NURTURING ROOTS:

A RESTORATIVE, OUTDOOR-ORIENTED TEACHING SYSTEM

by

AARON GATHRID

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Approved: *Dr. Patricia Lambert*
Primary Thesis Advisor

We spend our days inside climate-controlled boxes, tune out the noise of the world with headphones, and quench the gift of boredom with the immediate satisfaction of glowing screens. In avoiding discomfort, we have dulled our connection to the living world – a growing rift I call *terrestrial disconnect*. This disconnect contributes to rising mental health issues, loss of identity, and weakened grit and resilience. In the K–12 system, environmental education offers a powerful remedy, but existing programs are often spread too thin to have lasting impact, or too resource-intensive to scale equitably. In this thesis, I develop ROOTS – the Restorative Outdoor-Oriented Teaching System – a model designed to offer both the depth of meaningful environmental learning and the scalability to serve students in a wide range of settings. This adaptive, interdisciplinary curriculum aims to reconnect students with the natural world while building the psychological traits proven to support success: grit, purpose, and a growth mindset. ROOTS guides students from cosmic origins to their own sense of place through experiential tools that bring the cognitive and emotional power of nature-based learning into any environment. The goal is to cultivate resilience and a sense of belonging – helping students feel connected, challenged, and part of something greater than themselves.

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I. Introduction

A. Providing a Backdrop

Over my head, I see the bronze butterfly,
Asleep on the black trunk,
Blowing like a leaf in green shadow.
Down the ravine behind the empty house,
The cowbells follow one another
Into the distances of the afternoon.
To my right,
In a field of sunlight between two pines,
The droppings of last year's horses
Blaze up into golden stones.
I lean back, as the evening darkens and comes on.
A chicken hawk floats over, looking for home.
I have wasted my life. (James Wright, 1990)

James Wright's poem captures a fleeting moment of natural beauty and stillness, only to end with a haunting revelation: *"I have wasted my life."* This stark juxtaposition invites us to reflect on the overlooked value of connection – to the world, to others, and to ourselves.

Observation and reflection are essential tools for cultivating meaningful connection. In pausing to notice the delicate details of the world around us – a butterfly's stillness or the warm hum of cowbells – we unlock profound opportunities for interpretation. These moments of connection, shaped by our unique experiences and biases, allow us to find meaning and purpose in the seemingly ordinary.

James Wright frames this poem as a reminder of the immense value found in slowing down and tuning in to the world we inhabit, a value that is too often overlooked in our

distraction-saturated lives. By allowing observation and reflection to thrive, more space is created to discover our own unique sense of place and self.

B. Defining Terrestrial Disconnect

Picture this. A member of the Klamath Tribe in 1850 prepares salmon for dinner. These fish came from one place: the Klamath river and its tributaries. By necessity, indigenous peoples protected and harmonized with the natural elements they relied on. His ability to feed himself and his family depends on the health of the Klamath watershed and his personal connection to the water and the life it sustains (May, 2018). However, if a current-day non-indigenous resident of Klamath Falls, Oregon serves salmon for dinner, it likely came from the grocery store, the origin of which is shrouded in uncertainty. That fish could have been grown in an aquaculture factory in Canada, Chile, or Norway, or have been caught in Alaska or any Pacific Northwest waterway. Regardless of the Klamath river's health or his relationship with it, his ability to feed himself and his family is unchanged. There are far fewer repercussions for harming the environment, and less incentive – besides morals and personal value – to cherish and care for his slice of the natural world. He is, by way of society, disconnected from nature. This is *terrestrial disconnect*: humanity's growing alienation from the natural world in all that we consume and interact with.

Humans have rapidly become urban creatures. Fifty-five percent reside in urban areas, a number that has nearly quadrupled since the start of the twentieth century (UN, 2018). Urban environments breed a fast-paced lifestyle. Urbanites are forced to look past the cacophony of flashing billboards, gasoline-powered leaf blowers, and crowded spaces to achieve the seemingly impossible goal of balancing work, family, and self-care. "Most urban dwellers deem themselves

incapable of enduring the simultaneous exposure to so many stressors at once, and can even quantify a progressive deterioration of their mental faculties" (Prakash et al., 2023, p. 199). In fact, mental illnesses are now being labeled as an urban phenomenon, attributed largely to the "instability and insecurity that skew the dynamics of a healthy lifestyle" (p. 199). Yet, urbanization is new to humanity. Homo sapiens evolved and thrived for hundreds of thousands of years by working *with* their surroundings. For the most part, we cultivated native plants, constructed homes using nearby resources, and cared for our lands. The objects we interacted with and the spaces we inhabited were authentic.

The urban metropolis, on the other hand, ruptures all that was once authentic, shreds it into pieces, adds chemical enhancers, and spits it out for consumers to fight over. With life's necessities neatly packaged and labeled; all of the knowledge and effort needed to provide for oneself and their household can be replaced with the swipe of a credit card and a sense of oblivion as to where it all came from. Since urbanization represents such a new way of life in the human timeline, the negative impacts of this terrestrial disconnect could be far greater than we realize.

C. The Stakes of Terrestrial Disconnect

The stakes are not merely theoretical; they are deeply tangible. Studies demonstrate that exposure to natural environments can significantly enhance mental health. For instance, proximity to green spaces has been associated with lower levels of stress, reduced symptoms of depression and anxiety, and improved cognitive functioning (Pearson & Craig, 2014). Research shows that even passive exposure to natural scenes, such as viewing images of greenery, can lead to measurable recovery from mental fatigue, highlighting the power of nature's restorative

properties (Pearson & Craig, 2014). These effects extend to the chemical realm as well – simply inhaling oils extracted from conifers has been shown to lower heart rates and reduce blood flow to the prefrontal cortex, promoting a positive mood (Pyrah, 2023, p. 2).

This idea of nature integration lies at the heart of terrestrial connection. In the following two studies, one explores horticultural therapy in the Serbian city of Belgrade and the other examines Attentional Restoration Theory (ART), providing compelling evidence of nature's restorative potential. These studies not only quantify the impacts of nature integration on mental and physical health but also reinforce the urgency of reconnecting people – particularly those in urban and underserved communities – with the natural world in intentional and meaningful ways.

A Serbian study examining the mental health benefits of horticultural therapy provides critical insight into the power of nature to reduce psychological distress. Conducted in response to the rapid decline of green spaces in Belgrade – where the lowest concentrations of greenery correlate with the highest rates of respiratory and nervous system diseases - the study sought to measure the effects of structured nature-based activities on depression, anxiety, and stress (Vujčić et al., 2015, as cited in Vujčić et al., 2017, p. 386). Using the Depression, Anxiety, and Stress Scale (DASS21), researchers assessed participants before and after a four-week intervention in which they engaged in guided gardening activities within an urban botanical garden. The findings were striking. Stress levels in the horticultural therapy group dropped by an average of 23%, while the control group, which received conventional therapy without nature exposure, showed no significant improvement (Vujčić et al., 2017, p. 390). Beyond statistical reductions in stress and anxiety, participants reported increased emotional resilience, social connection, and a sense of belonging. This study demonstrates that even in the most developed

urban environments, nature remains a powerful force for psychological healing. The following study gives reason to why that might be.

Attentional Restoration Theory (ART) reveals how natural environments actively replenish cognitive resources and counteract the effects of mental fatigue. First proposed by Kaplan and Kaplan (1989), ART distinguishes between directed attention – required for navigating urban environments, digital screens, and complex problem-solving – and involuntary attention, triggered by the effortless stimuli of the natural world. In a state of "soft fascination," individuals engage in the subtle movement of tree branches, flowing water, or shifting clouds, allowing the brain to rest and reset (Kaplan 1995, as cited in Pearson & Craig, 2014, p. 3). Research on ART has found that individuals who spend time in nature demonstrate a 20% improvement in working memory and a 50% increase in performance on attention-based tasks compared to those in urban settings (Berman et al., 2008, as cited in Pearson & Craig, 2014, p. 5). Physiological studies further reinforce this phenomenon – nature exposure has been linked to lower cortisol levels, reduced heart rates, and increased activity in the brain regions responsible for emotional regulation and creativity (Bratman et al., 2015, as cited in Pearson & Craig, 2014, p. 6). These findings highlight a fundamental truth: the human mind is wired to thrive in natural environments, and the consequences of terrestrial disconnect are notably biological.

This thesis examines how weaving a richer understanding of the natural world into K-12 education can cultivate lasting personal growth. In doing so, it also explores how such approaches might expand access for communities traditionally left out of environmental learning. Inviting terrestrial connection into the classroom is not just an enhancement to education but a fundamental shift toward deeper engagement, well-being, and ecological literacy. The evidence demonstrates that engaging with nature – whether through immersive outdoor experiences or

simply noticing the life teeming in everyday surroundings – can foster mental clarity, curiosity, and emotional well-being. This is not just about improving education; it is about re-establishing a fundamental relationship between humans and the natural world, one that has been largely eroded by urbanization and industrialization. The challenge is not proving the benefits of nature integration, but ensuring that all children have the opportunity to cultivate a meaningful connection to the world around them – and, through it, a deeper sense of fulfillment.

D. Learning from the Land: Bridging Education and Terrestrial Connection

Moving forward, I explore how wilderness philosophy and experimental forestry principles can be translated into a K-12 education framework aimed at stimulating terrestrial connection for those who engage. By deepening our relationship with the environment, I believe we can cultivate a grander sense of identity, purpose, and resilience – qualities that are crucial not only for individual growth but for addressing the broader societal issues we face today. This research spans the philosophical debates over wilderness management, their creative applications in education curricula, and the integration of these ideas in a real-world experimental forest in Oregon's Willamette Valley.

At its essence, one's quality of life is deeply personal – shaped by the mosaic of experiences, challenges, lessons, and reflections that define us. Each individual discovers value and purpose in their own way. While the natural world may not resonate with everyone, I – and many educators – believe it offers an inexhaustible well of wisdom. Nature, in its raw beauty and unyielding reality, reminds us of our interconnectedness with the living world.

In my own life, developing an understanding of the natural world has profoundly shaped my perspective, allowing me to find joy and meaning in unexpected places. This journey began

long before I could identify tree species, feel at ease alone in the wilderness, or wonder how the intricate systems of the Earth operate to sustain life. These moments of curiosity and connection have been transformative, offering me a deeper appreciation for the world and my place within it.

The woods, rivers, and mountains all have their unique way of teaching and nurturing; a connected landscape holding vastly different forms of life and power. A western hemlock (*Tsuga Heterophylla*) seed cone melts into the ground moss in the woods near Foley Ridge; every square inch contains a near-infinite tapestry of life. Furious water piles over smoothed boulders, angrily pinching into a slot on Brice Creek, a rapid named Laura's Thighs. An endless sea of snow-capped mountains from the peak of McGowan in Idaho's Sawtooths; I am a small and insignificant climber in this Cretaceous age topography. These places capture my attention, require my focus, and light my curiosities. They give me reason to take a deep breath, to exempt myself from the stress and worry that serve me no good – leaving more time for action, for presence, and growth.

I grew up in the sprawling metropolis of Los Angeles, California – a place where the rubber meets the road in every sense of the phrase. It's a city of endless motion, where life speeds by, yet often feels like it's going nowhere at all. I went to school, played tennis, and spent time with family, but there was always this nagging sense of stagnation. I had all the time in the world, yet nothing meaningful to do with it. Looking back now, I felt like a passenger – disconnected and unfulfilled – yet unaware of how little input I had from the world around me.

