature, participants experienced emotions of respect and responsibility which deepened their relationship to nature and increased their motivation to conserve and protect it. This links to previous research outlining how environmental volunteering can lead to attitudinal shifts, conducive to a more ecocentric worldview (Sapci et al., 2025; Molsher & Townsend, 2016)

Pro-environmental behaviour and stewardship—Participant's narratives suggest the potential for NBIs to act as a powerful catalyst for pro-environmental behaviour by helping to

close the connectedness-action gap (Richardson, 2023). Participants' shift in perspective was central to this, enhancing their motivation and capacity for environmental stewardship. The analysis conveyed that the participants started to see themselves as part of a larger ecological picture—recognising their capacity to make a positive difference. Participants expressed how feelings of awareness, gratitude and empathy fostered a sense of duty and responsibility to protect and care for nature. Previous research highlights how these emotions are key components of PEB (Grund et al., 2024; Jacobs & McConnell, 2024; Li & Li, 2025). The project offered participants meaningful opportunities to effect tangible change within their communities—an important intervention given the widespread sense of helplessness many individuals report in response to the climate and ecological crises, which can contribute to feelings of hopelessness and subsequent inaction (Crandon et al., 2024; Said & Wölfl, 2025). Further, the ideation, development and implementation of NBIs increased participants' sense of agency and efficacy in terms of making meaningful change. Through hands-on involvement in developing the interventions, participants gained a deeper appreciation of the effort and consistency required to care for the natural environment. This process fostered a sense of place attachment and a perceived responsibility to protect natural spaces into the future which is an essential factor in ensuring the longevity of such interventions (Daryanto & Song, 2021). These findings align with prior research demonstrating that youth engagement in conservation and nature-based activities enhances their willingness to act on behalf of the environment (Barnason et al., 2022; McLeod et al., 2024)), and that participation in outdoor recreation can generate pro-environmental behavior spillover effects (Mateer et al., 2023). It also points to a potential 'feedback loop' whereby engagement in pro-nature behaviours strengthens individuals' connection to nature, which in turn reinforces further pro-environmental behaviour (Richardson et al., 2020).

Participants reported adopting new habits and engaging in tangible pro-environmental behaviours as a result of their involvement in the project, including improved waste management, conservation practices, volunteering, advocacy, and activism. Many expressed a commitment to sustaining their interventions and a clear interest in future projects, with some initiating independent environmental initiatives beyond the scope of the project. These outcomes suggest the potential for behavioral spillover, whereby participation in one pro-nature behavior encourages the adoption of others (Lanzini & Thøgersen, 2014). A notable outcome of the project was participant's newfound willingness to advocate for nature—sharing knowledge

gained through the project and becoming more vocal. This advocacy was facilitated by the identification of meaningful avenues for local impact and the provision of knowledge and psychosocial support. In particular, the development of key attributes such as confidence, self-efficacy, emotional regulation, and the seven proximal outcomes equipped participants with the skills and resilience necessary to advocate for nature. This is promising given that Nash et al., (2019) identified knowledge, skills and self-efficacy as key mediators in spillover effects. Additionally, they underscore that targeting behavioural catalysts 'that generate more socially diffuse spillover effects' could offer more potential than conventional spillover focused on individual isolated behaviours (Nash et al., 2019, p.1-2). One of the key outcomes of the widespread community involvement observed across participating countries. This highlights the potential for community-based interventions to generate large-scale, socially embedded spillover effects. Moreover, participants highlighted the value of the social networks developed through the project in coping with the emotional demands of taking action in the face of the climate crisis. These networks provided a foundation of solidarity and collective purpose, helping participants mobilise and channel climate-related distress into constructive action—echoing findings by Cosentino et al., (2024) and Godden et al., (2021) on the emotional buffering role of community and collective action. Further, this aligns with White et al., (2023) theory of Nature-based Biopsychosocial Resilience (NBRT) which suggests that nature-based social contact can support individuals build and maintain biological, psychological, and social (i.e. biopsychosocial) resilience-related resources to promote adaptation and action.

Cultural Differences: Our findings also suggest cross-cultural variations in nature connection. For example, participants in Armenia reported significantly higher levels of nature connectedness than those in Spain. Moreover, participants from Finland described a strong collective identity that is deeply intertwined with the land, where nature connection is not only a personal experience but also a cultural cornerstone. This reflects broader societal values in which forests, lakes, and outdoor traditions are central to everyday life and national identity, shaping both individual wellbeing and shared environmental responsibility. These values are reinforced by cultural practices such as Jokamiehenoikeus (Everyone's Law or the right to roam), a legal framework granting the public the right to freely access and enjoy natural spaces, including forests and waterways, regardless of land ownership. Such culturally embedded practices, supported by legal structures, may enhance nature connectedness and foster a more deeply rooted

ecological identity. However, further research is required to fully unpack these cultural differences. This speaks to recent work outlining how our relationship to nature is shaped by country-level factors, such as cultural norms, values, and opportunities for interacting with nature (Soga & Gaston, 2025).

Strengths and limitations

This study responds to calls for mixed-methods research, interdisciplinary collaboration, and increased participant diversity in nature-based intervention research (Lloyd & Gifford, 2024). Our cross-cultural, intergenerational, and intersectoral team—spanning youth work, environmental psychology, conservation, environmental education, and health—drew on decades of professional experience, observation, and insight. Guided by youth work philosophies and participatory frameworks, co-designed interventions were grounded in inclusivity, relationship-building, and responsiveness to participant needs, enhancing relevance and engagement. Working with participants to collaboratively develop interventions, supported more targeted and contextually sensitive NBIs, addressing community-identified needs and avoiding a top-down implementation approach. Our mixed-methods design enabled the integration of quantitative and qualitative data, offering a nuanced understanding of the experiences and impacts of the project. The socio-economic and cultural diversity of participants further strengthened the study's relevance across contexts. While efforts were made to translate key materials (e.g., the PWI-SC scale) into partner languages, linguistic diversity among participants may have posed challenges with language barriers potentially affecting accessibility for some. Addressing this more systematically is an important consideration for future research.

The PWI-SC scale was selected in alignment with partner objectives, however it may not have fully captured the specific wellbeing outcomes related to the intervention, as it measures general wellbeing rather than project-specific changes. Importantly, in our study, technical difficulties meant that we could not fully match survey data on wellbeing and nature connectedness pre- and post-interventions, and thus our quantitative results need to be considered as mainly descriptive. Nonetheless, the nuanced qualitative accounts from our focus groups shows a great diversity of wellbeing experiences, which standardised generic scales may not fully capture. This is an intrinsic limitation of quantitative measurement which further

supports the importance of qualitative investigations of impact (Lloyd & Gifford, 2024; Mitchell et al., 2024). Lastly, conclusions on impact are further limited by the absence of a control group in the interventions. While this reduces the robustness of the design, it was deemed appropriate by the team to involve all participants in the intervention and this is a trade-off that may require careful consideration in community-engaged research.

The focus groups provided rich qualitative insights on the interventions but represented only a subset of participants (24 of 65) and thus captured a specific range of participant's personal experiences. To address this and enhance the quality of the analysis, a rigorous member-checking process was conducted with all participants involved in the project, ensuring the accuracy of interpretations and the opportunity for all voices to be represented. It is also important to acknowledge that the findings reflect participants' self-reported behaviours and perceptions of the impact of the project on themselves and the broader communities at the time of the study. As such, the data captures immediate outcomes and subjective interpretations rather than long-term impacts, behavioural change or sustained community effects. It is possible that we observed no differences in wellbeing pre- and post- as benefits associated with nature connectedness may emerge gradually over time. Previous longitudinal research reveals that improvements in nature connection and associated wellbeing outcomes transpire over many years supporting the notion that transformative outcomes evolve through sustained engagement rather than immediate change (Barrable & Booth, 2020; Harris et al., 2025). Future longitudinal research and follow-up studies will be essential to evaluate the durability and broader influence of these interventions over time. Finally, the project's two-year funding cycle presents limitations for long-term engagement, underscoring the need for sustained support and continuity in future initiatives.

Implications for intervention design, practice and policy

This study offers valuable insights to inform community-level initiatives and broader policy:

1. *Intervention Design*: The use of co-design and participatory frameworks is crucial for the development of impactful interventions. Actively involving participants and community stakeholders in the ideation, design, and implementation processes fosters a sense of

ownership, place attachment, and collective responsibility. Such approaches not only enhance the relevance and cultural appropriateness of interventions but also contribute to their long-term maintenance and effectiveness. While co-design approaches bring important benefits, we note that individual differences and personal preferences shaped participants' experiences of the project, with some reporting challenges related to specific tools and structural elements of the programme. These findings underscore the importance of accounting for diversity during the co-design of interventions to ensure inclusivity and maximise meaningful, positive outcomes (McGowan et al., 2024). Effective co-design requires critical reflection on what constitutes authentic participation, with practitioners intentionally considering how inclusive practices are embedded from the outset. Interventions must account for individual differences in experiences and relationships with nature, offering flexible, culturally sensitive, and personally meaningful pathways for engagement. Prescriptive, one-size-fits-all models should be avoided in favour of adaptable frameworks that respond to diverse needs and contexts.

2. Interventions that facilitate immersive nature experiences, strengthen social connections, and create pathways for pro-environmental action have the potential to enhance youth mental health and foster long-term environmental stewardship. It is crucial to recognise that individual differences and preferences deeply influence young people’s relationships with nature and their ability to connect. These variations stem from a range of factors, including personal experiences, environmental contexts, and cultural backgrounds (Koivisto & Grassini, 2023). This underscores the importance of avoiding assumptions that all individuals have an innate affinity for nature or will derive uniform benefits from nature engagement. This is particularly pertinent in the context of the extinction of experience, whereby many young people have limited access to natural environments and may not feel as comfortable or connected to nature (Whitten, 2025). For some, nature may feel unfamiliar or even intimidating. Therefore, it is essential to meet young people where they are in their relationship with nature and support them to connect in ways that feel meaningful and applicable to them.
3. Focusing on the three interconnected levels of connection—nature, community, and self—may be a strong route to holistic planetary health. Interventions that engage emotional capacities, such as gratitude, empathy, respect, and responsibility, can facilitate

a shift in worldviews essential for sustainable transformation. The development of an ecocentric worldview, characterised by a sense of belonging to a larger ecological system, can foster collective identity, which plays a crucial role in mitigating feelings of helplessness, burnout, and hopelessness.

4. It is important to acknowledge that proposing a dual role for mental health professionals—supporting both individual mental health and planetary health—may be contested. Many practitioners already manage substantial responsibilities and may reasonably prioritise their focus on individual mental health outcomes. While integrating planetary health perspectives presents potential synergies for promoting ecological wellbeing alongside psychological wellbeing, it should be framed as a possible extension of practice rather than an assumed expectation or moral obligation. This perspective recognises both the promise and the practical constraints of adopting such a dual focus and underscores the need for careful consideration, interdisciplinary collaboration, and further empirical exploration.
5. Emerging research has identified nature connectedness as a potential risk factor for psychological distress which is considerably exacerbated in the context of escalating environmental degradation and the climate crisis (Barrable et al., 2025). This raises important considerations for interventions that seek to enhance nature connectedness among youth. While we acknowledge this potential risk, our findings suggest that a strong relationship with nature can also serve as a protective factor, offering emotional refuge, a sense of hope, and motivation in the face of climate-related distress. Considering this, future interventions must be designed with care to address potential emotional distress linked to deepening nature connectedness, ensuring appropriate support mechanisms are in place.
6. Interventions that foster social connection and shared purpose may be particularly effective in mitigating these concerns, supporting mental health and sustained PEB, especially given the emotional demands of engaging in action to protect and care for nature. Embedding initiatives within communities and leveraging existing social networks, institutions, and resources can enhance support, amplify impact through socially diffuse effects, and promote long-term sustainability. Socially visible and emotionally resonant interventions are more likely to spread through peer networks,

generating broader behavioural change than isolated efforts. Infrastructure to sustain these social connections is essential for lasting impact.

7. Supporting young people to channel emotions into action by identifying tangible routes to have direct impact within their communities can counter feelings of helplessness and hopelessness. Action-oriented approaches that model pro-environmental behaviours have critical implications for effective and transformative Environmental Education (EE).
8. Interventions that provide opportunities for young people to acquire and apply new skills, engage in challenge-based activities, and step beyond their comfort zones are particularly effective in fostering psychological resources such as agency, confidence, and hope. These attributes are essential for cultivating long-term engagement in environmental stewardship and should be central to the design of youth-focused environmental programmes and policies.
9. Engaging experienced practitioners and mentors with deep experiential knowledge is critical to the success and contextual relevance of interventions. A multi-sector, community-embedded approach can enhance the effectiveness of interventions by enabling tailored support. Practitioners who have expertise in working with nature, established relationships and built trust with the young people are uniquely positioned to recognise subtle shifts in wellbeing and to respond appropriately to the specific contexts and needs of each young person. Actively involving practitioners in the co-creation process also facilitates meaningful engagement with marginalised and minority groups, helping to overcome barriers to nature connection and address wider health inequities.
10. Long-term sustainability must be integrated into the design of nature-based interventions from the outset. Participants in this project consistently expressed a desire for continued engagement and opportunities beyond the initial project, highlighting the need for infrastructure that supports ongoing connection, mentorship, and pathways for future involvement. Short-term funding cycles present a barrier, making strategic planning essential to sustain momentum.
11. *Policy:* Finally, our findings underscore the need to intentionally embed opportunities for nature connection into our systems and daily routines, recognising its critical role in promoting planetary health. Nature connectedness has been described as ‘a basic human right’ (Richardson, 2023), yet systemic barriers, such as urbanisation, socio-economic

inequality, and the accelerating pace of modern life, continue to impede access, particularly among marginalised groups. To address these inequities, policymakers and practitioners must prioritise inclusive, equitable access to safe, high-quality natural spaces. This includes integrating nature-based experiences within schools, higher education, and workplaces, and supporting targeted programmes, such as PTN, that engage youth who are particularly vulnerable to the aforementioned systemic barriers. Government policy must double down on the protection and enhancement of natural spaces, with a focus on protecting existing natural spaces and reintroducing nature into urbanised settings (particularly low-SES communities). This requires investment in nature conservation, rewilding, and the integration of biodiverse, accessible green infrastructure into urban planning.

Conclusion

This project highlights the potential of nature-based interventions to promote wellbeing, nature connectedness and environmental stewardship. In each country, young people have taken meaningful action to support local biodiversity while actively engaging their communities. Findings highlight not only the individual benefits of the interventions but also the broader, ripple effects on communities. Participants' narratives suggest that these actions can revitalise local environments and communities; reimagining what youth-led, community-driven conservation can look like across the World. Participants reported a greater sense of agency and optimism, potentially linked to their engagement in environmental action. For the young people involved, a deeper connection to nature has given rise to reciprocity with the natural world whereby they described seeing themselves as part of nature. With this, came a sense of responsibility to care for nature, rooted in a deep connection, empathy and gratitude. This reveals how interventions that support young people to develop leadership skills, generate solutions, and mobilise within community groups—while drawing on social support, knowledge, and local expertise—can foster necessary change. Ensuring equitable access to natural environments is essential for fostering nature connectedness across diverse populations. Finally, designing nature-based activities that nurture ecocentric relationships with nature should be a core priority for building healthy, sustainable societies.

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Chapter 6—Discussion

This thesis set out to explore how nature-based interventions designed to foster nature connectedness can serve as a powerful pathway to wellbeing outcomes and environmental stewardship. Across three interconnected studies, this research examined: (1) the existing evidence on nature-based interventions for psychological wellbeing, identifying mechanisms that influence their effectiveness; (2) a cross-cultural exploration of young people's relationships with nature and the ways these relationships shape their mental health and pro-environmental behaviours; and (3) the co-design, piloting, and evaluation of contextually sensitive nature-based interventions to support youth mental health, nature connectedness, and environmental stewardship.

In this chapter, I advance my argument that NBIs can contribute far beyond improvements in health; outlining the specific dimensions of NBIs which are most effective and detailing how they hold transformative potential by fostering ecocentric worldviews, which underpins long-term sustainability and environmental justice. The chapter begins by providing a summary of the key findings of each of the three studies included in this PhD thesis. I then provide a broader overarching synthesis of the core collective findings across studies; highlighting their contribution to understanding the role of nature-based interventions in supporting planetary health and the implications for intervention design and practice. Included in this section is a critical reflection on the theoretical, methodological, and practical contributions of the thesis, as well as the broader implications for addressing the mental health and climate crises, systemic inequities, and the urgent need for shifting worldviews from anthropocentric to relational and ecocentric perspectives. Following this, I provide a critical reflection on the strengths and limitations of this research, providing particular insight into the challenges inherent to participatory and co-design approaches. The chapter concludes by identifying directions for future research, practice and policy.

