Curricular nature-based learning in higher education to support mental and environmental health

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The relationship between human health and nature is increasingly recognized in diverse health science and environmental disciplines, demonstrating the fundamental interdisciplinary connection between humans and the natural environments we live in. Human-nature connectedness and a positive human-nature relationship have positive effects on mental health and well-being, and environmental benefits in the form of pro-environmental attitudes and behaviours, including environmental stewardship. However, nature deterioration associated with the climate crisis can directly and indirectly negatively impact human health, including mental health. The complex interconnections between mental health and nature in the context of the climate crisis, require a broad interdisciplinary perspective to understand the diverse elements contributing to and stemming from the global climate crisis. Yet, it is unrealistic for an individual person or even a community to address the entirety of the problem. Instead, individuals and communities should focus on implementing meaningful changes on a smaller local scale, which can be adapted and expanded for systemic implementation. One potential strategy is through education. There is strong evidence to support the mental health and environmental benefits of outdoor education, nature-based learning, and nature-based experiences, but these models focus on restricted age groups and may have considerable barriers to access. In this paper, we offer suggestions to empower individuals to make meaningful positive changes in their local environments for their own mental health, with the hope it will act as a path towards systemic change through embedding a model of curricular nature-based learning into education systems, including higher education.

Introduction

There is no shortage of complex challenges present in the world today, including food insecurity, poverty, accessible education, sustainability, and the climate crisis.[1–4] These multifaceted challenges, known as 'wicked problems', have complex causes and wide-reaching consequences such that no single solution can be derived from an individual disciplinary silo.[5] Therefore, mitigation strategies must also be multifaceted and apply a systems-thinking approach to consider the 'big picture' and the relationships between various components, instead of considering each element in isolation.[3,6] At the forefront of these wicked problems is the climate crisis, which describes the irreversible damage to the climate and environment caused by global warming (gradual increase in the temperature of the earth's atmosphere) and climate change (long-term shifts in temperatures and weather patterns).[7–9]

Calls to action, and the actions themselves, are influenced by the mental health of those in positions to act. Feelings of eco-anxiety, eco-grief, eco-anger, and eco-depression are all drivers of either engagement with or dissociation from environmental programs or action.[10] Although mental health has traditionally been neglected in human health research, recent work includes recognition and exploration of the diverse elements that contribute to mental health.[11] Through a systems-thinking approach the relationship between mental health and the climate crisis is realized, with increasing evidence to support the interactions between these elements.[7, 12–15] Progress towards this understanding is reflected in human-nature connectedness,[16–18] and explored through One Health (an integrated approach to optimizing human, ecosystem, and animal health).[19] Understanding the connections between nature and mental health provides us the opportunity to design and implement strategies

on individual, local, and broader systemic levels, all of which benefit the environment and personal well-being.

Although a variety of nature-based experiences are successful in elementary and secondary level education, adult learning is excluded.[20] To maximize the impact for adult learning, it would be most efficient to use the extensive pre-existing post-secondary education system for an implementation starting point.

In this paper, we explore the connectedness between nature and mental health with a focus on solutions for personal mental health and local environmental health benefits. Then, we assess the existing models of outdoor education, nature-based learning, and nature-based experiences to create an integrative model for curricular nature-based learning in higher education.

Nature as an Influencer of Mental Health

The significant benefits of spending time in nature on mental health are well documented.[21–23] While longer, more immersive nature exposures are most beneficial, even short exposures are valuable.[24,25] The connection between nature and mental health is thought to be related to multiple factors, including the biophilia hypothesis, stress reduction theory, and attention restoration theory. The biophilia hypothesis is based on the innate tendency of humans to seek out nature connections.[26,27] Stress reduction theory is centered on the stress-lowering physiological response associated with spending time in nature,[28,29] while attention restoration theory postulates that time in nature restores cognitive resources and engages involuntary attention (i.e. noticing something because it stands out, not because one is focusing on it).[30,31] The positive effects of nature exposure on mental health are thought to be the result of a combination of these and other factors that are not yet fully understood.