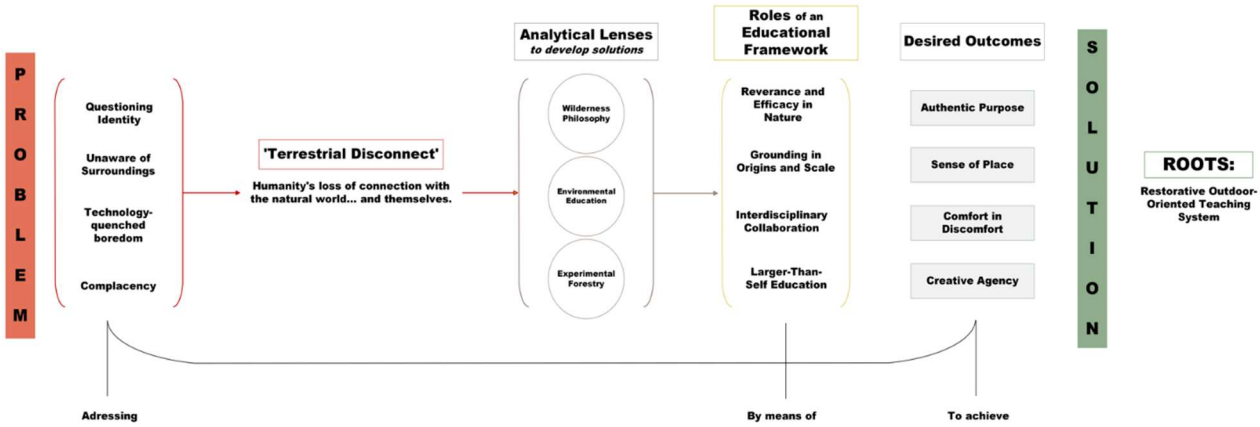
At age 15, I enrolled in a school in Ketchum, Idaho, a small mountain town of 5,000. I needed to get out of the city. The school embraced the philosophy that "not all classrooms have walls," and from the start, I was pushed well beyond my comfort zone: thrown into the rugged

mountains and powerful rivers of the American West with my classmates and teachers. I learned that these environments not only challenged us to be creative and resourceful but also demanded our truest, most authentic selves. To be vulnerable with one another, forming relationships rooted in genuine connection rather than convenience or status. Since then, I have become a version of myself that I am far prouder of and happier with. This research builds on the transformative experiences I was fortunate to have, seeking ways to make similar opportunities accessible to a broader audience in the realm of education.

To address the symptoms of terrestrial disconnect, I am developing the Restorative Outdoor-Oriented Teaching System (ROOTS): a curriculum proposal designed to foster deeper connections to nature and self. The ROOTS framework is devised to achieve four core goals for its students: fostering authentic purpose, cultivating a sense of place, building comfort in discomfort, and empowering creative agency. By prioritizing individual growth, it encourages students to embark on journeys of self-exploration. Using the tools of observation and reflection, students are equipped to harness the transformative power of terrestrial connection, inspiring the personal development that lies at the heart of a meaningful education.

E. Charting Variables: The Conceptual Framework

Figure 1: Conceptual Framework



The conceptual framework depicted in Figure 1, provides the foundation for ROOTS: a holistic environmental education (EE) model designed to cultivate students who are more present, passionate, and deeply in touch with themselves and the world around them. Each stage builds toward this goal, offering a structured approach to understanding and addressing the challenges of terrestrial disconnect.

The *Problem* Stage highlights universal vulnerabilities that diminish quality of life, with disconnection from the natural world at the core. This detachment disrupts our sense of clarity, belonging, and well-being. Research demonstrates that reconnecting with nature can restore these qualities, paving the way for education to bridge this gap effectively.

This research draws from three *Analytical Lenses* to inform ROOTS. First, wilderness philosophy examines humanity's evolving relationship with nature, uncovering how wilderness has shaped personal and collective well-being. Second, environmental education (EE) evaluates the strengths and limitations of existing EE programs, offering insights into best practices and

identifying gaps that ROOTS seeks to address. Third, experimental forestry highlights the role of interdisciplinary collaboration, demonstrating how integrating science, art, and philosophy enhances ecological understanding and inspires connection. Together, these lenses provide a comprehensive framework for designing an educational model that bridges knowledge, experience, and self-exploration.

The final stages focus on mobilizing these takeaways. The *Roles of an Educational Framework* define the guiding principles of ROOTS, while the *Desired Outcomes* articulate its transformative potential. ROOTS aims to counteract terrestrial disconnect by helping students cultivate four core traits. The first is authentic purpose: encouraging students to explore who they are and what drives them. The second is sense of place: grounding them in their communities, ecosystems, and environments. The third is comfort in discomfort: expanding their capacity to sit with uncertainty and face challenges with resilience. And finally, creative agency: empowering students to become active creators of their lives, not passive participants in them.

Through this framework, ROOTS emerges as more than a theoretical model – it is a practical and adaptable approach designed to bridge the gaps in environmental education, expand its reach to underserved urban communities, and foster meaningful, lasting personal growth through depth of connection.

F. Methodology

This research employs an interdisciplinary approach, integrating textual analysis, case study evaluations, and site observations to explore the relationship between nature, education, and personal development. Phase One consists of a literature review and textual analysis of key environmental thinkers, including John Muir, Gifford Pinchot, Wendell Berry, and E.O. Wilson, to establish the philosophical and ecological foundations of terrestrial connection. By tracing the

evolution of human-nature relationships, this research will inform the adaptation of these ideas into a modern educational framework. Phase Two examines existing environmental education models across the globe to assess their implementation, strengths, and limitations, through program evaluations and a site visit. Phase Three incorporates a case study of the HJ Andrews Experimental Forest near Blue River, Oregon, analyzing its interdisciplinary collaborations as a model for integrating science, art, and philosophy into education. These methods work in tandem to inform the design of ROOTS as an adaptable, holistic education approach.

II. Phase One: Wilderness Philosophy - Human and Nature

A. Two Visions of the Wild: Preservation and Conservation

Before examining broader environmental philosophies, it is essential to understand the foundational divide that has shaped the American wilderness and our relationships with it. John Muir and Gifford Pinchot represent two contrasting yet complementary views on wilderness – one rooted in reverence, the other in resourcefulness. Muir saw nature as sacred, a realm to be preserved for its intrinsic beauty and spiritual value, while Pinchot viewed it as a resource to be managed wisely for the benefit of present and future generations. These two perspectives, though seemingly at odds, offer essential lessons for environmental education, providing a framework that balances emotional connection with practical competency. I chose to begin this journey with two books, John Muir's *The Boyhood of a Naturalist* and *The Conservation Diaries of Gifford Pinchot,* acting as seedlings of insight into the early roots of these impactful thinkers.

Muir's childhood was a collection of never-ending observations. He noticed every detail of the natural world – from the maternal care of the speckled woodpecker to the irregular throbbing and flashing of lightning bugs, Muir saw it all. His curiosity directed his legs, and his reverence for life of all kinds defined his adolescence. And it seems that he never stopped. His thirst for learning – grounded in the belief that understanding deepens our connection to the land – is revealed aptly in this moment in a nearby meadow. Muir writes:

> These so-called 'kettles' were formed by the melting of large, detached blocks of ice that had been buried in moraine material thousands of years ago when the ice-sheet that covered all this region was receding. As the buried ice melted...forming hopper-shaped hollows, while the grass growing on their sides and around them prevented the rain and wind from filling them up. (Muir 1913, p. 35).

From a young age, Muir had an extensive knowledge of the natural world. Through his curious lens, he observed and learned from the land formations, animal species, and weather events that surrounded him. His experimental mind often led him to ask questions of creation; the ones that later in life would become his existential reflections.

Pinchot's upbringing with nature was far more structured, facilitated, and goal-oriented. Pinchot was trained in the French and German forestry models, studying at L'Ecole Nationale Forestiere in Nancy, France and later receiving mentorship from German forestry pioneer, Deitrich Brandis, who was instrumental in shaping Pinchot's pragmatic approach to conservation. Pinchot writes, reflecting on his time spent with Brandis:

> He [Dr. Brandis] believes that nothing general can be done until some state or large individual owner makes the experiment and proves for America what is so well established in Europe, that forest management is pecuniarily profitable. (Pinchot 1913, p. 33).

By 1898, Pinchot ran the U.S. Division of Forestry, which soon after became the United States Forest Service, a system which proved that forestry could both produce timber for harvest and maintain the forest for future generations, all while being a profitable industry.

Muir and Pinchot, though vastly different in their philosophies, together offer a dynamic lens through which to approach environmental education. Muir's unwavering reverence for the wilderness reminds us of nature's ability to inspire, heal, and ignite curiosity, while Pinchot's structured conservation principles teach us the value of stewardship, resourcefulness, and long-term sustainability. One fosters awe, the other fosters agency.

Their differences came to a head during the early 20th century with the proposed damming of Hetch Hetchy Valley in Yosemite National Park. Muir fought passionately to preserve the valley's untouched beauty, seeing it as a sacred space beyond human use. Pinchot,

by contrast, supported the dam as a necessary and efficient use of natural resources to serve the growing needs of San Francisco. In this conflict, we see the philosophical divide made tangible: preservation as spiritual protection versus conservation as pragmatic management.

Neither perspective alone is sufficient. Preservation without the sustainable use of nature's resources risks becoming an impractical ideal, while conservation without deep appreciation reduces nature to a mere commodity. Environmental education must embrace both – a reverence for the natural world and a responsibility to sustain it – forming a more complete foundation for how we teach our relationship with nature.

ROOTS bridges this divide by blending these philosophies into a holistic educational approach. It emphasizes direct, unmediated experiences with the natural world – those that cultivate reverence and wonder – while also instilling the skills and knowledge necessary for responsible engagement with the land. By merging Muir's emotional connection to nature with Pinchot's pragmatic stewardship, this framework creates an immersive learning environment where students not only appreciate the beauty of their surroundings but also understand their role in shaping and sustaining it.

B. Tracing Nature's Role in the Human Experience

To truly grasp the role of wilderness in the human experience – and its capacity to educate and inspire – the lens must be widened from just Muir and Pinchot. The literature chosen for this section broadens the scope, offering perspectives from change-making novelists, historians, scientists, teachers, and environmental thinkers of all types. Through their work, wilderness emerges as more than a battleground for preservation and conservation – it is a living and breathing ecosystem, a sustainable practice, a market economy, and a global business.

Wendell Berry's (1996) work shows that while humans have long shaped and defined wilderness, the natural world remains a source of deep wisdom, resilience, and connection – offering profound insights for those who take the time to understand its rhythms. In *The Unsettling of America*, Berry offers a sharp critique of modern industrial culture, particularly through its impact on agriculture. He contrasts two opposing attitudes toward the land: one that treats it with care and humility, and another that views it as something to be dominated and depleted. Berry writes, "The exploiter is a specialist, and expert; the nurturer is care... The exploiter's goal is money, profit; the nurturer's goal is health – his land's health, his own, his family's, his community's, his country's" (Berry 1996, p. 7). This distinction between nurturer and exploiter reveals not only the fundamental choices that shape our relationship with the land, but the motives behind them. This perception extends beyond agriculture and emerges clearly in some of America's most pivotal wilderness debates. The 1913 Raker Bill, for instance, approved the damming of Hetch Hetchy Valley to supply water to San Francisco – a decision driven by urgent public need, yet one that dismissed the valley's ecological and spiritual significance. In contrast, the National Parks and Recreation Act of 1978 protected Mineral King Valley from a proposed Disney ski resort, reflecting a nurturer's defense of natural integrity over commercial development. Through these cases, Berry's nurturer and exploiter personas take tangible form, influencing the fate of the American landscape.

To fully understand our detachment from the natural world, Wendell Berry turns to agriculture – a space where cultural values, land use, and human identity converge. In *The Unsettling of America*, Berry argues that the way we farm reveals the way we live: increasingly disconnected, efficiency-driven, and governed by the logic of control rather than care. Industrial agriculture reduces land to a tool and the farmer to a technician, eroding both ecological health

and cultural integrity along the way. For Berry, examining how we treat the land is not just about food systems – it is about recovering a vision of mutual responsibility.

