Connecting Children with the Natural World: Curricula Design for Ontario EcoSchools

By

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FOREWORD

Over the past nine years, my academic studies and professional practice as an educator has informed my understanding of human-induced environmental issues and challenged me to seek healthier human-nature relationships for the children I teach. My experience began at a local conservation authority where I delivered nature-based programming to young children, than shifted to the realm of academia where I examined the extent of environmental education (EE) offered in Ontario elementary schools. As an inspired young mind, I felt sure that my work was unraveling the 'ecological crisis' but failed to explore my own connection with nature or critically assess what I – and by extension Environmental Education (EE) – was offering my students. Was I merely indoctrinating children to adopt 'pro-environmental' behaviours? Why did I choose to include certain lessons and pedagogy while excluding others? What was the root cause of poor human-nature relationships and was teaching children about the environment truly shifting their existence in the world?

Not until I entered the Master in Environmental Studies (MES) program at York University did these latter questions surface, where self-reflections, readings, and seminars allowed me to recognize how superficial my knowledge was regarding human-nature relationships as well as EE. To address this deficiency, I created a Plan of Study (POS) that necessitated an in depth exploration of these topics under the title "Education for Connecting Children with Nature". The following project is a culmination of practical skills and conceptual understanding received by working through my POS, manifested in the design of curricula for Ontario elementary school educators. This curricula aims to assist educators on their own quest to connect students with the natural world, by engaging EE lessons that nurture positive and respectful child-nature relations. In acknowledging the incredible demands of educators to meet a plethora of teaching and learning objectives, this project will ultimately guide teachers step-

by-step through a series of modules that can be delivered in urban schoolyards throughout the province. With support from Ontario EcoSchools, an organization dedicated to improving environmental responsibility in Ontario schools, the curricula will be made publicly available on the organization's website for educators to draw upon as desired.

While this project is intended to reach beyond the walls of York University and be part of change in the Ontario community, it has also been undertaken as the final requirement to complete my MES degree. Designing curricula for nature connection fulfills this condition, as it brings together all three learning components stated within my POS. The first component – *Philosophies of Human-Nature Relations* – prefaces curricula development by exploring theories of child-nature bonding as well as offers a definition of nature connection to guide the learning modules. The second component titled *Activating Child-Nature Connections through Education* constitutes the main element of this project and is found embedded in each chapter. Emphasis is placed on the links between EE and nature connection, specific pedagogy needed to stimulate such connection, and the design of curricula itself. The final component of *Engaging Ontario Habitats in Nature Connection* is addressed through background research on urban natural history, which is then integrated in each lesson to produce curricula specific to an urban habitat. In sum, this project seamlessly aligns with my POS, complementing and building upon the field experience and course work I have completed over the past two years. Most importantly, it is a demonstration of my passion as well as commitment toward enriching schooling in Ontario and inspiring a future generation to know and feel the natural world around them.

INTRODUCTION

Nature is the beating heart of Earth, found both within and surrounding each extraordinary being on the planet. Linking human and nonhuman life, the natural world exists as an inseparable and vital part of each species survival. Yet, for the mass of humans living in North America, nature is viewed as detached from humanity and merely a backdrop of civilization to be manipulated and exploited at will (Livingston, 1994; Shepard, 1998). A consequence of this perspective is ecological devastation that takes many forms, including polluted air and water, habitat loss, and species extinctions, to name only a few (Fairbanks, 2010). Though many political, economic, and cultural aspects of humanity are at fault for this harmful way of being, education in North America is also highlighted as a major culprit due to human-centered schooling philosophies that teach dominance, objectivity, and abstraction toward the natural world (Orr, 2004; Blenkinsop & Egan, 2009; Affifi, 2011; Evernden, 1999). That said, education can also remedy human-nature tension, by teaching an alternative perspective and way of being that is rooted in wonder, awareness, animism, and love of the natural world (Bai, 2009; Orr, 2004; Affifi, 2011; Sobel, 2008). This project explores the latter form of schooling as it manifests in environmental education (EE), and seeks to encourage healthier human-nature relations through the design of curricula aimed at cultivating child-nature connections. In prefacing this curricula, this introduction examines the contemporary human-nature disconnect along with the role of education in influencing human-nature bonds. It closes with a description of the aims and specific context of this project, the methodology employed to design curricula, and an overview of each proceeding chapter.

Human-Nature Disconnect and the Influence of Education

Human relationships with nature are fractured and strained in North American society, where anthropocentric ideology continues to dominate ways of knowing and being in the world

(Fairbanks, 2010). This longstanding worldview is characterized by a belief that humans are superior to nature, denial that humans are part of the natural world, and an ethical stance that rejects the intrinsic worth of all nonhuman beings (Livingston, 1994; Fairbanks, 2010). Though the origins of anthropocentric views cannot be narrowed to a single historical moment or figure, a prime influence rests with Cartesian philosophies emerging in the 17th century (Bai, 2009; Evernden, 1999). During this time, a mechanistic perception of the world percolated into European (and by extension North American) minds, where nonhumans were – and ultimately remain to be – treated as unconscious instruments for human pursuits (Bai, 2009; Francione, 2004). Connected to this was a view that the natural world as a whole was inanimate, leaving the universe "stripped of sensuous qualities that have the power to profoundly move us emotionally" (Bai, 2009, p. 137). Consequently, humanity's ability to feel and develop affective attachment to the natural world became heavily suppressed. Additional complexities have emerged over time, including consumerism and urbanization, thus reinforcing present day conditions of human-nature tension (Fairbanks, 2010; Livingston, 1994).

In North American or 'Western' culture (i.e., a culture influenced by Euro-American philosophies), this tension is largely expressed as a disconnect between humans and the natural world (Louv, 2005; Weston, 2009). Attributes of disconnect include reduced sensory awareness, no sense of belonging or 'placelessness' in the natural world, and an absence of skills to recognize ecological dialogue in one's surroundings (Livingston, 1994). In other words, though humans walk through the natural world, we are not present and as a consequence, have left a wake of environmental devastation (i.e., toxic waste, destruction of habitats, overpopulation, etc.) with each anthropocentric choice made (Fairbanks, 2010). Yet instead of looking inward to explore and challenge our own relations with the natural world, technical solutions and economic growth remain the primary methods of addressing harm enacted upon the planet's

life systems; an artifact of mechanistic and rationalist philosophies (Orr, 2004; Sauvé, Berryman, & Brunelle, 2007). Accordingly, such actions toward 'protecting' or 'revitalizing' the environment are often motivated by maintaining society's standard of living over ecological health (Evernden, 1999).

These harmful priorities have not gone unnoticed amongst some educators and actions are underway to cultivate a future where humans, and in particular children, understand their role as one species among many in the vastly interconnected global ecosystem. Part of this movement is the systemic adaptation of elementary-level education to address environmental concerns. Presently, North American schooling at all levels of study is criticized for shaping poor human-nature relations, by readying children for participation in a capitalist system over living thoughtfully and responsibly as a whole human being (Orr, 2004; Stevenson, 2007a). Consequently, teachings on the natural world are reduced to theories, answers, abstraction, and memorization, while omitting values, consciousness, curiosity, and wonder (Orr, 2004). Thus, though the world begins as animate for a child, the existing school system will inevitably 'correct' this perception toward detachment from life (Evernden, 1999). At the same time, schooling is largely restricted to indoor settings, maintaining a sense that learning only transpires in a controlled artificial space (Gruenewald, 2002). Absent is the acknowledgement of nature as an invaluable teacher, along with the integration of lived experiences as an authentic learning pathway (Gruenewald, 2002; Orr, 2004). The lack of green space in certain schoolyards (i.e., those in urban settings) adds to these deficiencies, where turf and asphalt is the common backdrop to a child's minimal extent of outdoor learning (Bell & Dyment, 2006). All of this amounts to a "failure in the educational process to join intellect with affection and loyalty to the ecologies of particular places, which is to say a failure to bond minds and nature" (Orr, 2004, p. 95).

Despite these faults in North American schooling, education may also hold the key to a renewed way of existence. The prime caveat is that education to reconcile human-nature tensions cannot be governed by the same philosophies and societal expectations that created the disconnect. One domain of education taking on this challenge is EE; a form of schooling rooted in experience and affective engagement that confronts dominant anthropocentric knowledge and harmful interactions with the natural world (Sauvé, 2005; Russell, Bell, & Fawcett, 2000). In Canada, EE percolated into elementary and secondary institutions roughly four decades ago; however, its teachings remain caught in rationalistic ideology (Russell et al., 2000). This entails a highly anthropocentric focus on resource management, sciences, and sustainability education rather than shifting perceptions and inspiring emotional connections with nature (Russell et al., 2000; Sauvé et al., 2007). In Ontario, the focal province of this project, the trend of what can be defined as a weak approach to EE persists, despite provincial policy that requires integration of EE in all elementary and secondary subject areas (Tan & Pedretti, 2010; Ontario Ministry of Education, 2009). A central factor in this weakness is limited guidance from the province on EE content and pedagogy, leaving each educator to decide the extent of EE in their teachings and seek out external resources to assist them in this endeavor (Tan & Pedretti, 2010). Though plenty of EE resources are available (see World Wildlife Fund, 2015; Evergreen Brick Works, 2014; and Resources for Rethinking, 2015), few meaningfully challenge existing child-nature relations and even fewer have been developed with specific links to Ontario's ecosystems or nonhuman presences, particularly those in urban environments. Without access to such resources, Ontario children will continue to experience low quality EE programming, thereby contributing to further disconnect from the natural world.

One organization seeking to fill this resource gap is *Ontario EcoSchools,* who in 2005 designed a tiered certification program for Ontario's elementary and secondary schools to

encourage ecological literacy as well as ecologically-responsible actions in the school community (Ontario EcoSchools, 2015a; Ontario EcoSchools, 2015b). The certification process requires schools to consider their practices in teamwork and leadership, energy conservation, waste minimization, school ground greening, environmental stewardship, and curriculum content (Ontario EcoSchools, 2015c). EE is the underlying principle in the curriculum component, where educators are urged to regularly integrate environmental themes in lessons and take students outside for deeper learning experiences. According to Ontario EcoSchools, these EE teachings should "develop a sense of place, instruct how nature works, and encourage environmental advocacy" (2015c, p. 1).

To aid educators in teaching EE, Ontario EcoSchools has developed a free, online resource library containing a variety of downloadable lesson plans on topics ranging from environmental art to pioneer life. However, like the resource banks mentioned above, there is a lack of lessons specific to Ontario ecosystems or nonhumans, and few acknowledge outdoor learning in an urban setting. In addition, the majority of resources are rooted in science or action-based pedagogy, with only a sprinkling of sensory-based or affective learning activities that inspire curiosity and thoughtfulness toward nature. In seizing the opportunity to enrich this resource library and challenge child-nature disconnect, Ontario EcoSchools partnered with me in support of curriculum design centered on Ontario wildlife, urban schoolyards, and the cultivation of emotional bonds between children and the natural world. This project is a manifestation of the above partnership, demonstrated through the design of such curricula for the Ontario EcoSchools resource library.

Project Description, Methodology, and Overview

To meet the resource needs of Ontario EcoSchools as well as Ontario educators, the current project presents a mini-unit titled 'Nearby Nature Study', comprised of four lesson plans

or ‘curriculum modules’. Each module has been designed under the framework of EE for grades 1, 2, and 3 (elementary school level), with the intent of being taught in an urban schoolyard or accessible local habitat. In linking with Ontario wildlife, each module focuses on a common species found in an urban setting, including rock doves, broadleaf plantain, pavement ants, and eastern grey squirrels. Each module contains background information on the species, step-by-step activity instructions (including assessment opportunities, differentiated instruction, and extension activities), and any accompanying worksheets required for the lesson, to ensure the greatest amount of accessibility to educators inexperienced in teaching EE. The primary objective of the curricula is to cultivate an emotional bond between children and the natural world, whilst meeting curriculum expectations outlined by the Ontario Ministry of Education.

This qualitative project is undertaken via an examination of literature (secondary research methodology) including hard copy and web-based books, reports, government documents, journal articles, field guides, and curriculum resource documents. Designing such curricula first necessitates a review of literature on child-nature bonding, established in Chapter 1. This information provides the theoretical basis upon which the curriculum modules are developed. Further background transpires in Chapter 2, detailing a brief history of EE in Canada, Ontario’s EE policies and curriculum, and finally, barriers to teaching EE in Ontario. These findings uncover various approaches to teaching EE in Canada as well as how EE is intended to fit within existing curricula, and the needs of educators in integrating EE within their lessons. Chapter 3 then presents the ‘Nearby Nature Study’ mini-unit, comprised of the four curriculum modules on rock doves, broadleaf plantain, pavement ants, and eastern grey squirrels, designed for Ontario EcoSchools’ resource library. Chapter 4 provides a rationale for all pedagogical choices made in the curriculum modules, as they relate to cultivating child-nature bonds. This chapter reveals which instructional methods are most associated with nature connection and

demonstrates how such instruction can be meaningful in an urban setting. The project concludes with a brief discussion on the key aspects and limitations of the study, along with recommendations for further integrating EE in Ontario elementary school curricula.

CHAPTER 1: Child-Nature Bonding

A vast number of children in North America are disconnected from the natural world, as they are consciously and unconsciously taught to stay indoors, to disregard nonhuman life, to have no sense of place, and to fear nature (Livingston, 1994; Orr, 2004; Louv, 2005; Sobel, 2008; Dickenson, 2011; Strife, 2012). In 2005, journalist Richard Louv brought public awareness to child-nature disconnect through his popular book titled 'Last Child in the Woods'. Louv's work details the death of outdoor exploration, loss of natural history knowledge, and the resulting diminishment of relations between children and nature, at the expense of both the child and environment's wellbeing. Louv calls this phenomenon "nature-deficit disorder"; a term that has since been adopted by scholars, parents and environmental educators alike (2005, p. 10). For Louv, elementary schooling is a major factor influencing the extent of child-nature disconnect, going so far as to list environment-based education as an 'antidote' to nature-deficit disorder. This is not the first link made between nature connection and EE, as environmental educators including David Sobel (1996), Joseph Cornell (1998), and David Orr (2004) shed light on the ability of EE to cultivate child-nature bonds in the decade leading up to Louv's work. The inherent relationship between EE and nature connection is thus the focal point of the present project.

Yet, in order to nurture such bonds through EE and resist nature-deficit disorder, a conversation must first transpire on nature connection itself. In addressing this need, the following begins with an exploration of experiences or relationships humans may have with nature, and offers a definition of nature connection to underpin the curricula design (Section 1.1). The chapter then explores theories on when and how nature connection can occur in a child's life, to uncover initial pedagogical strategies needed within the EE curriculum modules (Section 1.2). Chapter 1 concludes with a brief discussion on the physical, cognitive,

developmental, and spiritual benefits of child-nature bonds, as well as barriers to nature connection (Section 1.3). This section provides further justification for integrating nature connection pedagogy in schools and brings awareness to the societal pressures resisting these EE teachings.

1.1 Defining Nature Connection

When speaking of connecting to nature or bonding with the natural world, the notion of *biophilia* is a common reference in literature. For Edward O. Wilson who popularized the term in 1984, biophilia is defined as an inherent affinity or attraction to life and lifelike processes that is linked to humanity's evolutionary history (Kellert, 1993a). With respect to the latter, biophilia may exist due to a competitive advantage it offered early humans (i.e., aided in physical and mental growth), in the context of having fierce dependence on the natural world for survival. This attraction is thought to remain entrenched in the human psyche, since the human brain evolved in a natural setting and is thus embedded with biocentric information, rather than evolving in an artificial or 'machine-regulated world' (Wilson, 1993). That said, in Wilson's version of biophilia, not all attractions to nature translate to a positive response. On the contrary, Wilson (1993) suggests that biophilia encompasses a suite of emotions toward nature that range from awe to indifference to fear. In taking this spectrum further, Kellert (1993b) hypothesizes nine expressions or experiences of biophilia common among humans, along with their functions related to species survival. These expressions are utilitarian, naturalistic, ecologistic-scientific, aesthetic, symbolic, humanistic, moralistic, dominionistic, and negativistic (see **Appendix A** for a summary of each expression). Most pertinent for the present study are the positive experiences in nature associated with naturalistic, ecologistic-scientific, humanistic, and moralistic tendencies.

According to Kellert, the naturalistic tendency "encompasses a sense of fascination, wonder, and awe derived from an intimate experience of nature's diversity and complexity" (1993b, p. 45). Kellert goes on to suggest that, "the mental and physical appreciation associated with this heightened awareness and contact with nature may be among the most ancient motive forces in the human relationship to the natural world…" (1993b, p. 45). With deep roots in human cognition along with an emphasis on a positive emotional response to nature, the naturalistic expression of biophilia offers a strong starting point for what nature connection is thought to be.

Adding to the naturalistic experience is the ecologistic-scientific tendency (with emphasis on the 'ecologistic'), which entails the understanding of interconnections between humans and the natural world, including the recognition of even the smallest of beings as vital contributors to a healthy ecosystem (Kellert, 1993b). The humanistic tendency refers to an emotional attachment (i.e., love) toward the natural world most often given to sentient beings, though Kellert states that, "humanistic feelings can be extended to natural objects lacking the capacity for reciprocity" (1993b, p. 52). Finally, the moralistic experience takes on a more spiritual theme, in that one feels a sense of order, connectedness, meaning in life, and self-identify through their interactions with the natural world.

Though support of the biophilia hypothesis is prominent (see Kellert & Wilson, 1993; Kahn 1997; Pyle, 2003; Orr, 2004; and Bai et al., 2010), there is also significant critique of biophilia as a valid, scientific concept describing human-nature relations. For instance, Kahn (1997) draws attention to the all-encompassing nature of biophilia, which he believes diminishes the concept's ability to explain the human condition. Specifically, since biophilia encompasses positive, negative, *and* neutral reactions to nature (i.e., every possible experience with the natural world), it can only be understood in metaphorical rather than testable terms. On a

similar note, Joye and De Block (2011) critique biophilia for its vague definition of what constitutes 'life and lifelike processes', as the resulting range of interpretations – such as 'lifelike' construed as non-natural – are thought to weaken its scientific merit. A final criticism to highlight is the lack of evidence to support genetics as the sole factor influencing biophilia. Kahn (1997) expands on this by describing the loss of deep human-nature connections by a society (i.e., Aboriginal communities) in only two or three generations. His conclusion, shared by Joye and De Block (2011), is that culture, learning, and experience must also play a vital role in the expression of biophilia.

Despite these shortcomings, environmental educator David Orr (2004) draws upon biophilia in his conception of what EE should teach and readily adopts the suggestion that humans are indeed attracted to the natural world. However, Orr argues that the term must be separated into two distinct entities – biophilia and biophobia – to better define and locate oneself in the domain of nature connection. Thus for Orr, biophilia refers to a solely positive connection with nature, echoing Erich Fromm's description of the term as "the passionate love of life and of all that is alive" (1973, p. 406). A biophilious person is then characterized by having a propensity to wonder, an ability to see the whole instead of smaller parts, leads by reason and example over force, and most importantly, seeks to better oneself rather than succumb to societal pressures of acquiring more 'things' (Fromm, 1973).

On the contrary, biophobia describes a negative connection or disconnection from nature, ranging from a "discomfort in natural places to active scorn for whatever is not manmade, managed, or air-conditioned" (Orr, 2004, p. 131). According to Orr (2004), this detestation is manifested in the manipulation and destruction of nature, including urbanization, ozone depletion, and pollution. Although Orr believes biophobia is culturally acquired as a result of modernization, Roger Ulrich (1993) suggests that the aversion may also be linked to

human evolution or rather adaptive responses of avoiding dangers in the natural world. In particular, though urban environments have reduced widespread fears of spiders, snakes, and heights, Ulrich reveals that these phobias are still present in the population as they are a survival mechanism, fixed in humanity's genetic composition. In other words, these real threats have caused humans to avoid certain aspects of nature as a way of increasing one's chance of survival.

Regardless of the origins, these two ways of being are central to Orr's (2004) EE pedagogy, where he believes the central difference between biophilia and biophobia is love. Specifically, biophilia is a love of nature; a love that is sacrificial and needs no reciprocity. It can be both cultivated and lost, and for children, can be awakened through education delivered by a compassionate adult community. Although love is not without hardship, Orr notes that 'real love' does not carry out irreversible acts of environmental devastation as is seen in biophobia. That said, Orr also asserts that the distinction between biophilia and biophobia is not so rigid. The terms are rather a continuum of nature orientation, each on the opposite end of the spectrum. According to Orr, "one can be both biophobic and a dues-paying member of the Sierra Club" or can "adopt the language and guise of biophilia and do a great deal of harm to the earth, knowingly or unknowingly" (2004, p. 136). The central point Orr makes is that we need to be conscious of where we are at on the spectrum and ultimately choose to become "students of biophilia" (2004, p. 46).

Beyond biophilia (though inherently related), John Livingston (1994) describes a form of nature connection linked to four states of self-consciousness that animals, including humans, may express. The first state is *individual* self-consciousness, where self-interest or self-awareness motivates one's actions. Livingston believes this form of consciousness is the most basic or 'primitive' in animals, and is the building block needed to develop consciousness beyond the self. For many animals, this individual self-consciousness occurs only temporarily

throughout their life, for instance when they are a newborn or experiencing a life-threatening situation. Yet for humans, Livingston suggests that individual self-consciousness is the dominant, rather than fleeting, frame of mind. It is only when humans open themselves to the other three states of consciousness that nature connection can transpire.

The second state of self-consciousness explored by Livingston (1994) is *group* self-consciousness or rather awareness shared among a group of species living together. Livingston exemplifies this consciousness by describing a flock of birds moving in unison, where the 'individual' is set aside and the group becomes one mind. However, animal species do not live in isolation of one another, leading Livingston to suggest a third level of consciousness known as *community* self-consciousness. This explains an awareness of the self as a participant in a multi-species society, rooted in deep feelings of interconnection among fellow species. Livingston explains this further stating:

> If all of the individual beings in a community share that total, great consciousness, then it is not unlikely that they may see individuals of their own and of neighbouring species not as 'others' but as simultaneous co-existences or co-expressions of that place, perhaps as extensions of themselves. (1994, p. 113)

This consciousness can then be taken a step further, toward planetary or biospheric consciousness – Livingston's fourth state of self-consciousness. According to Livingston, species who have not been domesticated (as humans are) have an innate awareness of earth's patterns and cycles, along with a shared consciousness among the community to react to ecological or planetary rhythms. This responsiveness to the language of the natural world is a reflection and acknowledgement of having a biospheric self, or a whole self. Being aware of one's biospheric self is "…emotional, not rational. It is an event, not a construction. It is experienced, not known. It is lived, not abstracted. It is received, not perceived. It is a gift, not an accomplishment"

(Livingston, 1994, p. 117). Connecting with nature is thus contingent upon humans recognizing and drawing upon all four states of consciousness in their lives.

Though humanity is currently obstructed from experiencing all four states of consciousness, Livingston (1994) believes it is well within human capacity to recover lost sensibility toward the natural world. Connecting with nature in this context is then perceived as a process, entailing the "seeking and the realization of a psychological *attachment*" (Livingston, 1994, p. 123). In referencing Paul Shepard's (1998) nature bonding theory (see Section 1.2 for a detailed description of Shepard's theory), Livingston asserts that such attachment must be nurtured in early childhood, once children have established a bond with their mother. At this life stage, conditions are set for expressing self-consciousness beyond the individual, if children are encouraged to wonder about nature and to experience the natural world – a sentiment shared by environmental educators and advocates including Orr (2004) and Louv (2005). For Livingston, the prime outcome of the bonding process is that each human feels part of something grander than himself or herself; that they become a sentient, biospheric participant in an interconnected ecosystem.

More recent discourse on nature connection reveals strikingly similar characteristics to the versions detailed above, with particular emphasis on the importance of childhood and education in nurturing such bonds. For instance, Anthony Weston (2009) affirms the harmful disconnect between children and the natural world and though criticizes EE for perpetuating this phenomenon, also looks to EE, or rather, a specific kind of EE for a solution. Weston argues that in order for EE to challenge child-nature disconnect, schooling must ultimately help children rediscover themselves as animals and inspire feelings of oneness or belongingness in the natural world. Alternatively, environmental educator Heesoon Bai perceives nature connection as "becoming fully present to the sensuous reality before us" and subsequently seeing the world as

"a place that we want to fall in love with, rejoice in, celebrate, adore, hold sacred, and worship" (2009, p. 143). For Bai, nature connection means embracing Orr's rendering of biophilia and acknowledging that humans, especially children, have the ability to be sensate and participatory beings in the natural world. Bai believes EE is a key element needed to expand this innate capacity, which must be guided by experiential teachings and love of nature.

In taking all of these conversations into consideration, a definition of nature connection for the purpose of the current project is as follows: nature connection is an inherent force, rooted in the psyche of each human that describes a psychological attachment to the natural world. Expressed as a form of love, nature connection is not static; rather, it can be cultivated, awakened, rediscovered, and/or lost. Nature connection is manifested in the way we carry ourselves through the world – having heightened sensory awareness, acknowledging ourselves as animals, being conscious of earth's rhythms, and feeling a sense of belonging in the universe. It is a deep bond, a kinship, with the natural world.

This definition of nature connection is the underlying philosophy that will guide the approach to EE within the curricula designed for the Ontario EcoSchools resource library. However, before the design commences, it is also necessary to explore theories of child-nature bonding, as a way of understanding when and how nature connection transpires in childhood. This in turn will inform the grade level, content and pedagogical strategies chosen in each curriculum module.