Spending time in nature also influences attitude and behaviour, which may be attributed to human-nature connectedness (the feeling of being a part of nature),[32] or the human-nature relationship that extends beyond to include actions and experiences that connect people to nature.[18] Increased connectedness to nature is associated with greater pro-environmental attitudes and behaviours (e.g. environmental stewardship) (Figure 1).[33–36] As such, it is reasonable to predict that the climate crisis and associated nature degradation negates these benefits,[7] and the climate crisis negatively impacts mental health. For

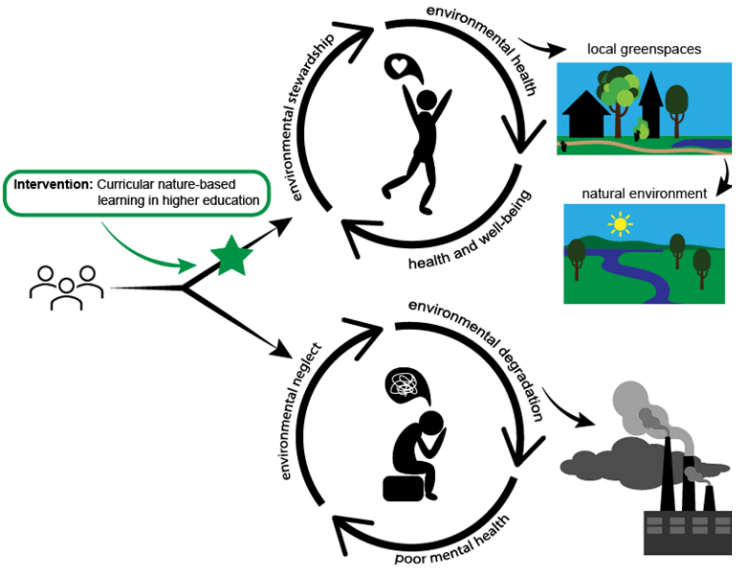

Figure 1 | Feedback cycles of 1) environmental stewardship, environmental health (e.g. pro-environmental behaviours, urban greenspaces, and the broader natural environment), and human health and well-being, and 2) environmental neglect (e.g. pollution, industrialization), degradation, and poor mental health. The intervention of curricular nature-based learning in higher education is proposed to encourage behaviours associated environmental stewardship and well-being.

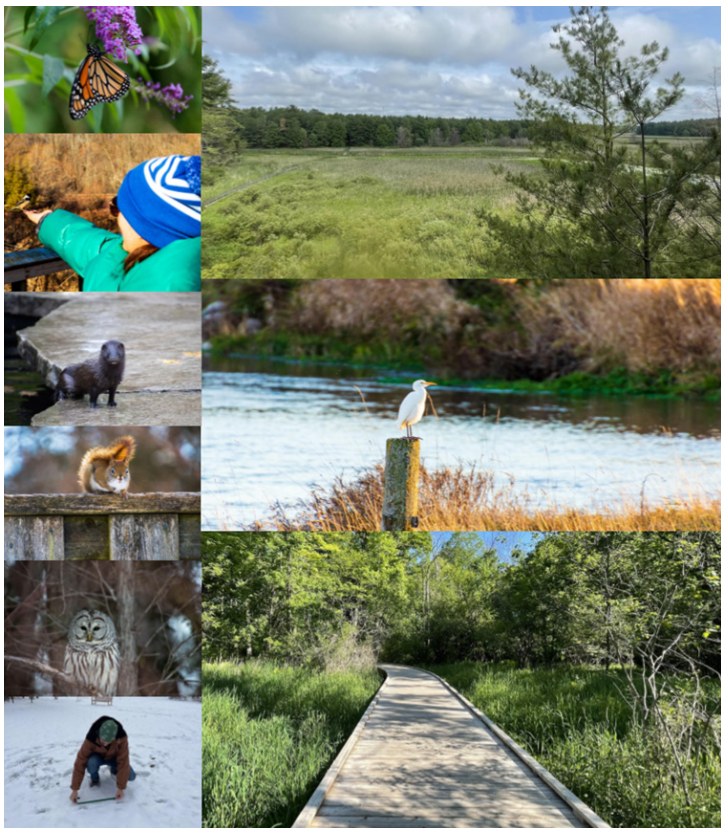

Figure 2 | A collection of nature pictures that highlight the beauty of greenspaces, along with animals that use those spaces. People are seen spending time in nature in a positive way. Individuals photographed have given consent for their image to be used. Photographer: Michelle Beltran