Summary of Key Findings

Study 1: Firstly, the findings from the umbrella review, which provided a comprehensive synthesis of existing evidence on nature-based interventions (NBIs), identified eight key factors

that appear to be particularly influential for intervention design and effectiveness considering wellbeing outcomes: 1) Immersive experiences and active engagement, 2) Social dimensions, 3) Physical activity (PA), 4) Duration/frequency of and adherence to intervention, 5) Target population and individual differences, 6) Quality of natural environment, 7) Practitioner/facilitator skills and approach, and 8) Co-design. Collectively, these findings provided evidence that interventions are most effective when they are immersive, promote active engagement (e.g., through physical activity or mindfulness), foster social interaction, and are co-designed through participatory processes that reflect the individual differences and lived experiences of participants. Moreover, sociodemographic factors, including age, gender, culture, socio-economic status (SES), and baseline trait nature connectedness, were suggested to shape intervention outcomes. These findings align closely with those of Kaleta et al., (2025), whose recent umbrella review identified similar moderating and mediating factors, particularly the roles of social interaction and physical activity in natural settings, alongside sociodemographic influences. Further this aligns with findings from Hall et al., (2024), whose intervention development study in England, designed to promote postnatal mental health among mothers and infants, demonstrated the value of co-design, immersive nature contact, and social/community contexts in developing meaningful and impactful nature-based programmes.

Importantly, the umbrella review also revealed that the type and quality of natural environments play a critical role in determining intervention outcomes with factors such as biodiversity, accessibility, and perceived safety spotlighted. Findings from Lomax et al., (2024) meta-review, on the effects of nature on the mental health and wellbeing of children and adolescents, support this emphasising that both the quantity and quality of nature are crucial across dimensions of access, exposure, and engagement. Similarly, Schwartz et al., (2023) found that varying levels of biodiversity and perceived species richness significantly influence psychological wellbeing, moderated by individual differences such as nature relatedness. Overall, the findings of this umbrella review underscored the importance of contextual sensitivity in designing NBIs. They highlighted that participatory and co-design processes can be influential here in ensuring interventions are responsive to the unique social, cultural, and environmental contexts of their participants; ultimately leading to more targeted, equitable, and effective approaches to promoting wellbeing and nature connectedness.

Study 2: Secondly, findings from the qualitative study, which employed reflexive thematic analysis, offered rich insight into young people's lived experiences and meanings of nature connection, revealing patterns of relational, embodied, and meaning-oriented connections to the natural world. These findings highlighted that young people's relationships with nature are shaped not only by sensory and emotional engagement but also by the meanings they construct through social, cultural, and developmental contexts. The study underscored the significance of early experiences in nature, intergenerational transmission, and sustained contact with natural environments across the lifespan as key foundations for fostering a deep and enduring connection with nature. This aligns with previous research emphasising the formative influence of childhood experiences in nature and the transmission of environmental values across generations in shaping both nature connectedness and environmental stewardship (Van Heel et al., 2023; Beery et al., 2020; Stanley et al., 2018; Oh et al., 2021). This is interesting in light of Richardson (2025) highlighting the significance of intergenerational transmission and recommendation of interventions targeting both young people and their family units in nurturing enduring connections to nature.

Crucially, this study also revealed the systemic and structural barriers that constrain young people's access to and engagement with nature, including limited availability of safe, accessible green spaces, safety concerns, reduced intergenerational transmission, and the pressures of modern, urbanised lifestyles. These findings are consistent with recent research highlighting that urbanisation, socioeconomic disparities, and inequitable distribution of green spaces significantly restrict opportunities for nature engagement, particularly among vulnerable or marginalised youth populations (Rigolon et al., 2021; Shanahan et al., 2022; Pritchard et al., 2020). Supporting our findings, safety concerns, including perceived threats in public green spaces, have been shown to reduce outdoor activity and engagement with natural environments for young people. For example, Whitten (2025) found that neglected or poorly maintained green spaces were associated with stronger fears of antisocial behaviour and safety concerns, which in turn led young people, especially females, to avoid these spaces. Further, research indicates that limited intergenerational transmission and reduced encouragement of nature engagement constrain the passing down of cultural and experiential knowledge, which is essential for fostering meaningful and enduring connections with the natural world (Van Heel et al., 2023). These barriers provided critical insight into intervention design for the Pathways to Nature project, which in turn

provided deeper understanding into the factors that constrain young people's engagement with nature.

Study 3: Lastly, the final empirical study drew on insights from the preceding studies to co-design and implement contextually sensitive nature-based interventions (NBIs) with young people from diverse cultural backgrounds. The findings of the Pathways to Nature project demonstrate that co-designed, immersive nature-based interventions can support multiple dimensions of wellbeing, across self, social relationships, and connection to nature, while simultaneously fostering pro-nature attitudes and behaviours. Participants highlighted the centrality of relational, embodied, immersive, and meaningful experiences in nature, emphasising that sustained contact with natural environments, social cohesion, and reflective practices were pivotal in enhancing their sense of agency, confidence, and emotional resilience. Findings underscore that the co-design process, which positioned young people as experts in their own experiences, enabled them to develop interventions that were personally meaningful and relevant to their communities. This approach amplified the impact on wellbeing and the perceived capacity to effect meaningful change both locally and beyond, fostering hope for the future. These findings provide a robust foundation for interventions that are not only contextually grounded but also capable of addressing both psychological and socio-ecological dimensions of human–nature relationships.

These results align with recent research. For example, Obeng et al. (2023) demonstrated that NBIs with young people in vulnerable situations enhanced nature connectedness, improved social relationships, and supported sustained wellbeing outcomes. Similarly, Nagi et al. (2025) found that an immersive, week-long nature camp for urban youth showed promising improvements in both wellbeing and nature connection. Although focused on physical activity and digital literacy rather than nature-based interventions, a recent study by Watkins et al. (2025) highlights the value of co-design and participatory approaches when working with young people. This qualitative co-design study showed that engaging adolescents as active partners in intervention design promotes ownership, responsiveness to lived experiences, and relevance to youth priorities. This aligns with our findings and underscores the importance of embedding co-design into interventions to ensure alignment with young people's needs, values, and social contexts.

The final empirical study provided further valuable insight into the systemic barriers that constrain young people's connection to nature. Young people's accounts revealed the everyday challenges they face in developing a meaningful relationship with nature, many of which were consistent across countries. For example, the pervasive pressures of modern life, including limited time, competing priorities, and a lack of dedicated space for nature engagement, emerged as a common barrier to nature connection. This is supported by recent research which indicates obstacles such as lack of time or limited access to nature, underlining how modern lifestyles and pressures interfere with young people's ability to engage meaningfully with nature (Zamora et al., 2023; Obeng et al., 2023; Wang et al., 2023).These findings underscore the importance of designing interventions that are both contextually sensitive and culturally grounded, offering pathways to overcome these obstacles and fostering meaningful, sustained connections between young people and the natural world. Interestingly, co-designed nature-based interventions appeared to catalyse both individual and collective action, with participants reporting not only tangible changes in their habits and behaviours but also increased advocacy within their communities. The ripple effects of these interventions, combined with broad community involvement, suggest strong potential for behavioural spillover, amplifying impact beyond the immediate participants. Cross-cultural differences further highlighted how societal values, legal frameworks, and cultural practices shape the experience of nature connection, underscoring the importance of designing interventions that are responsive to local contexts and culturally embedded traditions (Soga & Gaston, 2025; Macaulay et al., 2023; Richardson, 2025).

Collectively, these combined studies underscore the importance of embedding interventions to support nature connectedness as a foundational strategy for planetary health; enhancing wellbeing and catalysing much-needed action to protect and advocate on behalf of nature. Nature connectedness emerges as critical not only for supporting psychological health but also for fostering much needed pro-environmental behaviours. Crucially, the findings suggest a reciprocal cycle: whereby people who engage in actions to care for and protect the natural world experience enhanced psychological wellbeing at individual, community, and collective levels. Put simply, as we work to heal the earth the earth heals us. Further, this work emphasises that these benefits of connectivity to nature are particularly important for young people, with clear implications for long-term mental health outcomes, environmental attitudes and sustainable behaviours. Beyond these individual and collective outcomes, the findings underscore the

potential of nature-based interventions to enact transformational change towards ecocentric worldviews. This is vital given that the environmental crisis is not only ecological but fundamentally a crisis of values, rooted in extractive and exploitative worldviews. Addressing disconnection from nature, therefore, is not merely an ancillary concern but a pivotal foundational step towards sustainable transformation. As Kimmerer (2013) reminds us, restoring land without restoring relationships is an empty exercise; it is the relationship that both underpins and sustains the land.

Overarching Findings and Implications for Intervention Design

In the following section, I unpack the overarching findings which were particularly important across the three studies, focusing on four key areas: (1) the role of mindfulness, immersion and active engagement with nature; (2) the interplay between nature connection and social connection; (3) the importance of contextual sensitivity and co-design approaches, and (4) The relational approach. An integrative reading of the findings indicates that these key areas, and the resulting impact on wellbeing and pro-nature behaviours, are profoundly interconnected. Rather than representing isolated outcomes, nature connectedness functions as a developmental nexus, bridging psychological, social and ecological processes:

The Role of Mindfulness, Immersion and Active Engagement with Nature

A key finding identified is the fact that nature connection can evoke a form of mindfulness which fosters reflection, self-awareness, and emotional regulation. Across this thesis, empirical evidence points to mindful engagement as a core mechanism underpinning psychological benefits. For example, one of the key findings from the umbrella review was the importance of immersive experiences in nature and active engagement for mental health outcomes (Shrestha et al., 2025). Further, the qualitative exploration of young people's relationship with nature foregrounded mindful engagement as crucial (Shrestha et al., 2025). Many young people involved in this research, share how connecting with nature provides a space to pause, detach from everyday stressors, and engage in reflective internal dialogue. This mindful engagement

was repeatedly credited for reducing anxiety, stress, and depressive symptoms, offering a restorative sense of calm.

Nature connection, in this sense, functions as a healthy form of escapism; whereby engagement with natural surroundings can provide a grounding opportunity to process emotions and reframe challenges. In this way, nature connectedness mirrors the benefits of established spiritual and contemplative practices such as meditation, yoga, or prayer, which similarly cultivate presence, acceptance, and clarity (Ohlsson, 2022). This supports the large body of evidence underpinning mindfulness as a central mechanism mediating the psychological pathways of restoration from nature connection (Lengeiza & Swim, 2021; Djernis et al., 2019). The findings align in particular with work by McCauley and colleagues (2022; 2024), whose research underscores specific mindfulness facets. They emphasise dimensions such as decentering (a sense of 'detachment' from identifying with the self and other internal experiences), present-moment sensory awareness, and non-reactivity (observation of thoughts and emotions without reacting) as pivotal. My findings suggest that decentering is particularly significant when seeking to promote wellbeing and pro-nature behaviours. The process of decentering through mindfulness creates psychological distance from thoughts and emotions, mitigating unhelpful rumination and making the stresses of daily life less intrusive (Baer, 2009; Hölzel et al., 2011). Previous research suggests that mindful decentering allows an individual to be grounded in present experience in natural environments, facilitating deeper connection with nature and supporting restoration (Lymeus et al., 2018).

Building on this idea of decentering, we propose that both wellbeing benefits and pro-nature behaviours arise from *a shift in perspective on the self* that nature connectedness evokes. Our findings highlight how mindful engagement with nature can help individuals reframe their experience of self in relation to the wider world. This shift in perspective allows everyday worries, stressors, and anxieties to be seen in a broader context, alongside larger societal challenges, and supports individuals to recognise their place within the wider ecological web. Young people's accounts in this research show that this effect is particularly pronounced in expansive or awe-inspiring settings, such as mountains, the sea, or when witnessing the night sky, where participants described feeling "small, but in a good way." Such experiences facilitated a kind of *zooming out*, enabling mindful reflection on personal challenges and reinforcing a sense of interconnection with the more-than-human world. However, my findings

also demonstrate that encounters with the smaller details of nature, such as noticing the intricacy of a leaf or the movements of an insect, can similarly foster this effect. Importantly, young people describe this shift in perspective as *'feeling part of something larger than themselves.*' This change in perspective on the self is closely connected to the notion of self-transcendence. Self-transcendence involves a softening of the boundaries of the self, enabling individuals to experience a sense of oneness with others and the world around them (Lengieza, 2024; Lengieza & Swim, 2021). In human relationships, this often manifests as self-expansion, where the self-concept grows through meaningful social connections (Aron et al., 2022).

Expanding on this idea, we assert that an expanding self-concept, cultivated through deepening your relationship with nature, represents a powerful pathway toward both enhanced psychological wellbeing and environmental stewardship. This sense of smallness / awe may counteract the effects of social disconnection and digital comparison by cultivating humility, perspective, and interdependence, intervening against loneliness and anxiety in youth. In support of this, a recent study by Yang et al., (2025) found that inducing awe in adolescents increased social mindfulness and social responsibility, suggesting that awe-eliciting experiences may shift focus from the self to the social world. Similarly, findings by Song et al., (2033) reveals that awe can promote moral expansiveness via 'the small self.' In terms of stewardship, through decentering and self-transcendence, individuals can more fully immerse themselves in the environment, deepening connection with nature, and enabling them to challenge entrenched dichotomies between "human" and "nature" (Hanley et al., 2017; Wang et al., 2016). This shift evokes a new perspective, one that recognises the self as part of the natural world, and fosters a more relational and integrated worldview. As outlined in previous empirical research, this relational worldview is critical for sustainable behaviour and transformative change (Giusti, 2025; Pascual, 2023). In this way, our research provides a useful lens for understanding how nature connection simultaneously nurtures wellbeing and catalyses pro-environmental action. Our findings further illuminate this process by showing how nature connectedness can evoke self-transcendent emotions (Newton & Moreton, 2023) such as awe, gratitude, and empathy as well as pro-social behaviour (Piff et al., 2015; Sturm et al., 2023). These emotions not only enhance wellbeing but also inspire a sense of responsibility and moral duty to protect and care for the environment. In this way, nature connectedness functions both as a psychological resource and as a catalyst for ecological behaviour. This aligns with previous work linking nature

connectedness and self-transcendence (Lengieza et al., 2025; Lengieza & Aviste, 2025; Hanley et al., 2018), as well as research highlighting self-transcendent experiences in nature and nature connectedness in general as powerful routes to sustainability (Yan et al., 2024; Jacobs & McConnell, 2022; Barragan-Jason et al., 2022). Collectively, these findings suggest that the psychological benefits of nature connectedness are not merely incidental but are actively mediated by processes of mindful engagement specifically involving experiences of decentering, self transcendence and the more ecological embedded perspective that results from this.

Taken together, these findings highlight important implications for intervention design, particularly the need to intentionally integrate mindful engagement into approaches that foster nature connectedness, positioning it as a central pathway in advancing planetary health. Depending on the context, practitioners such as youth workers, or therapists can play a central role in encouraging and facilitating mindful engagement with nature. Importantly, mindfulness does not always emerge spontaneously through mere exposure to natural settings; instead, our pilot intervention study demonstrates that it can be actively facilitated through practitioner prompts and structured approaches to engagement—much like the role of a yoga teacher or meditation instructor in guiding contemplative practice. This places the practitioner at the heart of intervention design, with responsibility not just for providing access to nature but for shaping how participants attend to and reflect on their experiences. Recent research has explored the impact of practitioners encouraging mindful noticing of nature and 'restorative promoting' (e.g. sensory based practices) reporting significant impacts on wellbeing (Harries et al., 2025). Further, our results suggest that fostering mindfulness within nature can expand the self-concept, enabling deeper connection to the external world and potentially motivating ecological behaviours. This underscores the value of designing interventions that explicitly target pathways towards decentering and self-transcendence. Practical strategies include encouraging engagement with expansive, awe-inspiring environments (e.g., mountains, oceans, night skies) alongside prompts to notice subtle details of the natural world and evoke the expanding self-concept. When combined with facilitation practices, such approaches can powerfully enhance mindful reflection and perspective-taking. These insights also call for integrating interdisciplinary and holistic knowledge into intervention design. Traditions such as Buddhism and Sanskrit contemplative philosophies have long emphasised the interdependence of mindfulness, wellbeing, and ecological connection (Khoshoo, 1999), offering valuable conceptual resources. Concurrently,

youth work methodology provides a wealth of practical, scalable tools for embedding mindful engagement and reflective practice in ways that are accessible and relevant to diverse populations.

