

DISSERTATION

NATURE, CONNECTEDNESS, & COLLABORATION:
PATHWAYS TOWARD COLLECTIVE WELL-BEING

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Kaiya Anne Tamlyn

Department of Human Dimensions of Natural Resources

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Doctoral Committee:

Advisor: Sarah Walker

Sara LoTempio

Jamie Dahl

Jill Zarestky

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ABSTRACT

NATURE, CONNECTEDNESS, & COLLABORATION: PATHWAYS TOWARD COLLECTIVE WELL-BEING

In a world facing a variety of threats to people and the planet, diverse ideas and solutions are essential. Spending time in and feeling emotionally connected to nature is continually emerging as a strategy that provides benefits for collective human and environmental well-being. This dissertation examines how nature-based organizations can help people connect, or reconnect, with the nature around them to create positive social and environmental outcomes. Further, it examines how collaboration, whether between researchers and practitioners or within and across organizations, can play a vital role in these efforts.

The first manuscript conceptualizes the motivators, barriers, and strategies to collaboration as identified by researchers and practitioners working in the nature and health field and provides suggestions for increasing the existence and efficacy of these collaborations. Overall, researchers and practitioners had more motivators and barriers in common than unique to each group. Therefore, initiatives that specifically target commonalities can create important leverage points to support collaborative efforts and, thereby, the field more broadly.

The second manuscript embodies a collaborative partnership with a non-profit, nature-based organization in the USA to examine the well-being and pro-environmental outcomes of a novel app-based nature intervention. The results frame nature connectedness as a key influence for increasing the ability of nature exposure interventions to influence well-being outcomes.

Finally, the third manuscript continues the collaborative partnership with the same nature-based organization and expands our understanding of the traditionally studied well-being outcomes that can be achieved by a nature-based organization. This project explores the type and scope of well-being benefits that a small, nature-based organization can have on their community and its residents. Further, it identifies the strategies and context that influence the identified outcomes.

In addition to discussing what is currently known about the relationships between nature and well-being, this dissertation also highlights remaining and significant literature gaps.

I emphasize several places where continued research and learning are necessary, such as the use and efficacy of app-based nature interventions and the impacts of nature-based organizations on communities. I also demonstrate the varied ways that collaborative research projects can support building more wholistic and complex theoretical frameworks connecting time spent in nature with human and environmental well-being.

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CHAPTER 1: INTRODUCTION

Problem Statement

We are living in a time characterized by overlapping and compounding challenges spanning both human and environmental systems. Humans have exerted their widespread influence over the planet, altering the ecosystems that life relies on (Amel et al., 2017; Edo et al., 2024; Steffen et al., 2015). Human activities, led by western, colonial societies, have caused widespread biodiversity loss (Díaz & Malhi, 2022); damage to natural and built environments via extreme weather events exacerbated by climate change (Clarke et al., 2022); and widespread pollution of ecosystems (Kumar et al., 2022; Naidu et al., 2021). Because of and alongside these challenges, human well-being is also under threat. Health and mental health levels have suffered significantly in recent years (Bommersbach et al., 2023; Zheng & Echave, 2021) with US populations even seeing a decrease in life expectancies (Venkataramani et al., 2021).

There is evidence to suggest that human and environmental challenges alike are caused and perpetuated by a disconnection between humans and nature, with humans seeing themselves as apart from or above the ecological systems which we rely on (Barragan-Jason et al., 2022). This disconnect can be framed as both a physical and mental disconnection (Beery et al., 2023). Physical disconnection can include decreased time spent outside (Soga & Gaston, 2016), loss of connection to our food sources (Truman et al., 2017), and migration toward cities and urban centers (Ritchie et al., 2024), all of which decrease passive and intentional exposure to natural environments. This disconnect can also be seen in cognitive and emotional ways such as through “place-blindness” (Louv, 2011) or decreased knowledge about and connection to the ecosystems and species around us (Pilgrim et al., 2008). The predominant, western narrative that humans are “bad” for the planet could be supporting the perpetuation of this environmentally harmful pattern

of behavior. Our inability to see ourselves as a part of, and even beneficial to, natural systems might be part of the larger problem (Kimmerer, 2013).

There is continually increasing evidence that spending time outside and strengthening our relationships with nature will improve both human and environmental well-being, such as by decreasing stress and anxiety (Arola et al., 2023; Bettmann et al., 2024; Kotera et al., 2021), improving cognitive function (Amicone et al., 2018; Hopman et al., 2020), supporting immunity (Q. Li, 2022), increasing pro-social behavior (Goldy & Piff, 2020), and strengthening the likelihood of acting in pro-environmental ways (Barragan-Jason et al., 2022; Zelenski et al., 2015). Despite these varied and promising findings, there are still many questions that need to be answered to understand the full extent of these phenomenon and how they can be applied to real-world contexts (Frumkin et al., 2017; Mackay & Schmitt, 2019; Marvier et al., 2023). Research is just starting to conceptualize the interconnections between many of these variables. For example, there seems to be a relationship between well-being and pro-environmental behavior, with caring for and taking actions to protect the environment resulting in increased human well-being (Prinzing, 2023; Schmitt et al., 2018; Zawadzki et al., 2020). This is an idea that may seem counter intuitive based on the common understanding that pro-environmental behavior is in conflict with actions that support our own well-being (Kasser, 2017).

The purpose of this dissertation is to further our conceptualization of the interconnections between nature exposure, nature connectedness, well-being, and pro-environmental behavior while also exploring how interventions and researcher-practitioner collaborations can support solutions for the overlapping challenges facing humans and the planet. It (1) demonstrates how researchers and practitioners can better work together to make advances that support collective human and environmental well-being. It (2) provides an example one such collaboration through

a partnership with a non-profit practitioner organization in Vermont (USA) through a mixed methods project. And (3), presents suggestions for both research and practice as the field of nature and well-being works towards creating tangible, positive change for collective human and environmental systems.

Literature Review

Introducing Well-being

Understanding what it means to “be well” is a complex concept with a multitude of definitions. Definitions can vary by culture or research discipline, or through the specific measures chosen to quantify well-being in specific studies or contexts (Cooke et al., 2016; Voukelatou et al., 2021). Russell et al. (2013) demonstrate the multifaceted nature of this concept with their definition that includes 10 categories of well-being: “physical health, mental health, spirituality, certainty/sense of control/security, learning/capability, inspiration/fulfillment of imagination, sense of place, identity/autonomy, connectedness/belonging, subjective (overall) well-being” (p.478). The diversity of components that could be included in a well-being definition are often debated. For example, some aspects of well-being could be seen as universal, while others might be more culturally specific. Or it could be understood that there are culturally specific ways to meet universal needs (Doyal & Gough, 1991; Gough, 2014). In other words, the culturally specific variation in well-being could be broken down into the needs themselves (more universal) and the appropriate ways to meet those needs (culturally specific; Gough et al., 2007; Gough & McGregor, 2007).

Well-being can be understood from both objective and subjective lenses, a combination of which may provide the most comprehensive measure that includes both a person’s circumstances and their own perception of these circumstances (Gough et al., 2007). Measures of

objective well-being can exist across scales such as the commonly used country-wide measure of GDP (Voukelatou et al., 2021) or via much smaller variables like individual health measure like blood pressure (Muntner et al., 2019). Specifically in the field of nature and well-being, objective well-being tends to focus more on individual measurements of physiological health (e.g., D. Liu et al., 2021; Scott et al., 2021a) or cognitive functioning (e.g., Daniels et al., 2022; Vella-Brodrick & Gilowska, 2022), as some examples. These types of variables can be observed via physical observations and measurements, such as those taken by a heart rate monitor or blood test. Alternatively, subjective measures are based on an individual's own rating of their well-being and can vary across a wide variety of measurements and instruments (e.g., Diener et al., 2010; Dumas et al., 2020; Linton et al., 2016) including measures such as life satisfaction (e.g., Pocock et al., 2023; Poulsen et al., 2022), perceived stress (e.g., Poulsen et al., 2022; Putrino et al., 2020), or overall subjective well-being (Krols et al., 2022).

While it is crucial to understand the broad scope of the factors that influence well-being, most research focuses on one or more specific well-being factors per study to make measuring such a broad concept more feasible. In other words, researchers chose proxies for well-being. Some examples could include examining self-reported subjective well-being (Mavisakalyan et al., 2024; Topp et al., 2015), mental health symptoms of anxiety or depression (Kotera et al., 2021), measurements of physical health (e.g., cortisol levels, Antonelli et al., 2019; immune response, Hansen et al., 2017; heart rate variability, Scott et al., 2021a), or even larger-scale community measures, such as all-cause mortality (Rojas-Rueda et al., 2019). For the purposes of this dissertation, I have chosen to use well-being as an all-encompassing term that incorporates diverse definitions and varied components of health and well-being. Within my qualitative manuscripts, I encourage interviewees to define well-being in a way that best fits their own

definition to promote inclusivity and limit my own bias. For my quantitative manuscript, I measure self-reported subjective well-being via the WHO-5 (Topp et al., 2015).

Introducing Nature

There is ever-increasing evidence that nature positively influences well-being (Arola et al., 2023; Barragan-Jason et al., 2023; Bratman et al., 2019; Sulfa et al., 2024), but like well-being, nature does not have just one definition. Nature can be conceptualized as a socio-cultural construction with variations in what objects and beings are classified as “nature” or not (Alves & Vidal, 2024; Vidal et al., 2024). While a full discussion on this topic is beyond the scope of this dissertation, one example can be seen in how some cultures view humans as a part of nature while others do not (Beery et al., 2023; Hoffman, 2024). This dissertation relies on Russell et al.’s (2013) definition who describe nature as “living and nonliving components of ecosystems described in an expansive though not exhaustive way, excluding nonliving human-built environments” (p.475). It demonstrates a broad view that both living beings, such as humans and plants, and entities that are understood to be non-living, such as rocks, are all considered nature. This broad definition creates space for participants in all three manuscript of this dissertation to identify and define nature for themselves, limiting the potential for researcher bias.

Due to the extensive scope of nature, researchers in the nature and well-being field often focus on a single type of nature (e.g., wilderness or urban parks), landscape (e.g., forests or oceans), and/or way of engaging with that nature (e.g., walking, sitting, or gardening). Some research also expands the ideas of what we might consider nature by utilizing indoor nature (e.g., houseplants) or virtual nature (e.g., nature images or virtual reality nature environments). Using specific examples of nature helps narrow the scope of such a large variable, while also

allowing researchers a glimpse into what nature experiences may better provide specific well-being benefits. In other words, identifying the type of nature or nature experiences might be more strongly related to a particular mental health outcome (Barnes et al., 2019).

The type of nature or type of interaction experience is commonly referred to as nature exposure and defined as interacting with or passively experiencing natural landscapes or elements (e.g., Bratman et al., 2021; Zelenski et al., 2015) and can also include interactions with virtual nature (e.g., H. Li et al., 2021; Orr et al., 2021). Nature exposure has also been referred to as time spent in nature (Nay et al., 2022), nature contact (Lumber et al., 2017), human-nature interactions (Awoyemi et al., 2024), and nature experiences (Zhang et al., 2024), among other terms. Types of nature exposure within nature and well-being research are diverse. For example, Soga et al. (2017) studied gardening, a more cultivated type of nature, while Li (2022) examined forest bathing, Holland et al. (2018) examined wildland recreation, and Richardson et al. (2022) studied the act of simply noticing the nature around you.

Beyond being exposed to nature, how we feel about nature, or our relationship to nature, is an additional construct worth discussing. While cultural and individual-level relationships to nature can be varied and hard to quantify, various measures have been created to assess these relationships. One such measure is nature connectedness, or a person's subjective relationship to nature or feelings of oneness with nature (Mayer & Frantz, 2004). This concept has also been referred to as nature relatedness (Nisbet et al., 2009), environmental identity (Clayton et al., 2021), and inclusion of nature in the self (Schultz, 2002). Despite its varied names, nature connectedness is emerging as an important variable for promoting both human and environmental well-being (Arola et al., 2023; Barragan-Jason et al., 2022, 2023; Guazzini et al., 2025). Nature connectedness can be a trait characteristic (Mayer & Frantz, 2004; Nisbet et al.,

2009) or measured as a more temporary state (Mayer et al., 2009). Further, experiments have demonstrated that nature connectedness can be manipulated and changed within an individual (Sheffield et al., 2022).

Introducing Pro-environmental Behavior

The final variable of focus in this dissertation is pro-environmental behavior (PEB) or actions that protect, support, or mitigate negative effects on the natural world. These have also been referred to as conservation behaviors (Schultz, 2011), ecological behaviors (Kaiser et al., 1999), and environmentally significant behaviors (Stern, 2000), among others. Pro-environmental behaviors have been examined for many years and in diverse forms such as recycling (Burn, 1991), PEB in the workplace (Norton et al., 2015), native plant gardening (Champine et al., 2022), civic engagement specific PEBs (Pradhananga et al., 2015), and donating to environmental causes (Ibanez & Roussel, 2022), as a sample.

Many theories have attempted to explain pro-environmental behavior change, without one specific theory yet being able to provide all the answers (Kollmuss & Agyeman, 2002). The most widely utilized model is the theory of planned behavior, which posits that individuals react rationally and that their behavior is primarily controlled by attitudes, subjective norms, and perceived behavioral control (Ajzen, 1991). While it has since been demonstrated that the behavior change process is most likely more complex and that simply increasing an individual's knowledge to improve their attitudes does not often lead to behavior change, this is still a commonly relied upon method in practice (Kollmuss & Agyeman, 2002). Other theories have added additional factors that might influence behavior change such as personality and personal responsibility (Hines et al., 1987) or values and feelings, such as fear (Kollmuss & Agyeman, 2002).

Research continues to examine what factors can be encouraged or manipulated to most effectively inspire widespread and sustained participation in PEB. In their review, Gifford & Nillson (2014) reasserted the complex nature of changing behavior and identified 18 different factors that could be involved. The factors were broken down into personal and social categories with personal including things like worldview, education, and personality while social contained religion, norms, and social class, as some examples. It has also been demonstrated that participation in PEB can be manipulated via real-world interventions. A review of reviews identified the most effective strategies as those that harness motivation, opportunities, and abilities. However, the authors note that across the literature, the ability of interventions to influence behavior change was only modest (Gatersleben & Murtagh, 2023). Despite efforts by researchers and practitioners to promote the adoption of PEBs, the lack of widespread change demonstrates that alternative methods for encouraging behavior change need to be explored.

Nature, Well-being, & PEB

Nature & Well-being Theory

Increasing evidence points to the many ways that nature can positively influence human and environmental well-being with meta-analyses steadily demonstrating this relationship (Barragan-Jason et al., 2023; Mackay & Schmitt, 2019; Rojas-Rueda et al., 2019; Soga & Gaston, 2024). There are various theories as to why nature exposure, or spending time surrounded by or listening to natural elements, positively influences our well-being. While older and heavily debated, the biophilia hypothesis was one of the first ideas put forth by western scientists, claiming that humans have an innate connection to the other living beings that make up what we refer to as nature (Wilson, 1984). More recent and robust theories have arisen since, the most prominent being Attention Restoration Theory (Kaplan, 1995) and Stress Recovery

Theory (Ulrich et al., 1991). Attention Restoration Theory postulates that spending time in nature aids in restoring cognitive functioning (Kaplan, 1995). Since its original publishing, evidence for this theory has continued to grow. A meta-analysis highlighted that nature exposure does improve cognitive functioning in the domains of working memory, cognitive flexibility, and attentional control, with potentially higher levels of restoration from real-world, as opposed to virtual, nature (Stevenson et al., 2018).

Stress Recovery Theory is the idea that natural environments, as opposed to urban environments, help us to more quickly recover from stress because those are the environments that humans evolved in (Ulrich et al., 1991). The continued study of this phenomenon demonstrates further evidence, especially via research that explores nature's effect on specific physiological factors. A meta-analysis by Yao et al. (2021) demonstrated that nature exposure is associated with improvements in the physiological stress measures of salivary cortisol, systolic blood pressure, diastolic blood pressure, and heart rate variability. In addition, nature was associated with positive changes in self-reported stress, anxiety, and restorative outcomes. More recent arguments highlight that the mechanisms behind Attention Restoration Theory and Stress Recovery Theory might actually be operating in tandem, but further research is necessary (D. Li & Sullivan, 2016; Scott et al., 2021b).

Although these original theories are widely cited, their scope is limited and they mostly exclude contextual factors outside of direct nature exposure. A more recent theory from Marselle et al. (2021) works to reconceptualize existing ideas. Specifically focusing on biodiversity, they demonstrate 4 pathways between nature and well-being, three of which provide positive outcomes and one recognizing that nature can have detrimental influences on human health, such as through allergies, which is less often acknowledged in the nature and well-being field. The

three beneficial pathways include harm reduction (e.g., reducing exposure to pollutants), restoring capacities (e.g., aiding in recovery from stress), and building capacities (e.g., providing positive emotional experiences). Their model also demonstrates the influence of contextual factors such as socio-cultural influences and individual characteristics, ideas that are not commonly explored in the other theories. While the emergence of new conceptual frameworks helps increase our mechanistic understanding, we still lack models that wholistically and effectively explain the full impacts of nature on well-being.

Nature & Well-being Evidence

Despite continued discussion regarding the mechanisms behind nature's positive effect on well-being, the evidence of these benefits has been clearly demonstrated (Barragan-Jason et al., 2023; Frumkin et al., 2017; Furuyashiki et al., 2019; James et al., 2015; Lee & Maheswaran, 2011; Mayer et al., 2009). The studies highlighting the importance of nature exposure for our well-being are diverse in nature type, well-being type, exposure length, intervention type, and study design. In the words of a fellow researcher, "The array of possibilities for enhancing human well-being through nature exposure is bewilderingly heterogeneous" (Marvier et al., 2023, para. 2). As a small demonstration of nature exposure's positive effects, examples include how nature exposure from green space at schools improves attention for students of diverse ages (Mason et al., 2022a), how nature walks relieve states of anxiety (Kotera et al., 2021), and how diverse types of nature exposure lasting at least 10 minutes improve symptoms of mental illness (Bettmann et al., 2024). Barragan-Jason et al.'s (2023) recent systematic review of 16 meta-analyses confirm these results and more, pointing out how nature exposure is positively associated, and sometimes experimentally demonstrated to directly improve, cognition, social

factors, physical health, and mental health. Overall, there is a strong consensus that nature exposure positively influences human well-being.

Beyond being exposed to nature, there are also arguments that our connection with or relationship to nature can also influence our well-being. Based on current literature, there is clear evidence for a relationship between nature connectedness and well-being (Arola et al., 2023; Dean et al., 2018; Grabowska-Chenczke et al., 2022; Mayer et al., 2009). The most robust indication comes from the same systematic review of 16 meta-analyses by Barragan-Jason et al. (2023) which demonstrated a clear correlation between human well-being (including cognition, social factors, mental health, and physical health) and nature connectedness. Most often this relationship has been studied in adults, but another systematic review found evidence that it may also exist in children. Specifically, it concluded that nature connectedness was associated with an increase in positive outcomes like mood and decreased negative emotions like stress and anger (Arola et al., 2023). Despite strong correlational evidence, there is currently a dearth of literature establishing a causal relationship between nature connectedness and well-being (Arola et al., 2023; Barragan-Jason et al., 2023). Additionally, while not explicitly found during the literature search for this dissertation, there may be some theories that actually include nature connectedness as a necessary component for well-being. Even if this awareness has not been explicitly stated in western science research, it is an idea that is present in some Indigenous ontologies (Kimmerer, 2013).

Beyond nature exposure and nature connectedness having a relationship to well-being, they appear to have a relationship with each other. One study found an association between participating in outdoor recreation activities and nature connectedness (Beery et al., 2023) while another found that gardening, or even just being exposed to green space, and nature

connectedness were related (Krols et al., 2022). It has also been demonstrated that being exposed to nature can improve an individual's feelings of nature connectedness. For example, walking in a forest once a week for eight weeks increased nature connectedness (Chou & Hung, 2021). A meta-analysis showed that in 36 studies, nature exposure interventions significantly improved nature connectedness with a medium effect size. Some of the studies included in the meta-analysis had longitudinal data that demonstrated how continued nature exposure can help sustain feelings of nature connectedness (Sheffield et al., 2022).

Nature & PEB

Nature exposure and nature connectedness have also been shown to encourage participation in PEB. The relationship between nature exposure and PEB participation has been demonstrated in various contexts (e.g., Alcock et al., 2020; Kruize et al., 2019; Soga & Gaston, 2024). In England, a sample representative of the population showed positive associations between nature exposure, via neighborhood green space, and participation in PEBs which remained true across socio-economic status (Alcock et al., 2020). The authors note that this relationship may be affected by connectedness with nature or perceived value of nature, highlighting the complexity of these relationships. Soga & Gaston (2024) conducted a systematic literature review and meta-analysis which indicated that direct nature exposure had a positive relationship with a variety of PEBs including conservation volunteering, green purchasing, recycling, and energy conservation. However, they found this relationship to be especially strong for PEBs that contributed to biodiversity conservation. Even after correcting for publication bias, these results remained.

There is also causal evidence illustrating that nature exposure causes increased PEB. Zelenski et al. (2015) showed how watching nature videos increased engagement in simulated

PEBs more than watching non-nature videos or doing other non-nature tasks. Similarly, a virtual nature experiment found that participants exposed to nature were more likely to make increased donations to environmental causes compared to the urban condition (Ibanez & Roussel, 2022). Despite these promising findings that nature exposure leads to PEBs, more research is necessary.

There is also evidence that nature connectedness is associated with PEBs, as has been supported by at least five meta-analyses (Barragan-Jason et al., 2022; Mackay & Schmitt, 2019; Vesely et al., 2021; Whitburn et al., 2020) and a more recent systematic review (Guazzini et al., 2025). Nature connectedness is associated with household PEBs, nature conservation PEBs (Martin et al., 2020), sustainable consumption (Redondo et al., 2022), and climate actions (Vesely et al., 2021). This research is primarily cross sectional, but nature connectedness was able to predict PEB in a longitudinal study (Redondo et al., 2022). While the evidence demonstrating the association between nature connectedness and PEB continues to grow in depth and scope, there is surprisingly little evidence of a directional relationship from nature connectedness to PEB. One meta-analysis did find evidence of this relationship (Mackay & Schmitt, 2019), but there is a dearth of publications since then. To further complicate this relationship, nature connectedness has also sometimes been identified as a mediator and moderator of the relationship between nature exposure and PEB (Bubalo et al., 2026; Martin et al., 2020). Current evidence demonstrates that the relationships between these two variables are complex and in need of further investigation.

Well-being & PEB

The idea that humans must make sacrifices to protect the environment is widespread and pervasive. But this dichotomy of human well-being versus environmental well-being may not be

as distinct as we perceived it to be, if it is even present at all. There is emerging evidence that participating in PEB can actually increase well-being in certain situations (Prinzing, 2023; Schmitt et al., 2018). We often view our lives as being improved when we consume, use more, take more, etc. In other words, we see the sacrifices that we need to make to participate in environmentally friendly ways as decreasing our well-being or ability to act as we wish. For example, driving less, flying less, or not being able to choose the consumer products that we want. But recent research has suggested that making these changes may actually lead to an improvement in our well-being.

One study found that participating in 37 of 39 different PEBs was able to predict increased life satisfaction, even after controlling for demographics and perceptions of ecological threat (Schmitt et al., 2018). Further promising results from a randomized experiment with over 500 participants showed that those participating in PEBs saw increased happiness and meaning in life (Prinzing, 2023). These results, combined with evidence for the relationships between nature exposure, nature connectedness, and well-being, continue to illustrate the many ways in which these four variables are interrelated. Further, these relationships emphasize the argument that we must view ourselves as a part of the natural world, rather than apart from or above it, in order to improve both human and environmental well-being, or in other words, our collective well-being.

Bridging the Gap Between Research and Practice

Research findings are continually pointing toward the importance of increasing our understanding of human-nature relationships, for the benefit of both humans and the environment. Despite the growing breadth and depth of literature, the knowledge still needed to appropriately and effectively apply research to practice is extensive, especially with diverse

populations and in varied sectors (Gallegos-Riofrío et al., 2022a; LoTemplio, McDonnell, et al., 2023; Marvier et al., 2023). One component of this is ensuring that current and future research in the field of nature and well-being is informative for and applicable to practice (Marvier et al., 2023). Another is understanding how practitioners use the evidence put forth by researchers (Hansen-Ketchum & Halpenny, 2011).

LoTemplio et al. (2023), Marvier et al. (2023), and Hansen-Ketchum & Halpenny (2011) all posit recommendations for researchers that can help to bridge the research and practice gap in the field of nature and well-being. But, beyond these three manuscripts, research that is a) in alignment with the scope of this dissertation and b) focused on bridging this gap is non-existent. Examples of what I found include a 158-word opinion column stating the need for more implementation studies that help to bridge research and policy (Buckley et al., 2022), an exploration of why practitioners demonstrate reluctance to write green prescriptions (van den Berg, 2017), and other articles or books translating research into practice for one specific intervention or type of intervention (e.g., biophilic design; Kellert, 2018).

Despite the lack of literature at the nexus of research and practice, researchers and practitioners are both doing impressive work in their respective domains. But, many questions are unanswered regarding collaboration, interaction, and combined efficacy. For example, is research informing practice? Is practice communicating with research to share its needs and experiences? Ensuring these overlaps and the presence of knowledge sharing creates potential for larger, real-world impacts and evidence-based practice. While this research is not present in the nature and well-being field, other disciplines have argued that reducing the gap and increasing collaborative efforts would aid in tackling challenges, both human and environmental, around the

globe (Ebi et al., 2020; Hansen-Ketchum & Halpenny, 2011; Kadykalo et al., 2021; Lawrence et al., 2022; Steger et al., 2021).

Arguments from other disciplines about bridging the gap between research and practice may also apply to the field of nature and well-being. For example, ensuring that research priorities and findings are in sync with the work that is happening in the practitioner space, such as alignment between the benefits being studied and the benefits that practitioners are hoping to achieve on the ground. An important example can be seen in target audiences for researchers versus the groups practitioners are working with. Gallegos-Riofrío et al. (2022b) highlight how most often research participants are from WEIRD populations and countries, meaning white, educated, industrialized, rich, and democratic. However, these may not be the audiences most often targeted by nature and well-being practitioner organizations. Another disconnect can be seen in the locations where research findings are published, versus where practitioners can access relevant information. Findings are more often shared in academic spheres, such as journal articles that can be behind a paywall, than in practitioner or public spheres (Steger et al., 2021). Additionally, to ensure that their work is aligned with best practice, practitioners need available access to research findings that are free of technical terminology and research jargon (LoTemplio et al., 2023).

There are many ways to help bridge the divide between research and practice, but often it includes collaboration between these two parts of the field. Sometimes this is called transdisciplinary research, or in the words of Ferguson et al. (2022) researchers from “different disciplines working with nonacademic partners to create new knowledge and theory aimed at a shared question” (p. 228). Another style of researcher-practitioner collaboration is participatory community-based research, which Hansen-Ketchum & Halpenny (2011) argue can use the field

of nature and well-being to help improve local knowledge systems and support systemic change. It should be noted that the authors do not cite any sources about this method, but describe participatory community-based research as “community citizens, practitioners and policy makers from various sectors to examine the socio-ecological features and strategies needed for health promotion” (Hansen-Ketchum & Halpenny, 2011, p. 105). Further examples working to bridge this divide include research-community partnerships (Lau et al., 2020) and community-academic partnerships (Drahota et al., 2016).

While this type of collaborative work is crucial for real-world applicability, it is challenging and presents many barriers. While, to our knowledge, research has not been conducted in the field of nature and well-being, findings from other fields and sectors provide insight into the collaborative process. Individuals who participate in collaboration are motivated by the view that it is ethically right (Guimarães et al., 2019) and can help solve real-world problems (Bustos et al., 2024; Thompson et al., 2017). Additionally, collaborations can create, test, and tailor nature and well-being programs or initiatives for practitioners which simultaneously increases the external validity of research findings (Drahota et al., 2016).

Despite the promise of collaborations, there are barriers that can get in the way. In many cases it adds demands to time and capacity (Lau et al., 2020; Steger et al., 2021; Thompson et al., 2017) while also presenting additional hurdles like navigating institutional processes and methodological challenges (Shackleton et al., 2023; Thompson et al., 2017). Beyond logistics, opinions and perceptions can also get in the way, such as the view that transdisciplinary research lacks rigor (Shackleton et al., 2023). Non-researcher partners have additional concerns based on the historical harms of science and participant confidentiality, creating feelings of skepticism

(Lau et al., 2020). With both these motivators and barriers from collaboration in other fields in mind, it is crucial to understand the landscape for collaboration within nature and well-being.

Guiding Theoretical Frameworks

Research & Practice Framework

One framework guiding my dissertation is an understanding of the relationship between research and practice. As highlighted in the literature review, bridging research and practice can be an important step to help address real-world problems (Ebi et al., 2020; Hansen-Ketchum & Halpenny, 2011; Kadykalo et al., 2021; Lawrence et al., 2022; Steger et al., 2021; Thompson et al., 2017) and can take many different forms, such as transdisciplinary approaches (Ferguson et al., 2022; Knapp et al., 2019). Regardless of the name or format, the research and practice theoretical framework that I created (Figure 1) demonstrates that these collaborations are working towards the goal of real-world impact. They help create science-backed solutions that can be applied in on-the-ground scenarios. In a systematic review and state of the literature article, Drahota et al. (2016) outline the positive influences that researcher-practitioner collaborations can have for both science and real-world application. They suggest that research can provide practitioners with science-backed solutions or interventions, that can further be tested for and specifically fit to practitioner needs. In return, practice can provide research with first-hand knowledge and improved insights, overall increasing the external validity of research findings.

For my first manuscript, I created a framework (Figure 1) inspired by Drahota et al. (2016) and transdisciplinary research more broadly (Ferguson et al., 2022; Knapp et al., 2011). It will provide a foundation for my conceptualization of researcher-practitioner collaboration. The framework takes inspiration from a Venn diagram, with research and practice in their own circles

and an overlapping circle in the middle that contains transdisciplinary research and research-based practice. Two arrows represent the cyclical flow of information between research and practice, but both arrows exist within the transdisciplinary space, highlighting the importance of sustained partnership and collaboration as opposed to random, one-off arrows that could appear or exist between certain researchers and practitioners. The framework then demonstrates that the transdisciplinary work gets funneled into real-world impact, with an arrow wide enough to also incorporate pieces from both research and practice, demonstrating that they each also have their own role to play. While my first manuscript relies on this model heavily, the second two manuscript will use this framework to inform my practice as a researcher engaging in a transdisciplinary project

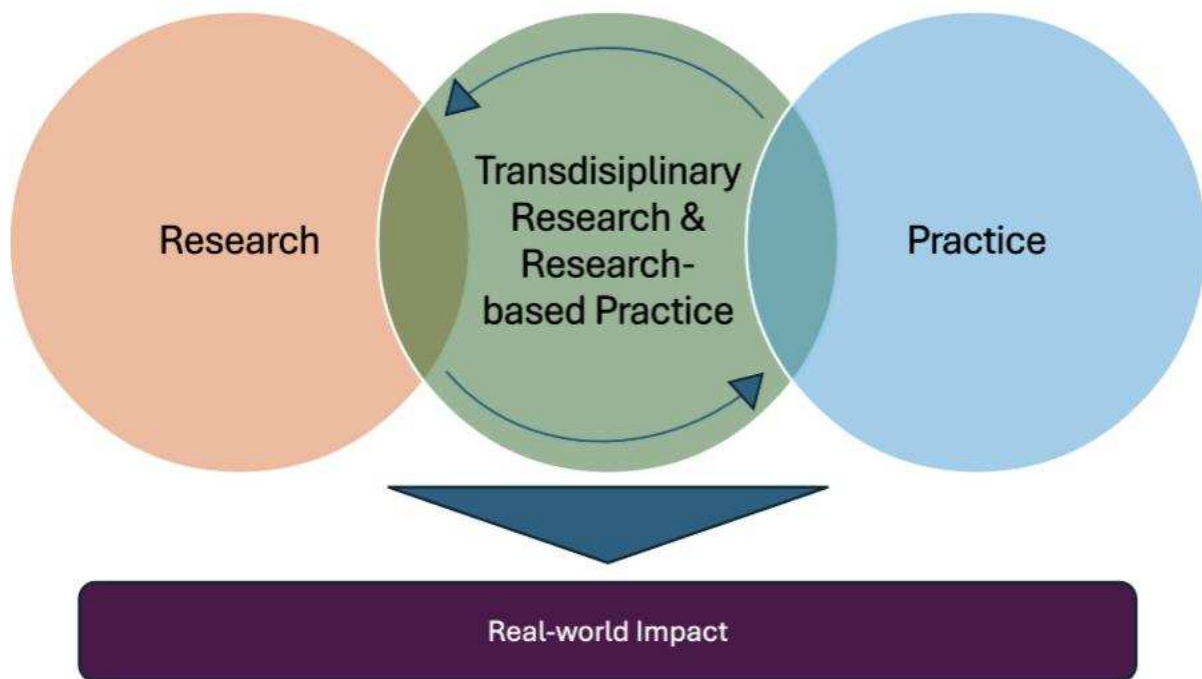


Figure 1. Framework outlining how collaboration between research and practice can increase real-world impact.

Nature, Well-being, & PEB Framework

I will also rely on a second conceptual model that I created, which combines prominent theories in the field of nature and well-being. It differs from models that currently exist in how it identifies the interconnectedness between the four variables: nature exposure, nature connectedness, human well-being, and environmental well-being (represented by PEB). This model builds most closely off of Barragan-Jason et al.'s (2023) work (Figure 2) which demonstrates the results of their meta-analysis exploring the relationships between nature exposure (what they refer to as physical connection), nature connectedness (which they refer to as psychological connection), well-being (which they refer to as human welfare, and PEB (which they call nature conservation). Their results demonstrate the causal relationship between nature exposure and human well-being, illustrating strong evidence that spending time in and around nature has diverse well-being benefits including for cognitive, social, mental health, and physical health outcomes. They also found abundant correlational evidence between nature connectedness and well-being, as well as nature connectedness and PEB. Their results include one meta-analysis demonstrating a causal link between nature connectedness and PEB. They also included a meta-analysis of experimental studies highlighting how nature exposure can increase nature connectedness. Due to Barragan-Jason et al.'s (2023) comprehensive and recent analysis, their findings strongly influenced my theoretical framework.

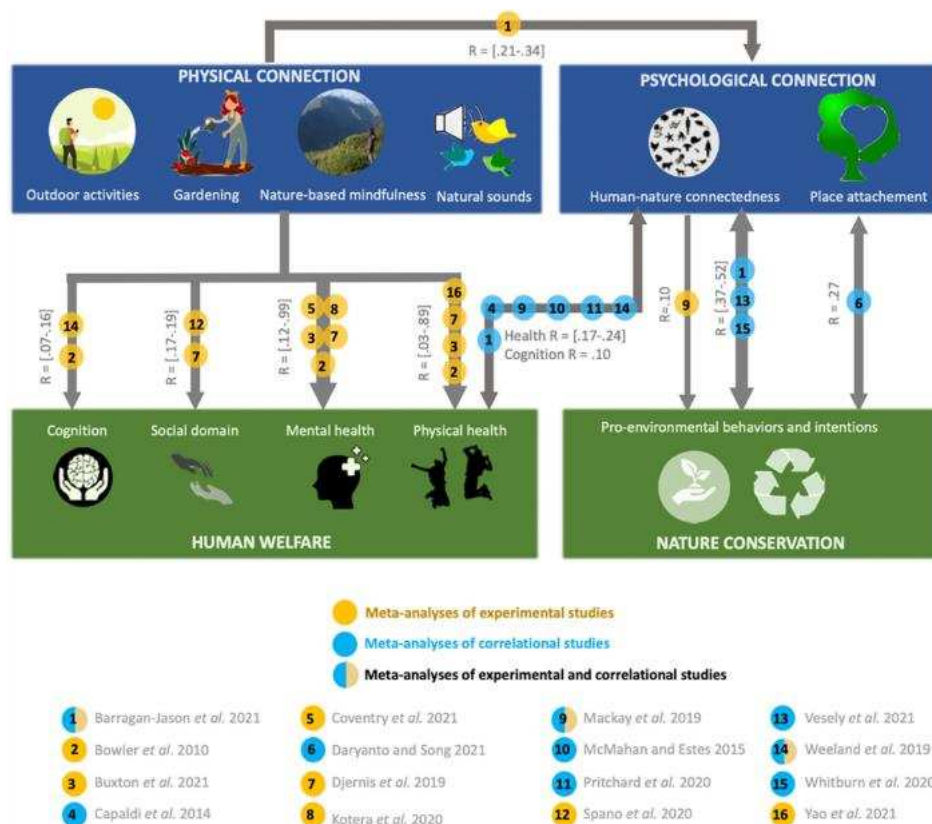


Figure 2. Barragan-Jason et al.'s (2023) visual representation of their systematic review of meta-analyses examining how physical and psychological connections with nature improve well-being and PEB participation.

This review, however, is missing key linkages necessary for my framework – whether nature exposure leads to PEB and the connection between well-being and PEB. While nature exposure has been demonstrated to be related to participating in PEB in multiple contexts (Alcock et al., 2020; Kruize et al., 2019; Soga & Gaston, 2024), Barragan-Jason et al.'s (2023) meta-analysis only included other meta-analyses, which at that time did not include this relationship. Since then, a systematic literature review and meta-analysis has been published, demonstrating how nature exposure has a positive influence on many PEBs including conservation volunteering, green purchasing, recycling, and energy conservation, even after correcting for publication bias. This relationship was especially apparent for PEBs that supported biodiversity conservation (Soga & Gaston, 2024). Further, there appears to be a relationship

between PEB and well-being, which is also missing from Barragan-Jason et al.'s (2023) model. Some studies have found that participating in PEBs increases human well-being (Prinzing, 2023; Schmitt et al., 2018). While this literature is new and very understudied, they further add to the arguments for conceptualizing collective well-being within western science.

The framework I have created for my dissertation (Figure 3) represents one way to view the interconnected relationships between nature exposure, nature connectedness, well-being, and PEB. Adapted from the model I developed for my theory competency examination, it differentiates between experimentally established directional relationships (dark green) and more theoretical/correlational relationships (light green). The diagram demonstrates how nature exposure improves well-being and participation in PEB while well-being and PEB also influence each other. Well-being also may lead to greater nature exposure. Nature connectedness leads to well-being and PEB, with PEB leading back to nature connectedness. Nature exposure and nature connectedness can also be seen as influencing each other.

Beyond the direct relationships between variables (e.g., nature connectedness and well-being or nature exposure and PEB), my theoretical framework includes the understanding that spending time in nature and having a strong relationship with nature leads to collective human and environmental well-being. In other words, to create a sustainable and livable future for all species, we must frame our understand well-being not just as human well-being versus environmental well-being, but our well-being collectively. This dissertation is built on the idea that increasing nature exposure and feelings of nature connectedness has the potential to provide the opportunity to enact a more collective conceptualization of well-being that includes humans and the environment.

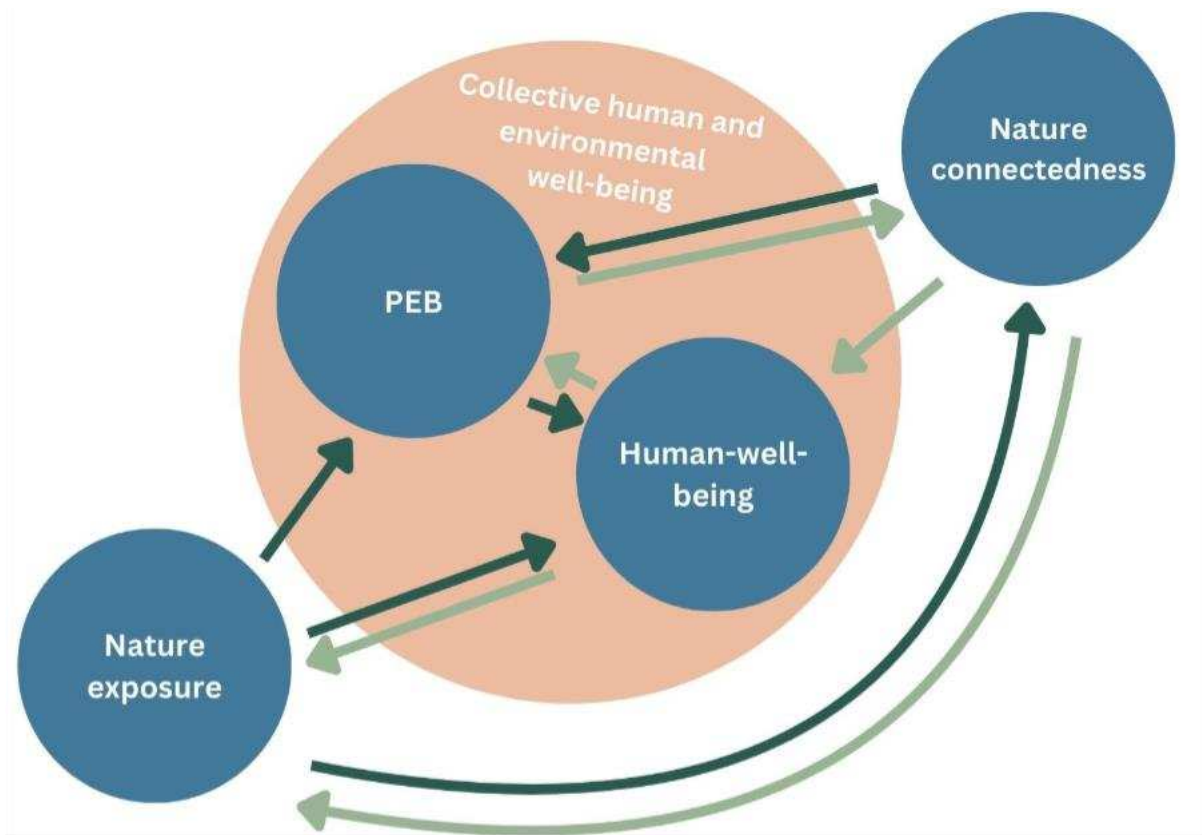


Figure 3. My framework demonstrates the relationships between nature exposure, nature connectedness, well-being, and PEB. Dark green arrows represent causal relationships while light green arrows represent correlational evidence. Additionally, it draws attention to an understanding of collective well-being.