of nature and weakens the human-nature relationship, fueling environmental neglect that contributes to climate change.[37,38] Concepts like "eco-anxiety"[11,39] and "eco-grief"[40] describe the psychological response (e.g. anxiety and grief) and persistent worry associated with witnessing irreversible environmental damage. For some people, simply being aware of the climate crisis contributes to poor mental health.[41] Taken together, an understanding of the mental health-related effects of climate change, and the current knowledge of the benefits incurred from spending time in nature, support development of prevention and mitigation strategies that can serve as a path towards personal and systemic changes.

Towards Environmental and Mental Health

There are many nature-based initiatives that can result in significant gains to personal mental health while supporting individual efforts to reduce environmental harm. Spending time in and with nature improves mental health by connecting people with their natural surroundings (Figure 2), and this can empower them to make environmentally beneficial changes. For example, birdwatchers are aware of the role of birds in the ecosystem and recognize the overall importance of biodiversity.[42] Ecotourists report donating more money to environmental organizations after their experiences.[36] Hikers pick up trash to conserve the beauty of the natural spaces they visit.[43] Each of these small efforts support nature and wildlife.

To maximize opportunities for people to participate in these types of activities and increase accessibility to nature, communities should work towards increasing access to urban greenspace.[44–46] Accessible nature spaces are especially important because the rapid speed of urbanization makes communities more vulnerable to climate risk (e.g. heat waves, flooding, natural disasters), and disproportionately impacts those who are marginalized and equity-deserving.[47,48] Urbanization threatens biodiversity by causing habitat fragmentation and reducing greenspaces, which negatively impacts people through reduced ability to access nature.[49]

Greenspaces provide direct benefits to the environment, like cooling effects and carbon sequestration in urban landscapes,[50–52] and they can be further enhanced through the addition of native flora, shelter or nesting structures, food, and water, to provide wildlife with usable habitat (e.g. wildlife gardening).[38,53–56] These spaces provide links for wildlife between large established natural spaces, and a place for humans to connect with the natural world and develop an understanding of the value of such spaces. Greenspaces with greater diversity of native plants and supplemental food sources are more beneficial to native animal species, lead to increased wildlife diversity, and are associated with increased wildlife sightings in urban landscapes.[38,53,57,58]

Actively engaging communities can foster an awareness of the need for their local and federal governments to address the climate crisis[59] and should encourage the government to consider the mutually beneficial outcomes of integrating mental health and environmental action programs. For example, nature spaces and exposures provide individuals and communities with access to significant cultural ecosystem services (non-material benefits from nature) like recreation, leisure, and mental health benefits.[60,61] The mechanistic pathways that explain nature-related mental health benefits are complex, but increased nature (e.g. increased vegetation cover, higher species abundance, more time outside) is consistently associated with reduced prevalence and severity of mental health challenges like depression and anxiety.[23,60,62] A variety of psychological pathways may explain this; for example, going for nature walks reduces rumination, and reduced rumination has a known link to reduced risk of depression.[62] Further, Scopelliti et al.[63] found that spending time in natural areas is psychologically restorative, more so than spending time anywhere else including enjoyable human-made settings.

The protective effects of nature on mental health appear to be most significant during childhood and adolescence, and for individuals from low income and marginalized groups, which are the communities who are also more likely to experience the negative health effects of climate change.[7,64–67] Despite the clear benefits for bringing nature to people, activities like citizen science (scientific research by members of the public)[68] and ecotourism (responsible travel with a focus on nature, conservation, and education),[69,70] or community greenspaces,[71] are often inaccessible. There is a call for increased accessibility and universal design in these initiatives,[72–74] indicating that these opportunities should be woven into existing social services that are widely accessed by individuals and communities to facilitate a systemic approach.