It is in this light that Berry challenges our modern outlook on life. Our cultural evolution, shaped by the technologies we embrace, has led us down a path increasingly confined by the capitalistic framework we all recognize. He writes:

> The only escape from this destiny of victimization has been to 'succeed' - that is, to 'make it' into the class of exploiters, and then to remain so specialized and so 'mobile' as to be unconscious of the effects of one's life or livelihood. The escape is, of course, illusory, for one man's producer is another's consumer, and even the richest and most mobile will soon find it hard to escape the noxious effluents and fumes of their various public services. (Berry 1996, p. 5).

Berry reveals the illusion of escape within a system that rewards detachment. He suggests that in a world governed by exploitation, success often means becoming insulated from the consequences of one's actions – yet no one is truly exempt. Industrialization has severed our ties to the land, stripping us of both accountability and a sense of belonging. To reclaim these, we must reorient ourselves – understanding our place, our scale, and our relationship with the natural world beyond human construction.

While Berry criticizes the forces that drive human separation from nature, the historian, William Cronon (1996) examines how this separation is embedded in our cultural perception of wilderness itself. His work challenges the romanticized idea of untouched nature, urging us to recognize that wilderness has always been shaped by human history and ideology. In Cronon's chapter of *Uncommon Ground*, "The Trouble with Wilderness," he parses through the history of American wilderness, focusing particularly on the evolving perspective of its role in the human

world. From its original connotation as desolate and savage until the late eighteenth century to its perception as sacred and Of God, the meaning of wilderness has evolved alongside American culture.

Cronon reminds us that what we call "wilderness" is often a carefully manicured landscape, curated to uphold a particular vision of untouched nature. National parks, for instance, have been selectively preserved to highlight dramatic scenery – towering mountains, pristine lakes, ancient forests – while systematically removing Indigenous peoples whose presence complicated the illusion of an uninhabited, "virgin" land. Trails are cleared, invasive species are controlled, certain wildlife populations are managed or even reintroduced, and visitor experiences are orchestrated to emphasize awe and solitude. In this way, wilderness emerges not as untouched nature, but as a reflection of the stories we choose to tell about it. He writes, “No matter what the angle from which we regard it, wilderness offers us the illusion that we can escape the cares and troubles of the world in which our past has ensnared us” (Cronon 1996, p. 10). He argues that it serves, in part, as a respite from the increasingly urbanized, fast-paced, and mechanized lives of America’s city dwellers, a notion driven partially by frontier theory, primitivism, and other restorative movements from the nineteenth and twentieth centuries.

Cronon’s argument that wilderness is a cultural invention challenges the notion of preserving untouched nature, urging us to recognize that even the most pristine environments are shaped by human history and intervention. Cronon writes, “If we allow ourselves to believe that nature, to be true, must be wild, then our very presence in nature represents its fall” (Cronon 1996, p. 10). This idea directly informs the ongoing debate between preservation and conservation in forest management, where the goal is not to keep forests frozen in time but to balance human influence with ecological health.

Cronon's argument reveals how nature is not only a physical space but a cultural construct, shaped by human interpretation. Biologist, E.O. Wilson, and poet, Robert Hass, expand this discussion by exploring how scientific and artistic perspectives can work together to deepen our understanding of nature and our place within it. *The Poetic Species* captures a unique dialogue between Wilson and Hass, highlighting the profound synergy between science and art. This conversation reflects the delicate balance at the heart of my educational framework – a balance between the individual and the collective, intellect and emotion, reason and imagination. Wilson reflects on the conflict between individual ambition and collective responsibility:

> If it goes too far toward individualism, societies would dissolve. If, on the other hand, it goes too far toward obedience to the group, the group would turn into an ant colony. So we're creatively conflicted moving back and forth between sin and virtue, rebellion and loyalty, love and hate. (Wilson & Hass 2014, p. 52).

Wilson's reflection captures the constant tension between individual ambition and collective responsibility – a tension that shapes both personal and social growth. ROOTS embraces this balance, guiding students to cultivate a strong sense of self while deepening their connection to the larger world around them.

Meanwhile, Hass reminds us that poetry, with its ability to stir emotion and reshape perception, is not just a literary exercise but a crucial tool in fostering deeper understanding and connection. In a 2013 project conducted by the Poets House, poems were placed throughout six major city zoos, placed alongside animal exhibits to provoke reflection and deepen emotional engagement. Hass (2014) reflects on the outcome:

> Though it surprised most curators and scientists participating in the zoo program, the poetry worked to engage people emotionally with what they were seeing. It worked not because

visitors to the zoos were students of literature, but because poetic thinking and metaphor are intrinsic to the way the human mind operates and are critical to grasping abstraction. (p. 16).

Together, Wilson and Hass emphasize the importance of balance and collaboration. Balance between science and emotion, function and feelings. And collaboration across disciplines; using poetry as a tool to engage with subjects that may otherwise seem daunting or uninteresting.

Barbara Mossberg – teacher, poet, environmentalist, and wearer of many fine hats – offers a unique perspective in this exploration of wilderness. Her work intertwines literature, philosophy, and environmental thought, emphasizing the power of storytelling to help us understand our place in the universe and how we wish to exist within it. She is a prizewinning writer and an accomplished environmental scholar, well-beloved by her students for her inspiring and emotional teaching. Her book, *Here for the Present*, weaves together the wisdom of past thinkers with her own reflections, illustrating how literature and nature shape our understanding of the world. Throughout her book, Mossberg emphasizes the importance of presence: the act of fully experiencing and appreciating moments that shape our character and leave lasting impressions.

Reflecting on the soul of Pacific Grove, CA and its poetic allure, Mossberg writes:

> From Plato's ancient grove of olive trees dating back to the bronze age, to William Cullen Bryant in "A Forest Hymn" - "The groves were God's first temples" - groves are conceived as sacred places of consciousness. (Mossberg 2021, p. 16).

Mossberg captures the spiritual and existential beauty of nature, illustrating its power to heighten awareness and deepen our understanding of the world and our place within it. She preaches the occasional 'slowing down' of life, that is, "to do justice to the gift of consciousness for living on earth" (p. 20). Both literature and the natural world serve as complementary avenues for self-

exploration, guiding us to look inward, find clarity, and connect more deeply with our own identity and the world around us. This is an elemental concept in the development of an educational framework – one that seeks to nurture a deeper sense of awareness, purpose, and connection. By encouraging learners to engage with both text and nature, more space is created for these powerful acts of presence.

The takeaways from Berry, Cronon, Wilson and Hass, and Mossberg collectively shape a vision of environmental education that is both profound and practical. Berry reminds us of the deep wisdom and belonging the natural world offers to those attuned to its rhythms, while Cronon challenges us to see wilderness as a product of human interaction, urging a more integrated view of nature. Wilson and Hass emphasize the importance of interdisciplinary learning, advocating for a blend of logic, emotion, science, and art to foster a deeper connection with the world. Mossberg, in turn, highlights the importance of being present, teaching us that true learning comes from engaging with the interconnectedness of life. These insights are woven together in the ROOTS curriculum, which seeks to balance the ideals of preservation and conservation. By grounding students in direct, immersive experiences with nature, ROOTS cultivates a reverence for the environment while providing the practical knowledge needed for sustainable engagement. In this way, the program mirrors Muir's emotional connection and Pinchot's stewardship, offering a holistic approach to EE that encourages both reverence and responsibility. This design serves as the foundation for evaluating existing EE programs and in determining how ROOTS can best perform on its desired outcomes while reaching the lower-income urban audiences that current EE programs fail to.

III. Phase Two: Environmental Education – Learning with Nature

A. Categorizing Environmental Education

Environmental Education (EE) encompasses a range of prescriptive pedagogies and actionable programs designed to foster nature connectedness and sustainability. These approaches can be categorized by structure and scale (the size of their intended audience). By exploring both the pedagogies and the academic programs that apply them, this section evaluates the different inputs, outputs, and implementations of EE across all scales.

Before analyzing specific pedagogical approaches, it is important to acknowledge a foundational philosophy that influences many of them: Early Childhood Environmental Education (ECEE). ECEE advocates for integrating environmental learning into early childhood education through child-centered, experiential approaches that cultivate exploration, environmental responsibility, and deep-rooted nature connection. Many EE frameworks build upon this foundation while applying distinct methodologies to achieve their desired outcomes.

B. The Guiding Pedagogies

These environmental education pedagogies offer adaptable frameworks that support schools in weaving environmental learning into broader educational practices. SEED (Social-Emotional and Environmental Education Development) operates more as a guiding philosophy, emphasizing play, exploration, and relational learning. BEETLES (Better Environmental Education, Teaching, Learning & Expertise Sharing) provides structured, research-based EE resources that schools can adopt and integrate into their curriculum. While these frameworks

contribute valuable pedagogical insights, their effectiveness depends on how educators implement them within specific contexts.

The SEED model exemplifies a framework rooted in ECEE principles, prioritizing social-emotional growth alongside environmental engagement. As Deborah Carter (2016) explains in *A Nature-Based Social-Emotional Approach to Supporting Young Children's Holistic Development in Classrooms With and Without Walls*, SEED "is not a new intervention package or curriculum, but a systematic framework for establishing a nature- and connection-based culture... promoting 'caring and relationship both as an educational goal and as a fundamental aspect of education'" (Smith, 2016, as quoted in Carter, 2016 p. 10). While SEED emphasizes empathy, reflection, and environmental stewardship, its broad, philosophy-driven approach lacks the structured guidance needed for consistent implementation across diverse educational settings. Educators seeking to apply SEED principles often face challenges in translating its holistic vision into concrete lessons and scalable practices.

The BEETLES Project, (Better Environmental Education, Teaching, Learning & Expertise Sharing), is a model designed to improve EE practices through the integration of research-based teaching strategies. The model focuses on fostering inquiry-based experiences that promote critical thinking, stewardship, and lasting connections with nature. BEETLES aims to equip educators with effective methods for outdoor teaching, emphasizing active engagement, and student inquiry. Its methods are grounded in best practices from science education; promoting curiosity and helping students construct their own understanding of natural systems through hands-on activities. Additionally, BEETLES supports the professional development of educators by sharing expertise and resources, enabling them to continually refine their practice and enhance student learning outcomes.

Moving forward, to fully understand the landscape of environmental education, it is essential to examine programs across three distinct scales: government-led initiatives that integrate EE into national curricula, institutional programs that follow established philosophies, and independent programs that offer locally driven, immersive learning experiences – each providing valuable insights into the strengths and gaps of existing models.

C. The Academic Programs: National Scale

These large-scale state-funded initiatives, such as Jamaica's Education for Sustainable Development (EESD), Hawaii's Place-Based Education initiatives, and Mexico's national EE programs aim to instill environmental awareness and promote sustainable practices at a large-scale societal level. Their standardized curricula focus on addressing global challenges like climate change and resource management, prioritizing broad accessibility over individualized learning. While they foster nature connectedness, their primary goal is to integrate sustainability principles into mainstream education.

Jamaica's Ministry of Education has taken numerous steps to promote Environmental Education for Sustainable Development (EESD). They have institutionalized EESD within schools and incorporated it into development planning, especially in elementary school curricula. Courses range from 'Plants and Animals in my Community' (Grade 2) to 'Using Earth's Natural Resources' (Grade 6, Social Studies) (Ferguson, 2008, p. 567). This diverse range of topics and complexity encourages students to develop an early appreciation for their surroundings and foster a deep connection to nature that grows as they age and mature. EESD positions students to grasp a sense of responsibility for environmental health. Through activities such as class projects like the 'Care Our School Campaign' (Grade 1), students are introduced to the concept of being

caretakers of their environment – not simply for human benefit, but as stewards of the natural world. Whether participating in clean-up efforts, nurturing plants, or raising animals, they learn to value and care for nature in its own right.

The Jamaican curriculum offers a rich example of how environmental education can encourage students to reflect on their place in the natural world. In Grade 3's 'Living and Non-Living Things in My Environment' students make close observations of life in the soil, fostering curiosity about ecosystems at a micro level. By Grade 5, in 'Exploring Our Country,' this curiosity broadens as students investigate plant and animal life in larger ecosystems such as ponds, lakes, and rivers, emphasizing the diversity and interconnectedness of nature. And the Grade 4 unit 'What is Religion' introduces a profound layer of introspection, prompting students to grapple with existential questions about life, death, and creation (Ferguson, 2008, p. 565-566).

