We are nature

Nature-based education for planetary health

L. Camargo and N. Segovia

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Table of contents

Executive summary

The escalating planetary health crisis demands innovative and transformative educational approaches. This paper presents nature-based education (NbE) as a critical solution, positioning nature at the heart of learning to foster a deep recognition of the interconnectedness between humanity and the natural world. NbE is integrated by diverse strategies such as environmental education, Indigenous knowledge and experiential learning to cultivate a profound sense of belonging, responsibility and active stewardship towards nature. This approach yields numerous benefits, including heightened awe and wonder, enhanced understanding of ecological systems, sharpened sensory awareness and significantly improved pro-environmental behaviours, ultimately leading to healthier, happier and more cohesive communities.

Additionally, the paper discusses the challenges and enablers of implementing NbE. It emphasises the need for political commitment, improved educational frameworks, greener learning spaces and well-prepared educators. By recognising the intrinsic connection between humans and nature, we are nature, NbE offers a pathway toward activating our capacity to create a more regenerative and resilient future for both people and the planet.

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"The natural world is the world, and man's creations are simply extensions of it … The earth is everywhere, become its student."

The Blue Dot – UNESCO, Rosalinda Ramirez-Yrizarry

Introduction

We are nature.

Education is fundamental to shaping our perceptions and values, particularly in understanding our place within the natural world. Through education, we cultivate the perspectives and appreciation needed to recognise our deep connection with Earth. However, over time, many of us have lost this sense of connection, creating mental, cultural and physical gaps that separate us from nature, as if it were something external and detached from who we are (UNESCO, 2022). Our health and survival depend on our ability to nurture the values, behaviours and attitudes that enable us to work with nature, not against it, and to understand our responsibilities in protecting and nurturing it (Abram, 1996; Sewall, 1999).

We face unprecedented challenges with climate change, biodiversity loss, water depletion, threats to our biosphere's integrity, nutrient cycle disruption, unsustainable land use and chemical pollution. We have significantly altered our surroundings through our relationships to and use of natural resources and a collective delusion of separation from the planet's natural cycles (Panorama Global, 2017).

These changes negatively impact our health and the planet's balance (Panorama Global, 2017). According to the Post Carbon Institute's *Welcome to the Great Unraveling* (Heisenberg & Miller 2023), we face a poly-crisis at the intersection of climate change, biodiversity loss, resource depletion and social inequity and this new period of "unraveling" requires new ways of thinking and acting as we enter an "age of consequences."

Considering these environmental and collective challenges, healing and addressing the relationship between humans and the rest of nature (including all the "more-than-human" beings) is critical to ensuring a healthy world. "To change the course and imagine alternative futures, we urgently need to rebalance our relationship with each other, the living planet and technology. We must learn our interdependencies and human place and agency in a more-than-human world because the choices we make today will determine our future" (UNESCO, 2021, p. 1). "The potential for engaging humanity in creating a better future has never been greater" (UNESCO, 2021, p. 1).

Education is at the heart of this endeavour. The man-made disconnect between humans and nature, the absence of systems thinking approaches and our education system, which perpetuates the conditions that threaten our shared future (UNESCO, 2021), are all challenges we must address, and transforming our education system is crucial.

We must reflect on how established ways of thinking about education, knowledge and learning inhibit us from opening new pathways toward our desired futures. Building a new education system requires reflecting on why and how we educate, and on how we have organised learning (UNESCO, 2021).

How can we help our current generation of learners unlearn unsustainable behaviours and attitudes toward nature? How can learning experiences become gateways to enhancing healthy relations with the environment and helping create conditions for all life to thrive? How can education become a tool for us to perceive and learn from our interconnections with nature?

Defining nature-based education: placing nature at the core of learning

"Bringing nature into the centre of education and allowing learning through active exploration and discovery activates learners' creative capacities and sense of being part of nature" (IUCN CEC, 2021).

At a moment when we have crossed six of nine planetary limits[1], stepping outside of our planetary safe operating space, and at a time when the resilience of our planetary systems is threatened (Stockholm Resilience Centre, 2023), it is imperative that education, at all levels, foster planetary citizens who can think and act in resonance with life, "creating the conditions conducive to life" as Janine Benyus has described it. There is an urgent need for education to have an integrated living systems approach that inspires and re-establishes a deep connection between humans and the rest of nature. Meier & Sisk-Hilton (2013) defined nature-based education as children's active learning in the natural world. In the last decades research and experience has shown nature-based education is much more. Nature-based learning experiences frame a mindset of embodiment and relationship: nature as knowledge, learning environment and teacher. These experiences foster deep connections with nature and highlight the interdependencies impacting the well-being of all life and the health of our planet's living and life-sustaining systems.

Nature-based education (NbE) is a system of blended educational strategies encompassing environmental education (as first defined by the IUCN), Indigenous ways of knowing, climate and biodiversity education, education for sustainable development, outdoor education and experiential education, mindfulness and socio-emotional

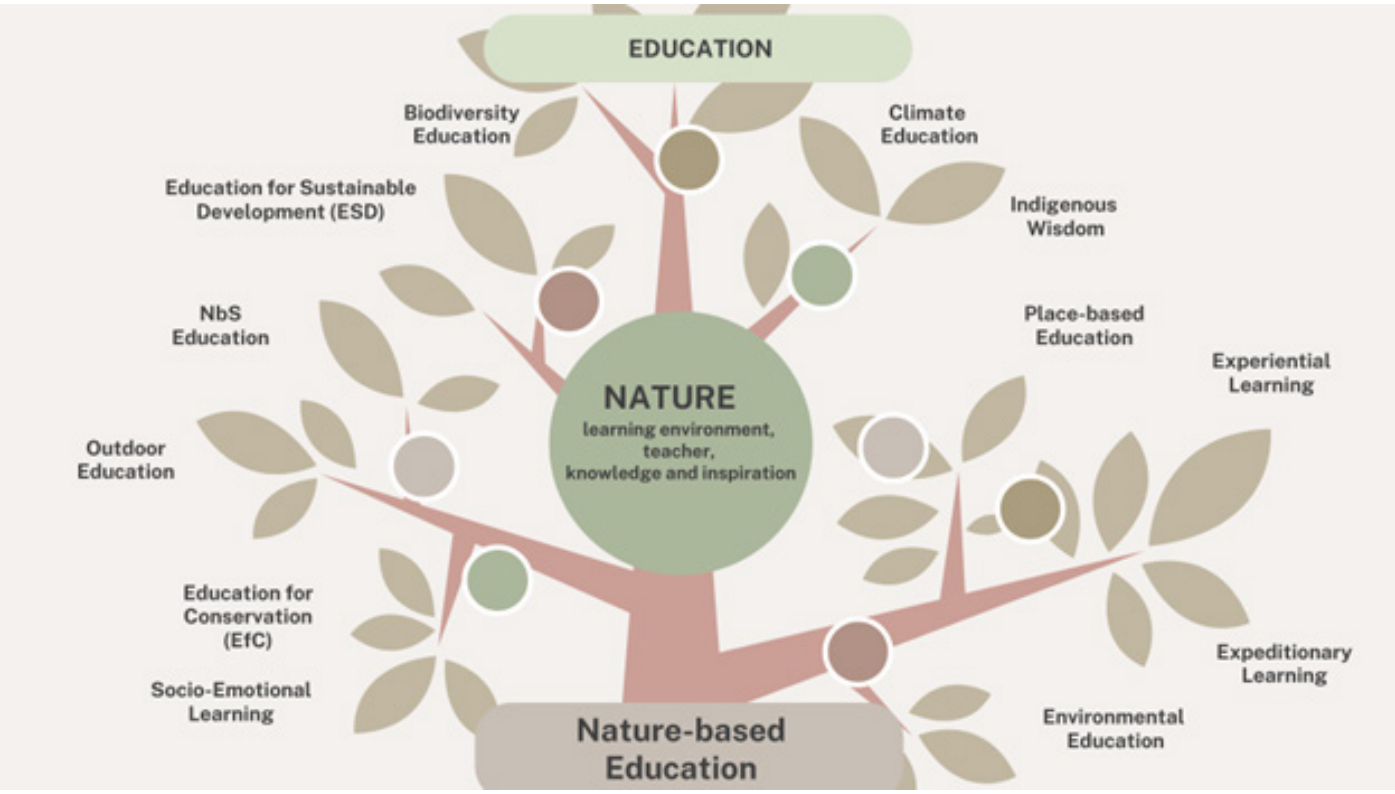

Figure 1: Bringing nature to the centre of active learning. L. Camargo, IUCN CEC.