A Systemic Approach for Long-term Change

To have the greatest impact, initiatives should be introduced early on in a more equitable and accessible way. While many nature-based projects, such as citizen science programs, are available around the world, in some cases they are less accessible than formal education. For example, they rely on participants being able to volunteer time and transportation, often skewing the sociodemographic and geographic distribution of those able to participate.[75–78] And yet, the mental health benefits should be available to all. Embedding nature-based experiences deliberately within systems of education adds value and support to participation, reduces barriers to access (but does not eliminate them entirely), and may yield significant societal benefits worth considering.

The mental health, well-being, and learning benefits associated with outdoor learning for elementary and secondary school students and teachers are well documented and programming is broadly practiced.[79–83] These outdoor experiences are diverse in format, ranging from semester-long field schools to short modules woven into core curriculum. The skills taught during outdoor education modules are often those which can only be performed outdoors (i.e. orienteering, canoeing, birdwatching). Once a student reaches post-secondary education, formalized outdoor learning ceases almost entirely despite no evidence to suggest that the mental health and well-being benefits cease to be realized in adulthood. In fact, the limited research available indicates continued benefits for adult learners.[84–86] Within Canada, the post-secondary outdoor and nature-based educational programing is largely restricted to elementary and secondary teacher training such as the Outdoor and Experiential Education track offered by the Faculty of Education at Queen's University, or specific programs such as the Outdoor Adventure Certificate offered by Algonquin College. Access to outdoor or nature-based learning experiences is not broadly integrated into post-secondary education because university systems emphasize traditional instructional methods in classrooms and ignore learning needs that can be better served by outdoor learning spaces.[20]

Outdoor education programs prioritize learning outdoor-related skills, and do not specifically address the personal mental health and well-being benefits of the outdoor classroom. Nature-based experiences, with their focus on health and well-being, are often highly barriered to access. Nature-based learning, though focusing on the benefits associated with mental health and well-being, is usually only accessible to children, often through the elementary and secondary school system. Therefore, an integrated model is required to retain those characteristics that could benefit adults across Canada. This model should remove the outdoor-skills specific learning outcomes of outdoor education and the barriers to access of nature-based experiences and retain the mental health and well-being benefits of both. Nature-based learning, with its emphasis on the mental health and well-being of the individual, if expanded to include adult students in post-secondary education, serves to overcome the challenges presented by outdoor education or nature-based experience models by being more easily accessible within the system of formal education (Figure 3). This curricular nature-based learning in higher education can be used as an intervention to move towards a positive cycle of environmental stewardship, environmental health, and human well-being (Figure 1).

There are programs within the post-secondary education system that can serve as proof of concept for widescale expansion of curricular nature-based learning. Undergraduate programs in field ecology have a long tradition of outdoor education, where students learn to conduct scientific research in outdoor settings. Field courses, short trips to local natural areas, and other opportunities are regarded as commonplace. These outdoor experiences exist to meet specific learning outcomes associated with practicing ecology, yet the mental health and well-being benefits cannot be ignored. Robertson et al. [87] suggest that the mental health support that students received by engaging in a citizen science outdoor nature-based experiential learning assignment contributed to both short term enjoyment of learning (despite COVID-19 pandemic-related stressors) and the long-term monitoring goals of the project itself. If these exposures to nature through education are meaningful, just like participating in an ecotourism adventure, we could also predict that the benefits would extend beyond individual mental health and well-being to include environmental health through a heightened awareness of the need to engage in environmental stewardship.