Despite Jamaica's strong commitment to EESD, a significant disconnect exists between policymakers and teachers, limiting the program's effectiveness. While environmental topics have been incorporated into various subject syllabi, widespread teacher training and professional development opportunities remain scarce. A study by Taylor (1988) found that 89% of teachers supported integrating environmental studies into existing courses, and 74.3% were willing to attend training seminars. However, due to budget constraints and lack of coordination among government agencies, structured teacher training initiatives have been inconsistent, leaving many educators without the necessary preparation to effectively instruct (p. 25). The absence of clear implementation strategies result in an often fragmented execution of EE, typically lacking context and applicability. Teachers are expected to incorporate environmental concepts into their lessons, yet many lack the interdisciplinary training needed to illustrate the interconnectedness of

environmental topics and their real-world applications. This disconnect not only diminishes the impact of EESD but also prevents students from engaging with environmental education in a meaningful and cohesive way.

Beyond inadequate training, poor communication between policymakers and educators has further stifled the success of EESD. Taylor (1988, p. 27) highlights how ministries, curriculum planners, and conservation agencies often work in isolation, leading to disjointed efforts and inefficiencies. Many teachers feel unsupported due to a lack of guidance on best practices and structured evaluation methods. Meanwhile, government agencies assume institutions like the Natural Resource Conservation Department (NRCD) or the Education Broadcasting Service (EBS) will lead public environmental education, despite these organizations lacking the necessary funding, personnel, and infrastructure (p. 26). This diffusion of responsibility leaves no centralized support system to ensure the effective implementation of environmental education, risking EESD becoming a well-intended but inconsistently applied framework rather than a transformative movement.

Hawaii's efforts to integrate EE and place-based education (PBE) into public schooling have been marked by both innovation and inconsistency. The state constitution mandated EE in public schools in 1978, followed by the development of a comprehensive K-12 curriculum guide by 1981 (Stone, 1982, p. 801). However, despite these early commitments, implementation has been sporadic. Programs such as the *Hawai'i Nature Study Program* and the *Outdoor Education Center* were designed to immerse students in local ecology, yet systemic challenges – such as funding shortages, reliance on mainland-based curricula, and a focus on standardized testing – have hindered their lasting impact (Chinn, 2011, p. 76). More recent initiatives, such as *Mālama*

I Ka ʻĀina (Sustainability), sought to integrate Hawaiian cultural perspectives into science education, encouraging students to engage with their surroundings through indigenous ecological knowledge and sustainability practices (Samaniego, 2012, p. 5).

Despite these advancements, significant challenges remain. Many teachers report a lack of preparation and institutional support for implementing PBE and EE in meaningful ways. Chinn (2011) found that science curricula often prioritize abstract, textbook-based content over locally relevant environmental issues, leading to a disconnect between students and their immediate ecosystems (p. 77). Moreover, standardized testing pressures have resulted in administrators prioritizing conventional subjects, sometimes at the expense of place-based learning opportunities. One elementary teacher noted the irony of being required to teach about oak and redwood trees – species not found in Hawaii – while local ecosystems were overlooked (Chinn, 2011, p. 76).

Additionally, the limited availability of professional development programs for teachers has left many educators without the tools to effectively integrate environmental and cultural knowledge into their instruction. Without a more cohesive strategy that aligns curriculum, teacher training, and policy support, Hawaii's environmental education efforts risk remaining fragmented, limiting their long-term impact on students' ecological literacy. This lack of place-conscious curriculum design limits the relevance and effectiveness of EE, highlighting the need for scalable and adaptable frameworks that can be customized to align with the unique ecological, cultural, and institutional contexts of different learning environments.

In 1983, the Mexican government established the Secretaría de Desarrollo Urbano y Ecología (Ministry of Urban Development and Ecology), marking a pivotal moment in the

country's EE policy. This initiative led to the Programa Nacional de Educación Ambiental (PRONEA) in 1987, which provided conceptual guidelines and methodologies for incorporating EE into primary education. However, while these policies laid the groundwork for environmental awareness in schools, their implementation remained inconsistent, and their impact was limited by broader structural challenges.

A major turning point came in 1986 when severe thermal inversions trapped smog over Mexico City, underscoring the urgent need for environmental education. In response, President Miguel de la Madrid mandated the Secretaría de Educación Pública (SEP) to integrate ecological principles into the national curriculum (De Alba et al., 1988). While this led to the inclusion of environmental topics in natural and social science textbooks, the approach remained largely theoretical rather than experiential.

Mexican EE philosophy, as articulated by Zurita et al. (1990, as cited in Barraza, 2001), aims to enable students to understand the origins and development of environmental issues while fostering both individual and collective responsibility. Yet, the execution of this vision has been constrained by the reliance on standardized textbooks as the primary instructional tool. Although textbooks provide extensive information on topics such as pollution, resource conservation, and biodiversity, they do not sufficiently promote critical thinking or hands-on engagement with environmental problems (De Alba et al., 1993). For example, the natural sciences curriculum emphasizes factual knowledge over investigative learning, limiting students' ability to apply concepts to real-world scenarios.

Barraza's (1993) study of Mexico's national curriculum found that while textbooks were generally informative and intellectually stimulating, they lacked active participation and real-world application. Her research identified eight key aspects of primary-level natural sciences

textbooks, with particular concern over their ability to relate concepts in ways that inspire personal connections to the environment. Additionally, a comparative study (Barraza, 1996) revealed that Mexican children demonstrated lower knowledge of ecological concepts compared to their English counterparts, a gap attributed to the curriculum's overemphasis on rote learning rather than experiential education.

Despite these shortcomings, schools that engaged students in environmental activities, such as recycling programs and community clean-ups, were more effective in fostering environmental awareness (Barraza, 2001). This highlights a crucial gap in Mexico's government-led EE: while policies and curricula acknowledge the importance of environmental stewardship, the dominant pedagogical approach remains passive.

A review of national EE programs reveals significant gaps in adaptability and educator support. Jamaica's programs suffer from a lack of teacher training, leaving educators without the tools to facilitate meaningful, nature-based learning. Hawaii's EE efforts highlight the need for a flexible, place-conscious curriculum that can adapt to different ecological and cultural landscapes rather than following a one-size-fits-all model. And in Mexico, the existing framework raises awareness but remains too passive – without hands-on engagement, students struggle to form lasting personal connections with nature.

D. The Academic Programs: Institutional Scale

Programs like Waldorf and Forest Schools represent structured, philosophy-driven systems of experiential learning. These models emphasize experiential education, using direct engagement to yield outcomes such as creativity, problem-solving, and emotional growth. Unlike government-led initiatives, which focus on large-scale impact, these programs prioritize individual development. However, their association with specific institutions or organizations limits their widespread adoption, restricting underserved populations from access to EE options.

Waldorf education, founded in 1919 by Rudolf Steiner, is built on a holistic and interdisciplinary approach, emphasizing creativity, experiential learning, and student autonomy. With over 1,000 schools worldwide, Waldorf institutions operate under a decentralized governance model where teachers collectively manage curriculum and administration on an individualized scale. While this structure allows for highly tailored education, it has been known to sacrifice structured academic development in some cases (Randoll & Peters, 2015).

Waldorf curricula encourage exploration through storytelling, art, and hands-on activities, but academic material is often loosely connected to these experiences. Research indicates that Waldorf students develop strong creative thinking skills and intrinsic motivation, yet many report gaps in structured learning, particularly in subjects like math and science. For instance, while Waldorf students perform well in physics conceptualization, they often struggle with methodological and analytical skills required in higher education (Wallner-Paschon, 2009, as cited in Randoll & Peters, 2015, p. 38). The lack of systematic knowledge-building means that while students engage deeply with material, they may not develop the structured, transferable skills needed for advanced study or practical use.

Moreover, Waldorf schools emphasize a phenomenological approach, where students observe natural processes before being introduced to formal scientific explanations (Randoll & Peters, 2015). While this does succeed in fostering curiosity, it can also leave gaps in technical understanding. A more direct integration of experiential learning with structured academic content could bridge this divide.

Waldorf's decentralized governance is both an asset and a liability. Unlike traditional schools with administrative hierarchies, Waldorf institutions are teacher-led, fostering autonomy and curriculum flexibility. This highly tailored approach is extremely effective is fostering student engagement and well-being (Randoll & Peters, 2015). Waldorf graduates frequently report high levels of confidence, independent thinking, and a positive relationship with learning (Liebenwein, et al. 2012, as cited in Randoll & Peters, 2015). However, self-governance also leads to inefficiencies, with teachers struggling to balance administrative duties with pedagogy. Decision-making can be slow, communication gaps arise, and the absence of standardized oversight means quality varies widely between schools (Randoll, 2013).

Despite these challenges, Waldorf schools cultivate students who are engaged, confident, and intrinsically motivated. However, setting tangible academic goals as the foundation for student exploration and creativity would ensure that these qualities complement a more structured development of critical skills, better preparing students for future academic and practical challenges.

Forest Schools provide a similar nature-based learning environment that emphasizes student-led exploration and discovery. Their origins are debated, with some tracing the model to Denmark in the 1950s and others pointing to earlier Scandinavian outdoor education practices in

the 1800s. Despite this uncertainty, the concept has evolved into a widely adopted approach to outdoor learning, prioritizing hands-on experiences in natural settings.

Unlike the Waldorf system, which follows a more centralized structure, Forest Schools operate independently, adapting their curricula to local contexts. While the UK's Forest School Association offers voluntary accreditation, there is no formal certification process, allowing for flexibility but also variation in implementation. Core principles emphasize long-term engagement in nature, fostering resilience, problem-solving, and environmental stewardship. This breadth allows Forest Schools to provide a tailored education, but it also raises questions about consistency and the extent to which the model supports academic development – issues that become particularly relevant when evaluating its broader educational impact.

A comprehensive review of two decades of research on Forest Schools (Dabaja, 2022) analyzed 28 studies to assess the long-term impact of this educational model. The findings reveal clear benefits in academic attainment, emotional development, and nature connection, highlighting Forest School's role in fostering both cognitive and social growth. Academically, students showed improved literacy and mathematical reasoning, particularly in problem-solving tasks, with one longitudinal UK study noting higher attainment among Forest School participants compared to their peers (Dabaja, 2022, p. 740). Emotionally, children exhibited greater self-confidence and resilience, with research emphasizing the role of independent decision-making and controlled risk-taking in fostering autonomy and well-being (Murphy, as cited in Dabaja, 2022, p. 741).

Perhaps most notably, Forest School fosters a lasting connection to nature that extends beyond childhood. Many students develop a strong attachment to outdoor learning sites, often naming locations and continuing to visit them years after their participation in the program has

ended (Harris, 2017, as cited in Dabaja, 2022). This deep-rooted sense of belonging not only enhances emotional well-being but also cultivates pro-environmental behaviors, with Forest School participants scoring significantly higher on environmental responsibility measures than their traditionally schooled peers (Dabaja, p. 744). These findings underscore the long-term significance of Forest School education – not only in shaping academic and personal development but in fostering a lifelong relationship with the world around them.

Two studies further investigate these themes. In a 2017 study, Bradley and Male (2017) explore the effects of Forest Schools on young children with Autism Spectrum Disorder (ASD). Through interviews and curriculum reflections, the researchers observe how the program helps children engage with nature and reduce anxieties. As one parent remarked about her son: "Before, he would only go outside for the trampoline... Now, he's more curious about his surroundings, like collecting shells in the garden." This, and many similar parent testimonials, speak to the power of nature-immersion in developing children's awareness of the environment and encouraging them to step beyond their comfort zones to find new interests.