The Interplay between Nature Connection and Social Connection

Secondly, the results of the three combined studies emphasise social connection as a core component in delivering both wellbeing outcomes and environmental stewardship. Findings across this thesis reveal how nature-based experiences support not only individual wellbeing, but also relational and communal dimensions of youth development. This underscores social connection as a potential mediating mechanism linking nature connectedness, wellbeing outcomes, and pro-environmental behaviours aligning with previous research (McNeil et al., 2022; Liu et al., 2022). The findings of our umbrella review identified interventions with a strong social dimension as among the most effective in fostering lasting benefits (Shrestha et al., 2025). Further, young people in our pilot intervention study consistently described how nature-based activities created space for meaningful social bonds, which in turn enhanced their wellbeing. They highlighted nature as an environment where they could "be themselves," facilitating authentic and meaningful connections with others. In this way, nature appeared to act almost as a mediator, much like a mutual friend, introducing individuals to one another and enabling connections to grow in organic and meaningful ways. These experiences fostered a deep sense of belonging and community. This is crucial, given the wealth of evidence linking social connectedness, sense of community, and psychological wellbeing in youth (Jose et al., 2012; Vora & Kinney, 2014). Further findings from our research highlight the importance of challenging, collaborative activities in nature for fostering social connections. Activities that required teamwork and cooperation were particularly effective in strengthening bonds among young people.

This is particularly pertinent in light of current statistics revealing that social disconnection is widespread among young adults. For example, *The World Happiness Report* revealed that in 2023, 19% of young adults across the world reported having no one that they could count on for social support, representing a 39% increase compared to 2006 (Helliwell et al., 2025). By creating spaces for social connection, nature-based interventions can counter loneliness and

isolation, which are recognised as key contributors to the current youth mental health crisis (Eccles, 2021). This is especially important during adolescence and early adulthood, a life stage marked by the transition from the family system to broader social networks (Crone & Dahl, 2012). In this sense, nature can act as a social catalyst, reinforcing interpersonal trust, shared goals, and a collective sense of belonging. Recent research supports these findings. For example, Nagi et al., (2025) found that participation in a one-week immersive nature camp significantly improved social connections, interpersonal skills, and reduced loneliness among young people with psychological needs. Similarly, Barron and Rugel (2023), highlight how green spaces promote not only individual wellbeing but also social cohesion and inclusion.

Of novel interest, is our finding that social cohesion, fostered through nature connectedness, can play a powerful role in supporting multicultural inclusion amongst youth. This findings aligns with recent research (Madera et al., 2025), and addresses a notable gap in the literature regarding the experiences of young migrants and their relationship with nature. Participants in the Pathways to Nature project, Chapter 5 (empirical study 2), described how shared activities in natural settings encouraged curiosity about peers from different cultural backgrounds and promoted recognition of their shared place in the natural world. In this sense, nature once again acted as a mediator, helping to overcome linguistic and cultural barriers. Young people reported developing greater empathy and understanding for those they would previously have considered "different." Additionally, those from migrant backgrounds described a stronger sense of belonging, inclusion, and community involvement, directly attributing these experiences to their involvement in the nature-based interventions and social cohesion this evoked. This aligns with prior research. For instance, Seeland et al. (2009) demonstrated that urban forests and parks serve as meeting points where youth from diverse cultural backgrounds, including immigrant families, can form new friendships and experience community inclusion. Moreover, connections with nature have been shown to facilitate intercultural processes, enhancing sociability, mutual trust, and pro-social behaviour among migrant youth (Seeland et al., 2019). These activities can foster intercultural interactions and help individuals establish roots in host countries. Furthermore, the bonds formed through nature-based activities have significant implications for fostering a sense of community, a key protective factor against experiences of discrimination (Garcìa-Cid et al., 2020). The medium of shared experiences enables nature to foster interpersonal relationships and social inclusivity. This insight is especially pertinent in light of

the unique challenges typically faced by youth with a migrant background (Borho et al., 2023), and the rise in discrimination and violence towards refugees and migrants in general (Wilson et al., 2024; Economic and Social Research Institute, 2024; Doras, 2024).

Importantly, our findings suggest that the benefits of social connection in nature extend beyond wellbeing and play a crucial role in promoting pro-environmental behaviour. In the Pathways to Nature project, the social dynamic encouraged young people to actively care for and protect nature, creating a shared sense of environmental identity. Social connection emerged as a key motivator for youth engagement. This speaks to theories such as Social Identity Theory (Tajfel & Turner, 1979; Clayton & Opotow, 2003), suggesting that when people engage with others in action to care for nature, they form a shared social identity around environmental care. This identity strengthens group norms of stewardship and motivates individuals to act in alignment with these values. This mechanism is particularly relevant for young people, who are in a developmental stage where peer relationships are highly influential and social norms strongly shape behaviour (Pinho et al., 2021). Youth are highly responsive to peer group norms and what is considered "normal" or "valued." Nature-based interventions can leverage this by fostering social connections and cultivating new normative values of care for nature. This aligns with recent research demonstrating that social norms and peer influence can significantly impact environmental behaviours among young people (Krettenauer et al., 2024; Collado et al., 2019). Similarly, Collective Efficacy Theory (Bandura, 2000; Bamberg et al., 2015) highlights how shared experiences in nature can build a sense of collective agency, reinforcing the belief that individuals working together can make meaningful environmental change.

Such experiences are especially powerful for young people, who often feel disempowered in the face of global environmental crises (Thomas et al., 2022). By experiencing connection and solidarity in nature, they gain confidence in their capacity to act and hope for the future. Nature-based group experiences also satisfy core psychological needs for relatedness, competence, and autonomy. Meeting these needs in a nature-based social context can foster intrinsic motivation not only for personal wellbeing but also for ecological behaviours. Moreover, transformative learning approaches (Giusti et al., 2025) suggest that collective reflection in nature can shift perspectives, fostering ecocentric worldviews and embedding long-term stewardship. Empirical studies reflect these mechanisms. For instance, environmental volunteering programs and youth-led conservation projects have been shown to enhance wellbeing (Growing Up in Ireland, 2019),

strengthen community ties, raise environmental awareness, deepen environmental values, and increase civic engagement (Gruno & Gibbons, 2024; Skilling et al., 2023). Such collective experiences highlight how nature can simultaneously build social resilience and environmental activism, weaving together wellbeing and stewardship in mutually reinforcing ways.

The findings of this research highlight social connection as a core mechanism through which nature-based interventions deliver multiple benefits: enhancing psychological wellbeing, fostering multicultural inclusion, and promoting pro-environmental behaviours. Integrating these insights into intervention design can amplify both individual and collective outcomes. Interventions should encourage teamwork, problem-solving, and cooperative engagement with nature. Collaborative tasks, group projects, and shared challenges foster interpersonal bonds and provide a natural pathway for youth to feel part of a collective effort. Leadership opportunities within these activities can further enhance social cohesion and self-efficacy. Interventions should foster a shared environmental identity shaping social norms. By structuring group activities around shared environmental goals, facilitators can leverage Social Identity Theory and Collective Efficacy Theory to cultivate pro-environmental norms. This can reinforce shared values and collective agency. Youth role models are a particularly effective mechanism here as seen in youth work. Given that nature provides a neutral, restorative space that can facilitate multicultural inclusion, promotion of inclusivity and cultural exchange within interventions is key. Activities should intentionally encourage intercultural dialogue, and opportunities for peer mentorship, enabling young people from diverse backgrounds to form connections, experience empathy, and develop a sense of belonging. Again, we emphasise the key role of the practitioner here in scaffolding peer support and encouraging reflection. Facilitators should provide structured opportunities for group reflection and discussion, helping participants process nature-based experiences and translate them into pro-environmental attitudes and behaviours. Integrating reflective practices, such as group storytelling, journaling, or facilitated debriefs, strengthens both social bonds and personal meaning-making. Lastly, it is crucial to prioritise the long-term sustainability of the communities built through nature connection. This was a core finding of our research reflected back to us as a key concern from participants. Social connection is most effective when reinforced over time. Interventions should aim for ongoing engagement, peer networks, and alumni programs to maintain relationships, strengthen collective environmental identity, and sustain behavioural change beyond the immediate intervention.

The Importance of Contextually Sensitive and Co-Designed Interventions

A central finding of this research underscores the fact that our connection with nature varies across contexts. As emerged from our umbrella review and empirical studies, these relationships are not uniform but are shaped by a wide range of contextual factors such as gender, age, socioeconomic status, cultural background, personal history with nature, individual preferences, and upbringing. Recognising these factors in intervention design is crucial, as they determine not only how young people experience and connect with nature, but also their ability to derive wellbeing benefits, develop biospheric values, and engage in pro-environmental behaviours. This finding highlights the multifaceted dimensions of our relationship with nature and aligns with previous research highlighting how individual differences and environmental factors shape nature connectedness (Bowler et al., 2010; McEwan et al., 2022)**.** Recently, Madera et al., (2025, p.21) systematic review calls attention to the fact that a significant number of studies in the field 'remain anchored to an individual-level perspective' overlooking broader contextual factors that shape young people's experiences with nature. Below I outline some of the predominant contextual factors which were recurring across this research and may be of particular interest moving forward:

Foundations in Upbringing: Findings from Studies 2 and 3 emphasise the formative role of childhood experiences in shaping nature connectedness. Early exposure to and encouragement in nature predicted stronger lifelong bonds, pro-environmental values, and wellbeing, whereas limited access, often due to urbanisation or socioeconomic disadvantage, was linked to weaker connections. These findings align with evidence that parental modelling, shared outdoor experiences, and early contact with green spaces strongly influence adult environmental attitudes and resilience (Macias-Zambrano et al., 2024; Barragán-Jason, 2023; Passmore et al., 2021; Evans et al., 2018). Early nature connection also enhances young people's adaptive capacity and hope in the face of environmental challenges (Madera et al., 2025; Mishra et al., 2025; Barrable & Booth, 2020; Chawla, 2015).

Gender: Gender emerged as a key influence on how young people access and relate to nature. Safety concerns and social norms often constrain girls' and young women's engagement with natural spaces, aligning with previous research (Bornioli et al., 2024), yet they frequently report

stronger nature connectedness and emotional benefits, potentially reflecting socialisation toward care and empathy (McDonald & Kanske, 2023; Madera et al., 2025; Price et al., 2022). These findings highlight the need for gender-sensitive intervention design, including strategies to engage boys and young men through active, skill-based, and embodied nature activities that also promote wellbeing and environmental awareness.

Age: Nature connectedness tends to decline through adolescence and early adulthood as academic and social pressures increase, reflecting an "extinction of experience" (Richardson et al., 2022, 2025). This decline coincides with a critical period for mental health vulnerability (VanderWeele et al., 2025; McGorry et al., 2022) and reduced engagement in pro-environmental behaviours (Colléony et al., 2020). These findings underscore the importance of developmentally attuned interventions that integrate nature connection into the lives of young people, counteracting urban and digital pressures while fostering resilience and ecological stewardship.

Socioeconomic and Environmental Contexts: Our findings reinforce growing recognition that access to nature is a key health equity issue underpinning levels of nature connectedness (Nicklett et al., 2024; Rigolon et al., 2021). Access is profoundly shaped by socioeconomic position and environmental context: young people in rural or nature-rich areas report stronger bonds with nature than their urban peers, for whom green spaces are often scarce, inaccessible, or unsafe. This inequity reflects a broader public health concern, as limited opportunities to engage with nature exacerbate disparities in wellbeing, resilience, and environmental engagement. Nature-based interventions must therefore address these structural inequalities, ensuring that meaningful connection with nature is accessible to all young people.

Cultural and Social Influences: Finally, the meaning of "nature" itself is deeply contextual and culturally mediated. Our findings show that cultural narratives, histories, and values shape how young people conceptualise and relate to the more-than-human world. In some contexts, relational worldviews position humans within ecosystems, while elsewhere, legacies of colonialism and modernity reinforce separation. Cross-cultural research shows that national and cultural norms significantly influence nature connectedness (Soga & Gaston, 2025), underscoring the need for contextually and culturally grounded interventions and further qualitative inquiry into how these meanings are constructed.

A Relational Approach to Nature Connectedness

Lastly, our overarching finding highlights the importance of adopting a relational approach to strategies aimed at restoring the human-nature relationship and intervention design. Relationships are central to the human experience and a key determinant of wellbeing (Holt-Lunstad et al., 2010; Berscheid, 1998). They shape how we treat others, often motivating pro-social behaviours (Agnew, 2014), willingness to sacrifice for relationship partners (McIntyre et al., 2015; Fehr et al., 2014), and prioritisation of collective interests over self-interest (Rusbult et al., 2001). In short, strong interpersonal bonds generate benefits for both individuals (e.g., greater wellbeing) and for others, including the more-than-human world (e.g. pro-sociality and stewardship). Accordingly, we make the case that relationships, be they with other people or with nature, are a fundamental part of the human experience; influencing not only our wellbeing but also our behaviour toward others. Our findings suggest that nature connectedness functions in much the same way: It is not simply an individual trait or static psychological construct but rather a living relationship—one that develops through connections with nature, with others, and with ourselves. Youth perspectives reveal that connection to nature is intertwined with broader relational and cultural contexts, including community norms, family practices, and local environmental narratives. This emphasises that nature connectedness cannot be fully understood or nurtured in isolation; it is co-constructed through social, cultural, and ecological interactions. Fostering nature connectedness is not a purely individual endeavour but a dynamic, ongoing, and evolving process that can be strengthened through collective intervention. Relational approaches, therefore, provide a crucial framework for designing interventions that are responsive to the diverse needs, abilities, and contexts of young people. We assert that without a relationship there can be no restoration of the land or movement towards true sustainable transformation. Further, we emphasise the importance of a relationship built on reciprocity, interconnectedness and mutual respect for sustained outcomes. In other words, treating human–nature connectedness as another form of interpersonal relationship is not only justified but also valuable as a new lens for addressing disconnection from nature. From this perspective, applying principles from the study of interpersonal relationships, such as trust, empathy, reciprocity, and care, offers a powerful framework for strengthening human–nature relationships.

It is important to note that we are not the first to propose this framing; our approach aligns with a growing body of research that identifies clear parallels between nature connectedness and interpersonal relationships (Lengieza & Aviste, 2025; Davis et al., 2009; Schultz, 2022). For example, Lengieza and colleagues (2023) argue that nature connectedness is best understood as a reflection of our relationship with nature, noting in their review that both interpersonal and human–nature relationships follow many of the same underlying principles. Similarly, Giusti and colleagues (2019, 2025) call for a relational, embodied, and transdisciplinary approach to rebuilding the human–nature relationship. Crucially, and as outlined in the introduction of this thesis, the very idea that nature connectedness operates as a relationship is not new—it sits at the heart of Indigenous worldviews and ways of being, which have long recognised reciprocity, respect, and relationality as foundational to human existence. I would argue that the increasing recognition of the value of these worldviews, within society more broadly, has strongly influenced the recent shift toward relational perspectives within environmental psychology, sustainability science, and policy discourse. Subsequently, major environmental institutions are now acknowledging that achieving a sustainable future requires a new relationship with nature (Convention on Biological Diversity, 2023; EEA, 2022; UNEP, 2021). Yet, despite this emerging shift in policy framing, relational approaches have not been fully realised in practice. There remains a lack of empirical work exploring what such approaches look like on the ground, or what specific techniques might be developed to actively restore the human–nature relationship (Lengieza et al., 2025; 2023). This is where the findings of this thesis make a novel and valuable contribution. Our research provides concrete insights into what a relational approach might entail in practice—highlighting the importance of drawing from youth work methodologies, acknowledging the unique ways young people perceive and interpret the world, and learning from Indigenous perspectives that centre relationality:

***Youth Work*:** Youth work offers a relational framework uniquely suited to fostering meaningful connections with nature. Central to youth work is the cultivation of trust, which enables youth workers to act as mediators, introducing young people to natural environments in safe, supportive, and culturally sensitive ways (Finkel et al., 2017; Lengieza et al., 2023; Jeffs & Smith, 2010). This relational approach is especially critical given the extinction of experience, where urbanisation and limited access make nature unfamiliar or intimidating for many young

people. Youth workers' expertise in navigating cultural, social, and economic differences allows for inclusive, contextually grounded interventions that respect diverse ways of experiencing nature (Soga & Gaston, 2025; Mygind et al., 2019). By operating in flexible, non-formal spaces and incorporating play, creativity, and experiential learning, youth work fosters authentic engagement, curiosity, and awe—key ingredients for lasting nature connection (Lester & Russell, 2010; Ord, 2016). Moreover, youth work's emphasis on long-term relationships and community building supports repeated and sustained contact with natural spaces, embedding relational and pro-environmental values alongside social cohesion. This collective, relational dimension strengthens both individual flourishing and long-term environmental stewardship, demonstrating how youth work can be a powerful vehicle for nurturing enduring human–nature relationships (Richardson et al., 2020; Kellert, 2002).