1.2 Theories of Child-Nature Bonding

To understand theories of child-nature bonding, one must start with the relationships that form at the beginning of a child's life; namely between the child and parents. Child psychologist Donald Winnicott studied this latter phenomenon, demonstrating that children, in their earliest years of life, come to locate themselves in the world through direct experience or

contact with their own body, their 'intimate parent' (i.e., mother or father), and their physical surroundings (Timmerman, 2013). The interactions taking place during this time (generally age five and under) form the basis of all future relationships between humans, nonhumans and the surrounding world (Winnicott, 1964; Timmerman, 2013). If for instance the parent is able to build a sense of trust with the child (i.e., provides appropriate nutrition, is present in the child's life, etc.), that trust will extend to the physical environment (Winnicott, 1957; Timmerman, 2013). If however the parent neglects the child, their relationship with the environment is gravely compromised as the child becomes insecure and frightened of their surroundings (Timmerman, 2013). Essentially, if the child does not bond with a parent in early years of life, bonding with the natural world may not come easily and may take a significantly longer amount of time to cultivate.

The influence of parenting in child-nature bonding is reiterated in Paul Shepard's (1998) theory of nature connection, which details four bonding events or matrices taking place during the juvenile phase (birth to age 20) of a human's life. These innate events are described as a "biological commitment" toward "building identity and meaning in the oscillation between autonomy and unity, separateness and relatedness" (Shepard, 1998, p. 110). In the first bonding matrix, such commitment begins as early as two months old and continues to age three, where the child develops a strong attachment to a mother. Like Winnicott's deductions, Shepard believes this child-mother bond is built upon direct interaction, involving nutrition, relaxation and recreation with the mother, coupled with the experimentation of safe distances from the mother's side. These might be deemed the most critical moments in a child's life, as a "good symbiosis with the mother endows the child with the emotional and intellectual potential for entering a new set of relationships with a wider structure, social and ecological" (Shepard, 1998, p. 101).

Between the ages of three and twelve (matrix II), the child explores the world external from the mother and from oneself; specifically, the natural world (Shepard, 1998). During this time, children's fascination as well as categorization of nonhuman life flourishes, and recognition of earth's rhythms begins to take root. Shepard believes these relationships formed in matrix II constitute a child's bond to the earth. In matrix III, occurring between ages 13 and 19, the conditions for self-transformation arise and further independence is realized through solitary experiences. This marks a period of bonding with the cosmos, where ecological and sociological relationships are established. The final bonding event at matrix IV takes places at age 20, centering on the achievement of self-identify and a complete notion of relatedness in the universe. This event entails taking on a role of leadership and developing kinship with young children and the wider community.

While these matrices depict a seemingly smooth sequence toward nature connection, Shepard (1998) reveals that disruptions at any bonding event will have a ripple effect throughout the child's life. For instance, if they are unable to bond with the earth during matrix II, their ability to bond with the universe in matrix IV is highly diminished. In this case, Shepard believes the universe is "likely to be perceived in some disguised form of infantile symbiosis, imperfectly integrated with the vast middle ground of the earth terrain and its living forms" (1998, p. 113). Thus, from Shepard's perspective, it is imperative that humans in their juvenile phase of life be nurtured to the fullest extent, with opportunities to become independent but participatory beings in the natural world. Only then are optimal conditions created for establishing bonds with nature.

Predating Shepard, Edith Cobb similarly speaks to the development of child-nature relationships, where childhood is described as a "point of intersection between biology and cosmology, where structuring of our worldviews and our philosophies of human purpose takes

place" (1977, p. 23). For Cobb (1977; 1959), the natural world plays a key role in this process, occurring between ages 5 and 12, since a child's perception of the world is constructed wholly by environmental stimuli. This makes childhood experience with nature highly sensory, linking together a child's internal nervous system with external systems of nature. With this in mind, the joy and exhilaration a child feels when engaged with the natural world is thought to be a "passionate response to an awareness of his own psychophysical growth potential as a continuity of nature's behaviour" (Cobb, 1977, p. 33). Cobb attributes this sense of belonging and understanding beyond oneself to the child's plasticity of response to environmental stimuli – a response that becomes less plastic and more rigid as the child moves into adulthood.

Moving forward several decades, this notion of plasticity remains highly influential in explaining the development of children's relationships with the natural world. Tom Puk (2012) explores this connection in the context of neurobiology, where he first reiterates that experiences in one's surroundings affect the development of neural networks (i.e., our perceptions of the world). Like Cobb's deductions, this is deemed most salient in childhood, when the brain is highly plastic or receptive to new information from the external environment. The greater plasticity allows information to become embedded in one's psyche and shape one's way of being; however, this may only transpire if the experiences are continued into adulthood. This is due to the brain becoming more rigid or resistant to accepting information from external stimuli as human's age, leading to the loss of content in neural networks if they are not consistently engaged. Adding to this is the alteration of external stimuli in adulthood toward human-centered constructs (i.e., technology), which ultimately shifts the experience one has in the natural world. To explain this process further, Puk details three life stages and their corresponding changes in neurobiology that may influence child-nature connections.

Stage 1 of Puk's (2012) model encompasses children from birth to grade three (roughly ages 0-8) when neuroplasticity and the influence of external stimuli are at their peaks. During this stage it is imperative that children engage in embodied outdoor experiences, such that ecological content in neural networks forms the basis of perception. Stage 2, occurring between grades 4-9 (roughly ages 9-14), requires a continuation of direct engagement in the natural world to ensure ecological content remains strong in neural networks. Since neuroplasticity is still high, Puk believes this stage should also be spent discovering relationships between humans and the natural world. The lessons learned during this time may then become the overarching framework for human-nature relations as the child moves into adulthood. Finally, in Stage 3 (roughly ages 15 and up), neuroplasticity begins to weaken and the brain both protects content of neural networks as well as uses the content to modify one's surroundings. Thus, if the content is ecological (internalized in Stages 1 and 2), it will be protected in the brain, which in turn reduces the tendency of the mind to change external stimuli to human-made forms. If a child has spent a significant amount of time outdoors and has explored human-nature relations, it is experiences in the natural world rather than human artifacts that will govern one's existence as they move into adulthood.

Though the theories described above differ in scope and sequence of bonding events, there are three common features that provide a picture of when and how child-nature bonds occur. First, it is evident that bonding can occur in early childhood, as cognitive processing and the nervous system are in prime conditions to experience the natural world with wonder and joy. Second, bonding with nature is highly dependent on nurturing, both from a mother and from adult presences (i.e., teachers), in order to guide one's understanding of relationships beyond the self. Lastly, bonding with nature is also dependent on direct experience or

engagement with the natural world, such that the mind and body come to know and feel the earth.

1.3 Benefits of Child-Nature Connection and Barriers to Bonding

As indicated by the scholars above, the benefits of child-nature connection may include self-fulfillment (Kellert, 1993b), awareness beyond the self (Livingston, 1994), increased sensory awareness (Bai, 2009), and a sense of belonging in the universe (Weston, 2009). That said, these outcomes of child-nature connection remain difficult to quantify and are weakly represented in literature. Alternatively, positive effects of direct experience in the natural world are well documented and thus offer insight into further implications of nature connection. To start, Kellert cites a variety of 'adaptational advantages' to spending time outside including:

> …enhanced physical skills and material benefits, greater awareness, increased protection and security, opportunities for emotional gratification, expanded kinship and affiliational ties, improved knowledge and cognitive capacities, [and] greater communication and expressive skills…. (1993b, p. 65)

Furthermore, scholars have correlated experience in the natural world (including interaction with nonhuman animals) with reduced levels of stress (Ulrich, 1993; Bratman, Hamilton, & Daily, 2012), increased – or replenishment of – attention (Kahn, 1999; Bratman et al., 2012), greater recovery from trauma (Ottosson & Grahn, 2008), and enhanced creativity (Ulrich, 1993). While these are by no means exhaustive lists, nor reflects the outcome for every person who spends time outdoors, the possibility of enriching one's life simply by engaging with the natural world is hardly trivial.

Unfortunately, many barriers exist to having meaningful experiences in the natural world and as a result, obstruct the cultivation of nature connection in today's children. One such barrier is urbanization. To start, Paul Shepard asserts that urban living is inherently stressful to

the adult community, causing a range of ailments from physical distress to paranoia to "chaotic child rearing" (1998, p. 95). In speaking to the latter, Shepard states that:

> Given such parents and adult mentors, the child exposed to the city effect is vulnerable to distortions of those episodes of conceptual order making that shape the individual in the first dozen years of life. (1998, p. 95)

Thus, children may internalize the anxieties felt by parents in a city, which can in turn impede children from experiencing bonding events in matrices I (bonding to the mother) and II (bonding to the earth) of Shepard's nature connection theory.

Besides the influence of parents, Shepard (1998) also reveals the effects of a 'stone habitat' – or human-made environment – on nature connection. Shepard suggests that children need interaction with nonhuman life to learn about otherness and to learn about themselves (i.e., how are they different from nonhumans and how are they the same). Since cities often have minimal nonhuman presences and are instead dominated by human forms, children rarely experience this 'otherness' and the consequences are threefold. First, children may come to believe that nonliving environments are the norm, such that "there is no intrinsic unfolding, no unique inner life at all, only substance that, being manipulated, gives the illusion of spontaneity" (Shepard, 1998, p. 102). Second, the child may only associate living entities with humans, which, being reminiscent of Descartes, has several ethical consequences. For Shepard, the primary implication of humanity's exclusive aliveness is that it "opens the door for all the dichotomies that separate the human from the nonhuman on the basis of soul, spirit, mind, history, culture, speech, rights, rights to existence, and so on" (1998, p. 102). Finally, the urban-raised child, under the illusion of isolation from nature, either manipulates the natural world or equally harmful, becomes a bystander rather than an active participant in the universe. For these children, Shepard believes "the world may be interesting and useful or dull and useless, but it is

not one that feels or thinks or communicates, that has special messages for [them], or that has independent purposes of its own" (1998, p. 102).

In exploring barriers to bonding in Shepard's matrix II, John Livingston (1994) similarly references a monotonous environment, like those found in urban spaces, as a primary culprit. These surroundings are deemed unfit for bonding with the earth, first in that they contribute to a child's "experiential undernutrition" (Livingston, 1994, p. 119). This refers to a lack of opportunities to interact with and experience nonhuman life; a natural desire and necessity in childhood. According to Livingston, the result of limited experiences beyond human creations is an inability to identify oneself as part of a biocommunity (i.e., a failure to bond in matrix II and subsequently matrices III and IV). A second related consequence of being raised in simple environments is that they reinforce humanity's already weak sensory system. Without strong capabilities to interact with the world in varying ways (i.e., smell, touch, hearing, etc.), establishing a connection with nature is extremely hindered.

Over the past few decades, further research on child-nature disconnect confirms and expands on what Shepard and Livingston have previously described. For instance, Richard Louv (2005) and Anthony Weston (2009; 2012) similarly fault urbanization for diminishing child-nature bonds. Louv and Weston add that a lack of experience beyond human constructs can instigate a fear of nonhuman animals or lead children to romanticize the unfamiliar such that co-existence with nonhuman beings is largely unnerving. At the same time, urban living can shift perceptions of nature itself, where nature is seen as abstract or a place one can visit outside the city boundaries, rather than a presence within and surrounding humans (Louv, 2005; Weston, 2012). Tom Puk (2012) believes these issues associated with urbanization link back to a child's neurobiology and the influence of external stimuli in shaping one's worldviews. For Puk, the central concern for children in cities is that:

> The developing mind is being stimulated on a daily basis overwhelmingly by technology, by media, by transportation, by books and by words rather than by the wind in the trees, the smell of the earth after a rain, the ever changing movement of water, the sound of silence in quiet meadows and the awe and majesty of ecological systems. (2012, p. 5)

Thus, with human-made artifacts engulfing the psyche each day from birth, connecting with the natural world is an innately challenging process.

A final notable child-nature bonding barrier linked to urbanization is the fear-based parenting trend in industrialized nations that is reducing a child's outdoor autonomy (Malone, 2007). Karen Malone attempts to navigate the causes and consequences of this trend stating:

> The advent of the notion of stranger danger and more recently the globalization of terrorism has added fuel to the Victorian sentimentalization of childhood as a time of innocence. (2007, p. 515)

If children explore urban environments unsupervised, parents are convinced that they will lose this innocence – and even their lives – by coming in contact with drugs, witnessing micro-crime, or being injured by traffic (Malone, 2007; Prezza et al., 2005). As a consequence, parents are working overtime to restrict as well as monitor their child's mobility, leaving few opportunities for children to engage in unstructured time outdoors (Malone, 2007). Children's freedom is in decline, replaced by an attachment to indoor media (i.e., television and computers), along with participation in a slew of after-school activities such as sports or music lessons where risks are perceived as low and supervision is high (Malone, 2007; Louv, 2005). In summarizing the plight of middle-class suburban children, Malone reveals that they "will only interact with their local streets through the windows of their car as they drive backwards and forwards from their daily activities" (2007, p. 524).

Though the benefits of connecting with nature are vast, ranging from spiritual to physical enrichment, the social and environmental barriers linked to urbanization (and more broadly, Cartesian philosophies) restrict opportunities for children to form bonds with the earth. This is especially harmful for children between the ages of three and twelve, when conditions are primed for bonding with nature or rather, forming an emotional attachment to the natural world, manifested in sensory awareness, feelings of belongingness, and love. Thus, it is imperative that we begin rethinking our living and teaching spaces to lesson the dichotomy between humans and nature, and most importantly, rethink the way we nurture our children. EE can play a critical role in this endeavor, if it is approached in a way that aims to mentor children in finding their own connection with nature. However, in the case of Ontario schooling, the approaches to EE stray from this organic philosophy, and instead often maintain dangerous Cartesian values that have influenced child-nature disconnect. The following chapter explores these various forms of EE in Ontario to learn how the province defines EE, how EE is currently integrated in elementary school curricula, and what the needs are of educators seeking to challenge existing pedagogy.

CHAPTER 2: Environmental Education and Ontario Elementary Schooling

Formal elementary schooling in Ontario begins as early as 4 years of age with full-day kindergarten, followed by Grades 1 to 8 (Ontario Ministry of Education, 2010). This amounts to roughly 9 years of a child's life spent inside a classroom, coinciding with the most pertinent ages of cultivating child-nature connection. For the Ontario Ministry of Education, the goal of schooling during these elementary years is to ensure students have strong skills in literacy and numeracy, as these are the "critical foundation for all other academic achievement and for a lifetime of success" (2015, p. 1). Though 'success' in this aim does not include a healthy relationship with the natural world, EE has been acknowledged by the Ministry of Education as an important part of a child's schooling and since 2007, has been integrated in many curriculum documents. However, some argue that in depth understanding and practice of EE in Ontario schools remains marginal and inconsistent (Beckford, 2008; Tan & Pedretti, 2010). Knowing the historic context of this situation and the current climate of EE in Ontario is a necessary step in designing curriculum resources for educators. The following chapter addresses this need, beginning with an overview of EE in Canada, including a definition of EE, past influences of EE and its links to nature connection (Section 3.1). The chapter goes on to discuss Ontario's EE policies and current EE curriculum (Section 3.2), and concludes with an exploration of barriers to teaching EE in Ontario elementary schools (Section 3.3).

2.1 EE in Canada: Past Influences and Links to Nature Connection

Joy Palmer (1998) traces the history of formal EE on a global scale to European 'nature study' courses in the late 1800s, which first took place in an urban setting. By the 20th century, 'nature study' expanded to 'rural study' and 'field study' courses, leading to the broad term 'environmental education' to describe schooling about the environment. The United Nations

and the International Union for Conservation of Nature (IUCN) picked up on this interest in EE and together provided one of the first globally-recognized definitions of EE in 1970 stating:

> Environmental education is the process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelatedness among man, his culture and his biophysical surroundings. Environmental education also entails practice in decision-making and self-formulation of a code of behaviour about issues concerning environmental quality. (Hesselink & Čeřovský, 2008, p. 7)

The definition urged educators to begin teaching students basic knowledge about the environment, with an underlying message of humanity's dependence on the environment for survival and subsequent need to support environmental health. While an important springboard for global recognition of EE, it must be noted that these early descriptions shied away from 'nature connection' discourse, leaving out any mention of cultivating an emotional attachment, sense of belonging, or kinship with nonhuman presences in the natural world.

The influence of this first definition became clear in North America, with the establishment of the North American Association for Environmental Education (NAEE) in 1972 (North American Association for Environmental Education [NAEE], 2015a). This membership organization was designed – and continues – to promote EE in the United States, Mexico, and Canada, via professional development and resource services (NAEE, 2015a). In offering their own definition of EE, the NAEE believes such education "teaches children and adults how to learn about and investigate their environment, and to make intelligent, informed decisions about how they can take care of it" (2015b, p. 1). This definition strongly replicates the international description developed forty years prior, touching on the same themes of gaining environmental knowledge and practicing stewardship.

In the 1990s, similar organizations began appearing in Canada including the Canadian Network for Environmental Education and Communication (EECOM) as well as the Canadian Journal of Environmental Education (Russell et al., 2000). During this time, the focus of EE had already begun a global shift from education *about* the environment (attaining general knowledge) to education *for* the environment (taking action), and then to education for sustainability (linking social, economic and environmental concerns) (Hesselink & Čeřovský, 2008). EECOM's current mandate reflects this changing perspective with a goal of "ensur[ing] Canadians are environmentally literate, engaged in stewardship and contributing to a healthy, sustainable future" (Canadian Network for Environmental Education and Communication [EECOM], 2015, p. 1). Once again, cultivating human-nature connections are omitted from national aims, where the focus instead rests on conservation of resources over transforming the self. That aside, the intent of these organizations was to create nation-wide dialogue on EE, in hopes of reconciling the fragmented and inconsistent teachings of EE across the country (Russell et al., 2000). Yet, with EE under provincial jurisdiction, teachings were – and remain to be – sporadic, as provinces along with individual educators have the authority to choose their own way of defining and facilitating EE (Russell et al., 2000).

As a result of this flexible approach, EE in Canadian schools takes on a variety of forms; though remain rooted in a concern for the environment as well as a belief that education is central to influencing human-nature relations (Russell et al., 2000; Sauvé, 2005). In examining the diverse field of EE, Lucie Sauvé (2005) identifies 15 interrelated approaches or 'currents' of EE, ranging from a traditional naturalist current to a more recent praxis current. For a full list of EE approaches and their respective descriptions, see **Appendix B**. For the majority of Canadian schools however, the influence of international EE guidelines coupled with the recent popularity of sustainability, has led EE teachings to be rooted in anthropocentric philosophies. This is

reflected in the three dominant approaches to EE taught in Canada, which Sauvé refers to as conservationist/resourcist, scientific, and sustainable development currents (Russell et al., 2000; Sauvé, 2005).

The conservationist/resourcist approach dates back to EE's formal appearance in Canadian schools circa 1970s and 1980s, where the environment was perceived solely as a resource for human utility (Sauvé, 2005). Contemporary teachings within the conservationist/resourcist approach remain grounded in this latter sentiment, focusing on management of resources (i.e., water, soil, animals, etc.) as well as encouraging behavioural changes such as reducing, reusing and recycling (Sauvé, 2005). For Russell et al., these teachings are problematic since viewing the environment as a resource "is part of the common heritage of people living in modern, industrialized societies where humanity is generally imagined to be not only different from, but superior to, all other life" (2000, p. 204). In addition, actions such as reducing, reusing and recycling are arguably shallow attempts to change one's way of being and take the focus away from larger-scale social reform (Russell et al., 2000). Thus, the conservationist/resourcist approach to EE is not able to nurture meaningful connections with the natural world, due to the focus on dominance over nature along with the call for superficial, rather than deep transformative changes to the self.

The scientific approach has also been present in EE since its original emergence in Canadian schools, with aims studying various phenomena in nature through observation, hypothesis formulation, and experimentation (Sauvé, 2005). This form of EE emphasizes cognitive learning strategies and views the environment as "an object of knowledge", whereby "that knowledge is necessary for more appropriate decision-making" (Sauvé, 2005, p. 17). The scientific approach is heavily criticized within EE, due to its roots in Cartesian philosophies, which promote instrumental (over intrinsic) value of nature, human separation from nature, and

the scientific method as the only valid mode of knowledge acquisition (Palmer, 1998). Russell et al. add that a solely scientific approach to EE:

> …conceals the values, beliefs and assumptions that underlie information and create an illusion of neutrality and anonymity. An emphasis on objectivity also works against the possibility of understanding plants, animals and other beings as experiencing subjects of a life. (2000, p. 205)

Furthermore, Elizabeth Dickenson (2013) suggests that the cognitive or analytical focus within the scientific approach to EE reduces the environment to a landscape of objectification and consumption. This, along with the previous criticisms, discourages students from becoming a sentient participant in the bio-community and ultimately impedes the cultivation of emotional connections with nature (Dickenson, 2013).

The final dominant approach to EE in Canada surrounds sustainable development, which Sauvé (2005) describes as a more recent trend advocating for economic development that will instigate social equity and ecological sustainability. Like the previous approaches, the environment is viewed as a set of resources for economic development, with an emphasis on rational use of such resources to ensure their availability for future generations. The sustainable development model of EE has been strongly critiqued over the past three decades, largely due to conflicting priorities in teachings that result from sustainable development's wide interpretation. For instance, Russell at el. (2000) detail one understanding of sustainable development in EE, where development is encouraged without restriction (often at the expense of environmental health), and humans are once again taught to be the dominant species. The harmful emphasis on the economy over ecological wellbeing has been acknowledged elsewhere (see Orr, 2004; Sauvé et al., 2007; Winter, 2007), and speaks to humanity's gravitation toward materialistic, consumptive ways of being. As a result, many sustainable development teachings

merely perpetuate anthropocentrism and in particular, exploitation of the natural world, thereby widening disconnect between humans and nature.

Despite the popularity of these three dominant approaches to EE in Canada, educators have the ability to challenge these harmful teachings by drawing upon Sauvé's (2005) naturalist, holistic, ethnographic, eco-education, and humanist/mesological currents. These currents are highlighted for their ability to foster child-nature bonding, as they employ pedagogy that encourage experiences of Kellert's biophilia (i.e., naturalistic, humanistic, ecologistic-scientific, and moralistic experiences), nurtures Livingston's scales of self (i.e., having emotional responses in the natural world and awareness beyond the individual), and provides the conditions to bond with nature in matrix II of Shepard's nature connection theory (i.e., having direct experiences in the natural world and understanding humans as animals in an interconnected ecosystem).

For the naturalist current, this transpires through cognitive, experiential, affective, spiritual, and artistic teachings that specifically aim to help children bond with nature (Sauvé, 2005). Such schooling offers an alternative to solely cognitive teachings about the environment, thereby allowing children to "tap into ways that we come to 'know' our environment through our emotional responses to it, rather than our scientific understanding of how processes and systems in our environment work" (Gurevitz, 2000, p. 255). According to Sauvé (2005), the naturalist current is often found within 'nature education' or 'outdoor education' programs, with an underlying philosophy that promotes nature's intrinsic value.

Sauvé's (2005) holistic form of EE similarly emphasizes human-nature relations, but acknowledges that one's relationship with the environment is grounded in a myriad of social relationships and interconnections from which the student makes meaning. Teachings within this current focus on unguided exploration of the natural world, such that students may develop their own relationships with the environment in a medium that comes naturally (i.e., sensory,

cognitive, affective, creative, and more). The holistic current also calls for physical experiences that encourage 'embodiment' or full presence in the natural world. In referencing Phillip Payne's work, Sauvé provides an example of embodiment as becoming one with a "canoe and tumultuous river that carries it, to better relate with the world and develop new forms of understanding" (2005, p. 21).

Like the holistic current, the ethnographic current pays close attention to the cultural aspects that affect one's relationship with nature and asserts that EE not force students into viewing the world in one way (Sauvé, 2005). Thus, teachings within the ethnographic approach, delivered through spiritual, experiential, and creative pedagogy, should be inspired by various cultural sources including indigenous peoples. The latter speaks to a recent appeal for 'two-eyed seeing' in EE, whereby western and indigenous knowledge are taught side-by-side (McKeon, 2012; Kapyrka & Dockstator, 2012; Bartlett, Marshall & Marshall, 2012). According to McKeon (2012), not only do Indigenous perspectives promote the inseparability of humans and nature, but also offer EE ideas of story, interconnectedness, land experience, community education, care-taking, change-making, and wholeness. The notion of wholeness is also the theme of Sauvé's (2005) eco-education current, which delves into the development of 'whole' human beings over one's lifetime. In this instance, educators facilitate experiences in the environment as a pathway to experiencing oneself. In terms of pedagogy, eco-education transpires through sensorial, affective, symbolic, experiential, intuitive, and creative means. The intention of eco-education is to then help students 'be in the world' and construct relations with non-human presences (Cottereau in Sauvé, 2005).

The humanist/mesological current of EE also emphasizes culture as an inherent element of the natural world, whereby the environment is perceived as a "place of existence, of living – a habitat – with all its historical, cultural, political, economic, emotional, and other

aspects" (Sauvé, 2005, p. 18). Sauvé (2005) reveals that 'place' is central to the humanist current and is thus closely linked to place-based education. This approach to EE encourages students to develop a sense of belonging to a particular environment one lives within – be it in a rural or city space. For Milton McClaren (2009), acknowledging the city as an environment is of critical importance in EE, as environmental educators often ignore urban settings as a site for cultivating nature connection. As a consequence, urban children's sense of place is overlooked and influenced by teachings on negative environmental impacts of cities, ultimately creating a vision of cities as 'anti-ecological' (McClaren, 2009). To avoid this scenario, educators must first respect student's perspectives of place, and then seek to cultivate a sense of place in urban dwellers (McClaren, 2009). Robert Pyle (2008) adds that place-based forms of EE must also engage local natural history as a way to demonstrate the aliveness of urban (and rural) environments to students who may not otherwise notice their nonhuman neighbours. Pedagogy associated with this humanist approach to EE includes cognitive, sensorial, affective, and creative exercises (Sauvé, 2005).

