Relational Ecology in Urban Greenspaces:

Creating a Design Tool for Biodiversity Programs and Events



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Dedication

I dedicate this work to my husband and parents for their constant encouragement, understanding, and support throughout my graduate degree and this capstone project. Luke was particularly supportive during the early stages of the work when I was first brainstorming my hopes and dreams for this research. Thank you, and I love you, Luke!

Acknowledgments

I acknowledge the lək̓ʷəŋən-speaking Peoples (Songhees and Esquimalt/Kosapsum) on whose territory the Nature Sanctuary stands, and the lək̓ʷəŋən-speaking and W̱SÁNEĆ Peoples — including the W̱JOŁEŁP (Tsartlip), BOḰEĆEN (Pauquachin), SȾÁUTW̱ (Tsawout), W̱SIḴEM (Tseycum) and MÁLEXEŁ (Malahat) — whose historical relationships with the land continue to this day. Their stewardship serves as the cornerstone for ecological health and biodiversity that has founded the endless nature-based social benefits for current and future generations that this research explores.

Thank you greatly to everyone at Swan Lake Nature Sanctuary for their support. I wish to extend my appreciation to Cara Gibson, who offered assistance, feedback, and her time in navigating the project's parameters and overall goals. Without her open-minded and uplifting personality, this project would not have been possible.

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Executive Summary

Human disconnection from nature is increasingly recognized as an underlying contributor to biodiversity loss, declining environmental stewardship, and reduced human wellbeing. As fewer people gain experiences in nature, there is less likelihood of parks and protected areas forming place attachment and identity. Therefore, nature-based programs have the potential to strengthen relationships between people and place and act as an intervention to the extinction of experience; however, there are few studies evaluating whether their programs successfully foster nature connectedness. This study investigates which aspects of the biodiversity-focused programs at Swan Lake Nature Sanctuary strengthen participants' relationships with nature and place within urbanized Victoria, British Columbia, Canada.

The research adopted a mixed-methods approach, combining a literature review with quantitative and qualitative evaluation of four existing programs hosted by the sanctuary. Adult participants (n = 21) completed a Likert-scale (1-5) survey that inquired about pre- and post-program feelings of nature connectedness, place attachment, and relationality. Given Swan Lakes pre-existing protocol, youth participants completed a slightly different, but complimentary, post-program (excluding pre-program) written reflections. Across all programs, post-program responses showed a shift toward ‘strongly agree’ statements describing connection to nature and stewardship. The largest improvements were observed in participants' confidence to teach others about local ecosystems (+1.43 mean change), feelings that Swan Lake was irreplaceable (+1.10), and connection to the naturalist community (+1.10). Qualitative responses highlighted seasonal observation, staff relationships, and wildlife observations as meaningful experiences that contributed to their relationship with Swan Lake.

These findings informed the development of a practical ‘Relational Ecology Program Design Tool’ that identifies characteristics associated with successful nature-based programming. Swan Lake can apply this tool to their future programs to optimize the impact on participants. This work contributes to the Industrial Ecology field by demonstrating that strengthening human–nature relationships can simultaneously support ecological stewardship, biodiversity conservation, and human wellbeing.

Graphical Abstract



Figure 1. Graphical abstract for the research project, beautified with the help of generative AI.

Keywords

Relational Ecology, Nature Connectedness, Industrial Ecology, Urbanization, Human-to-nature relationships, Ecological Restoration, Education, Stewardship

List of Acronyms

BC = British Columbia

CRD = Capital Regional District

CMA = Census Metropolitan Area

CNS = Connectedness to Nature Scale

GOE = Garry Oak Ecosystem

IPBES= Science-Policy Platform on Biodiversity and Ecosystem Services

KBA = Key Biodiversity Area

SNAP= Swan-Lake Nature Ambassadors Program

SLNS = Swan Lake Nature Sanctuary

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1. Chapter One: Introduction

1.1 Background of the study

This project aims to investigate how nature-based programs can be designed to strengthen participants' feelings of relationship to place during and after program attendance at Swan Lake Nature Sanctuary (SLNS). Developing a connection to the natural environment in urban areas through nature preserves, parks, and protected areas is critical for both hedonic (pleasure & happiness) and eudaimonic wellbeing (meaning & self-realization) (Capaldi *et al.*, 2015, pg. 2; Pritchard *et al.*, 2020, pg. 1146). Engaging in meaningful activities in natural settings and fostering both types of wellbeing improves social connectedness, promotes a healthier lifestyle, and can strengthen personal behaviours towards nature (Soga and Gaston, 2016, pg.97; Shanahan *et al*., 2019, pg.141; Pritchard *et al.*, 2020, pg. 1146). The understanding that connection with the natural world improves wellbeing has appeared repeatedly throughout recorded human history, yet numerous trends suggest people are becoming more disconnected, both physically and psychologically, from nature (Selhub & Logan, 2012). Since the 1950s, the percentage of the world's population living in relatively nature-impoverished urban areas, versus the nature-rich surroundings of rural life, is as high as 82% in North America (United Nations, 2014). In financially wealthy industrialized nations, less than 10% of each day on average is spent outdoors, and per capita participation in nature-based recreation is declining (Capaldi *et al*, 2015). Consequently, many people are not as connected to nature as they could or should be, affecting not only the wellbeing of the environment but the individuals within it. This study will therefore identify valuable ways to ensure nature programs at Swan Lake act as an intervention to nature-separation. By providing opportunities for meaningful contact with ecologically intact spaces, these programs may strengthen both momentary and long-term feelings of connectedness to place and non-human entities.

Given this study's specificity to nature-based programming and relationship to place, the research is being done in partnership with SLNS within their conservation boundaries and pre-existing program curricula. Swan Lake's core values are to prioritize the relationships

between people, plants, and place. The sanctuary can be seen as a "*living classroom fostering a greater understanding of nature through direct experience*" with 100,000 annual trail visitors as of 2025 (Swan Lake Nature Sanctuary, n.d.). Their vision is stated as *"A Gathering Place to Practice Land Care,"* providing direct insight into their driving principles of community engagement and education, land stewardship, and reconciliation. The term "practice" materializes through offering a multitude of community outreach programs that aim to increase a sense of connection to place and combat the distancing of people from wildlife in urban landscapes (SLNS, n.d.). Current programs cast a wide net of opportunity by providing a myriad of activities to choose from for all age groups, backgrounds, and physical capabilities, allowing for inclusion and accessibility. For example, there are both rigorous and relaxing activities: physical invasive species removal, slower-paced visual monitoring on trail, in-situ seed sowing at the nursery, place-based crafting in the nature house, and more. Each program offers unique opportunities to connect with wildlife, Swan Lake staff, community members that attend, and the land on which it takes place - fostering positive interactions between people and place.

Relational Ecology is the study of how humans and non-humans exist in relationship with one another and their environments, with an emphasis on interconnectedness, reciprocity, and synergy of ecological and social interactions (West *et al*., 2024). Relational values are a key component of relational ecology, but relational ecology aims to move beyond intrinsic, instrumental, or aesthetic value; in other words, moving beyond how nature can be acquired for human direct use or benefit. Instead, relational ecology implements 'eudaimonic' values, which translates to a '*good spirit'* and refers to experiences in nature that give people a sense of meaning in life and acts as the foundation for their values (Lengieza, 2024). Referring to the environment in relational terms has historically been part of human ecology, with a focus on how 'humans' and 'nature' should not be separate entities (Saxen, *et al*., 2018). Nonetheless, the concept of 'relational values' also appears within the subfields of anthropology, sociology, geography, and environmental studies. Place-based research in these fields reflects more than a century of close attention to human-environment interactions, emphasizing the value of defining human-environment interfaces in terms of relationships (Saxen, *et al*., 2018 pg. 54).

Provided relational ecologies' interdisciplinary reach, there is untapped potential for this body of research to permeate the field of Industrial Ecology. Industrial Ecology is the study of solutions to environmental challenges while considering the relationships between society, the economy, and the natural environment (International Society for Industrial Ecology, n.d.). Green spaces have been recognized as one of the most popular resources of urban ecosystems today by improving air quality, water purification, stormwater management, carbon sequestration, regulation of microclimate, habitat for urban wildlife, recreational, as well as spiritual and social unification (Gairola & Noresah, 2010, pg. 43). Hence, green spaces improve urban ecological *functions,* and provide ecological *services,* especially when the ecosystem is intact and highly functioning. Conservation and careful stewardship of urban biodiversity provide valuable ecological outputs which should be incorporated into city planning and management.

1.2 Statement of the problem

Urban parks, preserves, and biodiverse green spaces have gained considerable attention in the last few decades for their role in human wellbeing in conjunction with climate change mitigation and biodiversity conservation. Nonetheless, these landscapes are being degraded and diminished at a rapid rate worldwide due to urbanization (Gairola & Noresah, 2010, pg. 43). Habitat loss around Swan Lake can be primarily attributed to development, land-use change, and invasive species outcompeting natives (Fuchs, 2001, pg. 5). With extensive urbanization comes disconnection between humans and the natural environment, contributing to declines in social and mental health, particularly in the Western world (Richardson, 2025). As fewer people have access to nature, there is an “extinction of experience,” a term coined by Robert M Pyle over 20 years ago (Soga & Gaston, 2016). This phenomenon occurs when there is reduced exposure to nature and decreased understanding of it, forming a reinforcing feedback loop where a weakened relationship to place contributes to fewer stewardship behaviours, and by proxy, less guardianship of green spaces see Figure 1.1. Overall, it is suggested that incorporating the environment into the sense of self is essential to developing environmental care and stewardship.

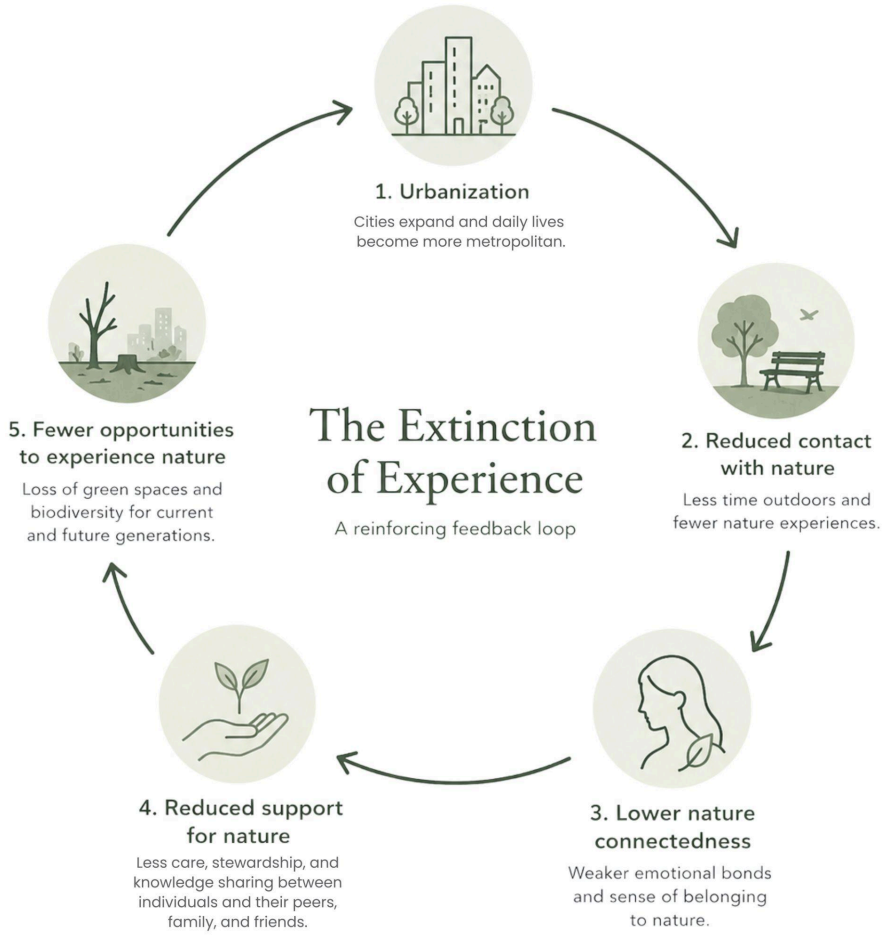


Figure 1.1 Visual representation of the "extinction of experience," a term coined by Robert M Pyle (1978). The graphic was made by Abigail Hyde using Canva and beautified with the help of Generative AI.

Human disconnection from nature and the decline in respectful and reciprocal human-nature relationships is recognized by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) as an underlying systemic cause associated with the environmental crises (IPBES, 2024, pg. 16). Increased urban and suburban lifestyles lead to an overreliance on cars, and an overall existence supported by modern technology and human-built features. Emblematic of the modern popularity of electronic media over nature-based recreation, children seem to be better at "identifying Pokémon than common

wildlife species" (Capaldi *et al*, 2015). In fact, a large national study of more than 2000 American youth (ages 8–18) revealed that youth spent approximately 49hrs/week consuming media as opposed to spending time outside (Bruni *et al*., 2017). This is an increase of over ninety minutes per day of media consumption compared to findings from a similar study in 1999 (Bruni *et al*., 2017). To break the cycle of extinction of experience, nature–based health interventions should be accessed by the public, such as activities and programs that embed nature connectedness and relationality into their design (Shanahan *et al*., 2019, pg. 2). Participating at any age helps form emotional relationships with nature and creates an intervention. The outcome of this project is to investigate the effectiveness of Swan Lakes nature-based programs in strengthening participants' sense of relationality with place and designing a tool for them to support future programs.

1.3 Scope of the study

The geographic scope of this research study is restricted to the protected conservation areas of Swan Lake Christmas Hill Nature Sanctuary in Victoria, British Columbia (BC), Canada. The official name of "Swan Lake Christmas Hill Nature Centre Society" was first incorporated in June of 1975 (Morrison, 2015, p. 6). For over 50 years, Swan Lake has been a hub for nature education and restoration by providing interactive programs for groups of all ages. Swan Lake is a charitable, non-profit organization that stewards 171 acres of wetlands and endangered *kwetlal* (Lekwungen language for Camas, *Camassia*) oak meadows systems (SLNS, 2025, p. 4). The Nature Sanctuary provides critical refuge for migratory birds, plants, and other wildlife that depend on this safeguarded habitat due to urbanization, land-use change, and invasive species sprawl in Victoria. The citizen science platform iNaturalist lists 1,879 species being observed by 1,342 people within the boundaries of the Swan Lake iNaturalist project (iNaturalist, July, 2026). Swan Lake's rich biodiversity provides a unique opportunity for people to experience and connect with a relatively intact ecosystem that has become increasingly rare to interact with.

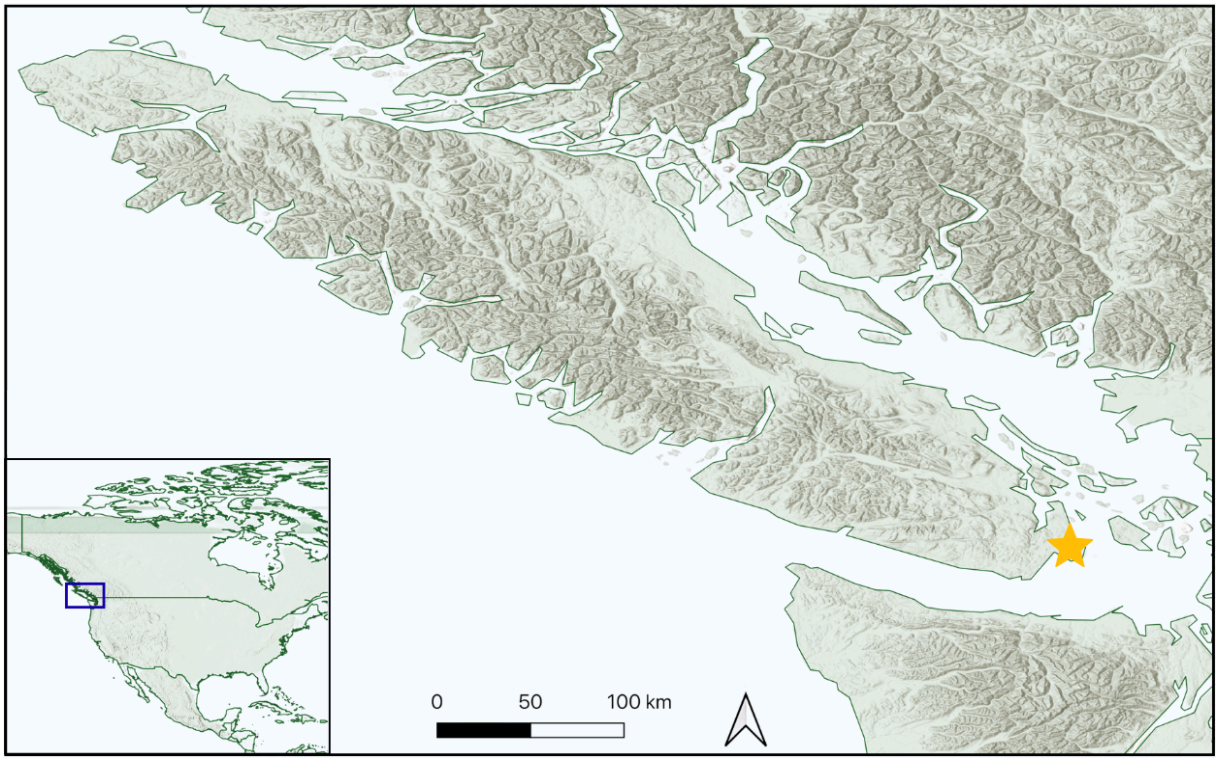


Figure 1.2. Map showing the location of Swan Lake (star) and Vancouver Island relative to North America. (Source: Abigail Hyde).