[1] Climate change, novel entities, stratospheric ozone depletion, atmospheric aerosol loading, ocean acidification, modification of biogeochemical flows, freshwater change, land system change, biosphere integrity

learning, among others. Nature-based education encompasses and expands upon this Commission's past work on education for conservation (EfC). More than a one-way-fits-all, NbE aims to serve as an educational ecosystem encompassing various initiatives that bring nature to the core of learning.

In practice, this means students might learn mathematics by calculating the growth rate of plants in a school garden, study history by exploring local Indigenous land use, or develop critical thinking skills through citizen science projects monitoring local bird populations. It manifests as outdoor classrooms where children learn through direct sensory engagement with their surroundings, or as curricula designed to integrate ecological principles into all subjects, fostering a deep understanding of interdependence. Concrete examples include forest schools where children learn through unstructured play in natural environments, or initiatives where urban students transform neglected green spaces into vibrant learning ecosystems.

Nature-based education serves as an enabler that transforms educational practices into strategies that help individuals become aware of, understand and appreciate the strong relations between significant challenges like climate change, food and water security, biodiversity loss, natural disasters, human well-being and planetary health. It is an educational approach towards nature-based solutions based on a sense of interconnectedness with the natural world and an understanding of how human activities impact the environment. It gives learners the knowledge, skills, values and attitudes to make informed decisions on pressing environmental and social issues while prompting further engagement in environmental protection efforts across fields and levels. NbE nurtures a conservation ethic, as learners recognise that they are part of, not separate from, the natural world.

For example, students involved in a school's waste reduction programme, applying principles learned through NbE, might develop a community composting initiative, showcasing practical problem-solving and environmental stewardship.

Nature-based education offers a holistic approach that integrates living systems into all forms of education to inspire and re-establish a deep connection between humans and the rest of nature (Camargo, 2022). Through NbE, individuals learn in, about, from and as nature (human and more-than-human). NbE can be incorporated into formal, non-formal and informal education, training and capacity building and recognises the importance of systems thinking, problem-solving learning and cultural diversity. Place-based and project-based instructional approaches are a natural fit for this ecosystemic approach. This could involve a geography lesson held by a river, observing its flow and erosion patterns firsthand, or a biology class studying local biodiversity in a nearby park, directly interacting with living systems. Indigenous Elders sharing traditional ecological knowledge in community workshops also exemplify NbE in action, demonstrating learning from and as nature.

Humanity has an innate desire to connect and a profound sense of curiosity. Most current educational systems teach us to compete instead of collaborate and to control rather than co-create, separating us from each other and the rest of nature. Bringing nature into the centre of education and enabling learning through active exploration and discovery activates learners' creative capacities and sense of being part of nature.

With leadership from the IUCN Commission on Education and Communication (CEC), global experts are reimagining environmental education. It is being expanded and re-envisioned as NbE. Nature-based education enables significant learning in any subject

and within the context of an interconnected and interdependent living planet. This approach invites education to move outdoors into nature and bring nature into education.

The main goal of NbE is to nurture a deep sense of care for and connection with all forms of life on our planet. It allows individuals to recognise that they are part of nature and not separated from it. Nature-based learning experiences encourage individuals to connect with and understand nature, leading to a strong sense of empathy, responsibility, community and regenerative capacity, enabling them to live responsibly and sustainably.

It addresses the widening gap between humans and the natural world (Firouzi, 2021). Similarly, Louv (2008) highlights nature deficit as a broad set of impacts resulting from the human-nature disconnection undermining cognitive, physical and emotional well-being. This disconnect is a driving force behind NbE, which offers an opportunity to design systems where deep connection with nature is a guiding principle. Nature-based education allows the development of a stronger sense of place and the understanding of the interconnectedness and interdependence with nature (Camargo, 2019).

Nature-based education is not a new concept; it has deep historical roots that span over two centuries. As noted by Prochner (2021), educational movements such as the nature study initiatives of the late 19th century and the forest schools of the early 20th century exemplify long standing traditions of integrating nature into learning environments. These historical examples highlight the enduring value of nature-based learning. However, to effectively transition modern education toward this approach, it is essential to establish a clear and unified framework that guides its implementation.

It is time to create a better story for our children, one in which the well-being of people and the planet sit at the centre, and individuals understand their intrinsic connection to nature, being nature themselves. "Raising a healthy child means nurturing their whole self: learning to live in balance, deepening their sense of connection, strengthening innate skills and capacities to feel activated and empowered. It means educating minds, bodies, spirits and emotions, recognising that "how" we educate is as important – perhaps much more so – than the "what" (Musikanski et al., 2019, p. 9, 34)."

Photo credit: OpEPA Archive

How do we bring nature into the core of learning?

A nature-based education approach requires examining our formal and non-formal education frameworks; greening our schools, universities and business training facilities; and preparing well-equipped teachers and trainers. It requires innovative, eco-centred, system-thinking-based curricula, proactive politicians, and enabling legislation and policies. NbE requires effective use of existing resources and the development of new funding mechanisms, partnerships and synergies.

"We are nature: nature-based education for planetary health" is an initiative of the IUCN CEC and partners to better understand the new educational paradigm we need and how we get there. It was prepared as a consultative process with CEC members, partners and global experts, and it aims to set the conceptual framework to support bringing nature to the core of learning.

It is a holistic vision that aims to motivate many actors and requires various action levels to succeed. Many efforts are underway in all spheres of governance to shift educational praxis in this direction. Many educators, trainers, lecturers and their institutions – including schools, universities and training organisations – have adjusted their facilities and methods of teaching. Cities and school boards are gradually modifying curricula and school designs, while universities are integrating sustainability factors into both their campuses and academic programmes. Governments are introducing policies and legislation that reshapes educational approaches on a broader scale. However, in response to the growing crisis of biodiversity loss, climate change and water-related disasters, there is still a pressing need to upscale and accelerate these efforts. Effective change requires sustained collaboration across disciplines and the implementation of systemic strategies that enhance long-term impact. To address these challenges, continuous and large-scale engagement across all sectors remains essential.

The transformation will involve simultaneously addressing many aspects:

Examining and adapting education frameworks: This means actively reviewing existing curricula to identify opportunities for nature integration, such as adding modules on local ecology to science classes or using natural history in social studies. For example, a national curriculum might mandate that all biology courses include a minimum of 20% outdoor, hands-on field study.

Greening learning spaces: This looks like transforming schoolyards into biodiverse outdoor classrooms, creating urban nature-based learning centres, or even dedicating specific areas within existing facilities for indoor nature connection points (e.g., biophilic design elements, living walls). A concrete step could be a municipal initiative to provide funding and expertise for every school to establish a native plant garden or a designated "nature play" area within five years.

Preparing well-equipped educators: This entails providing mandatory professional development for teachers in outdoor pedagogy, risk management in natural settings, and interdisciplinary approaches to nature-based learning. An actionable step is the creation of national certification programmes for nature-based educators, ensuring a standardised level of competency.

Developing innovative, eco-centred curricula: This involves designing new learning materials that embed ecological principles across all subjects, moving beyond mere environmental awareness to deep understanding and action. For instance, a school district might adopt a "watershed curriculum" where all subjects, from art to math, relate back to the local watershed's health and management.

Securing proactive political commitment and enabling policies: This means actively lobbying for legislation that supports outdoor learning time, allocates dedicated funding for NbE initiatives, and integrates nature-based learning into national education strategies. A clear priority is a national policy setting a minimum number of outdoor learning hours per week for all primary school children.

Optimising resource use and funding mechanisms: This involves identifying and leveraging existing community assets like local parks, nature centres and community gardens as learning environments, alongside developing new funding streams (e.g., government grants, philanthropic partnerships) specifically for NbE programmes.

Fostering strong partnerships and synergies: This translates into creating collaborative networks between schools, environmental organisations, Indigenous communities, local businesses and government agencies to share resources, expertise and best practices in NbE. For example, a local non-profit might partner with several schools to offer after-school nature exploration clubs or organise community-wide ecological restoration projects involving students and families.

We need examples, dialogue, inspiration, analysis, leaders, pedagogical tools and willingness to do this. We need a coordinating mechanism that brings together leaders, decision-makers, educators and all those who want to share their learnings and resources with others. For us, expecting and waiting for others to transform this world is easy. However, every person on this planet is responsible for our collective and planetary health. We are the ones we have been waiting for. We need to pause, reflect and act.

What can I do with what I have and know right now? Comprehending the planet as an interactive, interconnected and interdependent system could help initiatives, governments and organisations align forces and work together for planetary health. A systems-thinking approach is the foundation that allows us a higher-level perspective and a more integral and holistic lens. The world needs to move away from a reductionist, siloed perspective towards unity and synergies between people and the rest of nature.

A planetary problem requires a planetary solution including all humans, more-than-humans and the rest of nature.

Figure 2: Shifting education – what we need. S. Southey, IUCN CEC.