Young People's Worldview: A key finding from this research is the critical role of children and young people's worldviews in shaping relational approaches to nature-based interventions. The young people's narratives captured in this research highlight a reciprocal understanding of the world, in which young people recognise the interdependence of all living beings. Existing research supports this indicating that young people often perceive themselves, others, and the environment as part of an interconnected web of relationships, demonstrating relational and holistic ways of understanding the world (Haswell, 2023; Giusti, 2019; 2025). Many also demonstrate a sense of animacy, perceiving animals, plants, land, and water as sentient entities with their own feelings, emotions, and intrinsic rights (Piaget, 1929). Further this may explain why young people are increasingly stepping into the role of spokesperson for nature, challenging existing power dynamics and demanding recognition of the inherent rights of the natural world (Soler-i-Martí et al., 2024; Daly et al., 2024). Movements like Fridays for Future, initiated by Greta Thunberg, exemplify how youth activism is not merely a response to environmental crises but an assertion of ecological rights and justice rooted in young people's relational worldviews. These young activists emphasise interconnectedness and reciprocity, advocating for a systemic shift towards ecocentric values. Cause for concern is the fact that children's innate relational perspective and natural inclination towards animistic thinking is typically framed as an 'error' within Western rationalistic schooling; rather than something to be nurtured, listened to and learned from (Merewether, 2019). Traditional educational models often prioritise

anthropocentric perspectives, potentially diminishing the relational worldviews that young people naturally embody. Recent studies indicate that formal education can inadvertently suppress these perspectives, leading to a disconnection from nature and a diminished sense of ecological responsibility (McGimpsey et al., 2023). Addressing this is crucial, given that the environmental crisis stems from the Western worldview of seeing nature and beings in nature as inanimate things or 'resources' to be used rather than animate beings who are autonomous, communicative, and relational.

This underscores the necessity of re-evaluating our educational systems. To address this, children's natural relational worldview must be nurtured and celebrated. There is a growing call to integrate relational values into educational curricula, fostering environments where young people can engage with nature in meaningful ways built on relational models (Fasting et al., 2025; Giusti et al., 2025). This challenges typical models of education whereby children sit quietly and learn from adults. In reality, we assert that we have much to learn from children and their ways of seeing the world. Indeed, within this research, most of the learning emerged directly from young participants, whose insights challenged adult assumptions, broadened conceptual understanding, and revealed pathways for intervention that support both individual wellbeing and collective ecological flourishing. By embracing and nurturing the relational worldviews of young people and actively teaching with this perspective, educational systems can play a pivotal role in advancing the ecological transformation needed to address the climate crisis. Such integration not only supports the development of ecological literacy but also empowers students to become active participants in environmental advocacy, aligning with the broader goals of sustainability and intergenerational justice. Practically, this entails positioning young people as active co-creators and decision-makers in not only intervention design but also wider policy shaping planetary health. By centering their worldviews, researchers and practitioners can develop strategies that resonate with young people's sense of identity and agency, amplifying both their engagement with nature and their potential to act as stewards of the environment.

Indigenous Worldviews: We emphasise that this relational approach is rooted in Indigenous worldviews. As outlined in the introduction section of this thesis, indigenous perspectives often centre on interconnectedness, stewardship, and mutual respect between humans and the more-

than-human world (Kimmerer, 2013; Whyte, 2018). Therefore, a relational approach to rebuilding human–nature connections would be deeply enriched by integrating Indigenous worldviews, recognising Indigenous peoples as knowledge holders and custodians of reciprocal relationships with the land. These worldviews provide both ethical and practical frameworks for designing interventions that are relational, ecocentric, and culturally grounded; offering insights that have been cultivated and refined over generations. In practice, this involves collaborating with Indigenous communities as partners in the design, implementation, and evaluation of nature-based interventions. There are examples of this already in practice. For example, co-designed interventions and educational programmes in Aotearoa (New Zealand) have incorporated Māori concepts of kaitiakitanga (guardianship) and whanaungatanga (relational connection), resulting in interventions that foster both ecological stewardship and foster youth's natural relationality (ko au te taiao, 2021; Sport New Zealand, 2020; Paul-Burke & Rameka, 2017). I witnessed the impact of such programmes first-hand during my time in New Zealand in the final year of my PhD. Moreover, recent scholarship has provided practical guidelines for working at the interface of Western and Indigenous worldviews, offering a framework for co-design that ensures cultural integrity while advancing shared goals (Rolleston et al., 2022). Similarly, in Canada, environmental initiatives developed in collaboration with First Nations communities embed principles of reciprocity, ritual, and intergenerational learning, ensuring that interventions reflect local ecological knowledge and reinforce relational ethics toward the land (McGregor, 2021). These examples demonstrate that Indigenous worldviews do more than provide inspiration—they can shape the structure, objectives, and outcomes of both interventions and education. By learning from and collaborating with Indigenous knowledge holders, researchers and practitioners can ensure that relational approaches are not only theoretically sound but also grounded in practices that have sustained human–nature relationships for centuries. This integration also reinforces the ethical imperative of respect, reciprocity, and co-creation, positioning Indigenous peoples as central contributors to contemporary strategies aimed at fostering nature connectedness, wellbeing, and environmental stewardship.

This relational approach to nature connectedness has crucial implications for reshaping values and worldviews, potentially supporting a shift from anthropocentric frameworks toward ecocentric perspectives. By foregrounding relationships—with nature, with others, and with

communities—this approach can encourage young people to perceive themselves not as separate actors exerting control over nature, but as interconnected participants within a wider ecological system (Giusti, 2019; Haswell, 2023). This aligns closely with the call for a focus on relational values, which emphasise the importance of caring, responsibility, and reciprocity in human–nature relationships, rather than reducing nature solely to a resource or utility (Lengieza & Aviste, 2025; Pascual et al., 2021). The findings of this research highlight that when interventions foreground relational experiences, participants report not only enhanced wellbeing and social connection but also shifts in nature connectedness. By engaging with nature collaboratively and reflectively, young people can begin to internalise ecocentric principles—recognising the intrinsic worth of non-human life, the interdependence of ecosystems, and the ethical imperative to act as stewards rather than exploiters of the natural world. Nature-based interventions rooted in a relational approach can provide experiences that challenge the current dominant anthropogenic narratives; offering alternative frameworks where the health of human communities is inseparable from the health of the ecosystems in which they are embedded. These findings echo calls from degrowth and post-growth scholarship, which advocate for societal reorientation toward gratitude, sufficiency, ecological sustainability, and the nurturing of relational values over material accumulation (Saito, 2024; Jackson, 2021; Hickel, 2020; Kallis, 2018). In practical terms, this suggests that fostering ecocentric worldviews through relational interventions requires not only designing meaningful engagement with nature but also embedding opportunities for reflection on systemic values, cultural narratives, and ethical responsibilities. By positioning young people as active participants in these processes, relational approaches cultivate both individual transformation and the broader cultural shifts necessary for sustainable planetary stewardship. In this sense, interventions grounded in relational values operate as both educational and transformative catalysts, bridging personal wellbeing with collective ecological responsibility.

Strengths and Limitations

This PhD demonstrates several key strengths that enhance its academic and practical contribution. Its multi-level and integrative design, progressing from an umbrella review to cross-cultural qualitative exploration, and finally co-designed interventions, provide both conceptual depth and applied relevance. The umbrella review offered a rigorous synthesis of the

NBI evidence base, identifying methodological gaps and informing subsequent empirical work. The research's participatory and co-design approach represents a major strength, ensuring that interventions were contextually grounded and ethically robust through the active involvement of young people and practitioners. Importantly, the community-engaged nature of the empirical studies further strengthened the research by fostering reciprocal relationships with local organisations, communities and participants. This grounded the work in real-world contexts, enhanced its ecological validity, and supported the co-creation of interventions that were meaningful, sustainable, and responsive to community needs. A further strength lies in the cross-cultural scope, spanning four countries, which enhanced the transferability of findings and offered insight into how cultural and environmental contexts shape nature connection and wellbeing. Methodologically, the use of mixed methods, combining qualitative and quantitative measures and incorporating novel approaches such as photo-elicitation, strengthened validity and enabled a holistic understanding of NBIs. Lastly, by linking youth wellbeing, nature connectedness, and pro-environmental behaviour within a planetary health framework, this research provides novel theoretical and practical contributions that inform policy, education, and future intervention design.

While the methodological framework adopted in this thesis provided rich opportunities for collaboration, innovation, and contextual sensitivity, it also presented a number of challenges and limitations that require acknowledgement. A detailed consideration of limitations, specific to each study, has already been provided in the preceding chapters. Accordingly, here I focus on high-level limitations:

First, the umbrella review aimed to synthesise the broad spectrum of NBIs, encompassing interventions targeting behaviour change and environmental modification across diverse populations. While this provided a comprehensive meta-level overview, the broad focus may have limited the granularity of the findings. A narrower focus, such as focusing specifically on interventions designed to foster nature connectedness, or those aimed at young people, might have offered more actionable insights to guide subsequent research and intervention design. However, given the significant heterogeneity within the field, broad application of NBIs and lack of available meta-level synthesis we considered this high level and broad approach necessary and useful for providing overarching insight into intervention design and guiding our next steps. Considering that we have provided this evidence base, future reviews could adopt a more

targeted scope to deepen understanding of the mechanisms most relevant to youth populations and relational approaches to nature engagement. The umbrella review was also constrained by reliance on the quality/reporting of included reviews, substantial heterogeneity across NBIs, a necessarily narrative/interpretive integration without pooled effects, and scope limits (English-only, database/time cut-offs), which together temper causal and quantitative claims. Lastly, the umbrella review encompassed a high number of reviews, but we acknowledge that further reviews have been published since this work. This literature is growing exponentially, and it would be important to update and review new evidence.

Second, in the qualitative exploration of young people's relationships with nature (Study Two), the initial intention was to conduct a pluralistic analysis of the narratives to capture multiple layers of meaning and interpretation. Due to time and resource constraints, this was not feasible. Consequently, the thematic analysis primarily reflects the perspectives that emerged most prominently within the data, potentially overlooking subtler or contradictory themes. A pluralistic or multi-layered approach could have enriched understanding by revealing additional dimensions of youth perspectives on nature connectedness. With this in mind we suggest specific qualitative exploration into young refugees and migrants' experiences of nature (Madera et al., 2025), and investigation into young people's animistic orientation (Lengieza et al., 2023), as these have been highlighted as gaps within the research. (Soga & Gaston, 2025). However, further research is required to fully conceptualise and understand these cultural differences.

Lastly, beyond the difficulties in measuring impact quantitatively discussed in chapter 5, the final empirical study presented important challenges. This study presented a series of challenges related to the participatory and cross-cultural nature of the project; which are of novel interest for those carrying out such research. Conducting research across four culturally and linguistically diverse countries demanded careful translation, adaptation, and co-validation of research tools to ensure inclusivity and accessibility. Despite rigorous processes such as translation, back-translation, and pilot testing with youth participants, there remained the potential for subtle differences in meaning or cultural interpretation that may have shaped how participants engaged with, or understood, particular measures, and processes within the project. In addition, while participatory approaches such as Community-Based Participatory Research and co-design offer substantial benefits, they also require significant investments of time, resources, and emotional labour. Establishing trust, building equitable partnerships, and ensuring young people's voices

were meaningfully integrated into decision-making processes demanded an iterative and highly reflexive design. This reflexivity, though invaluable, also posed significant challenges in balancing the dual roles of researcher and facilitator, where the need for critical distance sometimes came into tension with the emotional engagement required to sustain authentic collaboration.

Further, the diversity of collaborators involved, including youth workers, conservationists, educators, psychologists, and young people, was both a strength and a source of complexity. Negotiating differing expectations, disciplinary perspectives, and power dynamics occasionally slowed decision-making and required compromise. Similarly, co-design processes, while generative, were not always linear, and the need to remain flexible sometimes constrained the ability to decipher which intervention approaches proved more effective. However, this speaks to our finding that there is no one-size fits all approach. Practical and logistical challenges also emerged. Coordinating international teams across different time zones, educational systems, and community infrastructures required considerable administrative coordination. While the final study incorporated youth worker's observations on practice, formal inclusion of youth workers' perspectives through focus groups or semi-structured interviews may have offered a more comprehensive understanding of the processes, challenges, and successes from the facilitator viewpoint. Such perspectives could have illuminated aspects of intervention delivery and youth engagement strategies that were not fully captured. Finally, while this research prioritised inclusivity, it is important to acknowledge that participation was still mediated by structural and contextual barriers. Some young people, particularly those experiencing severe marginalisation, geographic isolation, or acute mental health challenges, may not have been reached by the project, meaning that their perspectives remain underrepresented. As such, while the findings provide valuable insights into the role of nature-based interventions, they are based on a small and heterogeneous sample and should not be assumed to represent the full spectrum of youth experiences across all contexts.

Despite these limitations, the methodological choices made in this thesis were intentional and carefully considered. The challenges encountered also generated valuable learning about the realities of conducting interdisciplinary, participatory, and cross-cultural research. These reflections will inform future research and practice, particularly regarding how to design interventions that are both contextually grounded and scalable.

Recommendations for Future Research

While Empirical Study Two (Chapter 5) offers some tentative insight into the relationship between nature connectedness and the lived experiences of young migrants, this remains a profoundly underexplored area. The scarcity of research focusing specifically on young migrants' relationships with nature underscores a substantial gap in the literature and presents an important opportunity for future inquiry. Given the complex intersections between migration, identity, place attachment, and wellbeing, future research should examine how nature connection influences psychological, social, and environmental wellbeing in this population (Borraccino et al., 2020), particularly in light of the heightened vulnerabilities and adaptation challenges often faced by youth with a migrant background (Borho et al., 2023).

To advance understanding in this area, future studies should explore how different dimensions of migration experience, including length of residence in the host country, language proficiency, legal status, cultural adaptation, and socio-economic conditions, shape both opportunities for and barriers to developing nature connectedness. Furthermore, existing research in this domain has been predominantly individualistic, often overlooking broader structural and contextual influences that determine access to and engagement with nature. Future work would therefore benefit from a multilevel perspective, investigating the role of urban density, spatial inequality, environmental design, and policy frameworks in enabling or constraining nature contact. Additionally, more attention should be given to the social dimensions of nature connection. Peer relationships, family dynamics, and community belonging may play crucial roles in shaping how young people experience and interpret their relationship with the natural world. The integration of these ecological, social, and cultural layers would foster a richer and more contextually grounded understanding of how nature connection develops across diverse life circumstances (Madera et al., 2024). There is a pressing need for cross-cultural and comparative research examining nature connectedness at the collective or societal level. Such work could help identify key levers for strengthening global nature connectedness and promoting relational environmental values, particularly in Western contexts where human–nature relationships are increasingly fragmented (Richardson et al., 2025). Longitudinal and participatory approaches, especially those that engage young migrants as co-researchers, could be especially powerful for

understanding how nature connection can serve as both a pathway for wellbeing and a foundation for environmental stewardship and belonging.