Lens & Positionality

I want to acknowledge that this dissertation has been conceptualized from a primarily western science lens. I am a white woman who grew up in the settler colonial context of what is now known as the United States. I have received an extensive education and am learning how to do research in the ways taught by western academia. Therefore, the ideas utilized throughout this dissertation, including the definitions and theories, are primarily seen through this frame of reference. Other sciences or ways of knowing, such as those practiced by Indigenous nations, may have different conceptualizations of these ideas (J. T. Johnson & Murton, 2007). However, due to long-standing practices of colonization, discrimination, and oppression, alternatives to

western science have been mostly excluded from or appropriated by western, academic literature (Held, 2023; J. T. Johnson & Murton, 2007). I acknowledge that the lines of investigation and assumptions framing this dissertation do not represent universal ways of understanding these concepts and relationships.

CHAPTER 2: SETTING THE STAGE FOR RESEARCHER-PRACTITIONER COLLABORATIONS

Chapter Summary

Despite the benefits of nature exposure and nature connectedness for both human and environmental well-being documented in the literature, gaps remain in translating research into practice. Collaboration between researchers and practitioners has been highlighted as one method to bridge these gaps. In this study, we examine the motivators, barriers, and strategies to collaboration in the field of nature and well-being by interviewing researchers and practitioners working in the field. Interviewees highlighted many barriers such as finding collaborators, funding, capacity, and interpersonal challenges. Despite these barriers, all interviewees were motivated to participate in collaboration, often to improve real-world outcomes, benefit science, or support the efficacy of practice, among other reasons. Finally, our interviewees recommended strategies for successful collaboration including strong interpersonal relationships, starting small and simple, being willing to learn, collaboratively solving challenges, and creating written agreements about expectations. Overall, researchers and practitioners had many themes in common. Therefore, specifically targeting those, while recognizing the nuance in each groups' perspectives, can create important leverage points that will improve collaborative efforts and, thereby, support the overall field.

Introduction

Nature and well-being research, also sometimes referred to as nature and health research, has demonstrated diverse strategies to support the welfare of both humans and the environment (e.g., Barragan-Jason et al., 2023; Q. Li, 2022; Martin et al., 2020). There is robust evidence that spending time in nature supports physiological, cognitive, mental, and emotional well-being (e.g., Barragan-Jason et al., 2023; Kotera et al., 2021; Mason et al., 2022a) and also aids social

well-being by encouraging generosity and other pro-social behaviors (e.g., Goldy & Piff, 2020; Holland et al., 2018). Beyond human well-being, spending time in (and being emotionally connected to) nature can also increase environmentally friendly behavior, thereby benefiting the health of natural environments (Mackay & Schmitt, 2019; Soga & Gaston, 2024; Whitburn et al., 2020). As many disciplines and sectors work to address the challenges facing humans and the environment, the field of nature and well-being demonstrates that connecting people and communities to nature is a viable strategy for mending the intertwined crises of human and ecological welfare.

Despite this potential, translating this research into real-world action is a challenge. One study found that it can take an average of 17 years for research to make its way into practice (Morris et al., 2011). Although more recent data is likely needed, the research-to-practice-gap is widely recognized, and its existence severely decreases the ability of practitioners and policy makers to apply scientific findings to create real-world change (Thomson et al., 2025). Beyond ensuring that research makes its way to practice, communication and information transmission must be bi-directional between research and practice to create and maintain a robust and flourishing field (Fazey et al., 2013; Reed et al., 2014). In other words, we must ensure that the research being done is grounded in real-world needs and provides practically feasible solutions. Therefore, to meet the goals of both research and practice, effective communication between these two halves of the field is required. One way to achieve this is by creating direct links between researchers and practitioners through collaboration (Drahota et al., 2016; Hoekstra et al., 2020).

Increased collaboration between researchers and practitioners, which has also been referred to as transdisciplinary research, among other names, is crucial for overcoming the

barriers that silo research and practice (Ferguson et al., 2022). To our knowledge, limited literature about collaboration between researchers and practitioners has occurred in the field of nature and well-being. However, other fields demonstrate its importance in our response to worldwide human and environmental challenges (Ebi et al., 2020; Hansen-Ketchum & Halpenny, 2011; Kadykalo et al., 2021; Lawrence et al., 2022; Steger et al., 2021; Thompson et al., 2017).

Our aim is to fill this literature gap and work towards supporting the formation, efficacy, and positive outcomes associated with collaborative work. Specifically, we interview researchers and practitioners in the field of nature and well-being to understand the perceived motivators, barriers, and strategies to collaboration. We then compare our findings to current literature, provide suggestions for future research, and suggest strategies for successful collaborations.

Background

Researcher-practitioner collaborations come in various forms such as co-production (Chambers et al., 2021), transdisciplinary approaches (Ferguson et al., 2022; Knapp et al., 2019), participatory community-based research (Hansen-Ketchum & Halpenny, 2011), evidence-based practice (Lau et al., 2020), science with society (Steger et al., 2021), and community-academic partnerships (Drahota et al., 2016) as some examples. These approaches go beyond the traditional view of researchers conducting science and passing the findings on to practitioners. Instead, researchers work with those outside academia to address real-world issues while simultaneously contributing to scientific literature.

With limited scholarship focused on collaboration in the field of nature and well-being, we turn to theories from other disciplines. One specific example comes from the field of conservation where Steger et al. (2021) created a model for ‘science with society’. This model

contains a seven-step process outlining considerations and strategies that are important at every step of the research process. They share best practices to help guide a collaborative process that can respect research and practice while providing equal benefits for each. Steger et al. (2021), and many others, have argued that these transdisciplinary and other collaborative approaches are necessary to address the large-scale challenges of human well-being and environmental health (e.g., Ebi et al., 2020; Knapp et al., 2019; van Vooren et al., 2020). While types of collaboration and their impacts can be diverse, understanding the motivators behind them is essential for their development and efficacy.

Motivators for collaboration

Previous research identified commonalities in what motivates researchers and practitioners to collaborate. These common motivators can be characterized as intrinsic (e.g., it is ethically right) or extrinsic (e.g., anticipated rewards) and tend to center around creating positive change, especially for the researchers, other people, or society (Augsburg, 2014; Guimarães et al., 2019). In other words, motivators can be seen as future benefits that could be achieved from these efforts. Guimarães et al. (2019) found multiple factors that personally motivated researchers to engage in interdisciplinary and transdisciplinary research including the belief that it was ethically right, it helped to solve real-world problems, the potential for anticipated rewards, and the feelings of fulfillment that could arise from the outcomes of the work. In a study examining mental health-focused collaborations, Lau et al. (2020) found that motivating factors for practitioners included increasing the quality of their services, concrete incentives (e.g., gift cards), the opportunity to share their experiences or challenges they faced, and excitement about the potential knowledge gained.

A similar motivator was the opportunity to create change through tangible and real-world outcomes (Bustos et al., 2024; Thompson et al., 2017). Collaboration can harness first-hand, on-the-ground knowledge to help improve scientific insights (Drahota et al., 2016). The types of exchanges that collaboration creates can form bi-directional relationships between research and practice, helping to improve both science and implementation. Additionally, these opportunities can provide tested and specifically tailored interventions for community organizations while also increasing external validity of research findings (Drahota et al., 2016).

Barriers and challenges to collaboration

While collaborations between research and practice are an important strategy to enhance both real-world outcomes and scientific findings, a diverse set of challenges or barriers make collaborative work more difficult (Axelsson, 2010). While such scholarship in the field of nature and well-being is sparse, other fields, such as mental health services and environmental conservation, provide some insight into the challenges that can impede collaborations.

In these other fields, a commonly cited collaboration barrier is insufficient time to contribute to collaborative projects, especially the time needed to meaningfully engage with partners (Lau et al., 2020; Steger et al., 2021; Thompson et al., 2017). Similarly, differing timelines between collaborators can create challenges in implementation (Scholz & Steiner, 2015). Academic structures, such as institutional process and methodological limitations, can create roadblocks (Shackleton et al., 2023; Thompson et al., 2017) as can unequal power dynamics (Steger et al., 2021). The additional challenge of funding for collaborative work also presents a barrier (Bustos et al., 2024; Shackleton et al., 2023).

Further, literature indicates that barriers to collaboration may vary between researcher and practitioner populations. For example, some academic perspectives view transdisciplinary

research as lacking rigor (Shackleton et al., 2023), which discourages participation.

Alternatively, non-researcher collaborators have concerns about participant confidentiality, potential interpretation of findings, and overall skepticism about the intentions of researchers which is sometimes based on historical harms that research has previously caused (Lau et al., 2020). Finally, a lack of mutual benefit and/or lack of shared goals can also be barriers to success for these different populations (Bustos et al., 2024). We expect that some of these barriers may apply in the field of nature and well-being, but there is a current lack of research on this topic.

Strategies and Suggestions for Successful Collaboration

To address the specific barriers and motivators to collaboration between researchers and practitioners, it is important to understand what characteristics or strategies within these partnerships lead to success. Horcea-Milcu et al. (2022) suggest that the process of creating a quality collaboration begins at “phase 0” with an initiating period before decisions about research objectives are made. The conscientious formation of partnerships and ensuring the inclusion and balancing of different perspectives (Steger et al., 2021) diverse ways of knowing, and power imbalances are also key (Knapp et al., 2019). Similarly, mature collaborative relationships and contextual knowledge among team members can be beneficial (Ferguson et al., 2022). Understanding and thinking critically about the roles of individuals involved in the partnership is also helpful (Knapp et al., 2019). Strategies for group dynamics are likewise important, such as promoting quality communication, learning, and reflexivity while creating common framing and language for the group to rely on (Bustos et al., 2024; Shackleton et al., 2023; Steger et al., 2021). Additional group organization and management factors such as proficient leadership, beneficial knowledge exchanges, and well-structured meetings, along with shared vision and goals, are also beneficial (Bustos et al., 2024).

Aside from factors that help the group operate effectively, certain interpersonal characteristics support successful collaborations including authenticity, respect, trust, a collaborative spirit, openness, tolerance, creativity, curiosity, and flexibility (Guimarães et al., 2019; Shackleton et al., 2023; Steger et al., 2021). However, Steger et al. (2021) found that individuals in the partnership who are not researchers were more likely to value factors like humility, trust, and patience. Importantly, another finding that differed between researchers and practitioners was that projects proposed by non-researchers, such as practitioners and stakeholders, were often perceived to have a stronger effect on policy (Steger et al., 2021).

Research Objectives and Questions

With the importance of collaboration clearly demonstrated across the literature, this study seeks to understand the motivators, barriers, and strategies to collaborative work specifically in the field of nature and well-being from the perspectives of those working in practice and those conducting research. We aim to answer the following research questions:

1. What are the motivators for collaboration between researchers and practitioners working at the intersection of nature and well-being?
2. What are the barriers to collaboration between researchers and practitioners working at the intersection of nature and well-being?
3. What are strategies or opportunities that could support collaboration between practitioners and researchers working at the intersection of nature and well-being?

Methods

Participants & Recruitment

We conducted interviews with researchers and practitioners working in the field of nature and well-being. This manuscript presents data collected as a part of a larger needs assessment

involving surveys and interviews with both participant groups (see LoTempio et al., in prep; Merfeld et al., 2025; Tamlyn et al., 2024; Tamlyn et al., in prep, for additional outputs of this project).

Practitioners

The first group of participants in this study are practitioners, which we define as organizations working to connect people to nature to receive well-being benefits. Examples of practitioners include but are not limited to a medical practice prescribing nature time, a mental health center conducting nature therapy, a raft guiding service taking specific populations on river trips, or a program that takes students outside for experiential, hands-on learning. Participants were recruited via email from a list of practitioners from the United States who had previously participated in a survey as a part of a larger research project (Tamlyn et al., 2024; Tamlyn et al., in prep). The recruitment list was initially created by combining listservs from multiple professional networks and funders in the field of nature and well-being. In addition to this convenience sampling approach, we utilized snowball sampling, asking participants to recommend other organizations for recruitment. See Appendix A for more detailed recruitment information. Practitioner interviews took place during the fall of 2024.

We conducted 20 interviews with representatives from practitioner organizations. Organizations were based across nine US states, with Colorado (n=7) and Oregon (n=4) most strongly represented. Eight organizations operated across multiple states. One organization was governmental, five were for-profit, 11 were non-profit, and two others self-described as non-entity community organizations. The size of the organizations ranged from 1-220 full- and part-time employees, with an average of 31.5 employees. Eleven organizations had 1-5 employees, and three had 100+ including part-time employees.

Researchers

We defined researchers as those studying the intersection between nature, health, and human well-being. Due to the diversity of this area of research, we asked researchers to self-identify. Some examples of researchers could include university faculty members examining how spending time in nature influences symptoms of depression and anxiety, graduate students examining the efficacy of nature-based interventions in care facilities, industry consultants helping nature and well-being practitioner organizations assess the impact of their programs, or research scientists working to quantify the health implications of tree cover in a neighborhood.

Due to the limited but growing nature of this research field, we opened our sample to researchers worldwide. An additional factor in this decision was the challenge of categorizing research as “in the United States” due to diverse affiliations and research partnerships.

Participants were recruited via email from a list of researchers who had previously participated in a survey as part of a larger research project (see LoTemplio et al., in prep; Merfeld et al., 2025; Tamlyn et al., in prep). The initial list of researchers was a combination of a previously made list of authors who had published on the topic of nature and well-being (including contributions from colleagues Browning et al., 2025), and listservs of professional associations and organizations supporting research in this field. We asked those receiving the email to snowball the invite to others in their networks. Researcher interviews took place during spring 2025.

We conducted 23 interviews with researchers. Twenty-one of the interviewees held doctoral degrees, two of which were degrees in medicine. Of the two without doctoral degrees, one was in a PhD program and the other’s degree was unspecified, but they worked for an organization in industry that conducted research. Nineteen interviewees were associated with academic institutions and spread across disciplines including psychology, neuroscience, public

health, medicine, social work, natural resources, environment science, education, and anthropology. Psychology was the most represented with six interviewees. Four interviewees were not from academic institutions, two coming from medical practice, one in industry, and one from a research institution. Seventeen interviewees were from the United States, representing 12 states. Three were from Canada, one from India, one from Italy, and one from Switzerland.

Data Collection

We conducted interviews to better understand the motivators, barriers, and strategies for collaboration between researchers and practitioners. Practitioners and researchers each had their own separate yet complimentary interview guide (See Appendix B for interview guides). The primary author and a secondary author conducted semi-structured interviews (Glesne, 2011). Practitioner interviews lasted approximately 90 minutes while researcher interviews were approximately 60 minutes. Both interview guides contained questions for a larger project extending beyond the scope of this manuscript, which accounted for the difference in time between the two groups. Researcher interviews were designed following the conclusion of practitioner interviews. Due to the efficacy of the practitioner interview questions, the researcher interview questions were kept primarily the same, with only small changes to wording. This also ensured alignment in results between the two groups, allowing for comparison. The interviews were conducted via Zoom (Version 6.3.11) and the audio files were transcribed using Otter.ai (Version 3.8), then checked and cleaned by members of the research team. All procedures were conducted with approval from the Colorado State University Institutional Review Board protocol #5969.

Data Analysis

Interview data was analyzed using qualitative methods conducted by the primary author and a secondary author. Specifically, we conducted thematic analysis (Bazeley, 2013; Braun & Clarke, 2006) using the software NVivo (Versions 14 & 15). We began by deductively coding for our three categories of interest (motivators, barriers, & strategies). For two research questions (motivators & strategies), the primary researcher generated initial codes and for one research question (barriers) a secondary researcher generated initial codes. These codes were then inductively analyzed and themes were established via an iterative process amongst the primary researcher and two secondary researchers. All themes were checked and discussed by the research team until thematic agreement was reached. Practitioner and researcher data were analyzed separately, resulting in one set of themes for each group per research question. This created the ability to examine the similarities and differences between two groups using comparative analysis (Bazeley, 2013). All quotes in this manuscript are presented verbatim, except for the removal of some filler words to improve readability.

Results

Results are presented for the three research questions: motivators, barriers, and strategies. Each research question is presented in its own section including a general overview; a table presenting each theme, theme description, and an example quote; and a written description of the themes with more interviewee quotes.

Motivators for Collaboration

Broadly, researchers and practitioners were motivated to collaborate because they felt that it would help make the world a better place in a diverse set of ways. As an example, one researcher said:

Well, there's a lot of work to be done, and I can't do it by myself, right?

Interviewees often used broad language about making the world a better place, then proceeded to discuss what that meant to them more specifically, which we present in the themes below. Some of the themes were shared between researchers and practitioners while some were specific to each group, as we outline.

While the themes primarily center around larger outcomes (e.g., benefiting the science of nature and well-being or providing credibility for their organization), interviewees commonly brought up ideas that we would consider facilitators rather than motivators. These facilitators make achieving the motivating outcomes possible via collaboration, as opposed to being motivators themselves. For example, some practitioners mentioned learning about collaboration opportunities as a motivator, but we see it more as a factor that facilitates collaboration. While we have respected participants' characterization of these factors, we highlight this difference by labeling them as motivating facilitators. See Table 1 for brief descriptions and example quotes for all motivator themes.

Table 1. Motivators for collaboration themes from interviews.

Motivators		
Theme	Description	Quote
Shared Themes		
<i>To Benefit Practice</i>	Both groups felt that by working together, they would help to improve the quality and scope of on-the-ground nature and well-being work.	<i>But my impression is that the research that we do is to empower those practitioners to feel like what they're doing also impacts health, so they feel more confident and strong to move forward in more ambitious and faster ways. (Researcher)</i>
<i>To Benefit People</i>	Practitioners felt that by working with researchers, they would be providing additional benefits to their program participants. Researchers thought that collaboration	<i>It's good for our clients who can see, oh, people care about what we're doing and that I'm making progress. Like, this is actually really important. (Practitioner)</i>

	would allow their work to have tangible impacts.	
<i>Bridging the Gap Between Research and Practice</i>	By working together, researchers and practitioners felt they were helping to support the field in an enhanced capacity compared to their work by themselves.	<i>Research without application is worthless. Application with no research behind it is worthless. The two have to come together, and the two take different skill sets sometimes, and that's why I think it's important that they do collaborate, you know? (Practitioner)</i>
<i>Ease of Project Initiation, Logistics, and Feasibility</i>	(A motivating facilitator) A variety of factors such as being in close proximity to each other, having appropriate funding or finding a grant, having a preexisting relationship with a researcher or practitioner, and having the capacity to do the work, or maybe ensuring the project is quick or short.	<i>When we approach the cities to work with them, we tend to go to people we know, because you know them. I mean, you have their phone number already, and there's already a certain amount of trust which has been built. (Researcher)</i>
<i>Personal Interest & Fun</i>	Practitioners and researchers were motivated to collaborate simply because it aligned with their personal interests or would be fun for them.	<i>I liked the people, and then my interest was also peaked in the veteran group for the idea of, like, I would love to better understand the effects of multi day immersions. (Researcher)</i>
Themes Unique to Practitioners		
<i>Learning About Collaborations</i>	(A motivating facilitator) Practitioners are more motivated to collaborate with researchers when they know more about the process, benefits of working together, and that researchers were interested in collaborating with them.	<i>I feel like maybe just being connected with someone that's doing that, and kind of building that personal relationship and just like conversations around what that collaboration could actually look like. And maybe hearing from their perspective, like some of the benefits that we might not even be aware of. (Practitioner)</i>
<i>Validation or Credibility</i>	Practitioners were motivated to collaborate with researchers to help validate their programming or provide credibility to their work.	<i>It's always really important to have that kind of external validation of our work and be able turn that around and say, you know, hey, look at this. We're not just saying we're great. (Practitioner)</i>
Themes Unique to Researchers		
<i>To Benefit Science</i>	Researchers highlighted a diverse array of reasons why collaboration would support science, such as increasing generalizability and diverse perspectives.	<i>These days with science, it's... everything requires collaboration. And I think having the collaboration makes it stronger and makes it more valid and more generalizable. (Researcher)</i>

<i>Provide Opportunity to Grow the Field & Include Others in the Field</i>	Researchers discussed the many opportunities that collaboration could provide such as supporting student research or increased funding opportunities.	<i>So, what can we do with what we currently have, or that others...have? By communicating with each other, and not only getting new ideas from each other or more complete ideas, but also perhaps where we're missing some of the tools or access to groups that we need, we might suddenly start seeing that resolve by collaborating with the other. (Researcher)</i>
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Motivators Shared by Practitioners and Researchers

The first shared theme was *To Benefit Practice*. Both groups felt that by working together, they would help to improve the quality and scope of on the ground nature and well-being work. Researchers acknowledged that they felt they could support practitioners, such as through program evaluation or increasing practitioner empowerment. Practitioners believed that researchers would be able to provide valuable expertise which could support programming through improved design or relevancy. A practitioner explained:

Yeah, I think that the way that research can help practitioners is to help them find effective approaches, you know, to use with their audiences. And then, if that could actually be reinforced with more research, it could just be a self-supporting cycle.

Another shared theme was *To Benefit People*. Practitioners felt that by working with researchers, they would be providing additional support to their participants and enhance research that would increase evidence to be able to help more people in the future. While often this theme was shared in rather general language, such as stating they wanted to help people through their work, there was nuance regarding what this meant for each group. Practitioners recognized the potential increases in positive outcomes that they could have through partnership with researchers. Researchers overall felt that collaboration would allow their work to have more tangible and positive impacts on individuals, which would not occur through just their science itself. To quote a researcher:

So think thinking about like, how can we reach more individuals who are struggling with their mental health and promote some of these behavior changes in them. So working with directly with the providers, seems like a good path to reach more people.

Additionally, both practitioners and researchers felt that working together is an important step towards *Bridging the Gap Between Research and Practice*, the fourth shared theme. Both those in research and practice recognized the contributions of their own group and the disadvantage of it not being connected to the other group. They argued that so much work has accumulated but has not been implemented at the same scale. By working together, they felt they could help to support the field, recognizing that they may have some things to contribute, but that their impact could be magnified by partnering with members of the other group. This gap was acknowledged by one researcher who stated:

I see a huge gap in that connection between the academic and the applied world. So we, I'm super grateful for my colleagues working strongly on the theoretical or the methodological part, developing wonderful scales to measure anything. But the point is, you have the impression I have is that in the last 60 years, we developed an incredible amount of knowledge that is not having the impact that it should it should have...

Two other mutual themes were found. First was the theme of *Ease of Project Initiation, Logistics, and Feasibility*, which we view more as a motivating facilitator. This theme encapsulated a variety of factors such as having a pre-existing relationship with a researcher/practitioner, being in close proximity to each other, having appropriate funding or finding a grant, and having the capacity to do the work, maybe by ensuring the project is quick or short. For researchers, funding and capacity were the most salient factors which can be seen through this quote:

But a lot of this is just connecting so, so having those introductions and um, and funding. That's a huge that, just becomes an issue too.

The final shared motivator was *Personal Interest & Fun*, meaning that practitioners and researchers were motivated to collaborate simply because it aligns with their personal interests or would be a fun partnership to be a part of. A practitioner described:

And so I have a personal interest in just, you know, playing a small part in in contributing to that and helping it move forward.

Researchers also noted that part of this is the appeal that it would be interesting science as can be seen in the example quote in Table 1 (Motivators for Collaboration).

Motivators Unique to Practitioners

Both groups had more mutual motivators than unique motivators, as is evidenced by practitioners only having two themes of their own. The first theme, which we view as a motivating facilitator, was *Learning About Collaborations*. This is the idea that they would be more motivated to collaborate with researchers if they knew more about the process, the benefits of working together, or even that researchers were interested in collaborating with them in the first place. As this practitioner quote states:

I think just like access and knowledge that they exist and want to collaborate is the only answer to that.

The second practitioner-specific barrier was *Validation or Credibility*, meaning that practitioners were motivated to collaborate with researchers to validate their programming or provide credibility to their work. Many practitioners shared that they were interested in demonstrating the efficacy of their work with some highlighting the importance of demonstrating the effectiveness of their programming specifically to gain funding. Overall, validation and credibility were very strong motivators for practitioners.

Motivators Unique to Researchers

Just like practitioners, there were only two researcher-specific barrier themes. The first was *To Benefit Science*, which was the most saturated. Despite differences in their reasoning, researchers highlighted the ways that nature and well-being science would benefit from collaborating with practice such as helping science be more generalizable, having better guidance for research priorities, and increase critical and diverse perspectives. One researcher emphasized that collaboration would help them add skills and ideas to their project that researchers would not necessarily have:

And so having them as willing partners to actually, like, put the time in, as opposed to, like me just trying to do everything and like, it just doesn't really work that way, right? Like you have to have everyone on board and everyone do the thing that they're good at, essentially. Like, there are certain things that I'm good at, and then there's certain things that practitioners are going to be good at.

The second researcher-specific theme was that collaboration helps *Provide Opportunity to Grow the Field & Include Others in the Field*. They mentioned a diverse array of opportunities including applying for funding with a practitioner, helping to expose younger generations to the field, and the opportunity to financially support graduate students. One researcher also mentioned that collaborating with practitioners can be an opportunity to help make up for lack of financial resources, such as by combining the skills and resources that each group provides. While the opportunities presented were diverse, one researcher stated:

My biggest motivation is students. I just feel that if we don't have enough young people exposed to this new field, which has, which I still feel more hopeful than any other environmental field that I have worked in, that this, this is a hope for future, that if we need to give attention to future generation in order to attract them to this field

Barriers to Collaboration

From interviews with both groups, we were able to distill a collection of themes representing the various barriers to collaboration. Some themes were shared across groups while

others were specific to either researchers or practitioners. See Table 2 for a brief description of all themes and example quotes.

Table 2. Barriers to Collaboration.

Barriers		
Theme	Description	Quote
Shared Themes		
<i>Funding</i>	The lack of funding needed to participate in collaborations, especially research collaborations, was described as a barrier for both groups.	<i>Funding. Funding is always a huge challenge. (Practitioner)</i>
<i>Getting Connected with Researchers/Practitioners</i>	Researchers and practitioners expressed challenges of finding individuals in the other group to collaborate with.	<i>I think they're interested. It's just, it's hard to figure out who runs the program, like, who's in charge. Because IT services built the app, but obviously they don't want to be involved in research and things like that. And so it's just, it's definitely a difficult thing, and obviously slower than I would like. (Researcher)</i>
<i>Implementation Challenges for Practitioner Organizations</i>	Both researchers and practitioners recognize the extra burden that collaborative projects put on practitioner partners, especially with program evaluation and data collection.	<i>I find that trying to get practitioners, especially in a healthcare system that is already stretched to its absolute limit, and now you're asking them, hey, I need you to submit these forms to me at least once a week. (Researcher)</i>
<i>Time & Capacity</i>	Interviewees highlighted the amount of time and bandwidth needed to effectively engage in a collaboration prevented researchers and practitioners from doing so.	<i>And I think that that's just something to be cognizant of for any sort of collaboration, is that they're just gonna, they're gonna take more time, right? (Researcher)</i>
<i>Interpersonal Tensions</i>	Both groups expressed how working with others can lead to relational challenges, especially when working across knowledge systems, organizations, experiences, roles, and other individual factors.	<i>But I have had one that failed in terms of process. Like we got two peer reviewed journal articles out of it. Like it was like we did great research and data collection, but I no longer have a relationship with that program. And you could look at issues around miscommunication, people being territorial. (Researcher)</i>
Themes Unique to Practitioners		

<i>Sociocultural Barriers of Western Science</i>	Most commonly, research comes from a western, Eurocentric perspective and is often conducted in English, which did not always align with the needs of practitioner's participants. Additionally, this inherently comes with a western bias that influences definitions, thoughts, and experiences.	<i>I think it also kind of relates to the culture piece of it. I think we're examining in these English-speaking countries' perspectives from a white, Eurocentric lens of nature and like disconnection. So that kind of also falls along with those lines. And I wonder how that applies to other countries, other cultures, and why it's happening and how. What is connection to nature mean in different countries and cultures? (Practitioner)</i>
<i>Considerations Working with Kids</i>	Practitioners often stated their concerns about the ethical and legal barriers to collecting data from youth.	<i>And you know, research approval was double IRBs, yeah, not only [University Name], but through the Department of Corrections. And then when we were working with children, it was even more complicated. (Practitioner)</i>
<i>Bureaucratic Processes</i>	Practitioners expressed their hesitation to collaborate with researchers due to the institutional processes, considerations, and regulations that would need to be overcome.	<i>I don't know what the layers will be to have to get approval to do research. So, I mean, I think sometimes, you know, institutional regulations can be a little bit overwhelming. (Practitioner)</i>
Themes Unique to Researchers		
<i>Challenges of Science in the Real World</i>	Researchers often explained the mismatch that can be presented between the ideal situation/standards of a research project with what is feasible to conduct outside of a lab.	<i>I think the timelines for practitioners and academics are often very different. (Researcher)</i>
<i>Logistics</i>	Researchers discussed how logistical challenges they had faced during previous collaborations dissuaded them from participating in future collaborative projects.	<i>Working with a team that maybe, it's an international team, and so you've got time zone differences and cultural differences and language barriers. I mean, but even with a team of US researchers and practitioners, it's still a team, and you've got to get everyone on the same page, and you've got to schedule meetings. You've got to keep it all organized, and you've got to delegate appropriately. (Researcher)</i>

<i>Stability and Focus of Project</i>	Researcher interviewees explained the challenges that arise in collaborations that have to do with keeping all group members engaged and focused on the project at hand.	<i>...but for what we're doing here, you know, just keeping things focused and not being like, oh, squirrel! Squirrel. Squirrel again! Because there's so much work to be done, but really staying focused on that.</i> (Researcher)
<i>Understanding Each Other</i>	According to researchers, acknowledging and including each individual's role and expertise, aligning the group's priorities and goals, and understanding and navigating institutional differences all present barriers to understanding each group member.	<i>And I think, well, I know that we ended up having problems with things like data management and data collection that were essentially our areas of expertise. But we deferred to the community partner because we were trying to not be umm... patriarchal, so to speak. No, you know, authoritarian.</i> (Researcher)

Barriers Shared by Practitioners & Researchers

From the interviews, five themes were mutually expressed by researchers and practitioners. The first was *Funding*, which was generally characterized as the lack of funding needed to participate in collaborations, especially research collaborations. While this theme was straightforward and shared between both groups, researchers had an additional emphasis on a lack of prioritization of funding for nature and well-being work as well as collaborative/cross-sector work. Those from the United States emphasized the current challenges of funding due to removal of funding opportunities initiated by the federal government. As one researcher put it:

But I think when you've, when you're doing something that is a little bit different and hybrid like this that has obvious benefits, there's kind of a variety of sources to access funding and resources. That's a benefit, but it's also a barrier, okay, that, okay, this, oh, that's a little bit fringy, or, you know, a little bit outside what we do.

The second shared theme was *Getting Connected with Researchers/Practitioners*. Each group discussed the challenges of finding individuals in the other group to collaborate with. Sometimes this meant the actual act of finding someone and reaching out, while other times it was more about connecting with someone who was the “right fit.” More specifically,

practitioners expressed that they had never been contacted by a researcher and did not know how to get connected with one. They also were concerned about finding a researcher that could conduct the type of project they needed and how to discern if the researcher was ‘legit’ or ‘verified.’ Some researchers, especially early career, felt that they also had a lack of knowledge both to effectively collaborate and know how to collaborate, while other researchers highlighted the continued siloing that exists in research. Some researchers perceived that they were the only ones reaching out to collaborate, as opposed to practitioners reaching out to them.

The third shared barrier theme was *Time & Capacity*, primarily that the individuals interviewed felt that the amount of time and bandwidth needed to effectively engage in a collaboration prevented them from doing so. For both groups, this concern was expressed not just for themselves, but also for their perception of the opposite group. Researchers stressed the large amounts of time, capacity, and bandwidth needed to be a good collaboration partner, especially putting emphasis on the time investment for the relationship-building required. Practitioners shared these sentiments, expressing concern about putting even more work on their staff who are most likely already busy and under-resourced. As one stated:

One is the biggest one is just internal capacity. You know, we're a small nonprofit and we don't easily have the funding to dedicate to that kind of thing. And we, you know, each of our staff are already have a full time job plus. And so there's, that's, that's the biggest one, I would say. It's not for lack of wanting.

Similarly, the fourth shared theme was *Implementation Challenges for Practitioner Organizations*, meaning that both researchers and practitioners recognize the extra burden that collaborative projects put on practitioner partners. Most of this discussion centered around program evaluation and data collection. Practitioners discussed the oftentimes challenging logistics of data collection, including being outside and without Wi-Fi or having appropriate staff buy-in. Researchers also emphasized the burden it puts on staff, with some researchers

specifically highlighting overworked healthcare staff. A practitioner painted the picture of what data collection can look like for them:

And then, like remembering to print the papers and put them in my backpack, and then transport that backpack to the daycare drop off, and then to the trail and have an out. And so then sometimes it's like raining, and so the paperwork is getting wet. So there's, like the natural elements, the extra thoughtfulness that has to go behind it, and then not losing the sheet, getting it back in, putting them into the spreadsheet, and then locking them for the client's privacy. You know, just some of those logistics can get...it's cumbersome after a while.

The final shared barrier that arose as a theme was *Interpersonal Tensions* that can occur as part of a collaboration. These tensions vary widely in scope, but overall express that working with others can be a challenge, especially when working across knowledge systems, experiences, roles, etc. Examples of the interpersonal tension researchers discussed included people being territorial over data, miscommunication, and relational failures, which can cause a complete breakdown in the collaborative partnership. Examples from practitioners included not receiving the promised outputs from researchers, a lack of support, and perceptions of researchers as being inflexible.

Barriers Unique to Practitioners

Three barrier themes were unique to practitioners, the first being *Bureaucratic Processes*. Practitioners expressed their hesitation to collaborate with researchers due to the institutional processes, considerations, and regulations that would need to be overcome. In some instances, practitioners were worried about the bureaucratic processes on the practitioner side, including permission from regulating bodies they report to or gaining buy-in from administrators, while other times they were concerned about those on the academic side. One practitioner noted:

And at the end of the day, (organization name) is a (county name) Public Schools program. And so it's a school, and it's, and it's bounded by all of the rules and all of the policies and all of the bureaucracies of (county name) public schools.

The second practitioner-specific theme was *Sociocultural Barriers of Western Science*. One practitioner expressed concerns that most commonly research comes from a western, Eurocentric perspective and is often conducted in English, which they did not feel was appropriate for their participants. They also discussed conceptual challenges like definitions of nature and cultural differences in nature relationships, as is discussed in the quote in Table 2. With so much on the research side coming from white, western thought, they had concerns about what this might mean for their participants or the outputs of a collaboration. While this theme was not prevalent for all practitioners, it was especially salient for one interviewee who stated:

So there's a lot of already, like, a lot of barriers to jump through a lot of translations from, like, very, very specific academic language to common, common language to language that is more approachable to people who don't speak English first and or kids as well. So just a lot of like, layers to it.

The final practitioner barrier was *Considerations Working with Kids*. Practitioners often stated their concerns about the ethical and legal barriers to collecting data from youth. Some examples include buy-in and permission from school administrators and a more challenging Institutional Review Board process. A practitioner expressed:

I kind of specifically just kind of say that we'd have to be very aware of, you know, privacy issues for students and data breach issues for you know, the school, and you know all of the various kind of concerns that a big public school would have with a researcher coming in and working on a program that involves their students.

Additionally, one practitioner even stated that research is not possible with children, which although untrue, demonstrates the barrier perceived by some practitioners.

Barriers Unique to Researchers

Researchers presented a clear theme of the *Challenges of Science in the Real World*, or the mismatch that can be presented between the ideal situation and standards of a research project with what is feasible to conduct outside of a lab. These challenges spanned multiple

domains including timing, such as the mismatch between practitioners wanting data more quickly than the academic process would allow, data privacy challenges, and balancing scientific rigor with feasibility in applied research. As one researcher explained:

So like, little things like that, where it's just, you kind of maybe have to balance some of the rigor with what actually works in the real world.

Similarly, researchers identified *Logistics* as a barrier. They shared that logistical challenges they had faced previously during collaborations dissuaded them from participating in future collaborations. Many of the logistics mentioned were related to timing, whether it was navigating multiple time zones or finding times to meet that worked with everyone's schedules. Other examples include technology challenges and the difficulties of organizing a project. One researcher explained some of these challenges:

So some of these, some of these, I've just had to let go, like they're great partnerships, but I've had to let them go because the barriers for me to meet at two in the morning is really losing a day of work, you know, of concentrated work, and that's like that the value to that is not, uh added value is really difficult to put in.

For the third researcher-specific barrier theme, researchers discussed the challenges that arise in collaborations that have to do with keeping all group members engaged and focused on the project at hand in *Stability and Focus of Project*. They specifically discussed the retention of collaborators, making sure everyone stays focused, and the challenges that occur when the project loses momentum. Two other specific examples mentioned were the instability that comes with being a postdoc researcher and staff turnover on the practitioner's side. In the words of a researcher:

And so you get amazing people in the [practitioner] jobs, but they're not paid well. They're not compensated well. And, and they're usually young, and so they're in the job for a couple, three years, and then they get promoted or burned out, and they move on.

The final barrier presented by researchers was the challenge of *Understanding Each Other*. These challenges in understanding can be broken down into three categories including acknowledgment of each individual's role and expertise, alignment of the group's priorities and goals, and understanding and navigating institutional differences between collaboration partners. A researcher explained how what they referred to as "cultural differences" between organizations and inside versus outside academia could make this a challenge:

You know, I've done a lot of work over the last couple of years with the city of [location name] itself and so learning about how things work in City Hall and government has been very important to... just to really understand the culture of each other's systems. It's not even necessarily a single organization, but it's the systems.

Strategies for Collaboration

During their interviews, practitioners and researchers shared strategies to help support collaboration between the two groups. Some themes were presented by both groups while others were specific to either researchers or practitioners. See Table 3 for descriptions and example quotes for all strategies themes.

Table 3. Strategies to support collaboration between researchers and practitioners. Themes from interviews.

Strategies		
Theme	Description	Quote
Shared Themes		
<i>Connections Created via External Catalyst</i>	The creation and existence of organizations and platforms with the explicit goal of helping to connect researchers and practitioners interested in collaboration.	<i>I think, like we mentioned earlier, some kind of system whereby practitioners could describe their program and see if any researchers are interested in potentially doing a study. Also on the other side, a way for them to share their research findings with practitioners.</i> (Practitioner)
<i>Long-term Relationships</i>	The idea that it is important to create and maintain relationships and collaboratives with other individuals or groups.	<i>I think collaboratives are always good.</i> (Practitioner)
<i>Interpersonal Networking</i>	Ensuring that individuals interested in collaborating are putting in the	<i>Service, lot of service, a lot of boots on the ground. Those things you don't get</i>

<i>Effort</i>	personal effort required to establish connections.	<i>reimbursed for as faculty that really are key to your work. Like it's not part of my workload, it's just part of my life. (Researcher)</i>
<i>Recognize & Work Within Practitioner Capacity</i>	It is crucial to understand the capacity of the organization researchers are collaborating with and trying to ease burdens and work within practitioner's current systems to avoid disruption.	<i>It's not that we can't ask anything of our staff, but our staff already work very hard, and it's often a 24/7 job. And so the thought of, hey, do this thing as well can be really hard for them. And so being aware and finding the balance there where they are not asked to do things that are going to add to their stress levels. (Practitioner)</i>
<i>Clear Expectations & Written Agreements</i>	Deciding the purposes, short-term outcomes, long-term outcomes, goals, and standard procedures of a project through written documents and up-front communication.	<i>What are the long-term expectations of this relationship? And we should talk about that. We should chunk it, you know, we should say, well, what's the immediate expectations of this relationship, right? (Researcher)</i>
<i>Researchers Spending Time Getting to Know Practitioner Organization</i>	The idea that successful collaboration requires researchers to understand the needs and parameters that a practitioner organization is working within before making decisions or plans.	<i>I think understanding the needs of practitioners is really important for researchers, and kind of, what questions do they most need answered? And so, you know, when you were talking about data, like, typically, we're the ones putting data in. But what I think from practitioners is what do they want to know? (Researcher)</i>
<i>Availability & Use of Resources</i>	Ensuring that both practitioners and researchers have the necessary resources to dedicate, such as time, appropriate compensation for all parties, and team capacity.	<i>And so you have to incentivize people, because even if they want to do the work, it's challenging. (Researcher)</i>
<i>Strong Communication</i>	Creating solid foundations for working relationships, specifically by taking the time to build relationships, learn about others in the collaboration, and create systems that continue to uphold strong communication, such as regular meetings or strong note taking.	<i>Like you have to have everyone on board, and everyone do the thing that they're good at, essentially. Like, there are certain things that I'm good at, and then there's certain things that practitioners are going to be good at, and if everyone can do those things and trust each other, I think that's, that's where you're going to have the most successful collaborations. (Researcher)</i>
Themes Unique to Practitioners		

<i>Research that Aligns with the Real World</i>	Ensuring that any research that occurs through collaborative projects is tied to real-world challenges, parameters, and applicable solutions.	<i>I think just trying to be more aligned to what's going on in the world... (Practitioner)</i>
<i>Researchers Helping Gain Buy-In</i>	Having researchers help garner support from other involved parties, such as administrators and on-the-ground staff, could significantly support the ability to conduct and accomplish collaborative tasks.	<i>And so it's not, hey, we're going to go meet with the administration and then kind of run this research project. It's like, okay, let's go talk to sixth grade teachers. Let's go talk to, you know, the program managers. Let's get their thoughts on what's important and how we can build a research model and then go forward. And so a strategy or a tactic for me, if I were a researcher, would be to, you know, get buy-in from those important stakeholders. (Practitioner)</i>
<i>Alignment Between Researchers and Practitioners</i>	Collaboration can be improved by alignment in missions, type of work, shared goals, and ensuring that any collaborative projects are a win-win for both practitioner and researcher partners.	<i>I think the strategy should be that it's a good marriage, right? So that it's a really good fit. So thinking about that ahead of time, and getting a reality check on that from the get go in any sort of research design. (Practitioner)</i>
<i>Increased Understanding of Research</i>	Knowing that researchers may be interested in collaborating with them while also understanding the value of research and more about the research process would be important for practitioners.	<i>I would say, making the practitioners aware of the research and the need for their collaboration. If practitioners don't know about the research being done, there's no way they can join it - there's no way they can participate. So, yeah, just awareness. (Practitioner)</i>
Themes Unique to Researchers		
<i>Researcher-Specific Responsibilities</i>	A variety of personal duties that researchers felt supported positive research outcomes. Some of these were responsibilities for themselves while others were about filling roles to support practitioners, such as teaching practitioners about data collection and analysis.	<i>And then, to my point, because I think I'd benefit from this training, which is a training on how the data can inform practice, beyond here's a newsletter and here's a presentation on the results, take it and run, sort of thing. (Researcher)</i>
<i>Openness and Support with Data and Results Sharing</i>	Getting over data territoriality and having explicit conversations about who the data belong to while making results clear and usable to non-researcher populations.	<i>...and we make sure that whatever we are writing as a part of strategic plan or something, they get a say in it. (Researcher)</i>

<i>Blur Disciplinary Boundaries & Think Outside the Box</i>	Being willing to push boundaries and think creatively to foster fruitful collaborations.	<i>I think would be really great is, again, to have to have scientists go a little bit outside of our comfort zone... (Researcher)</i>
<i>Ensuring Inclusive Perspectives & a Willingness to Learn</i>	Ideas such as treating practitioners and community members as experts, centering Indigenous knowledge, challenging the status quo, recognizing who is not in the room but should be, and approaching collaborations from a learning mindset.	<i>I would say, let's think about what made the successful ones work. And I think the ones that were successful were because all of the partners were willing to learn from each other. (Researcher)</i>

Strategies Shared by Both Practitioners and Researchers

Practitioners and researchers had twice as many shared strategy themes for collaboration as they did themes that arose for each group individually. Multiple of these themes centered around the ability of researchers and practitioners to get connected. The first strategy theme was being a part of *Long-term Relationships*. This theme focused on the idea that it is important to create and maintain relationships and collaboratives with other individuals or groups. In other words, even when funding or a specific project ends, keep the partnership going, even if it is in a different capacity. In the words of one researcher:

So a continuous, a consistent relationship with people that could be your collaborators.