With these various approaches to EE in mind, Canada's provinces have begun to design their own EE policies such that educators have a standardized definition and framework from which to ground their teachings. For Ontario, this process was further developed in 2007 and has since lead to the creation of a policy framework, curriculum standards, and curriculum expectations in EE. These publications now guide the extent and quality of EE – including pedagogy for nature connection – taught in Ontario elementary schools.

2.2 Ontario Ministry of Education EE Policies and Curriculum

In 2007, the Ministry of Education formed a working group spearheaded by Dr. Roberta Bondar to write a report that would become Ontario's foundation for future EE policy and

curriculum (Ontario Ministry of Education, 2007). The report, titled *Shaping Our Schools, Shaping Our Future,* began by outlining Ontario's goals or 'intended outcome' of EE stating:

> Students will acquire the knowledge, skills, perspectives, and practices they need to participate as responsible citizens at the local, national, and global level, caring for each other and all living things. The education system will fulfill its critical role in both delivering effective environmental education, and modeling environmentally sustainable practices. (Ontario Ministry of Education, 2007, p. 4)

Bondar's team then created a list of learning strategies to meet these goals, including inquiry learning, problem solving, critical thinking, cooperative learning, action projects, and experiential learning. Most significantly, the report offered a definition of EE for Ontario schools that remains in place today:

> Environmental Education is education about the environment, for the environment, and in the environment that promotes an understanding of rich and active experience in, and an appreciation for the dynamic interactions of:
>
> • The Earth's physical and biological systems
>
> • The dependency of our social and economic systems on these natural systems
>
> • The scientific and human dimensions of environmental issues
>
> • The positive and negative consequences, both intended and unintended, of the interactions between human-created and natural systems. (Ontario Ministry of Education, 2007, p. 6)

The report concluded with a suite of recommendations, including the need for a formal EE policy framework along with the development of resources for educators such as sample units of study, teaching guides, and e-learning modules. From this first policy document, it is evident that Ontario's interpretation of EE aligns with scientific, resourcist and sustainable development

teachings (using Sauvé's language), rather than teachings that aim to connect children with nature. To echo earlier criticisms, this science-based focus undermines the multi-disciplinary and more holistic approach needed to cultivate child-nature bonds, by limiting children to seeing the world through a single, objective, inanimate lens.

In 2008, the Ministry of Education released a document titled *Standards for Environmental Education in the Curriculum* in response to the Bondar report, detailing thirteen curriculum standards to "prepare students to support environmental sustainability by bridging the gap between their awareness of issues and their ability to take action" (p. 1). These standards were organized into four themes – community, knowledge, perspectives, and action – meant to guide EE in revised curricula (Ontario Ministry of Education, 2008). Though sustainability language dominates the document, many of the standards can be associated with nurturing child-nature connections if interpreted as such. For instance standards of exploring the outdoors, developing a sense of connection with local and global environments, understanding interactions between human and natural systems, and considering perspectives of Aboriginal communities all link to elements of child-nature bonding. A full list and description of EE curriculum standards are available in **Appendix C**.

One year after the release of these curriculum standards, the Ontario Ministry of Education (2009) published their first comprehensive EE policy framework called *Acting Today, Shaping Tomorrow.* In acknowledging the lack of a universal EE model, the document offers three broad goals of EE in Ontario schooling along with actions to reach those goals, and five principles of EE to further inform the design of curricula in the province. The three goals outlined by the Ministry of Education are:

1. By the end of grade 12, students will acquire the knowledge, skills, and perspectives that foster understanding of their fundamental connections to each other, to the world

around them, and to all living things. (2009, p. 11) See **Appendix D** for Ministry examples of the knowledge, skills, and attitudes in EE.

2. Increase student engagement by fostering active participation in environmental projects and building links between schools and communities. (2009, p.14)
3. Increase the capacity of system leaders to implement evidence-based environmental education programming, practices, and operations. (2009, p.18)

The latter goal speaks to the 'whole-system responsibility' of EE, which necessitates the work of leaders in the education community to guide further policy development and environmentally responsible practices (Ontario Ministry of Education, 2009). Actions cited by the Ministry of Education to achieve these goals include offering professional development in EE, providing resources on EE concepts and practices, teaching in the school ground, partnering with community members on EE projects, and developing a school board EE policy.

In taking on these goals and actions, school boards, schools, and educators are then encouraged to keep in mind the following five principles of EE:

1. Environmental Education is not only about visible environmental issues but also about their underlying causes, and so places an emphasis on personal and social values and active stewardship.
2. Student engagement and leadership are central to environmental education.
3. Leadership by example means integrating elements of environmental education and responsible environmental practices into all decisions and actions.
4. Environmental education must be implemented locally so that it is meaningful and relevant to our diverse communities.
5. Realizing environmental education in Ontario schools is a long-term, ongoing process that will evolve over time. (Ontario Ministry of Education, 2009, p. 25)

In sum, Ontario's policy framework allows schools and educators to choose aspects of EE that work best in their specific context, though the emphasis remains on scientific understanding, action or project-based learning, and sustainability. This is demonstrated by the Ministry of Education's repeated aim of cultivating an environmentally responsible citizenry who will contribute to the economic, social, and environmental goals of sustainable development. The flexibility of this framework also allows educators to integrate EE into their teachings at any desired extent. This could range from its inclusion in all subject areas throughout the school year to a single lesson taking place in a single subject area.

To show how the policy framework can fit within existing Ontario curricula, the Ministry of Education released a document called *Environmental Education: Scope and Sequence of Expectations*, most recently updated in 2011. For each grade level (Kindergarten to Grade 8), the document lists a subject area and cites specific expectations or gives general suggestions from current curricula that may provide an opportunity to teach EE (see **Appendix E** for an explanation of 'expectations' in curriculum documents). For example, in the Grade 1 'The Arts' curriculum, the Ontario Ministry of Education quotes specific expectation D1.3 under the Visual Arts strand that states, "use elements of design in art works to communicate ideas, messages and personal understandings (i.e., a pattern of broken, wavy, and zigzag lines to make the bark of a tree look rough in a drawing...)" (2011, p. 16). Likewise, over 35 specific expectations from the *Science and Technology* curriculum are listed between Grades 1 and 3, constituting the most common subject area recommended for teaching EE in these grade levels.

That said, some subject areas have *no* specific expectations listed and instead have broad recommendations for integrating EE in teachings. Take for instance Grade 2 'Mathematics', where the Ontario Ministry of Education suggests that within the Data Management and Probability strand, "students can use a bar graph showing that more people

walk to school than take the bus" and that "the teacher could place such a bar graph in a broader environmental context" (2011, p. 25). Similarly, for Grade 1 'Native Languages', the Ministry states:

> Although no overall or specific expectations explicitly address environmental education, in each of the strands the learning context (e.g., a topic of thematic unit related to the environment) and/or learning materials (e.g., books, websites, media) could be used to foster in students the development of environmental understanding. Learning about aspects of Native culture and communities may provide for students opportunities to make connections with local places. (2011, p. 18)

The primary message delivered from this curriculum document is that EE can and should be taught in *every* subject area, since the environment underlies all human activity. That said, the document also reiterates a belief that EE fits best in the science curriculum, where expectations on acquiring knowledge about the environment already exist.

The document also further demonstrates the flexibility of EE in Ontario curricula, where educators are offered a starting point and must decide for themselves what content to teach and what approach to EE they will take. This can be viewed as positive or negative. For some educators, this provides the freedom to stretch beyond teachings of sustainability and dive into holistic, naturalistic, or even humanist teachings toward nature connection. At the other end of the teaching spectrum, EE can be marginalized or completely absent from student's learning. In these latter cases, cultivating child-nature connections is lost, affecting not only the child's development as a human being but also the health of wider ecological communities. Thus, obstacles to teaching EE must be explored prior to designing curricula, in order to develop the most accessible lessons that nurture child-nature relations for Ontario educators with minimal experience in this pedagogical field.

2.3 Barriers to Teaching EE in Ontario Elementary Schools

The barriers preventing Ontario educators from teaching EE can be organized into three main categories: knowledge-based barriers, perceived barriers, and systemic barriers. Knowledge barriers relate to a teacher's prior knowledge or experience in teaching EE, which for Ontario teachers tends to be limited. According to Beckford (2008), there are few opportunities in Ontario's pre-service training programs for educators to learn about EE and in addition, educators are not required by the province to attend professional development sessions on EE. Beckford goes on to state that, "the dearth of teacher education programs in EE results in a teaching force that lacks the necessary competencies to effectively address the aims and goals of EE" (2008, p. 56). This sentiment is not merely speculation, as Ontario teachers themselves cite a lack of training as a primary reason for omitting EE from their teachings. For instance, a survey of 132 elementary school educators in Ontario reveal that they do not teach ecological literacy because of a "lack of knowledge", "the idea that the environment is only about recycling", and that they "need more information about it" (Puk & Makin, 2006, p. 273). A survey of 377 elementary and secondary school teachers in Ontario also demonstrates a narrow view of EE, where the majority of educators expressed a strong belief that EE should be about socio-political action rather than nature connection (Tan & Pedretti, 2010). Educators in this survey went so far as to use the term 'indoctrination' to describe their method of instruction as an environmental educator (Tan & Pedretti, 2010).

Though these surveys took place nine years ago and five years ago respectively, these troubling responses may still be present among the current population of Ontario educators, as pre-service and in-service training in EE by the Ministry of Education and Ontario College of Teachers (Ontario's teaching license organization, whose membership is required to teach in Ontario's public elementary and secondary schools) remains on the margins. Upon examining

online course calendars of Ontario's 17 universities accredited by the Ontario College of Teachers (OCT), nine universities *do* offer courses related to the environment for Bachelor of Education candidates, who upon graduating can apply for a teaching license from the OCT. However, only seven of these universities have optional courses that explicitly mention EE, and in most cases, the primary focus rests on outdoor/experiential or adventure education. A summary of Bachelor of Education courses in Ontario related to the environment is available in **Appendix F.** In the case of licensed teachers (current members of the OCT), professional development in EE sanctioned by the OCT has yet to be established at the elementary level of schooling. That said, 'additional qualifications' – courses for licensed educators – in EE are currently in the design stages (Ontario College of Teachers, 2015). What this means is educators graduating with a Bachelor of Education in Ontario may not have any training in EE prior to teaching and have little support from the OCT and Ministry of Education to increase their knowledge of EE once working as a licensed educator. Thus, in the context of designing curricula in EE, it is imperative to remember that many educators are inexperienced in the field and will therefore require resources that have appropriate background information and clear, simple lessons as well as instructions, to encourage the integration of EE in their teachings.

In addition to knowledge-based barriers, Ontario educators also cite three central *perceived* barriers to teaching EE, which are obstacles based on misguided or misinformed assumptions. The first of these perceived barriers is an overcrowded curriculum or lack of time to teach EE (Tan & Pedretti, 2010; Puk & Makin, 2006). Puk and Makin's survey of Ontario elementary school educators exemplify this feeling, where educators state, "we don't have time [to teach ecological literacy] unless it is part of the curriculum", or "the curriculum is not set up to allow time for ecological literacy" (2006, p. 273). In Tan and Pedretti's (2010) survey of Ontario educators, this same sentiment was the number one reason cited for excluding EE in

teachings, despite the Ministry of Education's integration of EE in curriculum documents starting in 2008. Thus, there remains a sense that EE is an 'extra' subject that must be added on to existing teachings, rather than incorporated into existing lesson plans for any subject area. Within the curriculum design, it is therefore necessary to have each module *clearly* link with a variety of existing curriculum expectations, such that educators can *replace* their current non-EE lesson (for instance in Language or Science and Technology) with the EE lesson provided.

The second perceived barrier is a lack of resources, which was first identified in Puk and Makin's (2006) survey of Ontario educators, than echoed in *Shaping Our Schools, Shaping Our Future* (2007) as well as in Tan and Pedretti's (2010) survey. In these cases, resources refer to lesson plans, physical materials, a 'naturalized' space for outdoor learning, and funding for field trips. With respect to resources, educators in Puk and Makin's research commented that there were "not enough hands-on resources" for teachers, while the "time it takes to create/locate resources" was too great to include environmental topics in teachings (2006, p. 273). In speaking to limited funding, one Ontario educator from Tan and Pedretti's work states:

> If I do want to go on a geology trip, I have to look at hiring a bus and these days with school budgets being what they are, that is not as financial possible as it might have been in a more financially open time. And then, of course the finances too limit me […] Here I've got 30 kids and we're surrounded by White Pine trees but we only have enough tools to do the measurements of one or two at a time. (2010, p. 74)

Though these highlight only two examples, this lack of resources was the second highest reason for omitting EE in teachings cited by educators in both Puk and Makin's and Tan and Pedretti's surveys.

These findings suggest a number of assumptions made by Ontario educators, which need to be addressed in the design of curricula. First, there is a widespread belief that lesson

plans in EE are non-existent or difficult to access. Because of this, it is imperative that the curriculum modules are available from an established and visible organization like Ontario EcoSchools, can be accessed online at no cost, and includes all worksheets needed to complete the lesson. The second assumption is that expensive materials are needed to facilitate a high quality EE lesson. To address this barrier, the designed curricula must only use low-cost or recycled materials that may already be available from the school, in order to ensure finances do not impede the EE teachings.

The final assumption made within the 'perceived barriers' to EE is that it must take place outside of the schoolyard, in a more 'naturalized' space for the teachings to have merit. This view is not exclusive to Ontario educators, as surveys of teachers in the United States similarly cite a lack of access to natural outdoor settings as an impediment to teaching EE (see Ernst, 2013; Hotchkiss, 2011). In select instances, educators explicitly state that urban spaces were 'inappropriate' for teaching EE (Hotchkiss, 2011). To overcome this latter challenge, the curricula can be designed to take place in an urban schoolyard, where ecological diversity is seemingly low but accessibility is extremely high. In this setting, children will come to know that they are not alone in the schoolyard and on the contrary, have many nonhuman allies sharing their schoolyard habitat. However, in acknowledging that spending time in more naturalized spaces *is* important for a child's development, teaching in the schoolyard is merely a starting point for branching out and facilitating more meaningful experiences in an urban environment. For instance, educators may venture beyond the paved schoolyard and walk students to a local green space, where ecological diversity increases slightly. Here, students may learn which species are interacting with those in their schoolyard as well as practice sensory awareness in a space that offers a greater variety of sights, smells, sounds, and textures. From there, educators may take their students on a field trip to a local conservation area or protected park via public

transit, where ecological diversity – and the potential to enrich a child's life – once again increases. Though these latter options may not be possible for all educators, a schoolyard is one space each urban-based school has in common and can therefore be drawn upon to facilitate EE.

The final barrier to teaching EE is systemic, referring to the underlying structure of North America's education system, which is thought to inherently oppose EE pedagogy (Stevenson, 2007b). For Stevenson (2007b), this is because EE is a holistic and cooperative schooling where students actively think and create knowledge, whilst current schooling focuses on the individual, promotes passive knowledge acquisition, and ultimately seeks to uphold social order and economic growth. Stevenson summarizes this view stating:

> A function of knowledge in environmental education is immediate use for the social value of a sustainable and emancipated quality of life, which conflicts with the major function of school knowledge as storage for future use and the enhancement of individual status and economic well-being. (2007b, p. 147)

This latter statement is highly visible in Ontario curricula, where as mentioned earlier, literacy and numeracy take the priority over all other subject areas. As a result, educators find themselves having to justify teaching EE to administration, by linking EE to 'testable' subject areas. One educator in Tan and Pedretti's study exemplifies this challenge, particularly when teaching outdoors stating:

> …our schools are really concerned about data and reading scores and test scores and things. Any time not spent specifically learning those skills, is very difficult to justify. That's why I work some of my writing program into it so then it's easier to justify going out, and I can say to the Principal, 'we're looking for [materials] for our writing,' or 'this is part of our science curriculum' or 'we're learning to use scientific tools by using our telescopes and magnifying glasses'…. (2010, p. 73)

The link to science is once again notable, since in relation to systemic issues, questions arise about the compatibility of EE in a single subject area (rather than being taught across multiple disciplines), especially when that subject is rooted in a mechanistic worldview (Tan & Pedretti, 2010). While these matters are too vast and complex to reconcile in the design of four curriculum modules, steps can be taken to contest these system-wide norms. For instance, the modules can include as many cooperative-learning opportunities as possible, and have open-ended assessment guidelines for educators to be creative and decide how or if their students will be tested. In addition, though the modules may touch upon topics in the science curriculum, the lessons themselves should be grounded in the intrinsic value of nature and most importantly, seek to cultivate child-nature connection over solely scientific knowledge of the natural world.

To summarize, the learning modules created for Ontario elementary school educators must require little to no experience in teaching EE to facilitate the lessons, be easily accessed by educators seeking an EE resource, and involve only low-cost materials. In addition, the modules must be able to take place in an urban schoolyard (but can be extended to an accessible local habitat), and draw upon pedagogy and topics across multiple disciplines rather than science alone. Lastly, each module should focus on cooperation (over the individual), experience (over assessment), and nature connection (over nature exploitation). With these needs identified, the following Chapter presents four EE curriculum modules designed for Ontario elementary school educators in an urban setting to cultivate child-nature connections.

CHAPTER 3: Curriculum Modules for the Ontario EcoSchools Resource Library

Teaching EE in an urban environment adds an element of difficulty to an already challenging situation, as educators must not only weave nature connection pedagogy with curriculum expectations, but also find lessons that can be facilitated in seemingly barren urban habitats. To address this challenge, the following details four curriculum modules in EE specially designed for educators in southern Ontario cities. The modules cover curriculum expectations in Grades 1, 2 and 3, primarily from language, the arts, and science and technology. These modules are organized as a mini-unit titled 'Nearby Nature Study', prefaced by an introductory page for educators to gain a sense of lesson content (Section 3.1). Each module then focuses on a particular species that is well adapted to urban habitats and may be observed in the schoolyard. These species are rock doves (Section 3.2), common plantain (Section 3.3), pavement ants (Section 3.4), and eastern grey squirrels (Section 3.5).

For increased accessibility to Ontario educators, each module begins with a description of the lesson, connections to Ontario EcoSchools certification portfolio, and links to Ontario elementary curricula. See **Appendix G** for a list of specific expectations covered in the curriculum modules. The modules then include a 'planning notes' section, providing background information on the species, key terms in the module, a list of low-cost materials needed for the lessons, and the learning skills or work habits students will practice during the lessons. The bulk of the module resides in the 'teaching/learning strategies' section, where the lessons are explained in full detail. This section is separated into three components, which include 'indoor introduction' to introduce the topic and stimulate discussion, 'outdoor exploration' where initial learning is extended, and 'consolidation and reflection' to bring new ideas together and reflect on the species. The final portion of the module contains additional notes for educators on differentiated instruction, assessment opportunities, and extension activities.

The activities in each module were designed through a combination of original resource development along with the adaptation of existing EE resources from the Acclimatization Experiences Institute (1980), Cornell (1998), Kilburn (2012), Lingelbach and Purcell (2000), and Rodenburg, (n.d.). All background information on each species was retrieved from field guides and educational websites including antARK (2015), Arizona State University (n.d.), Balick (2014), Bennet and Tiner (2004), Bezener (2000), Eastman (2003), Eder (2002), Feinstein (2011), Hamilton and Smith (1990), Naughton (2012), Pennsylvania State University (2015), Runtz (2012), The Cornell Lab of Ornithology (n.d.), University of Nebraska-Lincoln (2015), Utah State University (n.d.), and Vitone and Lucky (2014). Upon receiving final approval from Ontario EcoSchools, each module will be made available in a free, downloadable document on the Ontario EcoSchools website with all corresponding sources and resources attached.

3.1 Nearby Nature Study Introduction

What is Nearby Nature Study?

Nearby Nature Study is a mini-unit on urban plants and animals, designed to take place in an urban schoolyard or accessible local habitat. Each lesson provides the opportunity for students to increase their nature knowledge, as well as learn how to *be* in the natural world and interact with nonhuman presences. With the aim of connecting children with nature, lessons draw upon experiential, sensorial, artistic, and affective teaching strategies.

Each Lesson Contains

- Suggested grade levels
- Connection to Ontario EcoSchools certification portfolio
- Links to Ontario curriculum expectations
- Background information on each species
- 3-part instruction
    - Indoor Introduction
    - Outdoor Exploration
    - Consolidation and Reflection
- Suggestions for differentiated instruction, assessment opportunities, and lesson extensions
- All worksheets needed for the lesson

Curriculum Covered in Nearby Nature Study

Science and Technology
Language
The Arts

Suggested Grades

1, 2, 3

Tips for Taking Students Outside

- Gain consent from school administration prior to teaching outside.
- Invite parents to donate extra coats (rain and winter), sweaters, hats, mittens, and boots to your class, so each child can be prepared for the weather.
- Consider inviting a peer mentor (Grade 7 or 8 students) to join your outdoor class and provide extra support. This may include supervising assistance and aiding with activity preparation or clean up.
- As a class, set clear expectations before going outside. Examples may include:
    - Be kind to oneself: dress appropriately for the weather, bring a water bottle
    - Be kind to classmates and teachers: listen to instructions and boundaries, use kind words, keep hands/feet to ourselves
    - Be kind to the natural world: do not harm any beings, keep the environment clean
- Always bring a first aid kit and phone outside.
- Leave a note on your classroom door with your location so administration or late students can find you.
- Pack a 'Naturalist Kit'. This may include binoculars, a magnifying glass or loupe, field guides on the day's topic, a compass, a collection jar or baggie, a ruler, gloves (rubber or work), and a whistle.
- Once outside, set clear boundaries, showing students where they can and cannot go.
- Consider using a whistle or make an animal call (i.e., coyote howl) to bring students back to you after an activity or when you need their attention.

How to Make Nature Study Journals

Materials Needed
Good On One Side (GOOS) Paper (i.e., scrap paper, letter size)
Cereal Boxes – ½ class set
Scissors
Stapler and Staples
Crayons and/or Markers

Time
Approximately 30 minutes

Instructions

1. Hand out 15-20 sheets of GOOS paper to each student.

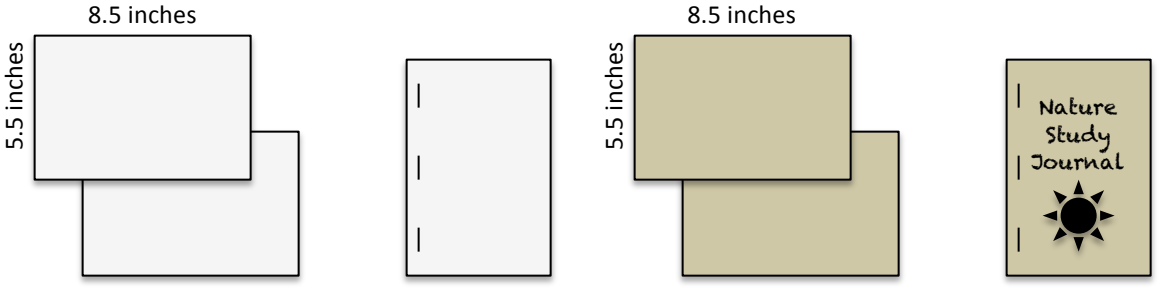
2. Cut GOOS paper in half.

3. Staple GOOS paper together along one side to create a book.

4. Cut the front and back off cereal boxes, then cut in half.

5. Staple one cereal box rectangle to the front of the journal and one cereal box rectangle to the back of the journal.

6. Invite students to decorate their journal cover with markers or crayons.



Step 1 and 2 **Step 3** **Step 4** **Step 5 and 6**

3.2 Rock Dove: Meet the Urban Bird in Your Schoolyard

In this learning module, students will be introduced to the world of birds by exploring physical and behavioural characteristics of Rock Doves, better known as Pigeons. The activities are designed to take place in an urban schoolyard or local habitat during the fall, winter or spring seasons. The module may be taught over the course of a week, or extended for a more in-depth exploration.

CONNECTION TO ONTARIO ECOSCHOOLS
Curriculum: Create lessons that allow students to learn in, about, and for the environment.

CURRICULUM LINKS - SCIENCE AND TECHNOLOGY/LANGUAGE, GRADES 1,2,3
OE = Overall Expectation
GRADE 1
Science and Technology *Understanding Life Systems: Needs and Characteristics of Living Things (2007)*
OE2. Investigate needs and characteristics of plants and animals, including humans
OE3. Demonstrate an understanding of the basic needs and characteristics of plants and animals, including humans
Specific Expectations: 2.3, 2.6, 2.7, 3.2, 3.5, 3.6

Language *Writing (2006)*
OE1. Generate, gather, and organize ideas and information to write for an intended purpose and audience
OE2. Draft and revise their writing, using a variety of informational, literary, and graphic forms and stylistic elements appropriate for the purpose and audience
Specific Expectations: 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 2.3, 2.4

GRADE 2
Science and Technology *Understanding Life Systems: Growth and Changes in Animals (2007)*
OE2. Investigate similarities and differences in the characteristics of various animals
OE3. Demonstrate an understanding that animals grow and change and have distinct characteristics
Specific Expectations: 2.2, 2.5, 2.7, 2.8, 3.1, 3.2, 3.3

Language *Writing (2006)*
OE1. Generate, gather, and organize ideas and information to write for an intended purpose and audience
OE2. Draft and revise their writing, using a variety of informational, literary, and graphic forms and stylistic elements appropriate for the purpose and audience
Specific Expectations: 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 2.3, 2.4

GRADE 3
Language *Writing (2006)*
OE1. Generate, gather, and organize ideas and information to write for an intended purpose and audience

OE2. Draft and revise their writing, using a variety of informational, literary, and graphic forms and stylistic elements appropriate for the purpose and audience
Specific Expectations: 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 2.3, 2.4

PLANNING NOTES
Background Information
The rock dove is a common **bird** well adapted to urban **ecosystems**, where tall buildings, bridges and towers imitate the rocky Mediterranean cliffs where they are from. While their colours are highly variable, they generally have orange eyes, red feet, blue-grey **feathers**, white at the base of a short **bill**, and a shimmering green or purple neck. Rock doves can be found in a city all year round, spending the day flying, **preening** (grooming) feathers, **calling** to one another by 'cooing', fluffing up feathers to stay warm, and **gleaning** (gathering) food from the ground. Their diet mainly consists of seeds, grains and fruit, though insects will also be eaten. At night, the birds will **roost** (rest) with the **flock.** When feeling threatened, rocks doves may puff out neck feathers, bow, and **strut** in a circle. If startled by a **predator** or passerby, the birds are known to 'grunt' and the entire flock may suddenly take flight. Main predators of the rock doves are hawks, falcons, owls, raccoons, and cats.