Given these varied and diverse influences on nature connection, a "one-size-fits-all" model for interventions risks overlooking the diversity of young people's needs and experiences. Instead, this research underscores the importance of contextually sensitive, co-designed approaches, where interventions are collaboratively developed with participants themselves. Positioning young people as experts on their own relationship with nature ensures interventions are grounded in lived realities, respectful of cultural perspectives, and tailored to diverse needs. Participatory methods not only empower young people but also ensure greater relevance, effectiveness, and long-term impact. Recent research has increasingly called for the integration of co-design and participatory methods into nature-based interventions for youth (Overbey et al., 2023; Obeng et al., 2023). This approach aligns with the ABC (Attitude–Behaviour–Context) Model of behaviour change (Guagnano et al., 1995), which highlights that behaviour is shaped not only by attitudes but also by contextual conditions (Liao & Yang, 2022; Shove et al., 2012). By applying this model to nature connectedness, it becomes clear that many young people may value nature yet remain unable to act due to barriers such as limited access, lack of supportive environments, or absence of social permission. By focusing on the unique contexts in which young people live, interventions can mitigate these barriers and create enabling conditions for pro-environmental behaviour. Co-design in this context should operate at multiple levels. At the programmatic level, interventions can be tailored to reflect participants' specific needs, interests, and contexts. At the structural level, co-design principles should inform the development of green spaces and infrastructure in ways that are inclusive, accessible, and responsive to local communities. In this way, NBIs can contribute to addressing health equity gaps by ensuring equitable access to nature, particularly for those who have been historically excluded. Taken together, these findings position co-designed, contextually sensitive NBIs as essential for unlocking the full potential of nature connection. By recognising diverse experiences and shaping interventions to facilitate this, we can foster inclusive pathways to wellbeing, strengthen biospheric values, and support more widespread stewardship of the natural world.

Finally, while we advocate for co-design and participatory methods we emphasise the importance of meaningful collaboration and participation. When working with young people, particularly those from socio-economically or culturally marginalised groups, there is a risk that

participation becomes tokenistic (Ibes et al., 2021; Fletcher, 2024). Previous research has shown that young people are often involved only consultatively—as a 'box ticking exercise' or to lend credibility by labelling research as 'participatory' and 'co-created'—rather than being meaningfully engaged throughout all phases of research, including in decision-making (Mandoh et al., 2021). Importantly, Butti (2025) highlights how power imbalances persist even in participatory research. Even when youth are involved, they may be constructed as 'agents' only in rhetoric, while still being treated as powerless. The risk includes tokenisation—where youth participation is symbolic rather than transformative which can cause more harm than good. This underscores the need for researchers to engage in ongoing, conscious reflection on what is meant by participatory or co-design, what practices are put in place and what are the ways of being that genuinely share power, value youth expertise, and ensure meaningful involvement at every stage of the research process.

Recommendations for Practice and Policy

This research represents just one element within a broader, interconnected approach to transformative change—which must occur across multiple levels affecting practice and policy:

Deep, systemic change is urgent and necessary. For humanity to move toward a truly sustainable future, we must undergo a fundamental transformation in our worldview, shifting from extractive and anthropocentric perspectives toward more relational, ecocentric ways of knowing and being. Or as one young person, involved in this research, describes it: *'We need a change in the way we see the world and our place within it.'* This larger cultural shift in how we know and relate to nature is the very bedrock upon which our collective future rests. This is something I have emphasised in the conclusion of each study in this thesis, but here I expand on its significance, situating NBIs as one strategy amongst multiple varied approaches which are necessary in achieving this broader paradigm shift.

The decline in nature connectedness cannot be understood in isolation, but rather as a systemic phenomenon, deeply rooted in long-term demographic and environmental shifts. Cultural attitudes and worldviews play a significant role in this with cultural transmission of nature connectedness highlighted as a pivotal factor leading to the current state of the planet

(Richardson et al., 2025; Lengieza & Aviste, 2025). Part of the difficulty perceiving reciprocity with nature stems from the Western worldview framing nature and other beings as inanimate resources to be controlled or utilised. This emphasises the importance of challenging this current paradigm and considering the social processes that influence our relationships with nature. We must confront assumptions about human exceptionalism, which position humans as superior to the other species who surround us. Part of this involves recognising the personhood of all beings as equally important, not in a hierarchy but a circle. While cultural transformations of this scale are undeniably difficult to engineer, the existence of past dramatic cultural shifts is a source of hope. Such shifts may, perhaps, be realised through a realisation that the current paradigm has become outdated and unsustainable. Positioned alongside a clear vision for a more sustainable future such change can be possible. A future where the human–nature relationship is valued and actively supported represents such a vision.

But what does this mean in practice? At its core, it requires a fundamental shift in how we perceive and value nature. Rather than framing it in terms of "ecosystem services" or "resources to be managed," we must begin to speak about nature as "our shared home" and "that which sustains us." This reframing positions nature connectedness not as an desirable "health promotion strategy", but as fundamental to our survival and flourishing. Practically, this means embedding nature connectedness across all levels of society: into policies, urban planning, and education, while simultaneously fostering a collective understanding about our symbiotic relationship with nature. On a personal and cultural level, it also means carving out regular space and time in our daily routines to experience and nurture this relationship. People must first be given the opportunity to connect with nature to cultivate a sense of belonging within it. Only then can we begin to address the deeper issues of orientation and affinity toward nature that lie at the heart of nature connectedness. This leads directly to my first suggestion on recommendations for practice and policy:

Inviting Nature back into our Cities, Policy, Planning, and Daily Life

How can we expect people to connect with nature if there is no nature in sight? A core finding of this thesis is the widespread inequity regarding access to nature, particularly in urban environments where many young people grow up surrounded by "concrete jungles" with little

opportunity for meaningful engagement. Urbanisation, already increased ten-fold and projected to grow further, has been consistently associated with declines in nature connectedness (Kamphuisen et al., 2025). Addressing this requires strategies that expand opportunities to access vibrant, biodiverse environments and integrate nature meaningfully into the public realm. Such change must be embedded within the systems and structures that shape everyday life: designing buildings and housing that bring nature indoors and outdoors, prioritising urban greening through biodiverse infrastructure, and ensuring equitable access for all communities. While many policy proposals for urban greening already exist, recent work (Richardson, 2025; Kamphuisen et al., 2025), underscores both the urgency and the scale of transformation required to avoid ecological tipping points and overcome shifting baselines. These models provide valuable guidance on the necessary timelines and levels of intervention. Policy actions should revolve around creating *space* and *time* for nature, within our systems:

1. It is not enough for environmental policy to recognise that relationships with nature are tangible drivers of action; this shift must extend across all areas of policy and decision-making; guiding urban planning, housing, and community development policies to provide spaces that facilitate nature connection. **Prioritising high-quality urban greening within city planning is essential, with a focus on creating biodiverse and accessible green spaces, such as parks, green corridors, and community gardens, which maximise opportunities for engagement.** This requires reimagining and rewilding our cities through biophilic design and expanding access to green spaces, particularly in lower socioeconomic areas where the deficit is most pronounced. Access to nature must be treated as a universal right, not a privilege. Importantly, urban greening efforts must be pursued in tandem with broader conservation and ecological rehabilitation to address widespread environmental degradation which has led us to this point. This means deliberately creating *space* for nature and inviting it back into the very places from which it has been pushed out.

2. Another pivotal part of this is creating *time* for nature connection. Indeed, mere availability of nature does not necessarily imply meaningful engagement. **Opportunities for immersive experiences in nature must be prioritised and incentivised.** It is crucial

that such opportunities are integrated throughout daily life, including within workspaces, schools, and other spaces where people spend the majority of their time. Transforming the amount of time people spend in nature through intentional design of green spaces and the integration of nature access across the public realm, including education, health, transport, arts, and housing sectors is pivotal. Practically, this could involve designing classrooms and offices with nature in mind, inviting it into these spaces and creating walking routes and green corridors between buildings. An effective approach may be to share knowledge about the direct benefits of connecting with nature for both physical and mental health.

3. These opportunities, however, require a change in orientation. **Social norms can and should be fostered,** for example, through cultural policy to foster novel and exciting engagement with nature. Health policy can and should highlight the interdependence of humans and the rest of nature. The law can also work toward supporting a change in our relationship with nature. Legal frameworks can afford natural environmental legal personhood. Precedents for this have been set in canonical laws (e.g. Mar Menor, Krämer, 2023).

4. Policies and interventions must **prioritise inclusivity, accessibility, and cultural relevance**, ensuring that nature is not only geographically and economically available but also socially and culturally welcoming. Crucially, true equity in nature engagement involves dismantling systemic barriers and actively creating opportunities for all communities to develop a relationship with the natural world (Rigon et al., 2025).

Nature-based Interventions aimed at Intergenerational Transmission:

As outlined throughout this work, nature-based interventions offer practical and scalable pathways for achieving cultural shifts and transformative change. However, we outline a specific focus for interventions on the intergenerational transmission of nature connectedness, highlighting the significance of targeting both children and parents. Promoting a connection with

nature in the next generation should be an important, shared priority shaping the integration of health and sustainability agendas. Critically, findings from Richardson's recent study (2025) identify intergenerational transmission as a key driver of transformative change. The study shows that intergenerational momentum can create a lag effect, where improvements in environmental conditions (opportunity) may take generations to translate into increased nature connectedness due to inherited low orientation from previous generations. Promisingly, the findings suggest that transformative change is possible when increases in nature access are combined with child-focused interventions and intergenerational engagement.

This represents a dual strategy of environmental restoration and strengthened intergenerational transmission. These results underscore that intergenerational transmission, historically a driver of decline, can also become a powerful mechanism for recovery when positively reinforced. This suggests that interventions focused on young people and family-based interventions could disrupt the cycle of disconnection. The intervention presented in this thesis provides a concrete example of such an approach, offering invaluable insights for practice. Such youth leadership and advocacy programs can empower young people to lead local environmental projects, promoting peer-to-peer influence. Furthermore, our findings highlight the potential of youth work approaches in supporting intergenerational engagement. Youth work engages not only the young person but also their wider family, friends, and community, creating a ripple effect that extends the impact beyond the immediate participants. Recent work supports this, pinpointing the integration of youth work into schools as a key pathway towards wellbeing and sustainability (Pantazidis & Pechtelidis, 2025). Here we outline additional complementary strategies which are essential in supporting sustained nature connectedness:

1. Integrate nature connectedness into family-oriented policies and parental engagement initiatives: Implement large-scale public awareness campaigns that encourage families to engage with nature (Richardson et al., 2020). Facilitate nature-focused family outings and provide parenting resources that highlight the wellbeing benefits of spending time in nature. Programs engaging new parents can help enhance their own nature connectedness, boost self-efficacy, and increase confidence in guiding young children to experience and appreciate nature for the first time. This is a key moment of change where

new parents need social support and can draw on community networks while laying the foundations for nature connectedness within their children.

2. Leverage social cohesion and existing social networks through community-based nature programmes: Local initiatives such as youth centres, nurseries, community gardens, conservation projects, or urban greening programs that engage families across generations. Integrating nature connectedness into existing societal structures can further help shape social norms and values, making nature engagement a natural and valued part of everyday life.

3. Draw on mentorship and intergenerational pairing: Programs pairing adults and children with experienced nature guides, ecologists etc. within the community to encourage knowledge transfer and modeling of nature engagement.

4. Cultural and storytelling approaches: Sharing stories, traditions, and local environmental knowledge that reinforce cultural ties to nature. A valuable example of this is the 'Nature Connection Project' (2025) originating in Australia. In Ireland, Manchán Magan has done canonical work on this topic (See *Listen to the Land Speak*).

5. We cannot ignore the fact that children and young people spend the majority of their time within educational settings; indeed, it is here that many of their values, attitudes, beliefs, and, crucially, their worldview are shaped. This positions the education system as a powerful catalyst for cultivating an ecocentric worldview. Recent research emphasises the potential of transformative education for sustainability in this regard (Giusti et al., 2025). Embedding such approaches within formal education systems—through prioritising nature engagement, outdoor learning, and ecological literacy across both schools and universities—can foster formative early-life experiences that cultivate lasting connections with nature and reinforce them throughout the lifespan. Spatially, schools can act as the beating heart of transformative cultural change, encouraging nature-rich routines and pro-nature behaviours within the local community. Exemplary models already exist—such as initiatives by the SEI & CEEW (2022) and the Green School Bali

(Agustin & Dwijendra, 2023)—which provide compelling guidance for what education rooted in ecological values can look like. Scaling up and adapting such models more widely will be essential to meet the demands of the current ecological crisis.

6. Lastly, incorporating young people's perspectives into environmental and health policy can ensure policies are by and for young people and shaped by their relational perspectives (See research on Postpaternalism, Daly et al., 2024).

Contributions of this Thesis

Contributions of thesis to Theory

By integrating classical environmental psychology theories with models of behaviour change, this thesis advances a more context-sensitive theoretical framework. It recognises the enduring value of Biophilia, SRT, and ART in explaining foundational mechanisms of restoration and wellbeing, while extending these models to account for a more encompassing perspective of the relational benefits of nature connection. This is a perspective which accounts for the cultural variability, developmental stage, and structural constraints which influence the human-nature relationship. This integrated approach positions nature connectedness not as a universally uniform outcome of exposure, but as a relational process and malleable construct shaped by lived experience, social context, and environmental conditions. It further situates pro-environmental behaviour within a broader ecological system of attitudes, opportunities, and barriers. In this way, this thesis builds upon and extends existing environmental psychology frameworks by foregrounding the contextual dimensions (systemic, relational, cultural, and structural) that shape young people's engagement with, and relationship to, the natural world. In doing so, the thesis moves beyond perspectives that tend to individualise nature connection and instead advances a more contextually embedded understanding of how connection is formed, sustained, and constrained.

Importantly, this reframing offers promising directions for intervention design, particularly in identifying and addressing contextual barriers while enabling meaningful and sustained

engagement. The findings highlight the longer-term developmental and relational implications of nature connectedness for youth mental health and environmental stewardship. Of particular significance is the potential for nature connectedness to strengthen social connection and restore "relational resources" essential for flourishing. Young people's accounts in this research illustrate how natural environments can provide spaces for authenticity, self-expression, and belonging, supporting the development of more genuine social bonds. These strengthened social connections, in turn, can foster a collective ecological identity and a shared sense of responsibility to care for and protect the natural world.

This counters dominant theoretical approaches that often focus primarily on short-term, immediate restorative outcomes of nature exposure, by demonstrating how sustained relational engagement with nature may support enduring psychological and behavioural change. In this way nature connectedness can provide a long term and enduring support for youth by promoting wellbeing, social connection and environmental stewardship. This shift in perspective on nature connectedness from a resource with immediate short-term gain towards a relational perspective with long term enduring benefits provides promising direction. This shift in perspective—from viewing nature primarily as a site of short-term restoration to understanding it as a relational context with enduring social and developmental benefits—aligns with emerging perspectives that frame nature-based interventions as preventative and promotive mental health supports rather than primary treatments for acute distress (e.g., Campbell et al., 2026). Further, this aligns with a reflection on theory within Environmental Psychology by Terry Hartig (2021) where he builds on the restoration perspective of the benefits of nature connection to propose two additional theories; Relational Restoration Theory (RRT) and Collective Restoration Theory (CRT. These theories expand on conventional restoration theory to call attention to the restoration of social support or 'relational resources' as held within closer relationships and as held collectively by members of a population. These theories contribute to a more encompassing narrative about nature experience and health, one that realises more of the potential of the restoration perspective and acknowledges how individual and relational restoration processes are deeply intertwined. This perspective advocates for the treatment of restoration in nature as a social ecological phenomenon. The findings of this thesis strongly align with this expanded restoration perspective. They suggest that the benefits of nature engagement cannot be fully understood at

the level of individual psychological recovery alone, but must be situated within relational and collective processes that shape identity, belonging, and shared responsibility.

Ultimately, this thesis contributes to the evolution of environmental psychology by linking restoration theories, relational models of nature connectedness, and context-sensitive behaviour change frameworks. In doing so, it supports the development of youth-focused, co-designed nature-based interventions capable of enhancing mental health while fostering environmental stewardship and advancing more ecocentric worldviews.

Contributions to practice and policy

This thesis makes a significant contribution to the interdisciplinary fields of environmental psychology, public health, and sustainability science by addressing calls for nature-based, ecocentric, and transformative approaches to sustainability (Giusti et al., 2025; Richardson, 2025; IPBES 2024; Redvers et al. 2023; Sass et al. 2020). By foregrounding the importance of inclusivity and equity, this research highlights the potential of co-designed interventions to address these disparities, outlining what meaningful collaboration with diverse communities involves in practice. Further this thesis calls for deeper critical engagement with how nature is positioned and valued within our dominant systems and social norms, linking the findings to broader debates on degrowth and alternative models of societal progress. By situating NBIs within this wider discourse, the thesis highlights their potential not only as practical mechanisms for improving wellbeing and promoting stewardship, but also as catalysts for the systemic, value-based transformations required to achieve sustainable futures. Real-world interventions require a contextually sensitive approach to ensure their compatibility with diverse spatial, cultural, and personal dimensions. This research advances a strong conceptual argument for embedding nature connectedness within societal systems and planetary health strategies, emphasising the fundamental importance of equitable access to nature to ensure that all individuals have the opportunity to cultivate a meaningful relationship with the natural world. The application of participatory, co-design frameworks foregrounds the role of a dynamic and inclusive approach to intervention design. Further, the conceptual framework offers a practical guide to designers and researchers in the field, in regard to the practical application of designing NBIs for mutuality, reciprocity and inclusion.