Similarly, another shared theme was *Interpersonal Networking Effort*, or ensuring that individuals interested in collaborating are putting in the personal effort required to establish connections. While this theme was spread across both groups, it was very salient for researchers. Some interviewees discussed that they could approach people they already knew while others discussed connecting with people they do not know. Other strategies included utilizing social media, going to spaces where you know members of the other group will be (e.g., conferences or

practitioner-hosted community events), and putting aside the time necessary to find and interact with those you are interested in collaborating with. One practitioner had the idea of:

More talks over coffee and beer. (Interviewer: Yeah) And you think I'm kidding, I'm not kidding.

Another similar theme, again shared by both groups, was *Connections Created via External Catalyst*. Within this theme, both researchers and practitioners highlighted that having organizations and platforms with the explicit goal of helping to connect interested parties would be an important strategy to support collaboration. Some suggested having websites or online platforms while others called for increased networking opportunities that specifically work to connect practitioners and researchers, both in-person and virtual. One researcher came up with a creative, dating app style solution:

I think a lot of this is, man, just like have a website that has, here are these practitioners and what they're doing, looking to connect with the researcher. And here are researchers who have these ideas we're looking to connect with. I mean, it's like a dating app, right? Essentially, well, you know, stupid as that just came out of my mouth. Essentially, that's what we that's what I think is needed. You know, swipe left or right. I don't know.

The next theme that occurred for both researchers and practitioners was *Strong Communication*. Both groups highlighted the importance of creating solid foundations for working relationships, specifically by taking the time to build relationships, learn about others in the collaboration, and create systems that continue to uphold strong communication, such as regular meetings or strong note taking. While this theme was present for both groups, it was more salient for researchers who really emphasized going slowly, building trust, and understanding each collaborator's roles and responsibilities. One researcher explained just how slow:

And it takes time. It takes a lot of time. I have a partner that I've been working with for three years, and we are still not writing the grant like we're still working on that

partnership of how this could work and what could this could look like, and how I can support her community, and what research would look like for them.

Similarly, the next theme shared between researchers and practitioners was *Researchers Spending Time Getting to Know Practitioner Organizations*. Both practitioners and researchers emphasized this as a crucial strategy for creating successful collaborations. For practitioners, this looked like truly understanding the organizations and how they functioned, with the examples of spending time, visiting in person, and being involved from the beginning of the project. One practitioner explained:

Something that helped this last time... was having them come out and see our programming in person, so that they could give us a right sized recommendation, because their recommendation before they went out changed from after they went out and saw programming. They're like, oh, we see now.

Researcher emphasis was focused on ensuring that they are centering the needs of the practitioner and practitioner's community and utilizing research questions developed by or co-developed with these parties.

A related theme that was present for both groups was *Recognize and Work Within Practitioner Capacity*. Practitioners discussed that sometimes their organizations have inflexible parameters, systems, or regulations beyond their control and that an important strategy that supports successful collaboration is having researchers use their flexibility and imagination to still provide successful outcomes. Researchers explained that it is crucial to understand the capacity of the organization you are collaborating with and trying to ease burdens, such as data collection processes, as much as possible. In a researcher's own words:

But I guess generally, just trying to think about how we can alleviate any barriers that they're experiencing and make it as easy as them, easy on them as we can to implement this without a lot of extra burden for them.

Relatedly, the theme of *Availability & Use of Resources* arose for both groups, emphasizing that an important strategy for collaboration is ensuring that both practitioners and researchers have the necessary resources to dedicate, such as time, appropriate compensation for all parties, and proper team roles filled. Both groups emphasized the importance of ensuring practitioners are equally/appropriately compensated, primarily financially, and researchers further emphasized the importance of not being extractive. Another aspect of this theme was the availability of funding in the first place. A researcher emphasized:

We need more public health investment. Because, you know, no one gets rich in this industry or and it's very hard to research in this industry, because it's preventative medicine.

The final shared theme which can be seen as an overarching tool to support many of the above themes is *Clear Expectations and Written Agreements*. Practitioners highlighted the need to have clear expectations of goals and outputs along with an established and realistic timeframe. Additionally, ensuring that the outputs themselves are accessible to non-researcher populations is also key. Researchers discussed the importance of upfront communication regarding planning, goals, and setting expectations for immediate and long-term outcomes. They also emphasized strategies for how to handle disagreements, all of which should be written and documented.

Unique Collaboration Strategies from Practitioners

Practitioners had four themes that were not shared by researchers, the first of which was *Increased Understanding of Research*. For practitioners, it would be helpful to know that researchers are interested in collaborating with them, while also understanding both the value of research and more about the research process. More simply, practitioners sometimes feel they lack the knowledge necessary to engage in collaborations. A practitioner shared:

I think that researchers demystifying research and making it less scary. I think that many people, I mean, I've taught research. I mean, students are terrified. Let's relax. We got this.

The second practitioner-specific theme was *Alignment Between Researchers and Practitioners*. They suggested that collaboration can be improved by alignment in missions, type of work, shared goals, and ensuring that any collaborative projects are a win-win for both practitioner and researcher partners. In their own words:

I mean, I think, I think what, what comes to mind is, is focusing on this idea of win, win, right? Like researchers need to collect this data of whatever that is, quantitative, qualitative, whatever it might be, and practitioners need to be able to see a benefit and a reason to participate in that, and it could be a very direct benefit.

Research That Aligns with the Real World was a similar theme that we found for practitioners when they spoke about successful collaborations. They argued that this would keep collaboration more feasible and results more applicable, both of which would provide positive outcomes. While some practitioners directly stated the importance of real-world or applicable research, others mentioned it in more subtle ways, such as making legitimate efforts to understand on-the-ground issues. In a practitioner's words:

That you're trying to make legitimate efforts to genuinely understand an issue, understand a problem, trying to find solutions that are real and true.

Finally, *Researchers Helping Gain Buy-in* was a theme that practitioners felt supported collaborative efforts. Practitioners explained that having researchers help garner support from other involved parties could significantly support the ability to conduct and accomplish collaborative tasks. As one practitioner explained:

...and the importance of it and what we're trying to get at, and, you know, really explaining the why behind it, because we also find that motivation and, like, understanding of the why can be a barrier as well, because if staff doesn't see the value of it, they'll be like, I'm not going to do it, which has happened.

Researchers could help add credibility to research projects, which could then gain the buy-in from important stakeholders like caretakers of participants (e.g., teachers) or other staff at practitioner organizations.

Unique Collaboration Strategies from Researchers

Researchers also had four unique themes. The first was *Researcher-Specific Responsibilities*. They explained this via a variety of duties they felt they had in ensuring that a collaboration was successful. Some of these were responsibilities for their own role, such as keeping their collaboration load manageable or playing the steady, consistent role as others in the collaboration fluctuate. Others were about filling roles to support practitioners, such as teaching practitioners about data collection and analysis. As one researcher explained:

So, but I think before do that, there probably needs to be more awareness of the benefits and what the process of talking to patients about it could look like, and some guidance on how to navigate those conversations.

Many researchers called attention to successful collaborations depending on *Openness & Support with Data and Results Sharing*. Primarily by recounting previous experiences, they highlighted the importance of getting over data territoriality and having explicit conversations about who the data belong to. They also explained the necessary support they could provide with data sharing, stating that it is important to reframe research so that it is clear and usable to non-researcher populations. A researcher explained one way this process worked for them:

Here's our documents that we've created for this park inclusion program or the palliative interventions that you might want to have. Go for it, make them your own. You know, and sort of sharing in a way, very open way that is not proprietary, has been part of the reach and spread and growth of this.

The next researcher-specific theme was to *Ensure Inclusive Perspectives and A Willingness to Learn*, with multiple researchers explaining that this is vital for successful

collaborations. This theme incorporates ideas such as treating practitioners and community members as experts, centering Indigenous knowledge, challenging the status quo, recognizing who is not in the room but should be, and approaching potential collaborators from a learning mindset. Most researchers interviewed did not contribute to this theme, however, it was highly salient to those who did. In a researcher's words:

So really, it's engaging in the community and being a part of it, going to meetings and meeting with people where they're at. I don't bring them to the university. I don't hold meetings at the university. That's not a really safe space for them, because it's kind of their land that we stole.

Another researcher described their questions for themselves:

Who isn't in the room? Whose perspective needs to be heard in the room to move this work forward?

The final theme, very similar to the above in salience to researchers, was to *Blur Disciplinary Boundaries & Think Outside the Box*. Researchers emphasized that a strategy they had found successful was being willing to push boundaries and think creatively in order to foster fruitful collaborations. One researcher shared that a way to do this is for researchers to go outside their comfort zone by doing more evaluation-style research, following the evidence, or being willing to fail. One researcher highlighted:

So, yeah, yeah, I think that those are some of the main points of collaboration that I would point out is just that being willing to kind of cross sectors, go into unusual spaces, do things in unusual ways, is a bit of a key to collaborate, and a kind of incredible flexibility that that it's really key to these collaborations.

Discussion

The field of nature and well-being contains promising insights and strategies to support the well-being of humans and the environment. To ensure there is synergy between research and practice, it is crucial that researchers and practitioners effectively communicate and work

together (Hansen-Ketchum & Halpenny, 2011; Van Herzele et al., 2011). A recommended strategy to support these efforts is collaboration. This project queried researchers and practitioners in the field to understand the motivators, barriers, and strategies relevant to collaborative work. Overall, we found that both researchers and practitioners are motivated by a wide variety of factors to participate in collaboration, often centered around making a difference. We also found that while there are diverse barriers that exist for both groups, there are also many strategies that can help to overcome these barriers to promote collaboration. Crucially, we found that, despite their differences, researchers and practitioners in the field of nature and well-being have many perceptions in common. There were more shared themes across all three categories than there were themes distinct for each group. Therefore, by specifically targeting the shared barriers and motivators while recognizing the nuance in each groups' perspectives, key leverage points exist to improve collaborative efforts and in turn, increase the capacity for both nature and health research and practice to improve.

Improving Real-world Outcomes, Practice, and Science

Our data presents strong evidence that both researchers and practitioners are interested in collaboration and recognize the positive outcomes associated with practitioner-researcher collaboration. When asked what motivated them to participate in research, a common response from both groups was that this work could help create positive change for the world. This is evident through the themes *To Make the World a Better Place* and *To Benefit People*, which more specifically acknowledged the individuals the collaborations could support, such as their patients or graduate students. Our findings align with previous studies from other fields which have emphasized how collaboration provides real-world, tangible outcomes, positive steps towards solving problems, and is ethically the right thing to do (Bustos et al., 2024; Guimarães et

al., 2019; Thompson et al., 2017). In nature and well-being, these outcomes point towards improving factors related to the physical, mental/emotional, or social health of individuals and communities. Our interviewees recognized the ability for this field to have real-world positive results. Practitioners recognized that collaboration would improve the ability to have those tangible outcomes through their work while scientists understood that collaboration would help their efforts to create real-world change.

Beyond creating broader change for individuals and the world, both practitioner and researcher groups were more specifically motivated by the idea of benefiting practice. In other words, they believed that collaborations would enhance the efforts of those helping to connect people to nature to provide well-being benefits. Literature has previously found this as a motivator for practitioners who recognize the opportunity to improve their programming (Lau et al., 2020). For example, if an organization was taking youth on outdoor recreation trips to benefit their mental health and social connection, collaborating with researchers could help them tailor their program to understand exactly which aspects created the largest difference and maybe some additional techniques to try. Similarly, researchers understand the benefits that this would have for science as well. Literature emphasizes collaboration as an opportunity to increase the external validity of research findings (Drahota et al., 2016), which our researcher interviewees expressed through increased generalizability and the ability to increase diverse perspectives in the literature. The current lack of generalizability and dominance of western bias in science was presented as a barrier to collaboration by some practitioners, suggesting a clear area for improvement, not only for nature and well-being, but for science in general. This finding is backed by additional literature highlighting that nature and well-being research tends to rely on

non-representative samples (Gallegos-Riofrío et al., 2022a), which has more generally been found to leave out perspectives from historically marginalized communities (Brady et al., 2018).

These disparities in the field present a dilemma. On the one hand, practitioners we interviewed working with individuals from diverse backgrounds who may not speak English as a first language expressed the challenge of collaborating with researchers coming from a western academic paradigm. This can present barriers at the very basic level, such as how a culture or individual defines nature (Alves & Vidal, 2024). On the other hand, to expand and diversify the ideas and findings within the field of nature and health, working with participants from varied cultural backgrounds, languages, and experiences is crucial. We therefore encourage researchers to be reflexive, communicate with practitioners about viable ideas and processes, and work to creatively and inclusively address these, and similar challenges. For example, discuss varied definitions of nature with your collaboration partners as a starting point.

Navigating Collaboration Logistics and Feasibility

Logistical obstacles were a strong and overarching topic throughout our findings. Researchers addressed many dimensions of this barrier to collaboration in the theme of *Challenges of Science in the Real World* by naming factors such as timing, data privacy, and balancing rigor with feasibility. In other words, the norms of the scientific process are a challenge to carry out in an on-the-ground setting. Researchers presented some ways to address this through the strategy theme of *Blur Disciplinary Boundaries & Think Outside the Box*. Within the many suggestions presented inside this theme, overall they expressed that it is important to be creative when planning a collaborative research project and acknowledge that western science can be adapted, within reason. This is where flexibility on the part of the researcher and input from practitioners (especially regarding feasibility) could be beneficial. In a

review of reviews, Hoekstra et al. (2020) found flexibility and creativity to be a key strategy in collaborative research projects. Practically, flexibility looks like practitioners being flexible when dealing with the slow timing of the academic process while for researchers it may mean being willing to understand and work within established practitioner systems for data collection. For example, in the field of nature and well-being, practitioner programs may take place outside, which creates challenges with inclement weather or a lack of cell-phone service. Therefore, researchers must demonstrate flexibility and creativity in designing data collection processes that fall within research best practices but do not require practitioners to fundamentally alter their programming.

An additional logistical barrier that arose was funding for collaborative work. It is notable that our interviews with researchers took place during the early months of 2025, a time of political change and significant decreases in funding provided by the US government, as felt by both research and practice in many sectors. Throughout our interviews, both groups mentioned that not having enough funding or the proper funding to put time or effort towards collaborative projects presented significant barriers for their willingness to engage. This finding aligns with Shackleton et al.'s (2023) explanation that in collaborative research, specifically transdisciplinary research, there is an extra challenge of funding. The field of nature and well-being is inherently interdisciplinary, falling at the intersection of countless fields, but commonly psychology, public health, and natural resources or ecology. Finding opportunities for funding that align with this diversity can be a challenge. Beyond acquiring funding, pressure or control regarding how to use the funds can also lead to challenges between partners within collaborations (Bustos et al., 2024), demonstrating further barriers due to funding.

Finding funding is one challenge, and finding the proper collaboration partner is another. Both practitioners and researchers often expressed that they lacked knowledge regarding how to get connected with the other group. We found that both groups commonly assumed researchers would more commonly be the party initiating contact, although some researchers expressed that being contacted by a practitioner would be a welcome experience. Based on our results, it seems that practitioners have less knowledge about whom to reach out to, how to get in contact, and even the appropriateness or norms of reaching out. Both groups were motivated to collaborate by already having or forming new relationships with members of the other group, as is evidenced through the theme *Relationship to Researcher/Practitioner*. There was, however, disagreement between members of both groups about the best ways to go about getting connected, with some emphasizing the need for personal effort and others recommending the formation or growth of external organizations that could act as facilitators of connection.

Interpersonal Factors

Once practitioners and researchers are connected, there are interpersonal factors that can then influence the quality or outcomes of the partnership. Researchers expressed the importance of relationships and shared understanding among partners through the theme of *Understanding Each Other*. More specifically, they discussed the importance of taking the time for everyone to get to know each other, starting with small, manageable projects, and ensuring strong communication at all times. Related ideas that arose from both practitioners and researchers include understanding each person's role and strengths, valuing varied types of expertise, and being flexible with real-world logistical needs (a note practitioners especially highlighted for researchers). Similar interpersonal strategies are heavily discussed in literature on collaborative and interdisciplinary research. Key suggestions include: incorporating and balancing diverse

perspectives or ways of knowing (Knapp et al., 2019; Steger et al., 2021); carefully and slowly forming the team and relationships (Horcea-Milcu et al., 2022; Steger et al., 2021); respect, trust, and a shared vision among partners (Bustos et al., 2024); and flexibility and a collaborative mindset (Steger et al., 2021). The overlap between these variables and our findings is considerable, underlining the importance of interpersonal factors and the collaborative team formation progress for the success of a project.

A specific interpersonal barrier was discussed by researchers through the theme of *Stability and Focus of Project*. Speaking mostly from personal experience, they expressed how personnel changes and lapses in focus on a project had caused challenges on teams they had previously been a part of. Keeping individuals engaged and focused for the duration of an academic project can be a challenge. In their systematic review, Drahota et al. (2016) found that changing or inconsistent membership of collaborative team hindered the process. While some of our participants agreed, one provided a different perspective. They suggested that instead of viewing this as a barrier and having it continually impact collaborative projects, these changes in personnel could be seen as infusions of new energy or sparks of inspiration, turning the barrier into an opportunity. With nature and well-being as a highly interdisciplinary and fairly new field, our understanding of the science is growing rapidly and beyond our own area of study. Personnel changes could provide opportunities to add new expertise, maybe from a discipline that has limited representation within the project, which could help the project be more well-rounded overall.

Integration of Findings for the Collaborative Research Process

Not all collaborations need to take the form of a research project – an understanding that was shared by some of our interviewees. However, research-based projects are a common style

of collaboration and something that many of our interviewees were interested in. To support in these efforts, we wanted to create a way for individuals to understand where and how our findings fit within the collaborative research process. Therefore, we have adapted Steger et al.'s (2021) model for science with society to include the motivators, barriers, and strategies that emerged from this project to further contribute to the theoretical literature.

Steger et al.'s (2021) model demonstrates the steps necessary to appropriately and effectively conduct transdisciplinary work in environmental science and many of the factors embedded within that process. As we have discussed, we are unaware of this type of research in the field of nature and well-being. However, we see strong similarities between our findings and Steger et al.'s (2021) despite differences in discipline. With their model presenting the underlying steps in chronological order, we build on their findings by highlighting the barriers and strategies present at each step in the field of nature and well-being. We view the motivators as the reasons pointing towards the importance of science with society. See Figure 4 for our adapted version of Steger et al.'s (2021) model.

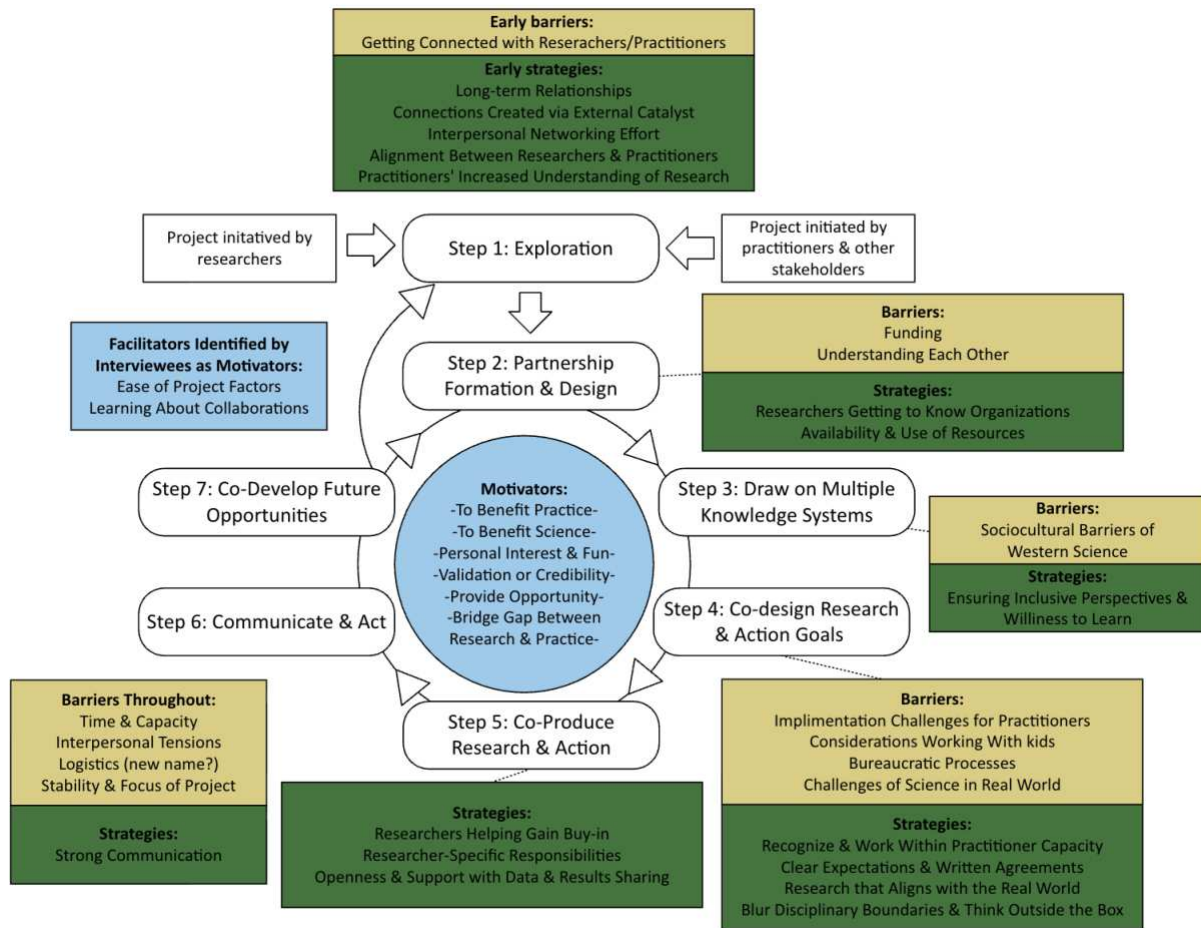


Figure 4. Our adapted model of Science with Society from Steger et al. (2021). The white boxes are from the original model. Each motivator (blue), barrier (yellow), and strategy (green) represents a theme from our findings.

As can be seen in our adapted model, there is one main barrier at the beginning of the research process: getting connected with a researcher or practitioner, respectively. However, our findings present five different strategies to help those groups find each other and ensure compatibility throughout the exploration stage. As the model progresses clockwise, there is strong input from our findings into the model in steps 1-5 and no inputs in steps 6 and 7, for which there are multiple reasons. First, adapting this model was a subjective process with various possible outcomes. For example, we see *Long-term Relationships* as a strategy to support the formation of research partnerships in Step 1. It could also be seen as a way to develop future

opportunities and placed alongside Step 7. Second, our participants may still be in the process of collaborative partnerships and, therefore, have not spent as much time communicating, acting on, or developing new opportunities from their projects. Third, it is possible there is something about the field of nature and well-being that does not align with steps 6 and 7, meaning that we may need to further adapt the model to fit the field. It is important to note that there were strategies and barriers that are omnipresent throughout the collaborative research process, prompting us to put them slightly apart from the model in the boxes on the left. This disconnect does not suggest that these findings are less important, rather that they may be the most important as they influence every stage of the process.

Applied Recommendations

Beyond demonstrating how our findings fit into the collaborative research process, we provide specific recommendations for both practitioners and researchers working in the field of nature and health. While more description and context for each item can be found in the results and discussion sections, Table 4 organizes these recommendations into those that are most appropriate for researchers, practitioners, and then combined recommendations. One note about our results that we found interesting: many of the themes from the researcher data point towards strategies they felt were their own responsibility. Practitioner data, on the other hand, pointed towards strategies that were suggestions for researchers. This could be due to the traditional view that researchers are considered experts and therefore given authority and responsibility in a situation, that previous collaborative experiences have led practitioners to have stronger takeaways about what they need from researchers, or a different reason. Because of this, the table below contains fewer takeaways for practitioners than it does for researchers. Across all of these

findings, we encourage those entering into a collaborative partnership to reflect on ways to embody these suggestions throughout their work.

Table 4. Brief overview of recommendations for research and practice.

Recommendations for Practitioners	Recommendations for Researchers
Initiate contacting researchers about the potential of collaborating.	Be flexible and willing to adapt research designs to logistically work with practitioner needs.
Make sure to know what you want/need before going into a partnership, including what is feasible for your programs and staff.	Proactively discuss the research process with practitioner partners, including what to expect, the ethics of conducting research with youth, confidentiality, and the data collection process.
Find opportunities to learn about the research process, such as ethical considerations for your participants or how research can work with youth participants.	Think creatively and outside-the-box with research design that will be applicable to real-world scenarios (e.g., help creatively solve data collection challenges for limited/no Wi-Fi scenarios).
Have discussions with researchers regarding your participant populations and speak up when you see potential misalignments in understandings or worldview.	Recognize that practitioners have varied expertise and experience that can support your research and the field.
(This square is intentionally blank, as our results presented more takeaways for researchers than practitioners.)	Prioritize research that aligns with the real world as practitioners may be less interested in mechanistic or theoretical questions.
Combined Strategies for Successful Collaboration	
Spend time getting to know collaboration partners (e.g., strengths, expertise), establish roles and responsibilities, co-create expectations, identify needs and shared goals, then write up agreements.	
Start small. Begin with a simple, base level project, then scale up.	
Have conversations about work-load and time to ensure that project requirements match both parties' capacities.	
Ensure inclusive perspectives and have a willingness to learn.	
Have conversations and create written agreements about data ownership and plans for dissemination.	
Join collaboratives and transdisciplinary groups and work to cultivate long-term relationships across the research-practice divide.	

Limitations

While data were collected from both practitioners and researchers, it is important to recognize that the project was conceptualized, and data analyzed, by researchers. Similarly, the

literature reviewed and cited is primarily from academic sources. While we, the authors, did our best to represent the findings fairly, we recognize our positionality as academic researchers may have influenced our findings. Additionally, while efforts were made to incorporate diverse perspectives, all authors are from and were trained in a western science perspective, underscoring our own findings regarding the need for increasing diverse perspectives within this field. Our similar backgrounds may have narrowed our perspective and the lens with which we approached this work.

For our interviews with practitioners, we recruited a nationwide sample from the United States. However, as described in the methods, our researcher sample was recruited worldwide. Neither sample was representative of their respective population. Both researchers and practitioners were able to self-identify as a part of their group. We did not collect personalized demographic data from individual participants. Rather, this research was conducted within a larger needs assessment project that viewed the individuals we interviewed as representatives of their organization or research group/team. We recognize that this does not take into account the individual positionalities and worldviews of the individuals themselves, and how individuals shape the organizations they work for. We were also not able to examine if certain socio-demographic groups were over/underrepresented in our sample. However, considering historical trends in nature and well-being research and practice, we suspect that white, western perspectives may have been overrepresented. In future projects we aim to take a different approach that better accounts for the positionality of our interviewees. Additionally, due to the challenging funding landscape currently present within the United States, researchers and practitioners coming from larger, more well-funded organizations may have been more likely to have the ability to participate.

Conclusion

The field of nature and well-being has demonstrated promise to support the health and well-being of people and the planet. We interviewed practitioners and researchers in this field to better understand the motivators, barriers, and strategies to collaboration, which has been demonstrated as an important strategy to creating real-world change. While there are many barriers to this type of work, such as funding, capacity and implementation challenges, there are also strong motivators that encourage individuals to participate despite the challenges, such as personal interest and the recognition that this work would improve programming and science. Further, we uncovered strategies, as suggested by both those in research and practice, that can support the facility and success of collaborations. Examples include forming partnerships slowly to build trust, being flexible, and emphasizing creativity. We found that researchers and practitioners have more motivators, barriers, and strategies for collaboration in common than unique ones, meaning that small efforts in the areas of overlap may be able to produce large benefits for both groups. We encourage researchers and practitioners to continue to reflect on how they can better support the synergy between research and practice in the field of nature and well-being as we work to create healthier, more sustainable communities.

CHAPTER 3: NATURE'S PASSPORT: THE WELL-BEING AND PRO-ENVIRONMENTAL BEHAVIOR OUTCOMES OF AN APP-BASED NATURE INTERVENTION

Chapter Summary

Nature-based interventions (NBIs) are a successful, cost-effective strategy for improving human well-being and promoting participation in pro-environmental behavior. However, there is limited research on the efficacy and outcomes of nature-based interventions implemented via mobile phone applications, or apps. We examine an app-based nature intervention aimed at improving the well-being of participants in the USA. We specifically studied how the program impacted participants' subjective well-being, nature connectedness, and self-reported pro-environmental behavior. Results of the current project did not yield statistically significant outcomes for our three variables of interest. We discuss design and methodological challenges that may have contributed to these results. Therefore, we recommend further research of app-based nature interventions to better understand their outcomes and efficacy. We also examined how nature connectedness may influence the relationship between nature exposure and well-being, an area of literature under continued investigation. We found that baseline nature connectedness did not significantly influence subjective well-being, but a change in nature connectedness did. This means that individuals who increased their nature connectedness throughout the intervention also saw significant increases to their well-being. We suggest continued research examining this relationship. For practitioners, we recommend that programs incorporate ways to increase nature connectedness alongside nature exposure. The current study adds to the sparse literature on app-based NBIs designed to improve well-being and provides suggestions for future research and practice.

Introduction

Reconnecting humans with nature is increasingly presented as a viable strategy to improve the well-being of both humans and the planet (Barragan-Jason et al., 2022, 2023; Q. Li, 2022; Martin et al., 2020). Both spending time outside and feeling an emotional connection to nature can improve physical, mental, and social health (Barragan-Jason et al., 2023; Goldy & Piff, 2020; Kotera et al., 2021; Mason et al., 2022a) while also increasing pro-environmental attitudes and behaviors (Barragan-Jason et al., 2022; Mackay & Schmitt, 2019; Soga & Gaston, 2024). Despite these promising findings, questions remain about the relationships between and mechanisms behind these variables, along with best practices for incorporating them into practice (Hansen-Ketchum & Halpenny, 2011; Jimenez et al., 2021; Marvier et al., 2023). For example, what role does nature connectedness play in the interaction between nature exposure and well-being? The current lack of clarity in the literature creates challenges for practitioners and organizations as they work to create positive impacts for people, societies, and the planet. The existing gap calls for the need to increase our understanding of how real-world, nature-based interventions are impacting individuals outside of a lab programming implemented in our communities (Marvier et al., 2023).

In addition to understanding potential influences of nature-based interventions more broadly, it is crucial that we learn the relationship between differing interventions and specific well-being constructs (Frumkin et al., 2017; Hunter et al., 2019; Shanahan et al., 2019). For example, how do the outcomes of an outdoors forest bathing intervention differ from an indoor or even virtual nature mindfulness meeting group? And what role does technology, such as an app-based nature intervention, play in promoting well-being? Further, how do program outcomes influence one another (i.e., nature connectedness and nature exposure)? These types of questions

necessitate the examination of programs working to connect people to nature to enhance understanding of impact and to improve efforts of both science and practice.

Our aim is to examine an app-based nature intervention to discern if it improves self-reported well-being of participants. We also assess whether this program might influence pre-cursors to environmentally friendly behavior, such as nature connectedness and nature exposure.

Furthermore, we analyze whether nature connectedness influences the relationship between nature exposure and well-being.

The Influences of Nature on Human & Environmental Well-being

While many seminal studies have examined the ways that human well-being can improve by spending time in nature (e.g., Atchley et al., 2012; Q. Li et al., 2007; Ulrich, 1979), reviews and meta-analyses have begun to paint a more well-rounded picture. Barragan-Jason et al. (2023) systematically reviewed meta-analyses and displayed how a variety of nature types (e.g., outdoor activities, natural sounds) lead to a wide scope of human well-being outcomes in the domains of cognition, social well-being, mental health, and physical health. Some reviews focus on a specific activity in nature. For example, Li (2022) synthesized the many ways that forest bathing can promote physical health and prevent disease, through mechanisms such as increased immunity, improved sleep, and balancing the nervous system. Other reviews focus on specific well-being outcomes and/or populations, such as how nature in schools leads to cognitive benefits for children and adolescents (Vella-Brodrick & Gilowska, 2022).

While researchers continue to learn about the well-being outcomes that nature creates for humans, the mechanisms behind these effects are simultaneously being explored. One of the most prominent theories describing these mechanisms is Stress Recovery Theory (Ulrich et al., 1991), which posits that elements of nature, such as sights and sounds, help reduce psychological

and physiological symptoms of stress within our bodies and improve mental and physical health. In contrast, Attention Restoration Theory (Kaplan, 1995) explains that spending time in natural environments creates the space and time that our brain needs to recover, especially as the more urban environments we live in tend to overload our attentional capacity. Newer models, such as one presented by Marselle et al. (2021) argue that there are four pathways linking nature's biodiversity to human health, including harm reduction (e.g., reducing pollution), restoring capacities (e.g., stress recovery), building capacities (e.g., uplifting emotional experiences), and also causing harm (e.g., allergies). Together, and combined with outside factors such as socio-cultural contexts, nature influences our well-being in a multitude of ways. While research is continuing to understand more about the mechanisms behind nature's ability to support human well-being, many questions remain (Frumkin et al., 2017). Answering these questions is crucial to help bridge the gap between research and practice to support the well-being of individuals in applied contexts.

One piece of the mechanistic puzzle that can become convoluted in nature and well-being literature is the distinction between nature exposure and nature connectedness. Nature exposure involves an interaction or passive experience in the outdoors or with natural elements (Bratman et al., 2021; Zelenski et al., 2015). It can include, but is not limited to, activities such as gardening (Soga et al., 2017), outdoor recreation (Holland et al., 2018), or spending time in urban nature (McEwan et al., 2022). Images of nature (McDonnell et al., 2025) and virtual reality nature (Orr et al., 2021) are also sometimes included. In contrast, nature connectedness is understood as a person's subjective feelings about or relationship with nature (Mayer & Frantz, 2004) and has also been referred to as nature relatedness (Nisbet et al., 2009) or environmental identity (Clayton et al., 2021). Nature connectedness can be understood as both a trait (Mayer &

Frantz, 2004; Nisbet et al., 2009) and a more fluid state (Mayer et al., 2009) that can be manipulated via interventions (Sheffield et al., 2022).

Nature exposure and nature connectedness are related to human well-being (e.g., Arola et al., 2023; Barragan-Jason et al., 2023; Mason et al., 2022a) and also with behaviors that support environmental well-being. Both nature exposure and connectedness have been associated with pro-environmental behaviors (PEBs), or actions that support and protect the natural world. While the correlational association between nature exposure and PEB has consistently been demonstrated (DeVille et al., 2021), some experimental studies demonstrate causation, with nature exposure creating increases in PEB (Ibanez & Roussel, 2022; Vanhatalo et al., 2022; Zelenski et al., 2015). Similarly, there is a strong indication that nature connectedness is associated with PEBs (Barragan-Jason et al., 2022; Whitburn et al., 2020), and some, but more limited, evidence that nature connectedness directly increases PEB participation (Mackay & Schmitt, 2019).

Further, nature connectedness has sometimes been found as both a mediator and moderator between nature exposure and PEB, and between nature exposure and well-being (Bubalo et al., 2026; Martin et al., 2020). In other words, a person's level of nature connectedness can impact the influence of nature exposure on their well-being or describe the reason for that relationship. However, the role of nature connectedness' relationships between these variables is still being deciphered. Some studies have found it to be significantly related (Baceviciene & Jankauskiene, 2022; Zhou et al., 2025), but the evidence is not always consistent. Additionally, because nature connectedness can be a trait or a state, it is also not clear which is needed to create beneficial outcomes. From an academic standpoint, research in this area could improve our theoretical and conceptual understanding of both the connections and

differences between variables, and the mechanisms behind these relationships. From a practical standpoint, it is about understanding what strategies organizations or programs should utilize to achieve their intended outcomes.

Nature-based Interventions

Despite promising evidence that connecting to nature can positively influence the well-being of both humans and the environment, much of the existing research has occurred with limited participant demographics (Gallegos-Riofrio et al., 2022b) and from limited research designs (Marvier et al., 2023) which, combined with other gaps, limit our current understanding (Barragan-Jason et al., 2023; Frumkin et al., 2017). Whilst the existing literature provides foundational knowledge, the existing limitations create challenges for the implementation of nature-based programs that can benefit individuals and communities (LoTempio, McDonnell, et al., 2023; Marvier et al., 2023). Such programs are often called nature-based interventions (NBIs) and are defined as programs or strategies that work to utilize nature or nature experiences within activities, or programs to improve the well-being of individuals (Shanahan et al., 2019). Well-being focused NBIs tend to fall into two categories: those focused on changing the environment to increase access to nature (e.g., greening indoor spaces or improving public green space) or those aimed at changing behavior to increase nature exposure (e.g., forest bathing, nature play; Shanahan et al., 2019). NBIs can encourage both passive engagement with nature, such as simply being in a natural environment (i.e., no activity or engagement, such as just looking at nature), or more active engagement, which requires some sort of physical or cognitive interaction (e.g., green exercise or nature therapy; Kaleta et al., 2025).

As research on NBIs continues to grow, we are learning more about their potential benefits and effective implementation strategies. NBIs present cost-effective strategies to support

physical health, mental health, and other forms of well-being (Kaleta et al., 2025; Pretty & Barton, 2020; Shanahan et al., 2019; Struthers et al., 2024). A meta-analysis demonstrated significant improvement for multiple health markers associated with physical health conditions (e.g., blood pressure, heart rate, fatigue; Struthers et al., 2024). For NBIs that include over 50 hours of nature exposure through the intervention, life satisfaction is shown to improve to an even greater extent than improvements from major life events such as marriage or having a baby (Pretty & Barton, 2020). That same study also found that there is an additional layer of economic benefits from the money saved on health care costs. While understanding the outcomes is important, we must additionally conceptualize how the context surrounding an NBI can influence the outcomes. Kaleta et al. (2025) present a thorough review of contextual factors, with examples including participant age, levels of nature connectedness, type of environment, and participants' motivation or preferences.

Despite this growing body of science, there are still significant gaps in what we know about NBIs, including the crucial component of effective use. The conversation of how to most effectively use NBIs in a variety of real-world settings and how to target specific outcomes is largely missing from the literature base. For example, current research does not differentiate how an organization can most effectively implement an NBI to improve the mental health of their participants as compared to improvements targeting physical well-being. This research to practice gap is a problem throughout the nature and well-being field (Hansen-Ketchum & Halpenny, 2011; LoTempio, McDonnell, et al., 2023; Marvier et al., 2023). For NBIs specifically, we need to understand the efficacy of different kinds of interventions, along with the limitations of the interventions and the barriers that may arise during implementation. While some studies have begun to identify these factors (e.g., Kaleta et al., 2025), a greater recognition

about how the local context influences efficacy will help practitioners better make decisions regarding where, how, and when to use each kind of intervention (Shanahan et al., 2019). Part of this important recognition is how personal characteristics, preferences, or intended well-being outcomes fit with the type of NBI, considerations which will further add to the effectiveness (Kaleta et al., 2025). An effort that will help to answer these questions is the examination of NBIs that are currently being used by nature-based organizations in diverse locations and with varied audiences. This will provide valuable insight into best practices for implementing NBIs within specific contexts.

Technology & NBIs

A new area in NBI research is digitally assisted NBIs. One example of digitally assisted NBIs is the use of mobile phone applications, and while severely understudied, this method has demonstrated effectiveness (Bowser et al., 2014; Kawas et al., 2020; McEwan et al., 2019). Apps have been increasingly used to help collect data or for individuals to track their nature exposure (e.g., Bardhan et al., 2023). However, use of an app for the delivery of NBI programming has been much less commonly studied, especially for well-being outcomes. In the primary peer reviewed study on this topic, McEwan et al. (2019) demonstrated that an app-based NBI encouraging participants to notice urban nature provided statistically significant improvement in subjective well-being after one month, as compared to a control group. In a presentation, Kawas et al. (2020) shared results about how utilizing the NatureCollections app significantly encouraged youth to spend more time outside and supported their nature connectedness. A third example of an app-based NBI demonstrated that listening to nature sounds (e.g., waves, birds, rain) positively influenced participants' learning, reduced procrastination, and improved self-efficacy

compared to controls. It should be noted that the nature exposure in this experiment was virtual (Luo et al., 2022).