Though Robertson et al.[87] describe engaging students of a first-year university biology course in a squirrel biology citizen science project, we believe that

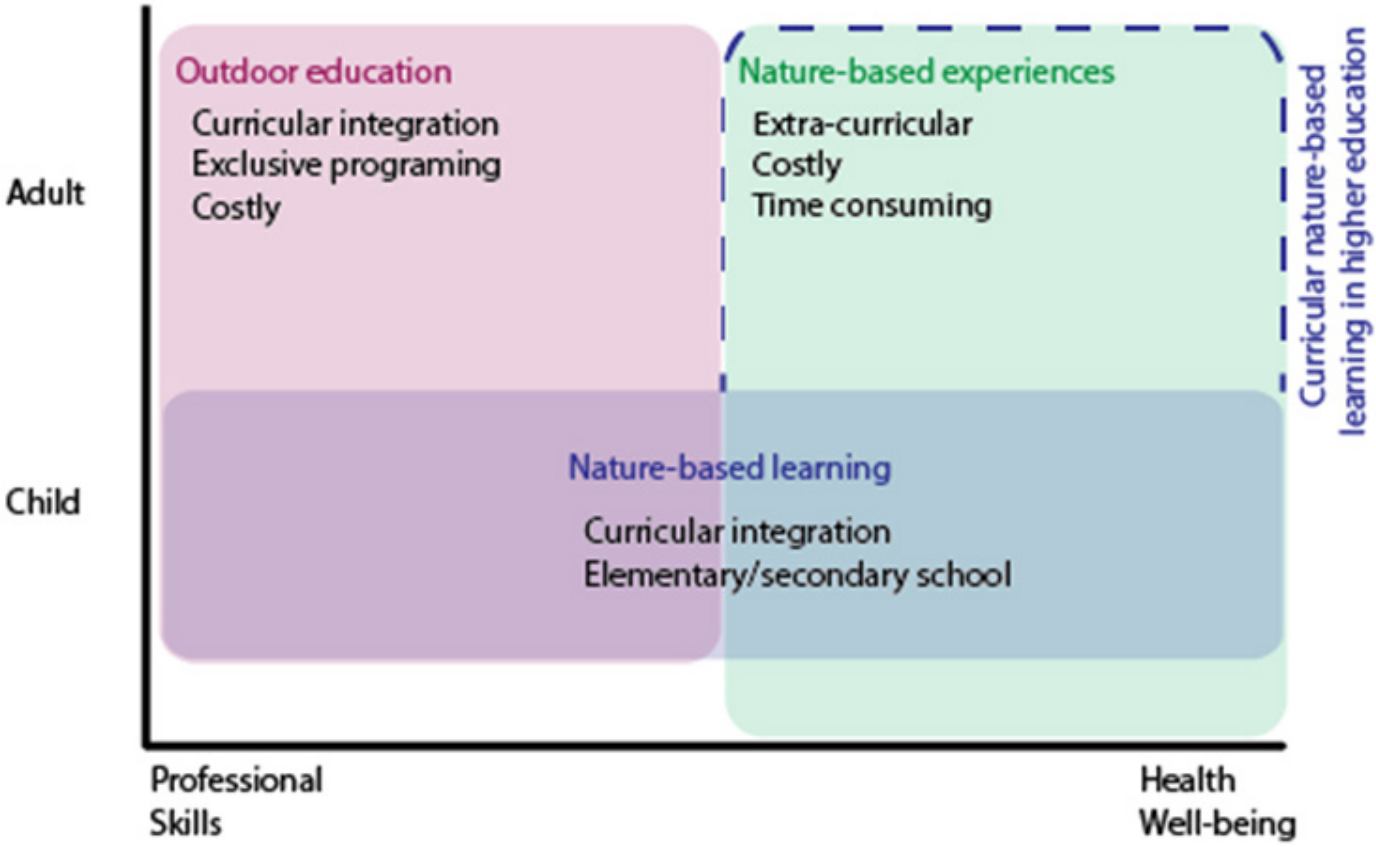

Figure 3 | Representation of the current models of outdoor and nature-based learning, and the proposed model of curricular nature-based learning to extend to higher education and adult learning.

nature-based learning is discipline agnostic and can be supported by almost any course in a variety of ways, all of which can improve the mental health of participants. For example, a mathematics course might include a module on mathematics in biological systems, requiring students to observe patterns in nature. A history course might include a module on the history of non-human organisms that requires students to visit with these individuals (e.g. native flora and fauna). With the dramatic rise in undergraduate students accessing educational accommodation for disabilities associated with declining mental health,[88,89] the need for nature-based learning to be woven into all post-secondary programs could not be greater.