The empirical work presented further extends our understanding of the human-nature relationship, offering invaluable insights into the underlying mechanisms leading to both health outcomes and sustainable behaviours. Through a rigorous umbrella review, this thesis consolidates a fragmented evidence base, critically evaluating methodological quality and identifying mechanisms that shape the effectiveness of interventions. Further this thesis addresses the deficit of research that seeks to understand the nuanced and contextually sensitive complexities shaping the human–nature relationship, providing particular insight into the personal, emotional, cultural, and symbolic significance of natural environments. Accordingly, this empirical work addresses a significant gap in research by employing an in-depth qualitative approach to extend critical understanding of these dimensions and to inform more inclusive design processes. By integrating young peoples lived experiences across diverse cultural contexts, it advances theoretical insights into the relational, embodied, and meaning-oriented dimensions of nature connection, while highlighting inequities in access to nature influenced by socioeconomic and structural barriers. Accordingly, this work not only extends conceptual understanding but also bridges gaps between theory and applied practice.

Expanding on the contributions of this research for practice and policy, the thesis provides actionable evidence and guidance on how interventions can be co-designed with community members and adapted to diverse cultural and social realities, offering a model for inclusive and context-sensitive intervention design. Further, this research provides particular insight into co-designing interventions with young people, who are a particularly relevant group given their heightened vulnerability to ecological crises, their central role in shaping future societal values and behaviours, and their potential to act as catalysts for long-term planetary health outcomes. Findings from the Pathways to Nature project demonstrate the potential of NBIs to enhance wellbeing, shift values towards relational and ecocentric orientations, and catalyse ripple effects that extend beyond individuals to influence entire communities. By emphasising certain processes which uphold accessibility and equity, within co-design, this research highlights how NBIs can move beyond individual health benefits to address systemic challenges of sustainability and justice.

Collectively, the work contributes to global discourse on transformative change by showing how NBIs can serve as a lever for systemic shifts in policy and practice—by creating

opportunities for meaningful human–nature connection as a foundation for planetary health. Beyond its contributions to research, practice, and policy, this thesis also supports the urgent epistemic shift from anthropocentric to ecocentric worldviews. By positioning nature not merely as a resource for human use but as a relational partner vital to collective flourishing, this research advances an alternative paradigm grounded in reciprocity, relational values, and mutual responsibility. The empirical findings, presented here, demonstrate that fostering nature connectedness through contextually sensitive, well-designed and equitable interventions can nurture ecocentric orientations among young people, embedding care, stewardship, and interdependence into their value systems. In this way, this thesis contributes to the need for transformative change by showing how NBIs can function not only as tools for improving health and behaviour, but as catalysts for reimagining human–nature relationships in ways that align with sustainable and regenerative futures.

Conclusion

This thesis highlights the multiple benefits of nature connectedness for young people, emphasising its central role in promoting mental wellbeing, pro-environmental behaviour, social connectedness, and ecocentric worldviews. Collectively, the findings reaffirm that human–nature relationships should be recognised as a key target for advancing both population health and climate action, laying the foundation for a sustainable future. By demonstrating that nature connectedness is a critical underpinning for human and environmental health, this work extends existing theory and provides new insights into the many ways in which human wellbeing and ecological flourishing are deeply interconnected. At the heart of these findings lies a broader cultural imperative: to repair our broken relationship with nature. This thesis therefore goes beyond ecological restoration, calling for the restoration of relational bonds between people and nature. Renewing this connection is essential if we are to address the socioecological crises that threaten our survival as a species. Spreading awareness of human disconnection from nature, and reconstructing this valuable bond, must become a collective priority.

This research underscores the potential of nature-based interventions as scalable mechanisms of achieving this, enhancing nature connectedness, wellbeing, pro-environmental behaviours, and cultivating relational values. Importantly, the evidence highlights the specific dimensions of

intervention design that are most effective—mindfulness, active and immersive engagement in nature, social dimensions of experience, co-design, and contextual sensitivity. Findings also stress the importance of adopting a relational approach, not only in intervention design but in broader strategies to strengthen nature connectedness. Approaching human–nature relationships in all their complexity, and situating them in their social and spatial contexts, offers a transformative pathway for restoring bonds with the natural world. The integration of young people's perspectives, alongside Indigenous worldviews rooted in relationality, is crucial. These perspectives highlight the importance of intergenerational transmission, underscoring the need for early-life and family-based interventions that lay the foundation for lasting connections with nature.

However, nature-based interventions are only one piece of the puzzle. For their potential to be realised, they must be supported by systemic changes that embed nature connectedness across public life. Sustained, long-term policy interventions are needed to shift population-level trajectories. This thesis therefore advocates for transformative policies across urban planning, housing, education, health, and community development to break the cycle of disconnection from nature. Such approaches include reimagining urban environments to ensure equitable access to biodiverse green spaces, fostering shared practices of care for nature within communities, and embedding nature connection and the ecocentric ethos within educational curricula. This vision, however, must be accompanied by opportunities, actions, and meaningful engagement to shift social norms and cultural values. Nature-based interventions can play a key role here highlighting the symbiotic and mutually beneficial nature of this approach. By reframing nature connection as a matter of justice, health equity, and ultimately survival, policy and interventions can play a central role in supporting the needed shift from anthropogenic to ecocentric worldviews. It is not only crucial that environmental policy comes to recognise that nature connectedness is a tangible driver of action but that this shift extends beyond environmental policy to permeate all areas of policy and decision making. Ultimately, there is an imperative to provide quality, immersive, and emotionally intimate contact with nature every day. Such foundational shifts are essential for achieving the scale of transformation needed to restore human–nature relationships and support long-term sustainability.

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Appendices

Appendix I Umbrella Review (Chapter 3)

Supplementary Material S1: PRIOR checklist

PRIOR checklist (preferred reporting items for overviews of reviews)

Section topic	Item No	Item	Location (page) where item is reported
Title			
Title	1	Identify the report as an overview of reviews.	1
Abstract			
Abstract	2	Provide a comprehensive and accurate summary of the purpose, methods, and results of the overview of reviews.	2
Introduction			
Rationale	3	Describe the rationale for conducting the overview of reviews in the context of existing knowledge.	4-7
Objectives	4	Provide an explicit statement of the objective(s) or question(s) addressed by the overview of reviews.	6-7
Methods			
Eligibility criteria	5a	Specify the inclusion and exclusion criteria for the overview of reviews. If supplemental primary studies were included, this should be stated, with a rationale.	10-13 (see Table 1)

	5b	Specify the definition of “systematic review” as used in the inclusion criteria for the overview of reviews.	13 (see Table 1)
Information sources	6	Specify all databases, registers, websites, organisations, reference lists, and other sources searched or consulted to identify systematic reviews and supplemental primary studies (if included). Specify the date when each source was last searched or consulted.	8-9
Search strategy	7	Present the full search strategies for all databases, registers and websites, such that they could be reproduced. Describe any search filters and limits applied.	Supplement Material S2
Selection process	8a	Describe the methods used to decide whether a systematic review or supplemental primary study (if included) met the inclusion criteria of the overview of reviews.	8-11
	8b	Describe how overlap in the populations, interventions, comparators, and/or outcomes of systematic reviews was identified and managed during study selection.	13
Data collection process	9a	Describe the methods used to collect data from reports.	14-17
	9b	If applicable, describe the methods used to identify and manage primary study overlap at the level of the comparison and outcome during data collection. For each outcome, specify the method used to illustrate and/or quantify the degree of	13

		primary study overlap across systematic reviews.	
	9c	If applicable, specify the methods used to manage discrepant data across systematic reviews during data collection.	13-14
Data items	10	List and define all variables and outcomes for which data were sought. Describe any assumptions made and/or measures taken to identify and clarify missing or unclear information.	12-14
Risk of bias assessment	11a	Describe the methods used to assess risk of bias or methodological quality of the included systematic reviews.	15
	11b	Describe the methods used to collect data on (from the systematic reviews) and/or assess the risk of bias of the primary studies included in the systematic reviews. Provide a justification for instances where flawed, incomplete, or missing assessments are identified but not reassessed.	15-17
	11c	Describe the methods used to assess the risk of bias of supplemental primary studies (if included).	NA
Synthesis methods	12a	Describe the methods used to summarise or synthesise results and provide a rationale for the choice(s).	15-17

	12b	Describe any methods used to explore possible causes of heterogeneity among results.	13-14
	12c	Describe any sensitivity analyses conducted to assess the robustness of the synthesised results.	NA
Reporting bias assessment	13	Describe the methods used to collect data on (from the systematic reviews) and/or assess the risk of bias due to missing results in a summary or synthesis (arising from reporting biases at the levels of the systematic reviews, primary studies, and supplemental primary studies, if included).	17
Certainty assessment	14	Describe the methods used to collect data on (from the systematic reviews) and/or assess certainty (or confidence) in the body of evidence for an outcome.	17-18
Results			
Systematic review and supplemental primary study selection	15a	Describe the results of the search and selection process, including the number of records screened, assessed for eligibility, and included in the overview of reviews, ideally with a flow diagram.	18-20
	15b	Provide a list of studies that might appear to meet the inclusion criteria, but were excluded, with the main reason for exclusion.	Supplementary S3
Characteristics of systematic reviews and supplemental primary studies	16	Cite each included systematic review and supplemental primary study (if included) and present its characteristics.	Supplementary Table S5

Primary study overlap	17	Describe the extent of primary study overlap across the included systematic reviews.	23
Risk of bias in systematic reviews, primary studies, and supplemental primary studies	18a	Present assessments of risk of bias or methodological quality for each included systematic review.	19-20
	18b	Present assessments (collected from systematic reviews or assessed anew) of the risk of bias of the primary studies included in the systematic reviews.	Supplementary S7
	18c	Present assessments of the risk of bias of supplemental primary studies (if included).	N/A
Summary or synthesis of results	19a	For all outcomes, summarise the evidence from the systematic reviews and supplemental primary studies (if included). If meta-analyses were done, present for each the summary estimate and its precision and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	20-37
	19b	If meta-analyses were done, present results of all investigations of possible causes of heterogeneity.	N/A
	19c	If meta-analyses were done, present results of all sensitivity analyses conducted to assess the robustness of synthesised results.	NA
Reporting biases	20	Present assessments (collected from systematic reviews and/or assessed anew) of the risk of bias due to missing primary studies, analyses, or results in a summary or	20-22

		synthesis (arising from reporting biases at the levels of the systematic reviews, primary studies, and supplemental primary studies, if included) for each summary or synthesis assessed.	
Certainty of evidence	21	Present assessments (collected or assessed anew) of certainty (or confidence) in the body of evidence for each outcome.	21-22
Discussion			
Discussion	22a	Summarise the main findings, including any discrepancies in findings across the included systematic reviews and supplemental primary studies (if included).	39-41
	22b	Provide a general interpretation of the results in the context of other evidence.	39-45
	22c	Discuss any limitations of the evidence from systematic reviews, their primary studies, and supplemental primary studies (if included) included in the overview of reviews. Discuss any limitations of the overview of reviews methods used.	45-47
	22d	Discuss implications for practice, policy, and future research (both systematic reviews and primary research). Consider the relevance of the findings to the end users of the overview of reviews, eg, healthcare providers, policymakers, patients, among others.	41-43

Other information			
Registration and protocol	23a	Provide registration information for the overview of reviews, including register name and registration number, or state that the overview of reviews was not registered.	7-8
	23b	Indicate where the overview of reviews protocol can be accessed, or state that a protocol was not prepared.	7-8
	23c	Describe and explain any amendments to information provided at registration or in the protocol. Indicate the stage of the overview of reviews at which amendments were made.	8
Support	24	Describe sources of financial or non-financial support for the overview of reviews, and the role of the funders or sponsors in the overview of reviews.	48
Competing interests	25	Declare any competing interests of the overview of reviews' authors.	1
Author information	26a	Provide contact information for the corresponding author.	1
	26b	Describe the contributions of individual authors and identify the guarantor of the overview of reviews.	1
Availability of data and other materials	27	Report which of the following are available, where they can be found, and under which conditions they may be accessed: template data collection forms; data collected from included systematic reviews and	48

		supplemental primary studies; analytic code; any other materials used in the overview of reviews.	

Supplementary Material S2 Search Strategy

Table. S2.1 Scoping Search strategy and keywords for this umbrella review

# Concept	Search query Keywords (searched within titles, abstracts, subject headings)
1) Intervention	"Nature–based Interventions" OR "NBIs" OR "Nature–based health interventions" OR "Nature interventions" OR "Nature–based activities" OR "Nature–based outdoor activities" OR "Green space" OR "Blue space" OR "Blue gym" OR "Ecotherapy" OR "Eco Therapy" OR "Eco–therapy" OR "Wilderness Therapy" OR "Nature-based therapy" OR "Nature therapy" OR "Nature-based therapeutic interventions" OR "Nature involvement" OR "Forest Bathing" OR "Shinrin-Yoku" OR "Green Care" OR OR "Nature-exposure" OR "Horticultural Therapy" OR "Wilderness Therapy" OR "Nature Play" OR "Wild Play" OR "Urban green space" OR "natural environment" OR "natural space" OR "Restorative nature" OR "Nature contact" OR "Nature exposure", " "Restorative garden" OR "Healing nature" OR "Healing garden" OR "Therapeutic nature" OR "Therapeutic garden"
2) Outcomes (Mental Health & Wellbeing)	"Mental health" OR "Psychological health" OR "Wellbeing" OR "Well-being" OR "Well being" OR "Happiness" OR "Life Satisfaction" OR "Quality of Life" OR "Anxiety" OR "Depression" OR "Stress" OR "Psychological stress" OR "Mental stress" OR "Vitality" OR "Burnout" OR "Exhaustion" OR "Fulfillment"

3) Study Designs	Systematic review OR Meta-analysis
4) Combination	1 AND 2 AND 3

S2.2. 22 Seed Studies/ Candidate references identified during preliminary scoping

1. Taylor, E. M., Robertson, N., Lightfoot, C. J., Smith, A. C., & Jones, C. R. (2022). Nature-based interventions for psychological wellbeing in long-term conditions: a systematic review. *International journal of environmental research and public health*, *19*(6), 3214.
2. Corazon, S. S., Sidenius, U., Poulsen, D. V., Gramkow, M. C., & Stigsdotter, U. K. (2019). Psycho-physiological stress recovery in outdoor nature-based interventions: A systematic review of the past eight years of research. *International Journal of Environmental Research and Public Health*, *16*(10), 1711.
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S2.3. Search Query developed with faculty librarian based on scoping searches

# Concept	Search String
1. Intervention 2. Outcome 3. Study Design	Nature-based Interventions OR (NBIs OR Nature-based health interventions OR Nature- based activities OR Nature-based outdoor activities OR Green space OR Blue space OR Blue gym OR Ecotherapy OR Eco Therapy OR Eco-therapy OR Wilderness Therapy OR Nature-based therapy OR Nature therapy OR Nature-based therapeutic interventions OR Nature involvement OR Forest Bathing OR Shinrin-Yoku OR Green Care OR Nature-exposure OR Horticultural Therapy OR Wilderness Therapy OR Nature Play OR Wild Play OR Urban green space OR natural environment OR natural space OR Restorative nature OR Nature contact OR Nature exposure OR Restorative garden OR Healing nature OR Healing garden OR Therapeutic nature OR Restorative garden) AND (Mental health OR Psychological health OR Wellbeing OR Well-being OR Well being OR Happiness OR Life Satisfaction OR Quality of Life OR Anxiety OR Depression OR Stress OR Psychological stress OR Mental stress) AND (Systematic review OR Meta-analysis)

Electronic Search of database – Academic Search Complete (EBSCO) – Conducted on Monday the 22nd of May 2022