While still a relatively novel and understudied contribution to the field, app-based NBIs provide an opportunity to increase the accessibility of nature and NBIs, especially if they were to focus on nearby nature, or the natural elements around them on a day-to-day basis. We posit that app-based NBIs may be able to increase financial and geographical access to NBIs because they do not require transportation to a location where an in-person initiative or program is taking place. Rather, individuals can focus on the nearby nature or urban nature around them, both of which have been demonstrated to improve well-being (Cartwright et al., 2018; Soga et al., 2021) and increase nature connectedness (Nisbet et al., 2020; Richardson & Sheffield, 2017). However, due to limited studies in this area, future research efforts are needed to explore the impacts and efficacy of app-based NBIs well-being and accessibility outcomes more thoroughly.

Summary of Gap

While nature connectedness and nature exposure have been demonstrated as a potential solution for the interconnected well-being of humans and the environment, questions remain regarding how NBIs are utilized in real-world contexts and applications. App-based NBIs may provide one potential strategy, but this area of research is extremely limited, especially for well-being outcomes. We need to understand what types of impacts can be achieved through app-based NBIs and how these impacts vary by NBI type, population, context, and other relevant factors. Additionally, more research is needed to continue to clarify how nature exposure influences well-being and PEB, and the role of nature connectedness within these relationships.

Objective

We aim to analyze an app-based NBI utilized in a well-being focused, non-profit setting in the USA. We want to understand the potential impacts on participants, specifically their subjective well-being, nature connectedness, and self-reported PEB, as well as the relationship between these outcomes. To do this, we will answer the following research questions:

Research Questions & Hypotheses:

1. Is there a significant difference in perceived well-being before and after participation in an app-based nature intervention?

H₁: Well-being will significantly increase following participation the app-based NBI.

2. Is there a significant difference in nature connectedness before and after participation in an app-based nature intervention?

H₂: Nature connectedness will significantly increase following participation in the app-based NBI.

3. Is there a significant difference in pro-environmental behavior before and after participation in an app-based nature intervention?

H₃: Participants will report significantly higher PEB following participation in the app-based NBI.

4. Does baseline nature connectedness influence the impact of an app-based NBI on changes in well-being?

H₄: Baseline nature connectedness will influence the impact of an app-based NBI on changes in well-being.

5. Does change in nature connectedness influence the impact of an app-based NBI on changes in well-being?

H₅: Change in nature connectedness will influence the impact of an app-based NBI on changes in well-being.

Methods

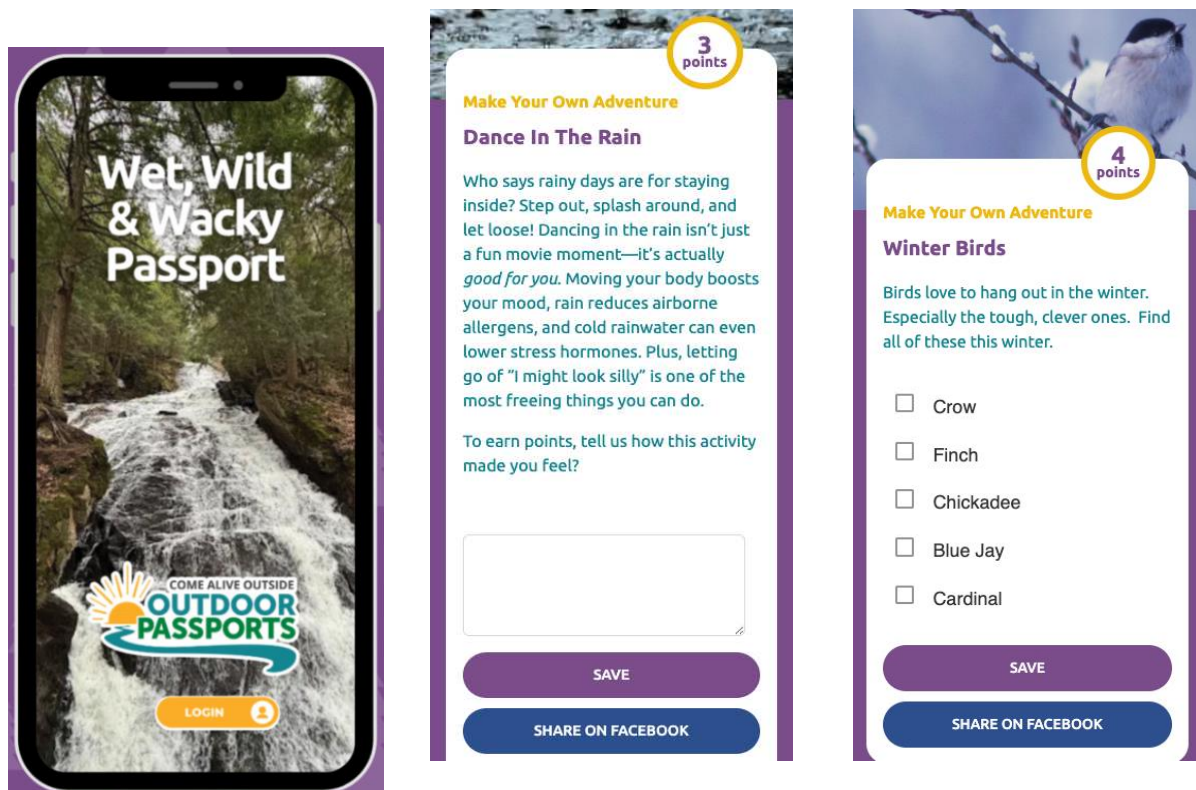
Case Study Organization & Program

To conduct this research, we partnered with Come Alive Outside (CAO), a small, nature-based non-profit in Vermont, USA. They run diverse programs that encourage individuals and families to spend time outside to improve their well-being. Their programs cover a wide range of intended well-being outcomes, but are primarily focused on improving physical, mental, and social health. They utilize diverse NBI programming and initiatives to encourage community members to engage with the outdoors and be physically active through activities such as daily walking challenges, temporarily turning city streets into green spaces, and nature themed activities for youth and families. To carry out their events and increase their reach and impact, CAO partners with organizations across the community, including the local hospital, the public health department, the chamber of commerce, and a large assortment of businesses and non-profits (Come Alive Outside, 2026).

This research project specifically focused on CAO's Passport program, an NBI that uses an app-based activity booklet filled with hyper-local and nature-based activities, community events, and fun challenges for participants to engage with on their own time. Some examples of the nature activities included free kayaking at a local park, taking time to watch the autumn leaves fall, and going on a walk to explore a statue in a city park. The Passports also included some non-nature activities, such as visiting the county fair and making healthy yogurt popsicles.

The Passport changes seasonally, with each version being available for approximately eight weeks. Additional passports have been created for non-seasonal themes as well, such as body positivity and LGBTQ+ Pride. Each passport has its own set of activities to participate in, but they all have a similar proportion of nature-based activities, community events, and suggested health behaviors. Figure 5 contains example images from the Passport app. Participants can earn points for the activities that they participate in and redeem these points to CAO for prizes and incentives. While CAO creates passports for both youth and adult target audiences, this research project specifically examined the adult versions. Based on publicly available demographics, the county that CAO operates in is home to 60,366 people, has a 96% white population, and has a poverty rate of 12.4%.

Figure 5. Example images from inside the CAO Passport app. The first image displays the cover page for a Passport. The second two images display examples of activities that can be found within each Passport.



Study Design

This study is a collaborative effort between CAO and our research team that examined a nature intervention currently in use to understand how the app-based program influenced changes in our variables of interest. We utilized a within-participant, pre- and post-design with data collection occurring before and after participants engaged with the Passport. To collect our baseline measurements, all participants were invited to participate as soon as they opened the Passport within CAO's app. They were provided with informed consent information, then invited to complete the pre-survey within the app itself. The Passport lasted approximately 8 weeks, throughout which participants were able to engage with the activities whenever and however they liked. At the end of the program, they were invited to complete the post-survey within the app to collect our final measurements. (See Appendix C for pre and post survey.) This within-subjects design allowed us to assess changes within participants over time. We repeated this data collection process four times across four different passports. The themes of the passports included in our study were Wet, Wild, & Wacky, Body Positive Vermont, Spooky Fall, and Winter Wellness. All passports were conducted between July 1st, 2025 and March 1st, 2026. All study procedures followed approval from the Institutional Review Board of Colorado State University Protocol #5969.

Participants & Inclusion Criteria

Our study participants were adults living in CAO's area of Vermont who were existing participants in CAO's Passport program. Inclusion criteria included being over the age of 18, and participating in CAO's Passport program.

For the t-tests used to answer research questions 1-3, we conducted an *a priori* power analysis test using G*Power (Faul et al., 2007). The results from these tests indicated that to

observe a medium effect (Cohen's $d = 0.5$) with 80% power, we would need 34 participants (Field et al., 2012). We were able to collect pre and post data from 37 participants.

Measures

Well-being

To measure well-being, we used the World Health Organization Well-being Index 5 question measurement, or WHO-5 (World Health Organization, 1998). This is a short, commonly used scale for self-reported, subjective well-being (Topp et al., 2015). The WHO-5 is made up of 5 questions asking respondents to rate how they have felt over the previous two weeks. For example, "I have felt cheerful and in good spirits" and "I woke up fresh and rested." Participants responded on a 6-point Likert scale from "All of the time" to "At no time." The scores from each question are added together, then multiplied by 4, providing a range of possible scores from 0 (low well-being) to 100 (high well-being; Topp et al., 2015).

Nature Connectedness

Nature connectedness was measured using the NR-6 (Nisbet & Zelenski, 2013), a commonly used, validated, short form version of the Nature Relatedness Scale (Nisbet et al., 2009). Participants answered six questions about how they feel about the natural environment and responded on a 5-point Likert scale from "Strongly disagree" to "Strongly agree." Examples of questions include "I take notice of wildlife wherever I am" and "I feel very connected to all living things and the earth." The final score is created by averaging the responses to the six questions and can range from 1 (low nature connectedness) to 6 (high nature connectedness; Nisbet & Zelenski, 2013).

Nature Exposure

Nature exposure was measured based on participation in the Passport itself, which was the NBI. Throughout the passport, participants had the option to engage in many nature-based activities that exposed them to the outdoors and natural elements. Some examples of activities included: meditatively watching fireflies, swimming in local state parks, winter birding, and going on a full moon walk. Due to data collection limitations in the mobile application, we viewed nature exposure as a binary with all participants receiving the nature exposure intervention.

Pro-environmental Behavior (PEB)

Current literature highlights a lack of high quality, validated measures for self-reported PEBs that apply to diverse scenarios and are a feasible length for administration. Therefore, we created our own generic PEB question that was applicable to our project and context (Lange & Dewitte, 2019). Specifically, we asked participants to agree or disagree with the statement, “I participate in behaviors that support the health of the Earth.” We recorded their responses on a 5-point Likert scale from “strongly disagree” to “strongly agree,” with a 6th response option for “unsure.” This question is broad enough to capture many types of PEBs and asks about actual behavior, instead of behavior intentions, as is preferred (Lange & Dewitte, 2019).

Analysis

All data was analyzed in R (R Core Team, 2022). To answer research questions 1-3, we utilized independent measures t-tests to determine changes in pre- and post-test scores (Field et al., 2012). Prior to the t-tests, we conducted visual normality and assumption checks using the differences scores (Field et al., 2012) and ran a Shapiro-Wilk normality test (Ghasemi & Zahediasl, 2012; Razali & Wah, 2011) on each variable (WHO-5, NR-6, and PEB). Based on

these results, we ran either a paired t-test for appropriately normal variables, or a Wilcoxon signed rank test, which are built for nonparametric data, for variables that did not pass normality and assumption checking (Field et al., 2012). The WHO-5 variable was appropriately normal, so we ran a paired t-test. The NR-6 and PEB variables fell outside the normal range on both the visual tests and the Shapiro-wilk normality test, prompting us to use the Wilcoxon signed rank tests. R automatically included a continuity correction for the Wilcoxon signed rank tests, which is a common practice based on data normality (Field et al., 2012).

For research questions 4 and 5 we ran linear mixed effects models due to having one group with repeated measures and the allowance to measure both fixed effects, demonstrating the overall trend, and random effects, represented by individuals differences (Gałecki & Burzykowski, 2013). For these tests, we centered the predictor (NR-6), which is important for models with interactions and small sample sizes (Field et al., 2012). For research question 4, we utilized participant's baseline nature connectedness score (NR-6 from the pre-survey) in our model to understand if an individual's level of nature connectedness prior to the intervention influenced their well-being outcome following the intervention (nature exposure). For research question 5, we utilized participants' NR-6 difference scores (the change in nature connectedness score from pre to post) to understand if a change in their nature connectedness influenced a change in their well-being following the intervention. For both models, we ran an intraclass correlation coefficient and found our use of linear mixed effects models to be justified (Field et al., 2012).

Following the creation of each model, we tested the assumptions and normality of the residuals and random intercepts and checked for outliers utilizing Cook's distance (Field et al., 2012; Gałecki & Burzykowski, 2013). We found two outliers in the model for RQ4 and one in

the model for RQ5. We removed these outliers and their pairs, then reran the models. While the AIC for each model was lower in the second set of models (Gałęcki & Burzykowski, 2013), the outputs remained almost identical as did the significance of the test. Due to this comparison, we recognized the outliers did not have much of an impact on either model, and therefore opted to retain the outliers to retain all possible data.

Results

We examined how an app-based NBI impacted participants' well-being, nature connectedness, and PEB. We also explored how baseline and a change in nature connectedness might influence well-being following nature exposure. We answered 5 research questions across two types of statistical analysis: t-test (or Wilcoxon signed rank test for nonparametric data) and linear mixed effects models (LMEMs). Our results are broken down by analysis type, then by research question within each type.

Demographic Information

Table 5 displays the demographics of our participants broken down by gender, age, income, and race. Participants were able to select all that apply for race, making the percentages equal greater than 100%.

Table 5
Participant Demographics with Frequencies and Percentages

Variable	n	Percent
Gender		
Man	3	8.1%
Non-binary	2	5.4%
Woman	31	83.8%
Prefer not to say	1	2.7%
Age		
18-24	3	8.1%
25-34	6	16.2%
35-44	13	35.1%
45-54	7	18.9%

	55-64	2	5.4%
	65-74	5	13.5%
	Prefer not to say	1	2.7%
Household Income			
	\$15,000-39,999	2	5.4%
	\$40,000-59,999	9	24.3%
	\$60,000-99,999	5	13.5%
	\$100,000-199,999	8	21.6%
	Over \$200,000	2	5.4%
	Prefer not to say	11	29.7%
Race			
	Asian	1	2.6%
	White	36	94.7%
	Prefer not to say	1	2.6%

Descriptive Statistics

Table 6 displays the descriptive statistics for our variables of interest.

Table 6
Descriptive Statistics for Variables of Interest

Variable	Min	Max	Mean	SD	Median
WHO5 Difference Score	-20	40	3.78	14.45	4
NR6 Difference Score	-2.33	1.5	0	0.71	0
PEB Difference Score	-4	1	-0.11	1.07	0

Nature Exposure's Impact on Well-being, Nature Connectedness, & PEB

We examined the change in three variables pre and post nature intervention including well-being (WHO-5), nature connectedness (NR-6), and PEB utilizing paired t-tests or Wilcoxon signed rank tests.

Well-being

For research question 1, due to the well-being variable meeting visual assumptions and normality (Field et al., 2012) and passing the Shapiro-wilk normality test (Ghasemi & Zahediasl,

2012; Razali & Wah, 2011), $w = 0.94$, $p = .062$, we used a paired t-test (Field et al., 2012). There was not a statistically significant difference between well-being pre- and post-nature intervention, $t(36) = -1.59$, $p = .12$, 95% $CI [-8.6, 1.0]$, $d = 0.26$. There was insufficient evidence to reject the null hypothesis, therefore our hypothesis (H_1) was not supported.

Nature Connectedness

For research question 2, the nature connectedness variable (NR-6) did not pass visual normality tests (Field et al., 2012) or the Shapiro-wilk normality test (Ghasemi & Zahediasl, 2012; Razali & Wah, 2011), $w = 0.83$, $p < .001$. Therefore, we used a Wilcoxon signed rank test as the alternative for a paired t-test (Field et al., 2012). There was not a statistically significant difference between nature connectedness before versus after the nature intervention, $V = 37.5$, $p = .93$, $r = -0.01$. Due to insufficient evidence to reject the null hypothesis, our hypothesis (H_2) was not supported.

Pro-environmental Behavior

For research question 3, the PEB variable did not pass visual normality tests (Field et al., 2012) for Shapiro-wilk normality test (Ghasemi & Zahediasl, 2012; Razali & Wah, 2011), $w = 0.82$, $p < .001$. Therefore, we used a Wilcoxon signed rank as the alternative for a paired t-test (Field et al., 2012). There was not a statistically significant difference between PEB before versus after the nature intervention, $V = 126.5$, $p = .69$, $r = -0.07$. These results do not present sufficient evidence to reject the null hypothesis, meaning our hypothesis (H_3) was not supported.

The Relationship Between Nature Connectedness and Well-being

We conducted two linear mixed effects models to answer two research questions examining the influence of nature connectedness on the well-being outcomes of a nature intervention.

Influence of Baseline Nature Connectedness

For research question 4, we used a linear mixed effects model to discern if a participant's baseline nature connectedness influenced changes in their well-being from a nature intervention. The model included random intercepts for participants to account for repeated observations. The intraclass correlation coefficient demonstrates that 63% of variance was between participants, not within participants, justifying our use of a mixed model (Field et al., 2012).

Our results demonstrate that there was a small, but not significant, improvement in well-being before versus after the nature intervention ($\beta = 3.78$, SE 2.41, $t(35) = 1.57$, $p = .13$). Baseline NC scores were not significantly associated with pre intervention well-being outcomes ($\beta = 2.00$, SE = 4.59, $t(50.11) = 0.44$, $p = .67$). The interaction between time and baseline NR-6 was almost zero ($\beta = -0.39$, SE = 3.95, $t(35) = -0.10$, $p = .92$), indicating that baseline nature connectedness measured before the intervention did not influence changes in well-being. A figure for these results can be seen in Figure 2. Therefore, we failed to reject the null hypothesis and our hypothesis (H4) was not supported.

We assessed the normality of the model's residuals (via a histogram, a QQ plot, and a scatter plot for homoscedasticity) and distribution of random intercepts (via a histogram and a QQ plot). Using Cook's distance (Field et al., 2012; Gałecki & Burzykowski, 2013), we checked for observations causing undue influence on the model, of which there were two. Analyses were repeated with those observations removed, which lowered the AIC from 602.36 to 584.84, suggesting a better fit. However, due to comparable results (i.e., lack of changes in statistical significance and minimal change in interpretation of effects), the model that included the full dataset was retained. See Figure 6 for a plot of this model.

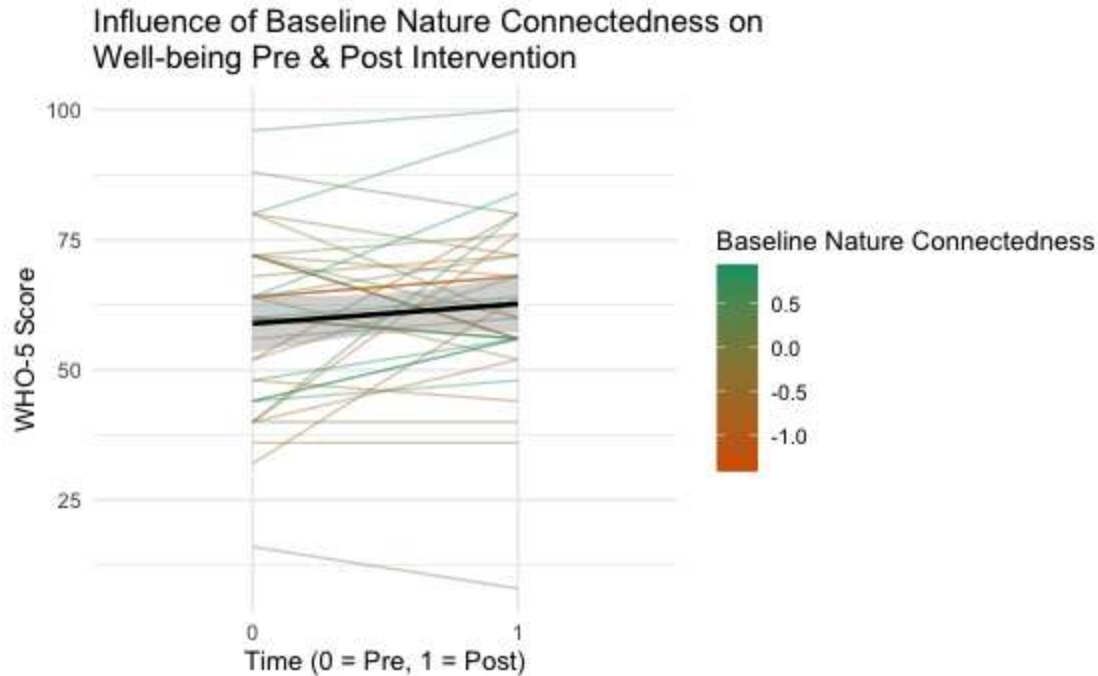


Figure 6. A spaghetti plot demonstrating the influence of nature connectedness (NR-6) measured pre-intervention (baseline) on participants' change in well-being (WHO-5) as measured pre and post nature intervention. Average nature connectedness is presented as 0 because the variable is centered. The black line represents the overall linear trend, with the gray area demonstrating the 95% CI.

Influence of Change in Nature Connectedness

For research question 5, we used a linear mixed effects model to discern if a change in participants' nature connectedness (NC difference score) over course of the intervention influenced a change in well-being following a nature intervention. The model included random intercepts for participants to account for repeated observations. The intraclass correlation coefficient strongly justified the use of a mixed model, with 69% of variance between participants (Field et al., 2012).

Our results demonstrate that there was a small increase in well-being following the intervention, but that it is not statistically significant ($\beta = 3.78$, $SE = 2.16$, $t(35) = 1.75$, $p = .089$). The main effect of change in nature connectedness was not significant ($\beta = -2.94$, $SE = 3.92$, $t(47) = -0.75$, $p = .46$). However, there was a statistically significant effect in the interaction between

the nature connectedness difference score and well-being ($\beta = 8.98$, $SE = 3.08$, $t(35) = 2.91$, $p = .006$). With these results, we were able to reject the null hypothesis which supports our hypothesis (H_5). This demonstrates that participants who had greater increases in nature connectedness over the course of the program saw greater improvements of their well-being. In other words, a change in nature connectedness influenced the relationship between well-being and nature exposure (the intervention). A visual for these results can be seen in Figure 3.

As with our model for the previous research question, we assessed the normality of the residuals and distribution of random intercepts, which presented as acceptable. We checked for observations causing undue influence on the model, removed one observation and its pair, then reanalyzed the model. The AIC did decrease from 595.35 to 576.83, suggesting a better fit. However, just as for the previous research question, due to comparable results (i.e., lack of changes in statistical significance and minimal change in interpretation of effects), we used the original model that retained all of the data. See Figure 7 for a plot for this model.

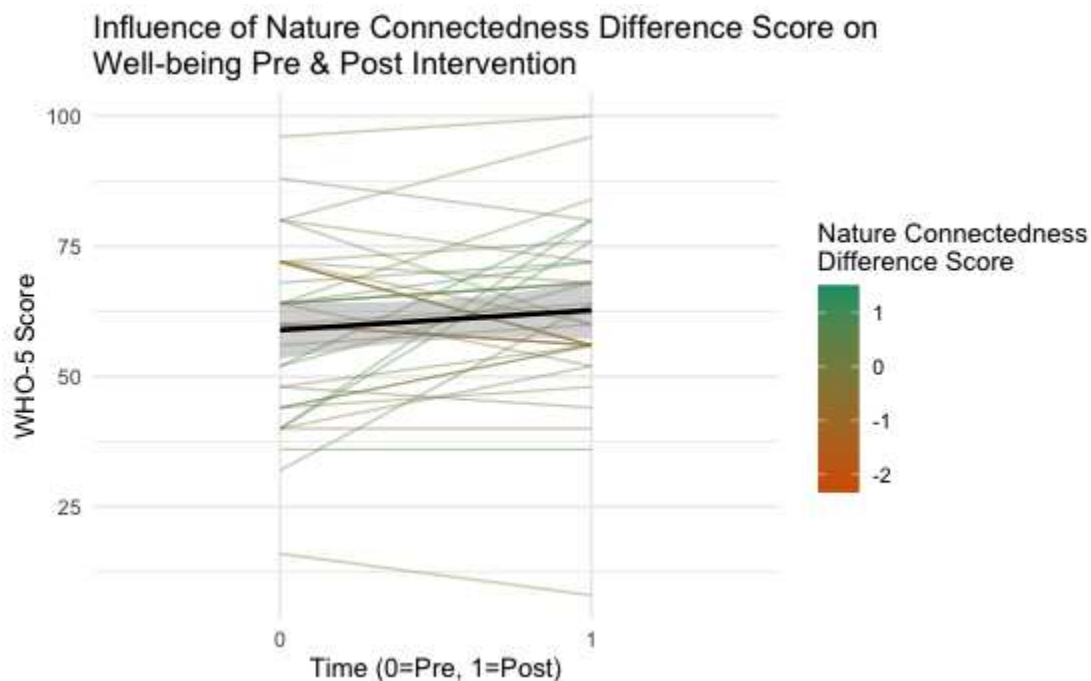


Figure 7. A spaghetti plot demonstrating how the change in nature connectedness (NR-6 difference score) influenced participants' change in well-being (WHO-5) as measured pre and post nature intervention. Average nature connectedness is presented as 0 because the variable is centered. The black line represents the overall linear trend, with the gray area demonstrating the 95% CI.

While Figure 7 demonstrates one line for each participant, along with the overall trend line and 95% CIs, a simpler line graph can demonstrate the more general trends. Figure 8 displays the influence of the nature connectedness difference scores on well-being when the nature connectedness difference scores are divided into two groups at the median (above median = high NC difference score; below median = low NC difference score). This more clearly demonstrates the impact of a change in nature connectedness on a change in well-being.

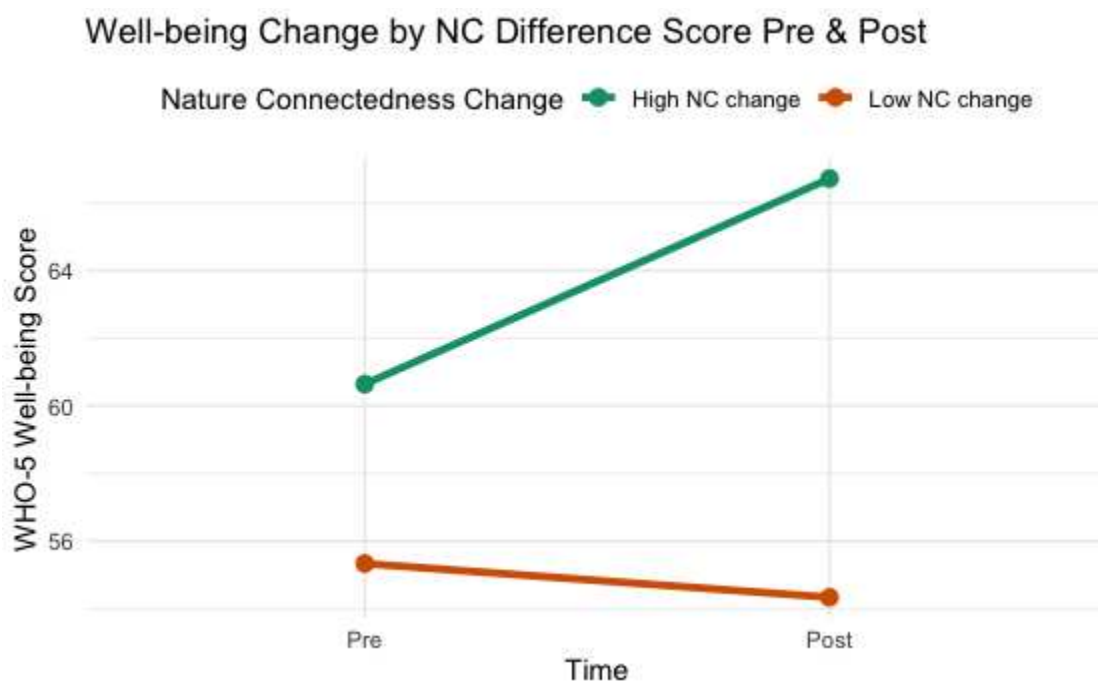


Figure 8. A line graph mapping NC difference scores into two groups at the median. Low levels of NC change (below median) are displayed in orange while high levels of change (above median) are displayed in green.

Discussion

This project analyzed an app-based NBI currently being utilized in Vermont, USA. We examined how the program influenced participants' subjective well-being, nature connectedness, and self-reported PEB, as well as the relationships between some of these variables. We did not see significant changes for well-being, nature connectedness, or PEB following the NBI; however, we will discuss some limitations of our study that may have played a role in these outcomes. We then explored if nature connectedness impacted the relationship between nature exposure and well-being. Participants' baseline nature connectedness scores did not significantly influence their change in well-being over the course of the NBI. We also examined if an individual's nature connectedness difference score (or their change in nature connectedness from pre-test to post-test) influenced their change in well-being. These results demonstrated a significant change in well-being, indicating that individuals whose nature connectedness increased over the course of the NBI saw greater, and significant, levels of improved well-being. This finding emphasizes the potential viability of increasing nature connectedness within NBIs that use nature exposure to enhanced well-being.

Explaining Null Results

We did not see any significant changes in pre- and post-measurements of any of our variables of interest (well-being, nature connectedness, or PEB). Our results are inconsistent with existing literature that demonstrates how nature exposure increases various types of well-being, nature connectedness, and PEB. In a systematic review of meta-analyses Barragan-Jason et al.'s (2023) results emphatically demonstrate the pathways from nature exposure to physical, mental, cognitive, and social well-being. While not supported by as much evidence, experiments have

also found nature exposure to influence PEB in various contexts (Ibanez & Roussel, 2022; Vanhatalo et al., 2022; Zelenski et al., 2015).

The disconnect between our results and the literature could be explained by multiple components of our study. First, we were only powered to detect a medium effect. As a result, there may have been a small effect that we were unable to detect. Therefore, replication of the current study with an increased sample size and increased power would be a beneficial area for future research. Alternatively, participants may not have received enough nature exposure via the intervention to lead to the expected effects. The question of how much or what kind of nature one needs to feel the benefits of nature remains widely discussed in the literature, meaning that we are still unsure how much nature exposure is necessary for positive outcomes or how that might vary by individual or type of nature (Coventry et al., 2021; Meredith et al., 2020; White et al., 2019). Participants in this program were able to engage with the Passport, and therefore nature, as much or as little as they liked, a factor we did not include in our analyses. We aim to incorporate a measure for level or dose of nature exposure in future projects. Finally, we may have experienced ‘ceiling effects’ for all of our variables, but especially baseline nature connectedness and PEB scores. For example, on average participants started with a nature connectedness score of 4 out of 5, indicating little room for improvement. Participants in this program likely already have a strong relationship with nature and interest in protecting the environment, highlighting the importance of thinking strategically about the target audience for similar NBIs

Most of the aforementioned explanations point to characteristics of our sample, rather than the true lack of relationship between nature exposure, well-being and nature connectedness. However, literature on app-based NBIs to improve well-being is very limited (see Luo et al.,

2022; McEwan et al., 2019, 2020 as the primary examples) and their ability to act as a vehicle for the well-being benefits of nature-exposure is largely undocumented. More often, nature-focused apps are used in interventions to collect nature exposure data (Bardhan et al., 2023) or track variables of interest, such as through ecological momentary assessment (Hammoud et al., 2024), rather than act as the intervention themselves. For example, the NatureDose app has been used in studies to collect data that pertains to how much time participants are spending outside (Bardhan et al., 2023). Therefore, our results in this novel area of research still provide valuable learning and align with McEwen et al.'s results for the potential efficacy of this type of NBI.

Despite the non-significance of our results, the app was able to significantly improve well-being for participants who simultaneously increased their nature connectedness. Further, we highlight the need for increased research into the use, efficacy, and outcomes of app-based NBIs. More specifically, we recommend developing metrics to understand if these interventions are actually exposing people to nature and, if so, how much and how often. We also suggest exploration of well-being outcomes beyond subjective well-being, nature connectedness, and PEB, as were measured in the current study.

Nature Connectedness as an Influencer

Research is continuing to disentangle the relationship, similarities, and differences between nature exposure and nature connectedness (e.g., Y. Liu et al., 2022; Martin et al., 2020). Existing literature widely demonstrates that nature exposure can benefit well-being (Barragan-Jason et al., 2023; Rojas-Rueda et al., 2019; Spano et al., 2020), support participation in PEB (Mackay & Schmitt, 2019; Soga & Gaston, 2024), and increase feelings of connectedness to nature (Sheffield et al., 2022). There is also evidence that nature connectedness can influence well-being and PEB, however the studies are often correlational, leaving a lack of clarity about

the exact relationships (Barragan-Jason et al., 2023). To complicate these relationships further, evidence suggests that nature connectedness may influence the relationship between nature exposure and well-being (Capaldi et al., 2017; Zhou et al., 2025). However, more evidence is needed to better understand the connections.

Our findings align with previous literature reporting that nature connectedness influences the relationship between nature exposure and well-being (Bubalo et al., 2026; Capaldi et al., 2017; McEwan et al., 2019; Zhou et al., 2025). Interestingly, we found that a person's baseline nature connectedness score did not seem to influence a person's well-being from before the NBI to after. Rather, a participant's nature connectedness change score (difference score between and pre and post) was the variable that was the influential factor. In other words, over the course of the program, as a participant's nature connectedness increased, so did their well-being. Similarly, McEwan et al. (2019) found that well-being outcomes from an app-based nature intervention were partly explained by nature connectedness. Their analysis demonstrated that a change in nature connectedness predicted changes in well-being. A recent review of reviews demonstrated the role that nature connectedness often plays as a mediator between nature exposure and wellbeing and also between nature exposure and pro-environmental behavior (Bubalo et al., 2026). This has important implications for both research and practice because we often focus primarily on nature exposure and its influence on well-being. However, our results further underscore the importance of paying attention to the role that nature connectedness is playing in this relationship. Further, continuing to differentiate between trait versus state nature connectedness (Mayer et al., 2009; Mayer & Frantz, 2004), or baseline versus changing nature connectedness, is a worthwhile endeavor. It may be that improving well-being is more about

increasing nature connectedness, rather than having a high nature connectedness baseline. This would be an interesting area for further inquiry.

Implications for Research & Practice

Research

Our mixed findings and mixed alignment with previous literature highlight a need for continued research on NBIs, especially those that are app-based and exist in a real-world context. Our null results have important implications for research in the nature and well-being field. First, context matters. Testing real-world NBIs that are currently being used by practitioners can help us to understand more about the potential well-being impacts and mechanisms behind them. Nature and well-being research often takes place in the vacuum of a scientific lab where context is removed. This creates knowledge gaps for those trying to implement interventions in the real world.

Second, nature connectedness may play a bigger role in the relationship between nature exposure and well-being than we realize. In alignment with previous literature (Bubalo et al., 2026; McEwan et al., 2019), we found that it had a significant impact on improved well-being following nature exposure. By using linear mixed effects models for our analysis, we were able to understand the individual differences within participants and identify that it was in fact the participants who experienced increases in nature connectedness who also increased their well-being. More simply, our analysis allowed us to isolate nature connectedness as the factor that made a difference in each participant's outcome. Therefore, this is a variable that should be included more often in NBI research so that we can understand this relationship in a more concrete way. Strengthening this knowledge will aid in our understanding of the mechanisms behind nature's impact on well-being and PEB and allow us to adjust current theories to more

accurately describe the processes that are occurring. Currently, the primary theories and conceptual frameworks (e.g., ART, SRT, & Marselle et al.'s 2021) focus on nature exposure, with Marselle et al.'s (2021) including feelings of connection to nature as an unspecified, external influence to their model. As this demonstrates, nature connectedness is largely missing as a mechanism behind nature and well-being theories. The current study demonstrates merit for the inclusion of nature connectedness as a mechanism in future theoretical frameworks.

Third, and representing an additional topic for continued study, is the use of mobile phone apps for NBIs. As is highlighted by McEwan et al. (2019), there is a challenge in creating an app that balances the type of engagement app-users are looking for with the needs of data collection. In other words, balancing enjoyment for users with utility for researchers. This is a challenge we found especially true as we used an app that was already created and running an NBI, which we then adapted for data collection. An additional consideration is how the use of a technology-based NBI may influence participant engagement with or exposure to nature. While the app may be helping them to get outside into natural spaces, it is possible that using an app is disconnecting them from nature or reducing the potential benefits of exposure. Research in this area is very limited, but so far results are mixed regarding if technology use in green spaces decreases the well-being effects (Jiang et al., 2019; Lang et al., 2025). Therefore, we suggest more research about the use of technology in nature and, more specifically, the efficacy of app-based NBIs that help people spend time in nature. Examples of their use for well-being outcomes in the literature are limited to McEwan et al. (2019) and Luo et al. (2022), who both found positive benefits, plus our study which provided mixed results. As we work to increase access to NBIs and nature more generally, apps could provide a viable option, but we first need to understand if and how they are having their intended impacts.

Practice

This research contributes understanding and future directions for practitioners. Specifically, our results highlight the importance of including program components aimed at increasing nature connectedness alongside nature exposure. As research continues to build the case about the importance of nature connectedness contributing to well-being and PEB, we encourage practitioner organizations to utilize nature connectedness as a “lever” within their programming, especially if they are currently relying heavily on nature exposure. In other words, if a program is utilizing nature exposure, what components of the program could be added or adapted to also increase nature connectedness? Further, recognizing and even evaluating nature connectedness as a programmatic outcome could provide precursor evidence toward other well-being or PEB outcomes. Aligned with the appropriate research examples, this line of argument could prove valuable for grant applications and reports to funders.

Limitations

As with all research, our study has limitations. The first was our small sample size. While we were appropriately powered for the t-tests, we were most likely underpowered for the linear mixed-effects models. Our next steps include conducting an appropriate power analysis for our models and continuing data collection to reach a sample size for sufficiently powered linear mixed-effects models. Second, our analyses included nature exposure as a binary variable, with all participants experiencing nature exposure due to their participation in the intervention. However, this categorical method does not account for the variability in nature exposure that participants actually received. In future studies, we hope to be able to include a better or more accurate temporal estimate to appropriately capture the duration of nature experiences. Third, the intervention we examined lasted approximately two months, which could be seen as a long time

to engage with an app-based intervention. Other studies have found 30 days to be too long to stay engaged with an app-based program (McEwen et al., 2021). There may also have been self-selection bias due to our evaluation of participants already choosing to participate in the NBI, leading to high rates of participants with high levels of nature connectedness and interest in PEBs. Additionally, our demographics show that our sample was overwhelmingly female identifying in comparison to community demographics, limiting the generalizability of our results for populations outside of our sample demographics. Finally, this was an observational study without a control group, increasing the risk of confounding variables influencing the results.

Conclusion

We analyzed the outcomes of an app-based NBI being used by a non-profit, nature-based organization in the USA. We examined the program's impacts on participants' subjective well-being, nature connectedness, and self-reported PEB. The app-based NBI did not significantly influence participants' well-being, nature connectedness, or PEB, which is likely a result of some potential methodological challenges, such as a small sample size and lack of ability to detect a small effect. We recommend further investigation of app-based NBIs to continue evaluating their efficacy in improving our outcomes of interest or providing other possible benefits. We also examined the role that nature connectedness might play in the relationship between nature exposure and well-being. While baseline nature connectedness did not significantly influence well-being outcomes, a change in nature connectedness did. In other words, individuals who experienced an increase in nature connectedness throughout the NBI also had a significant increase in self-report, subjective well-being. We encourage researchers to continue exploring the relationship between nature exposure, nature connectedness, and well-being as there is still a

lack of clarity about the role of nature connectedness in the literature. We suggest that practitioners utilizing nature exposure to improve well-being make sure to incorporate programmatic elements that simultaneously increase feelings of nature connectedness. Overall, we add to the very limited literature on well-being focused, app-based NBIs, provide suggestions for future research, and share recommendations for practitioners working in the nature and health space.

CHAPTER 4: COLLABORATIVE & CREATIVE: EXAMINING A NATURE-BASED ORGANIZATION'S ROLE IN THEIR COMMUNITY'S WELL-BEING

Chapter Summary

Despite significant research documenting how spending time in nature directly benefits human well-being, less is understood about how this research is applied in the real-world and how it can complement broader public health efforts. This study aims to increase our understanding by qualitatively examining a community-based non-profit organization in rural Vermont that leverages nature-based programs to support health and well-being in their community. We investigate the achieved impacts and associated programmatic strategies, along with the context specific factors that influence their impacts. Results showed diverse benefits for individuals including perceived improvements in mental and physical health, and an increased sense of belonging. Further, the results demonstrate positive outcomes at the community level, such as community development, economic growth, and increased community pride. Specific programming strategies led to these impacts, especially prioritizing access and inclusion, creativity, joyful outreach, and strong collaboration. We found a few key contextual factors that influenced these outcomes, such as an existing collaborative mentality and culture in the broader community. Notably, we found a focus on community driven work and effectively leveraging grants influenced programmatic outcomes. Overall, our findings demonstrate that a nature-based organization's positive impacts can stretch far beyond the individual well-being benefits that are typically studied. We discuss the implications for research, such as the need for continued exploration into the breadth and interconnectedness of potential well-being outcomes, especially across sectors, time, and scales. We also provide recommendations for practice including prioritizing inclusion and access while utilizing a collaborative mindset.