The benefits

Studies show that nature-based education (NbE) is a powerful mechanism for delivering numerous benefits for people and the environment. By bringing nature to the core of educational practices, NbE cultivates proactive and positive behaviours towards nature, fosters healthier and happier individuals, and strengthens community building through a deepened sense of connection and belonging. Examples around the world serve as practical showcases of effective NbE approaches, such as the Forest Schools in Japan, Green School in Bali, Nature Bridge in the USA, the Jane Goodall Institute Roots & Shoots Program, and nature-based education networks by OpEPA in Colombia, among others. Considering the significant portion of an individual's life spent in formal and non-formal educational settings, integrating nature through NbE offers an accessible and equitable pathway to ensure sustained and meaningful engagement with the natural world for all people.

Education is crucial for achieving a more sustainable future for everyone. Global initiatives like the UN Sustainable Development Goals emphasise this. Education for sustainable development (ESD) is a transformative and empowering tool to incentivise individuals, organisations and states to take pertinent actions to achieve the determined goals. Studies by UNESCO on the benefits of ESD determine that nature-based education promotes awareness and understanding of the interconnected social, economic and environmental dimensions of sustainable development. Studies highlight that ESD equips individuals with the knowledge and skills to address sustainability challenges and instills the values and attitudes necessary to live sustainably. ESD can help individuals develop a critical understanding of the world and the challenges it faces. Building critical thinking through nature-based education allows individuals to solve problems creatively and provides incentives, motivation and tools to take environmental actions (UNESCO, 2020). Incorporating a nature-based approach to ESD amplifies the impact and makes learning more significant.

For many individuals, formal education consumes a substantial portion of their formative years, often spanning 12 to 16 years, and continues through various forms of lifelong learning. While the current educational system frequently prioritises indoor, abstract learning, this vast amount of dedicated learning time represents an unparalleled opportunity. NbE leverages this existing educational infrastructure to systematically reintroduce and integrate nature into daily learning experiences. Compared to sporadic exposure to nature outside of educational settings, NbE offers a consistent and structured means to foster nature connection, ecological literacy and pro-environmental behaviours across diverse demographics. This strategic integration ensures that the benefits of nature are not limited to those with privileged access to wild spaces, but are instead made accessible and equitable through the universal reach of education.

Photo credit: OpEPA Archive

Increased awe, understanding and capacity to sense

NbE fosters an increased sense of awe, understanding and ability to perceive living systems by deliberately structuring learning experiences in and with nature. This hands-on engagement, characteristic of NbE, is essential for cultivating the deep appreciation needed for planetary health. By integrating direct sensory experiences into curriculum, NbE transforms abstract ecological concepts into tangible realities, enabling learners to truly 're-enchant' or fall back in love with the world and recover their sense of wonder.

Based on a study prepared by the University of California, Berkeley, awe is a complex emotion characterised by feelings of self-transcendence, a sense of being part of something greater than oneself, and increased generosity towards others, including the more-than-human world. Awe is crucial in creating a deep connection with ourselves and the world around us (Allen, 2018). Awe-inspiring nature experiences have been identified to meaningfully strengthen our relationship with the natural world across countries (Giusti et al., 2018). It is a feeling of wonder and reverence for something that transcends our understanding of the world. Nature provides an ideal setting for cultivating awe-inspiring and transcendent learning experiences.

Time in nature results in awe, unleashing feelings of humility, generosity and self-reflection. Awe is an emotion a person feels when encountering something vast and mysterious. It transcends our understanding of the world, shifting perceptions about reality. Because heightened awe experiences stimulate the vagus nerve, dopamine and oxytocin are released, increasing a sense of calm and connection to the world and nature (Williams, 2023).

“In studies conducted around the world, nature tends to rank in the top two or three categories of awe triggers” (Williams, 2023, p. 57). Awe becomes a healing tool that can be prescribed, cultivated and measured, allowing us to craft new stories about who we are, how we fit into the natural world and who we want to be (Williams, 2023). Awe is a learning window.

Experiencing awe fosters humility, increases prosocial behaviour and enhances sensory perception. Keltner and Haidt (2003) describe awe as a transformative emotion that broadens cognitive frameworks and inspires a greater sense of interconnectedness. Empirical studies indicate that experiences of awe increase prosocial tendencies, including generosity and helping behavior (Piff et al., 2015), and promote social well-being and cooperation, which are essential for cultivating sustainable communities (Anderson et al., 2018). Furthermore, these experiences drive pro-environmental action by enhancing connectedness to nature (Yang et al., 2018). Recent meta-analytic evidence further substantiates this "awe-to-action" pathway, demonstrating that awe is a significant driver of both social and ecological commitment by fostering self-transcendence and reducing self-interest (Lin et al., 2025).

Virtual tools, such as the California State Parks' PORTS programme, use immersive experiences to evoke awe and provide access to otherwise inaccessible ecosystems. Such initiatives align with Abram’s (1996) argument that re-enchantment with nature is crucial for rebuilding humanity’s connection to living systems. Reflective practices like journaling and storytelling further deepen learners' sensory capacities and understanding, fostering a holistic learning experience.

In his book *The Spell of the Sensuous*, David Abram explores the role of our senses as constantly engaged and intermingled with the world through which we come to know and understand it. Abram claims we must be “re-enchanted” with the world and recover our sense of wonder and intimacy with the natural world.

By learning in nature, we can enhance our comprehension of living systems and hone our ability to observe, sense, discover and document the subtle cues, signals and processes that contribute to planetary health now and for future generations.

Positive behaviours towards nature

Home to Us All: How Connecting with Nature Helps Us Care for Ourselves and the Earth (Charles et al., 2018), a report published by IUCN's initiative #NatureForAll with the Children & Nature Network and others, illustrates how connecting with nature creates meaningful and positive experiences that inspire our care for and stewardship of the planet, increasing pro-environmental attitudes and behaviours (or PEAB). Having positive direct experiences outdoors during childhood and role models who care for nature leads learners to take actions that benefit environmental well-being.

"We do not harm what we love. Creating opportunities for people to fall in love with the land imprints them with a natural desire to protect what they hold as special and meaningful, leading to an ethos of reciprocity and sustainability that can be enacted in various ways as forms of ecological regeneration and restoration" (UNESCO, 2022, p. 49). A review of 32 studies from multiple countries identified 98 outcomes of nature play and the most frequently reported outcomes related to connection and care for nature, self-confidence and self-regulation. "The most frequently reported outcomes across all the studies were connection to nature; stewardship of plants, wildlife, living things and nature/compassionate care for nature" (Ernst et al., 2021).

Unstructured play in nature during childhood strongly correlates with adult pro-environmental behaviour (Larson et al., 2018). NbE programmes should prioritise frequent, meaningful outdoor activities to embed a sense of environmental stewardship early in life (Camargo, 2020). Initiatives like iNaturalist integrate citizen science into classrooms, allowing students to engage actively with biodiversity through observation and documentation (Bonney et al., 2014). These activities not only enhance environmental literacy but also cultivate advocacy skills, motivating students to take action in conservation and sustainability efforts. Louv (2008) argues that direct contact with the natural world is essential for fostering a conservation ethic, as "we protect what we love."

Healthy, smart and happy people

NbE systematically provides the opportunities for nature connection that lead to happier and healthier people. Not only does physical activity enhance emotional well-being and resilience (Hofman-Bergholm, 2024) and reduce anxiety and depression, but studies show that time in nature reduces rates of obesity and chronic diseases like diabetes and heart disease. It also improves blood pressure, pulse rate and stress hormone levels (Charles et al., 2018).

A study in seven northeastern cities in China showed that increased access to green spaces was associated with lower blood pressure. Children attending schools with more green space were thus at lower risk of hypertension. While hypertension is less common in children than adults, it often originates in childhood and may track into adolescence and adulthood. The benefits of access to green spaces were more robust in children with higher BMI (body mass index) values. The results remained consistent even when family income and parental education level were considered (Xiao et al., 2020).

Learning outdoors with nature also improves performance and helps develop core skills, such as problem-solving, reasoning, creativity, curiosity, risk identification, social and emotional learning, and self-regulation. It enhances academic engagement, inquiry and critical thinking, and builds empathy for wildlife and living ecosystems (IUCN, CEC, 2021). It helps individuals to reinterpret our role within the

planet as part of nature, not disconnected from it, highlighting our impact and seeking mutually beneficial solutions.

Studies show that children perform significantly better outdoors than indoors in terms of spatial working memory tasks. There was considerably less neurological activity in the outdoor settings, suggesting that some cognitive processes may take less effort outdoors than indoors. It also reinforces that natural environments can be restorative concerning executive functions. This study explored the influence of green environments on children's cognitive functions, specifically attention, inhibitory control and spatial working memory. It aimed to understand the potential restorative benefits of natural environments on executive functions and to investigate the psychophysiological underpinnings of these improvements in attention. (Torquati, Schutte & Kiat, 2017).