The limitations to widespread adoption of nature-based learning opportunities within the curriculum are not unique to this model, but a symptom of a larger hesitancy to adopt evidence-based teaching approaches.[90–95] The reasons for hesitancy are well known and likely stem from lack of formal training in teaching practice.[91,96,97] We contend that many of the perceived challenges to introducing nature-based learning opportunities within courses can be creatively overcome. In Robertson et al.,[87] the nature-based learning module was offered in courses of over 950 first-year students in a core biology course, did not increase budget or teaching resources, did not take away from in-class time or content learning, was not at an extra cost (financial or time) to students, and represented 5% of the final grade. While more resource intensive models exist, we do not consider resourcing to be an obligate feature of the model. The challenge of encouraging evidence-based teaching practices within post-secondary institutions is timeless and often each specific intervention has limited effect. Broadly though, programs supported by educational developers, teaching-focused hiring criteria, professional development programs, engagement in the scholarship of teaching and learning, and development of low-maintenance teaching modules, can all be used to encourage adoption. No single evidence-based practice needs to be used in every course and nature-based learning could be introduced in courses where instructors are enthusiastic to do so.

One limitation that must be considered is access to natural environments. For example, a post-secondary institution

that is situated in the middle of a metropolitan city may have limited access to nature. However, most campuses would still have access to some natural elements (e.g. trees on campus) and student mental health, in addition to learning, could benefit from deliberate interaction with them. For example, a first-year physics course at The University of Guelph has incorporated a nature-based learning module by having students measure the circumference of trees on or off campus.

Since the overwhelming majority of research on nature-based learning is focused on children[16,98] there are many opportunities for future research within the context of understanding limitations and benefits of nature-based learning in post-secondary curriculum, and in measuring both the learning and mental health benefits. One item of particular importance would be to assess attitudes and motivations of students and instructors to facilitate wider adoption. Subsequent research could then focus on best practices, minimum program requirements, and specific mechanisms by which the benefit is delivered.

Conclusion

The climate crisis is causing irreversible damage to the environment, and this puts human health at risk in numerous ways. By promoting nature for mental health, we contribute to a culture of climate care that feeds back into improving mental health. Solutions for the climate crisis require multifaceted, interdisciplinary approaches including action from a diversity of people ranging from communities and individual citizens to government officials and organizations.[54] One individual does not have – and does not need to have – the ability to change the whole world, but each of us does have the power to make small impactful changes in our own lives and local communities through our beliefs, attitudes, and actions as environmental stewards. These small, achievable initiatives are necessary to restore and maintain our natural world, but are not necessarily barrier-free, and are not feasible if people and communities feel powerless or hopeless.[7] Although it is critical to understand the dire environmental situation, we must also provide people with the information, tools, and empowerment to do something about it. This is achievable on a local scale by increasing access to nature and is scalable to a larger systemic approach through the integration of accessible nature-based experiences into higher education programs. By ensuring that access to curricular nature-based learning is extended into all post-secondary education, we establish a framework through which a growing majority of our population could realize the health and well-being benefits with the potential to generate an environmental health movement and the cultural shift needed to address the wicked problem of the global climate crisis.

Land Acknowledgement

The Dish with One Spoon Covenant speaks to our collective responsibility to steward and sustain the land and environment in which we live and work, so that all peoples, present and future, may benefit from the sustenance it provides. As we continue to strive to strengthen our relationships with and continue to learn from our Indigenous neighbours, we recognize the partnerships and knowledge that have guided the learning and research conducted as part of this work. The University of Guelph resides in the ancestral and treaty lands of several Indigenous peoples, including the Attawandaron people and the Mississaugas of the Credit, and we recognize and honour our Anishinaabe, Haudenosaunee, and Métis neighbours. We acknowledge that the work presented here occurred on their traditional lands so that we might work to build lasting partnerships that respect, honour, and value the culture, traditions, and wisdom of those who have lived here since time immemorial.

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