Introduction

Research demonstrating the power of nature to improve the health and well-being of both humans and the planet is rapidly growing. Spending time outside can have multifaceted positive impacts on individuals and interpersonal relationships (Barragan-Jason et al., 2023; Rojas-Rueda et al., 2019; Soga et al., 2017; Spano et al., 2020). It can support mental health (Bettmann et al., 2022), improve physical, cognitive, mental, and emotional health (Barragan-Jason et al., 2023; Kotera et al., 2021; Mason et al., 2022a) while also helping us to be generous and kind (Goldy & Piff, 2020; Holland et al., 2018), improve our social connection and satisfaction (Arbuthnott, 2023; Oh et al., 2022), and overall increase our feelings of well-being (Krols et al., 2022). Due to these numerous beneficial outcomes, there are many organizations working to improve the lives of people and communities by connecting them with nature. Examples include, therapists incorporating nature into mental healthcare (Meore et al., 2021), doctors prescribing visits to local parks (Kondo et al., 2020), adventure therapy for veterans (Bettmann et al., 2022), and nature-based programs for incarcerated individuals (Moran, 2019).

Further, current research demonstrates that nature-based interventions have the potential to play an important role in supporting the well-being of individuals and communities while working towards public health goals (Shanahan et al., 2019). More specifically, nature-based programming and initiatives can complement more traditional healthcare approaches (Kaleta et al., 2025; Struthers et al., 2024; Tambyah et al., 2022). However, continued research is needed to understand how to implement what we already know about nature and well-being into real-world practice, especially for diverse populations and across varied contexts (Frumkin et al., 2017; Marvier et al., 2023). It is crucial to document the efficacy, outcomes, and influence of real-world nature-based programming to better understand a) the types of impacts nature-based

programs are having, b) how specific contexts may influence their outcomes, and c) gauge alignment between practice and current literature while simultaneously guiding future research directions with applied value.

To address these challenges, we conducted an in-depth, qualitative case study of one nature-based organization located in Vermont (USA) to examine its well-being impacts, what strategies it is using to achieve those impacts, and what role the context of the organization or community may be playing in shaping those outcomes.

Health & Well-being Model in the United States

Understanding the current healthcare context is critical for identifying the role that nature-based organizations can play in supporting societal health and well-being. In the United States, healthcare is primarily reactive, with a focus on diagnosing problems after they occur instead of working to foster health and well-being to prevent negative outcomes (Levine et al., 2019). This has been referred to as a “sick care” approach as it concentrates on acute care of illness instead of long-term health maintenance and preventing chronic illness or other problems before they occur (Marvasti & Stafford, 2012).

The field of public health has long recognized the need to shift away from the reactive model (McLaren et al., 2019). Adler et al. (2016) argue that this does not mean just putting more money into clinical healthcare systems as they are, rather investments need to be made in initiatives that support social determinants of health and decreasing health-damaging behaviors. More efforts need to be put towards focusing on disease prevention and improving health before illness occurs (Marvasti & Stafford, 2012). Presently, there is a nation-wide underinvestment in those types of public health efforts, and they remain underutilized (Adler et al., 2016; Levine et al., 2019).

While current healthcare systems fail to prioritize preventative care, many organizations are working to address these challenges. Those operating from this public health perspective are spread across diverse sectors and locations, working toward a variety of goals. Examples include large inter-governmental agencies like the World Health Organization, supporting well-being and providing preventative care all around the globe (World Health Organization, 2026). Others are focused on specific well-being outcomes (e.g., BEAM, working on mental health for Black individuals; *BEAM*, 2026) or are small, community-focused non-profits working in small geographic areas (e.g., Vuela for Health near Denver, CO; Vuela for Health, 2026). While there are countless examples of organizations working to improve the health and well-being of individuals and communities, nature-based organizations and interventions are becoming increasingly prominent as they present cost-effective solutions that support diverse well-being outcomes (Hinde et al., 2021; Pretty & Barton, 2020).

The Potential of Nature for Health & Well-being Outcomes

Research demonstrating the well-being benefits of nature most commonly study individual outcomes such as cognitive health (e.g., attention, Mason et al., 2022b; memory, Vella-Brodrick & Gilowska, 2022), physical health (e.g., cortisol, Antonelli et al., 2019; immunity, Q. Li, 2022), or mental/emotional well-being (e.g., mood Hamann & Ivztan, 2017; subjective well-being, Krols et al., 2022; symptoms of anxiety & depression, Shim et al., 2022).

Beyond benefits to individual people, there is also evidence that nature can support interpersonal relationships and community well-being, although this area is less extensively studied. A meta-analysis by Yao et al. (2025) reviewed evidence from more than 34,500 participants and found a robust correlation between how connected a person was to nature and their likeliness to engage in pro-social behaviors, such as helping, empathy, and cooperation.

Similarly, Arbuthnott (2023) reviewed the literature and reported that benefits to a person's social health can stem from both shorter-term and longer-term nature interactions. A 10-year longitudinal study on youth further supports these results. Children that lived in areas with higher greenspace participated in more prosocial behavior (Putra et al., 2021). Overall, this area of research demonstrates how nature-based interventions can improve social outcomes along with individual outcomes.

Theoretical Background

There are a handful of theories that aim to explain how nature-based interventions lead to their intended well-being benefits. Two commonly cited theories are Attention Restoration Theory (Kaplan, 1995) and Stress Recovery Theory (Ulrich et al., 1991). Attention Restoration Theory posits that while urban environments can overload our ability to pay attention, natural environments allow our brains the time and space they need to recover our cognitive abilities (Kaplan, 1995). Stress Recovery Theory argues that nature, especially certain sights and sounds in nature, reduce psychological and physiological symptoms of stress (Ulrich et al., 1991). While widely cited, these theories present a limited scope of the mechanisms leading from nature to well-being and mostly exclude contextual factors. A newer framework presented by Marselle et al. (2021) works towards addressing these gaps by identifying 4 pathways leading from biodiversity to human well-being. Three pathways represent a domain of well-being benefits (e.g., reducing stress, building capacities) and one domain represents potential harm that natural environments can cause (e.g., allergies). Additionally, their framework calls attention to the influences of environmental and socio-cultural contexts as well as individual characteristics. Despite this progress in theoretical understanding, we still lack models that sufficiently explain the impacts of nature interventions and the role of context in those outcomes.

Despite a need for continued research, nature-based interventions have been demonstrated as cost effective, impactful approaches to improve the health and well-being of individuals and communities (Kaleta et al., 2025; Shanahan et al., 2019; Struthers et al., 2024). They are versatile and can come in a variety of shapes and sizes. Some focus on improving access to nature, while others focus on behavior change and modifying people's relationships with nature (Shanahan et al., 2019). Further, these interventions can be the primary focus of an organization (e.g., Boyz in the Wood; S. Johnson et al., 2025) or separate from the organization's purpose (e.g., nature in the workplace; Gritzka et al., 2020). Despite this variety, they present viable strategies for improving human well-being in diverse ways.

Nuanced Perspectives Are Needed

Despite the potential positive outcomes, nuanced and historical perspectives are required when exploring the potential of nature and well-being initiatives. It is easy to get caught up in a blanket statement that nature is good for every type of well-being and provides benefits to all people. Yet many research questions remain unanswered, such as how well-being outcomes vary by personal factors like socio-economic status or ethnicity (Frumkin et al., 2017). Further, we know even less about how to best implement what we already know into real-world solutions (Marvier et al., 2023). Frumkin et al. (2017) present a broad overview of the literature and many questions that still need to be answered.

Most research in the field of nature and well-being has been conducted with white, western participants utilizing primarily western understandings of nature and well-being. This results in significant limitations in the generalizability of current findings (Gallegos-Riofrío et al., 2022b). Science must recognize and continue the work to understand the culturally constructed definitions of nature and diverse lived experiences with respect to outdoor

recreation. This includes addressing the diverse and disparate experiences of being outdoors which can be exclusionary to many individuals, especially those who are not white men (Wittmann & Garrity, 2025). Additionally, parks and green spaces are not equitably distributed, with fewer and lower quality nature near neighborhoods lower socioeconomic status and higher rates of minoritized populations (Spotswood et al., 2021; Winkler et al., 2024). Race and ethnicity to be associated with decreased forest access (Winter et al., 2019) while race, socioeconomic status, age, and gender influence participation in outdoor walking groups (Rigby et al., 2020). Beyond access, safety in natural spaces is also a concern, as has been discussed for LGBTQ+ individuals (Collins et al., in press, in prep). Wittmann and Garrity (2025) explain how American environmental history, particularly through the actions of white, rich men, continues to shape our outdoor narratives and experiences, especially of people who are not white, thin, or able-bodied.

In addition, the recognition of diverse relationships with the land and the benefits that nature could provide to minoritized populations are also limited in academic discourse. As one example, Black and African-American people have experienced legacies of violence and discrimination in the outdoors, while simultaneously their stories of resilience with and relationships to the land have been excluded from popular discourse (Finney, 2014). Research about the role of nature in the well-being of LGBTQIA+ populations provides another example. While nature experiences can provide positive benefits, historical trauma and unsafe sociopolitical contexts can create barriers to accessing those outcomes (Collins et al., in press, in prep). Due to this discrimination across body-types, identities, and nature relationships, it is crucial for science and practice in the nature and well-being field to critically examine assumptions and actions. Further, we need to conduct research in real-world settings with real-

world populations to better bridge the gap between research and practice within nature and well-being work.

Nature & Well-being in Research Versus Practice

Scientific inquiry in the field of nature and well-being is often very linear (LoTempio, Bettmann, et al., 2023; van Bekkum et al., 2026). For example, academic studies commonly look at how one particular outcome or mechanistic pathway leads from point A (e.g., nature exposure) to point B (e.g., well-being outcome). Even within projects examining multiple variables or interaction effects, the scope of the research is often quite narrow. Scholars argue that our current understanding of these mechanisms may not accurately represent the overall scope of interactions between nature and well-being (Robinson et al., 2024; van Bekkum et al., 2026). We also do not fully comprehend how they occur through specific interventions, such as outdoor therapies (Harper et al., 2021), or for specific populations (S. Johnson et al., 2025). While breaking down complex phenomena into smaller parts is a natural result of scientific inquiry (i.e. trying to isolate the influence of one variable on another), such narrow scopes create opportunities for misalignment between research and practice. In practice, organizations are working to provide diverse outcomes that are most likely interconnected and influencing each other simultaneously.

To use a different analogy, research often occurs in a vacuum, where context has been removed, extraneous factors are mitigated, and only a small subset of variables are examined. This is particularly true for nature and well-being research, which often stems from disciplines based in positivism, such as psychology (Breen & Darlaston-Jones, 2010). On the other hand, non-profit projects occur outside of that vacuum where variables interact with each other, and context matters. While some studies have started addressing this issue (e.g., Tomasso & Chen,

2022), the misalignment can lead to challenges in the evaluation and scientific study of programming, which creates challenges for organizations working strategically to understand the full scope of their impacts and how they are achieving them. Therefore, we need research that helps translate specific and narrow literature into complex practice settings. Holistic and novel methodological approaches, and triangulation of data types, may be strategies. Yet, we need more research that helps translate specific and narrow literature into complex practice settings. Further, these efforts should work to include diverse perspectives regarding the relationships between humans and nature (Amengual-Moreno et al., 2025).

Objective & Research Questions

We aim to conduct an in-depth qualitative investigation of a non-profit organization utilizing nature-based programming to understand how they are influencing well-being outcomes in their community, and how the context of the organization and local area enable these outcomes. Specifically, our study is guided by the following research questions:

1. What types of well-being impacts does a nature-based organization have on a local community?
2. Which strategies of the organization are perceived to lead to the identified impacts?
3. What factors of the organization and local community shape the ability of a nature-based organization to successfully achieve well-being impacts?

Methods

Come Alive Outside

The subject organization for our project is Come Alive Outside (CAO), a non-profit organization based in Vermont, USA. They operate in a rural county (according to the USDA's classification) whose population is primarily white (96%) with a poverty rate of 12.4%. Come

Alive Outside’s mission is to support the health and well-being of individuals, families, and entire communities by connecting them to the outdoor spaces in their community (Come Alive Outside, 2026). They work in partnership with other community organizations in the sectors of healthcare, public health, outdoor recreation, advocacy, and landscaping, among others. They utilize diverse programming and initiatives to meet their goals, including large community events (e.g., festivals & themed outdoor activities), activity booklets for youth and adults (“nature passports”), wellness challenges (e.g., walking a mile a day for 30 days), NatureRx (doctors prescribing outdoor time to their patients), and green street challenges (creating temporary green spaces and parks in certain downtown areas), in addition to many other offerings.

CAO utilizes a three-pronged approach of increasing awareness, providing opportunity, and using motivational techniques that, when combined, encourage individuals to spend time outside and increase in the well-being of community members (See Figure 1). Their mission is “to inspire collaborative community systems that create the awareness, intention and opportunity for people to live healthier lives outside”(Come Alive Outside, 2026). CAO’s model of practice can be seen in Figure 9.

CAO's Model of Practice

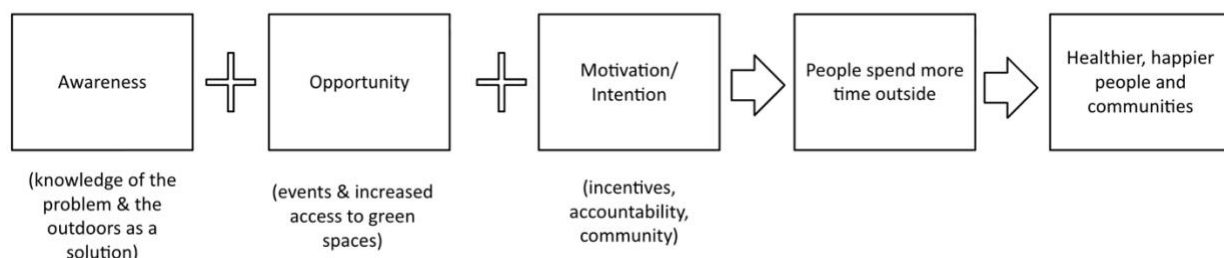


Figure 9. This diagram represents CAO’s model of practice that they developed to explain the logical flow of their programs to their intended outcomes.

Participants

We interviewed individuals connected with CAO and the surrounding Vermont community. Our participants spanned different relationships to CAO that can be broken down into 3 categories: internal (staff or board member), partner (staff of an organization that partners with CAO), or community member (an individual who participates in CAO programs). Internal staff included the current executive director, a former executive director, a volunteer, and current board members. Partners included staff (in some cases former staff) of other community non-profits, the public health department, the parks and rec department, the local school district, the chamber of commerce, and the local hospital. The group of community members was made up of individuals who have previously or are currently participating in CAO programming, are parents of participants, or both. Due to the small community, some participants may fall into multiple categories but were counted based on the role in which they were recommended for an interview. We used a combination of purposeful (Bazeley, 2013) and snowball sampling (Parker et al., 2019) to recruit our interview participants. We created a list of potential interviewees following conversations with CAO staff and board members and sent a recruitment email to the individuals identified. We then gathered the names and emails of potential participants utilizing snowball sampling (Parker et al., 2019). We continued to send recruitment emails to newly identified individuals.

The lead author completed 21 interviews, one of which contained two people. Seven interviews were with individuals internal to CAO, 8 were with partners, and 6 were with community members. See Table 7 for demographic data for interview participants. Three participants declined to provide any demographic information.

Table 7. Participant demographics by gender, race, and age.

Demographic Category	Number (n)	Percentage (%)
Self-Identified Gender		
Female	13	59%
Male	6	27%
Declined to respond	3	14%
Race (select all that apply)		
Asian	2	9%
Hispanic/Latino	1	5%
White	18	82%
Declined to respond	3	14%
Age		
25-34	5	23%
35-44	4	18%
45-54	6	27%
55-64	4	18%
Declined to respond	3	14%

Data Collection

All study members participated in semi-structured interviews with the primary researcher during fall 2025. Seven interviews took place in-person during the research team’s field visit to Vermont, USA. The remaining 14 interviewees took place via a virtual meeting platform (Teams, Version 26032.605.4378.6183) in the 7 weeks following the field visit. Informed consent was obtained at the beginning of each interview, then participants were asked a series of interview questions about CAO’s impacts, strategies, and how/why they have been able to find success within this specific community. The interview guide contained some questions that are beyond the scope of this manuscript. See Appendix D for the complete interview guide. Interviews lasted approximately 20-50 minutes, depending on the length of participants’ responses. Each interview was audio recorded.

In addition to interviews, the primary researcher attended a CAO board retreat to become better acquainted with the organization and its processes. The researcher obtained consent from

all board members, then used an observation protocol to record notes throughout the meeting (Busetto et al., 2020). See Appendix E for the observation protocol document. This process allowed the researcher to have a deeper and more thorough understanding of the organization and the surrounding community to provide additional context that supplemented interview data. The board retreat included presentations from staff, community partners, and in-depth discussions by board members about the strategic priorities of the organization.

Data Analysis

Interviews were transcribed via Otter.ai (Version 3.8), then cleaned by members of the research team. We analyzed the transcripts using thematic analysis (Bazeley, 2013; Braun & Clarke, 2006) via the software NVivo (Version 15). The primary researcher deductively coded both the interview transcripts and observation notes together for variables that answered the research questions including impacts, strategies, and contextual factors. Impacts are the positive or negative influences that the organization had on individuals and the community. These could also be referred to as outcomes or even benefits, in the case of positive impacts. Strategies are the tactics, processes, or actions utilized by the organization that caused the impacts to occur. And contextual factors are characteristics of the physical location, community, or organization that played a role in the occurrence of the impacts or strategies.

After the first round of coding, the primary researcher then inductively analyzed the codes and created a set of preliminary themes for each research question. These codes and themes were extensively discussed with a secondary researcher, then iteratively adapted and refined until there was thematic agreement between both researchers. All quotes presented in this manuscript are verbatim, except for removing identifiable information and some filler words to

improve readability. Study procedures were conducted in accordance with the Institutional Review Board of Colorado State University Protocol #5969.

Results

We present our results, which mirror the research questions, by starting with the impacts that CAO is having on the local community and its residents, followed by the strategies they are using to achieve those impacts, and then how their work aligns with local or organizational context to support their efforts and further their outcomes. A summary of all research questions, themes, and subthemes from the combined interview and observation data can be seen in Figure 10.

Research Questions & Themes

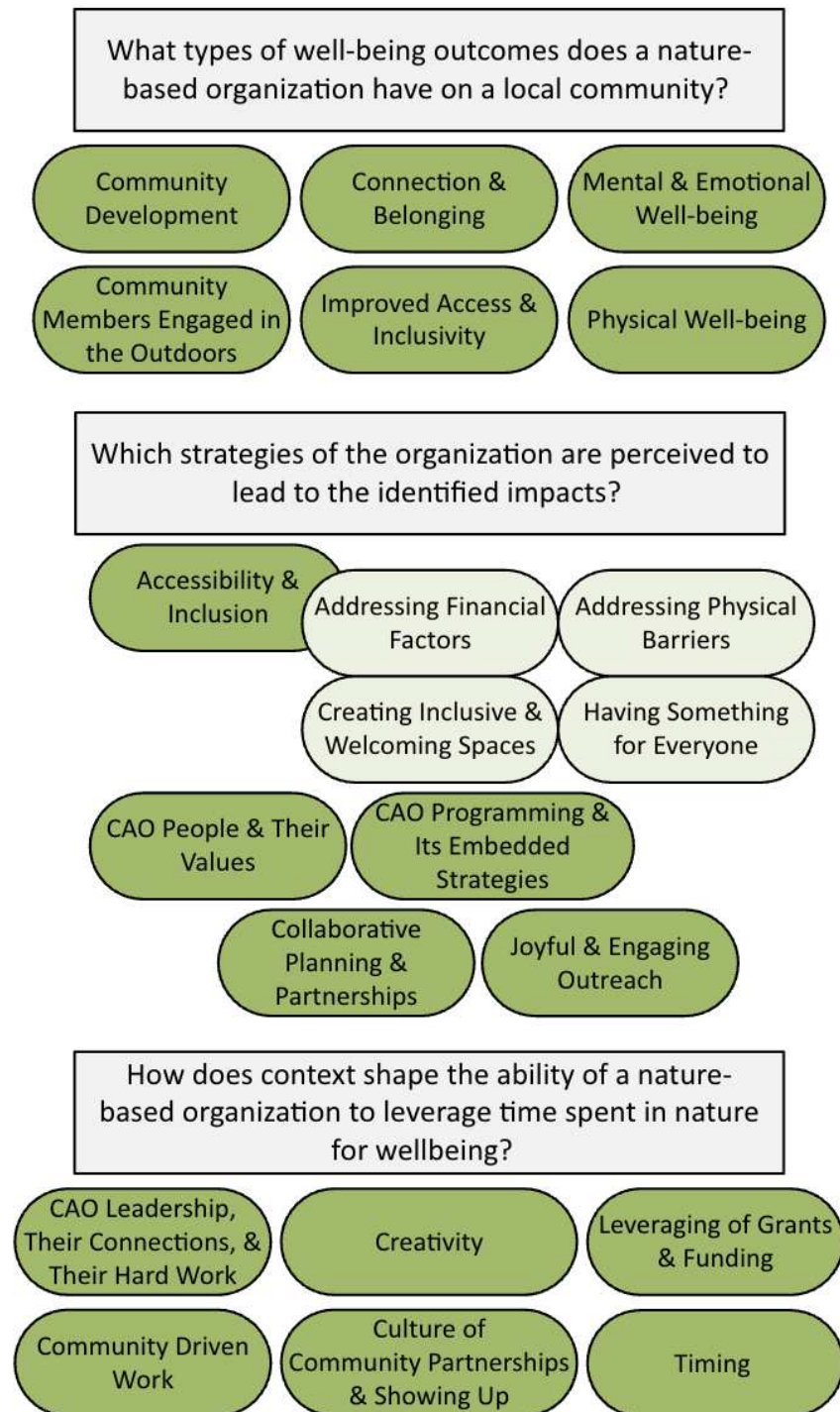


Figure 10. A visualization of manuscript 3's 3 research questions and the themes and subthemes associated with each research question. Themes are dark green and subthemes are light green.

Impacts of CAO's Work

Interviewees were asked about the impacts of CAO's work. We found the idea that CAO is creating positive outcomes was universal across interviewees. As one interviewee internal to the organization said:

I've been doing nonprofit leadership since college, so for 25 years, and even, like in college, and this is the organization where I have seen the most measurable and visible impact in the shortest amount of time.

Beyond broad statements about the generally positive outcomes of CAO's work, participants identified a diverse and widespread set of impacts, which we categorized into six themes: *Community Development*, *Community Members Engaged in the Outdoors*, *Connection & Belonging*, *Improved Access & Inclusion*, *Mental & Emotional Well-being*, and *Physical Well-being*. The themes, their descriptions, and example quotes can be seen in Table 8.

Table 8. The six themes represent the impacts CAO had on the surrounding community and its residents, as identified by interviewees.

Impacts		
Theme	Description	Quote
Community Development	CAO's work supports economic growth, cross-sector collaboration, and community perceptions/pride of the community, improving the well-being of the city itself.	<i>I mean, there's other programs that might stimulate, you know, compliment it, but [CAO programming is] very unique. So I think that that's something that the community really has pride in.</i>
Community Members Engaged in the Outdoors	CAO gets people of all ages out of the house, outside, and participating in outdoor recreation. Participants highlighted CAO's impact of helping individuals and families understand what activities are available to participate in and learning how to participate.	<i>I think it's helped get people to explore areas outside that maybe they wouldn't.</i>
Connection & Belonging	CAO impacts both individual, family, and community well-being by increasing belonging, building community, and increasing interpersonal	<i>Community connection, I think, is a huge one. Especially when you're talking about, you know, target populations - them feeling that sense of belonging and sense of support from their community</i>

	connection. Family well-being was also highlighted through increased bonding and shared involvement.	<i>can just help with, well-being in general. And create more of a stronger sense of community.</i>
Improved Access & Inclusivity	Interviewees described the varied and profound ways that CAO is addressing inequity and improving the lives of community members by promoting equity and access in outdoor recreation and other nature-based activities.	<i>So I really, actually think that's a huge contribution that [CAO] brings is promoting that diversity, equity and inclusion in [the] Rutland area, with a particular emphasis on that inclusion piece. Because one of the things I really love... about Come Alive Outside's program is that you can participate, basically no matter what.</i>
Mental & Emotional Well-being	Diverse and positive changes in overall mental and emotional health, with emphasis on specific factors such as self-efficacy, body positivity, and meaning/purpose. Additionally, increased positive emotions such as joy, happiness, and positivity.	<i>So yeah, increases self-worth, increases like that confidence, like all of those ripple effects around, like how somebody sees themselves as like a human being (laughs), worthy of respect and worthy of inclusion, belonging, all those, all those good things, I think is really powerful.</i>
Physical Well-being	Widespread and varied improvements in, knowledge about health, increased healthy habits, and physical health for interviewees themselves and others they know.	<i>And I really love that Come Alive Outside, you know, gets people out and moving so they can have those positive health outcomes that you get from physical activity without being like, 'I have to do this to lose weight, to be healthy.' It's 'I want to do this to have fun.' So I think making, you know, physical activity, something that is enjoyable and that people want to engage in has been a really important outcome.</i>

Community Development

Through the strongly prevalent theme of *Community Development*, interviewees expressed that CAO is working beyond the well-being of community members and influencing the social and economic foundations of the community and the institutions of the city itself. This includes positive outcomes for other non-profits, economic boosts for for-profit businesses, increased collaboration between sectors, and increased community pride/perceptions of Rutland.

These community-wide impacts are felt in ways beyond CAO's mission. An interviewee who works for a different non-profit in the community stated:

Come Alive Outside, really has sort of, whether they realized it or not, they've helped me be able to sustain my program, just because of all the things that they're doing. And my like, our, you know, capacity, I guess I would say.

Additionally, many interviewees discussed the widespread work that CAO is doing to get youth involved in community development, emphasizing their work with older youth/teens.

CAO is providing opportunities for teens to have a voice in the community, often by providing internships and/or helping them to design their own events.

Beyond the individual organizations and populations feeling that impact, their *Community Development* impacts are felt by the economic and social sectors of the city itself. Many examples were brought up via our questioning including helping teach residents about the history of the area resulting in increased city pride, encouraging community members to get out and active for local events, and helping community organizations get to know each other better through inter-workplace challenges.

Community Members Engaged in the Outdoors

Interviewees commonly expressed that CAO helps individuals to get out, explore, and have new experiences outdoors. They emphasized that this impact is felt by individuals of all ages and levels of outdoor experience. Participants also articulated that despite the area having incredible outdoor recreation opportunities, many community members are not engaged in them.

As one interviewee said:

You know, fishing, hunting, hiking, bicycling, skiing, just all these huge opportunities, and I think Come Alive Outside is trying to find out, you know, what interests people, and how can we make it happen for them, cost effectively.

CAO programming also provides opportunities for youth, teens, and families to learn about and participate in activities, increasing knowledge about the activities and recreation opportunities that are available to them. This also helps parents to have things for their families to do, which was often listed as a benefit.

The impact goes beyond just getting people outside but also helping them to have more experiences or gain new ideas or skills while they are there. One interviewee discussed that they have observed how the outcomes of these experiences have additional layers of impact by shaping the identity of participants and their relationships to the outdoors. In other words, not just getting them outside, but getting them involved, engaged, and connected to nature. While we might view this as a strategy to reach well-being outcomes rather than an outcome itself, many participants mentioned the programming as an impact in and of itself, as well as a means to reach other goals, compelling us to include it as an outcome.

Connection & Belonging

The idea that CAO increases belonging, builds community, and supports interpersonal connection was strongly embedded throughout almost every interview. The ways in which interviewees described these types of social well-being were diverse but commonly centered around the idea of getting people out of their houses to interact with others. This was especially true during the colder months, connecting individuals who normally would not interact, and helping people feel that they are a welcome part of the community – that they belong.

An interviewee explained that these outcomes occurred naturally as a result of the programming itself, for individuals and families alike. There was a perception that this was especially true for people who had a more challenging time making connections on their own or

did not feel as if they belonged in all community spaces. An interviewee internal to the organization said:

We also see a lot of kids and adults who don't fit in other places find a place to fit in with Come Alive Outside that might be different than, like, a rec program or a camp. And that, I think, is really, really great. And they come back!

It is important to emphasize that the social well-being impacts are a particularly strong outcome for CAO and, while explained across a broad spectrum of specific benefits, the general sense is that these impacts are commonly felt by community members. While connection and belonging can be seen as related to mental and emotional well-being, the strength of these outcomes across participants led us to believe it needed its own theme.

Improved Access and Inclusivity

Interviewees emphasized the multitude of ways that CAO is working to address inequity in the community by promoting and implementing access and inclusion. They do this through their programming, by doing their best to ensure that anyone who is interested is able to participate. CAO's work with affinity groups, such as the plus size community and the LGBTQIA+ community, is helping make outdoor spaces, community events, and the community itself more inclusive. As one interviewee said:

Even the Come Alive Outside programs that they do for like plus size people, I think is really amazing. And the impact there, I think again, it's just like people feeling included, especially in an outdoor, I don't want to use the word industry, but like, in the field.

The inclusion impacts they create also provide geographic access, as one interviewee explained:

A lot of the organizations that support folks in Rutland County are really heavily focused in the town itself, and a lot of folks fall through the cracks if you're like elsewhere in the county. And so I think that one of the things that they were trying to do is direct people to health resources through their passport program that were, you know, accessible in Pulteney or in Brandon, or a town center a little bit less central. So I think that's a huge thing.

While the immediate impacts of improved access and inclusion to their programming, the outdoors, health resources, and the community itself are important, the ripples of these may also stretch into the world beyond, by creating awareness and a more inclusive culture within the surrounding community and outdoor recreation sector.

Mental & Emotional Well-being

Participants commonly discussed improvements to mental health and well-being that they had experienced for themselves or people they knew. Some specific examples include increased confidence or self-efficacy, feelings of empowerment, self-acceptance, body positivity, and improved purpose or meaning in life. One participant explained how CAO's programming supported their mental health soon after moving to the Rutland area:

Really, the big one is that empowerment. Like, that's a big one for me.

Interviewees also described how CAO influences emotional well-being for individuals from all backgrounds and ages. They specifically mentioned how CAO brings fun, joy, and happiness to the community, creating a general sense of positivity. The emotional well-being impacts were commonly described in association with CAO's programming, as one interviewee stated:

I've seen a lot of kids be a lot more happier with Come Alive Outside.

Beyond just physical and mental/emotional well-being, it was common for interviewees to express the overall well-being benefits more generally before providing more specific examples. It is noteworthy that not a single interviewee mentioned instances where well-being is negatively influenced by CAO's work, despite most interviewees being prompted that negative comments were okay.

Physical Well-being

Respondents shared widespread and varied improvements related to physical health including, but not limited to, knowledge about health and healthy habits, increases in physical activity or other healthy practices, and improvements to their or others' physical health. The most mentioned impact was increased physical activity, especially through walking, something that often occurred with friends, coworkers, or at CAO programs. An interviewee described how one of CAO's walking challenges improved the health of family members:

So it was a good motivator. It was a really good motivator for [person's name]'s parents when they first moved here. And her parents are so much healthier now, because of that. It was the motivation they needed. And now they, you know, have that intrinsic motivation.

Beyond the individual physical health benefits that community members are seeing from this programming, there is an understanding of a deeper level of impact that CAO is helping achieve. As an interviewee explained, CAO is working to bolster and improve the preventative care space, an area that has its challenges in the US healthcare systems:

Oh, I think they're trying to put a band aid on the mental health and physical health. I think they're really trying to provide programming for preventative medicine across the board, across the board, and there's no support for that.

Additionally, interviewees shared how CAO was able to help provide these impacts for individuals who had struggled with healthy changes in the past. They were able to engage individuals in improving their healthy habits who were less inclined to do traditional exercise activities. An interviewee described:

The doctors who were active [with our program] were pleased that it was getting patients who they had a hard time getting to do preventative care in a certain way, were actually engaged in that.

Strategies That Lead to CAO's Impacts

To answer our second research question, we asked interviewees what strategies CAO is using to achieve the impacts described above. Answers spanned a wide variety of ideas which we distilled into five themes: *Accessibility & Inclusion*, *CAO People & Their Values*, *CAO Programming & Its Embedded Strategies*, *Collaborative Planning & Partnerships*, and *Joyful & Engaging Outreach*. The theme of *Accessibility & Inclusion* contains four subthemes: *Addressing Financial Factors*, *Addressing Physical Barriers*, *Creating an Inclusive & Welcoming Space*, and *Having Something for Everyone*. Table 9 provides a high-level summary of these themes, which are then discussed in greater detail below

Table 9. The five themes and subthemes that represent what interviewees identified as the strategies and characteristics leading to the previously identified impacts.

Strategies			
Theme	Subtheme	Description	Quote
Accessibility & Inclusion	Addressing Financial Factors	CAO works to make events free or low cost, provide free food, and make event locations accessible without a car.	<i>You know, I helped [CAO staff member] buy a couple kayaks a year or two ago, because I like kayaking. And so, you know, we went up to Dick's Sporting Goods, and I have racks on the Jeep, so we threw them on my racks and brought them home. But now they reside at the local, the local lake here in Wallingford. And there are events down there where you can come down and sign them out and kayak for free. And I go down and give instruction to people that have never done it.</i>
	Addressing Physical Barriers	Events are planned and advertised with physical accessibility in mind, inclusive of all body types and abilities.	<i>Like, there are those typical things that you would think of for people who are really outdoor enthusiastic, like, you know, hikes, go to the reservoir, swim in the lake, etc. But there's also things that, like, if you physically can't do that, or financially can't</i>

			<i>do that, that pretty much anyone can do. So like, step outside and watch the fireflies for a minute, or, you know, remember to drink your water throughout the day, or open your window and listen to the birds. And I think that's really part of the magic of who Come Alive Outside is. [Staff member name] and the other staff there have worked so hard to make the program something that anyone can participate in, and it's all fun.</i>
	Creating Inclusive & Welcoming Spaces	All programs are executed with a warm, welcoming, and inviting presence on behalf of CAO, regardless of a participant's identity or experience level.	<i>There is that feeling that you're not alone in this, and that like, we'll move at your pace, or like the slowest person's pace, and that's okay, and that's not wrong, and it's not...you have all those like, worthy, worthy considerations.</i>
	Having Something for Everyone	CAO programming works to include something that will interest everyone, oftentimes simultaneously, which can bring multi-generational quality time.	<i>Yeah, so even you know, folks that are 65 and up are getting the benefit of Come Alive Outside. I think, I mean, like I said, I've been doing this for a long time, and I see people that look like me, people that look like you, and kids that are in diapers, and everything in between. Purple hair, face pierced, tattoos, suit and tie. It doesn't really matter. It kind of transcends all, all types of people, which I think is pretty unique.</i>
CAO People & Their Values	N/A	CAO is achieving their impacts due to the values and mentality of the people involved, and their practice of those values.	<i>I mean, we're (non-profit organizations) all hustling money, but that, that community involvement, and that, that, you know, human, human services, sort of attitude, you know, and empathy for your fellow, your fellow citizens. It's all there, and that's one of the things I totally love about this organization.</i>

CAO Programming & Its Embedded Strategies	N/A	The programming and initiatives that CAO carries out, and the inclusive and creative strategies contained within those programs, drive their intended impacts.	<i>And the other piece of, part of that is they incentivize everyone, because I don't think anyone ever grows out of that, like, ooh, a prize! Even if it's like a weird Viking hat, or what's some of the other weird ones? Like a whoopee cushion. That was a weird one. But everyone loves a whoopee cushion. I think that like incentivizing, like, oh, I get to go play outside and I get a whoopee cushion. That's amazing.</i>
Collaborative Planning & Partnerships	N/A	CAO operates in a highly collaborative, communicative, and partnership-driven way. In particular, CAO leadership emphasizes partnerships and relationship building, cross-sector collaboration, and using a systems approach to address challenges.	<i>They're hitting the nail on the head with talking to youth directly, talking to people in the community directly, collaborating with other organizations very well. And you know, not just trying to reinvent the wheel or do something solo and on their own. They're very collaborative in the community.</i>
Joyful & Engaging Outreach	N/A	CAO is able to produce their impacts due to their meaningful and inviting promotion of their programming, but also their willingness to go out into the community and meet people where they are.	<i>There was also, I know that the, like the launching of the program in the schools was very important, because it allowed us to create relationships with the teachers, so that they were sort of bringing up and asking about the passports, and what did people do this weekend with your Come Alive Outside passport? All that sort of thing, and so, so teachers and the schools were sort of the vehicle for getting the passports to the kids, but they were also reinforcing the use of them when it was working very well.</i>

Accessibility & Inclusion

It was well understood across interviewees that CAO prioritizes accessibility and inclusion to ensure as many people as possible have access to their programming and initiatives. Interviewees expressed that CAO views access and inclusion in wholistically and multifaceted ways, which we synthesized into four subthemes: *Addressing Financial Factors*, *Addressing Physical Barriers*, *Creating Inclusive & Welcoming Spaces*, and *Having Something for Everyone*.

Addressing Financial Factors. Interviewees reported that CAO events are almost always free or very low cost, which they also reported was due to fees being covered by CAO and the grants they obtain. They further increase financial accessibility by providing food, often for free, or at least free for those who need it. There was a big emphasis on supporting youth from low-income families as well as transportation accessibility, hosting events that are accessible by walking or public transportation. In the words of an interviewee:

I can't remember the last time I even heard of something being charged for. I think that's one of the big focuses is finding free activities to do, and sometimes it means that Come Alive Outside is paying, you know, through a grant or something like that, for that access. But it's free to the participants...

Multiple people that we spoke to discussed the unhoused populations in the community and how they sometimes participate and enjoy themselves at CAO events. Come Alive Outside has sometimes brought events to areas where unhoused individuals are living.

Addressing Physical Barriers. It was common for interviewees to explain the physically inclusive and accessible nature of CAO programming and describe the various ways that CAO addresses physical differences. Examples include hosting events in easy-to-access locations, ensuring that events with physical activities had a low barrier to entry, and creating opportunities to include participants of different physical abilities, such as body-inclusive yoga.

An interviewee described that while CAO has always tried to be physically inclusive, they have more recently begun to describe the terrain so that those with mobility differences will know if and how their assistance devices will be able to function, such as if there are gravel paths.

So, like, where sure, if you say that it's accessible by wheelchair, but somebody that's not in a wheelchair might not think about hey, well, if it's gravel, it really might not be accessible to somebody in a wheelchair because their wheels sink, you know? So I've noticed that [CAO has] started even describing like the landscape for people with access, like mobility issues.

Creating Inclusive & Welcoming Spaces. While interviewees often spoke of different types of inclusion through various examples, the theme remained strongly the same: CAO does their best to make sure everyone feels welcome and included in their programming.

Beyond differences in physical abilities, CAO tries to be as welcoming as possible to those with all types of differences. One interviewee told a story about how as a volunteer at an event, they engaged in an extended and meaningful, non-verbal conversation about their love of s'mores with a participant who could not speak. An interviewee internal to CAO summed it up this inclusive effort well:

On Tuesday, we had a Beaver Moon Walk down at the meadow here. And we, like the advertisement on it was like, 'inclusive walk.' And then, the one thing was 'if you ever didn't feel like you belonged outdoors, but you like moons, and you like to hang out with people, and you like cider, come on down.' And so we had 11 people, and it was like, the weirdest group of, not weird, but just like, these people are not friends, right? Like, they don't know each other. They have very little in common with each other. Other than this is a very like, non-intimidating event, they know Come Alive Outside is a little goofy, and it's not going to be like... like we're going to go at the pace of inclusion.

Going at the pace of inclusion was mentioned by other interviewees as they described hikes or walks that they had been a part of, representing that this mentality is a strong part of CAO's welcoming and inclusive standard of operation.

Having Something for Everyone. The final sub-theme is that CAO achieves its impacts by ensuring they have events to fit everyone's interests. Whether it is within one program targeted at people of all ages, or different programs for different ages, they do their best to include events for everyone. As one interviewees said:

I'm not going to Jedi trails, but I'm definitely using like NatureRx, 100 miles 100 days, um. Anyways, so it's like a wide net that they are casting.

Interviewees described the many different age groups and interests that CAO programs are designed for including young children, older youth, teens, older adults, multigenerational families, those who like outdoor recreation, fans of Star Wars or Harry Potter, people looking to build connections, those who like going outside in winter, those who do not like going outside in winter, and so on. One participant explained that when looking through a list of CAO events, she understands that some are for her, and some are for other people, and that is okay.

CAO People & Their Values

The people we interviewed emphasized that it really is the people leading, working, and volunteering at CAO that make the impacts possible. While the examples are diverse, this theme emphasizes the characteristics of those involved, their willingness to consistently show up and work hard, and their ability to access and utilize resources in an efficient manner. As one interviewee said:

[Pronoun] makes such a strong effort to be out in the community and be known by everyone and be really approachable. And [pronoun] always has that sort of like, has that innate, playful nature that people want to engage with. And [pronoun] really brings that to Come Alive Outside. And I think a lot of people who come out to our programs come to see [same CAO staff member].

Other interviewees discussed how the people's connections, ideas, and values really influence CAO's work. As can be seen throughout many of the themes, the values of community, inclusion, and being willing to move forward and work with what you have that demonstrate

how the values of the people involved are acted on and carried out, helping their impacts to be realized.

CAO Programming & Its Embedded Strategies

Throughout our interviews, participants named a diverse array of CAO's activities, events, and programming, describing how each one led to one or more outcomes. More heavily mentioned programs include a youth adventure passport, seasonal or yearly events (e.g., Winterfest, Jedi Trails, Whoopie Pie Fest), walks (e.g., Mile-a-day, themed group walks), and NatureRx. One interviewee described two of their events:

Like even the Touch Grass Tuesday or the Mostly True Urban Legend Walks. Those are fabulous, and people love to come out when there's like a thing. It's not just like, oh, let's go on a walk. It's like, no, I'm going to take you on this walk and tell you about the Rutland human-faced bat, or whatever that one is.

However, maybe more important than the programs themselves, interviewees described the components of the programs that they felt were leading to successful outcomes. We synthesized those components across programs and found these strategies to be the most salient in making an impact:

- Building interpersonal connection
- Getting people out & active
- Health education & motivational support
- Incentives
- Silly, fun, creative programming

Multiple interviewees discussed how these components, especially when used in conjunction, combine to lead towards positive outcomes.