Additionally, studies among Barcelona's schoolchildren suggest that being raised in greener neighborhoods benefits brain development and cognitive function. Growing up in green neighborhoods prompts active, exploratory behaviours associated with brain development and cognitive functioning. Greener environments in childhood also provide indirect benefits for healthy brain development, such as reduced exposure to air pollution and noise, increased physical activity, and enriched microbial input (Dadvand et al., 2018).

Furthermore, studies suggest that nature play can positively influence curiosity, creative thinking, resilience and executive function skills. These skills and dispositions are critical for environmental problem-solving and policy-making. Nurturing children's capacity to be in awe, be curious, think critically and develop specific skills from playtime in nature benefits and positively contributes to sustainability (Ernst & Burcak, 2019).

Happiness, Well-being and Sustainability, written by Musikanski et al. (2020), highlights a strong connection between these three concepts and the possibility of achieving greater happiness and well-being for ourselves and future generations by living more sustainably with nature. The authors argue that happiness is more than a feeling of pleasure and contentment. It is a sense of purpose, connection and meaning in life. Musikanski et al. cite numerous studies showing that people who live in more sustainable communities tend to be happier and healthier with an increased sense of belonging, unity and collectivity. The book also argues that sustainable living can help us connect with nature and each other, contributing to well-being and happiness in life. Well-being is a broad concept encompassing physical, mental, emotional and social health. (Musikanski et al., 2020).

Belonging and community

Time in nature also influences social experiences, fostering a sense of connectedness among people and communities and promoting social cohesion and willingness to help. It builds a strong sense of belonging with the land and all life on it, which results in a desire to protect it. It promotes kindness, altruism, generosity and resource-sharing (Charles et al., 2018).

Creating meaning depends on the context in which an individual lives, thinks and operates; this is the premise of local-based learning (Geisen, 2014). "If we want to give children the opportunity to exist in a certain environment, we need to give them the safe space in which to develop a relationship with the environment and allow them to create their own world" (Geisen, 2014, p. 18). Learning happens when children connect with a concrete problem and understand what is required to solve it –

connecting with the environment and the community surrounding the challenge can help children foresee and understand the consequences of their actions.

Planetary health

The most significant benefit of nature-based learning would be planetary health or well-being. Our planetary crisis is impacting the well-being and health of young people worldwide, as no human can cope with such high levels and constant states of stress (Musson, 2023). “The unhealthiness of our world today is in direct proportion to our inability to see it as a whole” (Musson, 2023).

What do we understand when we think of a healthy planet? According to the Planetary Health Alliance, planetary health is “a solution-oriented, transdisciplinary field and social movement focused on analysing and addressing the impact of human disruption to Earth’s natural system on human health and all life on Earth.” In other words, it is a concept that focuses on the interdependence of human, animal and environmental health. Planetary health studies explore environmental changes and how they threaten the progress in human health and intend to model complex links between human health and natural systems (Haines & Frumkin, 2021; Panorama Global, 2017).

Failing to intersect human and planetary health will lead to the fragmentation of resources and potential integrated solutions. When it comes to planetary health, it is fundamental to highlight that all living beings on Earth depend on each other. When we think about health, we ought to consider systems and connections. “A symbiotic relationship between humans and the natural world is essential to sustain both human well-being and the well-being of ecosystems” (UNESCO, 2022, p. 5), and educating individuals concerning this intersection is crucial.

Recently, an article explored the role of rangers in the interconnected scheme of planetary health and environmental challenges. Rangers work and are responsible for vast areas of protected land but are often underutilised, underrecognised and underequipped. The article argues there is a need to bring rangers into conservation debates and place them as essential planetary health workers and critical players in environmental policy mechanisms (Stolton, 2023).

Planetary health is central to NbE. Addressing the anthropocene's challenges requires bridging health, environmental and social systems (Horton, Lo & Araujo, 2014). NbE introduces transdisciplinary thinking, enabling learners to approach issues like climate change and biodiversity loss with holistic solutions. For example, incorporating permaculture principles into school curricula exemplifies this approach. Permaculture education teaches students sustainable practices such as water conservation, regenerative agriculture and waste management, directly contributing to local ecosystem health and resilience.

Photo credit: OpEPA Archive

Where are we now?

If Earth's history were 24 hours, human history would last three seconds. For the first 50,000 generations, humans lived in balance and healthy harmony with nature. During the next 500 generations, things started to change, and for the last two to three generations, our relationship with nature has unraveled, in many ways, into despair. For 95% of human history, we have lived in harmony with natural cycles; what happened? (Musson, 2023). This is an invitation to return to "our intuitive sense of how to be well, do well and live well together" (Musson, 2023, p. 20). Exploring the past through a critical lens will allow us to address present challenges and build coherent solutions for our future.

Over the past few hundred years, our increasing reliance on technology, urbanisation and industrialisation has caused a severing of our intimate connection with nature. The concept of generational environmental amnesia is at play here. Generational environmental amnesia refers to the phenomenon where successive generations lose knowledge or awareness about the environmental conditions and natural resources that existed in the past, especially when those conditions have significantly changed. Younger generations may come to accept lower levels of environmental quality because they see it as normal, having never experienced a healthier or more pristine environment. As Kahn and Weiss, (2017) described it: "Across generations, the baseline shifts downward for what counts as healthy nature."

One of the challenges in addressing generational environmental amnesia is the difficulty in grasping the long time scales of environmental change. Many environmental shifts, such as the loss of biodiversity, the effects of climate change, or the depletion of natural resources, unfold over decades or even centuries. This gradual change can make it hard for individuals, especially younger generations, to recognise the extent of what has been lost. Without a clear sense of time, it's easy to perceive current environmental conditions as normal, which contributes to a lack of awareness about past states of nature. Understanding these long-term processes is essential for overcoming generational environmental amnesia and recognising the urgency of restoring and protecting our ecosystems.

Current education system

"The power of education lies in its capacities to connect us with the world and with others, to move us beyond the spaces we already inhabit, and to expose us to new possibilities. It helps to unite us around collective endeavours; it provides the science, knowledge and innovation we need to address common challenges. Education nurtures understanding and builds capabilities to help ensure that our futures are more socially inclusive, economically just and environmentally sustainable" (UNESCO, 2021, p. 10).

Our education system should provide opportunities to engage with nature experientially, bringing nature to the centre of learning and providing tools that help us perceive and understand the planet as an interconnected living organism. Education should be grounded in reciprocity, fostering relationships, nurturing connections and promoting positive behaviour toward all of nature – including human and more-than-human beings and the rest of the environment.

However, our current education system tends to compartmentalise, fragment and separate knowledge into subjects and themes, profoundly disconnecting us from the more-than-human world by presenting nature as something outside of and apart from us. Students today spend significantly less time outdoors than prisoners, who, according to correctional standards, are required to have at least one to two hours of outdoor recreation daily (American Correctional Association, 2021). In contrast, many

students in modern education systems spend an average of 90% of their school day indoors (Louv, 2008). The structure of traditional schooling often prioritises indoor, sedentary learning experiences over active, exploratory and outdoor education, despite growing research indicating that outdoor learning enhances cognitive development, creativity and well-being (Kuo, Barnes & Jordan, 2019).

Historically, education was not confined to classrooms. Ancient learning environments, such as those in Greece and in Indigenous cultures worldwide, emphasised outdoor learning, discussion-based pedagogy and experiential education. However, the Industrial Revolution (18th-19th century) shaped the rigid, classroom-based model we see today, aligning education with factory-style discipline and standardised instruction (Gatto, 2009). This era prioritized skills for factory work, like rote memorisation and adherence to strict schedules, over more holistic learning that engages with the natural world. While this model was effective for producing workers suited to industrial economies, it does not cater to the diverse learning needs of the 21st century.

By examining our educational history and understanding how current systems were designed, we can **reimagine education** to prioritise holistic learning. Incorporating **nature-based learning**, flexible learning spaces, and interdisciplinary teaching can create an education system that fosters creativity, well-being, and lifelong learning for all students.

Throughout history, humans and nature have become distant and separate. For a large part of the population, during the Agricultural Revolution, the land became separate from us, something we could control, own and manage. At the Age of Enlightenment, European thinkers defined a clear division and dichotomy between mind and body, human and nature, further increasing the sense of separation. Colonialism perpetuated a story of superiority, racism, hierarchy and dominance, serving the Industrial Revolution, where human-built institutions and structures directly *dominated* nature and urbanisation accelerated. For many modern societies, Earth became a resource we could extract and exploit, transforming nature into human-determined forms of value. Through ideas such as GDP and productivity, and the concept of accumulations, this new wealth became a measure of success, and the impacts generated on living systems became regarded as externalities not to be considered. This dominant and degenerative paradigm and worldview has overshadowed many ancestral communities worldwide who still live as nature, deeply connected to their lands in islands of coherence.