Key Terms
The following terms can be found in bold in the paragraph above. They include: bird, ecosystem, feathers, bill, preening, calling, gleaning, roost, flock, strut, and predator.

Materials/Resources
- Glue sticks
- Nature study journals - full class set*
- Pencils - full class set
- Bag of bird seed (no tree nuts or peanuts)
- Paper bags or equivalent - full class set
- *Birds with Varied Adaptations* (Resource 1)
- *Rock Dove Inquiry Sheet and Reflection* (Resource 2)
- *Rock Dove Behaviour Cards* (Resource 3)

*See instructions in Nearby Nature Study Introduction

Learning Skills & Work Habits
Independent work, collaboration, observation, critical thinking, creative thinking

TEACHING/LEARNING STRATEGIES
Indoor Introduction
1. Whole Class: Ask students to raise their hand if they have ever noticed birds near the schoolyard or their home. Ask students what they remember about the birds – what did they look like, what did they sound like, and what were they doing. Then, invite students to share a story about an experience they had with a bird.

2. Whole Class: Introduce the term 'ecosystem' and start a class discussion on the role of birds in keeping an ecosystem healthy. *Teacher Prompt: How do you think a bird helps plants grow? (Move seeds and pollen to new spaces). Can a bird be a home for other animals? (Birds are home*

to mites and ticks living in feathers and on skin). How can birds provide food for other animals? (Birds and bird eggs are eaten by other animals). Ask students to consider how birds affect their own life – do they eat eggs or birds, do they enjoy birding, and do they need the plants that birds help grow?

3. Pair Share: Distribute photos of three different birds to students or project an image in the classroom (Resource 1). In pairs, ask students to think about common features of birds (i.e., bill, feathers, feet, tail, wings, eyes, etc.). Compare with humans – which features do humans and birds share, and which features are unique to birds? Invite students to share their findings with the class. Then, ask students if they can identify bird #3 (rock dove) and reveal that they will be getting to know this bird throughout the week.

4. Individual Exploration: Hand out nature study journals along with the rock dove inquiry sheet and reflection sheet (Resource 2). Ask students to fill in the blanks on the inquiry sheet only – what do they already know about rock doves and what would they like to know about rock doves. Invite students to examine the photo and guiding questions to help with their responses. Students will cut out and glue the inquiry sheet as well as reflection sheet in their nature study journal.

Outdoor Exploration

5. Whole Class (PART 1): Take students outside with their nature study journals and a pencil, and review expectations for being outside. Explain to students that rock doves live in a large group called a flock and ask students how they think this behaviour would help rock doves survive. To explore the answer, students will participate in an active simulation. First, ask volunteers to spread birdseed in the play area and hand out a paper bag to each student. Tell students that they are now rock doves and invite them to practice strutting, coo-ing, and flapping their wings. Then, choose one student to be a red-tailed hawk and introduce the term 'predator'. The hawk will stand at the edge of the play area watching the rock doves collect birdseed in their paper bags. When given a signal (i.e., a nod from the instructor), the hawk will run into the flock and try to tag rock doves. When the hawk swoops in, rock doves must run to a designated safe zone before being tagged.

6. Whole Class (PART 2): Once the hawk has tagged as many doves as possible, count how many rock doves made it to safety and how many were caught. Tagged students will then sit at the edge of the play area with the hawk. Repeat the simulation, now with less rock doves. When the round is complete, ask students once again how many rock doves made it to safety and how many were caught. Repeat the simulation once more. When finished, ask students whether having less rock doves in the flock made them more or less in danger of being eaten. Why or why not?* Then, ask students what it was like to gather food but also watch for predators? Were they calm or were they on constant alert? How might a rock dove feel while collecting food? How did students feel when the hawk swooped in? Were they nervous? Excited? Scared? How might a rock dove feel when they spot a predator?

***Note:** Typically, a flock provides greater safety for birds because there are more birds watching out for predators and more birds able to work as a team to distract and confuse predators if one does appear.

7. Group Work: Students will now explore general behaviour of rock doves. Introduce gleaning, preening, roosting, calling, flying, fluffing feathers, puffing out neck feathers, and strutting. Divide the class into groups of 2-5 and hand out one rock dove behaviour card (Resource 3) to each group. Students will make up a short skit, with sounds and actions, demonstrating the behaviour on their card. As each group presents, the remaining students will guess which behaviour they are seeing. After three guesses, the group will reveal their behaviour along with the 'reason' for their behaviour. The group will also state how it compares to human behaviour (i.e., rock doves clean their feathers with their beaks, while humans stay clean by bathing with water and soap).

8. Individual Exploration: Students will then spend time watching rock doves in or near the schoolyard*. Discuss guidelines for observation, such as being still, being silent, and being respectful by giving the birds space. Then discuss guidelines for journaling (i.e., include date, time, and weather in each entry). Students may then record observations of rock doves in their nature study journals using pictures, words or both. Invite students to consider how their own presence affects the rock doves – what might the rock doves think of each student?

***Note:** If rock doves are not present, invite students to observe another bird species in or near the schoolyard. Alternatively, students may guess why there are no rock doves in the schoolyard or local habitat, and write about how the space could change to attract rock doves.

Consolidation and Reflection

9. Individual Exploration: Bring students into the classroom (or stay outside, weather dependent). Explain to students that they must now imagine themselves as a rock dove and create a story on a day in their life. Encourage students to use both words and pictures to tell their story, which can be written in their nature study journals. Invite students to integrate new vocabulary into the story such as predator, bill, gleaning, preening, roosting, or calling. Once stories are complete, gather students in a circle and ask students to share their stories with the group.

Consider providing students with the following questions to help them write:

- If you were a rock dove living near this school, what would you be doing in the morning?
- How does the sidewalk feel on your toes?
- What is it like to fly?
- Who did you meet today near the school?
- How does it feel to fly during strong wind or in the rain?
- How do you stay warm at night?
- Where is your favourite place to roost in this neighbourhood?
- What is it like to eat with a bill?
- What is your favourite food? Why?
- What does birdseed taste like?
- What predators are you watching out for?
- What can humans learn from you?
- What is your home like? What do you see? What does it smell like? What sounds can you hear?

10. Individual Exploration: Bring students into the classroom or stay outside (weather dependent). Students will now complete the reflection on rock doves in their nature study journal (from Resource 2).

DIFFERENTIATED INSTRUCTION

This learning activity can be adapted to meet a variety of learning styles and specific needs. For example, if students cannot run for the dove-hawk game, designate them the 'look-out' rock dove(s) who will warn the flock with a 'grunt' when the predator swoops in. Furthermore, the story assignment may be done in pictures only and explained orally. The story could also be a 'fill-in-the-blanks' assignment, in lieu of writing full sentences.

ASSESSMENT OPPORTUNITIES

Anecdotal evidence can be collected throughout the learning activity to identify gaps in knowledge or misconceptions to ensure they are addressed. Student understanding can also be assessed by examining the content of their observations and/or rock dove stories. They can also create a class/group display on the rock dove to be posted outside the classroom, so the school community can get to know their nonhuman neighbour.

EXTENSION ACTIVITIES

Build Bird Houses: Construct birdhouses from recycled materials to hang in the schoolyard. Use seeds from the dove-hawk game to fill the feeders. Spend time observing birds visiting the feeder, particularly in winter months.

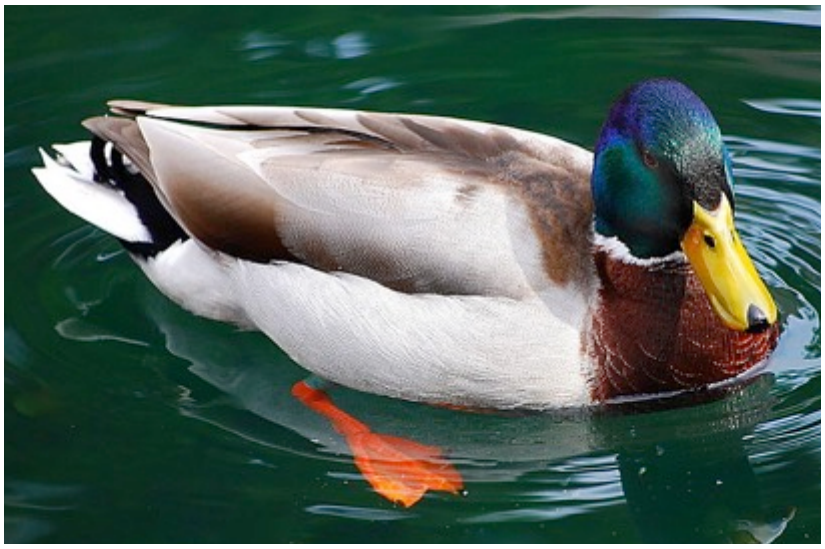
Rock Dove Storybook: Compile 'day-in-the-life of a rock dove' stories from students and create a rock dove storybook. Consider putting the book on display in the school library for students to read.

Birding Field Trip: Walk or take public transit to a local forest or wetland habitat and observe different bird species. Invite students to explore the habitat by listening and looking in trees or on the ground for birds as well as signs of birds (i.e., nests, feathers, eggs, scat, etc.). Students may write observations in their nature study journals.

TEACHING RESOURCES (see below)

RESOURCE 1
BIRDS WITH VARIED ADAPTATIONS
Photo Source: WikiCommons – commons.wikimedia.org

#1



#2

#3

RESOURCE 2
ROCK DOVE INQUIRY SHEET AND REFLECTION
Photo Sources: WikiCommons – commons.wikimedia.org

Rock Dove

What I know about rock doves:

Where do I live?
What sound do I make?
What do I like to eat?
What colour am I?
How do I avoid being eaten?
What do I do during the day?
Where do I go at night?
How do I walk?

What I want to know about rock doves:

Rock Dove Reflection

One thing I learned *about* rock doves:	One thing I learned *from* rock doves:
One thing I still wonder about rock doves:	One reason I am grateful for rock doves:

RESOURCE 3
ROCK DOVE BEHAVIOUR CARDS
Photo Sources: WikiCommons – commons.wikimedia.org

Gleaning

Definition: Getting food from the ground with their bills.

Reason: Like humans, rock doves need food for energy!

Preening

Definition: Taking care of feathers using their bills.

Reason: Helps them fly and keeps them clean.

Roosting

Definition: Resting.

Reason: Gives them energy for activities like flying, eating, and preening.

Fluffing Feathers

Definition: Puffing out their feathers.

Reason: Keeps rock doves warm in winter.

Flying

Definition: Moving in the air.

Reason: Way to move around.

Calling

Definition: Sound a rock dove makes.

Reason: To talk to each other and with other animals.

Strutting

Definition: Walking, moving the head back and forth.

Reason: Helps rock doves see better when moving.

Puffing out Neck Feathers

Definition: Fluffing up neck feathers.

Reason: Can happen when scared to look bigger.

Photo: Mike Pennington

3.3 Broadleaf Plantain: Meet that Pleasant Plant on the Sidewalk

In this learning module, students will learn about plants by examining physical characteristics, healing properties and the life cycle of 'broadleaf plantain'. The activities are designed to take place in an urban schoolyard or local habitat during the fall or spring seasons. The activities can be taught over the course of a week, or extended for a more in-depth exploration.

CONNECTIONS TO ONTARIO ECOSCHOOLS
Curriculum: Create lessons that allow students to learn in, about, and for the environment.

CURRICULUM LINKS - SCIENCE AND TECHNOLOGY/LANGUAGE GRADES 1,2,3
OE = Overall Expectation
GRADE 1
Science and Technology *Understanding Life Systems: Needs and Characteristics of Living Things (2007)*
OE2. Investigate needs and characteristics of plants and animals, including humans
OE3. Demonstrate an understanding of the basic needs and characteristics of plants and animals, including humans
Specific Expectations: 2.2, 2.3, 2.4, 2.6, 2.7, 3.2, 3.5, 3.6

Language *Writing (2006)*
OE2. Draft and revise their writing, using a variety of informational, literary, and graphic forms and stylistic elements appropriate for the purpose and audience
Specific Expectations: 2.1, 2.2, 2.3, 2.4, 2.5

GRADE 2
Language *Writing (2006)*
OE2. Draft and revise their writing, using a variety of informational, literary, and graphic forms and stylistic elements appropriate for the purpose and audience
Specific Expectations: 2.1, 2.2, 2.3, 2.5

GRADE 3
Science and Technology *Understanding Life Systems: Growth and Changes in Plants (2007)*
OE 1. Assess ways in which plants have an impact on society and the environment, and ways in which human activity has an impact on plants and plant habitats
OE 2. Investigate similarities and differences in the characteristics of various plants, and ways in which the characteristics of plants relate to the environment in which they grow
OE 3. Demonstrate an understanding that plants grow and change and have distinct characteristics
Specific Expectations: 1.1, 2.2, 2.6, 2.7, 3.1, 3.2, 3.3, 3.5, 3.6

Language *Writing (2006)*
OE2. Draft and revise their writing, using a variety of informational, literary, and graphic forms and stylistic elements appropriate for the purpose and audience
Specific Expectations: 2.1, 2.2, 2.3

PLANNING NOTES

Background Information

Broadleaf or common plantain is a sun-loving **perennial** plant from Europe that thrives in urban environments. Plantain is most often identified by its **leaves**, which are smooth, green, and oval shaped with large parallel veins. Each spring, these leaves grow from deep **roots** that survive all year-round in firm, trampled **soil**. In the fall, leaves will die back with the first frost. Plantain produces a **stem** with greenish-white **flowers** and brown **seeds** that are present from late spring to autumn. These seeds are **dispersed** by wind when it is dry outside, and stick to animals passing by when seeds are wet. While this plant is generally considered a **weed**, humans have traditionally used the leaves, roots, and seeds to treat fevers, wounds, stings, poison ivy, and coughs. Additionally, the young leaves can be harvested and eaten in salads! Leaves are also consumed by insects and grazing mammals (i.e., rabbits), while the seeds are eaten by birds such as rock doves.

Key Terms

The following terms can be found in bold in the paragraph above. They include: perennial, leaves, roots, soil, stem, flowers, seeds, dispersed, and weed.

Materials/Resources

- Tape
- Glue sticks
- Pencils - full class set
- Nature study journals - full class set*
- Construction paper - ten sheets of different colours (red, green, blue, purple, yellow, black, white, pink, orange, brown)
- Markers - ten (red, green, blue, purple, yellow, black x2, pink, orange, brown)
- Hula-hoop - one
- *Parts and Needs of Plants* (Resource 1)
- *Plantain Inquiry Sheet and Reflection* (Resource 2)
- *Plantain Healing Activity* (Resource 3)
- *Plantain Life Cycle Guided Fantasy* (Resource 4)

*See instructions in Nearby Nature Study Introduction

Learning Skills & Work Habits

Independent work, collaboration, observation, critical thinking, creative thinking.

TEACHING/LEARNING STRATEGIES

Indoor Introduction

1. Pair Share: Ask students to think of a plant they have noticed near their home or in the schoolyard and to describe that plant to a classmate – what did it look, smell and feel like? Then, ask students to brainstorm different parts of a plant (i.e., leaves, flower, stem, roots, seeds) and what a plant needs to survive (i.e., water, sunlight, warmth, air, soil). As answers are given, begin assembling a picture of a plant (Resource 1) on the classroom board or invite students to stick the pieces on the board as they guess them. Ask how these needs are the same or different from human needs and invite students to share a story of an experience they have had with a plant.

2. Whole Class: Begin a class discussion on the use of 'weeds' by humans and other species. *Teacher Prompt: What comes to mind when you hear the word 'weeds'? Even though humans generally dislike weeds, are they still important to humans? (YES, lots of plants we call weeds can be eaten and used for medicine). Do you think they are important to the health of other species too? What other species use plants and what for? (Insects [food, shelter, to lay eggs on], mammals [food], birds [food, nest materials], reptiles [food], etc.).* Reveal that they will be getting to know plantain – a plant often called a weed – throughout the week.

3. Individual Exploration: Hand out nature study journals along with the plantain inquiry sheet and reflection (Resource 2). Ask students to fill in the blanks on the inquiry sheet only – what do they already know about plantain and what would they like to know about plantain. Invite students to examine the photos and guiding questions to help with their responses. Students will cut and glue the inquiry sheet as well as reflection sheet in their nature study journal.

Outdoor Exploration

4. Whole Class (PART 1): Take students outside with their nature study journals and a pencil, and review expectations for being outside. Then, ask students to place plantain leaves around the schoolyard or local area (Resource 3) and one hula-hoop in the middle of the space. As students place the leaves, put construction paper, with instructions glued on (Resource 3), around the area with a marker of the same colour. Start a class discussion on using medicine to treat ailments. Ask students what they do when they get a cut – how do they heal it? What do they do when they have a cough or bee sting or a fever – how do they heal it? Where do they get the medicine that heals them? Ask students if they think a plant growing along sidewalks could heal all of these ailments. Students will then participate in an activity that uncovers the ailments plantain traditionally healed.

5. Group Work (PART 2): Divide students into groups of 3 or 4. Inform them that they are going on a hike and must visit 10 different locations, marked by construction paper. When they arrive at each location, they will use the marker to put a 'dot' in their nature journal so they remember where they have been. Then, they will follow the instructions on the construction paper (read these aloud to students before starting). If asked to collect plantain at a location, they will place the collected leaves in the hula-hoop before moving on. The activity ends when each group has visited the 10 locations. Once finished, ask students to recall what ailments they came across during the activity that plantain could heal. Discuss how this knowledge was passed on from Aboriginal peoples living in North America, who drew upon the natural environment for healing*.

***Note:** Generally, leaves are chewed (or crushed and spat on), and then placed on the wound, sting, or rash. To aid with cough and other internal ailments, the plant is often made into a tea. For further information on Aboriginal knowledge of plants, see Christi Belcourt (2008) *Medicines to Help Us: Traditional Métis Plant Use* and Amanda Karst, Linda Kershaw and Patrick Owen (2009) *Edible & Medicinal Plants of Canada.*

6. Whole Class: Ask students what they noticed about plantain's habitat during their 'hike' – what smells did they find, what did they hear, and what animals were present. Now that students have 'warmed up' their senses, direct students to lay on the ground with their eyes closed. Invite them to relax and think about their surroundings – how does the ground feel? Is

the air warm or cool on their face? Then, ask students to imagine they have transformed into a tiny plantain seed. Begin guiding children through the life cycle of plantain, having children imagine themselves as plantain at each life moment (Resource 4).

7. Individual Exploration: Students will then find plantain growing in or near the schoolyard and observe the plant*. Discuss guidelines for observation, such as being still and silent (insects may come to visit!), and being respectful by leaving it in the ground unless used for food/medicine. Then discuss guidelines for journaling (i.e., include date, time, and weather in each entry). Encourage students to sketch the plant and label plant parts if desired. While observing, encourage students to consider the following: How many leaves are there? Are there flowers? Are there seeds? Are any insects visiting the plant? Where is the plant growing? What else do you notice about the plant?

***Note:** If plantain cannot be found in or near the schoolyard, students may choose a different plant that is present to observe and sketch. Use this same plant for activity #8 below. Ensure the plant they are touching is not harmful (e.g., poison ivy).

Consolidation and Reflection

8. Individual Exploration: Students will write a poem about plantain in their nature journals. The poem may be written in a style of their choice or follow a given template (see below). Invite students to gather in a circle and share their poems with the class when complete.

When I see plantain, I think of _____.
When I touch plantain, I feel _____.
When I speak to plantain, I say _____.
When I listen to plantain, I hear _____.

9. Individual Exploration: Bring students into the classroom or stay outside (weather dependent). Students will now complete the reflection on plantain in their nature study journal (from Resource 2).

DIFFERENTIATED INSTRUCTION

Each activity can be adapted to meet a variety of learning styles and specific needs. For instance if a student is colourblind, write numbers on the plantain healing activity instructions and construction paper to supplement the colour. In addition, the poem may be told orally or transcribed into words with assistive technology.

ASSESSMENT OPPORTUNITIES

Anecdotal evidence can be collected throughout the learning activity to identify gaps in knowledge or misconceptions to ensure they are addressed. Student understanding can also be assessed by examining plantain observations and/or poetry. Students may also create a class/group display on plantain to be posted outside the classroom, so the school community can get to know their nonhuman neighbour.

EXTENSION ACTIVITIES

Planting in School Gardens: Plant local wildflowers in the school garden and document the flowers' growth, changes, and visitors throughout the season. Seeds and plants can be purchased at garden centres or greenhouses.

Guest Speaker: Invite an elder from a local Aboriginal community to share their knowledge of traditional healing (i.e., use of medicinal plants) to the students.

Plant Field Trip: Walk or take public transit to a local meadow, forest, or wetland habitat and observe different plant species. Invite students to explore the habitat by looking at colours, textures, and scents of the leaves, flowers, stems, and seeds of various plants. Students may write observations in their nature study journals.

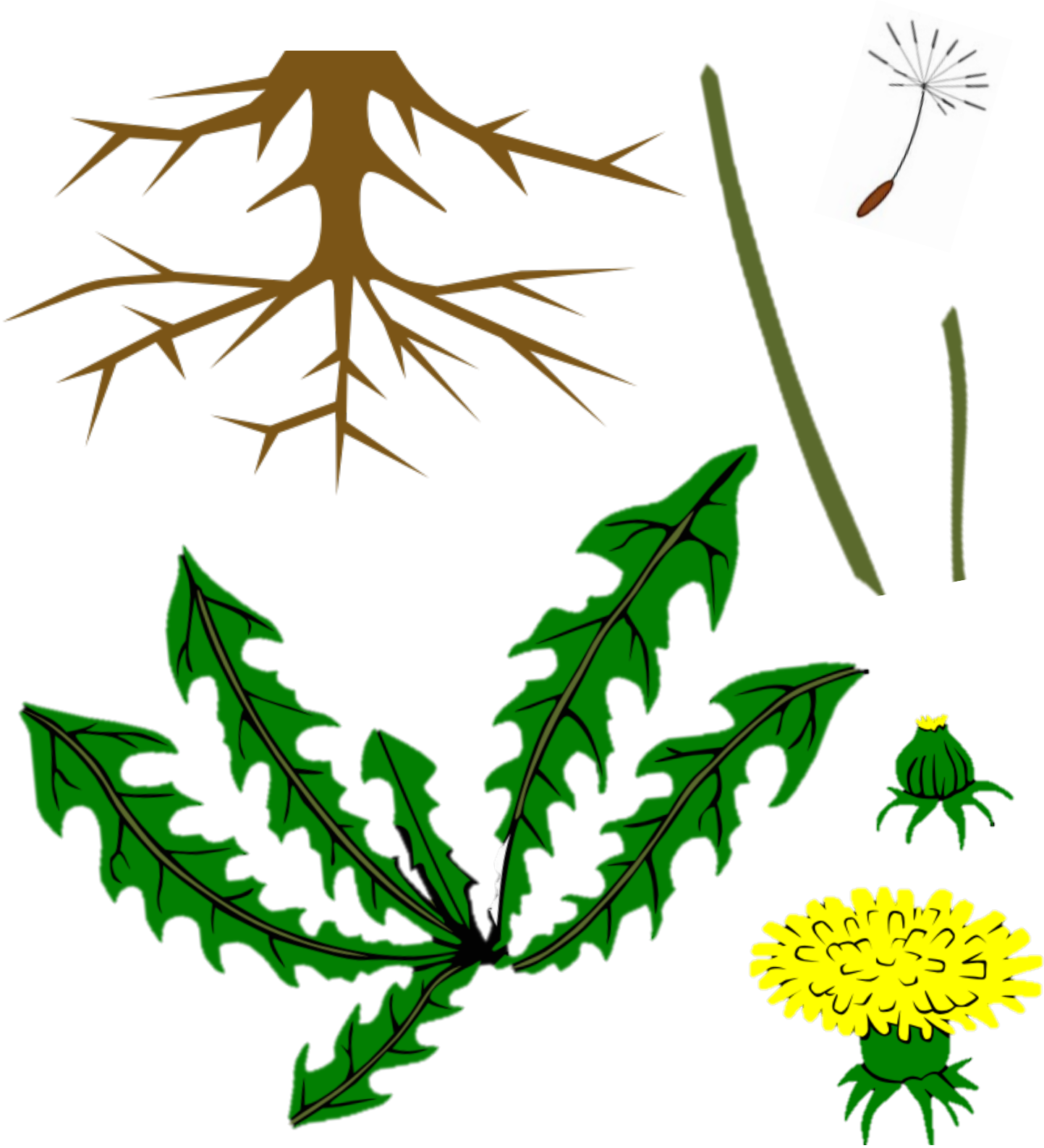
TEACHING RESOURCES (see below)

RESOURCE 1

PARTS AND NEEDS OF PLANTS

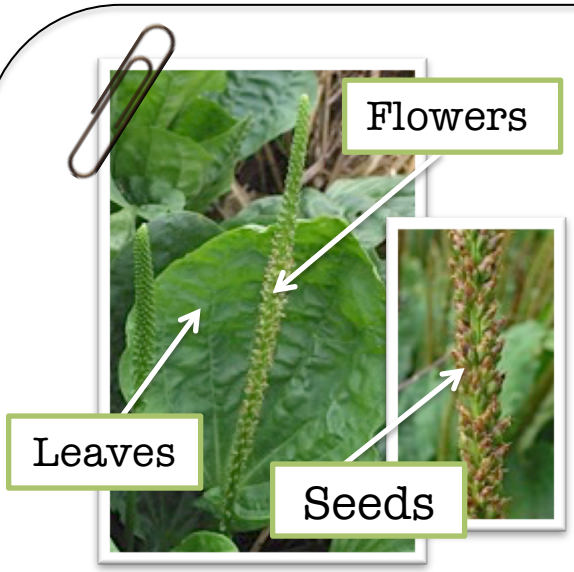
Instructions: Cut out each plant part and need, and laminate (optional)

Photo Source: Openclipart – openclipart.org and ClipArtBest - clipartbest.com



AIR

RESOURCE 2
PLANTAIN INQUIRY SHEET AND REFLECTION
Photo Source: WikiCommons – commons.wikimedia.org



Broadleaf Plantain

What I know about plantain:

What I want to know about plantain:

Where do I live?
What colour am I?
What time of year do I grow?
What shape are my leaves?
What do my flowers look like?
How do my seeds spread?