Similarly, a study by Sherwin, Mcree, and Cutting (2018) evaluates the impact of Forest Schools on 11 disadvantaged children, ages 5–7, over three years. Using both quantitative and qualitative methods, the study assessed changes in emotional well-being, self-regulation, and resilience. The Leuven Scale was used to measure engagement and emotional development, while the Connection to Nature Index (Cheng & Monroe, 2012) gauged shifts in students' sense of oneness with nature, empathy for living things, and environmental responsibility. Findings showed a marked increase in nature connection, with 70% of participants scoring well above national averages by the end of the study. As one child put it, "I am a survivor. I never give up." Researchers linked this growth to the program's combination of physical adventure, independent

decision-making, and sustained engagement with nature, which collectively fostered curiosity, confidence, and perseverance. The study also notes that the inherent risks in Forest Schools – such as navigating uneven terrain – help children develop a strong sense of accountability and resilience, teaching them what harms and heals.

Despite the well-documented benefits of Forest School education, its accessibility and authenticity present significant challenges. Dabaja (2022) highlights that most research on Forest Schools focuses on programs in well-resourced areas, raising concerns about scalability and equitable access to outdoor learning. Many schools, particularly in urban environments, struggle to implement true nature immersion due to limited green space, funding, and trained educators. Compounding this issue, the modern popularity of "Forest School" has led to its commercialization, where the label is often applied loosely to programs that lack the depth and long-term engagement central to its philosophy. As a result, some institutions market Forest School as an attractive add-on rather than a structured, pedagogically sound experience, reducing it to a branding tool rather than a meaningful education model. This disparity between genuine, research-backed Forest School programs and their more performative counterparts underscores the need for a framework that ensures both accessibility and fidelity to its core principles.

At the institutional level, many models struggle to balance experiential learning with structured academic outcomes. Waldorf education fosters creativity and exploration but lacks a solid academic framework. Experiential learning is most effective when it's intentional, with clear learning outcomes that engage students' varied interests and promote meaningful knowledge-building. In this context, the Forest School model offers an immersive approach but

faces challenges with accessibility and scalability, often losing its effectiveness when adapted for wider implementation.

E. The Academic Programs: Local Scale

Locally driven programs such as Whole Earth Nature School and Iowa Lakeside Laboratory offer flexible, hands-on environmental learning experiences tailored to specific communities. These initiatives, often privately funded, emphasize immersive engagement with nature and allow for significant innovation in educational methods. However, their reach is constrained by resources and regional focus, preventing large-scale accessibility.

The first program, Whole Earth Nature School, is a 501(c)(3) nonprofit based in Eugene, Oregon. Their educators have engaged with BEETLES resources and professional development to inform and enhance their outdoor, nature-based programming. The FOREST Program – *Friends Outdoors Reviving Earth Skills Together* – is their flagship 9-month experience and the subject of my evaluation. Designed for students in grades 7 through 12, the program emphasizes self-esteem, survival skills, and leadership through student-driven mentorship. Each week, mentors lead full-day excursions in local parks and forests, as well as three overnight trips annually. Curricula are tailored to students' interests, creating a highly personalized experience that fosters individual growth through hands-on, inquiry-based learning.

On March 8, 2025, I had the opportunity to attend a FOREST session – a rare chance to observe the program's unfiltered, experiential approach in action. That day, students participated in an outdoor cooking challenge, collecting ingredients from the forest, building fires, and preparing three-course meals. The activity demanded critical thinking, creativity, and

collaboration. Within moments, students were whittling utensils, crafting platters from found wood, and fully immersed in the moment – faces smudged with ash, knees caked in dirt, and spirits visibly lifted. What stood out was not the novelty of the setting, but the raw engagement: this was resilience, problem-solving, and joy through authentic challenge. It became clear that these outcomes are not bound to the forest – they're driven by meaningful experience.

The cost of $2,740 for the full-year program includes all activities, with payment plans and scholarships available. Despite these efforts, the program remains financially out of reach for many families – a concern noted by parents, even as they overwhelmingly praise its impact. The program's small cohort size, location-specific structure, and reliance on skilled mentors make it difficult to scale or replicate, limiting access for urban and lower-income students who might benefit most from its immersive, mentorship-based approach. The site visit underscored both the program's power and its limitations – and raised a critical question: how can we bring this kind of deep, transformative learning to students in any setting, not just those with access to wild spaces?

Iowa Lakeside Laboratory, founded in 1909 by Thomas Macbride, was established as a field station dedicated to immersive, hands-on scientific study in ecology, botany, and geology. Situated on the shores of Lake Okoboji, the lab was envisioned as a place where students and researchers could engage directly with the natural world, fostering a deep understanding of Iowa's diverse ecosystems (Zieglowsky, 1985). Over the decades, it has evolved into a renowned center for field-based education, maintaining its mission of connecting people with science through direct outdoor experience.

Today, Iowa Lakeside Laboratory extends its educational reach through a variety of youth programs designed to spark curiosity and environmental stewardship in children. Their summer camps, homeschool programs, and school-year camps serve students from preschool through ninth grade, offering hands-on learning in ecology, and field science. Through activities such as wetland exploration, reptile studies, and outdoor survival training, these programs immerse children in nature, cultivating scientific inquiry, confidence, and a lasting connection to the environment.

Executive director, Mary Skopec, speaks to the value of multi-disciplinary learning at the Lakeside Lab:

> When I look at where the interesting things are happening in research, it happens in the seams, where geology and biology intersect. I think that as the disciplines have matured, where those things come together – that interdisciplinary nexus – is where the greatest explosion in knowledge is happening. (Skopec, 2018).

This emphasis extends into the Lakeside Lab youth programs, where children engage in hands-on learning that weaves together ecology, biology, and outdoor skills, fostering a holistic understanding of the natural world.

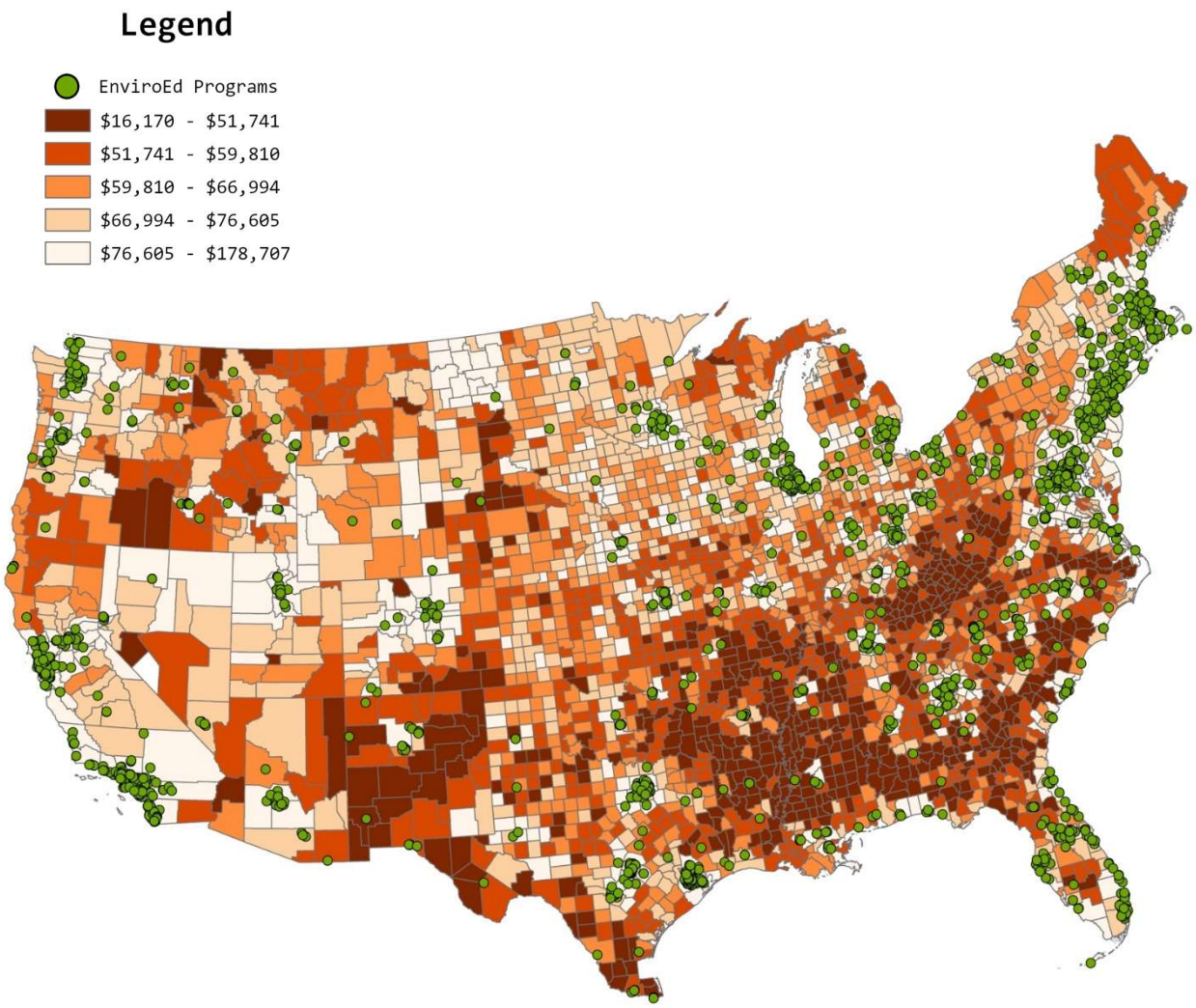
However, accessibility persists as a limiting factor. While the enrollment cost for Lakeside Lab's summer camps ranges from $25 to $125 for one to four day programs – making them relatively affordable compared to many private nature programs – the greater challenge lies in geographic accessibility. The lab's location, nestled among Iowa's pristine lakes and wilderness reserves, provides an unparalleled immersive experience, yet its remoteness can pose logistic hurdles for families without convenient transportation or local accommodations. This raises a critical challenge: how can immersive, nature-rich EE opportunities become accessible

to urban and lower-income communities without compromising the depth of experience these environments offer?

Despite the presence of environmental education in schools and community programs, several persistent barriers limit its broader impact. Many educators lack the training or institutional support to implement interdisciplinary, nature-based learning with confidence – especially within the structure of conventional classrooms. And when experiential approaches are implemented, they are reportedly disconnected from rigorous academic goals, leading EE to be seen as enrichment rather than core curriculum. Compounding these issues, the cost and logistical complexity of many programs make them difficult to implement and sustain – especially in under-resourced schools and regions.

On a local scale, programs like Whole Earth Nature School and Iowa Lakeside Laboratory demonstrate how resource-intensive models can provide rich learning experiences but remain financially and geographically out of reach for many families. While these models offer deep, place-based learning, they tend to emerge in communities with high financial and geographic privilege.

Figure 2. Environmental Education Distribution by Area Median Income



This map was created using ArcGIS shapefiles of public & private schools in the U.S., filtered by environment-related keywords (e.g., “forest,” “nature,” “Montessori,” “Waldorf”) and supplemented with manually identified environmental education (EE) programs. While not exhaustive, the map offers a representative snapshot: EE schools are disproportionately clustered in high-income areas, highlighting a troubling gap in access to nature-based education.

A spatial analysis of environmental education programs across the United States (Figure 2) reveals a clear pattern: these opportunities are disproportionately concentrated in higher-income areas. Large regions of the country – particularly those with lower median household incomes – remain underserved or entirely disconnected from EE access. This imbalance highlights a critical gap in the field: while experiential programs exist, they are not reaching the communities that could benefit from them most. ROOTS is designed to meet this challenge directly, expanding the reach of environmental education while preserving its depth and impact.

IV. Phase Three: A Case Study on Interdisciplinary Collaboration - H.J. Andrews Experimental Forest

A. The Experimental Forest and Birth of the Discovery Trail

Experimental Forests were established in the early 20th century as living laboratories: vast outdoor research sites dedicated to understanding the science of forest ecosystems. The first, Fort Valley Experimental Forest in Arizona, was founded in 1908 to study ponderosa pine ecology and sustainable forest management. Over the following decades, a network of 82 Experimental Forests and Ranges emerged across the U.S., driven by the need for rigorous, long-term research on silviculture, watershed health, and the ecological impacts of land management practices (Knoepp et al., 2019, p. 51). Initially established to improve forestry practices, these sites have since evolved beyond their utilitarian origins, now serving as critical hubs for ecological study, conservation, and climate research.