The Educational Revolution has enabled formal education worldwide to lift billions of people out of poverty. It has granted girls and women a significantly improved status in society and has organised our collective knowledge to facilitate exponential advancements in healthcare, disease prevention, sanitation and political engagement (UNESCO, 2015; World Bank, 2018). At the same time, it has helped to perpetuate these stories and narratives of division and separation taught to the masses all around the globe (Musson, 2023). It has resulted in an education system that is homogenising and designed to train individuals with skills the market requires to contribute to economic growth and development, leading to a loss of identity, the erosion of culture and language, and increased poverty and social unrest (Musson, 2023; Iyengar & Karadag Caman, 2023).

It is argued that our education system is 150 years outdated (Musson, 2023). It perpetuates the conditions threatening our shared future (UNESCO, 2021). We have prioritised cerebral knowledge over affective, ecological and relational knowledge, which has led to multiple crises faced

by societies worldwide (UNESCO, 2022). "The conventional wisdom holds that all education is good, and the more of it one has, the better. The truth is that, without significant precautions, education can equip people merely to be more effective vandals of the Earth. Now, more than ever, we need people who think broadly, who understand systems, connections, patterns and root causes" (Musson, 2023, p. 28).

The current education system exacerbates environmental amnesia by preventing students from questioning the environmental quality they deserve, as they have no baseline to compare it to. The traditional schooling model, with its compartmentalised approaches, creates a significant disconnect between students and the natural world. Instead of engaging directly with the environment, students learn about it through abstract subjects. This distance makes it difficult for them to grasp the complexities of ecosystems and the interdependence between humans and nature. To address the environmental challenges we face, the education system must shift towards experiential, nature-based learning that nurtures environmental stewardship and fosters a deeper connection to the natural world. Only by doing this can we break the cycle of forgetting and begin to restore our lost bond with nature.

We need a new social contract with our education system. We must reflect on how established ways of thinking about education, knowledge and learning inhibit us from opening new pathways toward our desired futures (UNESCO, 2021). Building a new education system requires reflecting on why we educate, how we educate, and how we have organised learning (UNESCO, 2021). The stories we tell shape how we understand the world: let us take Darwin as an example. Through Darwin, the idea of competition and survival of the fittest has shaped how we understand evolution and perceive nature (Musson, 2023). It has perpetuated, spread, and highlighted ideas of competition within our education system: "demands of the global education system have forced schools to focus more attention on exams and competition than on creating environments to nurture happy, healthy, thriving young people" (Musson, 2023, p. 27). In reality, evolution and nature are a story of collaboration and relationships (Musson, 2023).

Human-nature relationship

The growing gap between humans and nature, accelerated by industrialisation, has resulted in intergenerational environmental amnesia, where younger generations are unaware of the richness of the natural world and the drastic environmental changes that have occurred. This amnesia is dangerous, as it diminishes the urgency needed to address environmental degradation. In this context, education plays a crucial role in restoring this lost knowledge.

Nature-based education can help us rediscover our role in the natural world. "By being taught to see the world through an 'ego' rather than 'eco' perspective, we have been encouraged to put most of our attention on our understanding, logic and reason by taking things apart to make sense of them; rather than seeing and understanding things in context or relationship to the wider world, through our intuitive senses" (Musson, 2023, p. 23). This means prioritising individual human desires and immediate benefits (ego) over the well-being of the entire ecological system (eco).

Nature-based learning experiences can help us think more systemically, understand our world through relationships and interconnections, and ultimately perceive the oneness that encompasses all. Abram (1996) argues that we have become increasingly

alienated from the natural world, leading us to see the world as a collection of objects and resources rather than a living, breathing and interconnected organism. For instance, a forest might be seen merely as timber to be harvested, rather than a complex community of interdependent species that provides clean air, water and habitat.

By bringing nature into the centre of education, the environment and its living systems become our teacher, classroom and inspiration. Nature-based education serves as a pathway to deeply understand and solve our most pressing environmental challenges and to nurture individuals with a profound sense of empathy, responsibility, community and care. To thrive with nature, we need to integrate nature into our lives (Charles et al., 2018). Caring for and protecting something we do not know, relate to, or understand is difficult. Mending the gap between humans and nature will allow us to connect and relate to our surroundings. Human beings have an intrinsic need to build relationships, and this is not only limited to other humans but also to plants, animals, water, deceased ancestors, deities, landscapes, nation-states and other imagined collectives (UNESCO, 2022). Human-nature relationships are as central to our health and well-being as human-human relationships.

Nature-based education directly addresses environmental amnesia by giving students firsthand experiences with the environment, helping them understand what has been lost and what should be restored and preserved. By immersing students in nature, they develop a tangible connection to ecosystems, wildlife and natural processes, which creates a baseline for comparison. As students gain this understanding, they are more likely to question the current state of the environment and advocate for the quality of nature they deserve. Through storytelling, direct experiences and holistic learning, we can pass down vital ecological knowledge and ensure future generations are equipped to act on behalf of the Earth.

Nature-based learning fosters deep, complex relationships with nature. It focuses on understanding, valuing and encouraging symbiotic relationships with our surrounding ecosystems, not solely transmitting abstract ecological knowledge. Human-nature relationships are context-specific and develop over time together with the life that surrounds us. Valuing and nurturing our surrounding ecosystems involves developing accurate knowledge, emotional attachment, and practical skills. Nature-based education is a bridge to mend the gap between humans and the more-than-human health and well-being.

"Living" systems thinking

With systems thinking, NbE enables strategies to develop knowledge, skills and capacities that create bridges between nature and individuals – youth, businesses and entrepreneurs, politicians and decision-makers, and civil society – and among education subjects and environmental challenges (IUCN CEC, 2021). Our present challenges are all connected and require holistic and transdisciplinary approaches. For example, instead of separate government departments dealing with water pollution, air quality and urban planning in isolation, a systems-thinking approach would involve all departments collaborating to understand how these elements interact and affect each other, leading to more integrated and effective solutions.

Organisations worldwide have acknowledged that tackling environmental challenges requires an interconnective and collaborative perspective – a systems-thinking approach. For instance, the IPBES and IPCC co-sponsored workshop report in

2021 explored the connections between biodiversity loss and climate change. Climate change alters ecosystems, affecting thousands of organisms that share a complex interconnected web, leading to biodiversity loss. Additionally, the alteration of the ecosystems impacts different species and affects the carbon cycle by hindering the natural carbon sinks of the environment, increasing greenhouse gases.

The report observes that biodiversity and climate change have mostly been addressed separately, ignoring their intrinsic connections, each with its international convention and intergovernmental body within the UN framework. However, the paper also highlights that separating and addressing the subjects in isolation leads to unsuccessful conservation strategies. The report aimed to explore the connections and address the synergies and trade-offs between biodiversity protection and climate change mitigation and adaptation.

"Only by considering climate and biodiversity as parts of the same complex problem, which also include the actions and motivations and aspirations of people, can solutions be developed that avoid maladaptation and maximise the beneficial outcomes" (IPBES & IPCC, 2021, p. 5). This report exemplifies the need for systems thinking because it highlights how climate change and biodiversity loss, often treated as separate issues, are intrinsically linked – changes in one directly impact the other, requiring integrated solutions.

By contextualising the educational process in the surrounding ecological and social systems, nature-based education is a systemic driver of sustainable innovation.

Photo credit: OpEPA Archive

Enablers and implementation

A new education model requires a holistic approach. We need integrated and encompassing strategies that bind and transform all levels and players within the education matrix. Our current education frameworks, the need for more green learning spaces, nature-based education material and support for educators, limited legislation and funding, and fragmented problem-solving approaches among stakeholders are all challenges. However, within every challenge lies an opportunity for transformation. We have identified some limitations to nature-based education and have transformed them into potential pathways and enablers.

The pathways and enablers seem bold and overwhelming, especially in a field like education that is highly disarticulated, and it often seems each school, school board and government is pursuing its unique path, with limited consultation and sharing. These disarticulated initiatives have led to fragmented and separated solutions at a time when synergies, collaboration, dialogue, unity and systemic changes are crucial for long-term and collective success.

Enhancing education frameworks

This transformation will require revising and updating formal standardised educational frameworks, curriculum design and ways of learning. Transformative education is essential for addressing the current social-ecological crisis (Global Youth Biodiversity Network, 2023). Our current education system tends to classify and separate knowledge into subjects and themes. We need an education system that thinks long-term and systemically, encourages connections and fosters relationships. Our learning environments should offer spaces for exploration, appreciation and discovery through hands-on learning, allowing the development of effective, sustainable and regenerative solutions.