Broadleaf Plantain Reflection

One thing I learned *about* plantain:	One thing I learned *from* plantain:
One thing I still wonder about plantain:	One reason I am grateful for plantain:

RESOURCE 3
PLANTAIN HEALING ACTIVITY
Instructions: Photocopy several double-sided colour pages, cut out each leaf and laminate
Photo Source: WikiCommons – commons.wikimedia.org, Openclipart – openclipart.org and Jess Pelow

Various plantain leaves

Instructions: Glue each rectangle to construction paper of corresponding colour.

RED

You smell something new outside. Take two breaths in through your nose and continue to the BLUE station.

ORANGE

Something moves up ahead! Look for 1 animal (like an ant or bird!), then continue to the WHITE station.

BLUE

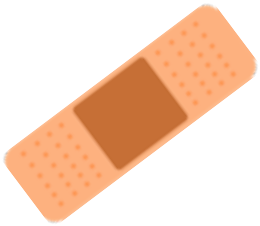
You touched poison ivy! Find 1 plantain leaf and continue to the YELLOW

WHITE

You picked too many plantain leaves for dinner. Return 5 plantain leaves to the area and continue to the PURPLE station.

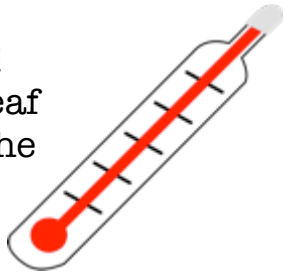
YELLOW

You tripped and cut your knee. Find 3 plantain leaves and continue to the PINK station.



PURPLE

You have a fever! Find 1 plantain leaf and continue to the GREEN station.



PINK

You hear something in the bushes! Close your eyes, listen for 3 different sounds, then continue to the BROWN station.

GREEN

Go on a treasure hunt! Find one hard object and one soft object, then continue to the BLACK station.

BROWN

You have a terrible cough! Find 2 plantain leaves and continue to the ORANGE station.

BLACK

You were stung by an insect! Find 2 plantain leaves and continue to the RED station.

RESOURCE 4
PLANTAIN LIFE CYCLE GUIDED FANTASY

Imagine yourself as a tiny plantain seed, curled up and sleeping in the soil beneath you. The dirt surrounds you, from head to toe, feeling heavy and cool to the touch. It's dark and quiet in this underground bed, keeping you cozy while you wait for the right moment to wake up. You start to hear a pitter-patter above you, then a steady 'shhhhhhhhh' noise. Is this a sign to wake up? Could it be the first rains of spring? Something wet starts to trickle though the soil. It slowly reaches your head, then washes over your entire body like a cool bath. You feel alive with energy! It MUST be time to wake up! You stretch and stretch until a root cracks open your shell and wiggles into the soil. For the first time, you taste water coming in through these new roots like a straw. You notice that you are not the only one in the soil. A worm tunnels past, brushing it's slippery body against your roots. It tickles! Then an ant burrows by, climbing on top of your head before continuing on it's way. You count all six feet gently tapping your rounded shell. 'Tap, tap, tap, tap, tap, tap'.

After saying hello to these new friends, you stretch once again and a small green leaf pops out from the top of your roots. You sense sunlight at the ground, feeling the warmth of the soil above you. Your leaf is drawn to the warmth and so you begin pushing up, feeling lighter and lighter until you break through the dirt. You spread out your leaf, laying flat on the ground, facing upwards towards the sky. The sun is more beautiful than you expected, with bright glowing rays touching everything around you. You no longer feel the cool soil, but feel warmth beaming from above. Then, the wind blows past you, 'wooooooooooosh', sending a ripple through your leaf and settling flat again as the air calms. You relax every part of your body, lying still on the ground.

More leaves start to emerge from your roots, making a green bouquet among the sidewalks and parking lots. The air is becoming warmer each day and the rains have almost stopped. It must be summer! You lay with your leaves spread out, soaking up the sunlight, feeling a gentle breeze move past. Just as you begin to doze off, you start to feel itchy, like something is crawling on you! You look around and see a small caterpillar climb up on to your leaves and start nibbling away at the fresh growth. Ouch! But before you shake them off, you notice something else. A small round stem has appeared right in the middle of your leaves! You forget about the caterpillar and watch the stem grow taller and taller, towering above your leaves. Teeny flowers start to burst open from all sides of the stem, smelling sweet as you breathe in through your nose. You feel overjoyed as your new stem and flowers bend, wave, and play in the breeze.

Many days pass and you feel on top of the world, but you start to notice some changes around you. The warm air is getting colder, the sun does not shine as long, and your flowers are turning brown. Autumn has arrived. Your light stem starts to feel heavy, as tiny seeds begin to form below each flower. A strong wind rushes by, 'wooooooooosh', knocking your seeds into the air and carrying them far far away. The next day, a cool autumn rain falls from the skies, making your seeds sticky to touch. The wind can't carry them, but you are in luck! A grey squirrel rushes past your stem with an acorn stuffed in their mouth and several seeds get stuck to their fur. As they bury their acorn, your seeds fall into the same hole, where they will sleep until the spring. You however, are wide-awake, feeling the cold air dance around your green leaves. You start to shiver and chatter your teeth. As the sun goes down, the first frost covers the ground in a blanket of ice crystals and your leaves are no more. You take a deep breath, yawn, and prepare your body for a long winter. With your roots safely underground, away from the snow, new leaves can form in spring and your life cycle can begin again.

3.4 Pavement Ant: Meet the Insect Living Under Your Feet

In this learning module, students will study life as a pavement ant, through an exploration of physical and behavourial features of ants, the life cycle of an ant, and an ant's habitat. The activities are designed to take place in an urban schoolyard or local habitat during the fall or spring seasons. The activities can be taught over the course of a week, or extended for a more in-depth exploration.

CONNECTION TO ONTARIO ECOSCHOOLS
Curriculum: Create lessons that allow students to learn in, about, and for the environment

CURRICULUM LINKS - SCIENCE AND TECHNOLOGY/THE ARTS, GRADES 1,2,3
OE = Overall Expectation
GRADE 1
Science and Technology *Understanding Life Systems: Needs and Characteristics of Living Things (2007)*
OE2. Investigate needs and characteristics of plants and animals, including humans
OE3. Demonstrate an understanding of the basic needs and characteristics of plants and animals, including humans
Specific Expectations: 2.3, 2.6, 2.7, 3.2, 3.5, 3.6

The Arts *Visual Arts (2009)*
OED1. Creating and Presenting
Specific Expectations: D1.1, D1.2, D1.3

GRADE 2
Science and Technology *Understanding Life Systems: Growth and Changes in Animals (2007)*
OE2. Investigate similarities and differences in the characteristics of various animals
OE3. Demonstrate an understanding that animals grow and change and have distinct characteristics
Specific Expectations: 2.2, 2.3, 2.7, 2.8, 3.1, 3.2, 3.3

The Arts *Visual Arts (2009)*
OED1. Creating and Presenting
Specific Expectations: D1.1, D1.2, D1.3

GRADE 3
Science and Technology *Understanding Life Systems: Soils in the Environment (2007)*
OE2. Investigate the composition and characteristics of different soils
OE3. Demonstrate an understanding of the composition of soils, types of soils, and the relationship between soils and other living things
Specific Expectations: 2.2, 2.6, 3.3, 3.4

The Arts *Visual Arts (2009)*
OED1. Creating and Presenting
Specific Expectations: D1.1, D1.2, D1.3

PLANNING NOTES

Background Information

Pavement ants are a tiny, dark brown to black **insect** from Europe. They are known for creating small mounds of soil near pavement called **anthills**, formed when ants dig out an entrance to their underground **nest.** A pavement ant **colony** consists of a **queen** who only lays **eggs**, and many female **workers,** who **forage** for food, improve the nest, defend the nest, and take care of young ants. At certain times of the year, the queen produces winged males and females who then mate. While the males die soon after, the females fly to a new location, drop their wings and start a new colony as a queen. The queen's nest is an elaborate system of tunnels, with specific chambers for eggs**, larvae** (legless, eyeless young)**, pupae** (adult-like, with antennae and legs folded against body), and food. Their diet includes dead insects, leaves, seeds, nectar, sap, and honeydew from aphids. To communicate, the ants release chemical **pheromones** from scent glands. Predators of the ants include birds, mammals, amphibians, and other insects.

Key Terms

The following terms can be found in bold in the paragraph above. They include: insect, anthills, nest, colony, queen, eggs, workers, forage, larvae, pupae, and pheromones.

Materials/Resources

- Glue sticks
- Pencils - full class set
- Nature study journals - full class set*
- Containers - three (i.e., plastic yogurt containers)**
- Cotton Balls - 30
- Scents (real or extracts) - three (i.e., mint, orange, and garlic)
- Large pieces of blank paper - 2 full class sets
- Pencil crayons
- Trowels (optional)
- *Insect Body Parts* (Resource 1)
- *Ant Life Cycle Puzzle* (Resource 2)
- *Pavement Ant Inquiry Sheet and Reflection* (Resource 3)
- *Soil Scavenger Hunt* (Resource 4)

*See instructions in Nearby Nature Study Introduction

**Label containers #1, #2, and #3. Place 10 cotton balls in each container. Put one scent in container #1. Put a different scent in container #2. Put a third scent in container #3.

Learning Skills & Work Habits

Independent work, collaboration, observation, inquiry, creative thinking, critical thinking

TEACHING/LEARNING STRATEGIES

Indoor Introduction

1. Whole Class: Begin a class discussion by asking students if they have seen insects at home or in the schoolyard. Ask students to describe what those insects looked like and what they were doing. Then, have students consider why insects are an important part of a healthy ecosystem. *Teacher Prompt: How do insects help plants grow? (Move pollen to new plants, move seeds)*

What animals eat insects? (Other insects [dragonflies, etc.], mammals [bats, squirrels, etc.], reptiles and amphibians, birds, fish). How do insects help make soil? {Break down rotting leaves, logs, etc.). Ask students to consider how insects affect their own life – do they eat plants? Do they wear clothing made from plants (i.e., cotton)? Do they enjoy watching insects? Invite children to share a story of an experience they have had with an insect.

2. Pair Share: Distribute photos of four different insects to students or project an image in the classroom (Resource 1). In pairs, ask students to brainstorm body parts of insects and guess what each body part is used for*. Compare these body parts with the human body. How are insects and humans similar and how are they different? Invite students to share their findings with the class. Reveal that students will be getting to know one insect – pavement ants – throughout the week.

***Note:** Antennae (for smell/touch), mouth/mandible (to carry food), eyes (to see), head (holds eyes, mouth, brain, antennae), legs (to move/clean), thorax (holds legs/wings), abdomen (holds stomach/scent glands), stinger (to release toxins), and petiole (bumps between the thorax and abdomen to bend abdomen).

3. Whole Class: Students will now explore the life cycle of an ant through a cooperative activity. Distribute one or two puzzle pieces (Resource 2) to each student. Students must fit their piece with another student's puzzle piece. These students will stay together, searching for more pieces from their classmates to complete the puzzle. Once the puzzles have been assembled, project an image of the completed puzzle for the class to see. Start a class discussion by asking students to explain what they think is happening at each stage of the life cycle.

4. Individual Exploration: Hand out nature study journals along with the ant inquiry sheet and reflection sheet (Resource 3). Ask students to fill in the blanks on the inquiry sheet only – what do they already know about pavement ants and what would they like to know about pavement ants. Invite students to examine the photo and guiding questions to help with their responses. Students will cut out and glue the inquiry sheet as well as reflection sheet in their nature study journal.

Outdoor Exploration

5. Whole Class (PART 1): Take students outside with their nature study journals and a pencil, and review expectations for being outside. Ask students to recall which part of the ant body is used to smell and locate food (*Antennae*). Explain that when food is found, the worker ants bring that food to the nest and leave a trail of chemical pheromones (a scent) to guide other worker ants to the food. Ask students who the workers gather food for (*queen, larvae, and pupae*). Students will then participate in a foraging simulation. To prepare, place 3 containers with cotton balls on the ground in a row.

6. Group Work (PART 2): Divide students into groups of 3 or 4 and tell students that they are now worker ants in a colony. One student in each group will be a scout ant, and the rest will be foraging ants. Foraging ants will begin the simulation with their eyes closed, and backs toward the 3 containers. The scout ant will then choose a container, take out one cotton ball, and bring it to their group without talking. The group will open their eyes, smell the cotton ball, walk to the containers, and try to find the container that has the same scent. When the group thinks they found the scent, they will bring a cotton ball back to the scout to compare with the original

cotton ball. If the smell is not the same, the cotton ball must be returned and the foragers must try to find the correct scent again. Once cotton ball scents have been matched, start a class discussion by asking students how it felt to rely on smell to find food – was this easy or challenging and why. How did working as a team help the group find the right scent? Ask students how else teamwork could help an ant colony survive. Ask students how teamwork is important to humans, and if they can think of a time when they asked for help to complete a task.

7. Pair Share: Students will then learn about an ant's habitat by exploring soil in the schoolyard or local habitat. Start a class discussion by asking why soil is important to an ant and to recall how an ant might be important to soil. Divide students into pairs and give each pair a soil scavenger hunt sheet (Resource 4). Students will complete the scavenger hunt at any patch of soil (i.e., school gardens) they can find. If trowels are available, offer them to students to dig up soil. When the scavenger hunt is complete, gather students in a circle and ask the following: Were any ants found? If yes, what did they look like and what were they doing? What was your favourite find in the soil? Were any other animals found? Did you find anything unusual in the soil? If yes, describe it and guess what it could have been.

8. Individual Exploration: Students will spend time searching for signs of pavement ants (i.e., mounds of soil) and observing ants in or around the schoolyard*. Discuss guidelines for observation, such as being still and being respectful to the ants (i.e., not harming them). Then discuss guidelines for journaling (i.e., include date, time, and weather in each entry). Students may then record their observations in their nature journal using pictures, words or both. Invite students to consider how their own presence affects the ants – what might the ants think of each student?

***Note**: If no mounds are present, students may search for and observe another insect or students may journal about their observations from the soil scavenger hunt. Alternatively, students may guess why there are no pavement ants in the area and write about how the habitat could change to attract pavement ants.

Consolidation and Reflection

9. Individual Exploration: Distribute two blank pieces of paper to each student. Using pencil crayons, students will first create a map of the schoolyard or local habitat that marks each location an ant mound is found. If there are no mounds, students may predict where a queen might start a nest and mark this on the map. Encourage students to include gardens, playgrounds and trees on their map, and to name places on their map. Then, bring students into the classroom (or stay outside, weather dependent). On the second piece of paper, students will imagine what it looks like underneath an ant mound and design their own ant colony. Encourage students to include tunnels, chambers**,** eggs, larvae, pupae, workers, the queen, food, and the mound. Once complete, hang student's artwork in the classroom or hallway.

10. Individual Exploration: Bring students into the classroom or stay outside (weather dependent). Students will now complete the reflection on pavement ants in their nature study journal (from Resource 3).

DIFFERENTIATED INSTRUCTION

This learning activity can be adapted to meet a variety of learning styles and specific needs. For instance in the artwork assignment, students may create an image digitally instead of drawing by hand.

ASSESSMENT OPPORTUNITIES

Anecdotal evidence can be collected throughout the learning activity to identify gaps in knowledge or misconceptions to ensure they are addressed. Student understanding can also be assessed by examining content of their observations and/or ant artwork. Students may also create a class/group display on the pavement ant to be posted outside the classroom, so the school community can get to know their nonhuman neighbour.

EXTENSION ACTIVITIES

Insect Hotel: Construct an insect hotel in the schoolyard, using recycled and natural materials (i.e., bricks, rugs, pine cones, straw, wood, etc.). Observe the insects visiting the hotel and consider making informational signs about the various guests.

Ant Drama: Create a play on life in an ant colony to perform for the school community. Characters may include: a queen, male ants, female workers, eggs, larvae, pupae, and ant predators.

Insect Field Trip: Walk or take public transit to a local meadow, forest, or wetland habitat and observe different insect species. Invite students to explore the habitat by turning over rocks and logs or observing flowers to find insects. Students may write observations in their nature study journals.

TEACHING RESOURCES (see below)

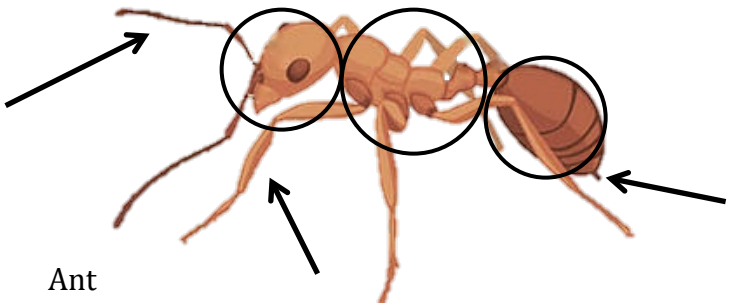
RESOURCE 1
INSECT BODY PARTS
Photo Source: WikiCommons – commons.wikimedia.org

Damselfly

Katydid

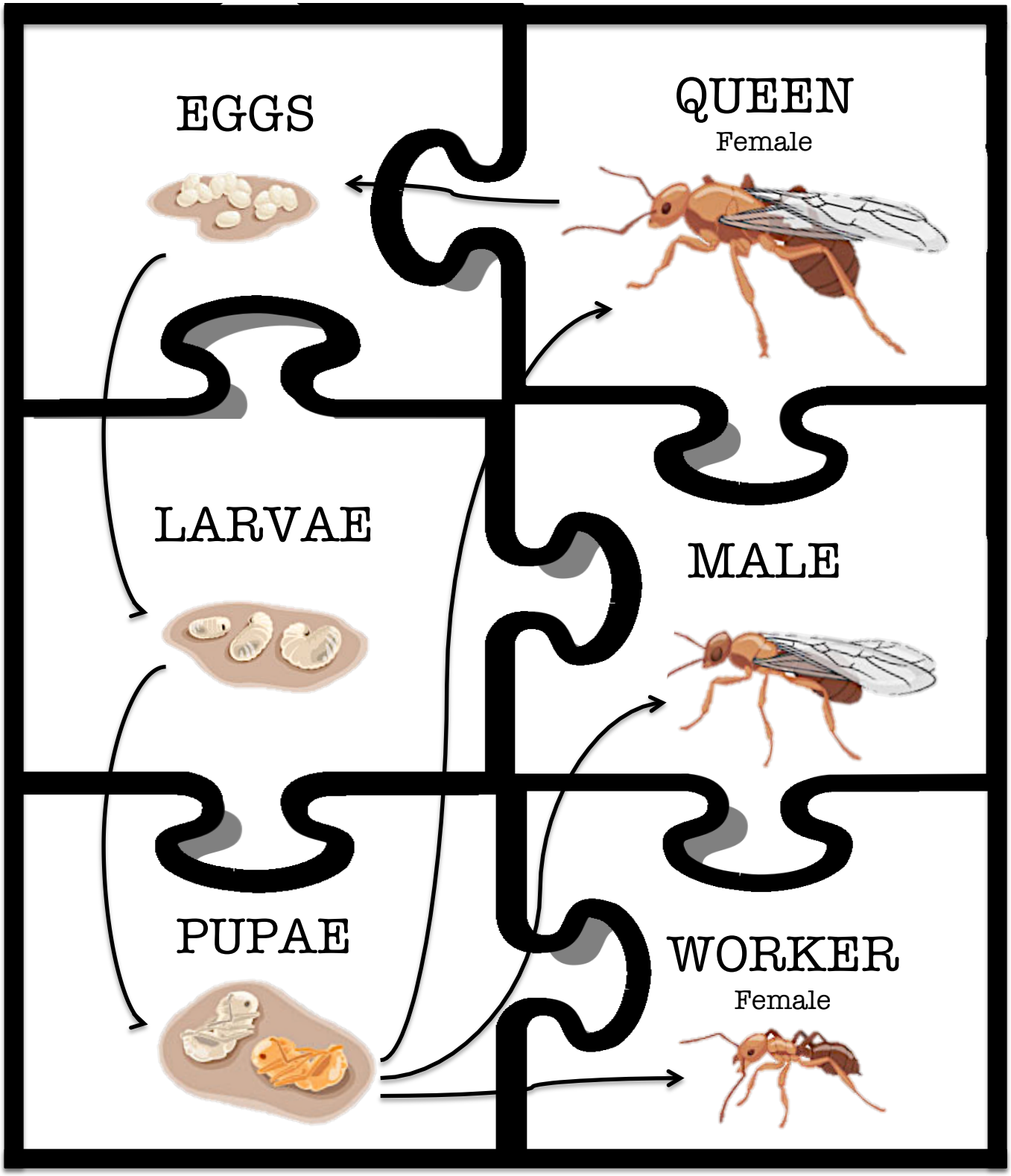
Butterfly

Honey Bee

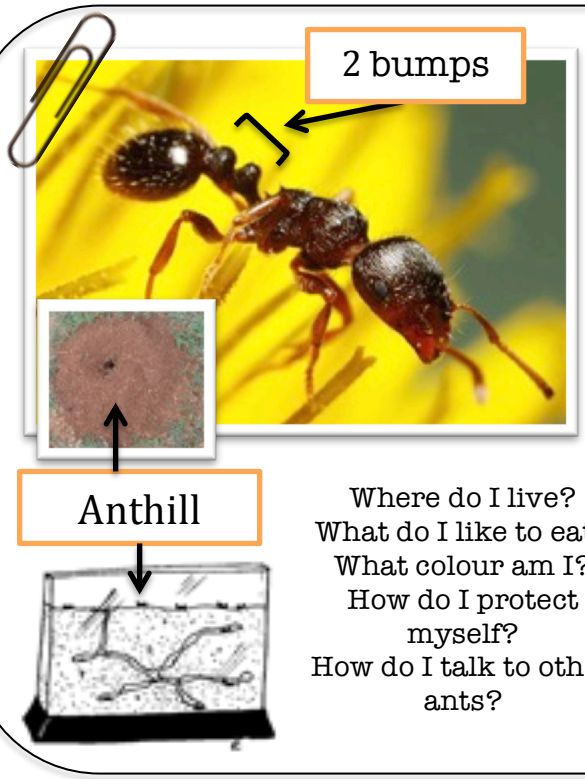


Ant

RESOURCE 2
ANT LIFE CYCLE PUZZLE
Instructions: Photocopy several pages and cut out each puzzle piece.
Photo Source: WikiCommons – commons.wikimedia.org and Openclipart – openclipart.org



RESOURCE 3
PAVEMENT ANT INQUIRY SHEET AND REFLECTION
Photo Sources: WikiCommons – commons.wikimedia.org and Mark A. Hicks – school.discoveryeducation.com



Pavement Ant

What I know about pavement ants:

Where do I live?
What do I like to eat?
What colour am I?
How do I protect myself?
How do I talk to other ants?

What I want know about pavement ants:

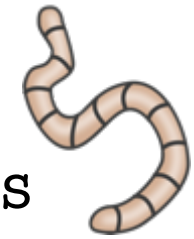
Pavement Ant Reflection

One thing I learned *about* pavement ants:	One thing I learned *from* pavement ants:
One thing I still wonder about pavement ants:	One reason I am grateful for pavement ants:

RESOURCE 4
SOIL SCAVENGER HUNT
Photo Sources: WikiCommons – commons.wikimedia.org and Openclipart – openclipart.org

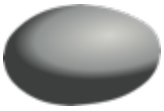
☐ Ants 

☐ Sand 

☐ Other Animals 

☐ Rotting Wood 

☐ Tunnels 

☐ Pebble 

☐ Roots 

☐ Eggs, Larvae, Pupae 

☐ Seed 

☐ Mystery Object(s) 

☐ Mushroom or Fungi 

☐ 3 shades of brown soil 

3.5 Grey Squirrel: Meet that Bushy-tailed Mammal in the Trees

In this learning module, students will learn about the eastern grey squirrel's life and habitat. This module is designed to take place in an urban schoolyard or local habitat during the fall, winter, or spring seasons. The module may be taught over the course of a week, or extended with the addition of a more in-depth exploration.