Collaborative Community Systems Approach

Across this theme, participants emphasized how CAO prioritizes a highly collaborative and partnership-driven work process. They discussed how CAO leadership places high value on community collaboration and the effort they spend building and maintaining those partnerships. Further, they emphasized CAO's ability and willingness to listen to partners and community members, evaluate their own efforts, and adapt to better support community needs. An interviewee who was involved towards the beginning of CAO's work in Rutland described it this way:

So the goal there was to kind of get, you know, school partners, healthcare partners in the community, public health partners in the community, as well as business leaders in the community, to be working together on this common program that was getting kids outside, and so that we were sort of activating people from different sectors around that common mission, if that makes sense.

This collaborative mentality allows CAO to achieve impacts by galvanizing individuals, organizations, businesses, and government entities around a common goal. One interviewee discussed that even if certain people or organizations may not agree on some issues, if you find the right topic or goal, such as getting youth outside or improving the health and well-being of the community, even folks who disagree will come together to support those efforts. The leadership of CAO has been instrumental in building those collaborative systems in the city and surrounding area.

Promotion & Outreach

While this is the least mentioned theme, interviewees discussed that CAO is able to produce impacts because of their efforts promoting their events and conducting community outreach. They explained this via examples such as putting a lot of effort into the delivery of their message, building relationships, and getting out into the community to speak at schools and

community groups. They also tap into local lore and interests to increase engagement, such as having a bigfoot mascot. One interviewee also explained how it is not just about the message itself, but about the delivery of the message:

You know, the message is important, but the delivery of the message and the excitement, enthusiasm that you bring with the messaging.

What About Rutland's Context Has Supported CAO's Success & Impacts

We asked interviewees why CAO has been able to build strong and impactful programming in this specific community when they were less successful in these efforts in other locations. What was it about this area that has supported their success? As participants answered these questions, their responses were less about specific characteristics of the location itself, but rather about how characteristics of CAO aligned with the values and characteristics that existed in the area. In other words, we asked about the location and community, but their responses continued to center around CAO, despite prompting. Some context about the community itself was mingled throughout their answers. Therefore, our themes center around how CAO worked to align itself and its work within the context of the area, as can be seen through our in-text descriptions. Specifically, our analysis led to six distinct themes: *CAO Leadership, Their Connections, & Their Hard Work*; *Community Driven Work*; *Creativity*; *Leverage of Funding & Grants*; *Culture of Community Partnerships & Showing Up*; *Timing*. The themes and their descriptions can be seen in Table 10, along with an example quote.

Table 10. The six themes demonstrate the alignment of context between CAO and Rutland that have helped create positive outcomes and allowed the programming to thrive.

Alignment with Context		
Theme	Description	Quote
CAO Leadership, Their Connections, & Their Hard Work	Interviewees often brought up the people involved with CAO, the relationships and opportunities that these	<i>But, you know, I think that that helped it get, you know, having those strong personalities that are, you know, widely known, I think</i>

	individuals brought to the table, and a willingness to put in the work necessary.	<i>made it much more acceptable to start with and take hold faster than maybe it would have if just sort of strangers that come into town, you know, and started it.</i>
Community Driven Work	Interviewees continued to highlight that CAO crowd sourced information and ideas from the community. For example, rather than CAO creating programming that they thought the community needed, they asked the community what they needed.	<i>And I think that our programs are going to continuously need to shift to like, meet the needs and the interests and trends of what's happening around.</i>
Creativity	CAO is willing to not play it too safe but do things that are a little weird to grab folks' attention and work collaboratively with others to find creative solutions to community challenges.	<i>And my suggestion to them was, after 10 years of doing this in Rutland, some of the things that have worked the best for us was not playing it safe. Yeah, doing weird shit, like rolling grass out in the middle of a city, right? Or having an 1,100 pound whoopie pie brought through downtown on a front-end loader.</i>
Leveraging of Funding & Grants	The financial connections and ingenuity of CAO's leaders, their ability to find and receive grants, and their creativity to adapt to meet a grant's requirements lead to overall financial acumen.	<i>And the importance of mental health, the importance of the outdoors was just again, we got funding for it. You get, I mean, you, you had the monies. I think that was probably a really big part was there was the money for it.</i>
Culture of Community Partnerships and Showing Up	The city's existing community-oriented mindset works well combined with a willingness to tackle problems collaboratively on the part of CAO, other community organizations, and community members. Additionally, the reciprocal mentality that any work we do for the community will come back and support us tenfold in the future was highlighted by an internal CAO interviewee.	<i>I haven't really lived for long periods of time in other communities, so it's hard for me to compare, but I have family members that live in other communities that just don't have that same kind of camaraderie.</i>

Timing	The timing of CAO's inception in the community may in part have led to its initial success. Interviewees highlighted how CAO's launch overlapped with a city-led rebranding campaign. Additionally their appropriate use of timing is demonstrated by their willingness to patiently fit their efforts into the community where and when it is appropriate.	<i>So I think it just hit it that perfect time, and it was so unique.</i>
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CAO Leadership, Their Connections, & Their Hard Work

Almost all interviewees described that the people involved with CAO are the reason for the organization's success in the area. They believe the leadership, their personal characteristics (e.g., not being pretentious), and their connections and social capital were the keys to making a difference. An interviewee explained one way in which the people in leadership roles are important:

...You need someone who can connect with people in a very personal way. [CAO internal member] is certainly that person, and [they] can go out and make you feel good about supporting them and being involved in coming to their events.

Other factors that have shaped CAO's ability to be successful in the area are their hard work, strategic planning, and relationship building. They continue to put time and attention towards events that establish presence, create recognition, and connect with the community along with demonstrating how these efforts are creating a measurable difference.

Community Driven Work

We found that CAO uses a very community-centered and participatory approach to their work, which aligns with how the city itself operates as a community. Instead of deciding what

they think will best meet the needs of the community, they include community members in the process of identifying of a need, strategizing how to best support this need, and continuing to follow the trends and interests of the community. While many interviewees discussed these ideas, one described:

I think that they're really great at soliciting feedback and information. Like they don't work in a vacuum. You know, they really listen to the community, they engage the participants that they serve. You know, I think that it's community led. I don't think it's like Come Alive Outside led.

In sum, CAO recognizes that they are a part of a community and work to ensure that they continue to respond appropriately to best serve others through an iterative and participatory process.

Creativity

Interviewees expressed that one of the reasons for CAO's success and impact on the community was the creativity they use in all aspects of their work. Their programs are simultaneously silly and simple. They think outside the box, do things a little differently, and are willing to be creative with their programming. For example, closing the main street to create a sledding hill or hosting Star Wars themed nature trail walks.

They also work collaboratively with other organizations or sectors within the community to creatively address problems. Sometimes creativity is the solution itself, while other times it is creativity that brings people to the table. As one interviewee explained, CAO wanted to host a town hall with their partners, but thought it would be boring. So they used the theme of a "potato party" to create fun and reinforce follow-through. The interviewee described:

And then her thought was, well, like, if you signed up to bring sour cream, you're not gonna bail on sour cream. And if I call it a party, it's not a stuffy community meeting - it's a potato party! Who's not going to want to come to a potato party?!

And yet what is interesting about their creativity is that it aligns within the community's existing culture, traditions, and norms, which interviewees described as highly important to residents.

They were able to fit in and create excitement without causing a stir.

Leveraging of Funding & Grants

Another factor leading to CAO's success is financial acumen. Especially at the beginning, this community was where they were finding money for fundraising and donations through the work and connections of the leadership team. As one interviewee internal to CAO noted:

So I went back to the group and said, hey, the hospital's all in. They want to do XYZ. They're, here, here's a form to fill out for the [grant name]. And it's \$100,000 you know? And we were an organization that was no more than \$25,000. So the fact that we just grew by 400% was like...

They have also succeeded in applying for diverse grants, adapting and leveraging their programming to follow funding (i.e., in the public health sector) while still staying true to their mission. They also provide high quality outcomes, creating a name for themselves among grantors as a dependable organization to fund.

Interviewees identified another reason for their funding success has been due to the amount of unmet need that the local area has to fill, demonstrating alignment between the context and the organization. Participants' discussions highlighted diverse needs, but centered around community members well-being struggles, such as low rates of health behaviors, widespread drug use, youth without much parental support, and an overall sense that the city needed programs to help fill these gaps.

Culture of Community Partnerships and Showing Up

Interviewees stressed one of the primary reasons for CAO's success in this location was the community-oriented mindset of both CAO and the community itself. They discussed how

diverse organizations within the community are working towards similar goals, collaborating with each other, and having strong relationships to be able to bring positive outcomes to the community. As one interviewee put it:

Like, it's an interesting if you're an outsider looking in, you might say like, well, politically, we do with things, things that are a lot different from the rest of the state sometimes. And sometimes we have infighting over things that you think would be no-brainers. But people really, then, even from opposite sides of the spectrum, will come together for something that's like, oh, that's good for kids and that's positive for the community.

Another contextual factor that has led to the positive outcomes and success of CAO is the community-minded mentality of residents. Interviewees highlighted over and over that residents are willing to show up to events. This community-focused mentality was called unique and dissimilar to other places interviewees have lived, which one interviewee named as a contextual factor behind CAO's success. This idea was taken a step further through CAO's mentality that showing up for your neighbors will in turn support you as well. In the words of someone internal to CAO:

Knowing that any support you provide to your community will come back to you tenfold.

An additional contextual factor that interviewees discussed as influencing this ethos of connection and collaboration is the city's size. It is a small, mostly walkable community where you can drive anywhere in five minutes, and everybody knows everyone. In other words, its size allows you access to others and community connections foster cross-pollination.

Timing

Interviewees discussed that the timing of CAO's inception in this particular location may have supported its initial success. As they were beginning their efforts, the city was in the process of rebranding to promote community pride and tourism. These efforts overlapped, creating additional momentum.

Additionally, the timing of the COVID-19 pandemic may have provided influence, especially when combined with the other health and well-being challenges the area was facing. For example, as the city was grappling with drug addiction and large unhoused populations, CAO's efforts were coinciding with a community looking for support and answers. One interviewee believes this timing was their primary reason for success:

I'd say number one is their timing. I think them landing here and COVID. I think everybody was looking for that connection.

Other timing factors that interviewees discussed were the current executive director's willingness to be patient, and bide her time to respect previously established relationships, build new relationships, and wait until the community was ready, rather than pushing things through on her schedule. Her patience and willingness to spend time led to increased trust and better outcomes.

Discussion

We qualitatively explored how CAO, a small, non-profit organization with a mission to get people outside to support their well-being, has impacted their city and its residents in a small town in Vermont. Results found that community members, community partners, and individuals internal to the organization perceived CAO's impacts to be meaningful and diverse, often supporting outcomes prioritized by public health institutions.

Our analyses clearly indicate not only that this type of organization can provide positive outcomes for the health and well-being of individuals within the community, but also that their impacts may reach beyond what nature and well-being research commonly explores. In addition to the more typically researched well-being outcomes (i.e., physical, mental and emotional, and

social), some of our findings point toward community-wide outcomes (e.g., sense of community, economic benefits, community pride).

To provide these impacts, the organization relied on creative programming, a collaborative mentality, an emphasis on inclusion, and values-driven leadership, among other strategies. Contextual factors also influenced their ability to achieve these outcomes, including their ability to effectively leverage grants and the community's willingness to show up to support events and initiatives. We explore how these findings contribute to wider discussions about nature and well-being and what they mean for both research and practice in this field.

Well-being Outcomes Across Scales and Sectors

Our results show a complex system of benefits that a nature-based organization can have across a community. It is important to note that we examined organization-wide benefits, not outcomes of a specific nature-based program. We observed benefits at different scales from individual (e.g., improved mental and physical health) to community (e.g., increased social well-being) to city (e.g., community development). While research in the nature and well-being field most commonly focuses on individual outcomes, more evidence is emerging for pro-social outcomes (Goldy & Piff, 2020) and broader community level outcomes, such as neighborhood attachment and social cohesion (Hume et al., 2022).

While aligned with previous findings, our results represent a less commonly studied perspective for research in the field as we work to understand the scope of well-being outcomes that can be achieved through the work of nature-based organizations. In addition to benefits at multiple scales, the outcomes we found were associated with a variety of sectors or industries (e.g., economy, healthcare, agriculture). Figure 11 illustrates how interviewees perceived impacts across sectors, such as public health, outdoor recreation, and advocacy work. With much of the

work in the field of nature and well-being occurring at the individual scale, we encourage researchers to contemplate what outcomes may be occurring outside of this scope and explore the interactions between impacts at various scales.

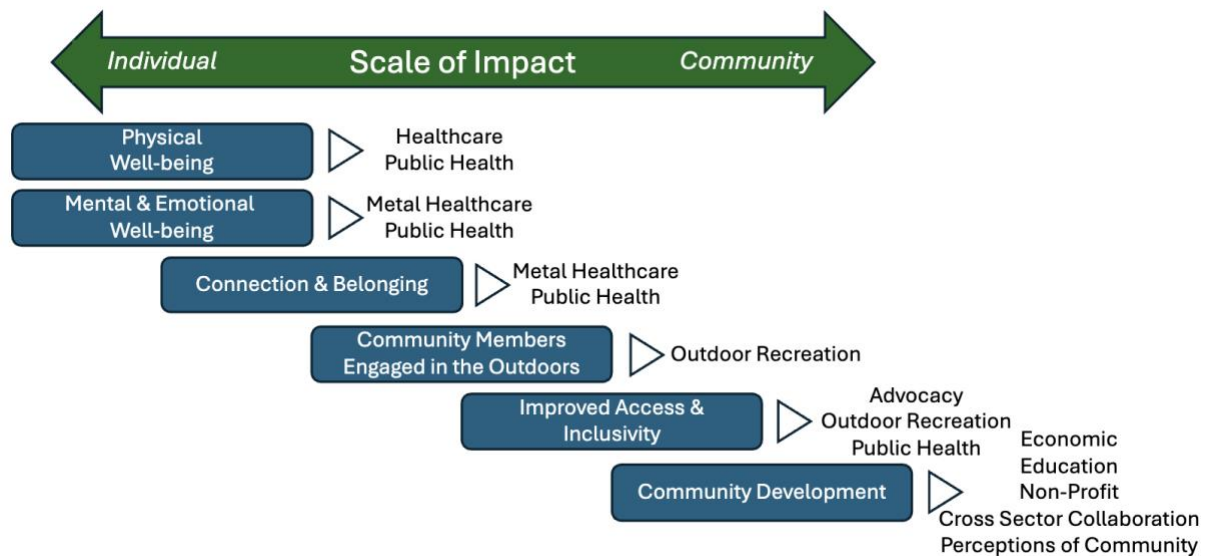


Figure 11. A model of the well-being outcomes presented in our results broken down by scale and sector.

Interconnected Well-being Outcomes

Our results also demonstrate how a nature-based organization can provide benefits that are potentially connected to and influencing one another. For example, an individual who is spending more time outside will probably see improvements in their mental health, which may simultaneously lead to increased social well-being, and increased connections with others in the community (Arbuthnott, 2023; Barragan-Jason et al., 2023; Goldy & Piff, 2020). Understanding these types of cascading connections between variables is less common in the literature.

Researchers are more often working to break down the elements of nature and well-being relationships into individual units that can be measured in a small-scale, linear way without the interference of context (i.e., in a vacuum). However, practitioners are working to create change

within a much more complex interconnected system, creating limitations for translating existing literature into meaningful applied outcomes.

Our research aligns with literature that calls attention to this disconnect between research and the real-world, and the limitations of current nature and well-being models (Robinson et al., 2024; van Bekkum et al., 2026). More specifically, we observed how one initiative or strategy could lead to both individual and community-wide outcomes and, further, that the first well-being outcome can then lead to a secondary well-being outcome. For example, by creating inclusive and welcoming spaces outdoors (a strategy), individuals are having increased feelings of connection and belonging (an outcome) which then can lead to more community members spending time outside together (another outcome).

Such complex understandings of interventions are common in the healthcare practice, where formal theory of change diagrams are used to articulate connections between strategies, outcomes, and broader impacts (Breuer et al., 2016). One way for research to better speak to the complex reality of practice, is to articulate their work within the broader picture of theory of change models. For practice, we encourage continued use of existing literature to demonstrate connections between linkages within theory of change models and pay attention to the limits of the research, such as its relevance to a specific context.

Through our expansive, qualitative inquiry, we have begun to conceptualize how interconnected the outcomes, strategies, and context-specific factors related to nature-based organizations can be. To demonstrate, we created a conceptual map to highlight the perceived relationships between these three types of constructs (see Figure 12). The complexity of the linkages between constructs can be seen in how some contextual factors influence CAO directly (e.g., timing) while others sit between the organization and the outcomes (e.g., creativity). While

further research is needed to establish these relationships, our results demonstrate the need for theory of change type inquiry into nature and well-being variables. This would provide increased empirical understanding of how variables fit within a scenario or context and provide practitioners a more well-rounded road map of what strategies to choose based on the outcomes they are striving for.

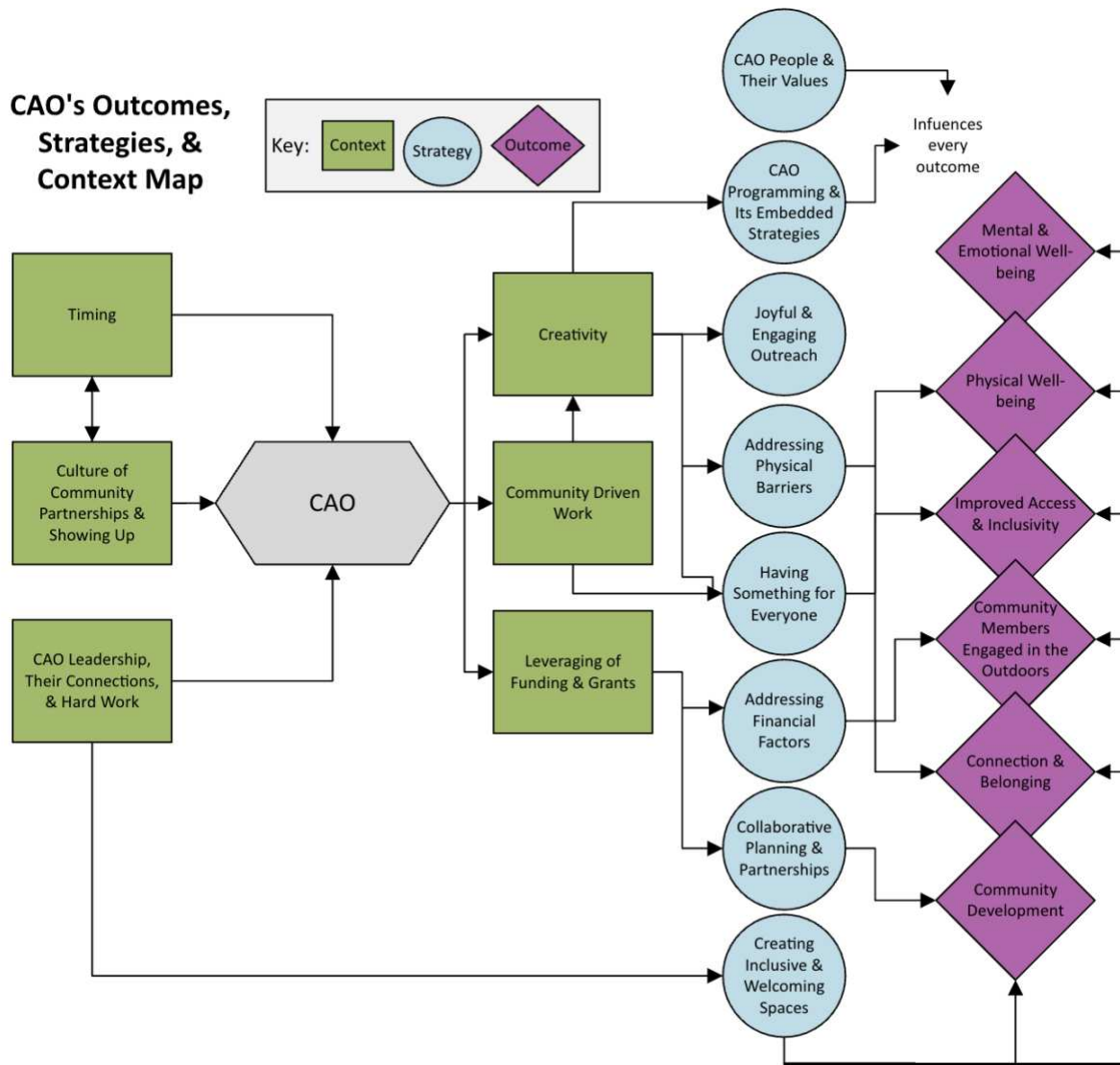


Figure 12. A model interpreting the interconnections between CAO's perceived outcomes (purple), strategies (blue), and context (green). The outcomes (purple) are overlapping to represent their potential influence on each other.

Collaborative Systems Approach

When we asked interviewees how or why they believed CAO was achieving well-being outcomes, sometimes they discussed a specific nature-based program, but they were much more likely to name a strategy used by CAO. Some strategies interviewees mentioned were embedded within CAO programming and not solely about exposing people to nature. For example, creatively theming events or utilizing incentives to encourage continued participation. Further, our results highlight the importance of a systems approach to addressing well-being through outdoor recreation and public health lenses. Interviewees repeatedly articulated that CAO viewed the community as a system and understood their role within that system. One interviewee used the analogy of a puzzle, describing how each piece (or organization) had its own role that fit together with the other pieces, all working together to create a larger image (e.g., working towards a goal or solving a challenge). Tangible representations of this can be seen in CAO's relationships with the local public health department and hospital, through which they collectively design programs to support the health of community members, without duplicating the efforts of the other organizations. Other examples can be seen in CAO's partnerships with non-profits and advocacy groups, combining skills and resources to create initiatives that promote each organizations' goals simultaneously. This recognition of knowing what your organization is, but also what your organization is not, has been found as beneficial for resilient collaboration (Taylor et al., 2023).

Overall, impacts across scales and sectors, interconnected well-being outcomes, and a collaborative community approach mirror what researchers often refer to as systems thinking. This concept has been included in scientific literature for decades (Hammond, 2011) and is spread across diverse scientific disciplines (Monat & Gannon, 2015; York et al., 2019). Systems

thinking aims to understand complex systems and their behavior, or how they operate create solutions for complicated, real-world challenges (Carey et al., 2015; Hammond, 2011; Lich et al., 2013; Morgan et al., 2024). In public health specifically, a systems approach can help decipher the complex factors that contribute to well-being and finding creative solutions to address public health challenges across scales and sectors (Carey et al., 2015; Morgan et al., 2024). Using the puzzle analogy, a systems approach helps to identify and connect the puzzle pieces necessary to learn about and solve problems. Our results demonstrate that CAO is incorporating systems thinking as they use nature-based programs to improve well-being in their community. While systems thinking is emerging more in the nature and well-being literature (e.g., Marselle et al., 2021) we are not aware of information documenting how novel it is for practitioner organizations in the field.

Inclusion & Access in the Outdoors

While nature and well-being scholarship often highlights outdoor time as beneficial for health, it can also carry unexamined assumptions rooted in privilege and exclusion (S. Johnson et al., 2025; Rigby et al., 2020; Winkler et al., 2024; Winter et al., 2019; Wittmann & Garrity, 2025). Our results emphasized how the accessibility and approachability of a nature-based organization's programming can influence community members' interest in spending time outside and putting effort towards improving their well-being. Examples of programs that supported these outcomes include body-inclusive outdoor yoga, free kayaking, and creating a borrow-what-you-need outdoor gear closet. However, interviewees also discussed the welcoming nature of CAO, demonstrating that it is not just about accessible programming, but also the approach of those running the programming matters.

Further, when we think of spending time in nature, we typically think of traditional outdoor activities such as hiking, fishing, gardening, skiing, etc. However, previous literature explains how this can be born out of western, whitewashed, exclusionary ideas. In other words, how we define nature can vary by culture (Carter & Rose, 2024; Dashper & King, 2022; Ho & Chang, 2022), and therefore, spending time “in nature” can look very different for people from varied backgrounds. Within these socially constructed ideas of nature and what it means to spend time outside, nature does not need to be considered something ‘out there’ but rather can be found within the spaces we inhabit every day (Cronon, 1996; Hartig et al., 2014). Current literature supports many examples of outcomes that can be received from nearby or indoor nature such as trees in urban areas (Wolf et al., 2020), houseplants in offices or classrooms (Ma, 2022), looking at nature images (McDonnell et al., 2025), and simply noticing whatever nature is around you (Passmore et al., 2025). Other findings suggest that our perception of the wildness of nature (Samus et al., 2022) and our sense of connection to nature can influence well-being outcomes (Pritchard et al., 2020). In other words, the definitions of nature that we use impact our well-being outcomes.

Our results demonstrate how one organization can work fluidly within a range of nature definitions, which they accomplish by specifically emphasizing creativity and openness. For example, because taking a walk on a street in a town falls within some individuals’ definitions of nature, CAO facilitates ‘Mostly True Urban Legend’ walks to get those individuals out and walking in the fresh air. However, they also lead hikes in more rural areas and supply camping gear for those who prefer those types of nature. Interviewees consistently discussed how CAO efforts toward equity, inclusion, and access were a vital strategy toward their impacts in the community.

Implications for Future Research and Practice

Our findings provide some crucial takeaways for implementation. For research, we recognize the need to move away from solely understanding how spending time in nature might lead to health benefits and move towards understanding the context of these programs with more nuance and the relationships between outcomes with more clarity. We recognize the methodological challenges this creates for researchers, but we encourage collaborative projects that think creatively and expansively about these topics. Systematic reviews and theoretical papers have begun to help these efforts. Barragan-Jason et al. (2023) reviewed meta-analyses and presented a model of the connections between nature exposure, nature connectedness, human well-being, and environmental well-being. Tamlyn et al. (manuscript in preparation) take it a step further to highlight the potential for feedback loops within these relationships. And Marselle et al. (2021) provide a novel model that incorporates a higher level of systems thinking than traditional nature and health models (i.e. attention restoration or stress recovery theories). We encourage research that continues this line of inquiry and results in literature that reflects the lived experiences of individuals and is useful for applying to practice.

Our findings highlight how the impacts of nature-based programming may reach beyond what we might typically think of as well-being outcomes. Therefore, evaluating the impacts of practitioner programs could be a good first step in conceptualizing the diversity and scale of the impacts they are achieving. For example, programs primarily focused on health outcomes might not be aware of the social or outdoor recreation sector impacts that are also occurring. For practitioners, using a systems thinking mindset to understand their role in the community and creating partnerships with other organizations may not only support their own work, but

positively influence the broader community. Collaborations open possibilities for extended reach or impact and new funding opportunities.

Broadly, our results show the importance of moving beyond simply measuring health comes at the individual scale to understand how nature-based organizations are having impacts across scales and sectors. Our results demonstrate that the strategies used by nature-based organizations may have their own impacts, separate from the nature-based impacts. For example, the ways in which we facilitate a person's experience in nature may also be creating benefits, which is an area of nature and well-being research that remains under examined. It is crucial for those in research and practice to understand that while physical and geographically accessible policies are important, so too are the ways in which these nature-based programming is facilitated (i.e. demeanor and attitude of staff). We encourage both researchers and practitioners to lean into diverse relationships with nature and consider programs that account for diverse experiences, social identities, and forms of nature connection.

Limitations

We studied one nature-based organization in one specific city that has its own unique context. Because of this, our findings may not be generalizable to other organizations, cities, or contexts. While we tried to remain constantly aware of our own biases, we are researchers trained in western science, which influences our understanding of nature, well-being, and our interpretation of participants' perspectives. Throughout our data collection, interviewees expressed extremely high regard for CAO and their programming, despite prompting that they could confidentially share negative opinions that they held, if they had any. We recognize that our sample may not have been fully representative of the population of the community,

especially considering that 59% of our interviewees identified as women. While our sample was 82% white, this is lower than the local population that is 96% white.

Conclusion

We qualitatively examined Come Alive Outside, a nature-based non-profit in Vermont (USA), to understand the outcomes of their programming, what strategies they used to achieve those outcomes, and how the local context influenced their work. We found a diverse array of benefits from individual (e.g., improved mental and physical health) to community (e.g., increased sense of belonging) to city-wide (e.g., economic development). Interviewees perceived that CAO was achieving these benefits through specific programming strategies, addressing access and inclusion, harnessing creativity, joyful outreach, and their use of strong partnerships. While some contextual factors such as the community's collaborative mentality influenced these outcomes, our findings highlight strategic factors within the organization itself that led to their success, such as practicing community driven work, effectively leveraging funding, and prioritizing creativity.

Our results demonstrate that while getting outdoors is CAO's founding mission, their impact stretches far beyond what we typically consider to be nature and well-being outcomes. Additionally, our findings align with needs that have been previously identified in the outdoor space – inclusion, access, and a broader understanding of conceptualizations of nature. For practitioners, we recommend expansive and inclusive definitions of nature, physically and financially accessible programming, and emotionally welcoming and inclusive program facilitators. These recommendations apply to research as well, ensuring continued focus on projects prioritizing comprehensive definitions and broad understandings of these concepts. We

suggest increased research examining how unique, context specific nature-based programs compare to programs that are more traditionally studied in nature and well-being research.

CHAPTER 5: CONCLUSION

Overview of Findings

As our world is faced with numerous challenges to both human and environmental well-being, we find ourselves in a time where diverse strategies and solutions are needed. Connecting, or reconnecting, with nature is continually emerging as a viable option to create positive outcomes for collective human and environmental well-being. This dissertation adds to the literature by demonstrating the role nature-based organizations can play in creating these outcomes, especially through helping individuals feel connected to the nature surrounding them. Further, it highlights how collaboration, whether between researchers and practitioners or practitioners and other organizations within their community, can play a vital role in these efforts. Despite what is currently known about these concepts, this dissertation also demonstrates that we still have large gaps in our understanding in the field of nature and well-being. I discuss several places where continued research and learning are necessary, such as the use and efficacy of app-based NBIs and the impacts of nature-based organizations on communities. However, I do not see this learning as a one-sided process where researchers gather information and disseminate it. Rather, it is an opportunity to foster collaboration and mutual learning for people on both sides of research and practice as we work to meet the coupled human and environmental well-being challenges of today.

While I undertook the projects within this dissertation with the assumption that collaboration is important, it emerged as a much stronger theme throughout my manuscripts than I anticipated, presenting the case for continued exploration and implementation. Researchers and practitioners both viewed collaboration as crucial to bridging the gap between research and practice. On the one hand, this means ensuring that the

information gathered via research is effectively used to create positive change for communities, organizations, and individuals. On the other hand, this means designing research projects that are based on questions relevant to current practice while simultaneously using samples that are representative of the audiences that practitioners are working with.

Further, through my collaboration with a practitioner organization, I saw the need for bridging the gap between research and practice within my own data. So often science portrays cause and effect through a narrow, linear view with one variable, or maybe two, influencing one outcome. However, I observed the interconnected relationships of variables, outcomes, and context that a nature-based organization can have. I also observed how outcomes can be spread across sectors and scales. Therefore, we need research projects and theories that acknowledge and work within these multiscalar and interrelated variables. These findings highlight the varied ways that collaborative research projects could play a role in improving not just our understanding of these concepts, but in building more complex theories. Current theories explaining the mechanisms behind nature's impacts on well-being (i.e. ART, SRT), fall into the scientific trap of narrow, linear causes and effects. While these are valuable in certain scenarios, to create real-world change we need to understand the outcomes of real-world organizations. Marselle et al (2021) have put forth a model that begins to encapsulate the complexity of nature's well-being outcomes, such as through the acknowledgement that socio-cultural factors and individual characteristics influence outcomes. While this is moving in a positive direction, there is still a large amount of research and theory development needed in this area of understanding. For example, their model specifically focuses on the well-being impacts of biodiversity while also clumping all contextual and individual characteristics together.

Collaborative projects where researchers analyze on-the-ground projects could play an important role in supporting these efforts.

In addition to implications for research, this dissertation also presents the importance of collaboration within and between practitioner organizations. My findings from the exploratory qualitative project with CAO present that their strategies and outcomes alike are influenced by their ability to work with partner organizations. As a nature-based organization, they were able to achieve their impacts on their participants through collaborative efforts, such as partnerships with health care organizations, other nonprofits, or local governmental organizations. However, it is not one-off collaborations that make a difference, rather building collaborative community systems that can continue to work together to make progress towards their goals without duplicating efforts.

My results also demonstrate that for both research and practice, collaboration requires an array of skills and significant effort. More specifically, navigating funding and logistics (manuscript 1), relationship building (manuscripts 1 & 3), personal capacity and effort (manuscripts 1 & 3), thinking outside the box (manuscript 1), and creativity (manuscripts 3). Creativity was highlighted as a strategy for creating research collaborations that create projects outside the traditional narrow, linear mechanistic pathways for nature and well-being. Creativity is also an impactful strategy for fun, inclusive nature-based intervention programming that makes people actually want to attend, keeps coming back, and therefore improves their well-being. This creativity also leads nature-based organizations to increase the access and inclusion of their programs. For example, finding ways to bring programming to the populations that need it most, or helping people to meet their basic needs while also helping them experience nature (e.g., by providing food or transportation). Across manuscripts, this

dissertation emphasizes the importance of creativity throughout the field of nature and well-being and how it is valuable for collaborative projects.

Similarly, the qualitative manuscripts within this dissertation called attention to the importance of, need for, and efficacy of inclusion and accessibility within nature and well-being work. In manuscript 1, researchers and practitioners alike described the varied ways that the structures of western science, narrow definitions of nature, or lack of diverse research samples infringe on the field's capacity. While manuscript 1 demonstrated how research is often focused on white, English speaking participants with a specific conceptualization of nature and traditional nature-based activities, manuscript 3 demonstrated an organization's creative strategies to break outside of this mold. For example, working to have programming for those with physical differences or mobility challenges and utilizing diverse definitions of nature within their programming.

Research is also taking steps to address access and inclusion in the field of nature and well-being, although more efforts are needed. Technology use in nature-based interventions may be able to increase access to programming. I assessed the outcomes of a novel, app-based nature intervention that participants can use to engage with nature programming on their own time and, often, in their own spaces. This exact style of nature-based intervention has not previously been documented in the literature, although one other similar intervention has been published (McEwan et al., 2019). Although we had limited findings in regards to the efficacy of the intervention, we did demonstrate the importance of nature connectedness in the nature – well-being relationship. These results align with previous literature demonstrating the importance of feeling connected with nature to improve well-being and increase pro-environmental behavior (Barragan-Jason et al., 2022; 2023). Despite these outcomes, more research is needed to fully

grasp the interconnected relationships between these variables. However, based on what we know, we encourage practitioners to include strategies to improve nature connectedness within their programs, especially if they are looking to improve subjective well-being.

Based on the above summary, my findings demonstrate the following key takeaways for research and practice.

For research:

- Work to build collaborative relationships with practitioners
- Incorporate context, complex relationships between variables, and outcomes across scales and sectors within research designs
- Create theories for nature and well-being outcomes that better explain the complexity of real-world, nature-based interventions and nature-based organizations as a whole
- Study app-based nature interventions
- Include nature connectedness as a variable with projects that primarily focus on nature exposure
- Embrace creativity, both as a way to break outside of the typical narrow, linear view of science and also to more effectively collaborate with practitioners
- Prioritize access & inclusion through definitions of nature, participant samples, and other areas of research that feel appropriate
- Work to expand our collective understanding of nature, the benefits that nature can help provide, the contextual factors that influence these benefits, and the relationships between the benefits themselves

For practice:

- Work to build collaborative relationships with researchers

- Emphasize creativity, access, and inclusion as core tenets of programs in ways that uniquely work for each organization
- Think about the access and inclusion barriers that might be present for participants, and creatively and wholistically work to overcome them
- Be sure to utilize conceptualize a broad definition of nature, then use a definition that fits with your audience and creatively design programs that fall within that definition
- Work to build collaborations with other organizations across sectors that help work towards collective well-being goals
- Recognize the benefits that programs are providing that fall outside of intended outcomes and how these outcomes might relate to each other
- Prioritize nature connectedness as a variable throughout programming, both as a goal and a measurable outcome

Overall, this dissertation adds insight to the nature and well-being field, while simultaneously identifying areas that need further exploration. In closing, I encourage researchers and practitioners alike to emphasize collaboration, creativity, access, inclusion, and nature connectedness throughout their work.

Moving Forward as a Researcher

Throughout the process of this dissertation, I have reflected on how I want to move forward as a researcher. Regarding how to move forward as a researcher. There are countless exciting directions that could stem directly from this project and many more ideas from the field as a whole. However, I am primarily left thinking about the idea of connection and interconnectedness, a concept that presented itself in every research project within this dissertation, albeit in varying ways.

My first manuscript examined collaboration between researchers and practitioners, with the results demonstrating the necessity of the interconnectedness between these two groups to benefit the field. Interviewees also highlighted how building connections between individuals within the field would help to spur collaborative relationships. Further, I found that researchers and practitioners have more in common than we might have expected – they had more themes in common than themes that were unique to each group. For example, both groups were motivated by the thought that collaboration would help to bridge the gap between research and practice and to benefit people while they were discouraged by a lack of funding and the recognition that it is challenging for practitioners to implement research projects.

My second manuscript found increases in feelings of human connection to, or relationship with, nature to be the factor that significantly and positively influenced participant's well-being. Participants that saw the greatest increases in nature connectedness had significant improvements for their subjective well-being. And finally, my third manuscript contained many different versions of connectedness such as the interconnected relationships between the nature-based organization's outcomes and the importance of collaboration between organizations within the community.

Through my work in the field of nature and well-being, I am continually amazed by the similarities and connections that I see across topics, groups, human challenges, and environmental issues. Even though it feels like we are facing new problems, crises, and epidemics in every facet of life on earth, what if their origins as well as the solutions we need to solve them are more interconnected than we realize? While this is most likely an oversimplification based on the ideas currently existing in western academic literature, there is enough evidence to demonstrate that the concept of interconnectedness is worthy of further

exploration, especially in terms of improving human and environmental well-being (e.g., Barragan-Jason et al., 2023; Ebi et al., 2020). I am specifically interested in continuing to explore nature connectedness as a variable of interest throughout various projects and contexts. Further, I'm curious about developing a more wholistic understanding of human and environmental well-being, or our collective well-being. While these ideas are more prevalent in Indigenous ways of knowing, they are not common in western science (Kimmerer, 2013). I'm excited to work on projects that respectfully and appropriately help identify or create strategies that can support this idea of collective well-being.

Throughout my continued research in this area, I am determined to work on applied projects that support the well-being of individuals, communities, and ecosystems in the real-world, while simultaneously contributing to academic research. With that comes collaboration with practitioner partners and efforts to bridge the research-practice gap, which I hope to enact through continued growth and experience as a transdisciplinary researcher. This dissertation has provided an opportunity to build a relationship with a practitioner organization, through the support and guidance of my advisor, helping me learn about the intricacies and responsibilities that this adds to the research process. While one could argue that this adds additional challenge to an already demanding academic career path, I would ask, what better way to solve problems and create impact through your research? What point is there to your work if you don't support (or get to see!) real-world impacts?

With all of this in mind, I still have much to learn as a researcher. I have skills to practice, ideas to develop, and conceptualizations to expand. This dissertation helped me learn and practice mixed methodologies through taking on qualitative and quantitative projects. While I feel confident in my ability to undertake each, I know that I have just scratched the surface with

methods I can use and my efficacy with those methods. I also want to develop as a transdisciplinary researcher, honing my communication, collaboration, and cross-sector/cross-disciplinary thinking skills. I aim to work with researchers and practitioners from diverse ways of knowing, varied backgrounds, unique perspectives, and expansive skillsets. Further, I know that I have more work ahead in the realm of a justice-based research paradigm. I want to focus on projects that work to dismantle inequity and center just futures for both humans and the planet.

Personal Reflection

As I sit here writing this conclusion, my home is under voluntary evacuation order for a nearby wildfire. My bag is packed, and my family and I are ready to leave if needed. This is the second fire so close to my house in four months. Recently, my future sister and brother-in-law's house was lost to a wildfire, along with their whole neighborhood, just a few towns away. Climate change is here. People both in our neighborhood and on the other side of the world are feeling the effects, with many people from smaller, more vulnerable countries disproportionately bearing the brunt. As a researcher, I read studies about the effects of environmental degradation and decreases in human well-being. As a human, I feel them.

When I started graduate school, I could not begin to conceptualize how to choose a topic or design a research project, let alone carry out the tasks necessary to successfully complete it. I just knew that I wanted help fix the problems I was observing in the world. Through my previous job as a wildlife rescue and rehabilitation specialist, I witnessed animals suffering directly because of human action or lack thereof: manatees struck by boat propellers, sea turtles trapped in cold waters due to shifting water temperatures, sand hill cranes hit by cars or golf balls, dolphins and ducklings orphaned and alone. As I slowly realized that all of this suffering

was a human behavior problem, I could no longer sit by and put band-aids on the outcomes – outcomes who were living, breathing beings that deserved better. So I decided to go back to school to study how to change human behavior to support the well-being of wildlife.

For my master's thesis I studied how people's attitudes and values influenced their willingness to plant native plants, which could support pollinators of all kinds and conserve water. But as I took classes, read studies, and examined my own research results, I again had the feeling that putting up signs to convince people to care was a band-aid. There must be a more effective solution. It was around this time that I read *Braiding Sweetgrass*, by Dr. Robin Wall Kimmerer, and some other books describing how spending time in nature could positively influence human well-being. I started to learn from authors and researchers who believed that our challenges may be rooted in the current, widespread disconnect between humans and nature. It was causing our own well-being, and that of the planet, to suffer. These are ideas that Indigenous sciences and different ways of knowing have stood by since time immemorial, but western science and society are just beginning to catch up to.

Last year, I was lucky enough to attend a lecture by Dr. Kimmerer at the Colorado School of Mines. While I hung on every word about responsibility, reciprocity, and the love between humans and the Earth, it was my experience afterward that that left the strongest impression. As my friends and I exited the building and crossed a parking lot, we saw Dr. Kimmerer making her way towards a car. Looking at each other, my friends and I were starstruck, knowing that we needed to act, but not sure what to do or say. Through an unspoken agreement, we settled on expressing gratitude, through random versions of “thank you!” as she passed by. Though she continued walking, she looked right at us, smiled, and said, “now go fix things!” I have never felt so inspired, ready to act, or responsible for doing my part to benefit the collective well-being

of humans and all of our fellow species. Humans are being faced by many challenges, and I am ready to do my part to make change for the better.