The new education approach we propose provides opportunities to engage with nature and learn through experience, bringing nature to its core as a learning environment, teacher and source of knowledge. Education systems worldwide are increasingly moving in this direction; how do we provide the tools to support these transitions?

Solidarity and collaboration

We need pedagogies of solidarity and cooperation (UNESCO, 2021). Teaching should be participatory, collaborative, problem-solving, interdisciplinary, intergenerational and intercultural – in other words, an active and dynamic conversation between students and educators (UNESCO, 2021). One way to achieve this is to use participatory teaching methods and unique learning pathways that respond to environmental and social contexts, local priorities, technology and resources available.

Education “should encourage us to understand the importance of what we share in common and the systemic interdependencies that bind us to one another and the planet” (UNESCO, 2021, p. 51). A brief created by the Global Youth Biodiversity Network (GYBN) identified collaboration as a pillar to transform education. Learning should encourage working together across different cultures, disciplines, and sectors (Global Youth Biodiversity Network, 2021).

Photo credit: OpEPA Archive

Experiential learning and outdoor activities

NbE often incorporates outdoor learning activities and uses experiential learning as a core pedagogy. NbE is enabled by experiential outdoor learning which offers a multifaceted approach to education with numerous benefits. From a health perspective, it encourages physical activity and exposure to fresh air, fostering overall well-being. In terms of mental health, immersing oneself in nature can reduce stress, anxiety and depression, while promoting a sense of calm and connection to the environment. Moreover, experiential outdoor learning enhances learning outcomes by providing hands-on experiences and fostering critical thinking, problem-solving skills and creativity. By engaging with the natural world around them, individuals develop a deeper understanding of ecological systems, and an appreciation for the more-than-human environment, contributing to personal growth and environmental stewardship.

Learning environments must allow students to discover a sense of purpose (UNESCO, 2021). We need active learning where there is cognitive and emotional engagement, which is authentic and relevant. For instance, project and problem-based learning is a way to actively and deeply engage learners with nature and supports critical thinking skills and connections with the world they are engaging with (UNESCO, 2021). Through critical thinking, learners are encouraged to question the status quo and think critically about the root causes of the social-ecological crisis (Global Youth Biodiversity Network, 2023).

Experiential learning helps address environmental amnesia by fostering personal connections with nature. When individuals experience nature directly, they are more likely to develop a sense of compassion for the environment. As they witness its beauty and intricacies, they begin to care more deeply about protecting it. Active learning activities, such as hiking, gardening or observing ecosystems, create lasting memories that make environmental changes more meaningful and memorable. This emotional connection can drive individuals to take action to preserve natural spaces and prevent further degradation, ensuring a more informed and engaged future generation. Physical, cultural and spiritual interactions with nature can also allow students to see the vulnerability of ecosystems firsthand. This emotional connection deepens the sense of responsibility to protect natural spaces, promoting a more compassionate and informed approach to environmental stewardship.

Place-based, local, and context-based education

In “The geography of childhood: Why children need wild places,” authors Gary Paul Nabhan and Stephen Trimble (1994) emphasise the importance of intimate, direct experiences in local natural settings for children’s development. They observe that “a few intimate places mean more to my children, and to others, than all the glorious panoramas I could ever show them.” This insight underscores how personal interactions with nearby natural environments, place-based education, can foster a deep sense of connection and ecological literacy in children.

Place-based education “increases academic achievement, helps students develop stronger ties to their community, enhances students’ appreciation for the natural world, and creates a heightened commitment to serving as active, contributing citizens.” (Sobel, 2004).

Additionally, local and context-based education allows students to connect to what is familiar and to explore their role in the ecosystem of their community. Nature is perceived and valued differently according to different cultural and institutional contexts. These unique and circumstantial relational values between nature and humans are inextricably linked to people's sense of identity and spirituality, determining their relationship and responsibility towards nature (Pascual et al., 2017). When actively and contextually involved, learners can participate in real-world projects and activities that address specific challenges and crises. By taking action, learners co-create a more just and sustainable world (Global Youth Biodiversity Network, 2023). Activating the transition to living-systems thinking, incorporating a "local" scale at the bioregional level will allow learners to know, understand and be able to act within a functional landscape, becoming actors in the transition to more regenerative ways of being.

However, "it is necessary to expand the way society recognises the diversity of values and to embrace pluralistic valuation approaches" because natural areas and their challenges will not be perceived in the same way by all people (Pascual et al., 2017, p. 12; UNESCO, 2022). How can we promote connection if not everyone is concerned about nature to the same degree or for the same reasons?

Place-based education helps address the wickedness of time comprehension. Place-based and local context allows students to connect past, present and future. By learning about the history of their local environment, students gain insights into how ecosystems and landscapes have transformed over time. Comparing past and present environmental conditions allows them to recognise changes, understand the impacts of human activity and realise the environmental trajectory of the future. Environmental challenges are then no-longer abstract theories, fostering a sense of responsibility and empowering students to take action in preserving their local natural heritage.

Incorporating the wisdom of Elders into place-based education further deepens this understanding. Elders, with their knowledge of local traditions, histories and natural cycles, offer invaluable perspectives on the long-term relationships between people and the land. Their stories and teachings provide a holistic view of the land's past, present and future, enriching students' comprehension of time and their role in sustaining it. Through the lens of Elders' wisdom, students not only see the environmental shifts over generations but also learn how their actions today can influence the future of the ecosystems they inhabit. This connection to the wisdom of Elders strengthens students' sense of identity, responsibility and agency in caring for their local environment, ultimately reversing the intergenerational environmental amnesia in future generations.

Local and context-based education celebrates diversity, improves equity and highlights traditional Indigenous and local ways of knowledge. It also helps students unlearn divisiveness. Interconnections and interdependence frame pedagogy and highlight interconnections to the world by learning in and with the surrounding environments. This educational approach treasures and sustains diversity and pluralism (UNESCO, 2021).

Photo credit: OpEPA Archive

Learning ecosystems

Learning ecosystems are dynamic networks that integrate people, content, diverse learning environments and technology to facilitate continuous development and support holistic learning. These ecosystems can be formal, such as partnerships between schools and local nature centres for curriculum enrichment, or informal, like community-led workshops on sustainable living. They encompass a wide range of activities, from traditional classroom instruction enhanced with outdoor experiences to online learning platforms that connect learners across geographical boundaries for collaborative environmental projects.

Learning ecosystems contribute to innovation, equity and sustainability. They support lifelong learning, developing 21st-century skills and creating learning communities that help us build the capacity to thrive in complex and uncertain futures. These ecosystems foster innovation and drive social change (Spencer-Keyse, Luksha & Cubista, n.d.; Díaz, 2023; Hannon et al., 2019). A holistic and relational approach to nature-based education can transform our educational systems, and foster a mindset that embraces and promotes a flourishing planet (Camargo & Baust, 2023).

When supported by nature-based education (NbE), these learning ecosystems become powerful engines for innovation, equity, and sustainability. NbE strengthens learning ecosystems by:

Creating diverse learning environments: Moving beyond traditional classrooms, NbE utilises parks, forests, urban green spaces and even digital platforms focused on nature to create rich, multi-sensory learning experiences. For example, a learning ecosystem might include a school garden where students learn botany and ecology, a partnership with a local conservation group for field research, and an online forum for sharing observations and data.

Fostering lifelong learning and 21st-century skills: NbE within learning ecosystems encourages continuous engagement with nature and develops critical skills needed for a sustainable future. This includes problem-solving through ecological challenges, developing communication skills by sharing nature observations, and cultivating collaboration through community environmental projects. An example is a community learning ecosystem where people of all ages participate in workshops on native plant restoration, developing practical skills and fostering intergenerational knowledge exchange.

Building learning communities: NbE connects individuals and groups through shared experiences in nature, strengthening social bonds and building collective capacity to address environmental challenges. These communities can be school-based nature clubs, neighborhood clean-up initiatives, or regional networks of environmental educators. A tangible example is a learning ecosystem centred around a local watershed, where schools, community groups and local government collaborate on monitoring water quality and implementing conservation measures, building a strong sense of shared responsibility.

Promoting a systems approach: NbE integrated into learning ecosystems helps individuals understand the interconnectedness of natural and human systems. By engaging with nature directly, learners see how actions in one part of an ecosystem affect others, fostering a holistic perspective. An example is a learning ecosystem focused on urban biodiversity, where students study the role of insects and birds in city parks, understanding how these small components contribute to the larger urban ecosystem's health.

Activating city-wide nature-based solutions: Learning ecosystems extend to urban environments, where NbE actively supports the greening of cities and the implementation of nature-based solutions. This transforms urban spaces – from educational institutions and neighborhoods to entire communities – into vibrant, biodiversity-rich learning environments. By encouraging ecosystem restoration and the creation of green infrastructure, NbE helps cities become places where living and learning with nature are integrated seamlessly.