CONNECTION TO ONTARIO ECOSCHOOLS
Curriculum: Create lessons that allow students to learn in, about, and for the environment

CURRICULUM LINKS - SCIENCE AND TECHNOLOGY/ LANGUAGE, GRADES 1,2,3
OE = Overall Expectation
GRADE 1
Science and Technology *Understanding Life Systems: Needs and Characteristics of Living Things (2007)*
OE2. Investigate needs and characteristics of plants and animals, including humans
OE3. Demonstrate an understanding of the basic needs and characteristics of plants and animals, including humans
Specific Expectations: 2.2, 2.3, 2.5, 2.6, 2.7, 3.2, 3.3, 3.5, 3.6

Language Oral Communication (2006)
OE2. Use speaking skills and strategies appropriately to communicate with different audiences for a variety of purposes
Specific Expectations: 2.2, 2.3, 2.4, 2.5, 2.6, 2.7

GRADE 2
Science and Technology *Understanding Life Systems: Growth and Changes in Animals (2007)*
OE2. Investigate similarities and differences in the characteristics of various animals
OE3. Demonstrate an understanding that animals grow and change and have distinct characteristics
Specific Expectations: 2.2, 2.5, 2.7, 2.8, 3.1, 3.2, 3.3

Language Oral Communication (2006)
OE2. Use speaking skills and strategies appropriately to communicate with different audiences for a variety of purposes
Specific Expectations: 2.2, 2.3, 2.4, 2.5, 2.6, 2.7

GRADE 3
Language Oral Communication (2006)
OE2. Use speaking skills and strategies appropriately to communicate with different audiences for a variety of purposes
Specific Expectations: 2.2, 2.3, 2.4, 2.5, 2.6

PLANNING NOTES
Background Information
The eastern grey squirrel is a **mammal** native to Ontario, who lives in the trees of **deciduous** forests and urban areas all year round. The squirrel is identified by their black or grey **fur**, small whiskers, ears on top of the head, and large bushy **tail**. As a **rodent**, the squirrel also has four

orangey **incisors** (front teeth) that never stop growing. These teeth are used to crack open nuts or strip the scales off pinecones to get at seeds, which they leave in a messy pile called a **midden.** In the fall, squirrels will bury thousands of nuts and seeds that they dig up in winter when food is scarce. Scientists believe these food **caches** are found by smell as well as memory. When threatened, the squirrels will **chatter** their teeth, make a harsh 'kuk kuk' or screeching noise, become motionless on tree trunks, or flick their tail. In addition to communicating, a squirrel's tail also helps with balance, keeping warm, and distracting **predators** like hawks, weasels, foxes, or cats. While the squirrels prefer to nest in **tree cavities**, squirrels in cities typically build large spherical nests out of twigs and leaves called **dreys,** located at the tops of trees.

Key Terms
The following terms can be found in bold in the paragraph above. They include: mammal, deciduous, fur, tail, rodent, incisors, midden, caches, chatter, predators, tree cavities, and dreys.

Materials/Resources

- Glue sticks
- Tape
- Nature study journals - full class set*
- Pencils - full class set
- Dishtowels (or similar cloths) - six to eight
- *Mammal Comparison* (Resource 1)
- *Squirrel Habitat Activity* (Resource 2)
- *Grey Squirrel Inquiry Sheet and Reflection* (Resource 3)
- *Squirrel Story Photos* (Resource 4)
- *Sample Squirrel Obstacle Course* (Resource 5)

*See instructions in Nearby Nature Study Introduction

Learning Skills & Work Habits
Independent work, collaboration, observation, inquiry, creative thinking, critical thinking

TEACHING/LEARNING STRATEGIES
Indoor Introduction
1. Whole Class: Start a class discussion by asking students if they have seen mammals – other than humans – near their home or schoolyard. Ask students to describe what they looked like and to guess what they were doing. Invite students to share a story of an experience they had with a nonhuman mammal. Then, pass around or project images from Resource 1. Ask students to brainstorm what makes a mammal different from a bird or an insect. Ask what similar characteristics they might share (i.e., legs, a heart, eyes, etc.). Reveal that the class will be studying eastern grey squirrels.

2. Whole Class: Students will then learn about a squirrel's habitat through an interactive activity. First, tape one photo from Resource 2 to each student's back without the student seeing the photo. Students must guess what their photo is by asking classmates yes or no questions. For example, am I a tree? Do I have leaves? Is my leaf on the Canadian flag? Am I a maple tree? Once they correctly guess their photo, they may remove it from their back and

continue to help classmates discover their identities. Once all students know who they are, start a class discussion. Ask students to say who they are and why they are important in a squirrel's habitat or how they might interact with a squirrel.* Compare with a human habitat – what needs are the same and what needs are different.

***Note:** maple tree (nest location, nest materials, food source), acorns (food), pinecone (food), hawk (predator), soil (bury food, grows trees needed for food), water (nutrition), mushroom (food), fruit (food), fox (predator), bone (nutrition – calcium), twigs (nest material), and grass (nest material).

3. Pair Share: In pairs, have students consider the role of squirrels in keeping an ecosystem healthy. *Teacher Prompt: How do you think a squirrel helps plants grow? (Bury nuts/seeds in the fall that grow into trees when left in soil). How do squirrels help fungi grow? (Eat mushrooms and spores are defecated - fungi needed for plant decomposition and plant survival). How do squirrels provide food for other animals? (Eaten by hawks, mammals). Can squirrels be a home for other animals? (Ticks, lice, fleas).* Ask students to consider how squirrels affect their own life – why is plant decomposition important (*makes soils, needed for plants to grow*), how are plants important to humans?

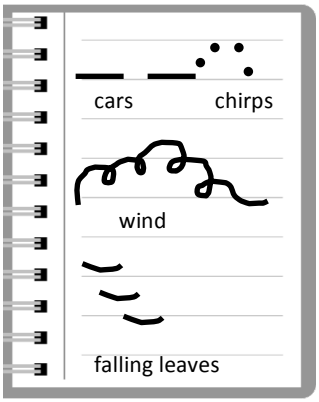
4. Individual Exploration: Hand out nature study journals along with the grey squirrel inquiry sheet and reflection sheet (Resource 3). Ask students to fill in the blanks on the inquiry sheet only – what do they already know about squirrels and what would they like to know about squirrels. Invite students to examine the photo and guiding questions to help with their response. Students will cut out and glue the inquiry sheet as well as reflection sheet in their nature study journal.

Outdoor Exploration

5. Group Work: Take students outside with their nature study journals and a pencil, and review expectations for being outside. Start a class discussion by asking students how they prepare themselves for winter. How might squirrels prepare for the winter? *(Bury seeds in the fall, called a cache).* Ask students how they think squirrels find the food they buried. *(Smell and memory)*. Student's memory will then be tested! Divide students into groups of 4 or 5 and invite each student to find one small object in the schoolyard. Students will then gather on the ground with their group and place the objects in front of them. Give students 15-20 seconds to observe the objects before covering the objects with a dishtowel. In their journals, students must draw the objects with as much detail as possible from memory while the objects are covered. After roughly 10 minutes, lift the dishtowel and invite students to share drawings with their group. Ask students if they found it easy or challenging to remember the objects and why. What strategy did they use to remember the objects? Ask students to recall what happens when a squirrel does not dig up their cache (*Seeds grow into trees).*

6. Whole Class (PART 1): Explain to students that in addition to squirrel's strong sense of smell, squirrels also have excellent hearing. Compare the location of a squirrel's ears with human ears, and invite students to cup their ears with their hands. Ask students how the sound changes with cupped hands around the ears. Ask students why they think it is important for a squirrel to have excellent hearing. What are they listening for? Why is hearing important to humans?

7. Individual Exploration (PART 2): Students will now write a song from all the sounds a squirrel might hear in their habitat. To start, students must find a place in the schoolyard or local habitat and sit with their journals. As they quietly listen to sounds around them, they will draw lines and dots to represent what they hear. Encourage students to raise the lines/dots when the sound gets louder and to lower them when the sound becomes quieter. Encourage students to either draw or write what sound they are hearing for each new 'note'. When the songs are complete, invite students to share their songs with the class. Start a class discussion by asking how the song of the squirrel might change in different seasons. What might a squirrel hear in winter, but not in summer? How might the song change at different times of day? What would a squirrel hear in the morning, but not at night? Lastly, how might a squirrel react to different kinds of sounds? Which sounds might make a squirrel nervous? Which sounds might give a squirrel comfort? Ask students if there are sounds that make them nervous, or give them comfort.



Modified from openclipart.org

8. Individual Exploration: Students will then explore the schoolyard or local habitat looking for signs of squirrels and squirrels themselves*. Signs include tracks, dreys, and middens (chewed twigs or pine cones), pictured on inquiry sheets. Discuss guidelines for observation, such as being still and silent, and being respectful by not disturbing or harming the squirrels. Then discuss guidelines for journaling (i.e., include date, time, and weather in each entry). Students may record observations in their nature study journals using pictures, words, or both. Invite students to consider how their own presence affects the squirrels – what might the squirrels think of each student?

***Note:** If no squirrels or squirrel signs are present, students may make general observations about the habitat and guess why squirrels may not be present. Ask students to think about how the area could change to attract squirrels and to write ideas in their nature journal.

Consolidation and Reflection

9. Group Work: In advance, hide photos from Resource 4 around the schoolyard or local area*. Divide students into groups of 5-6 and ask students to collect one photo each. Once all photos are found, students will gather in their groups, and lay their photos out in a 'storyboard' style. If there are duplicate images, ask students to trade a photo with another group. Then, students will create a collective story about squirrels living in the area. This may take place outside (weather dependent) or in the classroom. Students will take turns creating a line for the story based on the image they found. Encourage students to use words such as midden, cache, or drey in their story, and to write their lines in nature journals if needed. Once stories have been

created, each group will perform their story orally in front of the class. Students may choose to act out their story while it is being told.

***Note:** If it is not possible to hide photos in advance, simply hand out photos to each group.

10. Individual Exploration: Bring students into the classroom or stay outside (weather dependent). Students will now complete the reflection on grey squirrels in their nature study journals (from Resource 3).

DIFFERENTIATED INSTRUCTION

This activity can be adapted to meet a variety of learning styles and specific needs. For example during the memory activity, students with blindness or low vision may choose to memorize the name and order of the objects instead of drawing the objects. In addition, students may have their story lines performed with assistive technology rather than orally in the final activity.

ASSESSMENT OPPORTUNITIES

Anecdotal evidence can be collected throughout the learning activity to identify gaps in knowledge or misconceptions to ensure they are addressed. Student understanding can also be assessed by examining the content of their observations and/or oral stories. Students may also create a class/group display on eastern grey squirrels to be posted outside the classroom, so the school community can get to know their nonhuman neighbour.

EXTENSION ACTIVITIES

Build a Drey: Construct model dreys by weaving together twigs and branches found on the ground. Insulate with leaves, hollow out a hole in the centre, and line with dried grass.

Tree Planting: Plant local tree species in the schoolyard and document their growth, changes, and visitors throughout the season.

Squirrel Obstacle Course: Create an obstacle course in the schoolyard to practice behaviours of grey squirrels. See Resource 5 for a sample course.

Mammal Field Trip: Walk or take public transit to a local forest habitat and observe different mammal species. Invite students to explore the habitat by looking in trees and/or on the ground for mammals and signs of mammals including tracks, scat, fur, bones, twig chews, digs, dens, dreys, etc. Students may write observations in their nature study journals.

TEACHING RESOURCES (see below)

RESOURCE 1
MAMMAL COMPARISON
Photo source: WikiCommons – commons.wikimedia.org






Birds: rock dove (left), house sparrow (right). Insects: pavement ant (left), house fly (right). Mammals: grey squirrel (left), raccoon (right).

RESOURCE 2
SQUIRREL HABITAT ACTIVITY
Instructions: photocopy several pages (one photo per student) and cut out each image
Photo source: WikiCommons – commons.wikimedia.org

Maple Tree

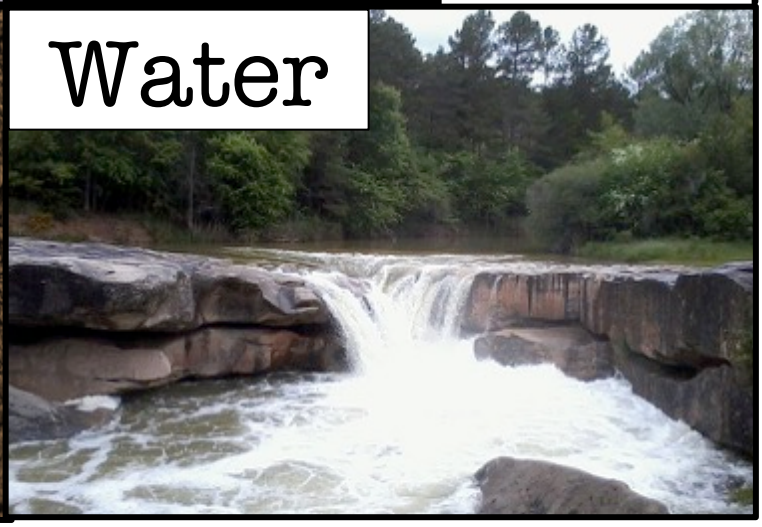
Acorns

Pinecone

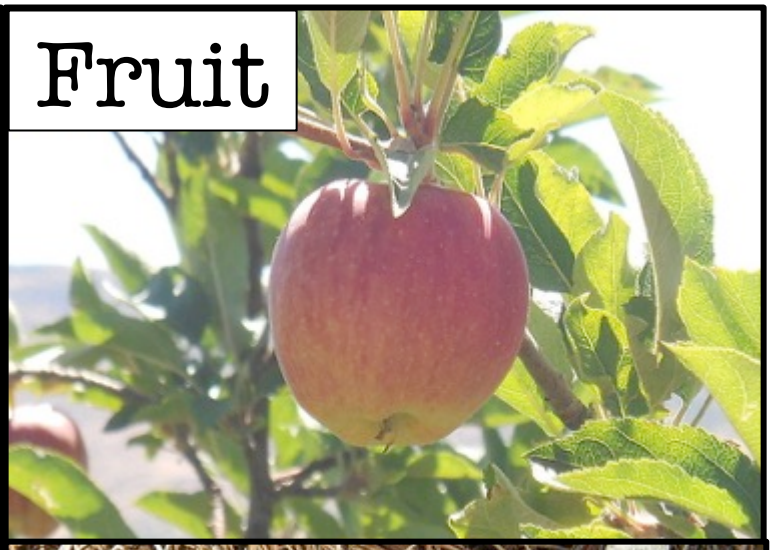
Hawk

Soil

Water




Mushrooms


Fruit

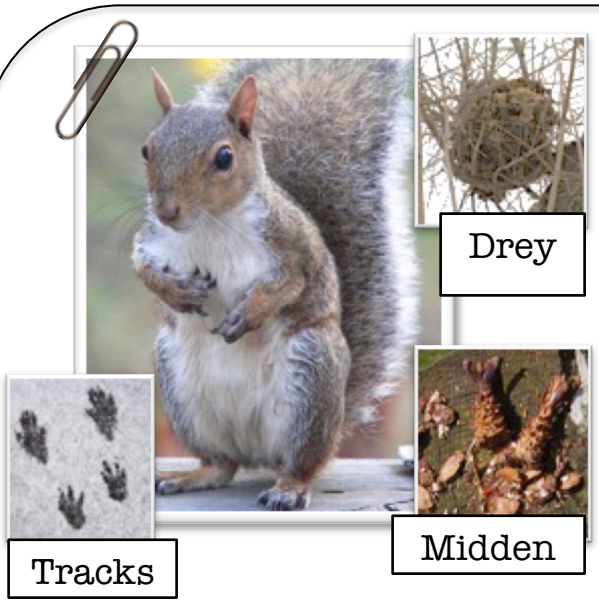

Fox


Bones


Twigs


Grass

RESOURCE 3
GREY SQUIRREL INQUIRY SHEET AND REFLECTION
Photo Source: WikiCommons – commons.wikimedia.org and Jess Pelow



Eastern Grey Squirrel

What I know about grey squirrels:

What I want to know about grey squirrels:

Where do I live?
What do I like to eat?
What is my tail used for?
How do I prepare for winter?
What is my nest made of?

Eastern Grey Squirrel Reflection

One thing I learned *about* grey squirrels:	One thing I learned *from* grey squirrels:
One thing I still wonder about grey squirrels:	One reason I am grateful for grey squirrels:

RESOURCE 4
SQUIRREL STORY PHOTOS
Instructions: photocopy several pages (minimum one photo per student) and laminate each photo.
Photo Source: WikiCommons – commons.wikimedia.org

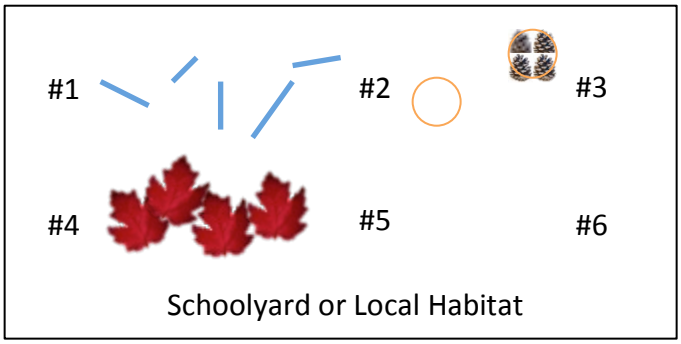
RESOURCE 5
SAMPLE SQUIRREL OBSTACLE COURSE
Photo sources: WikiCommons – commons.wikimedia.org and Openclipart – openclipart.org

Materials

- Construction paper – seven pieces, labeled #1, #2, #3, #4, #5, #6
- Pine cones – ten or more
- Mint extract (or a strong scent) – one bottle
- Berries (i.e., blueberries) – one per student
- Bag of leaves (if there is no snow)
- Sidewalk chalk – one piece (if there is no snow)

Set Up

Cut out each lesson (see below) and glue to construction paper with the corresponding number. For example, glue lesson #1 to construction paper labeled #1. Place construction paper around the schoolyard. At #1, draw lines with chalk (or make depressions in the snow) with gaps between them, to represent branches students must jump to. At #2, draw two chalk circles on the ground 10 feet apart (or make depressions in the snow), placing pinecones in one of the circles. At #4, place leaves in a pile (if there is no snow). Bury berries along the edge of the leaf pile (or in snow) and pour scent extract directly above the berries.

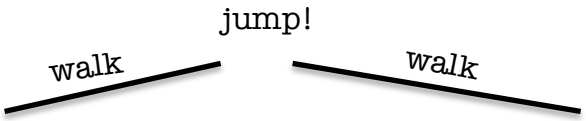


Instructions

Students will transform into baby squirrels who have just left their drey and are learning how to be a squirrel from their mother. Divide students into 'litters' of 4-5 and practice chattering as well as shaking their bushy tails. Groups will then travel to the six locations in the schoolyard marked by construction paper signs. Each group will start at a different number (i.e., start at 3 and move to 4, or start at 6 and move to 1, etc.). At each location, students will follow the instructions from mother squirrel. At various times in the activity, make a loud hawk call. Whenever students hear this call, they must stop what they are doing, run to the nearest tree (or fence if no trees are present) and freeze. Once everyone is motionless, tell students that the hawk has flown away and they can continue with their lessons. After groups have completed the lessons, discuss what they learned from mother squirrel and how each lesson might help them survive on their own.

Lesson 1

Practice your balance by walking along the lines and jumping from branch to branch!



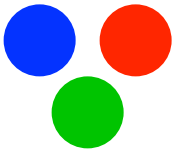
Lesson 2

How many pinecones can you move from one circle to the other in 10 seconds? Take turns trying and only take one pinecone at a time!

Lesson 3

Test your vision by playing a game of 'I spy'. Look for the following:

Colours



Living Beings

Lesson 4

Smell the snow or leaf pile in front of you. Be careful not to step in it! Reach in and collect one berry under the strong smell. Put berries in a pile by this sign.

Lesson 5

Learn how to use your tail! First, find a partner(s). One of you will be the squirrel body and the other(s) will be the squirrel tail. Then, act out the following:

Tail as an umbrella

Tail helps swim

Tail as a blanket

Tail flicks to communicate

Tail distracts predators

Tail keeps balance

Lesson 6

Practice walking like a squirrel! Put both hands on the ground in front of you. Move them forward together, then hop both your feet forward.

CHAPTER 4: Pedagogy for Nature Connection (Curriculum Module Rationale)

With the aim of cultivating child-nature connections in urban-based schooling, each curriculum module draws upon five interrelated pedagogies outlined in Sauvé's (2005) approaches to EE, which are associated with increasing one's bond to the natural world. These pedagogies are experiential (Section 4.1), artistic/creative (Section 4.2), sensorial (Section 4.3), affective (Section 4.4), and cognitive (Section 4.5). In acknowledging that each student will engage the lesson and experience the natural world differently, this variety of pedagogy is meant to increase the opportunity for each student to build a positive, healthy relationship with nature. The following outlines these five nature connection pedagogies, detailing their contribution to cultivating nature connection in children along with their links to the curriculum modules. For a full summary of nature connection pedagogy in relation to specific activities in each curriculum module, see **Appendix H**.

4.1 Experiential Pedagogy: Outdoor Learning and Play

In the context of EE, experiential pedagogy is a method of instruction that allows students to learn from the natural world through direct interaction and active participation in their environment (Chiarotto, 2011). This direct, lived experience in nature is often cited as a primary basis for establishing child-nature connections (see Puk, 2012; Kellert, 1993b; Shepard, 1998; Livingston, 1994), and as such, is encouraged in all five of Sauvé's (2005) highlighted approaches to EE (naturalist, holistic, ethnographpic, eco-education, and humanist/mesological currents). To reiterate Tom Puk's (2012) neurobiology perspective, this need for experience outdoors is due to highly active brain development between birth and grade 3, influenced almost exclusively by one's external surroundings. It is therefore critical that children spend time outside such that 'ecological content' can form the basis of information contained in the brain, which in turn shapes one's way of being and ultimately one's connection with nature. In linking

to curricula, Puk believes ecological content can be established if educators "allow the young child to playfully explore natural systems and to emphasize the innate beauty of these systems" (2012, p. 8). This latter recommendation is woven into each curriculum module, via outdoor games, sensory activities, nonhuman observation opportunities, and reflections on how extraordinary our nonhuman neighbours are.

Facilitating outdoor lessons can also contribute to nature connection by shifting away from book-centered learning and allowing children to physically, mentally, and emotionally engage with the subject matter (Dyment, 2005; Sauvé, 2005). This is particularly crucial in urban settings where monotonous landscapes typically discourage a range of felt experiences (Livingston, 1994). While an asphalt schoolyard may qualify as monotonous, it is important to remember that such spaces are still part of the natural world, subject to all natural processes as well as containing a plethora of plants and nonhuman animals if one knows where – and how – to find them. By guiding children to feel and experience, even in this mundane setting, the potential increases for children to become more aware of – and present in – the affective world around them (Bai, 2009). Should this reality become the norm, expressing love and attachment to the natural world may no longer be an ideology, but an organic part of a child's development. Within the curriculum modules, opportunities for felt experiences are similarly embedded in each activity taking place outside, namely through games, engaging the senses, and interacting with or observing the nonhuman.

Learning through play constitutes another key element of experiential pedagogy and is a longstanding tradition linked to the naturalist current (and more recently to eco-education), for its ability to inspire transcendent experiences and joyful, memorable moments in the natural world (Sauvé, 2005; Sobel, 2008; Cornell, 1998). For David Sobel (2008), such moments can contribute to a child's nature connection, but may only occur if activities are designed and

facilitated appropriately. One play-based design strategy supported by Sobel is termed 'animal allies', where children are invited to become – or emulate – nonhuman animals. Sobel justifies this pedagogy in referencing Paul Shepard's bonding matrix II, suggesting that a child's fascination with nonhuman animals and desire to learn about these animals is an evolutionary trait linked to the survival of humans. As children come to know animals through imitating and even through anthropomorphism, relationships between the child and nonhuman animals are established, which then provide a basis for bonding to the earth matrix (Shepard in Sobel, 2008). Shepard explicitly states that, "it is right for the child to mimic fox and goose in a game of pretend capture, or speak the lines of the little pig or Chicken Little" (Sobel, 2008, p. 30). Within the curriculum modules, this experiential learning strategy is most visible in the rock dove module (predator/prey game and behaviour skits), pavement ant module (scent game), and grey squirrel module (storytelling assignment).

In addition to 'animal allies', Sobel (2008) also encourages games centered on gathering or collecting various items as a pathway to nature connection. Like a child's attraction to nonhuman animals, Sobel believes that children are inherently drawn to gathering, similarly stemming from evolutionary heritage linked to humanity's past immersion in gathering-hunting societies. Since this desire remains embedded in children's psyches, educators can invigorate learning about nature (and one's relationship with nature) by provoking strong emotional responses associated with the thrill of finding 'treasure' (Sobel, 2008). Gathering games are found in the rock dove module (predator/prey game), plantain module (medicinal plant game), ant module (scent game), and squirrel module (memory game).

Related to gathering, the practice of exploration is another salient element of outdoor play and experiential learning, encouraged in naturalist, holistic, and eco-education currents of EE (Sauvé, 2005). According to Sobel, "children have an inborn desire to explore local

geographies" (2008, p. 34), and through such exploration, can develop a bioregional sense of place – a key component of nature connection. The importance of exploration is even recognized in the Ontario Children's Outdoor Charter, with a principle stating, "children should have formal and informal opportunities to discover and learn about nature through outdoor play and exploration" (2015, p. 1). While all forms of exploration are highly valuable, E.O. Wilson (2002) believes that special attention should be given to small-scale or microhabitat exploration, such as in soil or a single tree. This is due to the greater accessibility of these spaces, particularly in urban settings, as well as the ability of such habitats to inspire curiosity in children by making seemingly ordinary and known spaces unfamiliar (Wilson, 2002; Haluza-DeLay in Johnson & Catley, 2009).