For broader context, Victoria is the capital of BC on Vancouver Island. It is a medium-sized coastal city with a large summer tourism industry; according to the 2024 Economic Impact Report, almost 5 million people visited Victoria in 2023 (Destination Greater Victoria, 2024). Contrastingly, the Capital Regional District (CRD, 2024) estimated a resident population of 460,317 in 2024, an increase from Statistics Canada's reported 397,237 in 2021 (Statistics Canada, 2021). The land area of the Victoria Census Metropolitan Area (CMA) is 695.29 square kilometres, which equates to a population density of 571 people per square kilometre (Statistics Canada, 2021). The CMA has thirteen subdivisions, and Swan Lake is located within the division with the highest population density: the District of Saanich. Saanich had a population of 117,735 at a density of 1,137/km^2 in 2021 (Statistics Canada, 2023). The average age of residents in Saanich is 44, suggesting the area is particularly attractive to families and retirees (Statistics Canada, 2023). Vancouver Island is known for its “rugged” and “wild” nature, with easy-to-access outdoor adventures and opportunities, which is ideal for active young

and elderly people (Victoria Harbour Authority, 2026). Therefore, it is no surprise that Swan Lake is a highly frequented area by locals and visitors.

The temporal scope of this study was a condensed and concise three months between May-July; this timeline aligns with the program requirements of the Industrial Ecology capstone. The Swan Lake nature programs being studied by the researcher precede the duration of the research and will continue into the future indefinitely. Surveys were completed during the three months, but statistics of program attendance and hours spent volunteering were considered from the previous calendar year (2025). Approximately 5,236 man hours were spent in 2025 by volunteers participating in the Swan Lake's various programs of interest for this research: (1) Adopt A Patch, (2) Seed Sowers, (3) Swan Lake Nature Ambassadors Program (SNAP), and (4) Ecosystem Restoration Meet-ups (Swan Lake internal documents, 2025; find a description of each program in section 3 below). The duration of each program varies between a single session and multiple years; they include education on plant identification, propagation and care, as well as removal techniques for non-native/invasive species. These activities occur around the sanctuary throughout the seasons, except Adopt A Patch, which often pauses during summer break due to its emphasis on school groups.

1.4 Swan Lake Nature Programming

Nature-based program activities take place across all the unique habitats within the sanctuary, including the wetland, *kwetlal* oak meadows, and demonstration native plant gardens. Programming began in 1976 with 850 participants and had grown to more than 20,000 participants annually by 2010 (Morrison, 2015, pg. 27). Programs on site have been designed and developed to reach a wide range of participants, including students from kindergarten to Grade 12, members of the general public, families, and seniors (Morrison, 2015, pg. 27). According to the 2025 Supporter Survey Results, 230 respondents (24%) expressed gratitude for the Society's work and appreciation for the nature education, programs, and workshops (SLNS, 2025, pg. 4). This feedback affirmed the work of the Swan Lake team, given the goals of its nature stewardship programs have been to:

"*Deliver transformational programming to engage and serve diverse audiences that highlights stewardship education and advocacy, inquiry-based learning and contemporary science skills.*" - Swan Lake Strategic Plan (2022-2025)

As discussed with Cara Gibson, Executive Director of Swan Lake, successful environmental programs should not only teach facts, but also cultivate emotional connection, belonging, and relationality with the natural world. Ways in which these goals can be achieved vary in approach, but based on personal observation, hands-on education and experience building are the most successful ways for people to gain a connection with the natural world. Thus, the intended outcomes from visiting the sanctuary and participating in a program include:

(i) Fostering understanding of nature through education

Nature Education has always been a guiding directive for the Nature Sanctuary. Since 1976, Swan Lake has provided a gathering place for people of all ages to connect with nature and one another through educational opportunities. The favourable outcome of participating in any of Swan Lake's nature-based programs is to come out with deeper connections to nature and an understanding that healthy ecosystems link to the wellbeing of everything, because all aspects of life are interwoven, especially between that of nature and humans. By recognizing the interconnectedness of all life, *systems thinking* is achieved, and deep observation takes place where individuals can see that even small changes can create a ripple effect on the ecosystem. The next step of fostering understanding is to provide ecological literacy so that the knowledge and practices they learned during the program can be shared with additional people in their life, such as co-workers, friends, family, or acquaintances. Basic animal and plant identification skills are often considered a "prerequisite for understanding and appreciating biodiversity" because species are the fundamental unit of biodiversity (White *et al*., 2018, pg. 2). Ultimately, Swan Lake offers reciprocity to the people that tend it, offering knowledge and community to those that sustain the biodiversity.

(ii) Providing a safe space that feels nourishing

Swan Lake aims to build a space where people feel safe and welcome to come and reconnect to the land and water. Nature is for everyone and the sanctuary promotes hands-on experiences that are inclusive and low-barrier. The ecosystem provides a service in return to those that steward it, improving mental health and wellbeing (Capaldi *et al.*, 2015). The quiet and calm of nature can feel re-charging, and individuals who feel more connected to nature tend to have greater eudaimonic wellbeing, in particular "self-reported personal growth" (Pritchard *et al.*, 2020, pg.1146).

There is an interpretive Nature House on site that functions as a central meeting point and hospitable venue for workshops, research activities, and lectures. Typically, prior to participating in a program or event, participants will check in with staff at the Nature House. Building relationships between the staff and participants does not appear as a primary overarching goal of the nature programs, but is a silently strong derivative of comfort for participants and likely influences participants' likelihood to return. In fact, the research surveys found that interacting with the Swan Lake staff was a significant driver of increased relationality and connection to place. The longer volunteers and program participants visit Swan Lake and get to know staff, the more comfortable they feel in the space and the greater understanding they have of it and their role within it. Hopefully those experiences inspire a sense of guardianship where the sanctuary becomes irreplaceable with other parks and closer to the notion of being at "home" or somewhere that feels nourishing to them.

The Nature House contains an indoor classroom that was renovated in 2025 to include a kitchenette and accommodate up to 55 people. This renovation reflected a strategic vision to improve facilities for attendees of educational events and programs. In addition to hosting Swan Lake's own workshops and activities, the modernized space can be rented by external ecological and community organizations. Providing a comfortable, safe, and accessible venue for environmentally engaged groups can help strengthen Swan Lake's relationships with the broader community and expand its role as a centre for environmental education and collaboration.

(iii) Empowering people to become stewards

The last of the central goals of the programs is to empower participants to become active environmental stewards by applying ecosystem restoration and critical thinking skills to address ecological issues at home and in the community. It is understood that it takes an extended period of time for participants to feel enough confidence to implement skills learned beyond the sanctuary, but an act as simple as pointing out an invasive plant to a friend on a hike is considered fundamental environmental stewardship. Planting native plants in their own garden is another great first step. Once they have gained more personal experience with their own landscape, further knowledge sharing may also follow suit. Successful stewardship comes in all shapes, forms, and scales.

1.5 Project objectives

The overall objective of this project is to investigate the effectiveness of nature-based programs at Swan Lake in strengthening participants' sense of relationality with place. Once data collection is complete, use of the information to provide a design tool for Swan Lake to support community engagement and education, land stewardship, and reconciliation.

The specific objectives to achieve this include:

A. Audit current programs to visualize areas that are successful or are in need of improvement.
B. Suggest how programs at Swan Lake can be designed to strengthen the feeling of connection to nature for participants.
C. Incorporate these findings with a literature review to create a 'program design tool' that can be used to screen any future programs and events.

2. Chapter Two: Literature Review

2.1 Review of relevant literature

Nature preserves, parks, and protected areas are increasingly recognized as critical for

addressing the crises of biodiversity loss, climate change, and human health. The Millennium Ecosystem Assessment established that provisioning, regulating, cultural, and supporting ecosystem services underpin human wellbeing, yet are being degraded globally (Reid *et al*., 2005, pg. 6). Similarly, the planetary-boundaries framework indicates that biodiversity loss and land use change have already surpassed safe limits, emphasizing the need to conserve and restore ecologically valuable areas, including those located within cities (Rockström *et al*., 2009, pg. 472). Urban parks are especially important within the ever-encroaching development because it may be the only contact people have with nature, and without them, there is a reduction in everyday contact with biodiverse environments (United Nations Department of Economic and Social Affairs, Population Division, 2014; Gairola & Noresah, 2010). Urban biodiverse areas that protect remnant ecosystems are often the only accessible contact people have with truly natural environments due to transport, physical abilities, or time restraints. As opportunities for direct interaction with nature declines, people can experience poorer psychological wellbeing, including higher levels of stress, depression, and anxiety (Selhub & Logan, 2012; Capaldi *et al*., 2015; Shanahan *et al*., 2019). Human disconnection from nature and the decline in respectful and reciprocal human-nature relationships is recognized by the IPBES as an underlying systemic cause associated with biodiversity loss and the environmental crises (IPBES, 2024, pg. 16).

A key concept describing the phenomenon of human-nature relationship decline and how it contributes to environmental degradation is the "extinction of experience" (Soga & Gaston, 2016). Originally introduced by Robert M. Pyle (1975) and later developed by Soga and Gaston (2016), the **extinction of experience** refers to the progressive loss of direct human-to-nature interactions, which diminishes emotional connection to nature and weakens environmental advocacy, contributing to further ecological decline. As opportunities for interaction decline with urbanization, a reinforcing feedback loop emerges: reduced contact leads to diminished concern for nature because there is no connection to place, and thereby, there is less motivation for guardianship and stewardship. To break the cycle of extinction of experience, nature–based health interventions should be accessed by the public, such as activities and programs that embed nature connectedness and relationality into their design (Shanahan *et al*., 2019, pg. 2). Liu *et al*., (2022) found that nature connection had associations with pro-environmental behaviour in

Brisbane, Australia when surveying 1,000 adults. This is to say that although there are reduced pro-environmental behaviours from lack of relationship to nature, there is also the opposite effect where nature involvement is a mediator of pro-environmental behaviour, such as conservation volunteering.

Nature connectedness describes the subjective extent to which individuals experience themselves as emotionally, cognitively and physically related to the natural world (Liu *et al*., 2022). It is associated with both hedonic wellbeing, including pleasure and positive emotion, and eudaimonic wellbeing, including meaning, personal growth and a sense of purpose (Capaldi *et al*., 2015, pg. 2; Pritchard *et al*., 2020, pg. 1146). Nature connectedness can be situated within the broader concept of relational ecology, which aims to move beyond intrinsic, instrumental, or aesthetic value and instead focus on interconnectedness, reciprocity, and synergy of ecological and social interactions (West *et al*., 2024). Thus, relational ecology implements 'eudaimonic' values, which translates to a '*good spirit'* and refers to experiences in nature that give people a sense of meaning in life and acts as the foundation for their values (Lengieza, 2024). The IPBES sees nature connectedness as a powerful strategy for the transformative change needed for achieving the 2050 Vision for Biodiversity (IPBES, 2024).

Connectedness with nature has been measured using both explicit and implicit measures. Explicit measures include self-reported scales and surveys, such as Mayer and Frantz's (2004) Connectedness to Nature Scale (CNS), which measures an individual's emotional connections to the natural world (Bruni *et al*., 2017, pg. 3). The survey design for this research project was informed by questions in the CNS, such as "*I often feel a sense of oneness with the natural world around me*". It is important to note that there is no single question or response that captures every aspect of a human–nature relationship. Every person's experience is unique and a participant may gain ecological knowledge with or without developing place attachment, or they may report stronger emotional connection but not implement stewardship behaviours. Program evaluations with pre- and post- elements within the program surveys can provide insights on the degree of change and action.

Individuals who participate in nature-based interventions (i.e programming) report high levels of intrinsic motivation, and that their incentive and willingness to participate in biodiversity programs impacts the degree of connectedness (Capaldi *et al*., 2015, pg. 6). Once participants have positive and memorable experiences with the environment, they are also more likely to also continue engaging (i.e volunteering). It is worth noting that 'positive' does not necessarily have to equate to "pleasant". In fact, nature stimuli perceived as characteristically unpleasant may be remembered as a positive and meaningful experience because they overcame working on a "super rainy day" and being "targeted by insects". Repeated contact appears particularly important because continuing encounters allow people to develop familiarity, confidence and personally meaningful relationships with wildlife species and places (Passmore & Howell, 2014; White *et al*., 2018, pg.1). Recent research by Richardson (2025), further shows that nature connectedness is a measurable psychological response that can be strengthened through sustained engagement, making it a critical lever for environmental stewardship and long-term biodiversity conservation.

Repeated participation can specifically allow individuals to witness ecological change, the aftermath of restoration, and develop a sense of responsibility to the site. At Swan Lake, relationality of participants was expressed through observation of seasonal changes, relationships with staff and other volunteers, familiarity with particular trails or habitats, and friendships formed during programs. From this perspective, Swan Lake is not simply an area in which environmental education occurs. It can also be understood as "*a gathering place where people practise land care"* and develop relationships with one another and with the land: place as an embodiment of people's actions. In Greater Victoria, wetlands and Garry Oak Ecosystems (GOE) are becoming diminished and fragmented within the densely developed landscape. For this reason, many species at risk occur at Swan Lake, and although they are protected, invasive species and altered ecological processes still remain a threat (Fuchs, 2001; Garry Oak Ecosystems Recovery Team, n.d.). Therefore, the continued stewardship of the land *by people* is integral for its future health and functioning.

Place attachment and place identity are related but distinct concepts within the framework of relational ecology. Place attachment refers to the emotional and social bond that evolves between a person and a location, and place identity describes the extent to which that location becomes incorporated into a person's sense of self (Proshansky *et al*., 1983). Yi-Fu Tuan argues that "*place is not only a fact to be explained in the broader frame of space, but it is also a reality to be clarified and understood from the perspective of the people who have given it meaning*" (Tuan, 1979, p. 387). From this perspective, experience represents the entirety through which people perceive, interpret, and understand the world, allowing places to acquire personal and collective meaning. Following Tuan (1979), a place cannot be understood solely as a physical location; it must also be understood through the experiences and meanings that people associate with it. This research delves into the experiences of people specifically at Swan Lake and the survey question of "*Swan Lake could not be replaced by another natural area for me*" was aimed to target this feeling of place attachment.

Place attachment and the need for a relationship to the land and place was particularly evident during the COVID-19 pandemic when people were stuck indoors and restrictions increased social isolation. During this period, nearby natural areas provided a safe space for physical recreation, relief from stress, and fresh air. Based on 5,218 survey responses from nine countries, a study in 2021 found that contact with 'green and blue spaces' helped people cope with the mental-health effects of COVID-19 lockdowns, emphasizing how interaction with nature links to human health and wellbeing (Pouso *et al*., 2021). This perspective aligns with the One Health, Planetary Health, and EcoHealth approaches, which recognize that human health cannot be separated from the condition of ecological systems (Hill-Cawthorne, 2019). These findings reinforce the view that nature connectedness is not only a conservation concern but also an important component of human health and well-being.

Public health and ecosystem health are interconnected and should be perceived in conjunction with one another. When designing environmentally driven programs, the effect on the participants' wellbeing should be taken into consideration and whether there is equality in those able to access it. This perspective aligns with growing recognition that effective restoration

and conservation must integrate community, local knowledge, and Indigenous governance systems, as demonstrated in forest and landscape restoration contexts in Latin America (Aguiar *et al*., 2021). Ecological health and wellbeing also aligns with Indigenous-informed frameworks such as the concept of "healthscapes," which emphasizes that environmental and human wellbeing are inseparable and must be addressed through place-based, relational, and culturally grounded approaches (Morris *et al*., 2026). As written by Indigenous scholars, human connectedness within nature is a determinant of planetary health, and the environment is dependent on the human capacity to understand interconnectedness as a fundamental reality (Redvers *et al*., 2022, pg. e161). If the land is unhealthy, so are the people who live on it. The United Nations Declaration on the Rights of Indigenous Peoples draws attention to how Indigenous governance land management practices have integrated land-informed ways of knowing for traditional management since time immemorial (United Nations General Assembly, 2007); Aguiar *et al*., 2021).

In regard to nature education with children, research indicates that environmental education can strengthen ecological knowledge to varying degrees depending on program design. An example case study is Bogners (1999) evaluation of a year-long conservation program involving secondary-school students in Switzerland who learned about endangered common swifts by observing their behaviour and constructing nesting boxes. The program had a significant positive effect on their specific knowledge levels and on "two of the five environmental perception subscales" (Bogner, 1999, pg. 1169). These results emphasize that environmental perception is complex and that one educational programme is unlikely to influence every attitude or behavioural dimension. White, Eberstein and Scott (2018) found similarly positive outcomes from the six-week 'Bird Buddies' program. Children learned to identify local birds, monitored them in school grounds and took responsibility for maintaining feeders. Participants demonstrated substantial gains in identification skills and reported more positive attitudes toward birds. Based on responses from six (75%) of the participating teachers, a year after the project, "all but two reported that the class/school were still (regularly) feeding birds in their school ground" after the formal program ended (White *et al*., 2018, pg.13). The program's combination of repeated observation, practical responsibility and direct wildlife

experiences showed evidence for enhanced awareness of local biodiversity, alongside significant gains in both bird identification knowledge and attitudes, “which were greatest for children with little prior exposure to nature” (White *et al*., 2018, pg.1).

Bruni *et al.* (2017) evaluated several components of the ‘Get to Know Program’ which aims to encourage direct connection with nature through a variety of activities (i.e wildlife, hiking, creative arts, and special events), specifically among youth in southern California schools. Results indicated that not all nature-related activities increased children’s implicit connectedness with nature, the participation in the (short) Get to Know Natural Treasure Adventure and Virtual Hike did not have an effect on connectedness with nature. This is not surprising given that experiencing a hike encompasses all aspects of one's senses, not just sight. Participation in a creative arts activity was associated with a more positive change. Furthermore, increases in environmental knowledge seemed to depend “not just on direct experience, but on perceived freedom to choose these direct experiences” (Bruni *et al.* 2017 pg. 58). The authors suggested that highly task-oriented activities like a treasure hunt may direct attention toward winning a game rather than closely observing and relating to nature. Creative activities seem to be more effective because they require participants to practice deep observation and personally express their experiences.

Overall, this research contributes to a growing body of work that emphasizes the importance of nature connectedness to both conservation and human wellbeing. As shown by the literature, nature connectedness combats the extinction of experience, and by proxy promotes stewardship behaviours, leading to increased protection of green spaces, and linking to physical and mental human health. Nature programs and education initiatives are effective ways to nurture nature experiences, but current literature focuses mainly on school groups without including adult programs in nature. By linking relational values to measurable outcomes for youth and adults, it offers a practical framework for strengthening connections between people and the land. The Relational Ecology Program Design Tool created for Swan Lake will integrate these perspectives, frameworks, and values into the program design criteria.

2.2 Theoretical and conceptual framework

This research is grounded in the theories of nature connectedness, relationality, and environmental stewardship. Together, these perspectives help explain how participation in nature-based programs can influence the relationships that individuals develop with natural spaces and how place attachment and identity can encourage stewardship behaviors over time. In the context of this research, nature connectedness refers to the extent a program participant feels emotionally connected to Swan Lake. A stronger sense of connection to a natural place has been associated with an increased sense of wellbeing, environmental concern, willingness to protect nature, and promoting ecological knowledge with those around them (Passmore & Howell, 2014; Capaldi *et al*, 2015). Repeated visits, meaningful experiences, hands-on activities, and interactions with other participants help individuals develop a stronger connection (Passmore & Howell, 2014; White *et al*., 2018, pg.1).

Relational ecology considers how relationships with the land influence how individuals understand themselves and their responsibilities toward the more-than-human world (Martin, 2020). The theory of relationality specifically focuses on how people and nature are not separate entities, but are connected and dependent on one another. The interconnection is dynamic and shaped by experiences that occur within a specific place over time. From this perspective, successful nature-based programs provide more than facts about the ecosystem but also creates opportunities for participants to understand how their actions affect people, species, and places. Question 13 of the survey specifically targeted this framework: “I feel that everything in nature is connected (e.g., animals, plants, humans, water, air, land, fire, etc.)”. Questions also address a sense of belonging/oneness in nature and at Swan Lake.

Environmental stewardship provides the actionable outcomes between participants' internal experiences at Swan Lake and their potential actions at home or in community spaces. Stewardship involves responsible care and management of the environment through behaviours such as habitat restoration, protection, and advocacy. The more confidence participants gain, the more likely they are to be stewards. Question 10 and 11 of the survey specifically targeted this

framework: “experiences at the sanctuary motivated me to be an environmental steward” and “I feel confident teaching my peers about the local ecosystems in Victoria”. Survey results from participants of nature programs at Swan Lake provide a basis for examining whether participation was successful in strengthening feelings of belonging, care, and relationship.

The conceptual framework for this research proposes that program design influences participants' experiences, which affects relational outcomes and stewardship practices. Important program-design characteristics include hands-on participation, direct contact with nature and the witnessing of specific events (baby owlets maturing, a blue heron hunting, or turtles hatching), opportunities for deep observation and reflection, social interaction between participants and community participation, accessibility and flexibility, cross-generational knowledge sharing, repeated engagement, and an education on how place-based work is part of reconciliation.

The framework is summarized below:

<u>Program design characteristics</u>

→ hands-on activities, place-based learning, ecological knowledge, deep observation, reflection, social interaction between participants, and repeated participation.

<u>Participant experiences</u>

→ enjoyment, calmness and peace, meaningful moments with nature or wildlife, learning from community and staff, a sense of belonging, confidence, and emotional connection to Swan Lake.

<u>Relational outcomes</u>

→ stronger nature connectedness, place attachment, reciprocity, care, and responsibility.

<u>Stewardship outcomes</u>

→ increased intention and ability to apply restoration outside of the boundaries of Swan Lake, critical-thinking about personal actions and the broader scope, and environmental stewardship skills at home and in the broader community.

2.3 Research gap

There is currently limited research examining how community-based environmental organizations can systematically assess whether their educational and outreach programs are achieving their goals of strengthening relationships between people and nature. Existing evaluation methods often focus on participation rates, number of participants, or participant satisfaction rather than relational outcomes such as stewardship, place attachment, connectedness, and responsibility toward the natural world. Researchers in the field also generally use pleasant nature as stimuli and neglect some of the more unpleasant aspects (e.g., mosquitoes or forest fires) (Capaldi *et al.*, 2015, pg. 8). Swan Lake programs do not cater to certain experiences, and proceed to host events rain or shine. In fact, participants provided feedback that nature stimuli perceived as characteristically unpleasant was remembered as a meaningful experience because they overcame working on a “super rainy day” and being “targeted by insects". As a result, the program elements identified as being impactful are also realistic to nature experiences in the outdoors.

There are multiple studies that research the outcomes of education programs on children as part of their schooling (Bogner, 1999; Bruni *et al*., 2017; White *et al*., 2018), but not with adults that *choose* to participate in outdoor programs. By collecting feedback directly from program participants and identifying strengths and areas for improvement, the study contributes both a localized understanding of program impacts and a framework for assessing relational outcomes in future nature-based programming. The resulting program design tool aims to bridge the gap between academic research on human–nature relationships and the practical needs of organizations seeking to foster deeper and more meaningful connections with nature.

3. Chapter Three: Methodology

3.1 Study area

Swan Lake is an accessible, ecological hotspot located only six kilometers from downtown Victoria, BC. The nature sanctuary stands on the lands of the lək ʷəŋən-speaking and W̱SÁNEĆ Peoples — including the W̱JOŁEŁP (Tsartlip), BOḰEĆEN (Pauquachin), SṮÁUTW̱

(Tsawout), W̱SIḴEM (Tseycum) and MÁLEXEŁ (Malahat) — whose historical relationships with the land continue to this day. The boundaries of Swan Lake lie within the urbanized district of Saanich in Victoria, an increasingly developed landscape - see Figure 3.1. The nature sanctuary is one of the region's most important urban riparian habitats given that it provides essential ecological services including freshwater quality improvement, flood control, and carbon sequestration. The sanctuary consists of two physically and ecologically distinct locales: the wetland area surrounding the lake and the oak-forested rocky outcrops of Christmas Hill. These areas are separated physically into parcels: the Swan Lake lower parcel and the upper Christmas Hill parcel (shown by the green areas of the map shown in Figure 3.2). Educational programs take place at both ecosystem types throughout the year. The two parcels of Swan Lake are connected by a corridor trail along Nelthorpe Road, which takes roughly fifteen minutes to walk between. All of the lands are managed by Swan Lake under the terms of a Land Management Agreement between the Society and the Municipality of Saanich (Morrison, 2015, p. 8).



Figure 3.1 Images comparing the development and urbanization around Swan Lake over time. The image on the left was taken in 1966, and the screen capture on the right was from satellite imagery taken in 2019. It can be observed that houses have densified and there is less

crop land to aid in hydrology control. (Source: left - Swan Lake internal documents, right - Basemap imagery © Mapbox, c. 2019, accessed through the QuickMapServices plugin in QGIS).

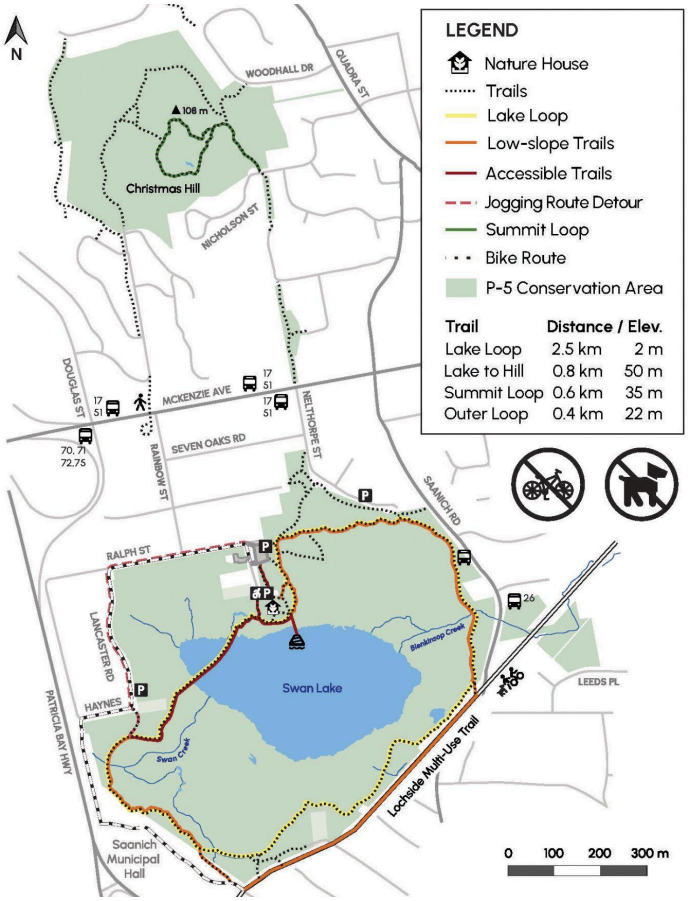


Figure 3.2 Map of Swan Lake Nature Sanctuary showing the two distinct parcels: Swan Lake (wetland) and Christmas Hill (rocky oak-forested hilltop). (Source: Swan Lake).

The diversity of habitats within the sanctuary contribute to its biological richness. Through its ongoing stewardship, Swan Lake has maintained relatively high levels of ecological integrity despite the surrounding urban density, providing a true "sanctuary" for birds, plants, fungi, insects, and other wildlife within the city. Christmas Hill has been deemed as an official Key Biodiversity Area (KBA) and Swan Lake is currently in the midst of technical review. This signifies that these properties are crucial places on the planet where unique species and ecosystems occur in important numbers and/or extent (Key Biodiversity Areas, 2026). Thirty-six rare, threatened, and endangered species are on site and being protected, making it a novel site

compared to nearby parks that have lower species richness. Thus, Swan Lake fulfills the following five KBA criteria: threatened biodiversity, rare biodiversity, the ecological integrity of broader systems, biological processes, and irreplaceability. These standards were outlined by the International Union for the Conservation of Nature global standard for the identification of KBAs (IUCN, 2016). The KBA Programme helps ensure the designated areas are safeguarded for future generations, although it does not provide a particular legal status.

Of further significance are the species compositions that reflect historic traditional land management by Indigenous lək̓ʷəŋən-speaking (Songhees and Kosapsum) Peoples. It was once an important hunting and gathering area, with over a hundred species of plants growing on site that are known to be used by the lək̓ʷəŋən-speaking People (Morrison, 2015, pg. 18). A particularly ethnobotanically significant species on site associated with GOE is **Kwetlal**, Camas bulbs *(Camassia quamash* and *Camassia leichtlinii)* that was a source of starch for the lək̓ʷəŋən-speaking People (Bryce, 2017). Many GOE species are now endangered, threatened, or vulnerable according to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (Beckett, 2022, p.2). The ecosystem itself is now one of the most threatened in Canada with “less than 5% of the original habitat remains in a near-natural condition” (GOERT, n.d.). For this reason, there are few other parks in Victoria that can provide the same experiences for people or ecosystem services and functions.

After all things considered, the biological and cultural values present in Swan Lake provide an excellent case study for the research into relational ecology in urban greenspaces. It provides a glimpse of the historic environment, but also a blueprint for what Vancouver Island could look like with attentive care and stewardship. Ideally, after program attendance, participants have a better understanding of place and feel a sense of guardianship and relationship to the land.

3.2 Research design

This project utilized a mixed-methods research design to investigate how nature-based programs at Swan Lake can be designed to strengthen participants' feelings of relationship and

connection to the land. The research combined a review of academic literature on human-to-nature relationships in conjunction with participant survey data to evaluate existing programs and identify opportunities for improvement. Quantitative data was collected through a structured survey which assessed participants' perceptions of nature connectedness, stewardship, place attachment, and relationality following participation in Swan Lake programs. The survey format was chosen to collect response data because it allowed for clear and concise before and after sections - the full survey can be seen in the 1.1 section of the appendix. It is worth noting that the surveys were printed and provided to the participant in person instead of sending it over email; this was a deliberate decision during research design to promote a sense of comfort for the participant. This style of delivery allowed them to stop and ask questions at any time if they felt confused by an aspect of the survey. Having dialogue with the participant before and after the survey also allowed the researcher to get to know the individuals more and hear personal anecdotes. Qualitative responses were optional at the end of the survey to record firsthand narrative stories and provide additional context to the survey results, collected answers captured participants' reflections on meaningful experiences and aspects of the program that worked best for them

The research was guided by the central question: How can biodiversity-focused events and programs at Swan Lake Nature Sanctuary be designed to strengthen the feeling of connection to nature for participants? To answer this question, the research was conducted in two stages. First, four of the existing programs were audited using participant feedback and the researchers' attendance to identify strengths, weaknesses, and recurring themes. Second, these findings were synthesized with evidence from the literature on nature connectedness, relational ecology, environmental education, and program evaluation to develop a practical program design tool. This tool provides a framework that can be used to screen future programs and events according to their potential to foster meaningful relationships between people and nature while supporting community engagement, environmental stewardship, and reconciliation.

Rather than evaluating the effectiveness of a single program, this research took four programs into account to identify characteristics associated with successful relational outcomes

and translating these findings into actionable design principles. The resulting program design tool is intended to provide Swan Lake Nature Sanctuary with an evidence-informed framework for evaluating existing programming and guiding the development of future educational and biodiversity-focused initiatives.

3.3 Programs of Interest

(i) Swan Lake Nature Ambassadors Program (SNAP)

This volunteer-led program involves monitoring the sanctuary grounds while also providing visitor experience support. While on site, they help the sanctuary staff get eyes and ears on the ground for what is occurring on the trails, land, and water. The number of staff on-site ranges between 8–16 depending on the season, which means limited capacity for physical monitoring, so Swan Lake is always grateful for this assistance. The responsibilities of the SNAP participants are to walk Swan Lake and Christmas Hill trails and to regularly have conversations with visitors about wildlife, cultural expectations, and appropriate behaviours. Other responsibilities of the SNAP ambassadors include picking up litter, noting species observations that may be interesting or abnormal, monitoring and reporting any safety concerns, and tracking the number of visitors and various types of visitor interactions (SLNS -SNAP Volunteers, n.d.). SNAP volunteers walk the trails for ~1.5 hours per session, and there are typically two volunteers per day, seven days a week. This schedule is determined at the beginning of the year and has flexibility, but requires a level of commitment by the volunteers. Cumulatively ~562.5 hours were volunteered by SNAP in 2025 (Swan Lake internal documents, 2025). The sanctuary sees this role growing in importance as the urban areas become more densely populated and there is increased visitation as a result.

In 2026, 18 people were directly enrolled as SNAP volunteers, and tens of thousands have benefited from the outcomes of the program (all visitors). For this research six SNAP volunteers provided answers to the survey. According to feedback from participants, this program brings a great sense of peace and responsibility. For example, SNAP observations are a critical part of the site evaluation that is written into the Environment and Climate Change

Canada grant 'Rare Species Recovery in an Urban Greenspace through Community Stewardship'. Community members that visit Swan Lake are very grateful for this volunteer role with many visitors reportedly thanking SNAP volunteers for their efforts.

(ii) Adopt A Patch

"*The Adopt A Patch program has become one of the students' favourite parts of our environmental science program at school. We love the relationship we have with Swan Lake.*" - Reynold's Second School Teacher (SLNS - Adopt A Patch, nd).

This restoration program is primarily designed for school groups who want to engage in hands-on experience and make a positive impact on the ecosystem at Swan Lake. Adopt Patch is a customizable program that provides flexibility for the teacher or supervisors. Groups commit to caring for a designated restoration area (their "Patch") and work sometimes independently and sometimes alongside Swan Lake Staff to remove invasive species, observe and monitor, and protect local biodiversity (SLNS - Adopt A Patch, n.d.). Rather than a one-off event, this program is built around repeated visits to the same Patch, allowing participants to see change unfold season by season - see Figure 3.3 to see an example of a 'Patch'. This long-term approach fosters place attachment, relationality, ecological knowledge, and measurable habitat improvement while also weaving together skill building and participant wellbeing.

The program duration depends on the school participating and the weather, but under ideal conditions, students participate ten months of the year (September to June). As of 2026, Kristen Banasch is the Biodiversity Coordinator for Swan Lake and leads the Adopt A Patch program. Therefore, the researcher worked alongside her during attendance of the program and looked at her collected data from the post-surveys. This year there were multiple schools and grades involved in the Adopt A Patch program: Reynolds Secondary School, Rogers Elementary, and Pacific Christian. The Reynolds 'World Cafe' wrap up event took place on June 15th with 36 students from grade nine to ten and they participated in their annual post-program survey in person. Rogers wrap up event took place on June 10th with 32 students from grade three to four. Given the young age groups, it can be difficult to ensure high-quality invasive species removal,

which tends to result in the returning of the invasives over time. Nonetheless, this provides a valuable learning experience for the students on the durability and persistence of non-native species and how important it is to do continual work with the land.



Figure 3.3 Photo of a school group removing invasive St. John's Wort on Christmas Hill. This has been a Patch for Pacific Christian for multiple years and Rogers Elementary for one year. (SLNS - Adopt A Patch, nd).

(iii) Ecosystem Restoration Meet-ups

Swan Lake's site director, Jay Rastogi, and his field assistants lead biweekly (Tuesday and Saturday) restoration meet-ups where volunteers work as a team to remove invasive species, improve trail quality, and protect the ecosystems at Swan Lake and Christmas Hill. The duration of the program meet-up is two hours from 9am to 11am, with an average participation rate between 5-12 people. This program does not have any commitment requirements, people can attend just once or continually over the years. An important aspect of the program event is tea, coffee, and cookies at the end (provided by Cookie Baker volunteers). This ritual is valuable for community building, sharing experiences, and strengthening connection between participants and the sanctuary. While attending the event, the researcher noticed that multiple participants were catching up in a friendly manner where they seemingly picked up the conversation where they

left off at the last session. This suggests that the meet-up is a part of their socialization with others and the community. Question 12 of the survey is “I feel connected to the naturalist community” to specifically determine if interactions such as these make a significant impact on the attendees' sense of community.

From the perspective of ecosystem functioning, this program is very important because Swan Lake has a plethora of invasive species present on site that were brought post-colonization. Particular species that the volunteers tackle are: Himalayan Blackberry, Scotch Broom, St. John’s Wort, Bur Chervil, Spurge Laurel, English Ivy, and others. The sanctuary is extremely thankful for the ~1,440 hours that were volunteered in 2025 to help maintain the health of the native ecosystems on site (Swan Lake internal documents, 2025). Without this program the sanctuary would have difficulty keeping up with the invasive species on site.

(iv) Native Plant Garden Stewards

Another form of restoration that takes place with Jay’s direction are the Garden Stewards. They help tend and care for the native plant demonstration garden and native plant nursery at the nature sanctuary. The garden is an important area to keep maintained and invasive-free because it showcases the diversity, beauty, and cultural significance of native plants. The nursery is also an essential area to monitor because it provides plants for the plant sale, restoration on site, seed stock, and community propagation. This program is a great way to get up close and personal with species on site because participants need to recognize their plant characteristics well enough to discern whether to leave the native or remove the non-native ones.

3.4 Method of data collection

Data for this study were collected using a survey developed by the researcher to assess the extent to which participation in programs at Swan Lake influenced participants’ sense of connection/relationship to nature. The survey design was informed by the CNS, a widely used instrument for measuring individuals’ emotional and experiential relationship with the natural world (see section 1.2 in the appendix for specific questions of interest). Drawing on concepts from the CNS and the objectives of this research, a 27-question survey was developed. The

platform in which it was created was “SurveyMonkey” a pre-approved platform by the University of Victoria. The majority of the questions use a five-point Likert scale ranging from “Strongly Disagree” to “Strongly Agree,” allowing participants to indicate the range to which they resonated with statements related to nature connectedness, place attachment, learning outcomes, and relational experiences associated with the sanctuary programs. In addition to the structured survey, participants were invited to provide optional qualitative comments and observations regarding meaningful experiences with Swan Lake programs with two questions with open text boxes, offering further insight into how these activities may foster relationships between people and nature.

All recruited participants were individuals actively involved in the 2026 Swan Lake programs, including teachers that oversaw students in the Adopt A Patch program. Given Swan Lake’s goals to provide community-driven interactions, it was preferable to the organization for the surveys to be in a printed format and delivered in person with verbal explanations. During these interactions, the researcher had a script on the purpose of the study and how participant feedback would be used to evaluate and improve future programs and educational initiatives. Participants were provided with physical printed copies of the survey accompanied by an implied consent form. To make sure information was conveyed, they were also verbally provided information about confidentiality measures (the survey was anonymous), voluntary participation, and data management procedures. Participants were given the opportunity to review the consent information before voluntarily completing the survey. Consent was indicated by proceeding to the survey questions. The total amount of time to complete the survey varied between 8-15 minutes on average. The printed format proved beneficial because it opened up the opportunity for open verbal dialogue and relationship building. It also allowed the participant to ask questions if they felt confused. Given the researcher provided the survey in person, there was also opportunity for the researcher to participate in the programs themselves. The attendance provided the researcher valuable first-hand experience in the program structure, environment, and demographics.

Given that the participants of the Adopt A Patch program were under the age of 18 and needed parental consent to participate in the survey, the researcher depended on the sanctuary's pre-existing program experience survey structure. Thankfully, given that goals of the program have remained consistent over time, the post-program questions still aligned with the project's objectives and research questions. Those results were compiled separately not to skew the data and will be discussed further in the analysis section.

3.5 Method of data analysis

Pre-and post Survey responses were analyzed to identify patterns in participants' reported experiences and perceptions of nature connectedness following participation in Swan Lake programs. Responses to Likert-scale questions were assigned numerical values from 1 (Strongly Disagree) to 5 (Strongly Agree), with higher values indicating stronger agreement with statements related to connection to nature, stewardship, place attachment, and relationality. Once the questionnaires were completed, the scores from 'before' and 'after' were subtracted from one another to represent degree of change for each survey question. Lower total scores represented little to no perceived change in participants' relationship with nature, Swan Lake, or the community. Questions receiving the lowest score change were identified as potential areas where current programming may be less effective at fostering nature connectedness and relational outcomes. These results were then used to identify recurring themes and areas for improvement across programs.

Qualitative comments provided by participants were reviewed and categorized according to common themes related to meaningful experiences. Findings from both the quantitative and qualitative analyses were synthesized to identify strengths and weaknesses within existing programs. Based on these findings, recommendations were developed to support the enhancement of current programming and to inform the creation of a program design tool that can be used to evaluate and guide future nature-based educational initiatives. The analyzed data and recommendations will be compiled into a presentation for the Swan Lake staff at the end of the project period. The results from the surveys and the design tool can be found in the following chapter.

4. Chapter Four: Results and Discussion

4.1 Presentation of the results

In this section, all of the data collected from the surveys are presented to portray the differences in relationality to the land before and after attending the nature-based programs at Swan Lake. A total number of 88 responses were collected and divided into two sections: adult responses (n = 21; researchers survey) and youth responses (n = 67; from Swan Lake's internal survey). Youth responses included two groups, specifically grade 3-4 (8-10 year olds; n = 31) and grade 9-10 (14-16 year olds; n = 36). The age groups were examined separately. Analysis of adult responses are based on (1) total values of answers to the Likert scale questions, (2) absolute change between before and after for those questions, (3) before and after responses partitioned by each program, and (4) qualitative written responses. The last section of the survey permitted *optional* written responses by individuals that wanted to share more personal thoughts and experiences, thus, written responses (n = 18) do not equate to the total number of participants. Quantitative results are primarily presented in histogram format, whereas, qualitative written responses are included as full quotations.

The youth responses were analysed separately based on data availability and question formatting. The researcher did not have access to pre-program survey responses because Swan Lake did not collect them before the researcher was on site. Thus, results could not be directly compared to those collected from the adults. Post-program survey analysis is based on (1) total values of answers to the Likert scale questions regarding feelings *after* participating (without before) (2) word cloud of written responses. Word clouds visually illustrate which words appear more frequently by proportionally enlarging the font in the display. This aids in observing main themes and central ideas to the participants. Overall, participants showed high (most commonly value 4 on the Likert scale) feelings of nature connectedness after participating in the programs.

4.1.1 Adult responses

(i) Cumulative Survey Responses

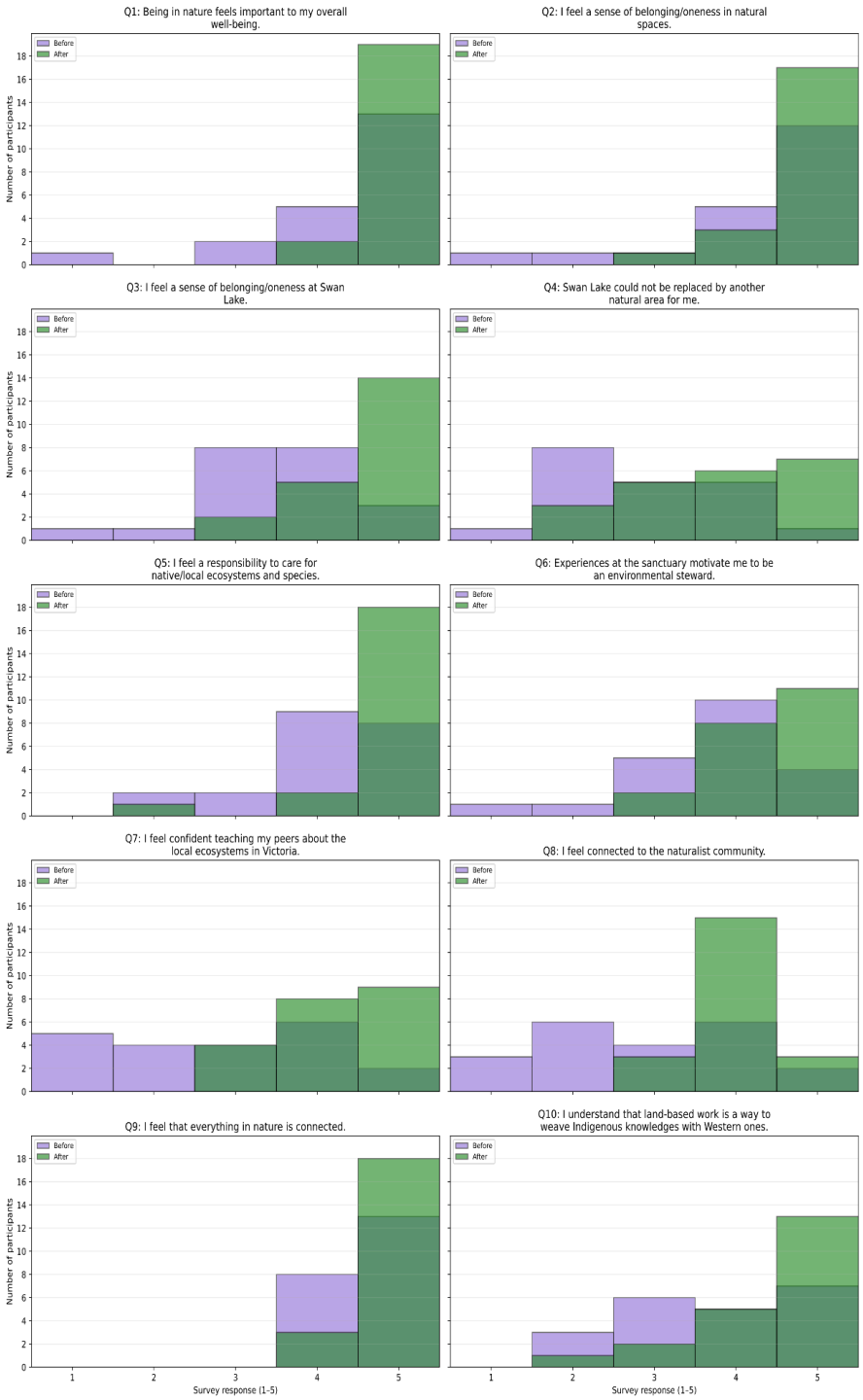


Figure 4.1 Distribution of participants Likert-scale responses (1–5) for each survey question before and after the program. Purple bars represent pre-program responses and green bars represent post-program responses. The bar height indicates the number of participants that selected each response.

(ii) Change in survey responses by question

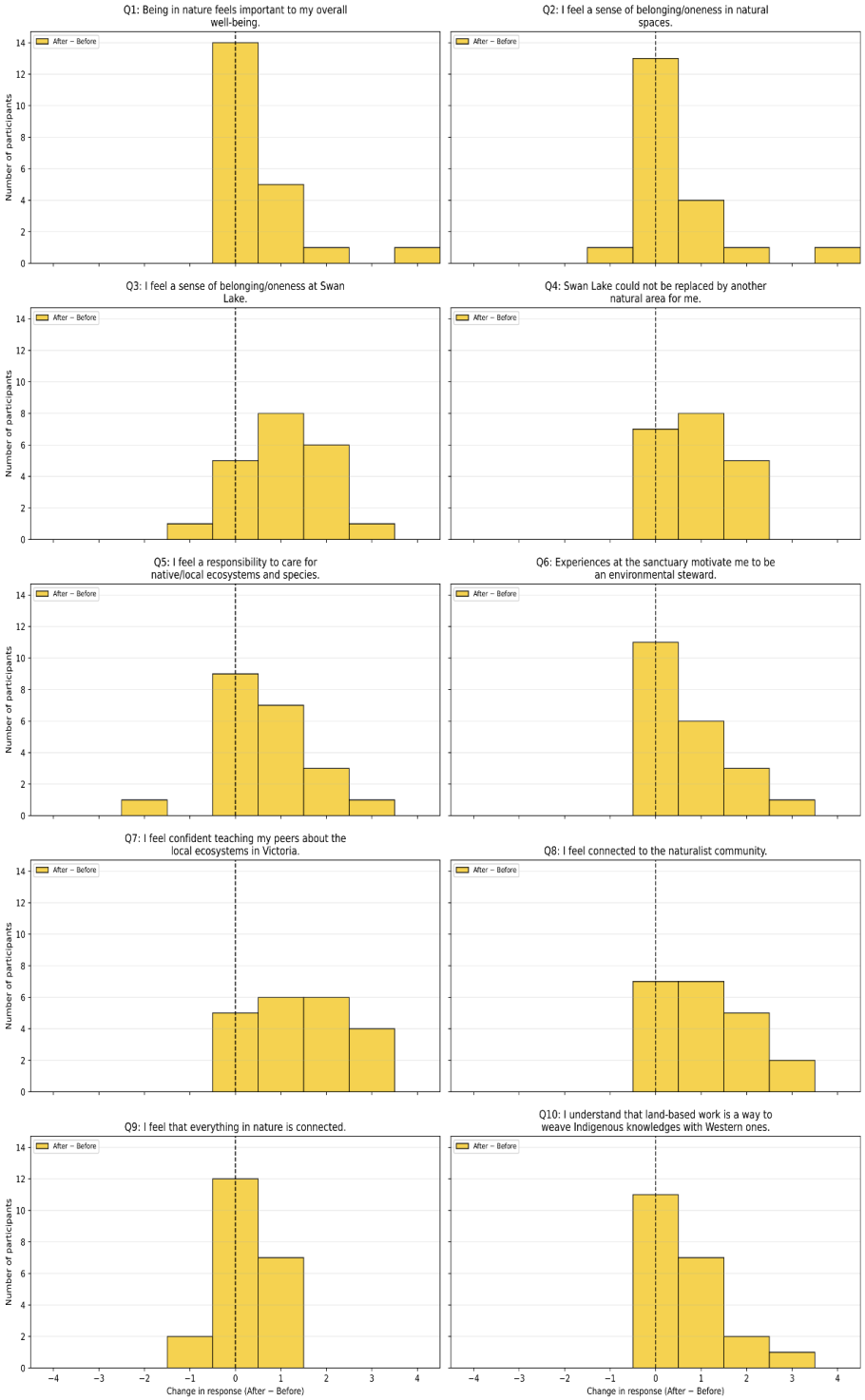


Figure 4.2 Distribution of change in participants' survey responses for each question, calculated as the post-program score minus the pre-program score. A change score of zero,

indicated by the dashed vertical line, represents no change in response. Positive values indicate that participants selected a higher Likert-scale response after completing the program, while negative values indicate a lower post-program response. The height of each bar represents the number of participants with each change score.

Table 4.1. Summary of pre–and-post changes in participants' Likert-scale survey responses by question. Total absolute change is the sum of every participant's change.

Question	Mean Change	Participants Who Changed	Total Absolute Change
1	+0.52	7	11
2	+0.67	8	16
3	+1.05	16	24
4	**+1.10**	**14**	**23**
5	+0.67	12	18
6	+0.71	10	15
7	**+1.43**	**16**	**30**
8	**+1.10**	**14**	**23**
9	+0.24	9	9
10	+0.67	10	14

Overall, the observed trend in Figure 4.1 is that the post-program distributions show a shift toward higher response scores, indicating an increase in relationality and nature connectedness. Figure 4.2 confirms that pattern by showing the change in value of responses extended by 1-3 points after program attendance. The most significant increase in mean change occurred across question 4, 7 and 8, and the least amount of change occurred for question 1 and 9. The highest mean change was +1.43 for Question 7: 'I feel confident teaching my peers about

the local ecosystems in Victoria'. In fact, question 7 had the highest number of 'strongly disagree' responses before taking a program at 23.81% (5 out of 21 people). This change in confidence by the participant is validating for Swan Lakes work because it achieves one of the three main goals of the program, "to empower people to become stewards" (See Section 1.4; c). The second highest mean change was a tie between question 4 and 8 at +1.10, which was 'Swan Lake could not be replaced by another natural area for me' and 'I feel connected to the naturalist community'. These data results also confirm the second goal of Swan Lake programming to 'provide a safe space that feels nourishing' (See Section 1.4; b). Irreplaceability comes with guardianship and emotional connections or memories; the more attached someone becomes to a place, the harder it becomes to move to another, especially when a sense of community is built.

The questions with the least substantial increase in mean change were not surprising to the researcher because individuals participating in pro-environmental behaviours statistically have strong connections to nature and are ecologically minded (Liu *et al*., 2022). The lowest mean change was +0.24 for question 9: 'I feel that everything in nature is connected' and +0.52 for question 1: 'being in nature felt important to my overall wellbeing'. The majority of participants selected either 'agree - 4' or 'strongly agree - 5' on both the pre-and-post survey. The reasoning behind the low mean change can be attributed to the lifestyle indices, 19% of participants had been to Swan Lake "many times" and 69.67% visited natural areas "a few times a month", with multiple people even stating they visited multiple times a week or every day. People who feel that nature is important to their wellbeing and mental health are naturally going to participate in environmental programs and have a greater understanding of nature connectedness because of personal observational experiences.

When looking specifically at each program, the post-program distributions generally shift toward higher response scores, indicating that every program is illustrating an increase in relationality and nature connectedness despite their varying approaches. For example, walking the grounds and visually monitoring with SNAP versus removing invasives with Adopt A Patch. That being said, differences should be interpreted cautiously because program sample sizes varied and responses were pooled across questions; Adopt A Patch teachers provided 7 survey

responses compared to 4 from the Tuesday Restoration Group. Interestingly, although the Tuesday Restoration Group had a small sample size (n = 4) the responses were the most variable with high value pre-program responses (see Figure 4.3). The variability can be attributed to the fact that the Restoration Group does not require extended periods of commitment or repeated visits, which is a central contributor to improving understanding and ecological literacy for the area. The correlation between survey responses and change relative to each program is explored in 4.2.

(iii) Before and after responses relative to each program

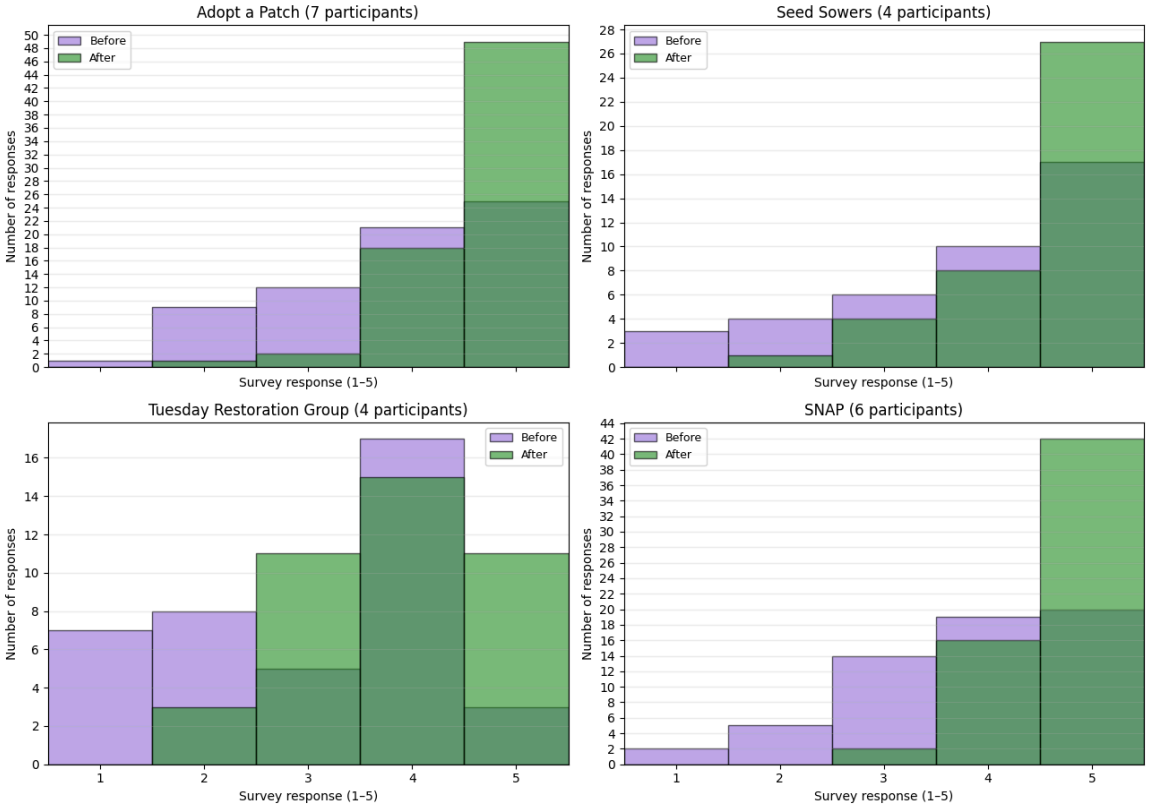


Figure 4.3 Distribution of total Likert-scale survey responses (1–5) before and after participation in four Swan Lake Nature Sanctuary programs: Adopt A Patch, Seed Sowers, Tuesday Restoration Group, and SNAP. Purple bars represent pre-program responses and green bars represent post-program responses. Bar height indicates the total number of responses recorded at each value across all survey questions and participants within each program.

(iv) Qualitative written responses

The following questions are what prompted responses:

1. *Specific aspects of the program that worked best?*
2. *Particularly meaningful experiences?*
3. *Additional Comments?*

A clear pattern emerged in the written responses, with participants increasingly expressing similar themes and ideas. The thematic convergence was observed with regard to observing the seasonal change and the cyclical nature of the sanctuary's ecosystems as well as interactions with staff on site. Seasons were mentioned by 6 of the 21 participants (28.57%), with quotes such as: "*Getting to watch nature change and* ***shift with the seasons is quite beautiful****. Birds migrate, have babies, and move along. I also love the joy that others feel while walking the paths and many people have told me it is a wonderful place"* and *"Walking the trails weekly and* ***seeing seasonal changes***" from SNAP volunteers, "*Working with others (and)* ***seeing seasonal changes***" from a Thursday Restoration Group participant, and "*Kids working together on a common task and watching the plants* ***change through the seasons****"* from an Adopt A Patch teacher. As previously expressed by Passmore & Howell (2014) and White *et al*. (2018), repeated contact with nature helps individuals develop a stronger connection because of deep observations and meaningful experiences that take place over time.

Staff were mentioned by 5 of the 21 participants (23.81%) showing a prominent theme of social connection and staff relationships. Quotes include: "*I love the* ***interaction with staff*** *+ visitors. I love seeing the birds, nature - the way they are free here. I love the sights + smells of the trees (plus other plants) during all seasons + all the changes that happen over a year in time"* from a SNAP volunteer, and "***leadership of staff****, clarity of purpose and timing, comradery"* from a Thursday Restoration Group participant. In particular, almost every Adopt A Patch teacher mentioned staff by saying*"****Kristen*** *was a huge asset to this program - her initial teachings on local plants/Indigenous connection helped us to understand more about this*

space." as well as *"The land has been great to connect to, but it is* ***working alongside staff that really increased the sense of relationship****. Having their support and experiences to guide was integral to feeling connected"*. It is clear that guidance in natural spaces is integral for people to feel comfortable and gain understanding of the interconnectedness and responsibility they hold.

Another less prominent theme, but equally substantiating, was that gathering information and learning new things was an important aspect of building a relationship with a place. A Thursday Restoration Group volunteer said that "*learning about more* ***plant names*** *I hadn't heard of yet*" was a particularly meaningful experience. The SNAP volunteers also said meaningful experiences were learning "*The history of the Garry Oak forest and Camas Flowers",* the researcher could relate to this quote because when she moved to the city and learned about GOE it improved her feeling of relationality to Victoria, BC. Another quote from a SNAP volunteer was that*"consistently showing up has made me more aware of the sensitivity of our ecosystem and how our* ***society has become blind***", it could be inferred that the participant is referring to being blind to the biodiversity around them, which in layman's terms can be referred to as "plant blindness". Plant blindness is a human cognitive bias that causes people to overlook or underappreciate plants in their daily environment, it is a complex phenomenon in the field of science education (Achurra, 2022). The researcher can also attest to experiencing this phenomenon, it is not until you learn to differentiate between leaf shapes and species that one begins to notice the biodiversity - the more you know the more you are seemingly able to see.

Unique responses often referred to particularly memorable experiences that were distinct and personal to that individual. The themes varied between connection with wildlife to community and shared values (see Table 4.2 for the summary of themes and representative quotations). For example, "*watching owlets develop and mature*", "*working around an old oak tree*", and "*working on a super rainy day*" represent the themes of 'observation of biodiversity', 'connection to significant places and natural features', and 'immersion through embodied experiences'. Certain experiences can impact an individual completely differently depending on their personality and background, and what becomes a personally meaningful experience relates to their relationship with the land and place. Working in the rain could be perceived as miserable

for some, but for this individual, it is remembered positively because it was an authentic and embodied experience; perhaps the challenging conditions became part of what made the experience meaningful. Another response that was unique and linked again to the importance of deep observation and interconnectedness was the "*appreciation for tiny beings*". The power of knowledge is observation, and the smaller and tinier the things that are observed, the more likely the person is taking their time in nature to co-exist and understand the extent of life in the environment around them. All quotes can be found in the 7.3 of the appendix.

Only 2 of the 21 participants chose to write additional antidotes, and both were teachers from the Adopt A Patch program. This is likely due to the researchers inability to directly ask the youth, so the teachers were open to offering deeper observations. Their written responses are as follows:

> *"This program means many different things to different students, each leaving with different memories from this space and an overall gratitude from the land. The opportunity to be outside is so important to their mental health."*

The acknowledgement of the impact on the youths mental health was of particular note. They also verbally mentioned to the researcher how students were calmer once they returned to the classroom after program attendance. These observations align with Capaldi *et al.* (2015) and Shanahan *et al.* (2019) notion that nature-based activities are a strong source for changes in mood, stress, and wellbeing after nature contact. In particular, the idea that contact with nature is a wellbeing intervention and a mental health strategy for people who have been disconnected from the natural environment because of urbanization and development. Relatively few programs appear to be capitalizing on nature as a positive mental health strategy, even though evidence suggests that repeated contact with nature produces larger increases in wellbeing than other interventions commonly cited in the positive psychology literature (Capaldi *et al.*, 2015, pg. 7).

Table 4.2 Common themes in participants' most meaningful experiences with quotes from program participants.

Themes	Representative quotations	Programs represented
Repeated engagement and seasonal observation	"Getting to watch nature change and shift with the seasons..."; "Walking the trails weekly and seeing seasonal changes."; "Not a particular experience, just the weekly experiences."	SNAP, Thursday Restoration Group, Adopt A Patch
Social connection and staff relationships	"Working with the land builds relationships.."; "Connection with the staff."; "Leadership of staff... comradery."; "Working alongside staff... was integral to feeling connected."	Adopt A Patch, Thursday Restoration Group, SNAP, Native Plant Garden Stewards
Learning and ecological literacy	"Learning about more plant names..."; "The history of the Garry Oak forest…"; "Sharing knowledge, working independently."; "More aware of the sensitivity of our ecosystem..."	Thursday Restoration Group, SNAP, Adopt A Patch, Native Plant Garden Stewards
Environmental stewardship and agency for action	"Removing invasives."; "Small acts make a difference."; "Kids working together on a common task..."	Thursday Restoration Group, SNAP, Adopt A Patch
Wellbeing and immersion through embodied experiences	"The feeling of peace + calm..."; "I love the sights + smells of the trees..."; "Working on a super rainy day."	SNAP, Native Plant Garden Stewards
Observation of biodiversity and connection with wildlife	"Watching owlets…"; "Appreciation for tiny beings."; "Seeing the birds..."	SNAP, Native Plant Garden Stewards
Connection to significant places and natural features	"Working around an old Oak tree."; "Walking the trails weekly..."	Adopt A Patch, SNAP
Community and shared values	"Participating in the native plant sale..."; "The joy that others feel while walking the paths..."	SNAP

"The thing I noticed most about the kids was that, during restoration, they would talk about anything and everything with laughter emanating from the bushes. The opportunity to do this work with each other in a public way, with cyclists and walkers stopping to commend them, creates a bond with the space and actions that were performed at that time. It is in these moments, I believe, when there are no grades for the work, but it is being recognized authentically, that a sense of connection and identity are formed."

The quote above highlights the importance of positive reinforcement and appreciation from the public to motivate the youth, theoretically making them proud of what they have accomplished. Positive memories tied to specific actions within the sanctuary boundaries build relationality with Swan Lake and the individuals participating in the program. With all survey responses considered, programs at Swan Lake have had a positive impact on participants' feelings of connection and relationship to place. People involved in programs with repeated visits over an extended period of time show a higher response value on the Likert-scale post-program compared to pre-program. For this reason, it can be concluded that results from existing literature on nature also align with this study.

4.1.2 Youth responses

(i) Cumulative Survey Responses

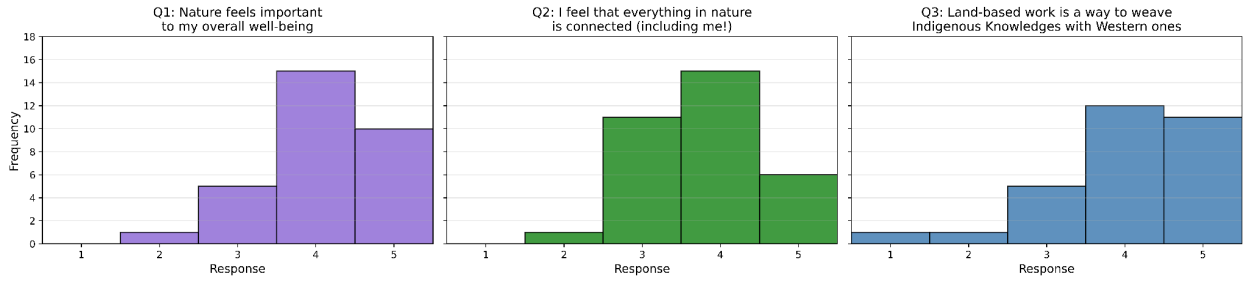


Figure 4.4 Distribution of Grade 3–4 participants' responses to Questions 1–3 following participation in the Adopt A Patch program. Responses were recorded on a five-point Likert scale, where higher values indicate stronger agreement with the survey statement. Bar height represents the number of participants selecting each response option.

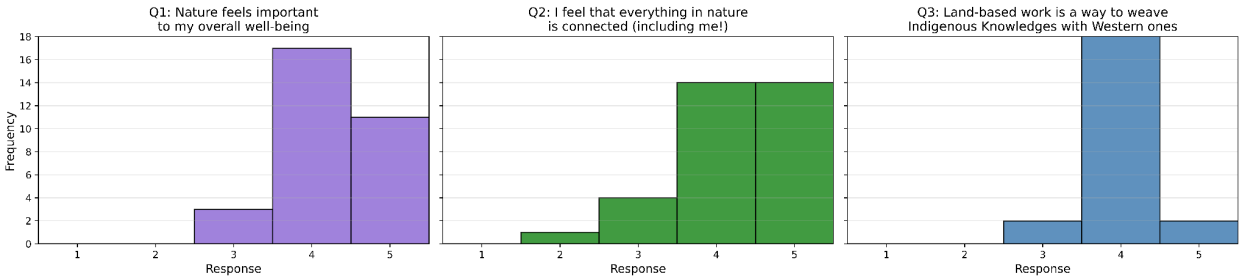


Figure 4.5 Distribution of Grade 9–10 participants' responses to Questions 1–3 following participation in the Adopt A Patch program. Responses were recorded on a five-point Likert scale, where higher values indicate stronger agreement with the survey statement. Bar height represents the number of participants selecting each response option.

Surveys for youth took place separately from the researcher and were completed by Swan Lake as part of 'World Cafe' wrap up event. This event occurs annually before summer break so that the kids get closure and appreciation for the hard work on their 'Patch' before they graduate from the program. The questions presented to the youth were chosen by Swan Lake staff and included three tallied answers and five were written. The questions were not mandatory, so the histograms have different totals of participants depending on the question. Nonetheless, the responses still showed interesting trends. The first interesting pattern is that the first two questions presented similarly among the two different age groups, showing '4 - agree' as the most common answer for both "Q1: Nature feels important to my overall wellbeing" and "Q2: I feel that everything in nature is connected". The main difference between the age groups was for the third question "Q3"land-based work is a way to weave Indigenous knowledges with Western ones'. This discrepancy could potentially be attributed to the increased complexity in the question, it is possible that only higher grades (depending on the schools) are students taught about Indigenous land management and histories. Grade 9-10's almost unanimously selected '4-agree' for the third question and the 3-4's had more variable responses from 1-5. For this reason, it would be particularly interesting for Swan Lake to complete the pre-program survey to see if work at the sanctuary impacted the understanding of Indigenous histories with the land and their integral land-based practices for ecological health.

(ii) Written responses, Grade 3-4



Figure 4.6. Word cloud for grade 3-4 when responding to the question: “What makes you feel at home here?”. Figure 7.4 in the appendix shows the written responses on the paper sheets.



Figure 4.7 Word cloud for grade 3-4 when responding to the question: “What are you curious to learn more about?”. Spirit bears and turtles were the most prominent answer.

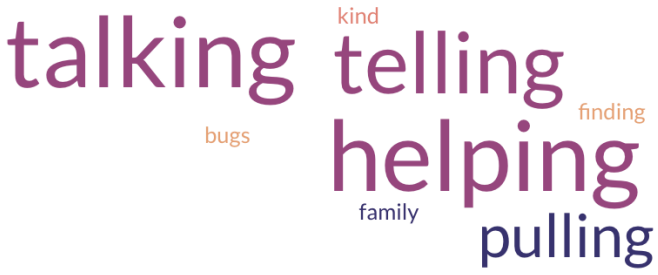


Figure 4.8 Word cloud for grade 3-4 when responding to the question: “How have you shared your learnings with others?”.

Written responses from the youth in grade 3-4 presented which moments stood out to them and aided in forming relationships to Swan Lake. The first written response indicated that animals, kristen, friends, and plants make them feel at "home" at Swan Lake (see Figure 4.6). A particular answer to this question exhibited the theme of 'observation of biodiversity and connection with wildlife': "*the time that Ms. K (Kristen) found an owl and saw a great blue heron*". It appears that seeing the birds was a particularly poignant memory for this child, and the fact that it was pointed out by Swan Lake staff. This is similar to the adults writing that watching the owlets mature was particularly meaningful (Table 4.2). Birds are often among the first forms of wildlife that people notice when they begin spending time in nature, particularly in urban parks. Many urban bird species are habituated to human presence, partly because of bird feeders and other reliable food sources, and are readily detected through their calls, movement, and flight across walking paths.

The second question showed that 'spirit bears' and 'turtles' were what 'they are curious to learn more about' (see Figure 4.7). The interest in spirit bears was unexpected, given that they are not found on Vancouver Island and exclusively exist in the Great Bear Rainforest on the central and north coast of BC. It can be assumed that they had learned about them recently at school and were fascinated by them. Swan Lake *is* home to the federally threatened Western Painted Turtle, *Chrysemys picta.* The students are taught about them briefly during the program, but are apparently eager to learn more. Lastly, they shared their learnings with others by talking, telling, and helping (Figure 4.8). These actions suggest that they have gained confidence from the program enough to share the information they have learned with "*mom and dad*" and "*my family*" (Figure 7.4 in the appendix shows full written responses). Students sharing information they have learned about restoration with their parents is a great way to begin stewardship at home.

(ii) Written responses, Grade 9-10



Figure 4.9 Word cloud for grade 9-10 when responding to the question: “What makes you feel at home here?”.



Figure 4.10 Word cloud for grade 9-10 when responding to the question: “What are you curious to learn more about?”.

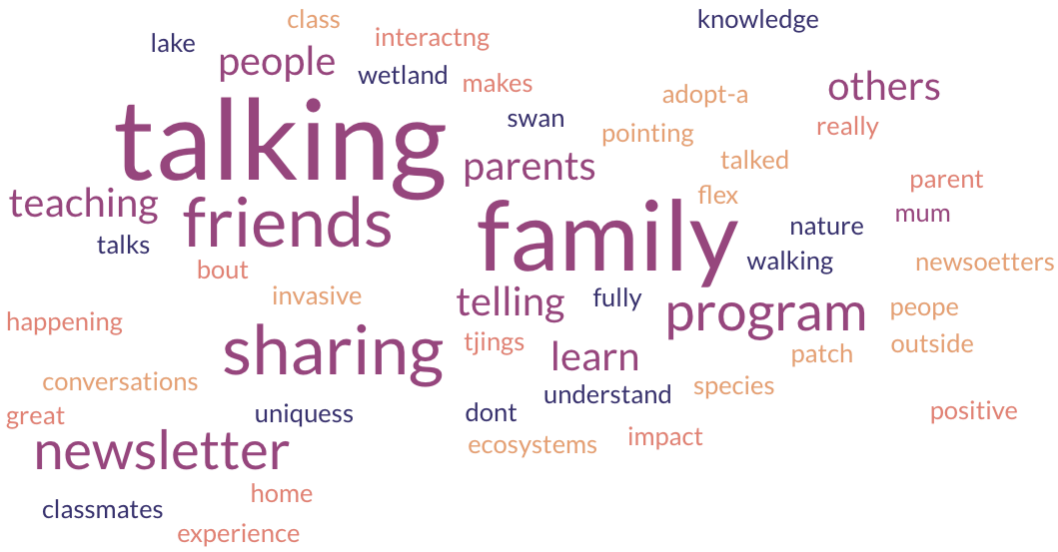


Figure 4.11 Word cloud for grade 9-10 when responding to the question: “How have you shared your learnings with others?”.

The same questions as grade 3-4 were answered by youth in grade 9-10. Similarly, their written responses presented which moments stood out to them and aided in forming relationships to Swan Lake (Table 4.3). The first written response indicated that many felt that being surrounded by nature makes them feel at “home” at Swan Lake (see Figure 4.9). There were a few particular answers to this question that stood out as being very personal and showed deep connection to place: “***no pressure*** *to be something you're not*”, “*having time to* ***clearly think*** *when I'm here*”, and “*being surrounded by the greatness of nature and all the* ***freedom*** *and possibilities*". These quotes display a positive impact on the participants' mental health and wellbeing while at Swan Lake, resonating with the themes of ‘wellbeing and immersion through embodied experiences’. The theme of ‘social connection’ also came up with repeated answers mentioning “*being with* ***friends***” and “*learning* ***together***” which emphasizes the importance of working with others during the program. The last prominent themes that arose from this question were ‘sensory and memorable encounters’ such as “*hearing the crickets*”, “*birds singing*”,” ***calm*** *environment*”, and “*little noise*”. Urban life and being in high school can both be very over stimulating environments with unpredictable loud sounds that can increase rates of anxiety.

Many people depend on nature for the peace and calm it brings, regardless of age, and for some it is the only thing that brings peace and calmness back into their lives (Robers, 2022, pg.34).

The second question showed that 'animals' and native plant species were what 'they are curious to learn more about' (see Figure 4.10). Themes of 'curiosity about species and ecological relationships' and 'interest in history' came up, showing that the students were ready to deepen their learning about Swan Lake. Examples of positive quotes from participating students include: "*what this land was used for before colonization*", "*long term effects of our restoration on the land*", and "*how to protect native bird species*". Another student wrote that they were interested in how "*nature effects our mental health and wellbeing*" which was particularly interesting to the researcher. It appeared many of the students were aware of the impacts of colonization, invasive species, and human kind on the environment around them. These answers are very useful for Swan Lake to design curriculum to target specific interests of the students and fulfill their eagerness to learn about nature.

Lastly, students shared their learnings with others by talking and sharing with friends and family, including parents (Figure 4.11). A Quote of interest to the researcher was "*random fact drops in conversation unintentionally*", this suggests that although the student wasn't trying to purposefully educate the individuals they were with, they felt that the information they knew would be of interest to the others because they found it memorable. Other students wrote "*pointing out invasive species to my family when we're outside*" and "*telling others about the program and the uniqueness of Swan Lake and other wetland ecosystems*". These answers suggest that Swan Lake has succeeded in their central goal of empowering participants to become active environmental stewards by applying critical thinking skills to address issues at home and in the community. Every form of stewardship helps combat ecological loss.

Table 4.3 Common themes in grade 9-10 participants' most meaningful experiences with quotes from Adopt A Patch participants.

Themes	Representative quotations
Wellbeing and immersion through embodied experiences	"Being surrounded by nature"; "Having time to clearly think when I'm here"; "It is peaceful and there is little noise"; "Water = relax, and relax = home"; "No pressure to be something you're not."
Sensory and memorable encounters	"Hearing the crickets"; "Birds singing"; "Watching waves on the lake"; "Each different sitting spot"; "Sitting in the willow tree and being harassed by ants and wasps";
Social connection and shared experiences	"Learning together"; "Being with friends"; "Working with people I know"; "Spending time with people in nature"; "Drumming."
Curiosity about species and ecological relationships	"More about migratory birds"; "More about native plants"; "How fungi, flora and fauna interact"; "Species of fish at Swan Lake"; "How duckweed and plants affect the lake."
Interest in history, restoration, and stewardship	"What it was like when it was a farm"; "What this land was used for before colonization"; "The long-term effects of our restoration"; "How invasive species got here"; "How to protect native bird species."
Sharing learning with others	"Talking to my family"; "Telling friends"; "Pointing out invasive species to my family"; "Sharing with parents and classmates"; "Newsletter"; "Teaching friends"; "Connecting what I learn here to things I learn elsewhere."

4.2 Discussion of the results

The results from auditing current programs through surveys and participation visualized areas that were successful or in need of improvement, fulfilling the first project objective. The findings suggest that relationship-building at Swan Lake occurred simultaneously between participants, wildlife, and the land during program activities. Activities included removing

invasive species on site, visual monitoring of the trails, and caring for plants in the example garden beds and growing in the nursery. The varied opportunities - depending on the program - allowed participants to interact physically with the ecosystem while also talking with staff, other volunteers, and sanctuary visitors. In this sense, restoration was not only an ecological task; it was a relational practice through which participants learned about the land while developing social connections. *Providing a safe space that feels nourishing* and *providing understanding of nature through education* are the two primary goals of the programs (See Section 1.4; c), both of which were achieved through current program designs. The qualitative responses repeatedly emphasized that staff guidance, camaraderie, and shared learning with friends was an important and successful aspect of fostering understanding and making participants feel comfort at Swan Lake, especially for Adopt A Patch school teachers. That being said, feedback from the surveys also suggested that participants were eager for deeper learning on specific species lifecycles, histories, and relationships with other organisms.

Another successful aspect of programming was that as participants spent more time working at Swan Lake, familiarity developed with species identifications and removal practices, increasing their confidence to share their knowledge with friends and family. Extending stewardship practices beyond the sanctuary achieves the third of the three main goals of the programs: *empowering people to become stewards*. This growing self-assurance was particularly evident in responses to Question 7, "I feel confident teaching my peers about the local ecosystems in Victoria," which produced the highest mean increase of all survey questions at +1.43. Stewardship may present itself as explaining ecological relationships, pointing out invasive species on a walk, or encouraging others to participate. As White *et al.* (2018) states, when more participants become capable of sharing, "ripple" effects take place where shared environmental knowledge spreads to families, friends, and peers. By proxy, guardianship and interacting with nature increases the support for green space creation and protection, acting as an intervention to the "extinction of experience"(Soga & Gaston, 2016).

Once surveys were completed, it became apparent that one of the most important factors shaping the relationship with nature is the influence of nature on wellbeing. The results indicate

that there are potential positive mental-health benefits for youth and adults. Teachers reported that outdoor participation was important for students' mental health and that students appeared calmer after returning to class. Youth also associated Swan Lake with peace, relaxation, mental clarity, and freedom from social pressure. These findings align with Capaldi *et al.* (2015), who identified willingness and adherence as advantages of nature-based wellbeing interventions, because wanting to partake in nature activities may encourage enjoyment and continued participation. White *et al.* (2018) similarly found that several children described feeling calm and relaxed during a bird-focused outdoor project, while recommending further research into the wellbeing benefits of activities in nature. Adults described the positive impact on their wellbeing from immersion through embodied experiences, such as the feeling of peace and calm when they visit. Observing seasonality, like watching the plants change and birds migrate, was also described as being particularly meaningful; the increased sense of understanding of place brought joy and connection.

The post-program distributions for all four adult programs showed a shift toward higher response scores, indicating an increase in relationality and nature connectedness. Results from Adopt A Patch, Seed Sowers, and SNAP all showed a high frequency in the total number of responses recorded at value 5 on the Likert scale and very few between 2-3. The Tuesday Restoration Group produced the most variable responses, although its sample was small (n = 4). One possible explanation is that The Tuesday Restoration Group requires less long-term commitment than the programs involving regular attendance over multiple months to years. Repeated visits provide more opportunities to develop relationships with staff and other participants, observe seasonal change, and see the effects of restoration work, in turn producing larger increases in wellbeing (Passmore & Howell, 2014; Capaldi *et al.*, 2015; White *et al*., 2018;). Future research could record attendance frequency and length of participation in detail to examine more directly how repeated engagement influences nature connectedness, confidence, and wellbeing.

4.3 Contributions to the field of Industrial Ecology

Industrial Ecology is the study of solutions to environmental challenges in regard to the three pillars of sustainability: society, the economy, and the natural environment (International Society for Industrial Ecology, n.d.). Traditionally, Industrial Ecology focuses on material and energy flows, life-cycle assessment, and industrial symbiosis. However, there is increasing recognition that achieving sustainability requires understanding not only of physical resource flows, but also the social relationships and the psychology of people that ultimately influence environmental outcomes (discussed in section 1.2). Green spaces have been recognized as one of the most popular resources of urban ecosystems today by improving air quality, water purification, stormwater management, carbon sequestration, regulation of microclimate, habitat for urban wildlife, recreational, as well as psychological, spiritual, and social unification (Gairola & Noresah, 2010, pg. 43). Hence, green spaces improve urban ecological *functions* and provide ecological *services,* especially when the ecosystem is intact and functioning. Given that green spaces, such as Swan Lake, have such a wide range of positive outcomes, the research contributes to all three pillars of sustainability in an interconnected way.

(i) Society

This research contributes to the social dimension of Industrial Ecology by introducing nature-based program participation as an important socio-ecological component of sustainability. There is a growing body of work that emphasizes the importance of nature connectedness to societal wellbeing and improved mental health, with Capaldi *et al.* (2015) and Shanahan *et al.* (2019) stating that nature-based activities are a strong source for changes in mood, stress, and wellbeing after nature contact. Nature connectedness has also been associated with psychological wellbeing, personal growth, and life satisfaction (Pritchard et al., 2020). Examples of quotes regarding peacefulness and feeling calm associated with Swan Lakes programs can be seen in Table 4.2 and 4.3. Existing research also suggests that the wellbeing boosts from nature contact can be achieved fairly quickly (Capaldi *et al.*, 2015, pg. 7). Thus, nature connectedness, which can be achieved through participating in nature programs, links to a happier life.

Nature is certainly not a cure for every mental health issue, but it is helpful in a way that is underutilized (and perhaps unknown) by mental healthcare providers. Many people have access to some form of green space or urban park, and for the poorest and most vulnerable members of society, nature interventions may offer opportunities to "enhance mood, reduce stress, and promote wellbeing, at relatively low cost" (Capaldi *et al.*, 2015, pg. 9). This aspect also links to the economic sustainable pillar of Industrial Ecology.

Another contribution of nature-based programs to society is community and social connection. Gaining friendships and making relationships with like-minded people relates to overall happiness and quality of life for many. Moreover, community cohesion contributes to social well-being; individuals who met at a program may help one another in other aspects of life outside of Swan Lake or another green space. Participants of the Swan Lake programs confirmed they felt they gained a sense of community, which was particularly meaningful to them.

Alongside mental health, societal services of protected areas also include physical health benefits. Participating in programs or visiting urban greenspaces promotes healthier lifestyles because people practice physical exercise (i.e walking, running, pulling invasives) around green spaces. Activities such as this significantly lowers the risk of diastolic blood pressure, heart rate, type II diabetes, obesity, and cardiovascular mortality (Twohig-Bennett & Jones, 2018). Despite this evidence, relatively few public programs intentionally use nature engagement as a strategy for improving well-being (Capaldi *et al*., 2015).

It is important to acknowledge there can be equity implications of green spaces. Swan Lake is a great example of an urban green space that provides equal access: there is no cost barrier to participate in the programs, there are many different programs for varying physical capabilities, and no one is turned away from experiencing the water and land. That being said, it is possible for urban greening to increase social injustices and inequity by consequently increasing housing costs and property values, contributing to disparity and gentrification in neighbourhoods (Grossmann *et al*., 2022, pg 1413). Given that this research is not studying the implementation of new urban spaces, gentrification is less of a concern in this context.

(ii) Economy

Although this project does not directly evaluate economic outcomes, healthier ecosystems and healthier communities may lower costs and contribute indirectly to economic sustainability. Connecting with nature is a relatively easy and cost-effective intervention for people who are disconnected from the natural environment and in need of physical and mentally stimulating experiences. Improved human health and mental well-being are associated with increased productivity (workplace and in schools), lower healthcare expenditures, and greater community resilience (OECD, 2026; Shanahan et al., 2019). Generally speaking, a country's wealth and economic standing are closely tied to its productivity. Increased productivity at work means higher efficiency and potentially lower resource use with boosted outputs. The healthcare benefits are on longer-term scales, as mentioned in the section above, interacting with nature is calming and promotes physical activity, in turn lowering risks of conditions like diastolic blood pressure, heart rate, type II diabetes, obesity, and cardiovascular mortality (Twohig-Bennett & Jones, 2018). It also likely reduces the demand on the health care system for mental health related visits, such as anxiety and depression. Relatively few programs appear to be capitalizing on nature as a positive mental health strategy (Capaldi *et al.*, 2015, pg. 7).

Investments in human–nature relationships can also generate value by strengthening the social systems upon which ecological management depends. For example, volunteering to remove invasive species. The BC provincial government invested $12 million post-COVID in 2021 to assist with the detection and removal of invasive species (Government of British Columbia, 2021). Costs such as these are mitigated by people offering to give their time to manage invasives in protected areas and urban green spaces. Enjoyable and accessible nature activities encourage continued participation and public service contribution. Therefore, investing in nature programming represents a form of preventative sustainability rather than reactive environmental management.

Lastly, natural urban parks provide services that protect people living near to them from environmental extremes and pollution. Examples include: flood control, stormwater

management, freshwater quality improvement, and regulation of microclimate (the Urban Heat Island effect). It is well documented that green spaces help combat heat, air, water, and noise pollution (Khalili *et al*., 2026). Without these spaces, there would otherwise need to be high cost investments by the city to implement green spaces and plant trees as a proactive measure. tUnlike green spaces, urban areas consist of mainly impermeable surfaces (pavement) that lead to the quick accumulation of water. The cost of reactive measures such as cleaning up after a flood can be very high for densely populated cities. Of particular concern with climate change is the frequency, duration, and intensity of heatwaves. Being next to a park lowers air temperatures due to shade, insulation, and cooling of evapotranspiration from plants. Therefore, being in proximity to a park boundary can mitigate the need for air conditioning or lower its usage, which in turn reduces energy consumption and demand on the grid.

(iii) Natural Environment

This contribution to Industrial Ecology has been discussed in depth throughout this study, so it will only be explored briefly in this section. Nature based-programs contribute to environmental sustainability because they break the cycle of extinction of experience, and by proxy, promote stewardship behaviours which lead to increased protection of green spaces. Liu *et al*., (2022) found that nature connection had associations with pro-environmental behaviour, and this study built upon such research to identify specific program characteristics that strengthen participants' connections with nature. Thus, this research contributes a practical mechanism for supporting biodiversity conservation through social engagement.

Increased confidence to share ecological knowledge, participate in restoration, and encourage stewardship among peers may allow conservation benefits to extend beyond Swan Lake into surrounding communities. Stewardship comes in many shapes and forms, but examples include: planting native plants in participants' own yards and creating habitat for pollinators and wildlife, removing invasives to allow native species to thrive, and educating friends and family to do the same. As more people create natural spaces more habitat patches are formed, and could eventually create corridors for species to move between parks and ecological spaces in suburban areas. The planting and protection of native species also preserves local

biological genetics and provides critical habitat for species that have co-evolved with said local species. Preserving intact and biodiverse ecological communities also means preserving environmental resilience to climate change and pathogens; the dilution effect, where high biodiversity means it is unlikely every species would be impacted. Restoration work, nature programming, and stewardship help maintain those biodiverse environments and protect the local ecology for future generations.

5. Chapter Five: Recommendations and Conclusion

5.1 Recommendations to Swan Lake

This section of the research addresses the second objective of the project: 'suggest how programs at Swan Lake can be designed to strengthen the feeling of connection to nature for participants'. The researcher will continue delving into this field of study for an extended three months following project completion. The hope is to optimize the long-term impact of nature education as a result of the the following courses of action :

A. Design curriculum for the Adopt A Patch program that emphasizes ecological literacy and addresses the overlapping written responses to the survey question "*What are you curious to learn more about?*".
    - An example of the curriculum structure is lessons about a specific species in accordance with its blooming time, this also aligns with the fact that people expressed seasonality as meaningful for connectedness.

B. Create educational materials and handouts that outline ways to apply ecosystem restoration and critical thinking skills to address stewardship issues at home and in the community.

C. Create a digital and physical handbook that gives participant "graduates" a well-structured and data-supported sequence of ways to apply conservation awareness, knowledge, and skills.

D. Draft a new nature stewardship program that aligns with the purpose and priorities of the organization and meet the needs of the community.

5.1.2 Relational Ecology Program Design Tool

This section of the research addresses the third objective of the project: 'incorporate these findings with a literature review to create a program design tool that can be used to screen any future programs and events'. The design tool seen in Figure 5.1 was largely inspired by Brousselle *et al*. (2024) 'Planetary health policy-design tool', which is a rapid impact assessment tool that considers the dimensions that matter the most to "ensure positive impacts for a thriving future". Similar to this project, it was intended to inspire program designers, decision-makers, administrators, and evaluators willing to positively influence planetary health and introduce such tools in their projects (Brousselle *et al*., 2024 pg. 270). Their work was also based on three premises for evaluation practice, as was this: social, economic, and environmental.

A total of six dimensions were chosen as integral for program success: community connection, cross-generational, reconciliation, fostering knowledge, deep observation, and biodiversity. 'Community connection' refers to time provided for participants to meet one another, as well as form relationships with Swan Lake staff. Swan Lake aims to provide a safe space that feels nourishing and provides time for conversations. According to survey responses, this dimension was very meaningful to participants and made people feel comfortable and more likely to return. 'Cross-generational' is similar to community connection and was an added dimension because many of the programs have a large range in ages from youth to elderly people. Interactions between age groups is an important aspect of community building because multi-generational conversations can lead to wisdom and experience sharing, as well as reduce loneliness for individuals who may be retired and looking for social interaction as part of their volunteering. Based on survey responses, friendships and sharing experiences with other people is meaningful for creating a connection with place.

Reconciliation' is also a very important aspect to the work, restoration work involves physical interaction with land that has historical significance; Swan Lake is located on the

traditional territories of the lək ʷəŋən-speaking and W̱SÁNEĆ Peoples. Swan lake aims to collaborate with Indigenous Knowledge Keepers to weave traditional wisdom into ecological restoration, native plant cultivation, and community stewardship. In other words, land-based work is a way to weave Indigenous knowledge with Western ones.

The third dimension is 'fostering knowledge', nature education has always been a guiding directive for the Nature Sanctuary. A central goal of all the programs is to empower participants to become active environmental stewards by applying ecosystem restoration and critical thinking skills to address ecological issues at home and in the community. Thus, it is included in the design tool to ensure that time is set aside to teach people enough about the plants they are working with and the planting/removal technique so that they feel confident enough to try it on their own as well. Another teaching at the forefront is the interconnectedness of nature and how they are a part of it; people have worked with the land since time immemorial in respectful and reciprocal ways. Knowledge sharing could resemble Swan Lake staff teaching SENĆOŦEN plant names, facts about the species that people are working with that day, or perhaps associated pollinator species. Wanting to learn more specifics about species at Swan Lake was a repeated theme in the feedback from the surveys. Once a curriculum is created for the programs, this dimension would also refer to the course material being taught.

The next dimension is 'deep observation', this includes witnessing and experiencing wildlife no matter how small or large. Deep observation can involve looking for "*tiny beings*", birding, nature journaling, drawing, sitting and watching the lake, and more. It is a broad concept of noticing and recognizing the interconnectedness of all life. Ideally, during the program, time is taken to show participants a wildlife interaction or observation that would be of interest to the public. Repeated contact may be an important aspect of this dimension, because it can take time

RELATIONAL ECOLOGY
PROGRAM DESIGN TOOL

Swan Lake Nature Sanctuary

Ready to run your program or event through the following dimensions?
Start by considering the program/event as it's currently designed and imagine it's being fully implemented. How might it involve or impact each dimension? Where does it land on the rating scale? What changes could be made to increase the positive impact between attendees and their relationship to the land?

If adjustments are made to improve, run it through the program tool again to see if the results are higher.



INSTRUCTIONS:

When completing this program tool, answers can be subjective, but still provide insights into how individual programs can be improved to better connect attendees with the environment. This should take between 10-15 minutes.

DIMENSION	RATING SCALE: Not at all (1)	Slightly (2)	Somewhat (3)	Mostly (4)	Completely (5)
COMMUNITY CONNECTION • Has time been provided for participants to meet one another? • If this is a recurring group, are participants able to reconnect? • Are staff taking time to personally converse with individuals?					
RECONCILIATION • Has there been a land acknowledgment? • Has the program leader expressed gratitude to the land through personal examples?					
FOSTERING KNOWLEDGE • Has space/time been set aside for knowledge sharing? For example, spending time talking about the species being worked with that day, its SENĆOŦEN name, the pollinators it attracts, etc.					
CROSS-GENERATIONAL • Are there multiple age groups present? Are they able to interact so that elders can share experiences with the youth. • Are all ages able to bond over a similar task?					
DEEP OBSERVATION • Has the presence of smaller life forms been recognized? Such as insects, spiders, amphibians, gastropods, fungi and more. • Do participants have the chance to experience co-existence with wildlife? Key examples: prey-to-predator or parental care.					
BIODIVERSITY • How many species are the participants being exposed to? • Have they only been able to experience one ecosystem type or multiple?					



The final score should at least be between 20-30, if below 20 try to restructure the program.

TOTAL SCORE:



Figure 5.1. Program Design Tool for Swan Lake to evaluate their nature-based programs.

for individuals to train their eyes and move beyond ‘plant blindness’. The more people learn and understand the stronger connection they may have, and eventually *Systems thinking* can be achieved from repeated observation and understanding that even small changes can create a ripple effect on the ecosystem.

Lastly, the sixth dimension is ‘biodiversity’ which aims to ensure that participants are exposed to either a diversity of species (plant, insect, bird, reptile, etc) or ecosystem types (wetland, meadow, rocky outcrop, forest, riparian, etc) while on site. Sometimes participants will work in one Patch or a small designated area, but given the species richness at Swan Lake there is always an opportunity to expose people to an array or species (native and not). Depending on the time of year, there is also an extensive diversity of pollinators and migratory birds that fly around the sanctuary. It is important for staff to make sure they are pointing out new things that either fly past or are sessile because not many people experience the ecological diversity that occurs at Swan Lake in their everyday life.

It is recommended for Swan Lake to use the Program Design Tool to screen programs and events to guide the development of future educational and biodiversity-focused initiatives. Each of the dimensions in the tool can be rated on a scale from 1 (not at all) to 5 (completely). The way the tool can be used is for a Swan Lake employee to run the program they have created through the listed dimensions and assigning values. They will have to imagine the program/event as they designed it and as though it is being fully implemented. Each dimension is described in subtext to help the rater consider and compare the elements in place. The final score should be between 20-30. If the score is below 20, they should try to adjust or restructure the program and then run it through the tool again to see if the results are higher.

5.2 Broader Recommendations

The findings of this research have impacts beyond individual nature-based programs and should be considered within broader municipal, educational, and sustainability planning. To start, cities should recognize relational nature programming as an integral part of education in schools. Many countries around the world are realizing the importance of connecting children with nature

and Forest and Nature schools are becoming increasingly popular (Capaldi *et al.*, 2015, pg. 7). Expanding the number of nature schools would require social and ecological infrastructure to support it along with stable funding, supportive policies, and official site-specific educational curriculums. However, over time, it would become clear based on data generated through students' paths after graduating the schools whether it is impacting their life choices and path forward in life. Someone in the future could then present this information to the city to (theoretically) prove that it is important work. It could be expected that initially setting up nature education for all schools could be costly, but the long term effects of stewardship, productivity, and public well-being would likely pay for itself.

Alternatively, schools and post-secondary institutions could require field-based courses for all degrees (even non-ecologically focused ones) where students participate in ecological restoration, monitoring, or land-based learning throughout an academic year. Long-term and repeated participation should be prioritized because relationships with place, ecological knowledge, and stewardship behaviours *require* time to develop. Partnerships with community organizations, like Swan Lake, would need to be agreed upon at least a year in advance to develop the educational materials because land-based education is extremely place-dependent.

Funding should also be provided to nature sanctuaries, nature education centres, and local parks to pay educators on site. This funding could come in the form of an annual dedicated grant that covers an employee's annual wage. Having a full time nature educator is essential to providing information to visitors and participants. The longer someone is able to have stable employment and work at a particular protected area, the more site-specific knowledge they will have, which in turn translates to relational information sharing.

Funding models should explicitly address equity. Transportation costs, program fees, scheduling, accessibility needs, and limited access to urban green space can prevent some communities from participating. Public funding should therefore prioritize low-cost or free programs and ensure that opportunities are accessible to youth, lower-income residents, Indigenous communities, elders, and people with disabilities. Overall, nature education can be

beneficial to everyone in society, and as a result of environmental stewardship behaviours, environmental health and sustainability are enhanced for future generations.

5.3 Recommendations for Future Research

Additional research that could take place by the researcher or others interested in nature education would be to conduct *longitudinal research*. This would involve reaching out to participants several months or up to a year after a program to determine whether increases in place attachment, nature connectedness, and ecological confidence are sustained over time. Results could be particularly interesting because participants frequently identified repeated visits and observing seasonal changes as meaningful aspects of their relationships with Swan Lake. Similarly, further research could target rates of *social diffusion*, where individuals influence others beyond their immediate family. This includes peer networks, educators, and community members who may amplify nature connectedness through "cultural transmission" (Richardson, 2025). This would be particularly interesting in regard to the stewardship goals of Swan Lake.

Most literature targeted a single educational program instead of multiple programs at a single location, which ended up providing interesting comparative results. Further research could also compare multiple programs, but would also benefit from larger and more evenly distributed samples across programs. Although the present study included 88 participants, matched pre- and post-program data were available only for the 21 adult participants, while the youth responses could only be examined as post-program data. Larger samples would also permit more reliable comparisons among program types, participant age groups, program duration, and frequency of attendance.

Another interesting aspect of this research would be "what kind of nature would work best?". A comparative study between nature programs at biodiverse nature sanctuaries and parks versus nature programs that take place in green spaces, but are mostly lawn and planted trees. It could be hypothesized that more biodiverse landscapes would yield higher rates of nature connectedness because there is more likelihood of wildlife interaction, but this has yet to be confirmed in scientific literature.

Lastly, the program design tool developed through this research should also be piloted and evaluated in future Swan Lake programs or even other nature education hubs. Programs designed or revised using the tool could be compared with existing programming to assess whether its recommended features lead to stronger outcomes. Particular attention could be given to the program characteristics emphasized by participants, including supportive relationships with staff, hands-on stewardship, repeated engagement, seasonal observation, social connection, and opportunities to develop ecological knowledge and confidence.

5.4 Considerations and Limitations

The main limitations of this research are related to sample size, timeframe, and the self-reported nature of the survey data. The temporal scope of the research was a short three months, as determined by the capstone project guidelines from the University of Victoria. Thus, the total number of survey responses the researcher could gather equated to 88 out of an estimated population size of ~500 people who participated in the selected Swan Lake nature programs in 2026. This represents 17.6% of the population, giving approximately a ±9.5 percentage-point margin of error at 95% confidence, which is adequate for identifying broad patterns and trends, but it is less suitable for making highly precise population-wide estimates. When looking at specific programs, the absolute sample size varied significantly. For example, SNAP only had a small total population of 16 participants in 2026, and the researcher collected 6 responses (which covers 37.5% of the population); but the Tuesday and Saturday Restoration Group has a large total population of approximately 416 people in 2025, and the researcher only collected 4 responses (which covers almost 1% of the population, assuming it would be similar in 2026). Therefore, the researcher was able to get an adequate sample size of programs that maintained the same re-occurring individuals, but did not get a large sample size relative to the total number of unique people that participate in the bi-weekly ‘casual’ volunteer sessions. This did not impact the study in a significant sense, because it was more important to get survey responses from individuals who had participated continually over time instead of one-off attendance.

A limitation that the researcher noticed with the youth (grade 3-4) surveys was that when one kid wrote something, it appeared that multiple other kids would write the same thing in an influenced fashion. This is more a limitation of the survey design itself than the children's responses. Ideally, the survey would be handed to each person individually so that they could not see other people's responses. That was how it was done with the adults, but because the researcher was attending the pre-designed program evaluation event, she could not influence how the survey was handed out. If the research were to be completed again, the design would be altered for this reason.

A main consideration for this research is that program participants and volunteers in the restoration field are likely to be nature-inclined. That being said, this does not affect the overall results of the work since the surveys are measuring a *rate of change* from before and after participating rather than total values selected. Regardless of individuals' initial feelings of connection to nature, there could be an increase or decline in connectedness to nature over time. It was stated in previous literature that people with pre-existing interests may incur higher rates of nature connectedness over time. Therefore, it is possible the rate of change would be similar regardless if they are nature-inclined or not. That being said, given the absolute sample size is so small, it can not be deduced from this research whether there is a difference in effectiveness dependent on a person's pre-existing feelings toward nature. The results obtained at this time can only be used to identify themes and provide descriptive observations rather than reporting generalizations for every participant's feelings. Therefore, the findings should not be considered representative of the entire group.

5.5 Conclusion

Amongst unprecedented biodiversity loss, habitat fragmentation, and urbanization, the importance of ecological systems is becoming increasingly recognized for the broad range of services it provides to society. However, because of modernized lifestyles and the increased dependence on modern technology and human-built features, there is a progressive disengagement with the natural world and the extinction of experience. Human-to-nature disconnection discourages environmental stewardship, leading to the loss of green spaces, which

in turn forms a positive feedback loop where fewer nature opportunities become available. Nevertheless, interventions such as nature-based programming can break the cycle by fostering understanding of nature through education and nature connectedness. Nature connection is positively associated with psychological wellbeing, pro-environmental behaviour, and conservation volunteering.

For this reason, the programs at Swan Lake presented as an ideal case study for demonstrating the importance of nature-based programs and their impacts on participants. The results found from participant survey responses provided reasons to be optimistic about the effects of nature contact on people's relationships with the environment. All post-program distributions show a shift toward higher response scores, indicating an increase in relationality and understanding of the ecological systems. The highest mean change was +1.43 for Question 7: ‘I feel confident teaching my peers about the local ecosystems in Victoria’. This achieves Swan Lakes central goal of empowering participants to become active environmental stewards by implementing skills learned beyond the sanctuary.

People are not external users of our natural ecosystems, but instead active participants whose relationships with nature influence both environmental outcomes and societal resilience. Designing programs that intentionally strengthen these relationships therefore represents an additional pathway through which Industrial Ecology can contribute to a sustainable future for this planet. If conservation organisations and municipalities can work together to help support these initiatives the benefits of nature connectedness could be maximized, improving environmental, economical, and social well-being

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7. Appendix

7.1 Survey (created by Abigail Hyde) and filled out by participants

Part 1: Lifestyle indices (4 questions)

* A. Had you visited Swan Lake prior to participating in a program?

- ☐ No, I had never been.
- ☐ Yes, a few times.
- ☐ Yes, many times.
- ☐ I can't remember.

* B. Do you visit other parks or natural areas very frequently?

- ☐ No, not really.
- ☐ Yes, a few times a month.
- ☐ Yes, a few times a week.
- ☐ Yes, almost every day.

* C. In a typical month, about how many hours do you spend at Swan Lake?

—

* D. Do you live near the sanctuary?

- ☐ ~5 minute commute.
- ☐ ~15 minute commute.
- ☐ ~30 minute commute
- ☐ ~60 minute commute
- ☐ Longer than an hour commute.

Part 2: *Before* participating in the program (10 questions)

1= Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly agree

___* 1. Before the program, being in nature felt important to my overall well-being.

____* 2. Before the program, I felt a sense of belonging/oneness in natural spaces.

____* 3. Before the program, I felt a sense of belonging/oneness at Swan Lake.

____* 4. Before the program, Swan Lake could not be replaced by another natural area for me.

____* 5. Before the program, I felt a responsibility to care for native/local ecosystems and species.

____* 6 Before the program, experiences at the sanctuary motivated me to be an environmental steward.

____* 7. Before the program, I felt confident teaching my peers about the local ecosystems in Victoria.

____* 8. Before the program, I felt connected to the naturalist community.

____* 9. Before the program, I felt that everything in nature is connected (e.g., animals, plants, humans, water , air , land, fire, etc.)

____* 10. Before the program, I understood that land-based work is a way to weave Indigenous knowledges with Western ones.

Part 3: *After* participating in the program (13 questions)

Duplicate of the 10 questions in Part 2 with the addition of:

*21. If you would like to share more, were there any specific aspects of the program that work best for you in feeling a sense of connection and place at Swan Lake? (e.g., working with others, witnessing a wildlife interaction, seeing blooms, ect.)

_____

*22. Was there a particular meaningful experience during the program that increased your sense of 'relationship' to the sanctuary?

_____

*23. [1-10 scale] How likely is it that you would recommend joining the program to a friend or colleague?

7.2 Connectedness to Nature Scale (CNS)

Questions from the standard CNS that inspired the researchers' questions for this study:

____1. I often feel a sense of oneness with the natural world around me.

____2. I think of the natural world as a community to which I belong.

____8. I have a deep understanding of how my actions affect the natural world.

____14. My personal welfare is independent of the welfare of the natural world.

7.3 Other quotes

- *"Working with the land builds relationships with others"* - Adopt A Patch teacher
- *"Sharing knowledge, working independently"* - Adopt A Patch teacher
- *"Removing Invasives"* - Thursday Restoration Group
- *"Connection with the staff*" - Adopt A Patch teacher
- *"Not a particular experience, just the weekly experiences"* - Thursday Restoration Group
- *"I've done plant walks and did a local landscaping program, so I feel like I'm going to learn more*" - Thursday Restoration Group
- *"The overall experience of being given permission to feel that small acts make a difference"* - SNAP
- *"Regular "visits" to the area means see(ing) natures changes over time"* - SNAP
- *"The feeling of peace + calm when I visit is very important to me".* - SNAP

7.3 Photos of written responses



Figure 7.4. Photos of the responses from the grade 3-4 program participants of the Adopt A Patch program. This survey format aligned with Swan Lakes standard for measuring the impact of the program.

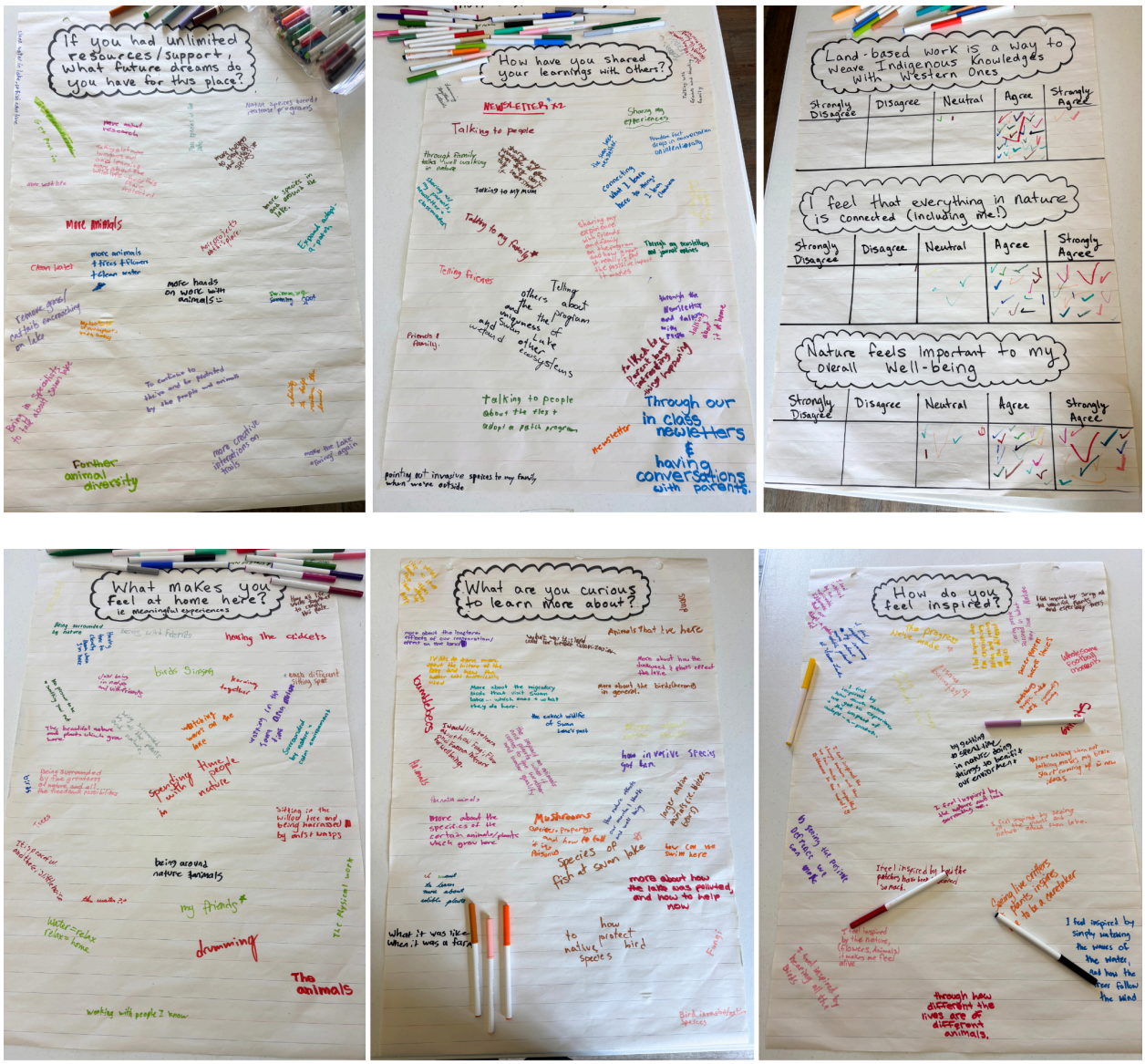


Figure 7.5 Photos of the responses from the grade 9-10 program participants of the Adopt A Patch program. This survey format aligned with Swan Lakes standard for measuring the impact of the program.