In essence, learning ecosystems, when infused with NbE, are crucial for preparing us to meet the complex challenges of the 21st century. They provide a framework for holistic learning that connects individuals, communities, and the planet, fostering a mindset that embraces and promotes a flourishing planet.

Technology and artificial intelligence (AI)

In a world increasingly dominated by technological advances that create an alternate digital reality, nature-based education becomes more crucial daily. As Richard Louv stated, "[t]he more high-tech we become, the more nature we need" (Louv, 2005, p. 296).

Technology can absorb much of an individual's attention, particularly among younger generations. Recent studies indicate that youth spend an average of 7 to 9 hours per day on screens, excluding school-related activities (Twenge, Spitzberg & Campbell, 2019). While offering many benefits, this digital engagement often distances individuals from direct experiences with nature, contributing to what Louv (2005) describes as nature-deficit disorder.

However, technology and artificial intelligence (AI) also play significant roles in enabling NbE. By enhancing how we interact with the natural world, they can accelerate learning and foster deeper environmental awareness. Digital tools allow us to experience aspects of nature that might otherwise be difficult to access – through high-resolution images, real-time soundscapes, interactive simulations and augmented reality experiences (Khan, Wang & Dabnichki, 2021).

Moreover, technology can enhance outdoor learning and exploration. Citizen science initiatives such as iNaturalist, eBird, and Globe Observer empower individuals to contribute valuable ecological data while deepening their biodiversity knowledge (Bonney et al., 2016). Additionally, AI-powered environmental monitoring tools, GPS-based trail guides and augmented reality field experiences enable users to engage more meaningfully with their surroundings (Silvertown, 2009).

While technology can be a powerful enabler of nature-based learning, real-world experiences remain essential. Authentic, hands-on interactions with nature foster emotional connections and ecological stewardship in ways that digital tools alone cannot replace (Chawla, 2020). The challenge lies in striking a balance and leveraging technology to enhance nature education while ensuring that direct engagement with the natural world remains at the heart of the experience.

Even though real-world experiences that establish deep connections are essential, embracing technology to enhance and complement nature-based learning is vital.

Implementation and scaling

Forming networks to work collaboratively on nature-based education will allow for quick implementation and scaling of the approach, making the most of the experience and knowledge currently embedded in the system. Scaling requires favoring both width and depth, while scaling up can be appropriate in some cases. Implementing NbE requires strong local roots and relevance, as well as applying local knowledge and cultural adaptations of existing practices and solutions to bring nature to the core of learning in a way that helps communities transition into new ways of learning. This process of local appropriation allows for deep rooting into education systems and learning narratives. Additionally, considering the importance of moving fast given our planetary predicament, starting to widely implement NbE narratives, small experiences and simple elements into the current system by all educators and institutions should be a priority to ensure access for everyone and to accelerate broad activation worldwide.

Greener learning spaces

Schools are learning communities and platforms of cooperation, care and change (UNESCO, 2021). We must explore and re-envision learning environment design and school ground infrastructure to include nature. The green infrastructures surrounding schools are a major enabler of nature-rich routines and affinity with nature (Giusti, Barthel & Lars, 2014). Spending time outdoors and surrounded by nature allows educators to illustrate living system cycles, processes, and interconnections.

Transforming school grounds into nature-rich environments can achieve multiple benefits, where children can learn with and in nature, and school grounds become community environmental centres.

Re-designing and greening learning environments such as school grounds is a strategic and cost-effective approach that improves academic performance, physical and mental health, social and cognitive skills, and creativity while increasing student well-being. Additionally, greener schools contribute to environmental benefits by enhancing biodiversity, reducing heat, conserving water, reducing energy and building climate resilience (Musson, 2023). It is an influential and accessible way to mitigate climate change; increasing investment into school ground design as a nature-based solution for climate as illustrated by the Paris Oasis Programme (Paris Oasis Schoolyard Programme, France, n.d.)

Biophilic design – incorporating natural elements into indoor and outdoor spaces – improves focus, reduces stress and enhances academic performance (Browning, Ryan & Clancy, 2014). Singapore's "green schools" project, which integrates vertical gardens and urban farms into campuses, offers a scalable model for urban areas with limited natural spaces. Additionally, augmented reality (AR) applications such as Seek by iNaturalist allow learners to engage with biodiversity virtually, bridging the gap for schools that lack access to outdoor resources.

Time in nature profoundly influences social experiences, fosters a sense of connectedness among people and communities, and nurtures awe and love for nature (Charles et al., 2018, 2025). "We do not harm what we love. Creating opportunities for students to fall in love with the land imprints them with a natural desire to protect what they hold as special and meaningful, leading to an ethos of reciprocity and sustainability that can be enacted in

various ways as forms of ecological regeneration and restoration." (UNESCO, 2022).

Offering outdoor learning environments and examining school infrastructures allows individuals and whole communities to connect deeper with nature, resulting in care, appreciation and understanding of our place in the world. According to the UNESCO (2020) and the Education for Sustainable Development 2030 roadmap, learning environments conducive to nature-based education are critical for successfully achieving the 17 Sustainable Development Goals (SDGs). Greener learning environments help ensure that schools and other learning spaces are safe and inclusive, providing learners with opportunities to engage in active and experiential outdoor learning (UNESCO, 2020). NbE is a powerful tool for moving toward and beyond the SDGs and addresses the goals interconnectedly (Camargo, 2024).

Prepared educators and greening curriculum

Educators, trainers, and students are a community of knowledge seekers and builders (UNESCO, 2021). Cooperation and collaboration are taught and practiced, and solidarity, compassion, ethics and empathy are ingrained in our learning (UNESCO, 2021). There is an urgency for professional development, training and technical capacity exchange to bring nature to the core of our learning environments. Educators' confidence and competence are essential to enhance individuals' connection to nature. We must recognise educators and teachers as knowledge producers and critical figures in transforming societies (UNESCO, 2021).

As we provide a new vision of what education should look like, it is vital to give transition tools to those involved. Providing professional development,

Figure 3: Greening School Grounds and Outdoor Learning© – a project of Children & Nature Network, Salzburg Global Seminar, IUCN's CEC and #NatureForAll, International School Grounds Alliance, Alana Foundation, Learning through Landscapes, Learning Planet and UNESCO, 2023.

capacity exchange, training and workshops for teachers, trainers, school administrators, decision-makers, politicians and others is crucial for a successful transition. The UNESCO roadmap towards Education for Sustainable Development (ESD) highlights building capacities for educators as one of the priority action areas towards a more sustainable world (2020). It focuses on equipping educators with the knowledge, skills and values necessary to teach ESD and includes providing professional development opportunities for educators. (UNESCO, 2020).

Greener teachers and trainers and greener curricula worldwide would lead to what Kwauk and Casey (2023) call *green skills*. These are not only skills for environmental literacy but also practical competencies crucial for transitioning to a low-carbon and climate-resilient economy. For example, green education practices involve teaching students about sustainable agriculture through hands-on farming in school gardens, introducing renewable energy concepts by building small-scale solar power models, or developing waste management skills through comprehensive school recycling and composting programmes. These practical experiences enable learners to participate in traditional green sector jobs, adopt more sustainable behaviours, adapt to the impacts of climate change and take action on climate justice. Participating in traditional green sector jobs, adopting more sustainable behaviours, adapting to the impacts of climate change, and taking action on climate justice are all skills that come from this approach (Kwauk & Casey, 2023). Nature-based education requires additional training in outdoor skills, risk management, and socio-emotional learning (SEL).

However, a set of skills is not enough. Effective green education practices and training teachers to include nature in the learning experience would also provide learners with necessary values compatible with a sustainable way of living, such as equity, justice and intergenerational responsibility. These green skills and values lead learners to take action on climate change through advocacy, activism, and everyday choices (Kwauk & Casey, 2023).

Furthermore, as the economy shifts, we need to prepare for existing and emerging nature-based career pathways. Government policies should encourage certification of career-development training programmes on environment and sustainability for professionals. We need funding for studies of the sustainability market to examine ways to improve the industry's access and benefits (Tubaishat, 2021).