#	Concept	Search String	# of hits
1	Intervention	Nature-based Interventions OR (NBIs OR Nature-based health interventions OR Nature-based activities OR Nature-based outdoor activities OR Green space OR Blue space OR Blue gym OR Ecotherapy OR Eco Therapy OR Eco-therapy OR Wilderness Therapy OR Nature-based therapy OR Nature therapy OR Nature-based therapeutic interventions OR Nature involvement OR Forest Bathing OR Shinrin-Yoku OR Green Care OR Nature-exposure OR Horticultural Therapy OR Wilderness Therapy OR Nature Play OR Wild Play OR Urban green space OR natural environment OR natural space OR Restorative nature OR Nature contact OR Nature exposure OR Restorative garden OR Healing nature OR Healing garden OR Therapeutic nature OR Restorative garden) AND (Mental health OR Psychological health OR Wellbeing OR Well-being OR Well being OR Happiness OR Life Satisfaction OR Quality of Life OR Anxiety OR Depression OR Stress OR Psychological stress OR Mental stress) AND (Systematic review OR Meta-analysis)	232
2	Outcome		
	Study Design		

3			

Supplementary Material Table S3. Characteristics of included systematic reviews. See Table 2 pp. 9-18 in published umbrella review:
https://www.sciencedirect.com/science/article/pii/S0160412024008043#s0115

Supplementary Material Table S4. Methodological quality of included systematic reviews (N = 64) See Supplementary Material 'Supplementary Data 4' in published umbrella review:
https://www.sciencedirect.com/science/article/pii/S0160412024008043#s0115

Supplementary Material S5. Table S.5. Deviations from protocol with justification

Deviation	Justification
1. **Decision not to split findings into two separate sister papers:** Our initial protocol proposed the potential approach of grouping evidence according to focus and methodology (qualitative or quantitative reviews) and splitting the findings into sister papers — What do we know about NBI, parts I and II. Results were to potentially be separated by quantitative and qualitative evidence subject to data extraction; when we would gauge if the evidence would support such a divide and if this approach would be useful and comprehensive	Given the heterogeneity of the studies included, we decided not to split the review in terms of methodology. Upon assessing the data, we determined that the evidence did not support this approach and such a divide was ultimately not feasible. Further, we determined such an approach would not provide any distinct benefits to the evidence synthesis. This decision was made when piloting our data extraction sheet. While gauging the potential scope to divide the review into quantitative and qualitative evidence, i.e., we determined that there is not enough quantitative vs qualitative reviews to warrant this divide and further mixed reviews do not present their findings in a way that would facilitate the separation of quantitative and qualitative evidence

2. Decision not to conduct a meta-analysis of quantitative results:	
Our protocol suggested that conducting a meta-analysis of quantitative findings would provide insight into the strength and direction of evidence of effect. Providing insight into effectiveness of NBIs: "It is expected that the quantitative evidence will be used to assess the strength and direction of the effect of NBIs on mental health and wellbeing outcomes, thereby providing insight into the effectiveness of interventions"	As anticipated in the initial protocol, meta-analysis was not possible due the heterogeneity of study populations, intervention type and plurality of disciplinary origins from which interventions originate. As our umbrella review considers one type of "intervention" (nature–based), but of varying composition (e.g. ecotherapy, green infrastructure, or blue environments), and the effect on several different health outcomes, we considered the challenge of dissecting each included review, extracting the results from each study, and the amalgamation of results, to be of insubstantial value given the likelihood for inaccurate statistical power and potentially misleading results (Brok et al., 2008). Additionally, broad inclusion criteria for review study design (e.g. quantitative and qualitative), prevented the quantitative pooling of syntheses

3. Decision not to develop an 'official' conceptual model:	
Our initial protocol stated: "The combined narrative synthesis will be used to develop a conceptual model. The model will be grounded in/formulated on the synthesised results of both the qualitative and quantitative evidence"	Given that this is an exploratory umbrella review and findings are subject to the diversity of disciplinary origins of reviews, significant heterogeneity of interventions and review findings, we decided not to present our review findings as an official conceptual model outlining factors which influence the effectiveness of NBIs. Rather, our results provide insight into potential factors of interest to consider when developing NBIs due to their potential impact on intervention effectiveness. Further, our review highlights the importance of considering population heterogeneity and the specific context within which the intervention is being developed and implemented

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Supplementary Material S6: PRECEPT Certainty Assessment Guiding Framework

Step 1: Identify the relevant questions

PRECEPT proposes applying the extended Patient/Population, Intervention, Comparator/Comparison/Control, and Outcome (PICO) format and integrating other questions to the extent possible.

PICO is considered to be the most appropriate way of framing questions related to interventions (domain (iv)) [2,9]. However, for studies on disease burden (domain (i)), it can be changed to focus on population, condition (i.e. disease) and context [10]. For risk factors (domain (ii)), the PICO format can be easily modified by replacing 'intervention' with 'exposure' and 'comparator' with 'absence of risk factor'. Furthermore, different risk factors can be compared with each other (risk factor x vs risk factor y) and different risk factor levels to establish an exposure–response relationship. For diagnostic accuracy studies (domain (iii)), PICO can be interpreted as population, index test, comparator test and outcome (target condition) [11].

Step 2: Perform the systematic review

Evidence should be identified and synthesised using a rigorous systematic review process. A systematic review usually includes six steps. For more extensive information on conducting a systematic review, readers are referred to the literature [9,14].

Assessment of methodological quality (risk of bias)

For appraising the methodological quality (risk of bias) of each study identified during the systematic review, the PRECEPT framework proposes using specific quality appraisal tools (QATs) according to study design [6]. A selection of 15 QATs, identified and selected during the first phase of the project by applying a systematic review-based approach [6], are proposed (Figure 3, Table 2). For each study design, the algorithm leads to the identification of a single QAT or a group of QATs. Risk of bias should be assessed in the form of a judgment rather than a score. It is suggested that the Cochrane classification scheme for bias is used: (i) high risk of bias; (ii) low risk of bias, and (iii) unclear risk of bias [14].

Synthesis of data

In the case of quantitative data, data synthesis can be conducted using meta-analytic techniques. If statistical pooling appears to be inappropriate, e.g. if interventions are too heterogeneous to be grouped in a meaningful way, if data are highly heterogeneous or if study designs differ considerably, a tabular, graphical or narrative synthesis might be more useful [15].

Use of existing systematic reviews

It is estimated that a new full systematic review takes between six to 24 months, but using existing systematic reviews for the development of new evidence assessments can shorten this by one to two thirds [16]. The use of existing systematic reviews might therefore reduce efforts and costs, making the evidence assessment process more efficient. Existing systematic reviews might complement the PRECEPT framework in various ways, e.g. by identifying studies, by answering full questions or by providing search strategies. Before using an existing systematic review, the need for an update should be evaluated. The process of identifying, assessing and applying existing systematic reviews should follow the steps proposed by Robinson et al. [17], and tools such as AMSTAR [18] or ROBIS [19] should be used to assess the methodological quality of existing systematic reviews.

Step 3: Apply the evidence-grading system and document the results

PRECEPT recommends a standard approach that uses the GRADE methodology to evidence-grading across all four types of domains.

Quantitative evidence

According to GRADE, the certainty in the evidence indicates the extent to which one can be confident that the estimate of effect is correct [4]. The units of analysis of GRADE are outcomes, meaning all assessments focus on the outcome of the intervention. At the beginning of the evidence review process, each outcome is rated from 1 to 9 regarding its importance to the decision, where outcomes rated 7 to 9 are regarded as ‘critical’, 4 to 6 as ‘important’, and 1 to 3 as ‘of less importance’.

For questions related to burden of disease (domain (i), outcomes can be measures of incidence or prevalence, as well as mortality or disability-adjusted life years. For questions regarding risk factors (domain (ii)), outcomes are those variables that are dependent on the risk factor. For diagnostics (domain (iii)), true positives, true negatives, false positives and false negatives are regularly used as surrogates for subsequent clinical outcomes. For questions regarding interventions (domain (iv)), outcomes are endpoints of clinical trials or observational studies.

Taking the entire body of evidence, not an individual study, on one outcome into account, four levels of certainty in the evidence, i.e. confidence in the estimate of the effect, are applied to the results of the review: very low, low, moderate and high. For interventions, RCTs are initially graded as high certainty, whereas all types of observational studies are classified as low certainty. Based on a defined set of criteria, decreasing (downgrading) or increasing (upgrading) by one or two levels is possible. Five criteria are applied for downgrading: (i) risk of bias, (ii) inconsistency, (iii) indirectness, (iv) imprecision and (v) publication bias. Three criteria are used to upgrade the certainty in the evidence: (i) large effect, (ii) evidence for a dose-response relationship and (iii) all plausible confounding would have reduced the effect. The lowest quality level among all critical outcomes defines the overall level of evidence across all outcomes. PRECEPT proposes the following unified approach using GRADE for all four domains (Figure 4), which is consistent with the current GRADE approach [4,20-22]:

1. For each body of evidence related to an outcome, an initial rating of the certainty in the evidence is performed. For some of the domains, this initial rating depends on study design.
2. Risk of bias is assessed using the appropriate QAT for the individual studies (see Step 2). A judgment about the risk of bias is made for the body of evidence, and evidence certainty can be downgraded, if necessary.
3. Thereafter, the other GRADE criteria for downgrading the certainty in the evidence (inconsistency, indirectness, imprecision, publication bias) are applied.
4. For the domains of 'intervention studies' and 'risk factor studies', upgrading of the certainty in the evidence is possible, according to the criteria introduced by GRADE. Evidence certainty should usually not be up graded after having been downgraded. It is currently unclear whether and how upgrading criteria are applicable to bodies of evidence on prevalence and diagnostics.

Qualitative evidence

For rating the evidence certainty of qualitative studies, PRECEPT proposes to assess limitations in the individual studies using the appropriate QATs. In addition, users of PRECEPT might

consider the GRADE–CERQual (Confidence in the Evidence from Reviews of Qualitative research) approach for assessing the confidence of evidence from reviews of qualitative research

Step 4: Prepare an evidence summary

At the end of the evidence appraisal process, a narrative evidence summary for communication of the results should be prepared. The following points should be captured: (i) the overall question, which describes the key question of the review, (ii) detailed questions, which lists the questions addressed by the review, and (iii) the volume of evidence, which describes the studies identified during the review, and (iv) the evidence statement and grading, which summarises the evidence which was identified by the review and the results of the grading process.

Harder, T., Takla, A., Eckmanns, T., Ellis, S., Forland, F., James, R., ... & Wichmann, O. (2017). PRECEPT: an evidence assessment framework for infectious disease epidemiology, prevention and control. *Eurosurveillance*, *22*(40), 16-00620. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5710124/#:~:text=The%20Project%20on%20a%20Framework,and%20question%20types%20into%20consideration.

Supplementary Material S7: Excel Spreadsheet of AMSTAR 2 Quality Assessment answers. See Supplementary Material 'Supplementary Data 6' in published umbrella review: https://www.sciencedirect.com/science/article/pii/S0160412024008043#s0230

Supplementary Material S8: Narrative Synthesis. See Supplementary Material 'Supplementary Data 8' in published umbrella review: https://www.sciencedirect.com/science/article/pii/S0160412024008043#s0230

Appendix II (Chapter 4)

Thematic Analysis: Example of Coding Framework

** How does young peoples' relationship to nature effect their mental health and sentiment of pro-environmental behaviour **

Transcript	**Codes**

Example extract from focus group 3 (pseudonyms provided): ***What does nature mean to you. So when I say nature what do you guys think of?*** **Saoirse (13):** Personally I just think of the land and the sea. You know trees, forests all that kind of stuff. The land the trees kind of everything that feeds into nature. I think of a field maybe with a load of trees or flowers on the floor just a bit of everything. **Safi (21)** For me I think of everything that is alive and within itself. So like my dog's life is my dogs life do you know what I mean it's connected to me in that way – but a rabbit outside is just doing it's own thing it's a part of nature. **Ruairí (17):** Yeah so when I think of nature I just think like in general it is everything as in we are just visitors onto like the earth that has nature absolutely everywhere so when you walk outside the smallest piece of a what we call a weed or a wildflower in a piece of cement – that's nature. Uh, looking	1. Nature as land and sea 2. Trees, forests, flowers embody/ feed into nature 3. Diverse nature – many different types 4. Nature as everything that is alive 5. Ecosystem of all life 6. Animals lives as nature 7. Connection of living things 8. Nature is everything 9. Humans as visitors onto the Earth 10. Nature everywhere 11. Small details of life are nature 12. Clouds and weather as nature

Research Question: How does young people's relationship to nature affect their:

1. Wellbeing
2. Sentiment of pro-environmental behaviour (PEB)

Two dimensions: 1) Nature connection and well-being 2) Nature connection and pro-environmental behaviour (PEB) with **six** themes

Nature Connection & Wellbeing

Theme	Description
1. Foundations/roots of our relationship to nature	Where does our relationship to nature begin – what supports or sparks that initial connection at beginning of life and throughout development: ● Innate awareness/ intrinsic connection to nature and understanding of our reciprocal relationship to the Natural World ● Importance of early life experiences – family, friends, school etc. Immersive nature experiences from a young age ● Support throughout development – School, programmes like Comhairle na nÓg Green Schools

	etc. the power of 'one person' introducing you to nature
2. Pathways to wellbeing	What are the unique pathways through which nature connection can enhance on young people's mental health: ● Calming/Grounding effect ● Social Cohesion ● Perspective on life
3. Individual differences	Focus on the importance of recognising *population heterogeneity* – Our relationship to nature and the benefits we experience are linked to individual differences, contextual factors: culture, SES, childhood memoires/ nostalgia etc.

4. Barriers	The various factors that prevent young people from cultivating this connection to nature and experiencing the subsequent benefits: ● Structure of modern life: lack of time, busy schedules, systemic issue ● Accessibility issues: geographically and in terms of access for those with disabilities ● Fear: parental fear, fear from narratives imposed by the media etc.

Nature Connection & Pro-environmental behaviour

Theme	Description
5. Overwhelm – Negative emotions	Nature contact/nature connection not always positive – can lead to a range of negative emotions. Being strongly connected to nature can lead to a sensitivity to the emotional impact of the environmental crisis. Influx of information that young people are consuming results in over stimulation/over saturation of information. This leads to a range of negative emotions resulting in general overwhelm: ● Feeling **blame** for the environmental crisis and pressure to be the ones who solve it 'eco-saviours'

	● Simultaneously feeling **'unheard'** or not listened to while paradoxically being positioned as saviours ● **Eco-anxiety:** resulting from saturation of information and witnessing environmental degradation first-hand
6. Nature connection as a catalyst for environmental stewardship	Nature connection can be an impetus for pro-environmental behaviour by: ● Tapping into innate/intrinsic urge to protect ● Exposure to environmental degradation leading to awareness and action ● Experiencing the mental health benefits of nature connection can evoke an urge to protect ● Specific pathway of *perspective* can be route to PEB: awe, gratitude, vitality etc. inspire environemtal action

Appendix III (Chapter 5)

Supplementary Material S1: Focus Group Question Guide

Focus Group Guide – Pathways to Nature

Aim of project: To explore how connecting with nature influences youth mental health, nature connectedness and supports pro-environmental behaviour – Drawing on youth work methodology

Purpose of the focus group: To allow participants to share their experiences of the project and explore the influence of mental health, nature connectedness and pro-environmental behaviour. *What have been the young people's experiences of Pathways to Nature?*

Dimensions of Interest

1. Experiences of Pathways to Nature & Nature Connectedness
2. Nature Connectedness & Mental Health/ Wellbeing
3. Nature Connectedness & Pro-environmental Behaviour

Focus Group Guide for Youth Workers

Introduction

Introduce yourself to participants and inform them of the general aim of the focus group:

"I am here to learn from your experiences. Think of this as a relaxed group discussion where we can openly share our stories. We are interested in understanding your experience of the Pathways to Nature Project, which you have been part of for the last few months. The focus group will last about 1 hour and a half. If there is anything you don't feel like sharing in the group, you can write down your answer or share it with me after the discussion."

Tell them to feel free to ask questions and to view the focus group as an informal discussion.

Questions

1. **Experiences of Pathways to Nature**

- What has been your favourite part of the Pathways to Nature Project?
- Were there any aspects of the project you didn't enjoy? Why?
- How has the project changed or influenced you?
- What is the main takeaway you have gotten from the project?

2. Nature Connectedness

- Using the 'Nature in Self' scale, where on this scale would you place yourself in terms of your connection to nature?

- Why have you chosen to place yourself there?
- Since participating in the project, how has your relationship with nature changed?
- **Prompt:** And what about your sense of connection to nature?
- **Prompt:** And what about your sense of identity/ self with nature?

Nature & Mental Health/ Wellbeing

- How did participating in this project make you feel?
- What were the main emotions that came up for you during the project? **Prompt:** At what point did they come up?
- Did you notice any differences or changes in your feelings and emotions during the project?
- If there have been changes, why do you think the project affected you this way?
- How do these emotions make you feel about nature?

Nature & Pro-Environmental Behaviour (PEB)

- Since participating in this project, what actions have you taken to protect/ care for nature?
- How has this project changed your feelings about protecting/ caring for nature?
- Looking at the Climate Emotions Wheel – What feelings came up for you while caring for nature? (Feel free to mention any emotions which don't appear on the wheel)

- How do you think spending time in nature influences these feelings?
- If nature could speak, what do you think it would say? **OR** What does nature need, in your opinion?
- Have you noticed that your actions in this project have had an impact on your local area?
- What else could you or others do to help?

Prompts

Tell me more about that

Can you say more on that?

Anything else/ to add?

What does everyone else think?
Do others have any different thoughts?

Climate Emotions Wheel: https://www.climatepsychology.us/climate-emotions-wheel
Self in Nature Scale: https://www.researchgate.net/publication/349078754_Measuring_Connection_to_Nature-A_Illustrated_Extension_of_the_Inclusion_of_Nature_in_Self_Scale

Supplementary Material S3: Translation process of Personal Wellbeing Index- School Children PWI-SC

Translation process: While the PWI-SC has been translated and validated for cross-cultural use in many countries, there were no available translations of the scale in Armenian, Finnish, and Spanish. Given that English was not the primary language of most participants, it was crucial that all participants could answer in their preferred language to uphold the project's values of inclusivity and accessibility. Accordingly, our team undertook the translation process of the PWI-SC into the three aforementioned languages. This was a rigorous and meticulous process guided by existing guidelines on cross-cultural translation (Cruchinho et al., 2024; Valūnaitė Oleškevičienė et al., 2018). The translation process was facilitated by the research team (psychologists, youth workers and young people) in collaboration with language/ translation experts in each country. The comprehension of the scale was validated by pilot-testing and co-designing the translations with young people from each country. These young collaborators played a key role in ensuring the accuracy and relevance of the translations. In addition, we employed a back-translation process (Kowal, 2014; Tyupa, 2011) to further verify the translations and identify any linguistic or cultural differences. This process supported an integrated intercultural learning between partner countries. Finalised translations were shared with the creators of the PWI-SC and have been published on the official Australian Centre on Quality of Life (ACQol) website, enhancing the scale's accessibility and its use with a diverse range of young people across different countries.

Translations available on the official Australian Centre on Quality of Life: (ACQol): https://www.acqol.com.au/instruments

Supplementary Material S4: Examples of Meaningful Co-design: Case Studies in Enacting Inclusivity and Participatory Practice

Here, I present specific case study examples that illustrate how values of inclusivity and accessibility were embedded both in methodological approach and in practice. These case studies serve as key examples of what is meant by genuine and meaningful co-design, demonstrating how principles of participation, equity, and collaboration were actively enacted throughout the research process. By highlighting these examples, I aim to show not just the outcomes of the project, but the ways in which inclusive practices shaped the process itself, fostering shared ownership, mutual learning, and empowered engagement among all participants.

Example 1: Embedding Inclusivity Through Translation and Language Support

Given that English was not the primary language for most participants in our final study, it was crucial to ensure that participation was not limited by language proficiency. This would be in direct conflict with our core values of inclusivity and accessibility and ultimately what we had set out to achieve with this project. To address this, our team undertook a rigorous and comprehensive translation process for all project materials. Information sheets, consent and assent forms were translated into the three partner languages: Spanish, Finnish, and Armenian. Additionally, the Personal Wellbeing Index–School Children (PWI-SC) Scale and all socio-demographic questions included in the Qualtrics survey were translated. While the PWI-SC has been validated for cross-cultural use in many countries, no existing translations were available in Armenian, Finnish, or Spanish. The translation process followed established guidelines for cross-cultural adaptation (Cruchinho et al., 2024; Valūnaitė Oleškevičienė et al., 2018) and involved collaboration between the research team (psychologists, youth workers, and young people) and language/translation experts in each country. To ensure accuracy and cultural relevance,

translations were pilot-tested and co-designed with young people from each partner country. These young collaborators were instrumental in validating comprehension and relevance. Furthermore, a back-translation process (Kowal, 2014; Tyupa, 2011) was employed to identify and address any linguistic or cultural discrepancies, fostering integrated intercultural learning among partner countries. The finalised translations were shared with the creators of the PWI-SC and published on the Australian Centre on Quality of Life (ACQol) website: https://www.acqol.com.au/ increasing accessibility for diverse young populations internationally. This commitment to language inclusivity extended beyond methodology into practice. All national training courses were conducted in the national language of each country. At international events, such as the International Youth Exchange and the PTN Youth Conference, youth workers provided on-site translations, and young people were encouraged to speak and express their views in their own language. These opportunities also allowed participants wishing to improve their English to do so in a supportive environment, which emerged as a key source of learning, confidence, and empowerment.

Example Two: Facilitating Inclusive Expression Through Visual Methods—Photo Speak

Our commitment to acknowledging diverse communication styles and needs extends beyond language differences to encompass deeper variations in how participants express themselves. For example, in Study Two (presented in Chapter Four), we employed a photo-elicitation technique, PhotoSpeak, to facilitate focus groups. Photo-elicitation involves incorporating one or more photographs into a research interview or focus group to stimulate discussion (Harper, 2002; Bigante, 2010; Thomas, 2009). Participants select a photo or image to help describe their answers, perspectives, or emotions. The technique can act as a catalyst to communication and helps participants open up and reflect by anchoring their thoughts to a tangible image. The technique was central to active participatory methods and proved to be particularly useful for working with young people. The methodology has been informed by the value of narrative research (Andrews et al., 2008), giving participants ways of communicating events, emotions and experiences through not just speech but also visual media. We chose photo-elicitation for its capability in underlining the process of participation and providing opportunities to communicate where spoken language might be difficult (Tolia-Kelly 2004). Within our group of young people,

in this study, there were a range of different learning abilities. Some young people find it difficult to verbalise their responses or find words to describe abstract processes. Further a multi-modal approach to data collection acknowledges the diversity of young people and the way in which they see the world. Visual methodologies enhance the richness of data by acknowledging and breaking down the disparities in power and status between the researcher and the participant (Rinaldi, 2006). However, photographic images alone do not empower; it is the shared construction of knowledge around conversations with the young people, based on their chosen images, which enables participant's meaning to prevail (Cook & Hess, 2007). Thus, data collection that is both person-centred and hands-on, enables participants to construct meaning through the research process and share it with researchers (Parker & Neuharth-Pritchett, 2006).

Example Three: Engaging Participants Through Creative Member-Checking

Innovative participatory activities were co-designed in Study Three to support member-checking and gather insights from both young people and practitioners (youth workers). Initial interpretations from the thematic analysis were shared with participants in accessible and engaging ways—through visual summaries, group discussions, and performative theatre—to ensure the themes genuinely resonated with their lived experiences. This reflexive engagement not only strengthened the accuracy of the findings but also deepened the collaborative knowledge-building central to this research. For example, at the International Youth Exchange, where all participants were present, I co-created a visual theatre performance to present the core five themes. This was developed in collaboration with a key youth worker experienced in using theatre to facilitate communication with young people. The performance intentionally avoided a formal academic PowerPoint presentation, which can be cognitively demanding and disengaging, especially given language barriers among participants. By using performative theatre, a "moving picture" approach, members of the project management team acted out each theme in a creative and engaging way, ensuring understanding and maintaining attention. Following the performance, young people broke into national groups for discussion, providing feedback both verbally and anonymously in writing to youth leaders. This approach helped participants feel comfortable sharing contradictory or critical feedback. Insights from these sessions were then incorporated into the ongoing thematic analysis, creating an iterative process that enhanced both

the credibility of findings and the empowerment of participants by recognising their expertise and lived knowledge (Hammer et al., 2017).

Supplementary Material S5: Participant Vignettes

These vignettes have been developed collaboratively with our youth worker partners who have drawn on their years of experience to provide composite vignettes reflecting some of the young people they have worked with over the project and their wider careers. These vignettes capture the diversity of young people involved in this research; Their unique backgrounds, challenges they face, experiences and contributions to the research. To create these vignettes, youth workers have drawn on the personal experience and impact of navigating through these interactions with young people, resulting in a greater understanding of their role as co-researcher and ultimately a partner in stewardship:

• **Máire (Ireland, 15 years old)** has spent her entire life surrounded by concrete, screens, walls and artificial light. She was born into a single parent family, the eldest of 3 children, the youngest of whom is now in the care of Túsla. Her mother is struggling with poverty – no job, no car, a cold house in the depths of winter, sometimes nothing in the fridge. She has few friends and addiction is a constant struggle in her area. Máire, though, is resilient – herself and her sister are survivors, looking after each other over the years through thick and thin. There were days in Máire's early life that she remembers with great fondness trips with her sisters to the beach in Tramore, and once, when she was brought up to the huge waterfall at Mahon Falls with her class on a school trip. She loved being in the open spaces in nature, but since she took on a caring role for her sisters, it's been a relentless cycle of walking through the council estate, budgeting the money for weekly expenses, helping the younger ones with homework, taking refuge in the online world spending hours on Instagram at night. When she does try to get some moments of calm and go for a walk in her local estate she really doesn't really feel safe. When Máire decided to do something for herself, and join the Pathways to Nature Project with the support of her Youth Worker, the One Good Adult in her life who was always on her side, she was initially terrified – but she instinctively knew that it would be good for her, and that she needed

something just to get her out of her own head. During the project, she saw how having youth workers and peers accompany her into natural spaces showed her where she can access nature in her local area and made her feel safe and welcome. Now, Máire has been involved with a network of young people across Europe, she's worked with her friends in her community giving back to nature. She now sees the value of being out in nature and carving out time for it in her day to day. She no longer views the future with fear, and looks forward with optimism and hope. At home, her sisters and her mother have seen the change in Máire, and her family see her as an example of someone they want to be.

• **Egina (Armenia, 22 years old):** My name is Egina. I moved from Kyrgyzstan to Armenia five years ago, leaving behind a childhood where nature was part of daily life. In Kyrgyzstan, I had time to see the countryside, to walk freely, to help my grandma with gardening – my hands in the soil, seasons marked by planting and harvest. In Yerevan, I built a new life – studying linguistics, developing design skills, working as a UX/UI designer while teaching languages. But my days became consumed by screens and pixels. The mountains surrounding Armenia were always visible on the horizon, yet somehow remained distant. It felt like the connection I once had with nature was left behind in another country.

When I joined Pathways to Nature, it was my first experience with this kind of project. I felt uncertain about what to expect. At Byurakan, everything changed. The program helped me to see nature's beauty in ways I hadn't felt since leaving Kyrgyzstan. Then came the real work – discovering Parpi village, somewhere I'd never been despite five years in Armenia. Planting trees felt like saying thank you to the land, like making a difference with my own hands. When I met the other participants and leaders from across Europe, it felt warm. We traveled to Finland, and I saw beauty that's hard to describe with words – the tallest trees I've ever seen in my life. I still think about them, these giants that made me feel small and safe at the same time. In Finland, I learned to make fire, to do canoeing, and – this still makes me laugh – to walk in the forest shoeless. Barefoot in the Finnish forest, knowing there were snakes, feeling every stick and stone and soft moss under my feet.

That was an experience I will never forget. It made me realize something important: I can do everything if I have the courage. If I could walk there, feeling vulnerable and alive, a little terrified and calm at the same time, what else could I do? I discovered places I'd never seen and

learned things I never knew. Now, I see nature differently. It's so much closer to me, that I have discovered an urgent sense to leave the city and go visit a place where I can, let's say- reconnect with nature after a long working week. Those tall trees in Finland, that shoeless walk, the trees I planted in Parpi – they're still with me, reminding me that courage isn't about never being afraid. It's about walking forward anyway, barefoot if necessary.

• **Amir (Finland, 17 years old)** was eight when his family fled Iraq and arrived in Finland in 2015. He learned Finnish quickly, adapting to his new school and culture with determination. His parents, however, have always struggled with the language and with finding stable work. At home, Arabic is spoken, and Finland still feels like a halfway place, a life between what was left behind and what lies ahead. Amir's father had been politically active in Iraq, and their family's escape was a matter of survival. Back home, his grandparents are old and unwell, and Amir worries about them constantly. They have little access to healthcare, and Amir feels the heavy responsibility to succeed, to study hard, get into a good university, find a well-paid job, and send money back home. His parents remind him often that he carries not only his own future, but the hopes of the whole family. At school, Amir does well. He studies at high school and has a few close friends, most of them also with immigrant backgrounds. He laughs easily and is polite, but deep inside, he hides something important: he is gay. In his parents' culture, being gay is considered shameful and even dangerous. In Iraq, it is a crime punishable by imprisonment, violence, or death. Telling his family is unthinkable. The fear of rejection and bringing "disgrace" to his parents keeps him silent.

Still, Amir has found small spaces of freedom. Recently, he joined Pathways to nature, an Erasmus+ youth project, encouraged by his youth worker. Through it, he met young people from all over Europe and, for the first time, could speak openly about who he truly is. During a trip to Ireland (his first time ever abroad) he met other LGBTQ+ young people and felt safe enough to be himself. The experience was very empowering. During the project activities in Finland, Amir felt accepted for who he is for the first time. Meeting other young people from across Europe helped him realize that he is not alone. Since then, he has become more confident and active, taking part in international youth events and discussions about equality and inclusion. Amir still worries about his family, about his grandparents far away, and about how he will one day reconcile his two worlds, the one where he must hide, and the one where he can finally breathe

freely. But now, for the first time, he feels that he can imagine a future for himself. And that hope gives him strength every day.

• **Elena (Spain, 16 years old)** described how growing up in a densely urban neighbourhood left her with few opportunities to spend time outdoors. Further natural disasters such as drought in her region have significantly impacted the plants and animals in her area. She mentioned how she finds it very distressing to witness the impact of these climate disasters on the nature in her locality. This also, significantly affects her ability to spend time in nature. She shared that her first experiences of nature during the project felt "like breathing properly for the first time," and she reflected on how moments of awe and calm in nature helped her manage anxiety. Her insights helped shape activities focused on sensory immersion and mindfulness. Elena shared how her relationship with nature has changed throughout her life: from being something unimportant in her daily routine to becoming an essential way of connecting with her surroundings beyond the urban space where she has always grown up. She explained that she is fortunate to live near a mountain, which she has been climbing for years whenever she feels overwhelmed by a hostile world. Even if it is a small environment, being surrounded by trees and nature brings her peace and makes her more aware of the beauty the planet has to offer.

For her, being in nature means taking a break from the thoughts that crowd our minds in everyday life, reconnecting with herself, and valuing what is truly important. Her participation in the project reminded her of how she felt about nature when she was a child and of the importance of being surrounded by it. Thanks to Lola's contribution, we were able to see the importance of nature in young people's lives; even if they do not put it into words, they all know they need it.

Supplementary Material S5: Sample Thematic Analysis Example

1) Spain Red 2) Finland Yellow

Theme	Quotes

A) PTN Intervention – What works and what could be improved?

- Ideation of NBI and making it a reality – Ownership sense of achievement
- **Training course** week – CONNECTION to nature, community and self

**Social dimension – group connection key takeaways all around social impact

- Sharing knowledge/ NBI with wider community – parents, local high school

Immersive - Being immersed in nature outside urban settings

- B1: Developing the idea for the nature-based initiative.
- B2: To me, the same. Generating ideas and making them a reality.

- G3: Well, the beginning of the project, living together, how we experienced it, and how we connected with the organization. We really enjoyed that week of training.
- G2: Me too, the time we spent together at the hostel. That week was what I liked most. And the group connection we had.
- G1: For me, the entire project is a great opportunity. What I liked most was meeting new people and doing different things in nature.
- What do you think gave you that calm? B1: That I was in an isolated area in the middle of nature, far from the city.
- **Key takeaways**
- G2: The experience of living together at the hostel.
- G1: What I'll remember

Theme	Quotes
B) Impact of PTN intervention · Immersion in nature leads to **Nature Connectedness** (connection - to nature, community, self) · Nature connectedness leads to **Awareness/ consciousness: empathy, gratitude and appreciation**	B1: It's made me feel more connected to nature. Self in nature scale - All consider themselves as strongly connected to nature – end of scale D-F · B1: Because I feel more aware of and connected to nature since I've been on the project. · G3: I was already connected to nature because I really like it, and now I'm even more so. · B2: I have noticed that I'm now more aware of nature.