While exploration has strong merit on its own, one pedagogical strategy designed to enrich exploration is mapping, linking to the humanist/mesological EE current that promotes 'landscape reading' (Sauvé, 2005). Though Sobel believes the prime age for mapping is around nine, he also asserts that children have a "biologically programmed fascination with identifying animals signs, tracking animals, understanding trail and drainage networks, and calculating shortcuts…" (2008, p. 36). In keeping the task as simple as drawing one's surroundings, mapping can encourage children to pay closer attention to the spaces they inhabit, which is a crucial step in developing relations to place (Sobel, 2008). Lesley Curthoys (2007) reiterates this sentiment in the context of mapping with university students, revealing how careful awareness of our surroundings enhances experiences with the natural world. In particular, Curthoys believes mapping can slow students down and help them see how alive as well as relational the world truly is. Curthoys states:

> Transformation from a busy to a mindful state of being moves us away from an abstract, voiceless experience of nature – nature as a mere backdrop for our activities – toward a more thoughtful engagement with a distinct landscape community. (2007, p. 75)

Concerned with fostering strong nature connections, exploration is thus encouraged in the dove, plantain, and squirrel modules (in nonhuman observation activities), as well as in the ant module (nonhuman observation, soil scavenger hunt, and mapping).

4.2 Artistic/Creative Pedagogy: Storytelling, Artwork, and Poetry

Like experiential pedagogy, artistic/creative teaching methods are also considered a key practice in naturalist, holistic, ethnographic, eco-education, and humanist/mesological EE currents (Sauvé, 2005). This form of instruction encourages students to use their imaginations and express emotions in a way that "all[ies] creativity with nature's own" (Sauvé, 2005, p. 13). Sobel (2008) believes such pedagogy can contribute to nature connection, as stimulating children's imaginations through a variety of creative-based media can shift the way a child sees the natural world. It can become a place of magic, mystery, wonder, and love, when children's minds are opened to endless possibilities (Sobel, 2008). One strategy to inspire the use of imagination is through storytelling – a time-honored custom within human culture that is of particular importance when bringing Aboriginal perspectives or 'two-eyed seeing' into curricula (Payne, 2010; McKeon, 2012; Kanu, 2011). According to Kanu (2011), storytelling is a primary method of sharing knowledge in Aboriginal communities, whereby stories are passed on orally from one generation to the next. These stories often involve the personification of nonhuman animals that are present in their lives, and have important lessons on virtues and community values to teach those who can uncover the layers of meaning embedded in each tale (Kanu, 2011). Phillip Payne adds that the practice of storytelling (i.e., creating, performing and listening) is integral to EE in that children are able to make meaning of the places they interact

with, as stories encourage "a 'direct' embodying, sensing and perceiving of wilder, in-between possibilities of that place" (2010, p. 308). Bai et al. similarly relay this unique effect of storytelling stating, "storytelling is not information transmission but consciousness transformation" (2010, p. 361). In other words, it is through the meaning, values, and life experiences coming out of stories that can help inspire biophilia in children, rather than 'disposable' facts (Bai et al., 2010). Within the curriculum modules, storytelling appears in the rock dove module (day-in-the-life story), grey squirrel module (oral stories), and as the opening activity in each module whereby children are invited to share stories of their experiences with nonhuman life.

In addition to storytelling, there is a general call for arts-based pedagogy within EE as a way to provoke emotional responses and subsequent attachment to the natural world (Adams, 1991). For Eileen Adams (1991), this is made possible by sensory experiences guiding the art, in combination with the contemplation and reflection that emerges out of art-based activities. In essence, children are given a creative forum to explore their relationship with nature. According to Adams, one method of facilitating such exploration is through drawing. This medium is thought to "capture the streams of perceptions and reactions that come crowding in" as well as "help pupils see and analyze what might otherwise go unnoticed or unremarked" (Adams, 1991, p. 27). Thus through drawing, a heightened awareness of the natural world, both emotionally and perceptually, can be realized. Artwork is included in the rock dove, plantain and squirrel modules (journaling), as well as in the ant module (journaling and ant nest drawings).

A second arts-based pedagogy important to nature connection is poetry. Like storytelling, Bai et al. (2010) believe that writing poetry in and about the natural world encourages children to be present and to feel in their surroundings, ultimately seeing the world beyond the self. Specifically Bai et al. state:

> When we are moved deeply, when we resonate with the coherence of the world that surrounds us, we become 'unselfed' and *biophilia* bursts open into our being…*Biophilia* only emerges when we can indwell our beingness or be present to the here and now, wherever we are. Not surprisingly, this is the same lesson in poetry-making and moving into a poetic consciousness. (2010, p. 360)

Bai et al. note that such resonation is difficult for adults, but on the contrary, comes easy to children. When given the opportunity to write poetry about the natural world, it is said to 'gush' from children's imaginations, allowing them to express their experience in way that cannot otherwise be verbalized (Bai et al., 2010; Hansen-Møller & Taylor, 1991). Poetry is explicitly included in the consolidation section of the plantain curriculum module, but may also transpire organically in any journaling exercise.

Aside from cultivating child-nature bonds, the inclusion of arts-based pedagogy within the modules also exemplifies the multi-disciplinary nature of EE and the ease at which a variety of subject areas can be taught side-by-side. This is of particular importance in the context of Ontario where, as discussed in Chapter 2, Science and Technology dominates EE curricula, guiding children toward a mechanistic and objective view of nature. Yet in acknowledging EE as multi-disciplinary, educators can break through the science mold by weaving other subject areas such as art into this previously narrow field. The fusion of subjects not only increases the quality of EE taught, but also shows educators that EE does not require extra time in the curriculum since expectations across a variety of disciplines can be integrated in a single lesson. Thus, combining disciplines creates more opportunities for EE to be included in teachings and as a result, increases the ability of children to find a connection with the natural world.

4.3 Sensorial Pedagogy: Sensory Enrichment

As detailed in Chapter 1, children are said to have a restricted ability to engage their senses, as a consequence of being completely immersed in a world crowded with human artifacts (Livingston, 1994). Livingston (1994) believes that this weakened sensory system is what impedes children from bonding to the earth in matrix II of Shepard's nature connection theory. To address this deficiency, sensorial pedagogy – or teaching methods that actively engage senses like sight, smell, touch, taste, and hearing in the environment – is perceived as a crucial component of EE and subsequently nature connection, found in the naturalist, holistic, eco-education, and humanist/mesoligical currents (Sauvé, 2005; Bai, 2009; Payne & Wattchow, 2009). In speaking to the link between sensory enrichment and nature connection Payne and Wattchow precisely state:

> For any pedagogy claiming responsiveness to the ecologically problematic human condition, there needs to be a shift in emphasis from focusing on the "learning mind" to re-engaging the active, perceiving and sensuous corporeality of the body with other bodies (human and more-than human) in making-meaning in, about, and for the various environments and places in which those bodies interact and relate to nature. (2009, p. 16)

For these educators, slowing down pedagogy to resist the rush of everyday life is central to opening students to these lived, sensory-based experiences. Heesoon Bai similarly calls upon educators to help children recover the senses, such that "we see, hear, feel the joy and pain, wonder and despair, in experiencing the earth and all its biotic communities" (2009, p. 136). Bai believes that by engaging the senses, children may start to see the natural world come alive, as a sentient being. In this scenario, kinship with nature need not be facilitated, but is naturally embodied by each child who has, through sensory recovery, undergone a transformation "at the heart of being" (Bai, 2009, p. 145).

Engel (1991) provides one example of this transformative capacity of sensory enrichment, in the context of seven-year old children participating in schoolyard sensory walk. After engaging in visual and auditory exercises, children were then asked to describe their experience. Engel reveals that the children "began to reorient and experience the outside in a more deliberately symbolic, communicative mode" and during the next sensory walk "actively looked, listened and reflected on their own responses and impressions" (1991, p. 44). This seemingly quick shift in perception as a result of sensory enrichment is not uncommon, provided that engaging the senses turns into a habit (Young, Haas, & McGown, 2010). Young et al. (2010) believe that our sensory capabilities can be strengthened with practice, similar to strengthening muscles from continuous exercise. Within the curriculum modules, sensory-based activities are most notably found in the rock dove module (predator/prey game), plantain module (medicinal plant game and guided fantasy), ant module (scent game), and squirrel module (memory game and listening activity).

4.4 Affective Pedagogy: Observation and Interaction

Affective pedagogy that elicits emotional responses to experiences in the natural world is present throughout the curriculum modules in games and art activities, but is especially related to the final 'outdoor exploration' portion of each lesson; observing and interacting with nonhuman life. This latter practice, found in naturalist, holistic, eco-education, and humanist/mesological forms of EE, is a key element of fostering nature connection in children, with two central reasons behind its significance. First, watching and engaging with nonhuman life helps children come to know themselves as a participant in a broader bio-community (Affifi 2011; Fawcett, 2002; Livingston, 1994). In particular, recognizing that we both watch and are being watched by nonhuman species leads to "an expanded view of ourselves as we feel how our size, motion, sounds, and manners may be experienced by those who watch us" (Affifi,

2011, p. 53). Essentially, children come to learn how their presence has an impact on the species sharing their home. As this occurs, it becomes clearer that their lives are inherently and often unknowingly intertwined with nonhuman life. At the same time, observation encourages comparisons between human and nonhuman beings, which provide children with an understanding of what it means to be human in a vastly diverse ecosystem (Fawcett, 2002).

As a child, observing and interacting with nonhuman species may also help develop a sense of kinship among those species – another integral component of nature connection. In a study by Leesa Fawcett (2002), kindergarten children were asked to tell stories about themselves and three common local species after 20 minutes of different contact with the species. The stories told were overwhelmingly rooted in friendship and kinship, where the children played together with the animals, shared meals, and got to know one another through conversation. By contrast, grade 5 students who were asked to tell stories about the same species *without* direct contact with them, told stories characterized by fear, anxiety, and general misunderstanding of the species. This latter response is closer to the norm, as Fawcett reveals that children's contact with 'wild' animals is indeed in decline, replaced by disconnected experiences via television shows and zoos. As a consequence, Fawcett believes that children are restricted from bonding to the natural world in matrix II of Paul Shepard's nature connection theory. The simple remedy is then increasing opportunities to interact with the nonhuman animals in our lives. Choosing four common urban species for the curriculum modules and encouraging emotional encounters that cultivate friendship and belongingness in the natural world directly aligns with this necessity.

4.5 Cognitive Pedagogy: Questioning, Reflecting, and Journaling

In the naturalist, holistic, and humanist/mesological approaches to EE, cognitive pedagogy appears as a teaching mode centered on knowledge acquisition about the

environment (Sauvé, 2005). To inspire nature connection, cognitive learning in these instances must focus less on scientific ways of knowing and instead center on inspiring wonder and curiosity (Fairbanks, 2010; Chiarotto, 2011; Young et al., 2010; Kilburn, 2012). This is largely due to children's natural propensity to ask questions about their environment, which can be drawn upon by educators to make learning in and about the natural world more exciting and meaningful to each child (Chiarotto, 2011; Young et al., 2010). In relation to nature connection, wonder is also considered a practice of 'other-acknowledging' or becoming more aware of nonhuman presences; then linked to developing humility, compassion, and respect toward the natural world (Hepburn, 2000; Hepburn in Butler & Acott, 2007).

One strategy used to foster wonder in education is by facilitating inquiry-based learning. According to Lorraine Chiarotto (2011), inquiry-based learning is a form of student-directed pedagogy centered on questioning, which stimulates curiosity and enhances critical thinking. The role of educators is to simply pose open-ended questions, allowing children's intrinsic interest to guide their learning, and ultimately their relationship with nature (Chiarotto, 2011). Though educators may provide *some* answers, Young et al. (2010) warn that providing *all* of the answers can extinguish the spark of curiosity. The critical point is that children are given the opportunity to discover and explore the natural world as well as their connection to the earth within their own timeframe and in a way that resonates with their innate fascinations. Within the curriculum modules, questioning or inquiry-based learning is applied in virtually every activity, with particular emphasis in the 'indoor introduction' portion of the lessons.

In addition to questioning, inquiry-based learning encourages students to engage in reflection, bringing the critical thinking piece to nature connection pedagogy (Chiarotto, 2011). Martin, Frane, and Zounková (2004) explore the practice of reflection in outdoor education, where they first reveal that every experience in the natural world does not necessarily elicit

transformative learning. This same view is reiterated elsewhere (see Dickenson, 2013), as outdoor activities such as hunting or snowmobiling can in some instances perpetuate a belief of human dominance over nature rather than emotional attachment to nature. For Martin et al., one's perspective may be shifted to the latter by engaging in reflection, as "it is the reflection process that turns the experience into experiential education" (2004, p. 12), through the connection of personal, social and environmental elements of the experience. In the context of secondary school students, Cheung (2012) adds that reflection brings awareness to one's beliefs as well as behaviour patterns, potentially bringing about revelations that inspire changes to one's life. Though the effect may not be as dramatic for elementary school children, practicing reflection at a young age may help children be more conscious and critical of their 'natural' experiences as they move into adolescence. Reflection is included in each curriculum module, as the last activity in the 'consolidation and reflection' portion of the lesson.

The final nature connection pedagogy highlighted is journaling, where students' artwork, stories, observations, and reflections are documented. Considered a staple practice by naturalists, journaling is believed to take tasks such as observation to the next cognitive – and in some instances spiritual – level, helping students in EE "develop a personal and lifelong connection to their local environment" (Hammond, 2005, p. 66). For Hammond, this transpires as journaling encourages students to "slow down and 'see', 'feel', and 'know' what they are experiencing" (1993, p. 172). It challenges students to venture beneath their shallow understandings of the natural world and uncover their own values or beliefs about nature (Hammond, 1993). Thus, journaling not only asks students to pay closer attention to their surroundings but to be inherently critical and reflective of their experiences in the natural world as well as their relationship with nature.

The utility of journaling is then enhanced by its ability to embed such experiences and thoughts into long-term memory. According to Hammond, this occurs from the simple practice of drawing and writing about one's encounters:

> [Children] will never forget the snake they saw, the swamp they waded, the turtle they held, or the thunderstorm they encountered… Once translated into words and illustrations, these experiences are archived in memory for future reinforcement. (2005, p. 66)

In Young et al.'s guide to nature connection, journaling is similarly linked to enhancing one's memory of experiences and is explicitly described as a habit that "stretches and etches all the details a little further into the brain" (2010, p. 64). The aim is to have children remember those special moments in the natural world where an emotional response was evoked and new friendships with nonhuman presences were formed. Should nature connection be cultivated at this young age, journaling may help ensure that such attachment becomes a lifelong, guiding quality in one's life.

Though not an exhaustive list of nature connection pedagogy included in the curriculum modules, the above descriptions show that there is an abundance of ways to cultivate child-nature bonds within existing curricula, even when teaching in a fenced-in, asphalt schoolyard. That said, the lessons can only contribute to such bonds if employed by an educator; one with an open mind, a willingness to try something new, and a readiness to reflect on their own relationship with the natural world. At the same time, these educators must acknowledge that the schoolyard is only one urban habitat among many. Though it is an important starting point, teaching in the schoolyard should be seen as a stepping-stone to eventually reaching beyond the fence and exploring local spaces like ravines, ponds, or a forested park. In these spaces, children will be introduced to different nonhuman presences sharing their home, which opens

the door for further curricula design on diverse urban species whilst promoting deeper child-nature connections. Once again, this can only be possible through the commitment of individual elementary school teachers, as they decide how to nurture the next generation of human beings. Taking students outside and choosing pedagogy for nature connection is one way of advocating for a different, healthier future; a future where humans realize kinship with nonhumans, have ample experiential and sensorial nutrition, and feel a sense of belongingness in the universe.

CONCLUSION

Addressing the disconnect between humans and the natural world is a task that can no longer be ignored, as it is an integral factor in the environmental crisis that will mark the 21st century. Though existing in Ontario at variety of social, demographic and geographic scales, this disconnect has a strong grip on those living in urban habitats where humans and nature are often perceived in opposition. Children in this setting are particularly vulnerable to embracing this harmful perspective, as they look to adults for guidance on how one should interact with the natural world, only to see dominance, disrespect, and disconnection. With these beliefs entrenched in one's being, the cycle of tension continues since each choice that child makes is then grounded in a toxic, anthropocentric worldview. Yet it is not in the hands of children to make changes that can move us toward a healthier sustainable future. Instead, it is up to adults to mentor children and show them the inseparability of humans and nature, the incredible nonhuman allies sharing our home, and the enrichment of human lives in cultivating an emotional bond with the natural world. These teachings are imperative for children at the elementary level of schooling, as this is a time in their life when the brain is highly capable of accepting new information that in turn becomes embedded in one's psyche. In addition, these years of childhood mark the transitioning from a bond with one's mother to potentially bonding with nonhuman beings or the Earth as a whole. In other words, these are the years in which lifelong nature connection can be nurtured, with benefits ranging from the spiritual (i.e., reaching self-fulfillment) to the physical (i.e., heightened sensory awareness).

While there is hope for such change, we have seen in the preceding pages that many Ontario children in their elementary years of schooling are rarely exposed to teachings that cultivate nature connection. This is despite the Ministry of Education's recent integration of EE in existing curricula. One reason for this continuing limitation is Ontario's narrow

anthropocentric approach to EE, which focuses on scientific, resourcist, and sustainable development teachings based on a belief of human superiority over nature. Adding to this is the lack of EE training in pre-service programs, along with perceived barriers of having no time, resources, or a 'naturalized' space to facilitate EE. Organizations such as Ontario EcoSchools are attempting to remedy these barriers and challenge existing worldviews, but there remains a large focus on cognitive pedagogy or rather cultivating ecological literacy over child-nature bonds. That said, Ontario EcoSchools is also confronting shallow EE teachings by supporting projects which aim to deepen the existing policy framework by helping children see and feel the natural world in a more wondrous, revered light.

It is in this spirit that I partnered with Ontario EcoSchools and designed the 'Nearby Nature Study' mini-unit for their online curriculum resource library. 'Nearby Nature Study' speaks to an alternative attitude of EE, drawing upon pedagogy from naturalist, holistic, ethnographic, humanist, and eco-education approaches to the field of study. In particular, the four curriculum modules within the mini-unit center on cultivating child-nature connections in an urban setting, via outdoor learning activities that emphasize common nonhuman beings often overlooked in cityscapes. These lessons are intended to expand children's views and emotionally animate their connection with the habitat in which they live through a combination of experiential, artistic, sensorial, affective, and cognitive instruction. In paying heed to barriers of teaching EE in elementary schools, each lesson is also low cost, has detailed instructions for educators inexperienced in EE, is designed to take place in a schoolyard, and links to a variety of existing curriculum expectations, namely from the Arts, Language, and Science and Technology. These lessons will be available for free on the Ontario EcoSchools website upon receiving a final assessment and approval by Ontario EcoSchools.

Regardless of the barriers addressed and the pedagogy employed, the outcomes of such a project are difficult to predict. For instance, there is no guarantee that every child will come away with a greater connection with nature upon completion of the mini-unit. To start, cultivating nature connection is a slow process. It requires recurrent experience and reflection within the natural world, and thus, the lessons within the mini-unit are merely a starting point to including EE more consistently throughout the school year as well as venturing outside the schoolyard for further outdoor experience. Yet nature connection may still not transpire, as each child will come into the lessons with preconceived notions of nature related to their social or cultural backgrounds, which may influence their ability to open themselves to an alternative way of being. This issue is magnified when parental figures are unsupportive of the teachings and suppress new feelings of nature connection in home life.

A second limitation of this project is that educators simply may not use the curriculum modules in their teachings. Despite efforts to make the lessons clear and accessible, educators with no experience in EE may still find the lessons overwhelming. Without policy mechanisms to require the integration of EE in lessons, teachers may not seek out resources that attempt to cultivate child-nature bonds. At the same time, Ontario elementary school educators still face a variety of barriers to teaching EE that were not addressed in the mini-unit. This includes a lack of support from administration due to EE's focus on affective learning over core academic achievement. Part of this challenge is the inherent difficulty in assessing nature connection, as it is not a concept that can be quantified, nor should be. Thus, convincing administration that an untestable subject should take priority in a school system based on testing student's knowledge and understanding is a significant barrier to the widespread engagement of EE by Ontario educators. As previously mentioned, it is largely up to these individual educators to determine

how EE can work within their teachings and within their schools: an undertaking that can require substantial time and dedication.

A final limitation of this project is related to the choice of species in each curriculum module (i.e., rock doves, broadleaf plantain, pavement ants, and eastern grey squirrels). These species are largely restricted to the southern portion of Ontario, with the exception of plantain, and are most commonly found in urban spaces. This means many rural educators and virtually all northern Ontario educators may not find the mini-unit relevant to their community context. This issue was considered at the onset of the project, as the original curricula design was planned for urban, rural and northern Ontario habitats. However, creating a mini-unit for each of the habitats was not feasible within the allotted timeframe to the complete this project. As a result, the urban habitat was chosen since urban areas are often marginalized in EE resources, particularly those with an outdoor teaching component. That said, all of the modules could be adapted to a rural or northern Ontario species. For example, the grey squirrel module could be changed to a red squirrel module or the rock dove module may be adapted to a crow module. One recommendation is that future projects explore these adaptations as well as develop additional resources on species commonly present in rural and northern Ontario communities.

A second recommendation for enriching the project is for Ontario EcoSchools to create a webinar or in-person professional development session on connecting children with nature. This would complement existing professional development offered by Ontario EcoSchools including 'Inquiry-Based Learning' and 'School Gardens' webinars that focus on outdoor teaching and learning (Ontario EcoSchools, 2015d). Important features of the session may include a definition of nature connection along with teaching strategies to nurture child-nature bonds, as a way to address minimal knowledge on this topic in Ontario schools. The 'Nearby Nature Study' mini-unit could be used as an example of how nature connection can be

cultivated whilst curriculum expectations are simultaneously met. If the sessions were in-person, this would also provide an opportunity for educators to ask questions about the modules and even engage in certain activities to be shown the intended facilitation. This in turn may help ensure the modules are put to use, thereby increasing the potential for nature connection pedagogy to find its way into Ontario elementary schools.

Until the Ontario Ministry of Education adopts a deeper version of EE, one rooted in a holistic rather than anthropocentric way of being, it remains in the hands of individual educators to challenge human-nature relations in elementary schooling. This might begin by seeking accessible EE resources like those found on the Ontario EcoSchools website and deciding how these resources will fit in their specific school context. From there educators can engage the EE lessons in the schoolyard, becoming a mentor for nature connection not just for their students, but for the broader school community as well. With respect to the latter, it may be the case that when one educator facilitates meaningful EE, others may follow suit upon witnessing the barriers to teaching EE overcome. The next step for such educators is then venturing beyond the schoolyard and into local habitats, to further enrich students' connection with nature. In these spaces, children come to learn how vibrant their ecological home is and that there are extraordinary beings all around them, inherently intertwined in each of their lives.

This knowledge and experience gained through EE can truly inspire deep transformations within a child. In David Jardine's words, "I *become* someone through what I know" (1998, p. 94). In essence, EE sets children on a transformative journey that can open them to the language of the natural world and shift one's own presence in nature. For Jardine:

> This little lesson may be the great gift that environmental education can offer to education as a whole. Coming to know, whatever the discipline, whatever the topic or topography, is never just a matter of learning the ways of a place but learning how to

> carry oneself in such a way that the ways of this place might show themselves. Education, perhaps, involves the invitation of children into such living ways. (1998, p 94)

In this passage, Jardine reminds us to look inward when exploring human-nature relations, but also that nature or rather this place Earth, is our ultimate teacher. That said, it is through the work of dedicated educators and organizations like Ontario EcoSchools that give children the opportunity to reflect on one's identity and learn from the natural world. In providing such opportunities through thoughtful EE, Ontario children are then able to experience the joy and wonder of the world around them, to feel connected to something greater than themselves, and to love nature.

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APPENDICES

APPENDIX A: Summary of Biophilia Expressions

Source: Kellert, 1993b, p. 59

Term	Definition	Function
Utilitarian	Practical and material exploitation of nature	Physical sustenance/security
Naturalistic	Satisfaction with direct experience/contact with nature	Curiosity, outdoor skills, mental/physical development
Ecologistic-Scientific	Systematic study of structure, function, and relationship in nature	Knowledge, understanding, observational skills
Aesthetic	Physical appeal and beauty of nature	Inspiration, harmony, peace, security
Symbolic	Use of nature for metaphorical expression, language, expressive thought	Communication, mental development
Humanistic	Strong affection, emotional attachment, "love" for nature	Group bonding, sharing, cooperation, companionship
Moralistic	Strong affinity, spiritual reverence, ethical concern for nature	Order and meaning in life, kinship and affiliation ties
Dominionistic	Mastery, physical control, dominance of nature	Mechanical skills, physical prowess, ability to subdue
Negativistic	Fear, aversion, alienation from nature	Security, protection, safety

APPENDIX B: Currents of Environmental Education

Source: Sauvé, 2005, p. 33-34

Current	Conception of Environment	Aims of Environmental Education	Dominant Approaches	Examples of Strategies
Naturalist	Nature	Reconstruct a link with nature.	Sensorial, Cognitive, Affective, Experiential, Creative/Aesthetic	Immersion; interpretation; Sensorial games; Discovery activities.
Conservationist/ Resourcist	Resource	Adopt behaviours compatible with conservation. Develop skills related to environmental management.	Cognitive, Pragmatic	Guide or code of behaviours; 3 Rs set of activities; Environmental audit; Conservation project.
Problem-solving	Problem	Develop problem-solving skills: from diagnosis to action.	Cognitive, Pragmatic	Case study: issue analysis; Problem-solving project.
Systemic	System	Develop systemic thinking: analysis and sythesis, toward a global vision. Understand environmental realities in view of enlightened decision-making.	Cognitive	Case study: environmental system analysis; Construction of ecosystem models.
Scientific	Object of study	Acquire knowledge in environmental sciences. Develop skills related to the scientific method.	Cognitive, Experiential	Study of phenomena; Observation; Demonstration; Experimentation: Hypothetico-deductive research activity.
Humanistic/ Mesological	Living Milieu	Know and apreciate one's milieu of life; better know oneself in relation to this living milieu. Develop a sense of belonging.	Sensorial, Affective, Cognitive, Experiential, Creative/Aesthetic	Itinerary; Landscape reading; Study of milieu; investigation.
Value-centred	Field of values	Adopt ecocivic behaviours. Develop a system of ethics.	Cognitive, Affective, Moral	Analysis of values; Clarification of values; Criticism of social values.
Holistic	*Holos*, *Gaïa*, All, The Being	Develop the many dimensions of one's being in interaction with all aspects of the environment. Develop an "organic" understanding of the world and participatory action in and with the environment.	Holistic, Organic, Intuitive, Creative	Free exploration; visualization; Creative workshops; Integration of complementary strategies.