Political commitment

During the Members' Assembly 2012, IUCN members passed Resolution 5.101, *Child's right to connect with nature and to a healthy environment,* (IUCN Members Assembly, 2012). In 2016, IUCN approved two additional resolutions, Resolution 6.085 *Connecting people with nature globally* (IUCN Members Assembly, 2016) and Resolution 6.084 *Environmental education and how to naturalise the spaces in educational centres for healthy development and better childhood connection with nature,* (IUCN Members Assembly, 2016). The former is a call for action to address the current biodiversity and climate crisis (planetary limits). It recognises that new approaches are needed to broaden societal support for conservation and to mobilise funding and action. It also acknowledges that meaningful experiences in nature are essential for the development of pro-environmental behaviour and support for nature's conservation. The latter was on environmental education, and naturalising spaces in educational centres is a call for action to ensure that children grow up in contact with nature and are aware of the benefits that nature provides them. In 2021, IUCN also approved Resolution 7.062 the *Role*

of children and youth in nature conservation, (IUCN Members Assembly, 2021) which is a call to action to ensure that children and youth learn about and connect with nature and participate in solving critical environmental issues.

Nature-based education is a strategy that directly addresses all four resolutions and aligns with their calls to action (IUCN, 2012). The Resolutions also show the IUCN and its members' commitment to education as a tool for connecting people to nature and enhancing pro-environmental behaviour, leading to a more resilient and sustainable planet.

We must call for advocating a political will, legislation, funding, support and urgency. People everywhere are moving towards a shared cause. Governments, international bodies, citizens, educators and our children call for change. New and promising initiatives are emerging worldwide from government and international organisations because there is an urgency to build integral and holistic education frameworks. We want and need proactive governments that support and fund the transition towards NbE. We are all working on this together.

We need more education and children-focused policies that enable time outdoors and the right to nature. We need more health and elder care policies that increase contact and time in nature. We need more planning and urban development policies for more nature-rich cities. We need more parks, outdoor recreation and tourism policies. Art and culture play crucial roles in developing a sense of oneness; policies that protect and encourage cultural perception of nature are critical. We urgently need policies that promote private sector investments in environmental programmes, infrastructure, research and solutions. We need policies that endorse and support biodiversity conservation organisations to work across sectors for more equitable and inclusive experiences (Charles et al., 2018).

Even though governments are making many efforts, we also need more effective coordination from our governments. We must build viable and effective systems that require financial, capital and human resources (Tubaishat, 2021). A more effective implementation strategy needs to be developed. Research for implementation is underfunded, and to transition toward a more holistic and integral education system, we need to mend the gap between knowledge and action (Haines & Frumkin, 2021).

Historic and emerging initiatives

Emerging initiatives are vital catalysts of political proactivity and policy-making. Various worldwide initiatives have worked to bring nature into the heart of education and bridge the gap between humans, more-than-human species and the rest of nature. In 1970, IUCN defined an emerging concept of *environmental education*, catalysing its implementation around the world as an ecosystem of disciplines and approaches that would inspire in young people a life-long connection to the natural world and commitment to its protection. The Tbilisi Conference in 1977 was the first intergovernmental conference on environmental education. The Earth Summit 1992 in Rio de Janeiro led to the conceptualisation of education for sustainable development (ESD). The United Nations Conference on Sustainable Development 2012 highlighted governments' commitment to mainstreaming education for sustainable development. The UNESCO Global Action Programme 2014 focused on promoting ESD actions at all levels and areas of education.

More recently, the Sustainable Development Goals (SDGs) positioned education for sustainable development (ESD) as a critical enabler for a better, more sustainable future within the 2030 Agenda. The

IPBES and IPCC report on climate change and biodiversity loss illustrates the need to join forces and tackle our environmental crisis through systemic thinking and interconnected solutions. Oceans Plastics Charter, the High Ambition Coalition for Nature and People, Abu Dhabi's ICE Principles, the Global Partnership for Education, IUCN's Commission on Education and Communications (CEC), IUCN UK nature-based education strategies, Greening School Grounds, #NatureForAll, and several UN-type processes initiatives by UNESCO, UNFCCC, CBD, WEEC, and WCC are examples of these initiatives seeking to bring nature into our education practices. Most highlight the urgency of more integral and holistic education frameworks, the importance of greening school grounds and offering outdoor learning, the need for political proactivity, legislation and funding, and the power of partnerships and alliances.

"Across the world, teachers, students, parents, leaders, policymakers, and citizens are calling out for a system change to help transform learning toward a healthier future for people and planet" (Musson, 2023, p. 31). The need for change is evident through increased ill-health symptoms among people, communities and nature's systems. More and more reviews from mainstream education systems highlight the urgency and need for change, and even our children are engaging in protest movements and activism to ensure a healthier future for all (Musson, 2023).

Government entities and policymakers worldwide are implementing new and promising national strategies to bring nature into education practices. For instance, in 2021, Jordan's Ministry of Environment built and published a plan for sustainability in environmental education. The perspective was that environmental culture, education and promoting behavioural change are part of the government's strategic goals, and investing in future generations requires building foundations to raise awareness and promote environmental education (Tubaishat, 2021). "The Ministry of Environment developed its awareness of the importance of reaching an effective national mechanism to support environmental education in line with sustainable development goals" (Tubaishat, 2021, p. 10).

People, institutions and the educational system must embrace this shared cause. Governments, international bodies, citizens and educators call for change. Building bridges and synergies among organisations is crucial for this time of transition. We must consider collaboration, systems and unity as we tackle planetary emergencies.

Partnerships and synergies

Strategic partnerships and alliances will be critical for the mainstreaming of NbE. We must consider our capacity to create a community of action, collaboration and unity as we tackle our planetary emergencies from our ways of learning and understanding living systems. Fragmenting and competing over resources contribute to the environmental crises we face, and we should instead align our messages and share knowledge, expertise and resources.

As we stated earlier, planetary challenges require planetary solutions. "Every person within the system has the power to change the system by shifting how they think, by widening perspectives, changing how they show up or simply how they relate to other people in the system. We can transform education simply by transforming ourselves and the stories we are a part of" (Musson, 2023).

NbE provides a common language across disciplines and actors, reinforcing human and

natural interconnection. This common language and conceptual understanding will allow us to integrate nature effectively into our learning environments at scale.

We need more institutions working together by effectively coordinating spaces that facilitate sharing practices, successes and setbacks. We need to foster teamwork among stakeholders, no matter how different their perspectives are. There needs to be thorough preliminary community research to understand current knowledge, attitudes, practices and motivation toward nature better. We need focus groups, interviews, mapping and surveys to adequately determine individuals' perceptions of nature (Tubaishat, 2021).

Youth should be mainly supported in taking action for planetary health, emphasising robust and well-resourced youth-led initiatives that provide opportunities for local communities to participate in decision-making about sustainable development and nature-based learning experiences (UNESCO, 2020).

Through nature-based education, the principles of nature guide how we collaborate (Charles, 2025). By creating opportunities for people to deeply connect with nature, and comprehend at multiple levels (head, heart, hands/body) the oneness of our ecological systems, we will realise that caring for and protecting nature protects our future, well-being and health.

Comprehending and sensing the planet as a whole, a system and an interactive, interconnected entity could help initiatives and organisations align forces and work together for a healthy world. This perception is the foundation that allows us to look from further away and understand health and learning as part of an interconnected web of life. NbE will enable individuals and communities to come together into wholes and avoid fragmentation because education and health are as interlinked as the Earth's ecological systems.

Loving nature

The cultivation of love and empathy for nature is foundational to NbE. Nabhan (1997) underscores the importance of embedding local and Indigenous narratives into education, connecting learners to cultural and ecological heritage. As practiced in programmes like the Wilderness Awareness School, nature journaling encourages students to document observations, emotions, and reflections from outdoor experiences. This practice deepens personal connections to the environment and reinforces the ethos of reciprocity. Firouzi (2021) emphasises that the pandemic revealed the intrinsic value of nature, providing a crucial opportunity to rebuild humanity's bond with the planet.

IUCN's #NatureForAll initiative echoes these principles, calling for intergenerational and community-centred approaches to reconnect individuals with the natural world and recognise the importance of falling back in love with nature, championing a global movement. We urgently need to provide numerous spaces for all members of society to connect with the rest of nature in meaningful ways, intergenerationally and within communities of all kinds. Bringing nature into our learning experiences and our everyday lives – as a teacher, as a classroom and as an inspiration – will help us understand, sense and embody that **We Are Nature** caring for itself.

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Figures

Resources

The following links and resources are good places to start and explore NbE and how it is being introduced in many spaces.

1. Nature ForAll
   https://natureforall.global/

2. IUCN CEC - NbE Technical Brief COP26
   https://www.iucn.org/resources/information-brief/nature-based-education-planetary-health

3. Greening Schoolgrounds and Outdoor Learning
   https://www.childrenandnature.org/schoolgroundgreening/

4. Children and Nature Network
   https://www.childrenandnature.org/

5. Visions and Recommendations for the Futures of Education
   https://www.iucn.org/resources/grey-literature/visions-and-recommendations-futures-education

6. OpEPA - Nature-based Education
   https://opepa.org/

7. Rewilding Education
   https://projectrewild.co.uk/

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