Now, as I look back over my graduate school experience, I am overwhelmed by the number of ideas that I have for potential future research projects. I am excited for the opportunity to carry them out, add to the literature, and, hopefully, create real-world change along the way. While I feel far more prepared to tackle these projects than when I first began, I know that this degree is only a small portion of the learning that is yet to come.

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REFERENCES

- Adler, N. E., Cutler, D. M., Fielding, J. E., Galea, S., Glymour, M. M., & Koh, H. K. (2016). *Addressing Social Determinants of Health and Health Disparities: A Vital Direction for Health and Health Care - NAM*. <https://nam.edu/perspectives/addressing-social-determinants-of-health-and-health-disparities-a-vital-direction-for-health-and-health-care/>
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, Theories of Cognitive Self-Regulation*, 50(2), 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
- Alcock, I., White, M. P., Pahl, S., Duarte-Davidson, R., & Fleming, L. E. (2020). Associations between pro-environmental behaviour and neighbourhood nature, nature visit frequency and nature appreciation: Evidence from a nationally representative survey in England. *Environment International*, 136, 105441. <https://doi.org/10.1016/j.envint.2019.105441>
- Alves, F., & Vidal, D. G. (2024). Plural Nature(s): An Overview of Their Sociocultural Construction. *Encyclopedia*, 4(1), Article 1. <https://doi.org/10.3390/encyclopedia4010001>
- Amel, E., Manning, C., Scott, B., & Koger, S. (2017). Beyond the roots of human inaction: Fostering collective effort toward ecosystem conservation. *Science*, 356(6335), 275–279. <https://doi.org/10.1126/science.aal1931>
- Amengual-Moreno, M., Cash-Gibson, L., Vivas, L., Eliana, M., Almazán, A., & Pericàs, J. (2025). Health & nature: A critical review of historical perspectives to support narratives for change. *International Journal for Equity in Health*, 24. <https://doi.org/10.1186/s12939-025-02550-y>

- Amicone, G., Petruccelli, I., De Dominicis, S., Gherardini, A., Costantino, V., Perucchini, P., & Bonaiuto, M. (2018). Green Breaks: The Restorative Effect of the School Environment's Green Areas on Children's Cognitive Performance. *Frontiers in Psychology, 9*, 1579. <https://doi.org/10.3389/fpsyg.2018.01579>
- Antonelli, M., Barbieri, G., & Donelli, D. (2019). Effects of forest bathing (shinrin-yoku) on levels of cortisol as a stress biomarker: A systematic review and meta-analysis. *International Journal of Biometeorology, 63*(8), 1117–1134. <https://doi.org/10.1007/s00484-019-01717-x>
- Arbuthnott, K. D. (2023). Nature exposure and social health: Prosocial behavior, social cohesion, and effect pathways. *Journal of Environmental Psychology, 90*, 102109. <https://doi.org/10.1016/j.jenvp.2023.102109>
- Arola, T., Aulake, M., Ott, A., Lindholm, M., Kouvonen, P., Virtanen, P., & Paloniemi, R. (2023). The impacts of nature connectedness on children's well-being: Systematic literature review. *Journal of Environmental Psychology, 85*, 101913. <https://doi.org/10.1016/j.jenvp.2022.101913>
- Atchley, R. A., Strayer, D. L., & Atchley, P. (2012). Creativity in the Wild: Improving Creative Reasoning through Immersion in Natural Settings. *PLOS ONE, 7*(12), e51474. <https://doi.org/10.1371/journal.pone.0051474>
- Augsburg, T. (2014). Becoming Transdisciplinary: The Emergence of the Transdisciplinary Individual. *World Futures, 70*(3–4), 233–247. <https://doi.org/10.1080/02604027.2014.934639>
- Awoyemi, A. G., Ibáñez-Rueda, N., Guardiola, J., & Ibáñez-Álamo, J. D. (2024). Human-nature interactions in the Afrotropics: Experiential and cognitive connections among urban

- residents in southern Nigeria. *Ecological Economics*, 218, 108105.
<https://doi.org/10.1016/j.ecolecon.2024.108105>
- Axelsson, R. (2010). Integrative Research and Transdisciplinary Knowledge Production: A Review of Barriers and Bridges. *Journal of Landscape Ecology*, 3(2), 14–40.
<https://doi.org/10.2478/v10285-012-0025-0>
- Baceviciene, M., & Jankauskiene, R. (2022). The Mediating Effect of Nature Restorativeness, Stress Level, and Nature Connectedness in the Association between Nature Exposure and Quality of Life. *International Journal of Environmental Research and Public Health*, 19(4), 2098. <https://doi.org/10.3390/ijerph19042098>
- Bardhan, M., Zhang, K., Browning, M. H. E. M., Dong, J., Liu, T., Bailey, C., McAnirlin, O., Hanley, J., Minson, C. T., Mutel, R. L., Ranganathan, S., & Reuben, A. (2023). Time in nature is associated with higher levels of positive mood: Evidence from the 2023 NatureDoseTM student survey. *Journal of Environmental Psychology*, 90, 102083.
<https://doi.org/10.1016/j.jenvp.2023.102083>
- Barnes, M. R., Donahue, M. L., Keeler, B. L., Shorb, C. M., Mohtadi, T. Z., & Shelby, L. J. (2019). Characterizing Nature and Participant Experience in Studies of Nature Exposure for Positive Mental Health: An Integrative Review. *Frontiers in Psychology*, 9, 2617.
<https://doi.org/10.3389/fpsyg.2018.02617>
- Barragan-Jason, G., de Mazancourt, C., Parmesan, C., Singer, M. C., & Loreau, M. (2022). Human–nature connectedness as a pathway to sustainability: A global meta-analysis. *Conservation Letters*, 15(1), e12852. <https://doi.org/10.1111/conl.12852>
- Barragan-Jason, G., Loreau, M., de Mazancourt, C., Singer, M. C., & Parmesan, C. (2023). Psychological and physical connections with nature improve both human well-being and

- nature conservation: A systematic review of meta-analyses. *Biological Conservation*, 277, 109842. <https://doi.org/10.1016/j.biocon.2022.109842>
- Bazeley, P. (2013). *Qualitative Data Analysis: Practical Strategies*. SAGE.
- BEAM: Black Emotional and Mental Health Collective. (2026). BEAM. <https://beam.community/>
- Beery, T., Stahl Olafsson, A., Gentin, S., Maurer, M., Stålhammar, S., Albert, C., Bieling, C., Buijs, A., Fagerholm, N., Garcia-Martin, M., Plieninger, T., & M. Raymond, C. (2023). Disconnection from nature: Expanding our understanding of human–nature relations. *People and Nature*, 5(2), 470–488. <https://doi.org/10.1002/pan3.10451>
- Bettmann, J. E., Anderson, I., Makouske, J., & Hanley, A. (2022). Mental Health Outcomes of Peer-led Therapeutic Adventure for Military Veterans. *Journal of Experiential Education*, 45(3), 295–315. <https://doi.org/10.1177/10538259211049535>
- Bettmann, J. E., Speelman, E., Blumenthal, E., Couch, S., & McArthur, T. (2024). How Does Nature Exposure Affect Adults With Symptoms of Mental Illness? A Meta-Analysis. *International Journal of Mental Health Nursing*, inm.13400. <https://doi.org/10.1111/inm.13400>
- Bommersbach, T. J., McKean, A. J., Olfson, M., & Rhee, T. G. (2023). National Trends in Mental Health–Related Emergency Department Visits Among Youth, 2011-2020. *JAMA*, 329(17), 1469–1477. <https://doi.org/10.1001/jama.2023.4809>
- Bowser, A., Hansen, D., Preece, J., He, Y., Boston, C., & Hammock, J. (2014). Gamifying citizen science: A study of two user groups. *Proceedings of the Companion Publication of the 17th ACM Conference on Computer Supported Cooperative Work & Social Computing*, 137–140. <https://doi.org/10.1145/2556420.2556502>

- Brady, L. M., Fryberg, S. A., & Shoda, Y. (2018). Expanding the interpretive power of psychological science by attending to culture. *Proceedings of the National Academy of Sciences*, *115*(45), 11406–11413. <https://doi.org/10.1073/pnas.1803526115>
- Bratman, G. N., Anderson, C. B., Berman, M. G., Cochran, B., de Vries, S., Flanders, J., Folke, C., Frumkin, H., Gross, J. J., Hartig, T., Kahn, P. H., Kuo, M., Lawler, J. J., Levin, P. S., Lindahl, T., Meyer-Lindenberg, A., Mitchell, R., Ouyang, Z., Roe, J., ... Daily, G. C. (2019). Nature and mental health: An ecosystem service perspective. *Science Advances*, *5*(7), eaax0903. <https://doi.org/10.1126/sciadv.aax0903>
- Bratman, G. N., Olvera-Alvarez, H. A., & Gross, J. J. (2021). The affective benefits of nature exposure. *Social and Personality Psychology Compass*, *15*(8), e12630. <https://doi.org/10.1111/spc3.12630>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. <https://doi.org/10.1191/1478088706qp063oa>
- Breen, L. J., & Darlaston-Jones, D. (2010). Moving beyond the enduring dominance of positivism in psychological research: Implications for psychology in Australia. *Australian Psychologist*, *45*(1), 67–76. <https://doi.org/10.1080/00050060903127481>
- Breuer, E., Lee, L., De Silva, M., & Lund, C. (2016). Using theory of change to design and evaluate public health interventions: A systematic review. *Implementation Science*, *11*(1), 63. <https://doi.org/10.1186/s13012-016-0422-6>
- Browning, M. H. E. M., McAnirlin, O., Pearson, A. L., Corral, A., Bardhan, M., Ouer, G., Morassafar, S., Abdullah, F., Almog, S., Ambarlı, H., Astell-Burt, T., Awoyemi, A. G., Beery, T., Berdejo-Espinola, V., Börger, T., Borja, Á., Brossoit, R. M., Burnett, H., Flint, H. B., ... Maddock, J. E. (2025). *Establishing Consensus on Standardized Survey*

- Measures of Time Outdoors in Nature* (SSRN Scholarly Paper No. 5583864). Social Science Research Network. <https://doi.org/10.2139/ssrn.5583864>
- Bubalo, M., Van Den Broek, K. L., Helbich, M., & Labib, S. M. (2026). *Fostering Mental Health and Pro-Environmental Behaviour through Nature Exposure and Nature Connectedness—An Umbrella Review* (SSRN Scholarly Paper No. 6292601). Social Science Research Network. <https://doi.org/10.2139/ssrn.6292601>
- Buckley, R., Zhong, L., & Cooper, M.-A. (2022). Mental health and nature: More implementation research needed. *Nature*, 612(7938), 33. <https://doi.org/10.1038/d41586-022-04135-z>
- Burn, S. M. (1991). Social Psychology and the Stimulation of Recycling Behaviors: The Block Leader Approach. *Journal of Applied Social Psychology*, 21(8), 611–629. <https://doi.org/10.1111/j.1559-1816.1991.tb00539.x>
- Busetto, L., Wick, W., & Gumbinger, C. (2020). How to use and assess qualitative research methods. *Neurological Research and Practice*, 2(1), 14. <https://doi.org/10.1186/s42466-020-00059-z>
- Bustos, T. E., Simkani, S., Sridhar, A., & Drahota, A. (2024). “Good Solid Relationships Make Programs Work”: A Mixed Methods Assessment of Determinants to Community Research Partnerships in Flint, MI. *Collaborations: A Journal of Community-Based Research and Practice*, 7(1). <https://doi.org/10.33596/coll.123>
- Capaldi, C. A., Passmore, H.-A., Ishii, R., Chistopolskaya, K. A., Vowinckel, J., Nikolaev, E. L., & Semikin, G. I. (2017). Engaging with Natural Beauty May Be Related to Well-Being Because It Connects People to Nature: Evidence from Three Cultures. *Ecopsychology*, 9(4), 199–211. <https://doi.org/10.1089/eco.2017.0008>

- Carey, G., Malbon, E., Carey, N., Joyce, A., Crammond, B., & Carey, A. (2015). *Systems science and systems thinking for public health: A systematic review of the field*.
<https://doi.org/10.1136/bmjopen-2015-009002>
- Carter, D. P., & Rose, J. N. (2024). Access for whom? White environmentalism, recreational colonization, and civic recreation racialization. *Administrative Theory & Praxis*, 46(2), 191–211. <https://doi.org/10.1080/10841806.2024.2305061>
- Cartwright, B., White, M., & Clitherow, T. (2018). Nearby Nature ‘Buffers’ the Effect of Low Social Connectedness on Adult Subjective Wellbeing over the Last 7 Days. *International Journal of Environmental Research and Public Health*, 15(6), 1238.
<https://doi.org/10.3390/ijerph15061238>
- Chambers, J. M., Wyborn, C., Ryan, M. E., Reid, R. S., Riechers, M., Serban, A., Bennett, N. J., Cvitanovic, C., Fernández-Giménez, M. E., Galvin, K. A., Goldstein, B. E., Klenk, N. L., Tengö, M., Brennan, R., Cockburn, J. J., Hill, R., Munera, C., Nel, J. L., Österblom, H., ... Pickering, T. (2021). Six modes of co-production for sustainability. *Nature Sustainability*, 4(11), 983–996. <https://doi.org/10.1038/s41893-021-00755-x>
- Champine, V. M., Jones, M. S., Lischka, S., Vaske, J. J., & Niemiec, R. M. (2022). Understanding individual and diffusion behaviors related to native plant gardening. *Journal of Environmental Psychology*, 81, 101798.
<https://doi.org/10.1016/j.jenvp.2022.101798>
- Chou, W.-Y., & Hung, S.-H. (2021). Cumulative Frequency of Nature Dose: How Continuous and Regular Forest Walking Improves Nature Relatedness, Restorativeness, and Learning Engagement in College Students. *Sustainability*, 13(20), 11370.
<https://doi.org/10.3390/su132011370>

- Clarke, B., Otto, F., Stuart-Smith, R., & Harrington, L. (2022). Extreme weather impacts of climate change: An attribution perspective. *Environmental Research: Climate*, 1(1), 012001. <https://doi.org/10.1088/2752-5295/ac6e7d>
- Clayton, S., Czellar, S., Nartova-Bochaver, S., Skibins, J. C., Salazar, G., Tseng, Y.-C., Irkhin, B., & Monge-Rodriguez, F. S. (2021). Cross-Cultural Validation of A Revised Environmental Identity Scale. *Sustainability*, 13(4), Article 4. <https://doi.org/10.3390/su13042387>
- Collins, S.-A., Walker, S., Alley, J., Dockendorff, K., Guinee, A., Hofecker, J., McDonnell, A., & LoTempio, S. (in press). *Understanding Stress Recovery and Wellbeing through outdoor immersion within LGBTQIA+ Populations*.
- Come Alive Outside. (2026). *Come Alive Outside*. <https://comealiveoutside.com/>
- Cooke, P. J., Melchert, T. P., & Connor, K. (2016). Measuring Well-Being: A Review of Instruments. *The Counseling Psychologist*, 44(5), 730–757. <https://doi.org/10.1177/0011000016633507>
- Coventry, P. A., Brown, Jennifer V. E., Pervin, J., Brabyn, S., Pateman, R., Breedvelt, J., Gilbody, S., Stancliffe, R., McEachan, R., & White, Piran C. L. (2021). Nature-based outdoor activities for mental and physical health: Systematic review and meta-analysis. *SSM - Population Health*, 16, 100934. <https://doi.org/10.1016/j.ssmph.2021.100934>
- Cronon, W. (1996). The Trouble with Wilderness: Or, Getting Back to the Wrong Nature. *Environmental History*, 1(1), 7–28. <https://doi.org/10.2307/3985059>
- Daniels, S., Clemente, D. B. P., Desart, S., Saenen, N., Sleurs, H., Nawrot, T. S., Malina, R., & Plusquin, M. (2022). Introducing nature at the work floor: A nature-based intervention to

- reduce stress and improve cognitive performance. *International Journal of Hygiene and Environmental Health*, 240, 113884. <https://doi.org/10.1016/j.ijheh.2021.113884>
- Dashper, K., & King, J. (2022). The outdoors as a contested leisure terrain. *Annals of Leisure Research*, 25(3), 435–443. <https://doi.org/10.1080/11745398.2021.1899832>
- Dean, J., Furness, P., Verrier, D., Lennon, H., Bennett, C., & Spencer, S. (2018). Desert island data: An investigation into researcher positionality. *Qualitative Research*, 18(3), 273–289. <https://doi.org/10.1177/1468794117714612>
- DeVille, N. V., Tomasso, L. P., Stoddard, O. P., Wilt, G. E., Horton, T. H., Wolf, K. L., Brymer, E., Kahn, P. H., & James, P. (2021). Time Spent in Nature Is Associated with Increased Pro-Environmental Attitudes and Behaviors. *International Journal of Environmental Research and Public Health*, 18(14), Article 14. <https://doi.org/10.3390/ijerph18147498>
- Díaz, S., & Malhi, Y. (2022). Biodiversity: Concepts, Patterns, Trends, and Perspectives. *Annual Review of Environment and Resources*, 47(Volume 47, 2022), 31–63. <https://doi.org/10.1146/annurev-environ-120120-054300>
- Diener, E., Wirtz, D., Tov, W., Kim-Prieto, C., Choi, D., Oishi, S., & Biswas-Diener, R. (2010). New Well-being Measures: Short Scales to Assess Flourishing and Positive and Negative Feelings. *Social Indicators Research*, 97(2), 143–156. <https://doi.org/10.1007/s11205-009-9493-y>
- Doyal, L., & Gough, I. (1991). *A theory of human need*. Guilford Press.
- Drahota, A., Meza, R. D., Brikho, B., Naaf, M., Estabillo, J. A., Gomez, E. D., Vejnaska, S. F., Dufek, S., Stahmer, A. C., & Aarons, G. A. (2016). Community-Academic Partnerships: A Systematic Review of the State of the Literature and Recommendations for Future

- Research. *The Milbank Quarterly*, 94(1), 163–214. <https://doi.org/10.1111/1468-0009.12184>
- Dumas, S. E., Dongchung, T. Y., Sanderson, M. L., Bartley, K., & Levanon Seligson, A. (2020). A comparison of the four healthy days measures (HRQOL-4) with a single measure of self-rated general health in a population-based health survey in New York City. *Health and Quality of Life Outcomes*, 18(1), 315. <https://doi.org/10.1186/s12955-020-01560-4>
- Ebi, K. L., Harris, F., Sioen, G. B., Wannous, C., Anyamba, A., Bi, P., Boeckmann, M., Bowen, K., Cissé, G., Dasgupta, P., Dida, G. O., Gasparatos, A., Gatzweiler, F., Javadi, F., Kanbara, S., Kone, B., Maycock, B., Morse, A., Murakami, T., ... Capon, A. (2020). Transdisciplinary Research Priorities for Human and Planetary Health in the Context of the 2030 Agenda for Sustainable Development. *International Journal of Environmental Research and Public Health*, 17(23), Article 23. <https://doi.org/10.3390/ijerph17238890>
- Edo, G. I., Itoje-akpokiniovo, L. O., Obasohan, P., Ikpekor, V. O., Samuel, P. O., Jikah, A. N., Nosu, L. C., Ekokotu, H. A., Ugbune, U., Oghrora, E. E. A., Emakpor, O. L., Ainyanbhor, I. E., Mohammed, W. A.-S., Akpogheli, P. O., Owheru, J. O., & Agbo, J. J. (2024). Impact of environmental pollution from human activities on water, air quality and climate change. *Ecological Frontiers*, 44(5), 874–889. <https://doi.org/10.1016/j.ecofro.2024.02.014>
- Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, 39(2), 175–191. <https://doi.org/10.3758/BF03193146>
- Fazey, I., Evelyn, A. C., Reed, M. S., Stringer, L. C., Kruijsen, J., White, P. C. L., Newsham, A., Jin, L., Cortazzi, M., Phillipson, J., Blackstock, K., Entwistle, N., Sheate, W., Armstrong,

- F., Blackmore, C., Fazey, J., Ingram, J., Gregson, J., Lowe, P., ... Trevitt, C. (2013). Knowledge exchange: A review and research agenda for environmental management. *Environmental Conservation*, 40(1), 19–36. <https://doi.org/10.1017/S037689291200029X>
- Ferguson, D. B., Meadow, A. M., & Huntington, H. P. (2022). Making a Difference: Planning for Engaged Participation in Environmental Research. *Environmental Management*, 69(2), 227–243. <https://doi.org/10.1007/s00267-021-01585-5>
- Field, A., Miles, J., & Field, Z. (2012). *Discovering Statistics Using R*. SAGE.
- Finney, C. (2014). *Black Faces, White Spaces: Reimagining the Relationship of african americans to the Great Outdoors*. The University of North Carolina Press.
- Frumkin, H., Bratman, G. N., Breslow, S. J., Cochran, B., Kahn Jr, P. H., Lawler, J. J., Levin, P. S., Tandon, P. S., Varanasi, U., Wolf, K. L., & Wood, S. A. (2017). Nature Contact and Human Health: A Research Agenda. *Environmental Health Perspectives*, 125(7), 075001. <https://doi.org/10.1289/EHP1663>
- Furuyashiki, A., Tabuchi, K., Norikoshi, K., Kobayashi, T., & Oriyama, S. (2019). A comparative study of the physiological and psychological effects of forest bathing (Shinrin-yoku) on working age people with and without depressive tendencies. *Environmental Health and Preventive Medicine*, 24(1), 46. <https://doi.org/10.1186/s12199-019-0800-1>
- Gałecki, A., & Burzykowski, T. (2013). *Linear Mixed-Effects Models Using R: A Step-by-Step Approach*. Springer New York. <https://doi.org/10.1007/978-1-4614-3900-4>
- Gallegos-Riofrío, C. A., Arab, H., Carrasco-Torrontegui, A., & Gould, R. K. (2022a). Chronic deficiency of diversity and pluralism in research on nature's mental health effects: A

- planetary health problem. *Current Research in Environmental Sustainability*, 4, 100148.
<https://doi.org/10.1016/j.crsust.2022.100148>
- Gallegos-Riofrío, C. A., Arab, H., Carrasco-Torrontegui, A., & Gould, R. K. (2022b). Chronic deficiency of diversity and pluralism in research on nature's mental health effects: A planetary health problem. *Current Research in Environmental Sustainability*, 4, 100148.
<https://doi.org/10.1016/j.crsust.2022.100148>
- Gatersleben, B., & Murtagh, N. (2023). *Handbook on Pro-Environmental Behaviour Change*. Edward Elgar Publishing.
- Ghasemi, A., & Zahediasl, S. (2012). Normality Tests for Statistical Analysis: A Guide for Non-Statisticians. *International Journal of Endocrinology and Metabolism*, 10(2), 486–489.
<https://doi.org/10.5812/ijem.3505>
- Gifford, R., & Nilsson, A. (2014). Personal and social factors that influence pro-environmental concern and behaviour: A review. *International Journal of Psychology*, 49(3), 141–157.
<https://doi.org/10.1002/ijop.12034>
- Glesne, C. (2011). *Becoming qualitative researchers: An introduction* (4th ed). Pearson.
- Goldy, S. P., & Piff, P. K. (2020). Toward a social ecology of prosociality: Why, when, and where nature enhances social connection. *Current Opinion in Psychology, Socio-Ecological Psychology*, 32, 27–31. <https://doi.org/10.1016/j.copsyc.2019.06.016>
- Gough, I. (2014). Lists and thresholds: Comparing the Doyal-Gough theory of human need with Nussbaum's capabilities approach. *Capabilities, Gender, Equality: Towards Fundamental Entitlements*, 357.

- Gough, I., McGregor, A. J., & Camfield, L. (2007). Theorising wellbeing in international development. In *Well-being in Developing Countries: From Theory to Research* (pp. 3–44). Cambridge University Press.
- Gough, I., & McGregor, I. A. (2007). *Well-being in Developing Countries: From Theory to Research*. Cambridge University Press.
- Grabowska-Chenczke, O., Wajchman-Świtalska, S., & Woźniak, M. (2022). Psychological Well-Being and Nature Relatedness. *Forests*, 13(7), Article 7.
<https://doi.org/10.3390/f13071048>
- Gritzka, S., MacIntyre, T. E., Dörfel, D., Baker-Blanc, J. L., & Calogiuri, G. (2020). The Effects of Workplace Nature-Based Interventions on the Mental Health and Well-Being of Employees: A Systematic Review. *Frontiers in Psychiatry*, 11.
<https://www.frontiersin.org/articles/10.3389/fpsyt.2020.00323>
- Guazzini, A., Valdrighi, G., Fiorenza, M., & Duradoni, M. (2025). The Relationship Between Connectedness to Nature and Pro-Environmental Behaviors: A Systematic Review. *Sustainability*, 17(8), 3686. <https://doi.org/10.3390/su17083686>
- Guimarães, M. H., Pohl, C., Bina, O., & Varanda, M. (2019). Who is doing inter- and transdisciplinary research, and why? An empirical study of motivations, attitudes, skills, and behaviours. *Futures*, 112, 102441. <https://doi.org/10.1016/j.futures.2019.102441>
- Hamann, G. A., & Ivtzan, I. (2017). *30 minutes in nature a day can increase mood, well-being, meaning in life and mindfulness: Effects of a pilot programme*.
<https://repository.mruni.eu/handle/007/14584>
- Hammond, D. (2011). *The Science of Synthesis*. University Press of Colorado.

- Hammoud, R., Tognin, S., Smythe, M., Gibbons, J., Davidson, N., Bakolis, I., & Mechelli, A. (2024). Smartphone-based ecological momentary assessment reveals an incremental association between natural diversity and mental wellbeing. *Scientific Reports*, 14(1), 7051. <https://doi.org/10.1038/s41598-024-55940-7>
- Hansen, M. M., Jones, R., & Tocchini, K. (2017). Shinrin-Yoku (Forest Bathing) and Nature Therapy: A State-of-the-Art Review. *International Journal of Environmental Research and Public Health*, 14(8), Article 8. <https://doi.org/10.3390/ijerph14080851>
- Hansen-Ketchum, P. A., & Halpenny, E. A. (2011). Engaging with nature to promote health: Bridging research silos to examine the evidence. *Health Promotion International*, 26(1), 100–108. <https://doi.org/10.1093/heapro/daq053>
- Harper, N. J., Fernee, C. R., & Gabrielsen, L. E. (2021). Nature’s Role in Outdoor Therapies: An Umbrella Review. *International Journal of Environmental Research and Public Health*, 18(10), 5117. <https://doi.org/10.3390/ijerph18105117>
- Hartig, T., Mitchell, R., De Vries, S., & Frumkin, H. (2014). Nature and Health. *Annual Review of Public Health*, 35(1), 207–228. <https://doi.org/10.1146/annurev-publhealth-032013-182443>
- Held, M. (2023). Decolonizing Science: Undoing the Colonial and Racist Hegemony of Western Science. *Journal of MultiDisciplinary Evaluation*, 19(44). <https://doi.org/10.56645/jmde.v19i44.785>
- Hinde, S., Bojke, L., & Coventry, P. (2021). The Cost Effectiveness of Ecotherapy as a Healthcare Intervention, Separating the Wood from the Trees. *International Journal of Environmental Research and Public Health*, 18(21). <https://doi.org/10.3390/ijerph182111599>

- Hines, J. M., Hungerford, Harold R., & Tomera, A. N. (1987). Analysis and Synthesis of Research on Responsible Environmental Behavior: A Meta-Analysis. *The Journal of Environmental Education*, 18(2), 1–8. <https://doi.org/10.1080/00958964.1987.9943482>
- Ho, Y. C. J., & Chang, D. (2022). To whom does this place belong? Whiteness and diversity in outdoor recreation and education. *Annals of Leisure Research*, 25(5), 569–582. <https://doi.org/10.1080/11745398.2020.1859389>
- Hoekstra, F., Mrklas, K. J., Khan, M., McKay, R. C., Vis-Dunbar, M., Sibley, K. M., Nguyen, T., Graham, I. D., Anderson, K., Anton, H., Athanasopoulos, P., Chernesky, J., Forwell, S., Maffin, J., Martin Ginis, K., McBride, C. B., Mortenson, B., Willms, R., Gainforth, H. L., & SCI Guiding Principles Consensus Panel. (2020). A review of reviews on principles, strategies, outcomes and impacts of research partnerships approaches: A first step in synthesising the research partnership literature. *Health Research Policy and Systems*, 18(1), 51. <https://doi.org/10.1186/s12961-020-0544-9>
- Hoffman, K. N. (2024). *Defining Nature: An Ameliorative Account of Nature as Reciprocal Relations* [Ph.D., University of Pennsylvania]. <https://www.proquest.com/docview/3068673675/abstract/516F0D384F7426APQ/1>
- Holland, W. H., Powell, R. B., Thomsen, J. M., & Monz, C. A. (2018). A Systematic Review of the Psychological, Social, and Educational Outcomes Associated With Participation in Wildland Recreational Activities. *Journal of Outdoor Recreation, Education, and Leadership*, 10(3), Article 3. <https://doi.org/10.18666/JOREL-2018-V10-I3-8382>
- Hopman, R. J., LoTempio, S. B., Scott, E. E., McKinney, T. L., & Strayer, D. L. (2020). Resting-state posterior alpha power changes with prolonged exposure in a natural

- environment. *Cognitive Research: Principles and Implications*, 5(1), 51.
<https://doi.org/10.1186/s41235-020-00247-0>
- Horcea-Milcu, A.-I., Leventon, J., & Lang, D. J. (2022). Making transdisciplinarity happen: Phase 0, or before the beginning. *Environmental Science & Policy*, 136, 187–197.
<https://doi.org/10.1016/j.envsci.2022.05.019>
- Hume, C., Grieger, J. A., Kalamkarian, A., D’Onise, K., & Smithers, L. G. (2022). Community gardens and their effects on diet, health, psychosocial and community outcomes: A systematic review. *BMC Public Health*, 22(1), 1247. <https://doi.org/10.1186/s12889-022-13591-1>
- Hunter, R. F., Cleland, C., Cleary, A., Droomers, M., Wheeler, B. W., Sinnett, D., Nieuwenhuijsen, M. J., & Braubach, M. (2019). Environmental, health, wellbeing, social and equity effects of urban green space interventions: A meta-narrative evidence synthesis. *Environment International*, 130, 104923.
<https://doi.org/10.1016/j.envint.2019.104923>
- Ibanez, L., & Roussel, S. (2022). The impact of nature video exposure on pro-environmental behavior: An experimental investigation. *PLOS ONE*, 17(11), e0275806.
<https://doi.org/10.1371/journal.pone.0275806>
- James, P., Banay, R. F., Hart, J. E., & Laden, F. (2015). A Review of the Health Benefits of Greenness. *Current Epidemiology Reports*, 2(2), 131–142.
<https://doi.org/10.1007/s40471-015-0043-7>
- Jiang, B., Schmillen, R., & Sullivan, W. C. (2019). How to Waste a Break: Using Portable Electronic Devices Substantially Counteracts Attention Enhancement Effects of Green

Spaces. *Environment and Behavior*, 51(9–10), 1133–1160.

<https://doi.org/10.1177/0013916518788603>

Jimenez, M. P., DeVille, N. V., Elliott, E. G., Schiff, J. E., Wilt, G. E., Hart, J. E., & James, P.

(2021). Associations between Nature Exposure and Health: A Review of the Evidence.

International Journal of Environmental Research and Public Health, 18(9), Article 9.

<https://doi.org/10.3390/ijerph18094790>

Johnson, J. T., & Murton, B. (2007). Re/placing Native Science: Indigenous Voices in

Contemporary Constructions of Nature. *Geographical Research*, 45(2), 121–129.

<https://doi.org/10.1111/j.1745-5871.2007.00442.x>

Johnson, S., Walker, S. E., Goulding, C., LoTempio, S., & Zarestky, J. (2025). “Nature from

My Perspective”: Leveraging Participatory Mental Modeling to Understand the Well-

Being Impacts of Outdoor Retreats for Black Men. *Ecopsychology*, 19429347251407579.

<https://doi.org/10.1177/19429347251407579>

Kadykalo, A. N., Buxton, R. T., Morrison, P., Anderson, C. M., Bickerton, H., Francis, C. M.,

Smith, A. C., & Fahrig, L. (2021). Bridging research and practice in conservation.

Conservation Biology, 35(6), 1725–1737. <https://doi.org/10.1111/cobi.13732>

Kaiser, F., Ranney, M., Hartig, T., & Bowler, P. (1999). Ecological Behavior, Environmental

Attitude, and Feelings of Responsibility for the Environment. *European Psychologist*, 4.

<https://doi.org/10.1027//1016-9040.4.2.59>

Kaleta, B., Campbell, S., O’Keeffe, J., & Burke, J. (2025). Nature-based interventions: A

systematic review of reviews. *Frontiers in Psychology*, 16, 1625294.

<https://doi.org/10.3389/fpsyg.2025.1625294>

- Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology, Green Psychology*, 15(3), 169–182.
[https://doi.org/10.1016/0272-4944\(95\)90001-2](https://doi.org/10.1016/0272-4944(95)90001-2)
- Kasser, T. (2017). Living both well and sustainably: A review of the literature, with some reflections on future research, interventions and policy. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 375(2095), 20160369. <https://doi.org/10.1098/rsta.2016.0369>
- Kawas, S., Kuhn, N. S., Tari, M., Hiniker, A., & Davis, K. (2020). “Otter this world”: Can a mobile application promote children’s connectedness to nature? *Proceedings of the Interaction Design and Children Conference, IDC ’20*, 444–457.
<https://doi.org/10.1145/3392063.3394434>
- Kellert, S. R. (2018). *Nature by Design: The Practice of Biophilic Design*. Yale University Press.
- Kimmerer, R. W. (2013). *Braiding Sweetgrass: Indigenous Wisdom, Scientific Knowledge, and the Teachings of Plants*. Milkweed Editions.
- Knapp, C. N., Reid, R. S., Fernández-Giménez, M. E., Klein, J. A., & Galvin, K. A. (2019). Placing Transdisciplinarity in Context: A Review of Approaches to Connect Scholars, Society and Action. *Sustainability*, 11(18), Article 18.
<https://doi.org/10.3390/su11184899>
- Kollmuss, A., & Agyeman, J. (2002). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, 8(3), 239–260. <https://doi.org/10.1080/13504620220145401>
- Kondo, M. C., Oyekanmi, K. O., Gibson, A., South, E. C., Bocarro, J., & Hipp, J. A. (2020). Nature Prescriptions for Health: A Review of Evidence and Research Opportunities.

- International Journal of Environmental Research and Public Health*, 17(12), Article 12.
<https://doi.org/10.3390/ijerph17124213>
- Kotera, Y., Lyons, M., Vione, K. C., & Norton, B. (2021). Effect of Nature Walks on Depression and Anxiety: A Systematic Review. *Sustainability*, 13(7), Article 7.
<https://doi.org/10.3390/su13074015>
- Krols, J., Aerts, R., Vanlessen, N., Dewaelheyns, V., Dujardin, S., & Somers, B. (2022). Residential green space, gardening, and subjective well-being: A cross-sectional study of garden owners in northern Belgium. *Landscape and Urban Planning*, 223, 104414.
<https://doi.org/10.1016/j.landurbplan.2022.104414>
- Kruize, H., van der Vliet, N., Staatsen, B., Bell, R., Chiabai, A., Muiños, G., Higgins, S., Quiroga, S., Martinez-Juarez, P., Aberg Yngwe, M., Tsihclas, F., Karnaki, P., Lima, M. L., García de Jalón, S., Khan, M., Morris, G., & Stegeman, I. (2019). Urban Green Space: Creating a Triple Win for Environmental Sustainability, Health, and Health Equity through Behavior Change. *International Journal of Environmental Research and Public Health*, 16(22), Article 22. <https://doi.org/10.3390/ijerph16224403>
- Kumar, R., Manna, C., Padha, S., Verma, A., Sharma, P., Dhar, A., Ghosh, A., & Bhattacharya, P. (2022). Micro(nano)plastics pollution and human health: How plastics can induce carcinogenesis to humans? *Chemosphere*, 298, 134267.
<https://doi.org/10.1016/j.chemosphere.2022.134267>
- Lang, W., McDonnell, A., & Lasko, C. (2025). Effect of Cellphone Usage on Stress Physiology in a Nature Environment. *RANGE: Undergraduate Research Journal*, 131.
<https://uen.pressbooks.pub/range26i1>

- Lange, F., & Dewitte, S. (2019). Measuring pro-environmental behavior: Review and recommendations. *Journal of Environmental Psychology*, 63, 92–100.
<https://doi.org/10.1016/j.jenvp.2019.04.009>
- Lau, A. S., Rodriguez, A., Bando, L., Innes-Gomberg, D., & Brookman-Frazee, L. (2020). Research Community Collaboration in Observational Implementation Research: Complementary Motivations and Concerns in Engaging in the Study of Implementation as Usual. *Administration and Policy in Mental Health and Mental Health Services Research*, 47(2), 210–226. <https://doi.org/10.1007/s10488-019-00939-w>
- Lawrence, M. G., Williams, S., Nanz, P., & Renn, O. (2022). Characteristics, potentials, and challenges of transdisciplinary research. *One Earth*, 5(1), 44–61.
<https://doi.org/10.1016/j.oneear.2021.12.010>
- Lee, A. C. K., & Maheswaran, R. (2011). The health benefits of urban green spaces: A review of the evidence. *Journal of Public Health*, 33(2), 212–222.
<https://doi.org/10.1093/pubmed/fdq068>
- Levine, S., Malone, E., Lekachvili, A., & Briss, P. (2019). Health Care Industry Insights: Why the Use of Preventive Services Is Still Low. *Preventing Chronic Disease*, 16, E30.
<https://doi.org/10.5888/pcd16.180625>
- Li, D., & Sullivan, W. C. (2016). Impact of views to school landscapes on recovery from stress and mental fatigue. *Landscape and Urban Planning*, 148, 149–158.
<https://doi.org/10.1016/j.landurbplan.2015.12.015>
- Li, H., Zhang, X., Wang, H., Yang, Z., Liu, H., Cao, Y., & Zhang, G. (2021). Access to Nature via Virtual Reality: A Mini-Review. *Frontiers in Psychology*, 12.
<https://doi.org/10.3389/fpsyg.2021.725288>

- Li, Q. (2022). Effects of forest environment (Shinrin-yoku/Forest bathing) on health promotion and disease prevention—The Establishment of “Forest Medicine”—. *Environmental Health and Preventive Medicine*, 27(0), 43–43. <https://doi.org/10.1265/ehpm.22-00160>
- Li, Q., Morimoto, K., Nakadai, A., Inagaki, H., Katsumata, M., Shimizu, T., Hirata, Y., Hirata, K., Suzuki, H., Miyazaki, Y., Kagawa, T., Koyama, Y., Ohira, T., Takayama, N., Krensky, A. M., & Kawada, T. (2007). Forest Bathing Enhances Human Natural Killer Activity and Expression of Anti-Cancer Proteins. *International Journal of Immunopathology and Pharmacology*, 20(2_suppl), 3–8. <https://doi.org/10.1177/03946320070200S202>
- Lich, K. H., Ginexi, E. M., Osgood, N. D., & Mabry, P. L. (2013). A Call to Address Complexity in Prevention Science Research. *Prevention Science*, 14(3), 279–289. <https://doi.org/10.1007/s11121-012-0285-2>
- Linton, M.-J., Dieppe, P., & Medina-Lara, A. (2016). Review of 99 self-report measures for assessing well-being in adults: Exploring dimensions of well-being and developments over time. *BMJ Open*, 6(7), e010641. <https://doi.org/10.1136/bmjopen-2015-010641>
- Liu, D., Kwan, M.-P., & Kan, Z. (2021). Analysis of urban green space accessibility and distribution inequity in the City of Chicago. *Urban Forestry & Urban Greening*, 59, 127029. <https://doi.org/10.1016/j.ufug.2021.127029>
- Liu, Y., Cleary, A., Fielding, K. S., Murray, Z., & Roiko, A. (2022). Nature connection, pro-environmental behaviours and wellbeing: Understanding the mediating role of nature contact. *Landscape and Urban Planning*, 228, 104550. <https://doi.org/10.1016/j.landurbplan.2022.104550>

- LoTemplo, S., Bettmann, J. E., Scott, E., & Blumenthal, E. (2023). Do Mental Health Changes in Nature Co-occur with Changes in Heart rate Variability and Executive Functioning? A Systematic Review. *Current Environmental Health Reports*, 10(3), 278–290.
<https://doi.org/10.1007/s40572-023-00407-6>
- LoTemplo, S., McDonnell, A. S., Nadkarni, N., Walker, S., Gallegos-Riofrío, C. A., Scott, E. E., Bettmann, J. E., Rojas-Rueda, D., Dahl, J., Tomasso, L. P., Lawler, J. J., Davalos, D., & Strayer, D. L. (2023). Healthy by Nature: Policy Practices Aimed at Maximizing the Human Behavioral Health Benefits of Nature Contact. *Policy Insights from the Behavioral and Brain Sciences*, 10(2), 247–255.
<https://doi.org/10.1177/23727322231197578>
- Louv, R. (2011). *The Nature Principle: Human Restoration and the End of Nature-Deficit Disorder*. Algonquin Books of Chapel Hill.
- Lumber, R., Richardson, M., & Sheffield, D. (2017). Beyond knowing nature: Contact, emotion, compassion, meaning, and beauty are pathways to nature connection. *PLOS ONE*, 12(5), e0177186. <https://doi.org/10.1371/journal.pone.0177186>
- Luo, J., Wang, M., Chen, B., & Sun, M. (2022). Exposure to Nature Sounds through a Mobile Application in Daily Life: Effects on Learning Performance among University Students. *International Journal of Environmental Research and Public Health*, 19(21), 14583.
<https://doi.org/10.3390/ijerph192114583>
- Ma, J. (2022). Interaction with Nature Indoor: Psychological Impacts of Houseplants Care Behaviour on Mental Well-Being and Mindfulness in Chinese Adults. *International Journal of Environmental Research and Public Health*, 19(23), 15810.
<https://doi.org/10.3390/ijerph192315810>

- Mackay, C. M. L., & Schmitt, M. T. (2019). Do people who feel connected to nature do more to protect it? A meta-analysis. *Journal of Environmental Psychology*, 65, 101323.
<https://doi.org/10.1016/j.jenvp.2019.101323>
- Marselle, M. R., Hartig, T., Cox, D. T. C., de Bell, S., Knapp, S., Lindley, S., Triguero-Mas, M., Böhning-Gaese, K., Braubach, M., Cook, P. A., de Vries, S., Heintz-Buschart, A., Hofmann, M., Irvine, K. N., Kabisch, N., Kolek, F., Kraemer, R., Markevych, I., Martens, D., ... Bonn, A. (2021). Pathways linking biodiversity to human health: A conceptual framework. *Environment International*, 150, 106420.
<https://doi.org/10.1016/j.envint.2021.106420>
- Martin, L., White, M. P., Hunt, A., Richardson, M., Pahl, S., & Burt, J. (2020). Nature contact, nature connectedness and associations with health, wellbeing and pro-environmental behaviours. *Journal of Environmental Psychology*, 68, 101389.
<https://doi.org/10.1016/j.jenvp.2020.101389>
- Marvasti, F. F., & Stafford, R. S. (2012). From Sick Care to Health Care—Reengineering Prevention into the U.S. System. *New England Journal of Medicine*, 367(10), 889–891.
<https://doi.org/10.1056/NEJMp1206230>
- Marvier, M., Kareiva, P., Felix, D., Ferrante, B. J., & Billington, M. B. (2023). The benefits of nature exposure: The need for research that better informs implementation. *Proceedings of the National Academy of Sciences*, 120(44), e2304126120.
<https://doi.org/10.1073/pnas.2304126120>
- Mason, L., Ronconi, A., Scrimin, S., & Pazzaglia, F. (2022a). Short-Term Exposure to Nature and Benefits for Students' Cognitive Performance: A Review. *Educational Psychology Review*, 34(2), 609–647. <https://doi.org/10.1007/s10648-021-09631-8>

- Mason, L., Ronconi, A., Scrimin, S., & Pazzaglia, F. (2022b). Short-Term Exposure to Nature and Benefits for Students' Cognitive Performance: A Review. *Educational Psychology Review*, 34(2), 609–647. <https://doi.org/10.1007/s10648-021-09631-8>
- Mavisakalyan, A., Sharma, S., & Weber, C. (2024). Pro-environmental behavior and subjective well-being: Culture has a role to play. *Ecological Economics*, 217, 108081. <https://doi.org/10.1016/j.ecolecon.2023.108081>
- Mayer, F. S., & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology*, 24(4), 503–515. <https://doi.org/10.1016/j.jenvp.2004.10.001>
- Mayer, F. S., Frantz, C. M., Bruehlman-Senecal, E., & Dolliver, K. (2009). Why Is Nature Beneficial?: The Role of Connectedness to Nature. *Environment and Behavior*, 41(5), 607–643. <https://doi.org/10.1177/0013916508319745>
- McDonnell, A. S., LoTempio, S. B., Scott, E. E., & Strayer, D. L. (2025). Nature images are more visually engaging than urban images: Evidence from neural oscillations in the brain. *Frontiers in Human Neuroscience*, 19, 1575102. <https://doi.org/10.3389/fnhum.2025.1575102>
- McEwan, K., Potter, V., Kotera, Y., Jackson, J. E., & Greaves, S. (2022). 'This Is What the Colour Green Smells Like!': Urban Forest Bathing Improved Adolescent Nature Connection and Wellbeing. *International Journal of Environmental Research and Public Health*, 19(23), Article 23. <https://doi.org/10.3390/ijerph192315594>
- McEwan, K., Richardson, M., Brindley, P., Sheffield, D., Tait, C., Johnson, S., Sutch, H., & Ferguson, F. J. (2020). Shmapped: Development of an app to record and promote the

- well-being benefits of noticing urban nature. *Translational Behavioral Medicine*, 10(3), 723–733. <https://doi.org/10.1093/tbm/ibz027>
- McEwan, K., Richardson, M., Sheffield, D., Ferguson, F. J., & Brindley, P. (2019). A Smartphone App for Improving Mental Health through Connecting with Urban Nature. *International Journal of Environmental Research and Public Health*, 16(18), Article 18. <https://doi.org/10.3390/ijerph16183373>
- McLaren, L., Braitstein, P., Buckeridge, D., Contandriopoulos, D., Creatore, M. I., Faulkner, G., Hammond, D., Hoffman, S. J., Kestens, Y., Leatherdale, S., McGavock, J., Norman, W. V., Nykiforuk, C., Ridde, V., & Smylie, J. (2019). Why public health matters today and tomorrow: The role of applied public health research. *Canadian Journal of Public Health*, 110(3), 317–322. <https://doi.org/10.17269/s41997-019-00196-2>
- Meore, A., Sun, S., Byma, L., Alter, S., Vitale, A., Podolak, E., Gibbard, B., Adams, T., Boyer, J., Galfalvy, H., Yehuda, R., Feder, A., & Haghighi, F. (2021). Pilot evaluation of horticultural therapy in improving overall wellness in veterans with history of suicidality. *Complementary Therapies in Medicine*, 59, 102728. <https://doi.org/10.1016/j.ctim.2021.102728>
- Meredith, G. R., Rakow, D. A., Eldermire, E. R. B., Madsen, C. G., Shelley, S. P., & Sachs, N. A. (2020). Minimum Time Dose in Nature to Positively Impact the Mental Health of College-Aged Students, and How to Measure It: A Scoping Review. *Frontiers in Psychology*, 10. <https://www.frontiersin.org/articles/10.3389/fpsyg.2019.02942>
- Merfeld, J., Tamlyn, K., Johnson, S., Terol, S., Collins, S.-A., Farwell, J., Zarestky, J., Walker, S., & LoTempio, S. (2025). *Nature and health researcher needs assessment:*

Investigating the state of evidence among researchers to better inform practitioners.