The H.J. Andrews Experimental Forest (HJA) is one of the most significant of these sites, spanning 16,000 acres in Oregon's western Cascades. Established in 1948 by the U.S. Forest Service, it quickly became a leading center for long-term ecological research (LTER), investigating forest succession, watershed dynamics, and biodiversity (Swanson, 2015, p. 21). In 1980, HJA was designated as one of the first National Science Foundation-sponsored LTER sites, deepening its role in monitoring environmental change over time. For decades, scientists at HJA have worked to unravel the complexities of old-growth ecosystems, but until the early 2000s, much of this research remained siloed within academic and professional communities. Recognizing the need to make ecological science more accessible, HJA has increasingly embraced interdisciplinary collaboration – merging science, art, and the humanities to foster a more holistic and approachable study of nature.

This shift laid the groundwork for initiatives like the Discovery Trail (DT), developed in 2012 as a way to bring ecological learning to a broader audience. Designed as a half-mile interpretive loop, the DT engages K-12 students in place-based, interdisciplinary learning, integrating hands-on science with storytelling, creative reflection, and interactive exploration. By making complex ecological concepts tangible and immersive, the Discovery Trail represents a model for how environmental education can bridge disciplines, spark curiosity, and inspire a lasting connection to the natural world.

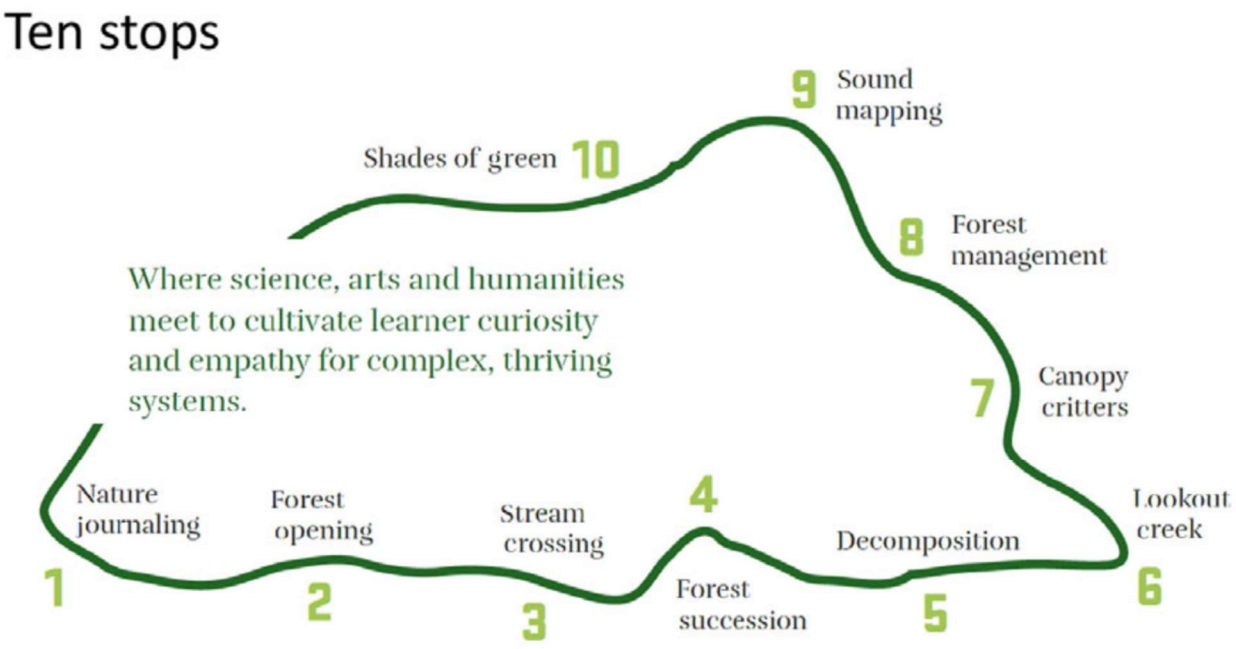
Unlike a traditional nature walk, the DT blends scientific observation with creative engagement, offering students a hands-on, multisensory experience. School groups visiting the forest spend an entire day on-site, typically guided by teachers or outdoor educators trained to facilitate an exploratory, student-driven learning process. Through structured activities – including silent sensory walks, guided tree identification, creative storytelling, and ecological inquiry – the Discovery Trail encourages students to interact directly with the landscape and form their own unique observations and reflections (Goralnik et al., 2021, p. 2).

B. The Interdisciplinary Learning Model

At the heart of the Discovery Trail is an interdisciplinary framework that merges environmental science, humanities, and personal reflection. The trail consists of ten learning stations, each designed to introduce students to a different facet of the ecosystem.

Figure 3: The H.J. Andrews Discovery Trail Map

Source: (Goralnik et al., 2021, p. 3)



As students move through the Discovery Trail, they encounter key ecological themes woven into the forest itself. They explore the concept of forest succession by observing contrasts between old growth stands and younger regenerating areas, gaining insight into how ecosystems evolve over time. Alongside streams, they are introduced to the critical role of water in shaping landscapes, seeing firsthand how flowing currents influence soil, vegetation, and aquatic life. Decomposition is another focal point, where fallen logs serve as living laboratories, demonstrating how decay supports new growth and sustains biodiversity. These experiences provide tangible examples of nature's cycles, reinforcing the interconnectedness of ecological processes.

Beyond ecological science, students engage with literature, storytelling, and art. Digital tablets stationed along the trail provide access to poetry, essays, and scientific interviews from the Ecological Reflections program, featuring works from resident writers and artists who have spent time at the HJA (Goralnik et al., 2021, p. 5). These materials offer different lenses through which students can interpret nature, reinforcing the idea that the environment is not just a biological system, but a source of cultural and philosophical meaning.

The goal is not simply to teach facts, but to help students cultivate a sense of curiosity, awe, and responsibility for the natural world. Research on interdisciplinary EE highlights that fostering responsible environmental behavior (REB) requires more than knowledge – it necessitates an emotional and ethical connection. By integrating creative inquiry with scientific exploration, the Discovery Trail helps students internalize ecological concepts, making them more likely to translate newfound awareness into long-term stewardship.

C. Student Experience and Lasting Impacts

The success of the Discovery Trail is reflected in student feedback and observational research. Studies tracking DT field trips found that 100% of participants self-reported feeling physically or emotionally restored by the experience. Beyond this, 67% of students noted an increased appreciation for forests, with many expressing a newfound curiosity about the complexity of natural systems and their own relationship to the environment (Markiewicz et al., 2023, p. 569). One teacher said that regardless of medium, the students "were engaged with [the experience]. They were curious. They paid attention" (p. 570). Teachers also reflected positively towards the tablets and viewed the multimedia elements as beneficial for student engagement without detracting from the experience.

With that being said, the biggest criticism from students was in regard to the overstimulating and workload-heavy nature of the Discovery Trail experience. 45% of students indicated that "doing the work on the DT" was their least favorite part… it didn't feel fun enough (Markiewicz et al., 2023, p. 571). The *Silent Sensory Walk,* however, ranked the most preferable among students – they valued the time and space to explore what resonated with them on a personal level.

This contrast highlights a key insight: while immersive, place-based learning can be deeply impactful, it must be designed with intention and care. The Discovery Trail's strength lies not just in its content, but in the moments that invite personal interpretation and quiet engagement. Its success serves as both a validation and a reminder – that even powerful lessons must be thoughtfully paced and meaningfully framed in order to resonate, rather than overwhelm.

D. The Discovery Trail, Reimagined

While the Discovery Trail offers a rich model for interdisciplinary, place-based learning, its biggest limitation is access. Its remote location and high implementation costs place it out of reach for many urban and under-resourced schools, where funding and logistical support for field-based learning are often limited. But the core power of the DT doesn't lie in its setting alone – it lies in the design of its experiences.

To extend this impact, its principles can be translated into urban environments: lessons on canopy ecology become explorations of street trees; forest poetry becomes storytelling in city parks. The emotional and cognitive effects of time in nature – wonder, stillness, curiosity – can be intentionally mimicked through sensory-based, inquiry-driven lessons, even without

wilderness. With thoughtful scaffolding and adaptable curriculum tools, the DT's spirit can live on in schoolyards, sidewalks, and classrooms.

E. Conclusion

The Discovery Trail shows that meaningful nature connection doesn't require months in the wild. When learning is immersive, reflective, and well-framed, even short encounters can spark lasting shifts in perception and belonging. By drawing from its model – and adapting its methods to new contexts – environmental education can move beyond geography, offering every student the chance to develop curiosity, connection, and a deeper sense of place, wherever they are.

V. Phase Four: The Restorative Outdoor-Oriented Teaching System (ROOTS)

A. Translating Research into Design

In Phase One of this paper, I lay the foundation for a pedagogy grounded in wilderness philosophy and the evolving relationship between humans and nature. In identifying the key principles of conservation and preservation, it becomes clear that a balance must be struck in order to foster reverence and responsibility towards the world around us. Philosophy sharpens how we think about living and learning with nature – framing environmental education as a practice rooted in values, not just knowledge.

This lens is further enriched by key voices across literature, history, and science. Wendell Berry urges a shift away from exploitation toward a more nurturing relationship with the land, showing that our treatment of nature is deeply tied to the way we live, work, and relate to one another. William Cronon challenges the myth of untouched wilderness, revealing how our perceptions of nature are shaped by cultural values – and how those values shape the systems we build around it.

E.O. Wilson and Robert Hass deepen this conversation by illustrating how scientific understanding and poetic insight together foster curiosity, empathy, and connection. Their dialogue affirms that intellect and emotion are not opposites, but essential partners in meaningful learning. Barbara Mossberg builds on this by emphasizing presence – expressing that literature and nature alike, invite us to slow down, reflect, and locate ourselves more fully within the world.

Collectively, these thinkers articulate the philosophical and practical foundations upon which ROOTS is built: an educational model that prioritizes presence, reflection, and connection – fostering environmental awareness and individual development.

In Phase Two, I examine existing environmental education programs to analyze the limiting factors and shortcomings that prevent them from achieving both broad reach and deep personal impact. While many programs aim to foster environmental awareness, they often fall short in areas such as hands-on engagement, interdisciplinary integration, and cultural or geographic adaptability.

Government-backed initiatives frequently rely on standardized curricula that emphasize information over experience, and theoretical knowledge over personal connection. Meanwhile, independent or place-based programs – though often more immersive – remain geographically isolated or financially inaccessible to the very communities most affected by environmental and mental health disparities.

This analysis reveals a critical gap: the need for a model that retains the depth and personal impact of experiential learning while being adaptable, scalable, and feasible across a wide range of institutional contexts.

In Phase Three, I look to the H.J. Andrews Experimental Forest and its Discovery Trail to understand the impact of brief, place-based experiences on student perception and connection. Even in a single, short walk, the trail demonstrates how an interdisciplinary approach – combining ecology, poetry, philosophy, and digital media – can cultivate lasting introspection and environmental awareness. By embedding sensory engagement, scientific insight, and creative reflection into one cohesive experience, the Discovery Trail serves as a powerful example of how depth and resonance can emerge from even brief encounters with nature.

Together, these three phases reveal a central tension: while the benefits of EE are felt and recognized, its practical implementation often falls short. Many existing models struggle to balance reach and impact. Programs either provide rich, experiential learning but lack rigorous academic integration – or they meet academic standards but fail to create meaningful, hands-on experiences. Institutional challenges persist as well: limited teacher training, rigid curricula, and financial or geographic barriers restrict access, especially in lower-income urban communities.

ROOTS (the Restorative Outdoor-Oriented Teaching System) was developed in response to these gaps – a curriculum built to be both academically robust and experientially rich, while remaining flexible enough to adapt to diverse educational settings and accessible to the students who need it most.

To address these challenges, ROOTS is designed as a complementary curriculum – one that integrates seamlessly alongside existing coursework without requiring schools to overhaul their programs. Its modular structure allows educators to select from detailed, ready-to-implement lessons and activities that align with the core themes of the framework. Each "branch" offers tangible, scalable experiences with clearly defined inputs, outputs, and materials – whether that's a digital story, a cup of soil, or an urban sidewalk to observe. This approach minimizes the need for extensive faculty training while maximizing both accessibility and depth of experience – aiming to bring the transformative power of environmental learning into classrooms of all kinds.

B. The ROOTS Philosophy

ROOTS is built on the idea that true understanding – of both the world and oneself – comes not just from information, but from experience. Knowledge carries weight, but only meaning sets it into motion. A child who memorizes the names of trees but never sits beneath their shade, or learns about ecosystems without feeling the weight of damp soil in their hands, is missing something essential. ROOTS is about creating these moments – where learning becomes tangible, where curiosity is awakened, and where students begin to see themselves as active participants in the living systems around them.

Observation and reflection are central to this process. So much of the world's complexity is hidden in plain sight, waiting to be noticed. The patterns of leaves on the ground, the shifting movement of a river, the way history is embedded in the landscapes we inhabit. ROOTS encourages students to slow down, to ask questions, to recognize relationships between seemingly separate things. This practice is more than just seeing; it is a way of engaging with the world that turns typical surroundings into sources of wonder, insight, and belonging.

Understanding the natural world also means recognizing the ways humans shape it. ROOTS invites students to navigate the balance between preservation and conservation – between holding nature as sacred and recognizing it as a resource that sustains life. These perspectives are often seen as opposing forces, but in reality, they are complementary. ROOTS encourages students to consider this duality, to think critically about how we interact with the environment, and to develop a relationship with the world that is both thoughtful and responsible.

Beyond knowledge, ROOTS emphasizes the practice of presence. In a world teeming with distraction, there is immeasurable value in simply being where you are – fully immersed in

an experience, a challenge, a conversation, or a question. Whether students are exploring an outdoor landscape or engaging in deep creative thought, they are given the space to sit with uncertainty, to embrace discomfort, and to discover resilience in the process. This practice of slowing down and engaging deeply aims to builds confidence, adaptability, and a lasting sense of connection.

A truly meaningful education does not separate disciplines, but instead weaves them together. Science, art, history, and philosophy all offer unique ways of understanding the world, and ROOTS embraces this holism. Through literature, storytelling, creative expression, and ecological study, students will engage with the environment as more than just a biological system – it becomes a source of identity, culture, and thought. This interdisciplinary approach makes environmental education (EE) accessible beyond wilderness settings, ensuring that even students in urban and under-resourced areas can engage with these ideas in meaningful ways.

While many EE models thrive in resource-rich settings, ROOTS is designed to meet students where they are. Its flexible framework makes it possible to implement meaningful, place-based learning in diverse environments – from classrooms and schoolyards to city streets and public parks. By embedding environmental literacy across subjects and adapting to a range of geographic and institutional contexts, ROOTS seeks to expand access of the experiential learning that has long been out of reach for many communities.

ROOTS responds to a critical need in environmental education – one that prioritizes adaptability, accessibility, and depth of experience. By bridging knowledge with personal connection, it seeks to create learning environments where every student, regardless of background, can engage meaningfully with the natural world and learn more about themselves along the way.

C. The ROOTS Pedagogy

ROOTS is structured to guide students on an expansive journey of discovery, helping them uncover their place in the world by exploring both the vastness of the universe and the intricate details of life on Earth. The curriculum offers a broad exploration of humanity's role in the cosmos – questions of astrophysics, the origins of the universe, and how life emerged on our planet. From this sweeping perspective, students will journey inward, from the stars and galaxies above to the delicate webs of life beneath their feet, including the interconnectedness of soil, roots, and microorganisms that sustain our world. Each module builds upon the previous, fostering a deep sense of belonging, purpose, and responsibility as students explore the world from the grandest scales to the most intimate details of the ecosystems around them.

D. Curriculum Overview

Picture a living tree – its roots grounded deep in the soil, its branches reaching outward in all directions. At its base lie four core motifs: *The Cosmic & Earthly Foundations*, *The Elements That Shape Us*, *The Living Web*, and *The Human Connection*. These roots nourish the entire curriculum, anchoring learning in meaningful, interconnected concepts. As students engage with topics and hands-on experiences, their growth mirrors the tree's natural structure – rising through the trunk and extending into branching pathways, each representing a distinct environmental focus.

Through this progression, students gradually explore the full canopy of knowledge, while also embodying traits reflected in the tree itself: groundedness, resilience, authenticity, and a deep connection to the soil that sustains them. The ROOTS framework is both coherent and

flexible – offering a consistent developmental progression while allowing schools and educators to adapt content to their local context and learning goals.

The Cosmic & Earthly Foundations

Branches*:* The Origins of the Universe, Scale and Time, Life on Earth, Birth of the Hominin

Focus: Exploring the vastness of the universe and the origins of life, from the Big Bang to the evolution of human beings.

The Elements That Shape Us

Branches*:* Fire, Water, Stone, Air

Focus: Understanding the physical elements of the Earth and how they influence both natural and human systems. From water cycles to the chemistry of fire, this branch explores the foundational forces of life.

The Living Web

Branches*:* Trees and Forests, Soil & Fungi, Cycles & Symbiosis, Death & Regeneration

Focus: Investigating the interconnectedness of ecosystems, from plant life to soil systems and the cycles that drive regeneration and sustainability.

The Human Connection

Branches*:* The Birth & Life of Forest Management, Commodifying the Wild, Natural Elements in the Built Environment

Focus: Exploring how human perspectives of nature have changed over time. It considers how society organizes, uses, and conceptualizes the natural world and examines the systems that impact our landscapes and lives (forestry, agriculture, recreation).

E. Rings of Growth: Learning Across the Years

The ROOTS curriculum is designed with Growth Phases, each aligned to students' developmental stages across the K–12 spectrum. These phases support an evolving understanding of material while giving educators the flexibility to tailor lessons to the specific needs of their grade level, whether in an elementary, middle, or high school setting.

Seedling (K-3):

In these early years, students begin to form their environmental awareness through tactile experiences and curiosity-driven learning. Activities might include identifying the sun as a source of energy, recognizing basic landforms, exploring local plant and animal life, and observing the weather and seasons. Through storytelling, nature walks, and sensory-based projects, students begin forming foundational concepts about how the natural world works and how they are a part of it.

Sapling (4-6):

As students grow, they engage in more structured inquiry. This phase fosters deeper exploration of specific themes, linking early experiences to more sophisticated ideas through investigation and discovery. Topics might include exploring the water cycle, mapping local ecosystems, studying soil and plant relationships, or identifying the roles of decomposers and pollinators. Students begin to see how natural systems are interconnected, building the observational and analytical skills that prepare them for deeper environmental understanding.

Mature Growth (7-9):

Students revisit key themes with more analytical tools, integrating science, history, and geography to deepen understanding. Example topics include studying fire as a natural and cultural force, analyzing how human land use has shaped ecosystems, or exploring the scientific principles behind renewable resources. This stage promotes critical thinking through real-world connections and interdisciplinary insight.

Full Bloom (10-12):

Students explore how natural forces and environmental systems are embedded in modern infrastructure and daily life. Topics may include how cities source water, how electricity is generated (solar, wind, geothermal, hydro), or how trees influence urban environments. The aim is to develop a grounded understanding of the natural underpinnings of human systems – preparing students to recognize the ecological threads that run through engineering, energy, and the built environment.

The ROOTS curriculum follows a clear, adaptable structure that meets students' developmental needs while allowing flexibility across classrooms and institutions. It fosters both environmental understanding and awareness of humanity's role within it. Most importantly, ROOTS centers the individual – each unit is designed to spark personal insight, inviting students to question, interpret, and connect with the world in their own way. The goal is not just literacy, but a deeper sense of place and a stronger sense of self – because knowing the world begins with knowing your place within it.

F. Lesson & Activity Samples

The following serve as examples of theoretical lessons and activities to be embedded within the ROOTS curriculum. Both examples are designed to reflect one of the four core learning themes, while also fostering one of the guiding outcomes: authentic purpose, sense of place, comfort in discomfort, and creative agency. These examples illustrate how ROOTS translates big ideas into hands-on, age-appropriate learning experiences that are both meaningful and adaptable across educational settings.

TIME TRAVELERS: A JOURNEY THROUH THE UNIVERSE

Root: The Cosmic and Earthly Foundations

Branch: Scale & Time

Growth Phase: *Seedling Years* – Grade 3

Guiding Outcome: Authentic Purpose

Summary

This lesson invites students to step into the story of the universe: from the cosmic beginning to the emergence of humans. Using an interactive timeline stretched across the classroom or schoolyard, students visualize the scale of deep time. Along the way, they collect stamps in their personal "Stardust Passport," a keepsake booklet that helps them track major events and reflect on their own place in the universe's unfolding story.

Objectives

- Understand that the universe is very old (14 billion years).
- Explore key milestones in Earth's natural history through story and movement.
- Learn that everything – including themselves – is made of elements formed in stars.
- Connect personal identity to a shared, ancient cosmic history.

Set-Up

This activity requires a physical timeline, using a long length of rope or string with secured markers at 7 key intervals. Each marker should include a visual or symbol representing a major event, along with a short, age-appropriate description.

Each student will also receive a small "Stardust Passport" booklet to collect stamps corresponding to the timeline events, and jot-down thoughts that come to mind along the way.

Lesson Backstory

A long, long time ago – almost 14 billion years – everything was packed into one tiny point, smaller than anything you can imagine. Then, in an instant, it started to expand, stretching in every direction. It wasn't a loud explosion like fireworks – it was more like the unfolding of space itself. And space is still expanding, even now, like a balloon that never pops.

> As stars formed, they created the ingredients for life: carbon, calcium, oxygen, iron. When those stars died, they released those elements across space – eventually forming new stars, planets, and life. That means everything around us – plants, animals, the ground we stand on, and even our own bodies – are made from the same materials formed in ancient stars. You are made of stardust.

Today, we're going to become time travelers. We'll walk through a timeline of the universe, stopping at important moments in cosmic history. At each point, you'll collect a stamp in your Stardust Passport and learn more about how we got here. Write down anything that sticks with you!

Timeline Events

Each event is marked along the physical timeline, where every foot of rope represents 200 million years. As students walk this visual journey through the universe, they'll begin to grasp just how long our story has been unfolding – and how recently we arrived. The goal is to help them internalize the scale of cosmic time, and reflect on how each step has shaped the world they know today.

1. The Beginning of the Universe - (13.8 billion years ago)

A long time ago, everything in the universe was packed into something super tiny. Then, it started to stretch and grow – this is how space and time began!

2. The First Stars Shine - (13 billion years ago)

The first stars lit up the dark sky. Inside them, tiny bits of matter cooked together to make the stuff that would one day become planets, animals – even us!

3. Our Solar System Forms - (4.6 billion years ago)

The sun was born, and around it, pieces of dust and rock came together to make the planets – like Earth!

4. Life in the Ocean - (3.5 billion years ago)

Tiny living things started to grow in the oceans. They were so small you couldn't see them, but they were the beginning of life on Earth.

5. Plants Grow on Land - (500 million years ago)

Plants began to grow out of the water and onto the land. They helped make Earth a better place to live for animals and people.

6. Dinosaurs Appear - (230 million years ago)

Dinosaurs walked the Earth for a long, long time. They lived in forests, by lakes, and even where we live today.

7. Dinosaurs Disappear - (66 million years ago)

Something big – like an asteroid – hit Earth and changed everything. The dinosaurs couldn't survive, but this made space for new animals, including us, to one day grow and thrive.

8. Humans Arrive - (300,000 years ago)

The first humans showed up – just recently, if you think about the whole timeline. We've only been here for a tiny moment in Earth's big story!

Reflection

Even though we are small and only here for a short time, we are a part of something much, much bigger. That doesn't make us less important – it makes our time, and what we choose to do with it, even more special.

So what will you choose to do with your time?

KNOW THY NEIGHBOR: THE LIVING WORLD OF TREES

Root: The World Around Us

Branch: Trees & Forests

Growth Phase: *Mature Growth* – Grade 8

Guiding Outcome: Sense of Place

Summary

This lesson guides students into the world of trees – not as scenery, but as living, growing beings that shape their environment and reflect it. Through close observation, field identification, and species-specific study, students will explore how trees function, how they differ, and why these differences matter in the local landscape. The goal is to deepen students' sense of place by learning to recognize, name, and understand the trees that surround them – transforming passive background into meaningful presence.

Objectives

- Understand how trees function as living organisms and integral components of ecosystems.
- Learn to identify and describe native and common regional tree species.
- Recognize that many trees in urban and forested areas are intentionally planted and managed.
- Cultivate a deeper familiarity with one local tree species through focused research and observation.

Mini-Lessons

To prepare for meaningful observation, students engage with a series of short, focused mini-lessons that introduce essential concepts about tree life and form. These provide just enough background, so students know what to look for as they begin identifying and connecting with species in the field.

1. Where Did Trees Come From

Explore the evolutionary origin of trees – how early plants developed vascular systems, lignin, and structural adaptations to reach sunlight, eventually giving rise to the towering organisms we know today.

2. How and Why do Trees Grow So Tall: What's Happening Beneath the Bark?

Unpack how trees transport water, store energy, and grow – looking at xylem, phloem, and the marvel of vertical living.

3. How do Trees Change over Time?

Examine the life cycle of a tree – from seed to sapling to maturity to decay – and how trees respond to seasons, stress, and time.

4. Who Else Lives Here?

Introduce the idea of a tree as an ecosystem – hosting mosses, fungi, birds, insects, and more – and the reciprocal relationships that sustain forest biodiversity.

5. Who Put These Trees Here?

Many trees we see were planted by people. This lesson introduces students to the idea that trees often reflect human decisions, histories, and values, helping them understand how natural and built environments intertwine.

Species Overview

Students are introduced to several tree species native to their region (in this case, Oregon's Willamette Valley). Each species is presented alongside tangible reference materials – such as leaves, bark, or cones – to help students recognize and distinguish them in the field.

Douglas Fir – Evergreen conifer; tall and straight with thick, furrowed bark; fire-adapted and dominant in many Pacific Northwest forests.

Incense Cedar – Evergreen conifer; scale-like leaves and fibrous, fragrant bark; produces distinct duckbill-shaped cones and thrives in dry, mountainous forests.

Western Hemlock – Evergreen conifer; soft, drooping needles with a narrow crown; thrives in cool, moist conditions and often grows beneath Douglas fir in layered forest canopies.

Oregon White Oak – Deciduous broadleaf; thick, spreading limbs and rounded leaves; an acorn-bearing species that supports oak savannas and critical wildlife habitat.

Bigleaf Maple – Deciduous broadleaf; massive leaves and moss-covered branches; a keystone tree for forest floor nutrient cycling and canopy biodiversity.
Red Alder – Deciduous broadleaf; smooth gray bark and serrated leaves; a fast-growing pioneer species that enriches soil by fixing nitrogen after disturbances.

Adopt-a-Tree Project

Each student selects a new regional species to focus on, engaging with it through observation and reflection – whether it's near their school, home, or a local park. The goal is to build a relationship with and understanding of the tree through the unique 'tree profile they create,' including:

- Observations of the tree's physical attributes
- Personal reflections on what they notice, feel, and experience while engaging with the tree
- Any interesting or unusual characteristics they discover
- Leaf samples, sketches, or photographs that represent their connection with the tree

Once each student has completed their summary, all the trees selected will be shared and *planted* as part of a classroom grove. This could be done by affixing tree profiles to a large bulletin board or creating a collage. The grove will visually represent the diversity of regional species and the relationships each student has formed with their chosen tree.

Reflection

As you begin to understand the trees around you, you also begin to understand more about where you are – the place that holds you and connects you to something larger than yourself. The trees, the earth, and the landscape are all part of the story that has been unfolding long before we arrived.

What role do you play in that story, and how does the place you live shape who you are?

G. ROOTS Curriculum Handout

The following handout offers a visual summary of the ROOTS curriculum, designed to communicate both its structural framework and practical application. The front side outlines the curriculum's telescopic design and guiding phases, while the reverse provides a selection of sample lessons and activities that illustrate how the framework translates into adaptable, real-world experiences. Together, these elements serve as a snapshot of the curriculum's scope, sequencing, and interdisciplinary intent.

Figure 4: ROOTS Curriculum Handout

ROOTS Curriculum Preview

The Restorative Outdoor-Oriented Teaching System

Like a living tree, ROOTS is anchored by core environmental themes – the "roots" that stabilize and nourish each branch of study. From this foundation, learning extends upward through developmentally aligned phases, guiding students as they develop a greater understanding of the world around them and the person within.

The Four Roots

Root	Branches	Focus
The Cosmic & Earthly Foundations	Origins of the Universe · Scale & Time · Life on Earth · Birth of the Hominin	Tracing the origins of existence and humanity's emergence
The Elements That Shape Us	Fire · Water · Minerals · Air	Understanding Earth's elemental forces and their impact
The Living Web	Trees & Forests · Soil & Fungi · Cycles & Symbiosis · Death & Regeneration	Exploring ecosystems and the interconnected cycles of life
The Human Connection	Commodifying the Wild · Natural Elements in the Built Environment	Examining how human systems interact with and alter nature

The Growth Rings

Phase	Core Question	Focus
Seedling (K–3)	What is this place, and how do I fit within it?	Sense of place & self
Sapling (4–6)	How do living systems connect, and what is my role?	Relationships & systems
Mature Growth (7–9)	How do people shape environments – and how do environments shape people?	Time, impact & identity
Full Bloom (10–12)	How can I contribute meaningfully to the future of my community and planet?	Responsibility & legacy

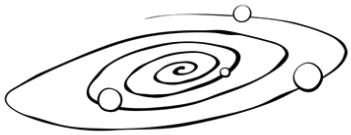
ROOTS…

Cultivates grit and resilience through experiential learning

Promotes deep, personal connections to the natural world

Encourages interdisciplinary exploration and real-world application

Complements the subjects students are already learning



TIME TRAVELERS: ***A Journey through the Universe***
Root – Cosmic and Earthly Foundations
Growth Phase – Seedling Years

Students step into a life-size timeline of the universe, collecting stamps in their "Stardust Passport" as they trace the story from the Big Bang to the emergence of life on Earth. Through immersive storytelling and scaled experience, they begin to grasp the depth of time and their place within it.

Key Concepts
· I exist in a universe that has been unfolding for nearly 14 billion years
· The atoms in my body were forged in ancient stars
· My story is part of a much older, shared cosmic journey

I carry the story of the universe · My time matters · What will I do with it?

KNOW THY NEIGHBOR: ***The Living World of Trees***
Root – The Living Web
Growth Phase – Mature Growth

Students step into the world of trees – not as background objects, but as living, growing neighbors. Through hands-on study and close observation, they learn what makes a tree a tree: how it functions, how it grows, and how it came to be. They explore the unique roles different species play in the landscape, and begin to see trees as individuals shaped by both nature and human history. As they get to know the trees around them, their neighborhood becomes not just a place they live, but a living system they're part of.

Key Concepts
· Trees are living beings shaped by time, place, and adaptation
· Each species plays a distinct role in its environment
· Our landscapes tell stories of both nature and human influence

I am a part of a living web · What role do I play?

H. Business Model

For ROOTS to stand apart from existing nature schools and outdoor programs, it must be designed not as a standalone alternative, but as a flexible supplement – easily integrated into K–12 schools without requiring major curricular overhauls or faculty training. For this reason, it is structured as a curriculum package that teachers can implement with minimal training and adaptable materials suited to their local environment.

To make this vision actionable, ROOTS would pursue a multi-pronged funding strategy that includes applying for grants from organizations that already support environmental education and equitable learning. Promising sources include the National Environmental Education Foundation (NEEF), the North American Association for Environmental Education (NAAEE), and the Captain Planet Foundation, all of which provide funding for K–12 environmental programming, teacher development, and curriculum integration. On the public side, ROOTS could also align with Title IV-A funding under the Every Student Succeeds Act (ESSA), which supports well-rounded educational opportunities including environmental and outdoor learning.

The initial launch could begin with grant-funded pilot programs in select public schools – particularly those serving low-income or urban communities. These pilot sites would provide data, feedback, and case studies to refine the curriculum and prove its effectiveness. From there, ROOTS could expand through a regional model, where districts apply directly for funding or collaborate with nonprofits to bring the program into more classrooms. Over time, the goal would be to offer a digital learning platform, along with optional training pathways and field-based partnerships that schools can opt into based on their unique needs and capacity.

By emphasizing adaptability, local relevance, and affordability, ROOTS positions itself not as a luxury program, but as a scalable tool for student-centric growth in American education – grounding students in observation, reflection, and a sense of belonging.

I. Digital ROOTS Integration

In addition to serving as a flexible curriculum framework, ROOTS has the potential to evolve into an interactive, digital learning platform - accessible through a dedicated portal. This proprietary interface would reflect the ROOTS philosophy through a dynamic tree model, where users navigate the curriculum by following branches and tracing ideas back to their roots. Embedded within the platform would be a rich library of lesson content, activity guides, and implementation tips, along with curated videos from leading voices across disciplines - such as environmentalists, scientists, artists, and philosophers. Imagine learning about ecosystems with guidance from figures like David Attenborough or exploring climate science alongside Bill Nye. Schools could implement the platform as a comprehensive tool for integrating ROOTS into their curricula, with funding for its expansion and accessibility potentially supported by environmental organizations, government grants, or other initiatives. At the same time, families and individuals could access ROOTS independently as an enriching resource for environmental learning outside of formal school settings - extending its reach, accessibility, and impact across diverse communities.

VI. The Next Steps

A. Missing Research in Industry Landscape

While ROOTS fills a clear gap in environmental education, it's important to note that the landscape of adaptable, scalable EE curricula is still underexplored. More research is needed to understand what exists, what's working, and where the greatest opportunities for impact remain. As I continue developing ROOTS, part of that work will be mapping the field it hopes to grow within.

B. Grit and Growth Mindset

At the same time, growing research on grit is reshaping our understanding of what education must prepare students for – not just academic achievement, but long-term success and fulfillment. Angela Duckworth's research on grit reframes how we understand success. It's not talent, IQ, or income that drives long-term achievement – it is the ability to stay focused and persistent through challenge. Students with grit don't just perform better academically; they are more likely to lead successful, fulfilling lives (Duckworth et al., 2007).

But grit doesn't appear on its own. Carol Dweck's work on the growth mindset shows us how it's built – through the belief that ability can grow through effort, struggle, and meaningful experience. Students who hold this belief are more likely to embrace difficulty, recover from failure, and stay motivated over time (Dweck, n.d.). Together, Duckworth and Dweck's work forms a blueprint for what education must prioritize: not just what students know, but how they develop the inner strength to keep going.

ROOTS must evolve with this in mind. Its core outcomes – purpose, place, resilience, and agency – are not just meaningful in an environmental context. They are the psychological foundations that allow students to build grit and adopt a growth mindset. These traits are critical not only for mental health, but for long-term success and fulfillment in any path.

The next phase of ROOTS must focus on making this connection clear – structuring lessons, activities, and assessments that intentionally support the development of these deeper traits. Because if ROOTS can help students grow strong from the inside out, we're not just teaching them about the natural world – we're preparing them to thrive in it.

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