Current	Conception of Environment	Aims of Environmental Education	Dominant Approaches	Examples of Strategies
Bioregionalist	Place of belonging, Community project	Develop competencies in/for local or regional community ecodevelopment.	Cognitive, Affective, Experiential, Pragmatic, Creative	Exploration of our shared milieu; Community project; Project of local or regional ecodevelopment.
Praxic	Locus of action/reflection	Learn in, by, and for environmental action. Develop reflexive skills.	Praxic	Action-research; Reflexive posture in activities or project.
Socially Critical	Object of transformation, Place of emancipation	Deconstruct socio-environmental realities in view of transforming them and transforming people in this process.	Praxic, Reflexive, Dialogic	Analysis of discourses; Case study, Debate, Action-research.
Feminist	Object of solicitude	Integrate feminist values into the human-environment relationship.	Intuitive, Affective, Symbolic, Spiritual, Creative/Aesthetic	Case study, Immersion, Creative workshop, Communication & exchange activity.
Ethnographic	Territory, Place of identity, Nature/culture	Recognize the close link between nature and culture. Clarify one's own cosmology. Valorize the cultural dimension of one's relationship with the environment.	Experiential, intuitive, Affective, Symbolic, Spiritual, Creative/Aesthetic	Fables, Stories and legends; Case study; Immersion; Modelling; Mentoring.
Eco-Education	Role of interacation for personal development, Locus of identity construction	Experience the environment to experience oneself and to develop in and through it. Construct one's relationship with the "other-than-human world".	Experiential, Sensorial, Intuitive, Affective, Symbolic, Creative	Life story; Immersion; Exploration; Games; Introspection; Sensitive listening; Subjective/objective *alternance*.
Sustainable Development/ Sustainability	Resource for economic development, Shared resource for sustainable living	Promote economic development that takes care of social equity and ecological sustainability; Contribute to such development.	Pragmatic, Cognitive	Case study; Social marketing; Sustainable consumption activities; Sustainable living management project.

APPENDIX C: Standards for Environmental Education in Ontario Curricula

Source: Ontario Ministry of Education, 2008, p. 2

THEMES	STANDARDS	RELATED CONCEPTS
COMMUNITY	The curriculum provides students with opportunities to: • engage in authentic learning situations and interactions in their local environment (e.g., natural, built, cultural); • explore and appreciate the outdoors, to help develop their understanding of the local environment; • develop and communicate a sense of connection with the local and global environments; • demonstrate environmental stewardship by thinking globally and acting locally.	✓ Sense of connection ✓ Responsible citizenship ✓ Sense of place ✓ Sense of local and global citizenship
KNOWLEDGE	The curriculum provides students with opportunities to: • study a variety of human and natural systems at the local, regional, and global levels; • develop a general understanding of the kinds of interactions that occur within and between human and natural systems; • understand the concept of sustainability and the behaviours, practices, and approaches that promote sustainability in various areas of human activity.	✓ Human and natural systems ✓ Interactions within and between systems ✓ Sustainability
PERSPECTIVES	The curriculum provides students with opportunities to: • consider different points of view or perspectives (e.g., historical, economic, political, Aboriginal, cultural, technological) on the environment and the role of human beings in relation to it; • examine and explain the assumptions and motivations underlying their own and others' (e.g., other individuals', NGOs', governments', other countries') actions and reactions with respect to environmental issues or concerns; • develop and articulate their own perspective on human–natural interactions and environmental issues.	✓ Consideration of diverse points of view ✓ Critical thinking and evaluation ✓ Formation of an opinion
ACTION	The curriculum provides students with opportunities to: • develop skills in problem solving, inquiry and research, decision making, and action planning; • contribute to the protection, conservation, and remediation of the environment; • develop, communicate, and implement plans to support sustainability.	✓ Skills and practices ✓ Protection ✓ Innovation ✓ Conservation ✓ Remediation

APPENDIX D: Knowledge, Skills and Attitudes of Environmental Education in Ontario Schools

Source: Ontario Ministry of Education, 2009, p. 26

KNOWLEDGE

Environmental education should enable students to learn about:

- the resources of the Earth, particularly soil, water, minerals, and air, their characteristics, and their role in supporting living organisms;
- the nature of ecosystems and biomes, their health, and their interdependence within the biosphere;
- the dependence of humans on environmental resources for life and sustenance;
- the characteristics of human societies, including nomadic, hunter-gatherer, agricultural, industrial, and post-industrial, and the impact of each on the natural environment;
- the role of science and technology in the development of societies and the impact of different technologies on the environment;
- the process of urbanization and the implications of deruralization;
- the interconnectedness of political, economic, environmental, and social issues in the present world;
- cooperative national and international efforts to find solutions to common environmental issues and to implement strategies for a more sustainable future.

SKILLS

Environmental education should enable students to:

- define such fundamental concepts as environment, community, development, and technology, and apply these definitions in local, national, and global contexts;
- use a range of resources, communications skills, and technologies in addressing environmental questions;
- develop problem-solving skills and critical and creative thinking skills, including the ability to reason and apply logic, to recognize and apply abstract patterns, to identify connections and relationships between ideas and issues, and to test ideas against new information and against personal experience and beliefs;
- work towards a negotiated consensus when there are differences of opinion;
- detect and assess bias and evaluate different points of view;
- recognize the need to incorporate an environmental perspective in decision-making models.

ATTITUDES

Environmental education should enable students to:

- appreciate the resilience, fragility, and beauty of nature and develop respect for the place and function of all living things in the overall planetary ecosystem;
- appreciate that human life depends on the resources of a finite planet;
- appreciate the role of human ingenuity and individual creativity in ensuring survival and achieving sustainable progress;
- become mindful of perspectives other than their own and be prepared to modify their ideas and beliefs when appropriate (e.g., understand and respect First Nation, Métis, and Inuit concepts of knowledge);
- appreciate the challenges faced by the human community in defining and implementing the processes needed for environmental sustainability;
- develop a sense of balance in decisions that involve conflicting priorities;
- maintain a sense of hope and a positive perspective on the future.

APPENDIX E: Explanation of 'Expectations' in Ontario Curricula

Modified from: Ontario Ministry of Education, 2013, p. 20

Example: Grade 1 Social Studies

Expectations in each subject area are organized into *strands,* labeled A, B, C, D, etc.

Overall expectations describe in general terms the knowledge and skills students are expected to demonstrate by the end of each grade. The numbering of overall expectations indicates the strand to which they belong (i.e., B1 through B3 are the overall expectations for strand B).

Grade 1

B. PEOPLE AND ENVIRONMENTS: THE LOCAL COMMUNITY

OVERALL EXPECTATIONS

By the end of Grade 1, students will:

B1. **Application:** describe some aspects of the interrelationship between people and the natural and built features of their community, with a focus on how the features of and services in the community meet people's needs (**FOCUS ON:** *Interrelationships*)

B2. **Inquiry:** use the social studies inquiry process to investigate some aspects of the interrelationship between people and different natural and built features of their local community, with a focus on significant short- and long-term effects of this interrelationship (**FOCUS ON:** *Cause and Consequence*)

B3. **Understanding Context:** describe significant aspects of their community, with reference to different areas, services, and natural and built features, demonstrating an understanding of some basic ways of describing location and measuring distance (**FOCUS ON:** *Significance; Patterns and Trends*)

SPECIFIC EXPECTATIONS

B1. Application: Interrelationships within the Community

FOCUS ON: *Interrelationships*

By the end of Grade 1, students will:

B1.1 describe some of the ways in which people make use of natural and built features of, and human services in, the local community to meet their needs, and what might happen if these features/services did not exist

Sample questions: "Where does your family go to buy food? What might happen if the store (farmers' market, farm) were no longer there?" "Who uses the local park? Why do they use it? Is there anywhere else these activities could take place if the park weren't there?" "How would you feel if the playground were torn down?"

Student talk: "I like playing on the swings. I would be sad if they were not there. The other park is far away, so I wouldn't be able to go there much."

B1.2 identify some services and service-related occupations in their community (*e.g., occupations such as sanitation worker, store clerk, restaurant server, repair person; services provided by the post office, the band office, the water treatment plant, grocery stores, gas stations*), and describe how they meet people's needs, including their own needs

Student talk: "We put leaves out in bags in the fall. In the spring we get compost that is made from leaves and old food. We put it in the garden to help things grow."

B1.3 create a plan that outlines some specific ways in which they can responsibly interact with the built and/or natural environment in the local community (*e.g., map out the location of garbage and recycling cans in parks so they can properly dispose of their waste; help plan a garden at home, composting in the school, or other ways of reducing their environmental footprint; plan ways to participate in clean-up days*), and describe how their actions might enhance the features of the local environment

Specific expectations describe the expected knowledge and skills in greater detail. The expectation number identifies the overall expectation to which it relates (i.e., B1.1 relates to the overall expectation B1).

The *examples* help to clarify the requirement specified in the expectations and to suggest its intended depth and level of complexity. The examples are illustrations only, not requirements. They appear in parenthesis and are set in italics.

APPENDIX F: Bachelor of Education Courses Related to the Environment in Universities Accredited by the Ontario College of Teachers

University	Course Title	Course Description	Source
Brock University	Environmental/ Outdoor Education	This course explores the main currents of environmental education, focusing on **environmental education** policy, curriculum, teaching methods, and learning theories. Striking a balance between theory and practice, the course features a mix of in-class and field trip experiences, including visits to local nature sites and other venues. The course focuses on educating "in, for and about" the environment and will help teacher candidates to become future school ambassadors who promote an environmental ethic of care in their teaching.	www.brocku.ca/education/currentstudents/consecutiveconcurrentfinalyear/optionalcourses#8Y15
Lakehead University	Curriculum and Instruction in Outdoor, Ecological, and Experiential Education	This course will examine the knowledge, skills and values necessary to develop and implement outdoor education programs in school programs and in programs outside regular schooling for students at the Intermediate-Senior level as specified in the Ministry of Education and Training Documents. *Open to intermediate/senior candidates in Environmental Science only	http://navigator.lakeheadu.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&topicgroupid=9651&entitytype=CID&entitycode=Education+4284
Nipissing University	Outdoor and Experiential Education	This is a course where pre-service teachers will participate in experiential based activities in an outdoor setting. Through integrating curriculum (grade K-10) and interdisciplinary studies (grade 11-12), the participants will examine the knowledge, skills and values necessary to develop and implement outdoor education programs. Pre-service teachers in this option course will be involved in planning, teaching and evaluating outdoor education activities. They will spend a minimum of two weekends in an outdoor environment, have classroom instruction and participate in reflective online discussions.	http://www.nipissingu.ca/calendar/Pages/Course.aspx?CourseName=EDUC-4916
	Outdoor Experiential Education	This one session course is intended for educators interested in extending and applying knowledge, skills and practices in the design, implementation and assessment of the curriculum. This course will focus on the analysis and implementation of Ministry of Education curriculum documents, Ministry publications and school board policies. An examination of the philosophy of outdoor education; essential concepts of outdoor education as found in science, geography, and social studies; a development of units of study; methods and skills involved in conducting outdoor experiential education studies and classroom follow-up. A blend of theoretical understandings with practical applications rooted in the Ethical Standards and Standards of Practice for the Teaching Profession will be the underpinning throughout the course.	http://www.nipissingu.ca/calendar/Pages/Course.aspx?CourseName=EDUC-4205

University	Course Title	Course Description	Source
Queen's University	Educational Uses of the Environment	This two-part course is available only to teacher candidates registered in the OEE program track. Part 1 is a five-day field trip orienting candidates to methods and principles of adventure activities, **environmental education** and skill acquisition. Solos in wilderness settings may be included in Part 1. Part 2 is a three-week Practitioner's Workshop (two-week experiential internship and one-week intensive follow-up.) Participation in a traditional winter camping practicum as part of this workshop is possible for OEE candidates. Parts of both components occur in outdoor and off-campus settings. *Outdoor and Experiential Education candidates only	http://queensu.ca/calendars/education/Educational_Studies__EDST_.html
	Principles and Programs in Experiential Education	A study of the theories of experience-based education as derived from the literature and tested analyses of experiential practices and programs. A pedagogical understanding of both the theory and practice of designing innovative outdoor programs is explored through project work involving the ideas of ecological literacy. Emphasis is placed upon integrated subject matter. Also considered are the development, organization, operation and evaluation skills required to lead experiential-based programs in school systems. Sessions vary in length to provide for a mix of activities within the normal duration of a half course. *Outdoor and Experiential Education candidates only	
	Outdoor and Experiential Education	Prepares candidates for leading dynamic school and community based outdoor education as found in a variety of environmental contexts in all teaching subjects. Also considered are alternative experiential settings including museums, adventure programming, integrated learning, rehabilitation for special populations, expeditionary learning, alternative education, local project-based learning, and **environmental education**. *Outdoor and Experiential Education candidates only	http://www.queensu.ca/calendars/education/Program_Focus__FOCI_.html
Trent University	Indigenous and Environmental Education	Examines current issues, theories, and practices of Indigenous and **environmental education** as they pertain to the learning environment for K-12 classrooms. Students examine and critically assess these issues, theories, and pedagogies as they develop personal philosophies related to their own teaching and learning. *Only open to students in year 2 of the BEd program	http://www.trentu.ca/calendar/documents/TrentCalendar2015_MayFINAL.pdf
University of Ontario Institute of Technology	Environmental Education	In this course, students will have opportunities to develop critical skills for implementing **environmental education** in the Ontario context. The course will employ a project-based approach, enabling participants to develop resources for infusing Environmental Education in academic, professional, and everyday lives. Students are expected to complete readings, reflections and research tasks; participate in individual and group learning activities; and complete projects and demonstrate knowledge, understanding, and application of environmental content and issues. Activities will include digital technology- based learning (blogs, discussion boards), field studies (outdoor/experiential learning) and traditional (Aboriginal) environmental knowledge.	https://shared.uoit.ca/shared/department/registrar/current-students/documents/2014-2015%20Undergraduate%20Academic%20Calendar%20and%20Course%20Catalogue%20print%20version%20June%203%202014.pdf
	Outdoor Education	Canoe Tripping, Backpacking, Winter Adventure, Bush Snowshoeing and Tenting	

University	Course Title	Course Description	Source
University of Windsor	Ecology and Wellness: Environmental Education for 21st Century Ecological Stewardship	Ecology and Wellness will engage Teacher Candidates in the study of environmental issues, concepts and **environmental education** pedagogy. Teacher Candidates will have opportunities to explore and investigate environmental issues at various spatial scales---local, provincial, national and global. The course will provide opportunities for Teacher Candidates to critically reflect on key environmental concepts including conservation, preservation, sustainability, stewardship, ecology, environmental justice, and sustainable development. It will also expose Teacher Candidates to pedagogies, resources, experiences and activities for teaching environmental education. The course is conceptualized as a unique blend of traditional classroom and field experiences and will provide learners with opportunities to be involved in the Eco-Schools Project and other environmental education programs during their in---school experiences.	http://www1.uwindsor.ca/education/current/ecology-and-wellness-environmental-education-for-21st-century-ecological-stewardship
Wilfred Laurier University	Outdoor and Environmental Education	This elective course provides TECs (Teacher Education Candidates) with the knowledge and skills to implement an integrated school-based Outdoor and **Environmental Education** program. Various approaches to outdoor and environmental education, current theories and practices will be explored.	http://legacy.wlu.ca/calendars/course.php?c=35890&cal=1&d=1354&s=645&y=61
York University	Educating for a Sustainable Future: A Multidisciplinary Approach	This course provides an introduction to the theory and practice of education for sustainability. It traces the approach from its origins in outdoor and **environmental education** to its contemporary expression as an interdisciplinary approach that explores the relation between education and social, economic, and environmental issues.	https://w2prod.sis.yorku.ca/Apps/WebObjects/cdm.woa/14/wo/J9pQRxOKMh9b28XcqKCAXM/6.1.10.8.3.11.0.5

APPENDIX G: Specific Expectations Covered in Curriculum Modules

Grade	Curriculum Document	Strand	Specific Expectation (examples excluded)
1	Language (2006)	Oral Communication	2.2 demonstrate an understanding of appropriate speaking behaviour in a few different situations, including paired sharing and small- and large group discussions
			2.3 communicate ideas and information orally in a clear, coherent manner
			2.4 choose appropriate words to communicate their meaning accurately and engage the interest of their audience
			2.5 begin to identify some vocal effects, including tone, pace, pitch, and volume, and use them appropriately to help communicate their meaning
			2.6 identify some non-verbal cues, including facial expression, gestures, and eye contact, and use them in oral communications, appropriately and with sensitivity towards cultural differences, to help convey their meaning
			2.7 use one or more appropriate visual aids to support or enhance oral presentations
		Writing	1.2 generate ideas about a potential topic, using a variety of strategies and resources
			1.3 gather information to support ideas for writing in a variety of ways and/or from a variety of sources
			1.4 sort ideas and information for their writing in a variety of ways, with support and direction
			1.5 identify and order main ideas and supporting details, initially with support and direction, using simple graphic organizers
			2.1 write short texts using a few simple forms
			2.2 begin to establish a personal voice in their writing by using pictures and words that convey their attitude or feeling towards the subject or audience
			2.3 use familiar words and phrases to convey a clear meaning
			2.4 write simple but complete sentences that make sense
			2.5 begin to identify, with support and direction, their point of view and one possible different point of view about the topic
	Science and Technology (2007)	Understanding Life Systems: Needs and Characteristics of Living Things	2.2 investigate and compare the basic needs of humans and other living things, including the need for air, water, food, warmth, and space, using a variety of methods and resources
			2.3 investigate and compare the physical characteristics of a variety of plants and animals, including humans
			2.4 investigate the physical characteristics of plants and explain how they help the plant meet its basic needs using a variety of methods and resources
			2.5 investigate characteristics of parts of the human body, including the five sense organs, and explain how those characteristics help humans meet their needs and explore the world around them using a variety of methods and resources
			2.6 use appropriate science and technology vocabulary, including investigation, explore, needs, space, and food, in oral and written communication
			2.7 use a variety of forms to communicate with different audiences and for a variety of purposes
			3.2 identify the physical characteristics of a variety of plants and animals
			3.3 identify the location and function of major parts of the human body, including sense organs
			3.5 describe how showing care and respect for all living things helps to maintain a healthy environment
			3.6 identify what living things provide for other living things

Grade	Curriculum Document	Strand	Specific Expectation (examples excluded)
1	The Arts (2009)	Visual Arts	D1.1 create two- and three-dimensional works of art that express feelings and ideas inspired by personal experiences
			D1.2 demonstrate an understanding of composition, using principles of design to create narrative art works or art works on a theme or topic
			D1.3 use elements of design in art works to communicate ideas, messages, and personal understandings
2	Language (2006)	Oral Communication	2.2 demonstrate an understanding of appropriate speaking behaviour in a variety of situations, including paired sharing and small- and large-group discussions
			2.3 communicate ideas, opinions, and information orally in a clear, coherent manner using simple but appropriate organizational patterns
			2.4 choose a variety of appropriate words and phrases to communicate their meaning accurately and engage the interest of their audience
			2.5 identify some vocal effects, including tone, pace, pitch, and volume, and use them appropriately, and with sensitivity towards cultural differences, to help communicate their meaning
			2.6 identify some non-verbal cues, including facial expression, gestures, and eye contact, and use them in oral communications, appropriately and with sensitivity towards cultural differences, to help convey their meaning
			2.7 use a few different visual aids to support or enhance oral presentations
		Writing	1.2 generate ideas about a potential topic, using a variety of strategies and resources
			1.3 gather information to support ideas for writing in a variety of ways and/or from a variety of sources
			1.4 sort ideas and information for their writing in a variety of ways, with support and direction
			1.5 identify and order main ideas and supporting details, using graphic organizers and organizational patterns
			2.1 write short texts using several simple forms
			2.2 establish a personal voice in their writing, with a focus on using familiar words that convey their attitude or feeling towards the subject or audience
			2.3 use familiar words and phrases to communicate relevant details
			2.4 use a variety of sentence types
			2.5 identify, initially with support and direction, their point of view and one or more possible different points of view about the topic
	Science and Technology (2007)	Understanding Life Systems: Growth and Changes in Animals	2.2 observe and compare the physical characteristics and the behavioural characteristics of a variety of animals, including insects, using student-generated questions and a variety of methods and resources
			2.3 investigate the life cycle of a variety of animals using a variety of methods and resources
			2.5 investigate the ways in which a variety of animals adapt to their environment and/or to changes in their environment, using various methods
			2.7 use appropriate science and technology vocabulary, including life cycle, migration, adaptation, body coverings, and classify, in oral and written communication
			2.8 use a variety of forms to communicate with different audiences and for a variety of purposes
			3.1 identify and describe major physical characteristics of different types of animals
			3.2 describe an adaptation as a characteristic body part, shape, or behaviour that helps a plant or animal survive in its environment
			3.3 identify ways in which animals are helpful to, and ways in which they meet the needs of, living things, including humans, to explain why humans should protect animals and the places where they live

Grade	Curriculum Document	Strand	Specific Expectation (examples excluded)
2	The Arts (2009)	Visual Arts	D1.1 create two- and three-dimensional works of art that express feelings and ideas inspired by activities in their community or observations of nature
			D1.2 demonstrate an understanding of composition, using principles of design to create narrative art works or art works on a theme or topic
			D1.3 use elements of design in art works to communicate ideas, messages, and understandings
3	Language (2006)	Oral Communication	2.2 demonstrate an understanding of appropriate speaking behaviour in a variety of situations, including small and large-group discussions
			2.3 communicate orally in a clear, coherent manner, presenting ideas, opinions, and information in a logical sequence
			2.4 choose a variety of appropriate words and phrases, including descriptive words and some technical vocabulary, and a few elements of style, to communicate their meaning accurately and engage the interest of their audience
			2.5 identify some vocal effects, including tone, pace, pitch, and volume, and use them appropriately, and with sensitivity towards cultural differences, to help communicate their meaning
			2.6 identify some non-verbal cues, including facial expression, gestures, and eye contact, and use them in oral communications, appropriately and with sensitivity towards cultural differences, to help convey their meaning
		Writing	1.2 generate ideas about a potential topic, using a variety of strategies and resources
			1.3 gather information to support ideas for writing in a variety of ways and/or from a variety of sources
			1.4 sort ideas and information for their writing in a variety of ways
			1.5 identify and order main ideas and supporting details into units that could be used to develop a short, simple paragraph, using graphic organizers
			2.1 write short texts using a variety of forms
			2.2 establish a personal voice in their writing, with a focus on using concrete words and images to convey their attitude or feeling towards the subject or audience
			2.3 use words and phrases that will help convey their meaning as specifically as possible
			2.4 vary sentence structures and maintain continuity by using joining words to combine simple sentences and using words that indicate time and sequence to link sentences
	Science and Technology (2007)	Understanding Life Systems: Growth and Changes in Plants	1.1 assess ways in which plants are important to humans and other living things, taking different points of view into consideration and suggest ways in which humans can protect plants
			2.2 observe and compare the parts of a variety of plants
			2.6 use appropriate science and technology vocabulary, including stem, leaf, root, pistil, stamen, flower, adaptation, and germination, in oral and written communication
			2.7 use a variety of forms to communicate with different audiences and for a variety of purposes
			3.1 describe the basic needs of plants, including air, water, light, warmth, and space
			3.2 identify the major parts of plants, including root, stem, flower, stamen, pistil, leaf, seed, and fruit, and describe how each contributes to the plant's survival within the plant's environment
			3.3 describe the changes that different plants undergo in their life cycles
			3.5 describe ways in which humans from various cultures, including Aboriginal people, use plants for food, shelter, medicine, and clothing
			3.6 describe ways in which plants and animals depend on each other

Grade	Curriculum Document	Strand	Specific Expectation (examples excluded)
3	Science and Technology (2007)	Understanding Life Systems: Soils in the Environment	2.2 investigate the components of soil, the condition of soil, and additives found in soil using a variety of soil samples from different local environments, and explain how the different amounts of these components in a soil sample determine how the soil can be used
			2.6 use a variety of forms to communicate with different audiences and for a variety of purposes
			3.3 describe the interdependence between the living and non-living things that make up soil
			3.4 describe ways in which the components of various soils enable the soil to provide shelter/homes and/or nutrients for different kinds of living things
	The Arts (2009)	Visual Arts	D1.1 create two- and three-dimensional works of art that express personal feelings and ideas inspired by the environment or that have the community as their subject
			D1.2 demonstrate an understanding of composition, using principles of design to create narrative art works or art works on a theme or topic
			D1.3 use elements of design in art works to communicate ideas, messages, and understandings

APPENDIX H: Nature Connection Pedagogy Linked to Specific Curricula Activities