<https://sites.warnercnr.colostate.edu/cnisp/>

Monat, J. P., & Gannon, T. F. (2015). What is Systems Thinking? A Review of Selected Literature Plus Recommendations. *American Journal of Systems Science*, 4(1), 11–16.

<https://doi.org/10.5923/j.ajss.20150401.02>

Moran, D. (2019). Back to nature? Attention restoration theory and the restorative effects of nature contact in prison. *Health & Place*, 57, 35–43.

<https://doi.org/10.1016/j.healthplace.2019.03.005>

Morgan, M. J., Stratford, E., Harpur, S., & Rowbotham, S. (2024). A Systems Thinking Approach for Community Health and Wellbeing. *Systemic Practice and Action Research*, 37(2), 161–183. <https://doi.org/10.1007/s11213-023-09644-0>

Morris, Z. S., Wooding, S., & Grant, J. (2011). The answer is 17 years, what is the question: Understanding time lags in translational research. *Journal of the Royal Society of Medicine*, 104(12), 510–520. <https://doi.org/10.1258/jrsm.2011.110180>

Muntner, P., Shimbo, D., Carey, R. M., Charleston, J. B., Gaillard, T., Misra, S., Myers, M. G., Ogedegbe, G., Schwartz, J. E., Townsend, R. R., Urbina, E. M., Viera, A. J., White, W. B., & Wright, J. T. (2019). Measurement of Blood Pressure in Humans: A Scientific Statement From the American Heart Association. *Hypertension*, 73(5), e35–e66. <https://doi.org/10.1161/HYP.0000000000000087>

Naidu, R., Biswas, B., Willett, I. R., Cribb, J., Kumar Singh, B., Paul Nathanail, C., Coulon, F., Semple, K. T., Jones, K. C., Barclay, A., & Aitken, R. J. (2021). Chemical pollution: A growing peril and potential catastrophic risk to humanity. *Environment International*, 156, 106616. <https://doi.org/10.1016/j.envint.2021.106616>

- Nay, A., Kahn, P. H., Lawler, J. J., & Bratman, G. N. (2022). Inequitable Changes to Time Spent in Urban Nature during COVID-19: A Case Study of Seattle, WA with Asian, Black, Latino, and White Residents. *Land*, 11(8), Article 8.
<https://doi.org/10.3390/land11081277>
- Nisbet, E. K., Shaw, D. W., & Lachance, D. G. (2020). Connectedness With Nearby Nature and Well-Being. *Frontiers in Sustainable Cities*, 2, 18.
<https://doi.org/10.3389/frsc.2020.00018>
- Nisbet, E. K., & Zelenski, J. M. (2013). The NR-6: A new brief measure of nature relatedness. *Frontiers in Psychology*, 4. <https://doi.org/10.3389/fpsyg.2013.00813>
- Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2009). The Nature Relatedness Scale: Linking Individuals' Connection With Nature to Environmental Concern and Behavior. *Environment and Behavior*, 41(5), 715–740. <https://doi.org/10.1177/0013916508318748>
- Norton, T. A., Parker, S. L., Zacher, H., & Ashkanasy, N. M. (2015). Employee Green Behavior: A Theoretical Framework, Multilevel Review, and Future Research Agenda. *Organization & Environment*, 28(1), 103–125.
<https://doi.org/10.1177/1086026615575773>
- Oh, R. R. Y., Zhang, Y., Nghiem, L. T. P., Chang, C., Tan, C. L. Y., Quazi, S. A., Shanahan, D. F., Lin, B. B., Gaston, K. J., Fuller, R. A., & Carrasco, R. L. (2022). Connection to nature and time spent in gardens predicts social cohesion. *Urban Forestry & Urban Greening*, 74, 127655. <https://doi.org/10.1016/j.ufug.2022.127655>
- Orr, N., Yeo, N. L., Dean, S. G., White, M. P., & Garside, R. (2021). “It Makes You Feel That You Are There”: Exploring the Acceptability of Virtual Reality Nature Environments for

- People with Memory Loss. *Geriatrics*, 6(1), Article 1.
<https://doi.org/10.3390/geriatrics6010027>
- Parker, C., Scott, S., & Geddes, A. (2019). Snowball Sampling. *SAGE Research Methods Foundations*. <https://doi.org/10.4135/9781526421036831710>
- Passmore, H.-A., Mangat, A., Dhanoa, T., Richardson, M., Howell, A. J., & Lutz, P. K. (2025). Enhancing personal and planetary wellbeing: A comparative study of the “3 Good Things” and “3 Good Things in Nature” interventions. *International Journal of Wellbeing*, 15(4). <https://doi.org/10.5502/ijw.v15i4.4233>
- Pilgrim, S. E., Cullen, L. C., Smith, D. J., & Pretty, J. (2008). Ecological Knowledge is Lost in Wealthier Communities and Countries. *Environmental Science & Technology*, 42(4), 1004–1009. <https://doi.org/10.1021/es070837v>
- Pocock, M. J. O., Hamlin, I., Christelow, J., Passmore, H.-A., & Richardson, M. (2023). The benefits of citizen science and nature-noticing activities for well-being, nature connectedness and pro-nature conservation behaviours. *People and Nature*, 5(2), 591–606. <https://doi.org/10.1002/pan3.10432>
- Poulsen, M. N., Nordberg, C. M., Fiedler, A., DeWalle, J., Mercer, D., & Schwartz, B. S. (2022). Factors associated with visiting freshwater blue space: The role of restoration and relations with mental health and well-being. *Landscape and Urban Planning*, 217, 104282. <https://doi.org/10.1016/j.landurbplan.2021.104282>
- Pradhananga, A. K., Davenport, M., & Olson, B. (2015). Landowner Motivations for Civic Engagement in Water Resource Protection. *JAWRA Journal of the American Water Resources Association*, 51(6), 1600–1612. <https://doi.org/10.1111/1752-1688.12346>

- Pretty, J., & Barton, J. (2020). Nature-Based Interventions and Mind–Body Interventions: Saving Public Health Costs Whilst Increasing Life Satisfaction and Happiness. *International Journal of Environmental Research and Public Health*, 17(21).
<https://doi.org/10.3390/ijerph17217769>
- Prinzing, M. (2023). *Pro-Environmental Behavior Increases Subjective Well-Being: Evidence from an Experience Sampling Study and a Randomized Experiment*. OSF.
<https://doi.org/10.31234/osf.io/ac89k>
- Pritchard, A., Richardson, M., Sheffield, D., & McEwan, K. (2020). The Relationship Between Nature Connectedness and Eudaimonic Well-Being: A Meta-analysis. *Journal of Happiness Studies*, 21(3), 1145–1167. <https://doi.org/10.1007/s10902-019-00118-6>
- Putra, I. G. N. E., Astell-Burt, T., Cliff, D. P., Vella, S. A., & Feng, X. (2021). Association between green space quality and prosocial behaviour: A 10-year multilevel longitudinal analysis of Australian children. *Environmental Research*, 196, 110334.
<https://doi.org/10.1016/j.envres.2020.110334>
- Putrino, D., Ripp, J., Herrera, J. E., Cortes, M., Kellner, C., Rizk, D., & Dams-O'Connor, K. (2020). Multisensory, Nature-Inspired Recharge Rooms Yield Short-Term Reductions in Perceived Stress Among Frontline Healthcare Workers. *Frontiers in Psychology*, 11.
<https://doi.org/10.3389/fpsyg.2020.560833>
- R Core Team. (2022). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. [Computer software]. <https://www.R-project.org/>
- Razali, N. M., & Wah, Y. B. (2011). *Power comparisons of Shapiro-Wilk, Kolmogorov-Smirnov, Lilliefors and Anderson-Darling tests*.

- https://www.researchgate.net/publication/267205556_Power_Comparisons_of_Shapiro-Wilk_Kolmogorov-Smirnov_Lilliefors_and_Anderson-Darling_Tests
- Redondo, R., Valor, C., & Carrero, I. (2022). Unraveling the Relationship between Well-Being, Sustainable Consumption and Nature Relatedness: A Study of University Students. *Applied Research in Quality of Life*, 17(2), 913–930. <https://doi.org/10.1007/s11482-021-09931-9>
- Reed, M. S., Stringer, L. C., Fazey, I., Evely, A. C., & Kruijsen, J. H. J. (2014). Five principles for the practice of knowledge exchange in environmental management. *Journal of Environmental Management*, 146, 337–345. <https://doi.org/10.1016/j.jenvman.2014.07.021>
- Richardson, M., Hamlin, I., Elliott, L. R., & White, M. P. (2022). Country-level factors in a failing relationship with nature: Nature connectedness as a key metric for a sustainable future. *Ambio*, 51(11), 2201–2213. <https://doi.org/10.1007/s13280-022-01744-w>
- Richardson, M., & Sheffield, D. (2017). Three good things in nature: Noticing nearby nature brings sustained increases in connection with nature / *Tres cosas buenas de la naturaleza: prestar atención a la naturaleza cercana produce incrementos prolongados en conexión con la naturaleza*. *PsyEcology: Bilingual Journal of Environmental Psychology*, 8(1), 1–32. <https://doi.org/10.1080/21711976.2016.1267136>
- Rigby, B. P., Dodd-Reynolds, C. J., & Oliver, E. J. (2020). Inequities and inequalities in outdoor walking groups: A scoping review. *Public Health Reviews*, 41(1), 4. <https://doi.org/10.1186/s40985-020-00119-4>
- Ritchie, H., Samborska, V., & Roser, M. (2024). Urbanization. *Our World in Data*. <https://ourworldindata.org/urbanization>

- Robinson, J. M., Breed, A. C., Camargo, A., Redvers, N., & Breed, M. F. (2024). Biodiversity and human health: A scoping review and examples of underrepresented linkages. *Environmental Research*, 246, 118115. <https://doi.org/10.1016/j.envres.2024.118115>
- Rojas-Rueda, D., Nieuwenhuijsen, M. J., Gascon, M., Perez-Leon, D., & Mudu, P. (2019). Green spaces and mortality: A systematic review and meta-analysis of cohort studies. *The Lancet Planetary Health*, 3(11), e469–e477. [https://doi.org/10.1016/S2542-5196\(19\)30215-3](https://doi.org/10.1016/S2542-5196(19)30215-3)
- Russell, R., Guerry, A. D., Balvanera, P., Gould, R. K., Basurto, X., Chan, K. M. A., Klain, S., Levine, J., & Tam, J. (2013). Humans and Nature: How Knowing and Experiencing Nature Affect Well-Being. *Annual Review of Environment and Resources*, 38(1), 473–502. <https://doi.org/10.1146/annurev-environ-012312-110838>
- Samus, A., Freeman, C., van Heezik, Y., Krumme, K., & Dickinson, K. J. M. (2022). How do urban green spaces increase well-being? The role of perceived wildness and nature connectedness. *Journal of Environmental Psychology*, 82, 101850. <https://doi.org/10.1016/j.jenvp.2022.101850>
- Schmitt, M. T., Aknin, L. B., Axsen, J., & Shwom, R. L. (2018). Unpacking the Relationships Between Pro-environmental Behavior, Life Satisfaction, and Perceived Ecological Threat. *Ecological Economics*, 143, 130–140. <https://doi.org/10.1016/j.ecolecon.2017.07.007>
- Scholz, R. W., & Steiner, G. (2015). The real type and ideal type of transdisciplinary processes: Part II—what constraints and obstacles do we meet in practice? *Sustainability Science*, 10(4), 653–671. <https://doi.org/10.1007/s11625-015-0327-3>

- Schultz, P. W. (2002). Inclusion with Nature: The Psychology Of Human-Nature Relations. In P. Schmuck & W. P. Schultz (Eds.), *Psychology of Sustainable Development* (pp. 61–78). Springer US. https://doi.org/10.1007/978-1-4615-0995-0_4
- Schultz, P. W. (2011). Conservation Means Behavior: Conservation Means Behavior. *Conservation Biology*, 25(6), 1080–1083. <https://doi.org/10.1111/j.1523-1739.2011.01766.x>
- Scott, E. E., McDonnell, A. S., LoTempio, S. B., Uchino, B. N., & Strayer, D. L. (2021a). Toward a unified model of stress recovery and cognitive restoration in nature. *Parks Stewardship Forum*, 37(1), 46–60. <https://www.jstor.org/stable/48799185>
- Scott, E. E., McDonnell, A. S., LoTempio, S. B., Uchino, B. N., & Strayer, D. L. (2021b). Toward a unified model of stress recovery and cognitive restoration in nature. *Parks Stewardship Forum*, 37(1). <https://doi.org/10.5070/P537151710>
- Shackleton, S., Taylor, A., Gammage, L., Gillson, L., Sitas, N., Methner, N., Barmand, S., Thorn, J., McClure, A., Cobban, L., Jarre, A., & Odume, O. N. (2023). Fostering transdisciplinary research for equitable and sustainable development pathways across Africa: What changes are needed? *Ecosystems and People*, 19(1), 2164798. <https://doi.org/10.1080/26395916.2022.2164798>
- Shanahan, D. F., Astell–Burt, T., Barber, E. A., Brymer, E., Cox, D. T. C., Dean, J., Depledge, M., Fuller, R. A., Hartig, T., Irvine, K. N., Jones, A., Kikillus, H., Lovell, R., Mitchell, R., Niemelä, J., Nieuwenhuijsen, M., Pretty, J., Townsend, M., Heezik, Y. van, ... Gaston, K. J. (2019). Nature–Based Interventions for Improving Health and Wellbeing: The Purpose, the People and the Outcomes. *Sports*, 7(6). <https://doi.org/10.3390/sports7060141>

- Sheffield, D., Butler, C. W., & Richardson, M. (2022). Improving Nature Connectedness in Adults: A Meta-Analysis, Review and Agenda. *Sustainability*, 14(19), Article 19.
<https://doi.org/10.3390/su141912494>
- Shim, S. R., Chang, J., Lee, J., Byeon, W., Lee, J., & Lee, K. J. (2022). Perspectives on the Psychological and Physiological Effects of Forest Therapy: A Systematic Review with a Meta-Analysis and Meta-Regression. *Forests*, 13(12), Article 12.
<https://doi.org/10.3390/f13122029>
- Soga, M., Evans, M. J., Tsuchiya, K., & Fukano, Y. (2021). A room with a green view: The importance of nearby nature for mental health during the COVID-19 pandemic. *Ecological Applications*, 31(2), e2248. <https://doi.org/10.1002/eap.2248>
- Soga, M., & Gaston, K. J. (2016). Extinction of experience: The loss of human–nature interactions. *Frontiers in Ecology and the Environment*, 14(2), 94–101.
<https://doi.org/10.1002/fee.1225>
- Soga, M., & Gaston, K. J. (2024). Do people who experience more nature act more to protect it? A meta-analysis. *Biological Conservation*, 289, 110417.
<https://doi.org/10.1016/j.biocon.2023.110417>
- Soga, M., Gaston, K. J., & Yamaura, Y. (2017). Gardening is beneficial for health: A meta-analysis. *Preventive Medicine Reports*, 5, 92–99.
<https://www.sciencedirect.com/science/article/pii/S2211335516301401>
- Spano, G., D’Este, M., Giannico, V., Carrus, G., Elia, M., Laforzezza, R., Panno, A., & Sanesi, G. (2020). Are Community Gardening and Horticultural Interventions Beneficial for Psychosocial Well-Being? A Meta-Analysis. *International Journal of Environmental Research and Public Health*, 17(10), 3584. <https://doi.org/10.3390/ijerph17103584>

- Spotswood, E. N., Benjamin, M., Stoneburner, L., Wheeler, M. M., Beller, E. E., Balk, D., McPhearson, T., Kuo, M., & McDonald, R. I. (2021). Nature inequity and higher COVID-19 case rates in less-green neighbourhoods in the United States. *Nature Sustainability*, 4(12), 1092–1098. <https://doi.org/10.1038/s41893-021-00781-9>
- Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E. M., Biggs, R., Carpenter, S. R., de Vries, W., de Wit, C. A., Folke, C., Gerten, D., Heinke, J., Mace, G. M., Persson, L. M., Ramanathan, V., Reyers, B., & Sörlin, S. (2015). Planetary boundaries: Guiding human development on a changing planet. *Science*, 347(6223), 1259855. <https://doi.org/10.1126/science.1259855>
- Steger, C., Klein, J. A., Reid, R. S., Lavorel, S., Tucker, C., Hopping, K. A., Marchant, R., Teel, T., Cuni-Sanchez, A., Dorji, T., Greenwood, G., Huber, R., Kassam, K.-A., Kreuer, D., Nolin, A., Russell, A., Sharp, J. L., Šmid Hribar, M., Thorn, J. P. R., ... Waiswa, D. (2021). Science with society: Evidence-based guidance for best practices in environmental transdisciplinary work. *Global Environmental Change*, 68, 102240. <https://doi.org/10.1016/j.gloenvcha.2021.102240>
- Stern, P. C. (2000). New Environmental Theories: Toward a Coherent Theory of Environmentally Significant Behavior. *Journal of Social Issues*, 56(3), 407–424. <https://doi.org/10.1111/0022-4537.00175>
- Stevenson, M. P., Schilhab, T., & Bentsen, P. (2018). Attention Restoration Theory II: A systematic review to clarify attention processes affected by exposure to natural environments. *Journal of Toxicology and Environmental Health, Part B*, 21(4), 227–268. <https://doi.org/10.1080/10937404.2018.1505571>

- Struthers, N. A., Guluzade, N. A., Zecevic, A. A., Walton, D. M., & Gunz, A. (2024). Nature-based interventions for physical health conditions: A systematic review and meta-analysis. *Environmental Research*, 258, 119421.
<https://doi.org/10.1016/j.envres.2024.119421>
- Sulfa, D. M., Suwono, H., & Husamah, H. (2024). Human connection with nature improves wellbeing and pro-environmental behavior: A literature review. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, 10(2), 698–713. <https://doi.org/10.22219/jpbi.v10i2.32674>
- Tambyah, R., Olcoń, K., Allan, J., Destry, P., & Astell-Burt, T. (2022). Mental health clinicians' perceptions of nature-based interventions within community mental health services: Evidence from Australia. *BMC Health Services Research*, 22(1), 841.
<https://doi.org/10.1186/s12913-022-08223-8>
- Tamlyn, K., Johnson, S., Collins, S.-A., Farwell, J., Zarestky, J., Walker, S., & LoTempio, S. (2024). *Nature and health practitioner needs assessment: Investigating organizational capacity to leverage science for impact*. <https://sites.warnercnr.colostate.edu/cnisp/>
- Tamlyn, K., Walker, S., Zarestky, J., Dahl, J., & LoTempio, S. (manuscript in preparation). *Force of nature: A new framework to explore the potential of nature exposure and nature connectedness to create a closed-loop positive feedback system for the good of people and the planet*.
- Taylor, L. A., Aveling, E.-L., Roberts, J., Bhuiya, N., Edmondson, A., & Singer, S. (2023). Building resilient partnerships: How businesses and nonprofits create the capacity for responsiveness. *Frontiers in Health Services*, 3.
<https://doi.org/10.3389/frhs.2023.1155941>

- Thompson, M. A., Owen, S., Lindsay, J. M., Leonard, G. S., & Cronin, S. J. (2017). Scientist and stakeholder perspectives of transdisciplinary research: Early attitudes, expectations, and tensions. *Environmental Science & Policy*, 74, 30–39.
<https://doi.org/10.1016/j.envsci.2017.04.006>
- Thomson, D., Zimmermann, G. L., & Montesanti, S. (2025). Does the “17-year gap” tell the right story about implementation science? *Frontiers in Health Services*, 5.
<https://doi.org/10.3389/frhs.2025.1704368>
- Tomasso, L. P., & Chen, J. T. (2022). Toward a Theory of Nature Experience and Health—Linda Powers Tomasso, Jarvis T. Chen, 2022. *Ecopsychology*.
https://journals.sagepub.com/doi/full/10.1089/eco.2022.0005?utm_source=chatgpt.com
- Topp, C. W., Østergaard, S. D., Søndergaard, S., & Bech, P. (2015). The WHO-5 Well-Being Index: A Systematic Review of the Literature. *Psychotherapy and Psychosomatics*, 84(3), 167–176. <https://doi.org/10.1159/000376585>
- Truman, E., Lane, D., & Elliott, C. (2017). Defining food literacy: A scoping review. *Appetite*, 116, 365–371. <https://doi.org/10.1016/j.appet.2017.05.007>
- Ulrich, R. S. (1979). Visual landscapes and psychological well-being. *Landscape Research*, 4(1), 17–23. <https://doi.org/10.1080/01426397908705892>
- Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology*, 11(3), 201–230. [https://doi.org/10.1016/S0272-4944\(05\)80184-7](https://doi.org/10.1016/S0272-4944(05)80184-7)
- van Bakkum, J. E., McDougall, C. W., Wendelboe-Nelson, C., Mason, S. S., Williams, A. J., Jepson, R., & Malden, S. (2026). Understanding the Nature-Wellbeing Relationship in

- Adults: A Qualitative Metasynthesis Review. *Wellbeing, Space and Society*, 100359.
<https://doi.org/10.1016/j.wss.2026.100359>
- van den Berg, A. E. (2017). From Green Space to Green Prescriptions: Challenges and Opportunities for Research and Practice. *Frontiers in Psychology*, 8.
<https://doi.org/10.3389/fpsyg.2017.00268>
- Van Herzele, A., Bell, S., Hartig, T., Podesta, M. T. C., & van Zon, R. (2011). Health Benefits of Nature Experience: The Challenge of Linking Practice and Research. In K. Nilsson, M. Sangster, C. Gallis, T. Hartig, S. de Vries, K. Seeland, & J. Schipperijn (Eds.), *Forests, Trees and Human Health* (pp. 169–182). Springer Netherlands.
https://doi.org/10.1007/978-90-481-9806-1_6
- van Vooren, N. J. E., Drewes, H. W., de Weger, E., Bongers, I. M. B., & Baan, C. A. (2020). Cross-Sector Collaboration for a Healthy Living Environment—Which Strategies to Implement, Why, and in Which Context? *International Journal of Environmental Research and Public Health*, 17(17), 6250. <https://doi.org/10.3390/ijerph17176250>
- Vanhatalo, S., Liedes, H., & Pennanen, K. (2022). Nature Ambience in a Lunch Restaurant Has the Potential to Evoke Positive Emotions, Reduce Stress, and Support Healthy Food Choices and Sustainable Behavior: A Field Experiment among Finnish Customers. *Foods*, 11(7), Article 7. <https://doi.org/10.3390/foods11070964>
- Vella-Brodrick, D. A., & Gilowska, K. (2022). Effects of Nature (Greenspace) on Cognitive Functioning in School Children and Adolescents: A Systematic Review. *Educational Psychology Review*, 34(3), 1217–1254. <https://doi.org/10.1007/s10648-022-09658-5>

- Venkataramani, A. S., O'Brien, R., & Tsai, A. C. (2021). Declining Life Expectancy in the United States: The Need for Social Policy as Health Policy. *JAMA*, 325(7), 621–622. <https://doi.org/10.1001/jama.2020.26339>
- Vesely, S., Masson, T., Chokrai, P., Becker, A. M., Fritsche, I., Klöckner, C. A., Tiberio, L., Carrus, G., & Panno, A. (2021). Climate change action as a project of identity: Eight meta-analyses. *Global Environmental Change*, 70, 102322. <https://doi.org/10.1016/j.gloenvcha.2021.102322>
- Vidal, D. G., Alves, F., Valentim, C. S., & Freitas, H. (2024). Natures instead of nature—plural perceptions and representations of nature and its challenges for ecological transition: A systematic review of the scientific production. *Environmental Sciences Europe*, 36(1), 108. <https://doi.org/10.1186/s12302-024-00934-5>
- Voukelatou, V., Gabrielli, L., Miliou, I., Cresci, S., Sharma, R., Tesconi, M., & Pappalardo, L. (2021). Measuring objective and subjective well-being: Dimensions and data sources. *International Journal of Data Science and Analytics*, 11(4), 279–309. <https://doi.org/10.1007/s41060-020-00224-2>
- Vuela for Health. (2026). *Vuela for Health | Health Promoters and Community Organization*. <https://www.vuelaforhealth.org/>
- Whitburn, J., Linklater, W., & Abrahamse, W. (2020). Meta-analysis of human connection to nature and proenvironmental behavior. *Conservation Biology*, 34(1), 180–193. <https://doi.org/10.1111/cobi.13381>
- White, M. P., Alcock, I., Grellier, J., Wheeler, B. W., Hartig, T., Warber, S. L., Bone, A., Depledge, M. H., & Fleming, L. E. (2019). Spending at least 120 minutes a week in

- nature is associated with good health and wellbeing. *Scientific Reports*, 9(1), N.PAG-N.PAG. <https://doi.org/10.1038/s41598-019-44097-3>
- Wilson, E. O. (1984). *Biophilia*. Cambridge: Harvard University Press.
- Winkler, R. L., Clark, J. A. G., Locke, D., Kremer, P., Aronson, M. F. J., Hoover, F.-A., Joo, H. E., Rosa, D. L., Lee, K. J., Lerman, S. B., Pearsall, H., Vargo, T. L. V., Nilon, C. H., & Lepczyk, C. A. (2024). Unequal access to social, environmental and health amenities in US urban parks. *Nature Cities*. <https://doi.org/10.1038/s44284-024-00153-2>
- Winter, P. L., Crano, W. D., Basáñez, T., & Lamb, C. S. (2019). Equity in Access to Outdoor Recreation—Informing a Sustainable Future. *Sustainability*, 12(1). <https://doi.org/10.3390/su12010124>
- Wittmann, B., & Garrity, D. (2025). Sick of the City: Unpacking the Fat Body Politics of Wilderness. *Environment and History*, 0(0), 1–23. <https://doi.org/10.3828/whpeh.63861480345888>
- Wolf, K. L., Lam, S. T., McKeen, J. K., Richardson, G. R. A., van den Bosch, M., & Bardekjian, A. C. (2020). Urban Trees and Human Health: A Scoping Review. *International Journal of Environmental Research and Public Health*, 17(12), 4371. <https://doi.org/10.3390/ijerph17124371>
- World Health Organization. (1998). *Wellbeing measures in primary health care/the DEPCARE project*. <https://iris.who.int/items/07a5e1ac-9832-4088-a25d-0338088bdb05>
- World Health Organization. (2026). *Promoting well-being*. <https://www.who.int/activities/promoting-well-being>

- Yao, W., Zhang, X., & Gong, Q. (2021). The effect of exposure to the natural environment on stress reduction: A meta-analysis. *Urban Forestry & Urban Greening*, 57, 126932.
<https://doi.org/10.1016/j.ufug.2020.126932>
- Yao, Z., Li, M., & Liu, H. (2025). Cultivating Care Through Nature: A Meta-Analysis of Nature Connectedness and Prosociality. *Sustainability*, 17(23).
<https://doi.org/10.3390/su172310580>
- York, S., Lavi, R., Dori, Y. J., & Orgill, M. (2019). Applications of Systems Thinking in STEM Education. *Journal of Chemical Education*, 96(12), 2742–2751.
<https://doi.org/10.1021/acs.jchemed.9b00261>
- Zawadzki, S. J., Steg, L., & Bouman, T. (2020). Meta-analytic evidence for a robust and positive association between individuals' pro-environmental behaviors and their subjective wellbeing. *Environmental Research Letters*, 15(12), 123007.
<https://doi.org/10.1088/1748-9326/abc4ae>
- Zelenski, J. M., Dopko, R. L., & Capaldi, C. A. (2015). Cooperation is in our nature: Nature exposure may promote cooperative and environmentally sustainable behavior. *Journal of Environmental Psychology*, 42, 24–31. <https://doi.org/10.1016/j.jenvp.2015.01.005>
- Zhang, B., Wang, J., & Abdullah, A. binti. (2024). The effects of art therapy interventions on anxiety in children and adolescents: A meta-analysis. *Clinics*, 79, 100404.
<https://doi.org/10.1016/j.clinsp.2024.100404>
- Zheng, H., & Echave, P. (2021). Are Recent Cohorts Getting Worse? Trends in US Adult Physiological Status, Mental Health, and Health Behaviors Across a Century of Birth Cohorts. *American Journal of Epidemiology*, 190(11), 2242–2255.
<https://doi.org/10.1093/aje/kwab076>

Zhou, M., Luo, Y., Xu, Z., Zhang, R., & Liu, X. (2025). Nature Exposure and Subjective Well-Being: The Mediating Roles of Connectedness to Nature and Awe. *Sustainability*, 17(12), 5406. <https://doi.org/10.3390/su17125406>

APPENDIX A

Manuscript 1: Detailed Recruitment Information - Practitioners

Our research team conducted an internet search to identify diverse practitioner organizations nationwide. We also distributed a participation interest form at the SHIFT Summit 2023, a conference convening researchers and practitioners working in the field of nature and well-being. The initial recruitment email for our survey was sent to this combined list, with a request for recipients to forward the email to other people or organizations in their network, beginning the process of snowball sampling. Additionally, we used our network to send requests to organizations and partners that have email lists of their own including the REI Cooperative Action Fund, GP RED, the Children & Nature Network, Nature & Health: Utah, Nature & Health: Washington, Nature & Health: Northern Colorado, Colorado State University Extension, Fort Collins Natural Areas Department, and the Natural Leaders Network.

Manuscript 1: Detailed Recruitment Information - Researchers

Additionally, we sent requests to other known research organizations we that have email lists of their own including the Nature and Health Alliance, GP RED, the Children & Nature Network, Nature & Health: Utah, Nature & Health: Washington, and Nature & Health: Northern Colorado

APPENDIX B

Manuscript 1: Practitioner Interview Guide

(Two sections of this interview guide that are beyond the scope of this manuscript are excluded.)

If participant had previously collaborated with a researcher:

1. In your response to our survey, you indicated that your organization has collaborated with a researcher or researchers in the past. Can you tell me more about that collaboration?
 - a. Prompt if needed: If you don't mind sharing, who were the key partners in the collaboration? What were their roles?
 - b. What motivated your organization to engage in this collaboration?
 - c. Would you describe the collaboration as successful? If so, why?
 - d. Prompts:
 - i. Even though this collaboration could be seen as successful, what are some barriers or challenges you faced along the way?
 - ii. If no: What were some of the barriers or challenges that you feel prevented this from being successful?
 - e. If you were going to collaborate with researchers again, what would you like to see happen differently?

OR If participant had not previously collaborated with a researcher:

1. In your response to the survey, you indicate that your organization has not collaborated with researchers in the past but is interested in future collaborations.
 - a. What barriers have prevented you from engaging in a collaboration with a researcher previously?

- b. What do you see as the potential benefits of a collaboration with researchers?
- c. What are things that would motivate you to collaborate with researchers?
- d. What do you need from a researcher partner to make a collaboration successful?

Everyone:

- 2. What do you see as strategies that would support collaborations between researchers and practitioners more broadly?
- 3. If you had a conversation with a researcher focused on the health and well-being benefits of time spent in nature.
- 4. What would you want them to know about your organization's work?
 - a. What questions would you want to ask them?
 - b. Prompt: Why OR how would their answers influence your work?

Manuscript 1: Researcher Interview Guide

- 1. Have you collaborated with a practitioner or practitioner organization in the past? If so, can you tell me about this collaboration?
 - a. If yes:
 - i. What was your role in this collaboration? (e.g. a consultant, conducted fieldwork at the organization, co-designed and conducted research with the organization?)
 - ii. How did you and this practitioner/practitioner organization get connected?
 - iii. What motivated you to engage in this specific collaboration?
 - iv. Would you describe the collaboration as successful? Why or why not?

1. If yes: Even though you see this collaboration as successful, what were some barriers or challenges you faced along the way?
 2. If no: What are some of the barriers or challenges that you feel prevented this from being successful?
- v. If you were going to collaborate with practitioners again, what would you like to see happen differently?
- b. If no:
 - i. Why not?
 - ii. What do you see as the potential benefits of a collaboration with practitioners?
 - iii. What would motivate you to collaborate with practitioners?
 - iv. What would you need from a practitioner partner to make a collaboration successful?
2. What do you see as strategies that would support collaborations between researchers and practitioners more broadly?

APPENDIX C

Manuscript 2: Pre & Post Survey

Note: Additional questions were included in the survey that were not involved in the outcomes for this project.

1. By clicking Yes, you acknowledge that you have read and understand the consent provided in the link above. By clicking No, your responses will not be included in the study.
 - Yes, I consent
 - No
2. I am over the age of 18
 - Yes
 - No
3. My ideal vacation spot would be a remote, wilderness area.
 - Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Strongly agree
4. I always think about how my actions affect the environment.
 - Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Strongly agree
5. My connection to nature and the environment is a part of my spirituality.
 - Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Strongly agree
6. I take notice of wildlife wherever I am.
 - Strongly disagree
 - Disagree
 - Neither agree nor disagree

- Agree
 - Strongly agree
7. My relationship to nature is an important part of who I am.
- Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Strongly agree
8. I feel very connected to all living things and the earth.
- Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Strongly agree
9. I participate in behaviors that support the health of the Earth.
- Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Strongly agree

For the next 5 questions, please describe your experience over that last 2 weeks:

10. I have felt cheerful and in good spirits.
- At no time
 - Some of the time
 - Less than half of the time
 - More than half of the time
 - Most of the time
 - All of the time
11. I have felt calm and relaxed.
- At no time
 - Some of the time
 - Less than half of the time
 - More than half of the time
 - Most of the time
 - All of the time
12. I have felt active and vigorous.
- At no time
 - Some of the time

- Less than half of the time
- More than half of the time
- Most of the time
- All of the time

13. I woke up feeling fresh and rested.

- At no time
- Some of the time
- Less than half of the time
- More than half of the time
- Most of the time
- All of the time

14. My daily life has been filled with things that interest me.

- At no time
- Some of the time
- Less than half of the time
- More than half of the time
- Most of the time
- All of the time

15. What is your zip code? (Enter N/A if you prefer not to answer.)

Open response box

16. What is your annual household income?

- Less than \$15,000
- \$15,000-39,999
- \$40,000-59,999
- \$60,000-99,999
- \$100,000-199,999
- Over \$200,000
- Prefer not to answer

17. What is your age?

- 17 or younger
- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65-74
- 75-84
- 85 or older
- Prefer not to say

18. What is your gender?

- Woman
- Man
- Non-binary
- Not listed here (please specify) - open response box
- Prefer not to say

19. Which of the following categories best describe your racial and/or ethnic identity? (Select all that apply)

- American Indian or Alaskan Native
- Asian
- Black or African American
- Hispanic or Latino
- Middle Eastern or North African
- Native Hawaiian or Pacific Islander
- White
- Not listed here (please specify) – open response box
- Prefer not to say

APPENDIX D

Manuscript 3: Interview Guide

- 1) Can you start by telling me about your connection to Come Alive Outside (CAO)?
 - a. What programming specifically?
- 2) Can you tell me about your connections or involvement with the community of Rutland?
- 3) We are interested in the outcomes of CAO's work. Can you tell me about the impacts or value that CAO brings to the Rutland community?
- 4) How does CAO go about achieving these impacts?
 - a. Prompt: What is CAO doing that leads to each of these impacts?
- 5) What else would you like to see CAO do in the Rutland community?
- 6) Can you think of any opportunities for CAO to do their work more effectively?
- 7) My understanding is that Come Alive Outside existed as an organization before it existed in Rutland, but it struggled to survive as an organization in other places. Why do you think Come Alive Outside has been able to grow into a viable/dependable organization in Rutland?
 - a. Prompt: What is unique to the Rutland Community that has enabled CAO to grow /solidify its programming?
 - b. In other words, what do you think it is about Rutland specifically that makes Come Alive Outside's model have the impacts it does?
 - c. Context could mean culture, history, challenges, values, geography, people, etc.
- 8) How could CAO better address the unique context or issues of the Rutland community?

- 9) Is there anything else about Come Alive Outside or their programming, and the role they play in the Rutland Community that we haven't covered that you would like to talk about?

APPENDIX E

Manuscript 3: Observation Protocol

Goals:

- Identify social-ecological impacts that Come Alive Outside provides to the community that are mentioned throughout the meeting.
- Note discussion about Come Alive Outside components or programs that lead to these outputs.
- Note context specific factors that are named or discussed that may support the outcomes identified.

Data collection table

Impact	Program or organizational component	Context	Notes
Example Impact 1:	Description of the program/component	Details about the context that may be useful	Any additional notes that seem relevant
Impact 2			
Impact 3			
And so on			

Additional notes: