



Evaluating Equity within Outdoor Environmental Education Programs:  
A Case Study of the Nisqually River Education Project

by

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A Thesis  
Submitted in partial fulfillment  
of the requirements for the degree  
Master of Environmental Studies  
The Evergreen State College  
January 2018

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## ABSTRACT

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Environmental education is key to shaping attitudes and behaviors towards ecosystems at all scales. Many organizations seek to fulfill the environmental-educational needs of communities in order to provide appropriate experiential environmental programs for students and the local population. In addition, interest in equity is growing. While little research has been done to evaluate equity goals and effects in environmental education programs, there is concern that a one-size-fits-all approach that fails to consider differing backgrounds such as race, family, income, gender, and ethnicity hinders learning.

The following case study focuses on the Nisqually River Education Project (NREP), a non-profit organization through the Nisqually River Foundation that conducts environmental education programs in Thurston County, Washington. As is the case with many environmental education programs, the NREP seeks to serve the needs of a diverse community. This thesis uses survey responses from students in both a rural and an urban school participating in NREP to ascertain differences in environmental attitudes and behaviors, as well as determine how the impacts of an environmental program such as NREP differ between the two. The results indicate that there are some differences between environmental attitudes and behaviors between students from the two schools. While the NREP had different effects in each of the schools, overall the program was effective in increasing student perception and interest in environmental behaviors and activities. Further, this perception and interest increased for some of the survey responses throughout the school year, and did not appear to dissipate after the program activities had ended, indicating a lasting effect of the NREP on the students. This thesis will contribute to the larger body of knowledge on equity within environmental education, and it will inform future environmental education programs.



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## **Acknowledgements**

This study would not be possible without the participation of the Nisqually River Education Project's Director, volunteers, and Prairie Elementary and Mill Pond Elementary's 5<sup>th</sup> grade students and teachers. I also could not have done without the endless love and encouragement of numerous friends, family, co-workers, and cohort members.

Finally, I would like to express my sincere appreciation for my thesis advisors, Professors Kevin Francis and Miranda Mellis, for providing me with the support and scaffolding necessary at various points in order to move forward in this process.



## INTRODUCTION

### **Nature Deficit and Environmental Education**

Nature-deficit disorder (NDD), though not an official diagnosis (Driessnack, 2009), is the main behavioral disorder associated with the personal and cultural symptoms of nature dissociation. It describes the “diminished use of the senses, attention difficulties, and higher rates of physical and emotional illnesses. The disorder can be detected in individuals, families, and communities” (Louv, 2005). To combat the symptoms of NDD, environmental education activity is proposed as a solution to cure nature-deficit disorder in today’s youth.

Significant contributing factors to NDD, such as technology-dependent lifestyles and industrial development, are on the rise (Dwyre, 2015). However, recent research attests to the positive benefits of time spent in nature to developmental health in children, both physical and mental. Allowing children to apply their learning outside of the classroom will increase their ability to gain appreciation for nature and make intimate connections with people and places through exposure to their environment. (Louv 2005)

This connection to nature and environment is also considered vital to understanding what is thought to be the source of many of the environmental problems that are currently faced by society. When individuals have an intimate understanding and appreciation of their local environment, it is believed that they will be motivated to make choices in election of representatives and community issues that will benefit the continuity and preservation of the environment, which affects everyone. (Stapp, William, et al. 1969)

Critics of a proposed solution of place-based environmental education (EE) to NDD and environmental awareness call into question the quality and effectiveness of EE and how different demographics respond to EE (Dickenson, 2013; Cardozo, 1994; Adler, 1993; Sanera 1998; ICEE 1997). However, in terms of compulsory content areas like social studies, science, language arts and math, research does show that students who participate in outdoor, or placed-based, education programs tend to outperform their traditionally educated peers (American Institutes for Research, 2005; Lieberman & Hoody, 1998).

Which leaves the question: does a one-size-fits-all approach in EE effectively bring about a positive increase in environmental knowledge, behaviors, and attitude in children from different backgrounds? Arcury and Christenson argue that this awareness of group variation in environmental knowledge and attitudes forms a basis for improving the quality of environmental education (2010). This thesis focuses on the Nisqually River Education Project, in order to understand whether EE addresses NDD more so within students who are from urban areas than rural areas.

### **Nisqually River Education Project**

One organization attempting to address NDD is the Nisqually River Education Project (NREP), which was established in 1991 to promote environmental education and connection to place. Since it was established, NREP has introduced students and volunteers throughout the Nisqually Watershed to the ecological and cultural importance of the river and its many tributaries. Today, the program's activities include water quality

testing, tree plantings, salmon tosses, nature walks, and even a student-led “Green Congress,” which brings participating students together at the end of the school year to present their water quality data and attend workshops related to culture and the environment. Almost 1000 students participate in NREP’s diverse activities annually.

### **Study Design and Methods**

To assess the effectiveness of environmental programs like NREP and to determine differences in environmental attitudes and behaviors between students in a rural setting versus a more urban setting, surveys were given at the end of the 2016-2017 school year to 5<sup>th</sup> grade students at Prairie Elementary and Mill Pond Elementary, two adjacent elementary schools located in Yelm, Washington. Prairie Elementary was considered to be in a rural setting, while Mill Pond Elementary was considered to be in a more urban one. Prairie Elementary has mandatory participation in NREP for 5<sup>th</sup> grade students, while Mill Pond Elementary has only one class voluntarily participating in the program.

The qualitative surveys given to the students included six questions designed to ascertain the dependent variables: students’ perception of their environmental behaviors, knowledge, and attitude. These questions (in the form of statements) were: “I protect water quality,” “I help restore natural habitats and protect wildlife,” “I know about wildlife and native plants,” “I pick up trash and recycle at school and at home,” “Spending time in nature is important to me,” and “I talk with friends and family about all these things” The students had the option to answer with “not at all,” “a little,”

“some,” and “a lot.” There was no neutral option, as that can cause a survey to be ineffective. In this one-time survey at the end of the school year, students answered questions about their self-assessment of attitudes and knowledge for “before,” “during,” and “after” the school year. To determine significant results from the surveys, a comparison was done between the independent variables to determine the mean responses of students from each school by question and change in question response from before, to during, to after the school year.



## LITERATURE AND BACKGROUND

### Introduction

In a time when technological advances have meant a greater disconnect with nature in exchange for time spent with electronic devices indoors, understanding the costs to emotional, physical, and cognitive health and our need for a connection with the natural world have become increasingly important. Studies regarding human-nature relationships have given way to the popular theory of Nature Deficit Disorder, as new understandings and support for this connection are on the rise. As outdoor environmental education programs seek to fill the gaps between human-nature and classroom-nature relationships, questions have begun to arise concerning the equity of such programs.

Critiques have arisen to address concerns that experiential outdoor education programs lack the ability to reach out to students from various demographic backgrounds. However, due to a multitude of variables, studying the effect of these programs on environmental behaviors, knowledge, and attitudes within students of differing backgrounds is a difficult and complicated task. Although NGOs, such as the Nisqually River Education Project, seek to provide outdoor environmental education programs to all students within the Nisqually River Watershed and beyond, critiques have emerged to challenge the intent and purpose of such activities (Dickenson, 2013; Adler, 1993; Cardozo, 1994; Sanera, 1998).

Despite the critics, evidence continues to shed light on the benefits of outdoor learning programs. Research has shown that providing students with the opportunity to get out of the classroom and connect their learning with their local environment supports

mental, emotional, and physical development in children, as well as student learning and success, in comparison to their traditionally educated peers (American Institutes for Research, 2005; Lieberman & Hoody, 1998; Louv 2005; Louv 2010).

Few recent studies have researched the difference in the environmental behaviors, knowledge, and attitudes between rural and urban residents. However, Leftridge and Robert (1980) conducted a study of the perceptions of environmental issues of high school students attending rural and urban schools. Their findings concluded that urban students appeared to be less perceptive of environmental issues than rural students. Therefore, the expectation for the included surveys in this case study is that there will be significant differences in the students' perceived knowledge of nature and environmental attitudes, as indicated by their survey answers, between the rural school (Prairie Elementary) and the more urban school (Mill Pond Elementary).

In this literature review, I seek to provide research relating to the nature-human and the different components of outdoor education programs, as they seek to fill the gap between the two. First of all, it is important to give a specific definition for the term "nature" as it can have many connotations, depending on one's personal background and lifestyle. What is known as "nature" to one living amongst an urban sprawl may be brushed aside and minimized by another, based on their cultural or outdoor experiences in larger, less manicured settings. Next, it is important to understand the relationship nature has with our mental and physical health in order to understand the need for children to participate in outdoor activities. I will outline some major studies and sources

that support this correlation and the importance of time spent in nature. Then, Louv's Nature Deficit Disorder theory will be introduced as a means of explaining the increasing disconnect between humans and nature in our modern, technically advanced world. As children spend more time outdoors and more time indoors in front of phone, television, and computer screens, they spend less time in nature. Despite the provided criticisms of environmental programs in general, research lends its support to the benefits of such programs. I will discuss the importance of field trips taken out of the classroom to connect environmental education to the outdoors.

### **What is Nature?**

The concept of what constitutes as "nature" or being "natural" changes based on where or who you ask; indeed, the best definition would likely come from an international coalition, like the World Health Organization (WHO), as they are comprised of individuals, governments and organizations representing various demographics and have come to a general agreement of what it is and why it is important. In 1986, the WHO signed an international agreement at the First International Conference on Health Promotion, called the Ottawa Charter for Public Health Promotion. This agreement was signed in Ottawa, Canada, and laid the foundation for local communities, national governments, and international organizations to achieve the goal of "Health for All." Through the international collaboration of these groups, and better health promotion by the year 2000, they hoped to enable individuals to increase control over, and to improve, their health (WHO, 1986).

According to the Charter, nature exists on large and small scales. The definition of nature includes a wide range of organic locales as large as forests and savannahs to ones as small as lawns and garden plots. A sterile environment that doesn't include the processes of life, such as death of species, reproduction, and species interrelationships, falls outside the definition. Dirt, water, air, plants, and animals are also incorporated into the definition of nature. Nature is composed of the large processes of geology and the small processes of genetics and biology that have shaped the terrestrial and zoological landscapes of the present (WHO 1986).

The charter suggests that every effort should be made by man to preserve these natural spaces. The environment humans live in is directly linked with a holistic approach to health and extends into every single aspect of everyday life. Therefore, it is important, in the pursuit of health and longevity, to preserve and conserve nature in its many forms. Parks are necessary to preserve natural and cultural landscapes. Without parks, many individuals would have zero access to nature. There is endless utility for education and recreation possible through parks; while conservation helps maintain, through public institutions, a richly diverse biome and heritage otherwise unattainable (WHO, 1986).

### **Physical and Mental Health**

Drastic changes in human environments have been shown to have serious implications for both physical and mental health. Humans have spent many thousands of years adapting to natural environments, yet have only inhabited urban ones for relatively few generations (Glendinning 1995; Roszak *et al.*, 1995; Suzuki 1997; Gullone 2000).

Never in history have humans spent so little time in physical contact with animals and plants, and the consequences are unknown (Katcher and Beck, 1987). Already, some research has shown that too much artificial stimulation and an existence spent in purely human environments may cause exhaustion and produce a loss of vitality and health (Katcher and Beck, 1987; Stilgoe, 2001). Modern society, by its very essence, insulates people from outdoor environmental stimuli (Stilgoe, 2001) and regular contact with nature (Katcher and Beck, 1987).

Many studies have sought to research the correlation between health and nature. Among the most intriguing studies are those conducted at the University of Illinois, where their Human-Environment Research Laboratory has found that symptoms of attention deficit/hyperactivity disorder were significantly decreased when children as young as 5 engaged with nature (Faber and Kuo, 2001; 2004; 2009). Another study found an association between more green areas within inner-city neighborhoods and slower increases in the average body mass of children within those areas over a two-year study. Both of these studies suggest a need for an increase in child-nature interactions, not only in educational programs, but in inner-city green spaces, in order to provide access to more children and the increased physical and psychological benefits of time spent in nature (Bell, et al., 2008).

Driessnack, a pediatric nurse, summarizes Richard Louv's theory of nature-deficit disorder and discusses the implications of nature-deficit disorder from a medical perspective, focusing on the effects of sedentary lifestyles (obesity, diabetes, hypertension, and depression). As a review article, she brings in and discusses numerous secondary studies and surveys supporting the notion of the new "backseat generation"

(Karsten, 2005) and presents suggestions and ways in which both pediatric nurses and parents can mitigate some of these factors. Driessnack encourages her peers in the medical field to communicate with parents the benefits of “unstructured play out-of-doors for children and the importance of reconnecting children with nature and its impact on growth, development, learning, and long-term health.” She recommends several books which outline various outdoor activities for children, such as *I Love Dirt: 52 Activities to Help You and Your Child Discover the Wonders of Nature* (Ghahremani, 2008).

### **Nature Deficit Disorder**

In his book, *Last Child in the Woods* (2005), Richard Louv warned that frequent contact with the natural world is important for a child’s physical, emotional and mental development. It is here, in his book, that he first introduced the term Nature Deficit Disorder (NDD). However, it is not intended as an official diagnosis. It simply seeks to address the costs to children as they are increasingly deprived of direct contact with nature and play in the outdoors (Driessnack 2009). Louv argues that children are better able to deal with fear, learn their strengths, and build skills necessary for sustained intellectual development when they come in contact with nature, and he strongly argues the correlation between experiences in nature and children’s physical and mental development (2005).

Emerging studies provide further support for Louv’s *backseat generation* (Karsten, 2005). Today, children are driven from place to place. Between 8 and 18 years of age, they average approximate 6.5 hours watching TV, on their phones, or playing

video games, which leads to a diminished capacity to relate verbally and somatically to their community and local environment (Driessnack, 2009). These children often have little knowledge of what plants grow in their neighborhood, or which watershed their house is located in. One study revealed that children more easily identified Pokémon characters than common flora or fauna (Balmford, Clegg, Coulson, & Taylor, 2002).

### **Cultural Assumptions and Critiques**

Despite his findings, critiques of his theory have emerged that call into question Louv's cultural bias, arguing that Louv romanticizes his white, middle-upper class youth, as he encourages the masses to return to his idea of a "normal" past that "obscures race, class, and gender politics" (Dickenson, 2013). This means that the modes by which he encourages children to return to a "normal" childhood experiences consists of ways of "relating to nature that are guided by cultural assumptions" (Dickinson, 2013). This suggests that the assumption of outdoor play and environmental education programs may not account for the needs of children from various demographic backgrounds, who suffer from nature-deficit disorder.

Elizabeth Dickinson provides a critical review of Richard Louv's theory of nature-deficit disorder. She acknowledges that the little contact students have these days with their natural surroundings often takes place in the form of fieldtrips, and that, even within the sphere of academia, students are experiencing less and less contact with the outdoors. To reconnect students with the outdoors, Louv (2005) prescribes outdoor activities such as: exploring, building forts, cataloging, playing in tree houses, and

collecting (e.g. leaves, insects, etc.). However, these are all ways, Dickenson claims, of relating to nature that could be considered to be “guided by cultural assumptions,” because not all individuals have access or means to participate in these activities (Dickenson 2013).

Beyond this, Dickenson also points out that, although Louv briefly discusses pressures on parents, he fails to address the specific burdens of “low-income households, and cultural conventions,” which could have a significant impact including reduced access to natural areas. She suggests that researchers could even be considered to have unconscious environmental education messages because they ignore race, class, and gender politics and tend to speak to and for affluent, white audiences.” Dickinson calls for further research to “dig deeper” into nature-deficit disorder’s cultural roots.

Dickenson makes a powerful argument; the strength of which is grounded in concern for equity and access to natural areas, so that children from various backgrounds might reconnect and enjoy nature as much as any other. However, one could argue that Louv merely sought to make some suggestions for parents and children to connect with the outdoors by recalling enjoyable activities from his own childhood. In this case, it would be prudent for Louv to connect with individuals from various demographic backgrounds in order to compile a broader, more equitable list of suggestions for outdoor play.



## **One-Citizen, One-Vote**

Since its conception, environmental education could be considered a field with political ends. The Supreme Court ruling on the one-citizen, one-vote concept puts pressure on all individuals to become active, voting members of society (Baker v. Carr; Reynolds v. Sims). Individuals are tasked with making decisions that affect their environment; specifically, they cast votes on community issues, elect representatives, and as they come into direct contact with the environment itself (Stapp, 1969). In his article, *The Concept of Environmental Education*, Stapp cites three major objectives for environmental education to achieve the greatest impact: “1) provide factual information which will lead to understanding of the total biophysical environment; 2) develop a concern for environmental quality which will motivate citizens to work toward solutions to biophysical environmental problems; and 3) inform citizens as to how they can play an effective role in achieving the goals derived from their attitudes.”

Educational programs play a vital role in preparing the public to be informed voters. In order to prepare each citizen to actively participate in the decision-making process, it is imperative that all individuals, regardless of their demographic background, gain a full understanding of the problems that confront the environment and its interrelationship with the community. What is, for adults, yet another technological paradigm shift, may be causing irreparable damage to the youngest and most vulnerable members in our communities. This is vitally important for environmentalism. If younger generations feel no connection to their local environment, then it is unlikely they will make decisions in the future to protect it. Without equity within environmental education

programs, it is questionable that all members of the public will develop the tools required to make sound and rational legislative decisions.

### **Critiques of Environmental Education**

“As if children don’t have enough to worry about these days—AIDS, wars, starving people—environmentalists are teaching them that their very planet is at risk. The pressure is on, and it’s taking its toll. The sight of an active smokestack brings tears to their eyes. Any tank truck could be carrying the load that will do in their neighborhood. No TV show about animals is complete without a moody scene of predation and the obligatory drone of doom... but man is this animal’s worst enemy.”  
(Cardozo, 1994)

Cardozo posits that “overly hostile environmental education that treats humans as willful pillagers of Gaia” may cause children to feel like intruders in nature, destined to destroy their world. He writes that their hopelessness is misplaced; he explains that the earth is tough, and it is humans who are fragile. Despite any human impacts, the earth will still likely remain in its place, orbiting the sun. Cardozo is concerned that, in the end, *we* will be the ones to be extinct, like the dodo bird. His argument could be true, that “save ourselves” is less resonant than “save the earth,” but Cardozo feels that environmental education is not providing the whole story to children (Cardozo, 1994).

There is some concern about the amount of environmental misinformation taught through environmental education. “If teachers aren’t prepared to challenge or correct information that is wrong or mischaracterized, the inevitable result is that children learn an unhealthy dose of environmental fiction” (Adler, 1993). One recent Roper Poll found that American children are grossly misinformed about the environment. America’s “Green Point Average,” according to this poll, was only 31%, a failing grade by any measure.

There is a big gap between intent and performance when students are taught about environmental issues (Sanera, 1998). The review of environmental education materials by the Independent Commission on Environmental Education (ICEE) back in 1997 found evidence of this disparity. For example, the ICEE report states that environmental education materials often do not provide a framework for progressive building of knowledge; fail to prepare students to deal with controversial environmental issues; and fail to help students understand tradeoffs in addressing environmental problems. Many high school environmental science textbooks have serious flaws (Sanera, 1998) as there have been concerns over whether students are able to make direct connections outside of the classroom. Despite the ubiquity of environmental messages aimed at kids, there is increasing evidence that children are not learning much of anything about the environment, save for simple platitudes and a blind faith in environmental causes (Adler, 1993).

Another critic posits that the focus on the environment increasingly comes at the expense of basic instruction in important subjects, such as science and history. Adler writes that, without an adequate grounding in these disciplines, children will understand

little about the world around them, let alone the environmental concerns that are now en vogue (Adler, 1993). It is, therefore, understandable that some critics worry that the allocation of resources will cause basic education to suffer. Some disagree with Adler in this assessment that environmental education comes at the expense of basic instruction, as it is possible that science, history, and environmental education can be taught as interdisciplinary subjects and should not be considered mutually exclusive (Pearce et al., 2005; Semerjian et al., 2004; Vincent et al., 2011).

### **Academic Merit of Programs**

Finances, time, and efforts are invested into each environmental program in an effort to provide this type of experiential education and Louv himself believes that learning experiences confined to classrooms tend to limit opportunities for students to have firsthand exposure and make connections between what they learn in a classroom with people or places (2005). Today, what little contact students these days have with their natural surroundings often takes place in the form of fieldtrips. However, in the wake of No Child Left Behind budget cutbacks and assessment testing, educators must justify fieldtrips as having educational merit (Dickinson, 2013).

Not only do fieldtrips assist students in making meaningful connections to their community and local ecosystems, these opportunities have also been found to play a role in their academic performance in other content areas. Richard Louv (2010) expands on his earlier concept of nature-deficit disorder in the article, “Do Our Kids Have Nature-Deficit Disorder?” which explores how educators can incorporate nature and outdoor

education into the curriculum. This article is particularly noteworthy, as Louv presents several secondary studies that back up the significance of fieldtrips and outdoor programs. Among the most notable are the recent studies in California and other participating states have shown that, in terms of compulsory content areas like social studies, science, language arts and math, students who participate in outdoor, or placed-based, education programs tend to outperform their traditionally educated peers (American Institutes for Research, 2005; Lieberman & Hoody, 1998). This data not only lends support to the merit of fieldtrips, but to Louv's theory of nature-deficit disorder, which suggests that more time out in nature as children can result in increased cognitive and emotional health.

### **Nisqually River Watershed Natural History**

The continued health of the Nisqually River plays is vital within the Pacific Northwest's ecosystem. The river travels 78 miles through the forested, mountainous terrain of Pierce, Lewis, and Thurston counties, Joint Base Lewis-McChord, and the Nisqually Indian Reservation before it empties into the Puget Sound (Robinson and Alesko, 2011). It is, therefore, interesting that the Nisqually is the only watershed in the United States with its headwaters in a national park and its delta in a national wildlife refuge, and also finding itself located within an hour's drive of three metropolitan areas, while it continues to be one of the least developed and healthiest major rivers in the region (Robinson and Alesko, 2011).

Mount Rainier, considered to be the most prominent feature of the Nisqually River watershed, is a geologically recent addition to the landscape. Rising more than 14,000 feet, this snow-capped volcano is believed to be no more than a million years old. Resting on layers of basalt and sandstone, dating back 40 million years to the newly formed region of the Pacific Northwest, Rainier's frequent eruptions spread hot volcanic rock, pumice and molten lava across the Pacific Northwest, carving out today's valleys and plains.

Over the course of thousands of years, incited by their sheer weight, the successive layers of snow on Rainier were packed into glaciers. The Nisqually Glacier covers more than nearly two square miles of the mountainside at more than 400 feet. As the heat from the sun warms the frozen mass, small, liquid beads find their way through the vast network of channels and tunnels within the interior of the glacier. It is the convergence of these small beads which begin the 78-mile-long journey of the Nisqually River's route down Mount Rainier's mountainside and out towards the ocean.

Much of the surface water in Western Washington finds its way to the Puget Sound, the result of glacial activity 15,000 years ago in the late Pleistocene, which acts as a mixing bowl as fresh water unites with the salt water from the Pacific. It is estimated that 140 billion cubic feet of fresh water converges within the Puget Sound annually. The Nisqually River (Figure 1) is responsible for approximately half of the volume of fresh water that spills into the southern Puget Sound (Gordon and Lembersky. 1995).

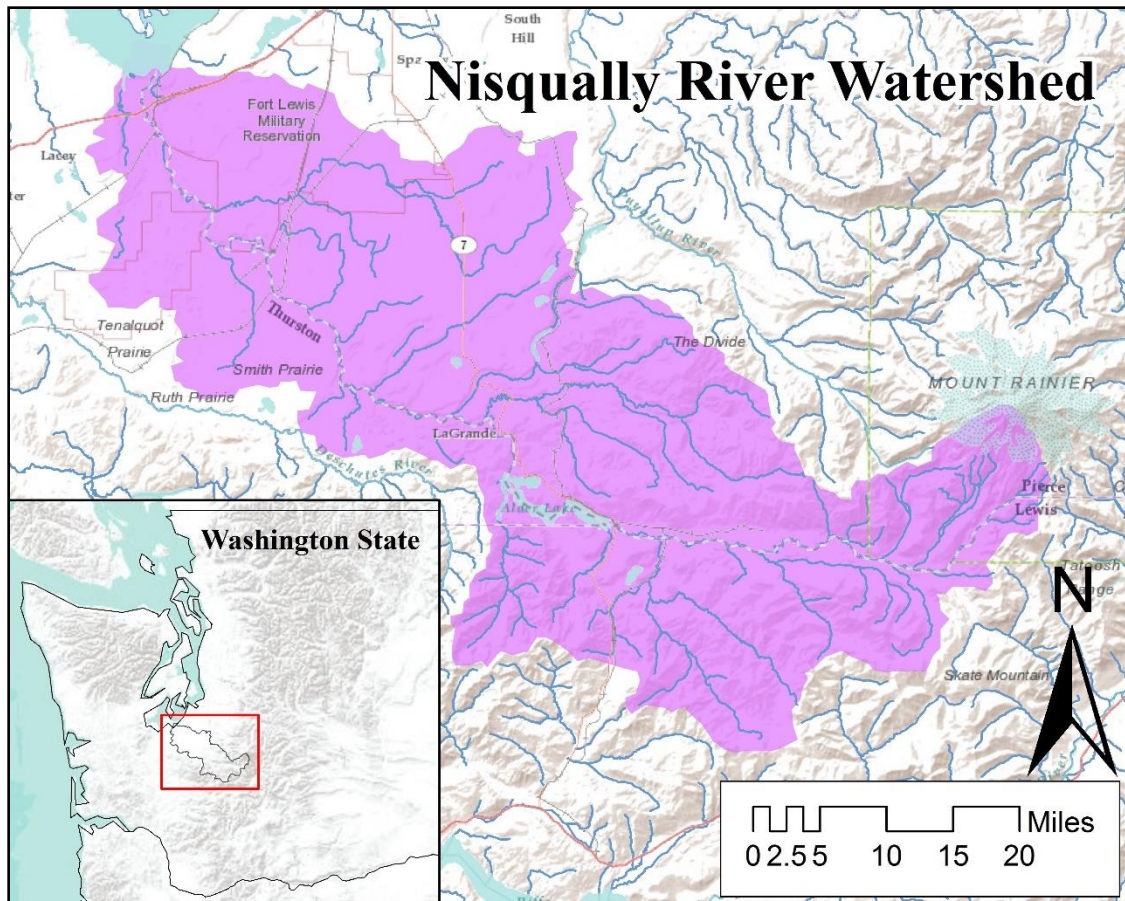


Figure 1: Nisqually River Watershed

### Nisqually Social History

In the documentary, *As Long as the Rivers Run*, Northwest Indian Fisheries Commission Chairman Billy Frank Jr’s late father, Willy Frank Sr., described the Nisqually watershed as paradise before the arrival of settlers. In the 1850s settlers molded the watershed to conform to their own needs. They diked the estuary area for agricultural purposes, channelized the river in other areas, and greatly altered the natural habitat, damaging the whole ecosystem. But over the past five decades, a collective effort has been undertaken involving a range of jurisdictions and partners from many vocations and

ethnic backgrounds working with the Nisqually Tribe at the helm to return the Nisqually estuary to its natural condition. Recognized as a river of Statewide Significance under the 1972 Washington State Shore lands Management Act, the Nisqually supports extensive salmon runs, timber and agricultural resources, and hydropower generation. It is also home to several threatened and endangered species, and offers many recreational opportunities. Preserving this beautiful river has long been a focus of the community along with tribal, state, and local governments (Robinson and Alesko, 2011).

Prior to the arrival of settlers in the Pacific Northwest, the Nisqually river ecosystem flowed with clean, clear water and lush riparian zones, wetlands, and other natural habitats. With the intention of making the river more stable for construction along its banks, settlers built embankments in order to impede the erosion of the land and block the Nisqually from its natural course. Banks previously lined with fallen trees which had kept the water cool and provided habitat for both adult and juvenile salmon, including areas for hiding and resting throughout the course of their migration, were cleared for crops. Not only did the destruction of the river's riparian areas and its natural course put strain on the journey of the salmon to and from the ocean, it also degraded their historic spawning habitats, leading to even further declines in the salmon population (Robinson and Alesko, 2011).

With the steady increase in the arrival of the settlers, the Europeans began to require even more prime riverfront land in order to build homes, farms, ranches, and towns and they sought to attain this from the local tribe. The Nisqually tribe has made the Nisqually river watershed its home for thousands of years. The River has afforded immense wealth to the tribe in the form of shellfish, salmon and other fish. Among the



aquatic life afforded by the river, it also attracted deer and other game, and provided nutrients to the surrounding temperate forests, rich with berries, roots, and herbaceous plants (Robinson and Alesko. 2011).

As the population continued to grow rapidly, the strains on the watershed increased as well. Large-scale farming, forestry and hydroelectric technologies amplified the anthropogenic effects on the watershed (Carpenter. 1994). Cities beyond the watershed's boundaries began to emerge. Vacation cabins and residential areas began to replace farmland and woodlots, further burdening the region's resources. Both wildlife habitats and water quality were degraded. A lack of adequate plans for shoreline protection and building codes proved the rapid development of the region to be detrimental to the health of the river and its riparian zone. (Gordon and Lembersky, 1995).

However, the Nisqually River watershed isn't the only watershed to lay claim these challenges. Throughout the Pacific Northwest, nearly every watershed in the Puget Sound region face similar problems. It is not surprising that the Puget Sound Water Quality Management Plan of 1987 called to the region's local governments to introduce pollution control plans for the "top-ranked watersheds" within the 12 Puget Sound counties (Gordon and Lembersky, 1995).

Signs of the current vitality of the watershed include the rich timberlands, producing both lumber and jobs both in and out of the industry, and healthy salmon runs that consistently return to the river and its tributaries each year (Carpenter. 1994). Today the Nisqually's thriving state of health can be attributed to the fervent commitment of

members within the Nisqually watershed's community. The efforts to protect the 720-square-mile area of both public and private land was motivated by the desires and concerns of private and public stakeholders alone to conserve this highly valued region (Gordon and Lembersky. 1995).

In 1985, in recognition of the importance of the watershed and the support for its conservation, The Washington State Legislature voted to "initiate a process that emphasizes the natural and economic values...and that will bring about a stewardship program for the Nisqually River...to assure enhancement of economic and recreational benefits for this generation as well as those to come." Among the first steps was forming the Nisqually River Task Force, a regional planning body of representatives from the Nisqually Tribe, private citizen groups, public resource management agencies, individual land owners, and various interest groups, such as the hydropower, agriculture, and timber industries (Carpenter. 1994). The task force reviewed the supplied information regarding the Watershed, and followed up by drafting a set of policy recommendations. The plan was finally adopted by the Legislature two years later, in 1987, and addresses public access, natural resource enhancement and protection, and flood control issues (Gordon and Lembersky. 1995).

### **Nisqually River Education Project**

The Nisqually River Education Project (NREP) was established in 1991 following the Nisqually River Management Plan (NRT Force and NR Council, 1987). The 12th key element of the management plan states that:

“All interpretive and education programs involving the Nisqually River basin should: emphasize the Nisqually River as a whole system with particular focus on the natural resources, archaeological and cultural history and economic values; utilize existing programs, facilities, resources, and materials to the extent that they support the whole river system concept; be coordinated by an interagency and private consortium, or board, of interested and involved persons; and be supported by adequate funds enabling the consortium to implement the program” (NRT Force and NR Council, 1987).

In this sense, the NREP has striven to bring an integrated educational experience to students and volunteers living within the Nisqually Watershed. The Nisqually River Council, the collective under which NREP operates, aims to connect agencies and people to work together towards sustainability within the Nisqually River watershed, while the goal of the NREP is to connect people with nature and give a sense of place and a feeling of responsibility towards their local environment. The NREP does this by organizing class field trips and larger events throughout the watershed (NREP website).

Major NREP activities include: water quality monitoring, tree plantings, salmon tosses, “Eye on Nature” field trips, and GREEN Congress. Water quality monitoring is the most widely attended activity. Almost 1000 students participate annually, testing water quality at over 35 sites (NREP website). This activity serves to educate students about the scientific process as they spend time at local sites throughout the watershed. The results of the water quality testing are also used to determine if there are any pressing issues with water quality that are less likely to be caught if only a small number of

scientists were able to conduct the testing. Student GREEN Congress is held towards the end of the school year for a portion of the students to present their findings and attend environmental workshops. These activities further connect students to each other, to the scientific process, and to their local environment.

Tree plantings, salmon tosses, and “Eye on Nature” field trips are less-attended, but still thoroughly enjoyed by students and volunteers. Tree plantings are held in fall and are located throughout the watershed all the way down to the river delta. The goal of these trips is for students to get their hands dirty and learn about the importance of riparian vegetation to watershed health. Salmon tosses, possibly the most popular of the field trips, are held in winter. For these field trips, students toss frozen salmon carcasses into the Nisqually River and its tributaries. The students have great fun getting salmon guts on their hands while they learn about returning marine derived nutrients into the river and watershed food chain. “Eye on Nature” is held in the spring, and takes students to the Billy Frank Jr. Nisqually National Wildlife Refuge to take nature walks, observe wildlife, and learn about the cultural and historical background of the refuge.

Overall, the NREP has diverse activities for a range of students within the Nisqually watershed, meant to bring them in touch with nature and participate in the scientific process in a meaningful way as part of their community.

## METHODS

### Study Area

Of the schools participating in the NREP, two were selected for this case study. These were Prairie Elementary and Mill Pond Elementary, two adjacent schools located in Yelm (Figure 2). They were chosen as they represent an urban area (Mill Pond) and a rural area (Prairie). Demographically, the two schools are very similar, with Mill Pond being slightly more diverse than Prairie (Tables A1 and A2; Washington State Report Card). As they are located adjacent to each other and have similar demographics, these schools presented an opportunity to study nature deficiency—and the effects of an environmental education program—between an urban and a rural area. It is important to note that Prairie Elementary 5<sup>th</sup> grade classes participated in NREP’s creek observations twice a year, fall and winter water quality testing, and Green Congress towards the end of the school year; whereas Mill Pond Elementary participated in the fall and spring water quality testing program.

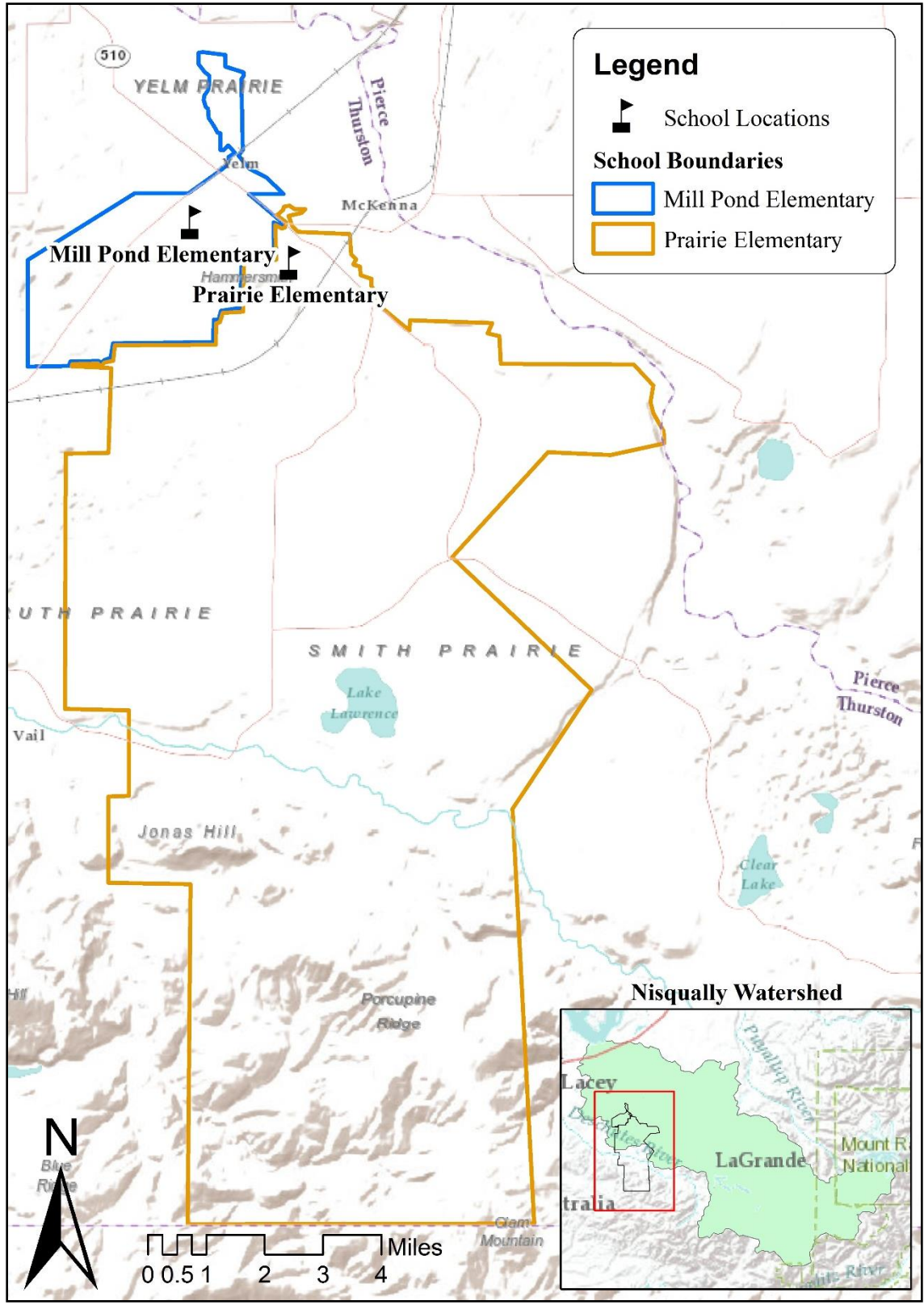


Figure 2: Mill Pond Elementary and Prairie Elementary school district boundaries.

## **School Profiles**

### Prairie Elementary School

Prairie Elementary School is located in the eastern part of Yelm, and its boundaries encompass about 110 square miles of suburban and rural farmland. The school had 526 to 562 students enrolled in the 2015-16 school year. Prairie Elementary is majority white, with white students making up 72.4% of students in the school, while different minority groups make up 0-14.4% of students, and students of mixed race are 9.9%. (Table A1; Washington State Report Card)

Currently, all 5<sup>th</sup> grade classes in Prairie Elementary are required to participate in the NREP. There are three classes in total participating in the program. Prairie Elementary is one of the few schools where participation in the NREP is mandatory. The Prairie Elementary student surveys used in this thesis were taken from two of the three participating classes.

### Mill Pond Elementary School

Mill Pond Elementary School is located in the western part of Yelm, and takes students from an area of 10 square miles, mostly in the downtown area of Yelm. The school had 549 to 563 students enrolled in the 2015-16 school year. Mill Pond Elementary is also majority white, with white students making up 66.6% of students in the school, while different minority groups make up 1.4-15.1% of students, and students of mixed race are 10.1%. (Table A2; Washington State Report Card)

Currently, there is only one 5<sup>th</sup> grade class at Mill Pond Elementary participating in the NREP. This is more customary for the program, as most schools in the area do not require classes to participate, so participation depends on the individual teachers. The Mill Pond Elementary student surveys used in this thesis were taken from the single class participating in the NREP.

### Standardized Testing

In terms of standardized testing, 5<sup>th</sup> graders at Prairie Elementary performed better in science, English, and math than those in Mill Pond Elementary (Measurements of Student Progress). The greatest difference in test scores for these students was in the subject of science. Prairie Elementary had 81.9% of students meeting standards, whereas Mill Pond Elementary only had 37.9% meeting standards (Washington State Report Card). These standardized tests are conducted in the spring, towards the end of the school year.

### **Survey Methods**

Surveys have been used by many researchers as a means to measure the different components of environmental education (Alekseeve 1998, Eagles and Demare 1999, Musser and Diamond 1999, Palmer et al. 1999, and Subbotina 2000). A majority of these have been used to gauge people's environmental values and attitudes towards the environment. Generally, it has been agreed that the complexity in nature of all the components of environmental education and "human" dimension can prove to be a difficult task to accurately assess (Bartosh 2003).



The development of environmental education components, such as enforcement of responsible behaviors, knowledge, and skills are affected by various external factors. Among these external factors are: attitudes of family, friends, and community, family social status, education, living environment, knowledge, culture and traditions. Therefore, it can be difficult to effectively portray this range of complex components through statistical functions. In that sense, it is my belief that a mix of quantitative, statistical results, mixed with qualitative interpretation, would provide a more complex interpretation of the findings. Sogunro (2001) suggests that environmental education researchers should utilize various combinations of these methods in order to produce a much more nuanced and in-depth interpretation of the results.

I identified six survey points to pose to students about their interest, knowledge, and involvement in environmental education and behaviors: I protect water quality, I help restore natural habitats, I know about wildlife and native plants, I pick up trash and recycle at school and at home, spending time in nature is important to me, and I talk with family and friends about these things (Appendix B). With these, I sought to determine how students' environmental attitudes and behaviors had changed throughout the school year based on their self-assessments at the end of the year. Short answer surveys were also provided to teachers and volunteers to determine their perspectives through a qualitative approach. Survey participants were identified through email correspondence with the NREP director, school principals, and teacher volunteers. The surveys were either emailed to the teachers, or presented to the school principals.

Garland (1991) argued that the presence or absence of mid-points within Likert scales can produce distortions within the results. The optimal number of rating scale

points to use has generated much debate within the social research community. Survey participants are to express both the strength and direction of their opinion about a particular topic, and rating scales are meant to limit any bias as effectively as possible. There is evidence that the presence of mid-points within scales produce distortions within the results of the survey. Therefore it is desirable that participants make a definite choice, opposed to neutral responses. In this sense, a scale which lacks a midpoint is preferable (Garland, 1991).

To this end, I decided to create and distribute my survey without the presence of a mid-point in order to encourage the participating students to refrain from neutral responses. Each survey point includes a 4-point Likert scale, ranging from “a lot” to “none,” as participants were to rate their environmental behaviors and attitudes “before this school year”, “during this school year”, and “after this school year”. The teachers were then instructed to distribute the surveys towards the end of the school year (May-June) in order to get a fuller picture of the changes of environmental attitudes and behaviors of the students after participation in the NREP’s environmental programs.

### **Data from Surveys and Analysis**

To obtain quantitative data from the school surveys, student answers were graded from 0 to 3, where 0 corresponded to the “not at all” survey response, 1 to “a little”, 2 to “somewhat”, and 3 to “a lot”. This allowed separate data points for each student, with the two schools as different survey groups.

In order to find out whether the change depicted in the retrospective assessment, administered at the end of the school year, of environmental attitudes and knowledge at various points earlier in the year were temporary, or if they had effects lasting past the program, two values were calculated from the graded survey. The first value was the difference between “Before this School Year” and “During this School Year.” This value represents the immediate change in attitude toward the environment as a result of the program. The second value was the difference between “Before this School Year” and “After this School Year.” This value represents a more lasting effect of the program. The change in attitude from the beginning of the school year to the end of the school year indicates an overall change in attitude about the environment and environmental behaviors. For statistical analysis, Student’s T test was used to determine the mean responses of students from each school by question and change in question response as described above. The tests were also divided into “before,” “during,” and “after” to examine differences in attitudes between schools at different times in the school year.

#### Analyzing ordinal data parametrically

There has been an enduring argument over the treatment of ordinal data as interval data for data analysis (Sullivan and Artino, 2013). With ordinal data, the differences between “a lot,” “some,” “a little,” or “none” on a frequency response Likert scale are not measurable. In contrast, the difference between responses with interval data do have the capacity to be calculated and are, in fact, measurable. In the case of using mean, it has been considered by some as an invalid parameter when analyzing ordinal data, and nonparametric procedures such as rank, median, or range should be used to analyze such data; whereas means and standard deviations are suggested for interval data

scales (Boone and Boone, 2012; Allen and Seamen, 2007; Sullivan and Artino, 2013; Clason and Dormody, 1994).

However, there are those who suggest that analyzing ordinal data as interval data is a valid and, perhaps, more compelling method of data analysis. Allen and Seamen (2007) suggest that parametric statistical tests are more powerful, easier to interpret, and more informative than the alternative nonparametric tests. However, they caution that analyzing ordinal data as interval data could misrepresent and mislead survey findings. Norman (2010) addressed this point by arguing that, not only are parametric tests safe to use with ordinal data, such as in the case of Likert scale data, but that parametric means of testing provide a generally more robust set of results than nonparametric tests. In other words, it is plausible for parametric tests to deliver “the right answer,” even when assumptions are violated, because the parametric tests are sufficiently robust enough to provide unbiased answers, even in the case of Likert scale responses (Norman, 2010). The real question is whether or not the data has been analyzed in such a way to meaningfully answer the research questions (Clason and Dormody, 1994).

## **RESULTS AND DISCUSSION**

### **Student Survey Results: Comparing Mill Pond and Prairie Elementary**

This section exhibits the results of the students' post-participation surveys and responses from the teachers, NREP director, and volunteer. Each question is addressed individually, followed by the results. Responses for student surveys were compared Before, During, and After the school year to assess any change in the students' perceived environmental knowledge, attitude, and behavior. These responses were then compared between the two schools to determine urban or rural residency impacted the student answers.

Question 1:

Question 1				Before-During	During-After	Before-After
Combined				+1.1489 p<0.0001	-0.2340 p=0.3398	+0.9149 p<0.0001
Mill Pond				+1.0667 p<0.0001	-0.0667 p=0.9479	+1.0000 p<0.0001
Prairie				+1.1875 p<0.0001	-0.3125 p=0.3365	+0.8750 p=0.0004
Difference Between Mill Pond and Prairie						
	Before	During	After	Before-During	During-After	Before-After
Difference (P-MP)	-0.2896 p=0.1560	-0.4104 p=0.0656	-0.1646 p=0.4850	-0.1208 p=0.6203	0.2458 p=0.3519	0.1250 p=0.6478

Figure 3: Responses to Question 1 (I protect water quality). The first three rows show the  $\mu$  response for the schools combined and difference between  $\mu$  responses at each school. The three far, right columns show difference between Before  $\mu$  and During  $\mu$ , During and After  $\mu$ , and Before  $\mu$  and after  $\mu$  at each school. The bottom row shows the differences in  $\mu$ , between Mill Pond and Prairie Before  $\mu$ , During  $\mu$ , After  $\mu$ , Before-During  $\mu$ , During-After  $\mu$ , and Before-After  $\mu$ .

### Results:

For Question 1, “I protect water quality,” students in both schools showed an improvement in attitude and behavior towards water quality throughout the year, with both schools having approximately equal responses for before and after the school year. However, the average response was higher for students at Prairie Elementary than those at Mill Pond Elementary before, during, and after the school year. For both schools, responses showed an increase in student behavior between the beginning of the school year to during the school year. Another trend was noted with the decrease from during the school year to after the school year.

### Discussion:

The fact that responses at Prairie Elementary were higher than Mill Pond Elementary may indicate that students coming from a more rural setting feel more engaged in environmental issues and activities surrounding the protection of water quality, even while students were engaged in the activities. The increase from the beginning of the school year to after the school year shows that student behaviors and attitudes towards water quality protection improved while immersed in the NREP activities. It is interesting to note that, on average, students at both schools noted a decrease in their attitude and behavior towards water quality after the school year. This may simply be due to the fact that they were no longer engaging in the water quality programs for the year. However, when comparing the lower beginning of the school year response values to the higher after of the school year response values, one can assume that the program was successful in improving student behaviors towards protecting water quality.

Question 2:

Question 2				Before-During	During-After	Before-After
Combined				+0.1087 p=0.8628	+0.2391 p=0.4918	+0.3478 p=0.2257
Mill Pond				-0.3333 p=0.6018	+0.4667 p=0.3744	+0.1333 p=0.9211
Prairie				+0.3226 p=0.4284	+0.1294 p=0.8719	+0.4519 p=0.1936
Difference Between Mill Pond and Prairie						
	Before	During	After	Before-During	During-After	Before-After
Difference (MP-P)	0.6760 p=0.0273	0.0301 p=0.9271	0.3677 p=0.2153	-0.6559 p=0.0287	0.3373 p=0.2331	-0.3186 p=0.2213

Figure 4: Responses to Question 2 (I help restore natural habitats and protect wildlife). The first three rows show the  $\mu$  response for the schools combined and difference between  $\mu$  responses at each school. The three far, right columns show difference between Before  $\mu$  and During  $\mu$ , During and After  $\mu$ , and Before  $\mu$  and after  $\mu$  at each school. The bottom row shows the differences in  $\mu$ , between Mill Pond and Prairie Before  $\mu$ , During  $\mu$ , After  $\mu$ , Before-During  $\mu$ , During-After  $\mu$ , and Before-After  $\mu$ .



### Results:

For Question 2, “I help restore natural habitats and protect wildlife,” the average response value at Mill Pond Elementary before the school year was higher than at Prairie Elementary. The results show that student interest decreased at Mill Pond Elementary during the school year and increased interest in students at Prairie Elementary. However, the results were approximately equal at both schools when comparing their environmental restoration and wildlife protection behaviors at this time. After the school year shows an increase in response values for students at both schools.

### Discussion:

Students at Mill Pond Elementary showed greater concern towards restoring natural habitats and protecting wildlife at the beginning of the school year. Coming from a more urban environment, the idea of natural areas and wildlife may seem more romantic to them, since they do not live in the midst of it. However, their attitudes and interests decreased during the school year. Perhaps the students did not engage in the NREP’s natural habitat and wildlife protection programs, or their interest dwindled as they became immersed in their academic studies. Unlike Mill Pond Elementary, the response values from Prairie Elementary started lower and increased during the school year to be approximately equal during the school year. This result indicates that NREP activities increased the interest of students from rural areas in protecting wildlife and nature, and that perhaps this interest was lacking more for these students before the program. Ultimately, both schools showed a positive increase in behaviors and attitudes towards natural habitat restoration and wildlife protection, which supports the project’s success.

Question 3:

Question 3				Before-During	During-After	Before-After
Combined				+0.4783 p=0.0188	+0.1087 p=0.8074	+0.5870 p=0.0028
Mill Pond				+0.4667 p=0.1178	+0.4000 p=0.2029	+0.8667 p=0.0014
Prairie				+0.4838 p=0.0967	-0.0323 p=0.9893	+0.4516 p=0.1295
Difference Between Mill Pond and Prairie						
	Before	During	After	Before-During	During-After	Before-After
Difference (MP-P)	0.1226 p=0.5855	0.1054 p=0.6901	0.5376 p=0.0112	-0.0171 p=0.9923	0.4323 p=0.0553	0.4151 p=0.0568

Figure 5: Responses to Question 3 (I know about wildlife and native plants). The first three rows show the  $\mu$  response for the schools combined and difference between  $\mu$  responses at each school. The three far, right columns show difference between Before  $\mu$  and During  $\mu$ , During and After  $\mu$ , and Before  $\mu$  and after  $\mu$  at each school. The bottom row shows the differences in  $\mu$ , between Mill Pond and Prairie Before  $\mu$ , During  $\mu$ , After  $\mu$ , Before-During  $\mu$ , During-After  $\mu$ , and Before-After  $\mu$ .

### Results:

For Question 3, “I know about wildlife and native plants,” the average response value was higher for students at Mill Pond Elementary than those at Prairie Elementary after the school year, but responses were approximately equal between schools before and during the school year. Mill Pond Elementary showed an upward trend in their response values in regards to their knowledge of native plants and wildlife. The students’ response values increased by approximately the same amount between before and during the school year, and during and after the school year. Students at Prairie Elementary showed an increase in knowledge between the beginning of the school year and during the school year, and then remained approximately equal in their responses between during the school year and the end of the school year.

### Discussion:

This result is somewhat counter to Question 2, “I help restore natural habitats and protect wildlife,” in that student perception of knowledge increased due to the program for students in the urban setting, as opposed to an attitude change for the students from the rural setting. This suggests that while students from the more urban area may initially be more environmentally mindful than students from the rural area, students were, overall, less confident in their knowledge of nature. On the other hand, their knowledge continued to increase, even after the school year. Prairie Elementary students showed that their confidence in native plant and wildlife knowledge increased slightly throughout the school year. Again, the success of the NREP was upheld as both school show an increase

between the response values between the beginning of the school year and after the school year.

Question 4:

Question 4				Before-During	During-After	Before-After
Combined				+0.3830 p=0.0453	+0.0851 p=0.8541	+0.4681 p=0.0105
Mill Pond				+0.5333 p=0.0762	+0.0667 p=0.9578	+0.6000 p=0.0406
Prairie				+0.3125 p=0.2759	+0.0938 p=0.8888	+0.4063 p=0.1166
Difference Between Mill Pond and Prairie						
	Before	During	After	Before-During	During-After	Before-After
Difference (MP-P)	0.1604 p=0.5023	0.3813 p=0.0854	0.3542 p=0.1020	0.2208 p=0.2438	-0.0271 p=0.8982	0.1937 p=0.4198

Figure 6: Responses to Question 4 (I pick up trash and recycle at home and at school). The first three rows show the  $\mu$  response for the schools combined and difference between  $\mu$  responses at each school. The three far, right columns show difference between Before  $\mu$  and During  $\mu$ , During and After  $\mu$ , and Before  $\mu$  and after  $\mu$  at each school. The bottom row shows the differences in  $\mu$ , between Mill Pond and Prairie Before  $\mu$ , During  $\mu$ , After  $\mu$ , Before-During  $\mu$ , During-After  $\mu$ , and Before-After  $\mu$ .

## Results:

The average response of Question 4, “I pick up trash and recycle at home and at school,” was slightly higher for students at Mill Pond Elementary than those at Prairie Elementary during the school year. The response trends at both schools were similar when students considered their recycling behaviors throughout the school year. Mill Pond Elementary’s response values increased from the beginning of the school year to during the school year, and remained constant through the end of the school year. Although the response values were slightly lower at Prairie Elementary, the more rural students’ responses exhibited the same trend as the more urban students. Both schools showed an increase in their recycling attitudes and behaviors between the beginning of the school year and after the school year.

## Discussion:

Higher responses at Mill Pond Elementary would indicate that students in the urban area were slightly more inspired to pick up trash and recycle before, during, and after the program than students in the rural area. However, the students from both schools showed an increase between the beginning of the school year to during the school year. This trend supports the claim that, regardless of rural or urban living, student interest in environmental concerns, in this case recycling, increases while they engage and are immersed in environmental activities. Similar to the results of the previous three questions, students at both schools showed an increase in their recycling attitudes and behaviors between the beginning of the school year and after the school year. From this

we see the continued trend that supports the success of this environmental education program.

Question 5:

Question 5				Before-During	During-After	Before-After
Combined				+0.1739 p=0.4623	+0.0870 p=0.8235	+0.2609 p=0.1794
Mill Pond				+0.2667 p=0.4754	+0.0667 p=0.9537	+0.3333 p=0.3169
Prairie				+0.1290 p=0.7735	+0.0968 p=0.8653	+0.2258 p=0.4583
Difference Between Mill Pond and Prairie						
	Before	During	After	Before-During	During-After	Before-After
Difference (MP-P)	0.0430 p=0.8553	0.1806 p=0.3924	0.1505 p=0.4109	0.1377 p=0.5417	-0.0301 p=0.8448	0.1075 p=0.5755

Figure 7: Responses to Question 5 (spending time in nature is important to me). The first three rows show the  $\mu$  response for the schools combined and difference between  $\mu$  responses at each school. The three far, right columns show difference between Before  $\mu$  and During  $\mu$ , During and After  $\mu$ , and Before  $\mu$  and after  $\mu$  at each school. The bottom row shows the differences in  $\mu$ , between Mill Pond and Prairie Before  $\mu$ , During  $\mu$ , After  $\mu$ , Before-During  $\mu$ , During-After  $\mu$ , and Before-After  $\mu$ .



### Results:

The average response value at Mill Pond Elementary was slightly higher than that of Prairie Elementary's response values for question 5, "spending time in nature is important to me." Student responses at Mill Pond Elementary increased a fair amount between before and during the school year, and then only slightly increased between during and after the school year. The trend at Prairie Elementary for the school year shows that, since the start of the school year, student attitudes about spending time in nature increased incrementally. Both elementary schools showed an increase in their interest in spending time in nature.

### Discussion:

The fact that the average response value at Mill Pond Elementary was higher than at Prairie elementary, suggests that students who live in a more urban area might have a greater appreciation for the benefits of spending time in nature than the students that live in a more rural setting. This is further supported by the fact that the average response value between before the school year and during the school year increased by a greater rate at the urban school than at the more rural school. The data supports the idea that students in more urban areas initially feel more strongly about spending time in nature, even while immersed in activities, than those in more rural areas. However, results from both schools show a positive increase in student attitudes in regards to spending more time in nature, reinforcing the success of the NREP.

Question 6:

Question 6				Before-During	During-After	Before-After
Combined				+0.3696 p=0.1357	0.0000 p=1.000	+0.3696 p=0.1357
Mill Pond				+0.4000 p=0.3448	+0.0667 p=0.9700	+0.4667 p=0.2382
Prairie				+0.3548 p=0.3423	-0.0322 p=0.9910	+0.3226 p=0.4113
Difference Between Mill Pond and Prairie						
	Before	During	After	Before-During	During-After	Before-After
Difference (MP-P)	-0.1290 p=0.6334	-0.0839 p=0.7420	0.0150 p=0.9580	0.0452 p=0.7864	0.0989 p=0.6869	0.1441 p=0.5579

Figure 8: Responses to Question 6 (I talk with family and friends about these things). The first three rows show the  $\mu$  response for the schools combined and difference between  $\mu$  responses at each school. The three far, right columns show difference between Before  $\mu$  and During  $\mu$ , During and After  $\mu$ , and Before  $\mu$  and after  $\mu$  at each school. The bottom row shows the differences in  $\mu$ , between Mill Pond and Prairie Before  $\mu$ , During  $\mu$ , After  $\mu$ , Before-During  $\mu$ , During-After  $\mu$ , and Before-After  $\mu$ .

## Results:

The average survey results at both schools were approximately equal before, during, and after the school year for Question 6, “I talk with family and friends about these things.” Mill Pond Elementary showed an increase from before the school year to during the school year, and a slight increase from during the school year to after the school year. Students at Prairie Elementary exhibited a slightly different trend, where student interest in discussing environmental matters increased from before the school year to during the school year, and then maintained through to after the school year. Students at both schools showed a positive increase in environmental behaviors when comparing the before the school year values to after the school year values.

## Discussion:

Out of all 6 questions, Question 6 received the lowest response values from students at both schools. This is unfortunate because it suggests that students at both rural and urban schools were less interested in sharing their experiences, attitudes, and behaviors with family and friends, even while immersed in the NREP’s activities. This could be due to a number of different reasons, such as preference to discuss other matters, to fear of exhibiting different interests than their family and friends, thereby setting themselves up to be ridiculed or made an outcast. Although this behavior received the lowest response values from both schools, it did show an increase when before the school year was compared to after the school year, providing further support for the claim that the NREP has a positive impact on student environmental attitudes and behaviors.

## **Correlations with Test Scores**

While standardized tests do not fully reflect a student's comprehension of a given subject, they can be used as a supplemental indicator of their interest and performance. In the example of this thesis study, Prairie Elementary has a much higher percentage of students meeting standards for science than Mill Pond Elementary. This may be caused by a variety of factors, which could include teacher involvement, accessibility to science-oriented programs such as the NREP, and general student interest. For instance, Mill Pond's low science test scores may be due to the fact that hands-on science education programs, like NREP, are not mandatory, and therefore may indicate a disconnect where students are not performing well in the sciences due to low interest because of lack of exposure. Certainly, nature deficit could contribute to student lack of interest in the natural world, and consequentially, in the sciences. It is also telling that the school with mandatory participation environmental science education program has much higher test scores in science. Further research into this subject would benefit by investigating the contrast between the two schools' science curriculums.

## **Teacher and Other Survey Results**

Of the short-answer surveys given to teachers and volunteers, three were returned from teachers, one from the director of the NREP, and one from a volunteer of the program. The responses were pooled together, attempts were made to not distinguish between roles when reporting responses.

### Question 1:

What drew you to the NREP's Programs?

### Results:

For Question 1, five of the five individuals who responded appear to have been drawn to the NREP through some form of introduction, either through their school, school district, or a program at The Evergreen State College. One participant appreciated the unique opportunity the NREP offers students. They described it as “[connecting] the classroom to the real world, and [having] the students doing real citizen science.” Three responders saw the benefit such a program could bring through their own passions. For instance, one teacher was drawn by their personal “interest[s] in environmental education;” another was attracted to the practical “hands on [application] inquiry and learning.” A further example of this was a respondent’s personal enjoyment of “helping younger students learn about science and the environment.”

### Discussion:

It seems clear that 3<sup>rd</sup> party introductions between the NREP, teachers and volunteers are vital to the project’s success and community engagement. Moreover, the participants’ personal passions and interests in hands-on learning, citizen science, and concern for the environment appear to be the primary drivers for continued involvement in the programs. One might conclude that passionately engaged teachers everywhere would understandably jump at the chance to extend their student’s thirst and search for knowledge into the real world.

## Question 2:

Do you feel that outdoor education is important for students to make connections between what they are learning and the local community/environment? Why?

## Results:

All participants were in agreement in their responses to Question 2 towards the importance of the aims of the NREP providing an opportunity. An example of this is one participant's response in regards to the importance "for students to make connections between what they are learning and the local environment." One responder compared it to being "what scientists do." Two out of the five responders agreed that the connection to the environment would influence the students' attitudes and behaviors. For instance, "If they are more connected and more involved they are more likely to actually care about the environment and what's going on around them and be involved in their community in the future." Another illustration of this was a participant's hope that students will "realize that the learning they are taking part of is part of a bigger picture and that they can make a positive impact on the world."

## Discussion:

Besides children being more involved and understanding their natural environment, the programs aim to provide them with applicable real-world experiences in order to enrich and extend their knowledge base, and the participant responses are supportive of this goal and the success of the NREP in working towards it. One might theorize that the more senses students engage in their pursuits, the easier it is for them to connect their learning to the bigger picture. Therefore, not only do the NREP's programs

support student learning, they also encourage participation of citizen science as they develop future scientists.

### Question 3:

Do you feel that spending time in nature is important to a child's mental/emotional/physical development? Why?

### Results:

Every participant was in agreement to the importance of spending time in nature to a child's mental/emotional/physical development in Question 3. One participant described nature as having a "calming" effect on the students and explains that it is "important to understand and explore the world that we live in." Another responder suggested that the students are "at home in nature." Nature provides "fresh air, exercise, and experiences," and that children "do not get enough time in" it. Another participant suggested that there is too much "focus nowadays on standardized testing—I think schools are even cutting back on outdoor time in general—and that can take a toll on mental/emotional/physical health."

### Discussion:

While all participants were in agreement to the importance of spending time in nature to a child's mental/emotional/physical development in Question 3. The response of the teachers is interesting in regards to the effect nature has on children. Recess has always been a time for children to engage with the outdoors, but even then exposure to nature is

limited when artificial jungle gyms are used. As children progress upwards towards high school graduation such potentially calming breaks and experiences, which help tie together the mental, physical and emotional developments of children, are waylaid completely in the academic setting.

#### Question 4

Which of the NREP's activities do you feel are the most successful at engaging students?  
Why?

#### Results:

Overall, the responses to Question 4 were quite varied toward which activities were the most successful and engaging to the students. Three out of the five responders agreed that water quality testing was the most successful. Another felt that "In terms of reaching the broadest range of students, tree planting and habitat restoration was most successful."

One even found the salmon tosses to be a personal favorite and suggested that it was a student favorite as well, based on their observed participation. They noted that "almost all the students end up participating." Another participant surmised that tree planting and restoration potentially reach those who are weaker at class work. "It reinforces what they have learned about water quality and gives them an opportunity to positively impact the streams and rivers they are studying. Often students who struggle in school excel at tree planting! Many, many teachers comment at the pleasant surprise of seeing students who normally are not successful in the classroom jump into the tree planting with enthusiasm."



### Discussion:

Implementation and involvement by the teachers possibly has an effect depending on their own preferences, like that of the respondent who preferred the salmon tosses. Although the water quality testing was stated to be the most popular, according to the majority of responders, the other two participants gave cause to suggest that the students, and adults have varied interests and passions that one activity alone could not serve. Happily, the NREP includes a number of activities which would likely appeal to different demographics at different levels.

### Question 5:

Do any other classes in your school/grade participate in the NREP's programs? Why?

### Results:

Like the responses to Question 4, Question 5 received mixed responses. While two responders stated their school district requires that all 5<sup>th</sup> grade classes participate in the NREP's programs, another school only had one class participating. This participant explained it was "due to time constraints."

### Discussion:

It is clear that not all school principals or districts require each 5<sup>th</sup> grade classroom to participate in the NREP's activities. This may be due to the fact that the teachers, principals, or school districts have differing priorities, which could be a

reflection of nature disassociation within the authority figure(s) presiding over the schools or classes themselves. This disassociation is suggested due to the fact that the 5<sup>th</sup> grade classes in the more rural school were required to participate in the activities, whereas only one 5<sup>th</sup> grade class from the more urban school participated because the other teachers had other priorities.

#### Question 6:

How would you describe the students' level of engagement on the NREP fieldtrips? Does this transcend across demographic backgrounds (socio-economic status, race, culture, gender)?

#### Results:

In response to Question 6, two out of the four responders agree that the fieldtrips appeal to all the students. This is evident in the following responses: “all students enjoy the fieldtrips,” and “they all loved it.” However, the other two responders stated that it only appealed to most of the students. For example, one participant reported that “students mostly participate evenly across demographic backgrounds;” similarly, the other stated that “Most of the engagement is very high.” These two described engaging and keeping students focused as being more difficult. “Girls generally seem a little more focused than the boys” on the tasks at hand and “sometimes it’s like herding cats,” and “if there aren’t enough adults present to staff the different stations [then student engagement will be lower].”

### Discussion:

The two participants that described engaging and keeping students focused as being more difficult suggest that there are several factors that come into play, such as gender. If the girls were more engaged in the activities, then this could possibly be due to gender roles or the simple fact that the girls might find certain technical activities more engaging than the boys. Apart from gender, it seems that parent support and participation is key to the success of the NREP. While the first two responders did not go into detail about as to why or how all of the students enjoyed and loved the programs, they agreed that the fieldtrips do appeal to all the students, regardless of demographic backgrounds. Perhaps these were classes where there was more parental support in terms of chaperoning the fieldtrips.

### Question 7:

How, if at all, have student behaviors changed after participating in the program? Does this transcend across demographic backgrounds (socio-economic status, race, culture, gender)?

### Results:

Four out of the five responders agreed that it changes behaviors at least some, while one reported that behaviors did not change, yet did not provide any details. One of the responders who saw a change in behavior suggested that “[students] are proud of themselves and know they are doing important work”. Another participant supported this change by citing previous studies; “according to our end of the year survey from previous

years, yes.” Further responses claimed that prior experience with the NREP can determine student maturity when participating in activities. For example, “students have a different attitude about it than students with minimal background or previous involvement. They take it a little more seriously and sometimes even take on leadership roles in highly involved activities like water quality testing.”

### Discussion:

According to a majority of the responses, it seems that the NREP’s activities give children pride and a sense of accomplishment, because they understand the importance of what they are doing. It’s clear that, for the most part, the more students have opportunities to participate in activities, like those of the NREP, the more students grow and come to understand and respect the importance of what they are learning and participating in. Although not every class sees the same level of success in behavioral changes, one might speculate that, perhaps, these were among the classes that had limited parent involvement in the form of chaperones.

### Question 8:

Do you feel that the NREP successfully reaches out to all students, regardless of economic status, race, or cultural association? Why/Why not?

### Results:

Responses to Question 9 indicate that all five of the five participants agree that the program successfully reaches out to all students. For example, one stated that “it is paid

for by them and available to everyone. However, another participant noted a potential issue: “It really depends on the teachers who decide to participate, though. Since the program isn’t mandatory, not all schools participate, and sometimes only a few teachers in each school participate, so there are potentially a lot of students the program isn’t reaching, but demographic groups within the area are generally represented in the students who are able to participate.”

Discussion:

Consensus among all five participants indicates that the program, where available and funded by the public, successfully reaches out to all students, regardless of economic status, race, or cultural association. The nature of the setting seems to suggest it is conducive towards positively breaking down demographics. The issue is that the program isn’t mandatory. It comes down to the schools or school districts where, at times, only a few teachers in each school decide to participate. This means that there could be a significant number of students that don’t have access, simply because their teacher chose to opt out of the opportunity, which may make it difficult for those involved closely to gauge the impact.

Question 9:

Do you have any suggestions that could improve the NREP’s ability to equitably reach all students?

### Results:

Taking the previous questions and answers into consideration, generally the teachers agree that “the support and the Green Congress are fantastic.” However, there was only one suggestion for improvement: “The program does outreach and festivals and whatnot, so I think trying to get more and more teachers involved is the best way to reach out.”

### Discussion:

Taking the previous questions and answers into consideration, generally the teachers agree that the support given by the NREP was sufficient, so it’s not too surprising that there’s only one real suggestion for improvement. Given some of the responses from this and the other questions, it’s not surprising that it be for more teacher involvement from the surrounding communities. Teachers can be considered as the gate keepers to the hearts and minds of children. If they can be helped to see the benefits that taking the time out to participate in preservation of resources and develop a passion for these things, then uncountable children will be given the opportunity for awareness and participation in the activities as well.

### Summary

The two participants that described engaging and keeping students focused as being more difficult suggest that there are several factors that come into play, such as gender. If the girls were more engaged in the activities, then this could possibly be due to gender roles or the simple fact that the girls might find certain technical activities more engaging than the boys. Apart from gender, it seems that parent support and participation is key to the success of the NREP. While the first two responders did not go into detail

about as to why or how all of the students enjoyed and loved the programs, they agreed that the fieldtrips do appeal to all the students, regardless of demographic backgrounds. Perhaps these were classes where there was more parental support in terms of chaperoning the fieldtrips.

## **CONCLUSIONS**

### **Effectiveness of the NREP in Addressing Nature Deficit**

The student survey results indicate that students feel they gain knowledge and experience from participating in environmental learning activities led by the NREP. Whether or not they continue to pursue studying environmental sciences, it is clear that their environmental attitudes and behaviors are positively altered by the program, and they feel more connected to and responsible for their natural environment.

This improvement in student attitudes appears to be similar for students in both urban and rural schools. In some cases, it even appears that the students in Mill Pond Elementary (the urban school), gained more from the program. This supports the idea that such a program addresses nature deficiency in students from areas where access to nature is limited.

### **Other Schools Taking Part in the NREP**

Although this study focused on schools with similar demographics, it is important to note that the NREP reaches out to more diverse groups of students as well. For example, Wa He Lut Indian School located in the lower watershed has at least one class participating in the program, as does Shining Mountain Elementary School, a special needs school. Although there is a standard procedure for any testing (like water quality), the approaches to environmental education outside of these procedures are up to



individual teachers. For instance, teachers may choose to invite volunteer experts in different fields to help with field trips and to contribute to cultural experience.

### **Generalizability and Application to Other Programs**

The model of the Nisqually River Education Project is to bring different agencies and groups together to educate as many students as possible in their local natural environment, using a shared resource (the Nisqually River Basin) as a teaching tool. Such a tool provides diverse opportunities for students to experience nature and feel more connected to their community. The main limitation of environmental education programs like the NREP is that they are not mandatory in every school or every district and therefore, participation is based on teacher involvement. If school districts or principals were to implement mandatory participation of an outdoor environmental education program, as in the case of Prairie Elementary, environmental learning would not be limited to the few teachers who take the initiative to implement them. Additionally, continued focus on standardized testing limits the time available for students to participate in these programs.

### **Caveats and Limitations of this Study**

For the sake of respecting the privacy and identities of the teachers participating in the NREP's activities, the director of the project and her superiors felt it appropriate to send an email to the teachers to introduce the thesis study and request volunteers, rather

than disclose contact information. From this email communication, three 5<sup>th</sup> grade classrooms in Yelm, Washington agreed to participate in the study. These teachers were given the option of administering the survey themselves, or inviting the researcher into their classroom to administer the survey to the students. They unanimously agreed that, in the interest of time, they felt more comfortable administering the survey themselves, rather than organizing a time and date with a third party. It was decided that one survey would be conducted at the end of the school year, rather than three separate surveys (beginning, middle, and end), in an effort to ease the burden on the teachers and maintain participation levels. This would be much like a similar survey conducted in previous years by the NREP in order to evaluate their program.

Of course, the one-time nature of the test poses some methodological issues associated with the students assessing their own attitudes and knowledge for all three moments and the end of their experience, rather than at each stage of the process. Asking participants to assess their attitudes and knowledge over the course of the year is less advantageous than throughout the course of their participation in the program, which would garner more accurate results without the limitations of memory distortion. However, an end of the year assessment does provide an opportunity for each participant to reflect on the change of their attitudes and knowledge over the course of the school year. In the future, a more accurate assessment would be obtained from surveying students at three points; at the beginning, middle, and end of the year.

While the teachers volunteered to administer the tests themselves, the students were required to obtain parental approval before participating in the study. Two of the participating classes were from Prairie Elementary and one of these classes was from Mill Pond Elementary, resulting in unequal sample sizes from each school. However, not all of the students in the classes submitted surveys, resulting in lower sample sizes; a total of 32 participating students from Prairie Elementary and 15 participating students from Mill Pond Elementary. According to the National Center for Education Statistic's Digest of Education Statistics, the average class size of elementary schools in Washington State is 23.7 (2016). This suggests there was 63% of student survey participation at Mill Pond Elementary and 68% of student survey participation at Prairie Elementary. It is unknown as to whether the difference could be chocked up to a lack of parental or student interest in participating in the study.

Due to the fact that the students were not asked to self identify for ethical reasons, and because there were only two schools surveyed, there could not be correlations made between the effects of the program and equity in other areas such as race, ethnicity, or socio-economic status. This was partially remedied by the teacher and volunteer survey results, which indicated that that students across different backgrounds benefit from the program.

The teachers were then instructed to distribute the surveys towards the end of the school year (May-June) in order to get a fuller picture of the changes of environmental attitudes and behaviors of the students after participation in the NREP's environmental programs.

## **Future Studies**

To determine the effectiveness of outdoor environmental education programs at equitably reaching out to students of various backgrounds, long-term studies are needed. The data provided by this study and past research can help to inform future evaluations as to the demographics that should be targeted by these programs. The data can also help to pinpoint where connections made between nature and the classroom benefit student environmental attitude and behaviors. Future research should incorporate opportunities to observe actual students engagement in these activities throughout the school year to make direct connections as to how these variables act in relation to student backgrounds. Additional efforts should focus on long-term effects of these students' exposure to programs.

Comparative studies should be undertaken to determine how generalizable the conclusions of this research are. Do 5<sup>th</sup> grade students in rural and urban areas in different parts of the United States reflect similar environmental knowledge, behaviors, and attitudes? Understandably, students residing in a major metropolitan area, or in a small, Midwestern town might offer different results. It can be theorized that students who participate in a similar environmental education program and live in more extreme conditions of rural and urban living would provide different results. Researching a nationwide program, such as Project WILD, or a network of smaller programs across the nation, might be more effective at providing a comprehensive array of results from various demographics across the country. By conducting further inquiry of more diverse populations and areas, including specialty schools such as the Wa He Lut Indian School

and Shining Mountain Elementary, common themes might be revealed that could apply to equity within environmental education programs on a larger scale.

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## Appendix A: School Demographics

Table A1: Demographic data for Prairie Elementary

Enrollment		
October 2015 Student Count	526	
May 2016 Student Count	562	
Gender		
Male	287	54.6%
Female	239	45.4%
Race/Ethnicity		
Hispanic/Latino	76	14.4%
American Indian/Alaskan Native	12	2.3%
Asian	3	0.6%
Black/African American	1	0.2%
Native Hawaiian/Other Pacific Islander	1	0.2%
White	381	72.4%
Two or more races	52	9.9%
Special Programs		
Free or Reduced-Price Meals	221	39.3%
Special Education	93	16.5%
Transitional Bilingual	34	6.0%
Migrant	0	0.0%
Section 504	7	1.2%
Other Information		
Unexcused Absence Rate	321	0.4%

Table A2: Demographic data for Mill Pond Elementary

Enrollment		
October 2015 Student Count	563	
May 2016 Student Count	549	
Gender		
Male	299	53.1%
Female	264	46.9%
Race/Ethnicity		
Hispanic/Latino	85	15.1%
American Indian/Alaskan Native	12	2.3%
Asian	10	1.8%
Black/African American	16	2.8%
Native Hawaiian/Other Pacific Islander	8	1.4%
White	375	66.6%
Two or more races	57	10.1%
Special Programs		
Free or Reduced-Price Meals	232	42.3%
Special Education	97	17.7%
Transitional Bilingual	12	2.2%
Migrant	5	0.9%
Section 504	16	2.9%
Other Information		
Unexcused Absence Rate	288	0.4%

Appendix B: Sample Student and Teacher Surveys

**Student Survey:**

<b>NISOUALLY RIVER EDUCATION PROJECT STUDENT SURVEY 2016-2017</b>												
	<b>Before this School Year</b>				<b>During this School Year</b>				<b>After this School Year</b>			
	<b>A Lot</b>	<b>Some</b>	<b>A Little</b>	<b>None</b>	<b>A Lot</b>	<b>Some</b>	<b>A Little</b>	<b>None</b>	<b>A Lot</b>	<b>Some</b>	<b>A Little</b>	<b>None</b>
I protect water quality. Comments:												
I help restore natural habitats and protect wildlife. Comments:												
I know about wildlife and native plants. Comments:												
I pick up trash and recycle at school and at home. Comments:												
Spending time in nature is important to me. Comments:												
I talk with family and friends about all these things. Comments:												

**Interview questions for NREP Director, Volunteers, and Teachers:**

What drew you to the NREP's programs?

Do you feel that outdoor education is important for students to make connections between what they are learning and the local community/environment? Why/Why not?

Do you feel that spending time in nature is important to a child's mental/emotional/physical development? Why/Why not?

Which of the NREP's activities does your class participate in?

Do any other classes in your school/grade participate in the NREP's programs? Why/Why not?

How would you describe the students' level of engagement on the NREP fieldtrips?

Does this transcend across demographic backgrounds (socio-economic status, race, culture, gender)?

How, if at all, have student behaviors changed after participating in the program?

Does this transcend across demographic backgrounds (socio-economic status, race, culture, gender)?

Do you feel that the NREP successfully reaches out to all students, regardless of economic status, race, or cultural association? Why/Why not?

Do you have any suggestions that could improve the NREP's ability to equitably reach all students?

