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Environmental Science and Culture: Exploring the Factors Contributing to the Pro-Environmental Behavior of Rural Youth

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ABSTRACT

This mixed methods study contributes to the pro-environmental behavior literature by introducing the concept of environmental science capital to explore the factors influencing pro-environmental behavior in rural youth. This study's proposed theory of change attempts to build upon the Kollmus and Agyeman model of pro-environmental behavior by theorizing that environmental science capital is the "missing middle" needed to overcome the barriers to pro-environmental behavior. We hypothesized that meaningful nature experiences, role models, connectedness to nature, STEM interest and environmental identity would help rural youth increase their environmental science capital in order to "bridge the gap" and overcome barriers to pro-environmental behavior. We found that environmental identity, STEM interest, environmental science capital, and political identity are significant contributors to pro-environmental behavior. Qualitative findings revealed that participants use different language when describing different identities and that there is a tension between participants' environmental identity and other self-described identities.

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GLOSSARY

Connectedness to Nature	The connectedness to nature scale measures to what degree people feel part of nature.
Environmental Identity	A sense of identity that transcends the individual and encompasses one's position as part of a living ecosystem. Includes identities related to science, the outdoors, nature, and environmentalism.
Environmental Science Capital	Sum of the environmental science-related experiences that one builds up over a lifetime. Environmental science includes agriculture, animal care, fisheries and wildlife, ecology, botany, limnology, and other sciences dealing with the environment.
Meaningful Nature Experience	An experience with nature that one interprets to have a serious, important, or useful quality.
Pro-Environmental Behavior	Any behavior contributing to environmental sustainability. These behaviors may be collective (i.e. voting based on environmental issues, participating in a rally for an environmental cause, choosing an environmental career) or individual (i.e. composting, recycling, not using home air conditioner on a hot day, choosing to purchase a product based on sustainability).
Role Model	A person looked to by others as an example to be imitated.
Rural	According to the U.S. Census Bureau, rural refers to all population, housing, and territory not included within an urban area. Two urban areas are recognized: Urbanized Areas (UAs) of 50,000 or more people; and Urban Clusters (UCs) of at least 2,500 and less than 50,000 people.
Science Capital	Sum of the science-related experiences that one builds up over a lifetime that influences certain social groups to participate in science.
STEM Interest	Interest in the fields of Science, Technology, Engineering, and Mathematics. Science includes both physical and life sciences, such as environmental and agricultural sciences.

Sources: Archer et al., 2015; Brugger et al., 2011; Kollmus & Agyeman, 2002; U.S. Census Bureau

CHAPTER 1: INTRODUCTION

Background of the Problem

Since the Industrial Revolution, human activity has been the most significant factor influencing the environment (Vitousek, Mooney, Lubchenco, & Melillo, 1997). Human influence on the Earth system is so significant that scientists are calling this geological age the Anthropocene, or the Age of Humans (Crutzen, 2006; Lewis & Maslin, 2015; Steffen, Grinevald, Crutzen, & McNeill, 2011). Global climate change, deforestation, pollution, and threats to biodiversity are just a few major environmental problems that have been driven primarily by human activity (Walther et al., 2002). Knowledge of how humans influence the environment has given rise to an environmental revolution pushing environmentally-friendly alternatives to previous ways of life. Additionally, the public is generally aware of the issues facing the Earth today (O'Connor, Bord, & Fisher, 1998).

However, there is plenty of progress that must still occur in order to adequately slow the pace of environmental degradation. Some of that progress will be in the form of scientific research monitoring the progression of environmental problems, some will be in further technological advances, but most of that progress must come from a greater understanding of human psychology and inspiring behavior change (Leviston, Leitch, Greenhill, Leonard, & Walker, 2011; St. John, Edwards-Jones, & Jones, 2011; Stern, 1992; Swim, Stern, Doherty, Clayton, Reser, et al., 2011). Despite an awareness of the issues facing the earth today, some people debate the extent to which those issues are human-caused (Arbuckle, Morton, & Hobbs, 2015; Weber & Stern, 2011), and others

exhibit relatively low levels of pro-environmental behavior, despite their noted interest and concern for the environment (Kollmus & Agyeman, 2002). Environmental efforts will only be successful if a larger number of people support it personally, socially, and politically. Thus, understanding why people do, or do not, engage in all types of pro-environmental behavior is one of the greatest challenges of our time.

Researchers have been interested in understanding the root of pro-environmental behavior for a long time, but there is no single factor or technique that increases all types of pro-environmental behavior in all types of people. The assumption that people simply must be educated about environmental problems in order to act on that knowledge has been refuted and even when one cares deeply about environmental problems, they still face barriers to action (Kollmuss & Ayeman, 2002). Decades of research from environmental and behavioral psychology into this awareness-action gap shows that the factors that lead to pro-environmental behavior are complex, multifaceted, and inconsistent between individuals (Blake, 1999; Lane & Potter, 2007; Moser & Dilling, 2011; O'Brien, 2013; Taylor, 1989). Pro-environmental behavior can depend upon environmental knowledge, values, attitudes, perceived locus of control, personal and social norms, extrinsic motivation, age, sex, race, socioeconomic status, religion, and geographic region (Clark, Kotchen, & Moore, 2003; Finger, 1994; Karp, 1996; Scannell & Gifford, 2010; Steg & Vlek, 2009). Even when all the factors come together so that one forms an intention to engage in pro-environmental actions, barriers such as access, past behavior and habits, and social pressures can prevent pro-environmental behavior (Gifford, 2011; Hargreaves, 2011; Kollmus & Agyeman, 2002). We know that behavior is more likely to change when there is an emotional tie to the issue (Sia, Hungerford, &

Tomera, 1986), yet people are less likely to change their behavior if they are emotionally overwhelmed by alarmist claims or feel that claims are being exaggerated (Whitemarsh, 2011). In an age where the public has access to an enormous amount of accurate information at their fingertips, they are also faced with an onslaught of misleading claims and politicized information in the media (Askanius & Uldam, 2011; Ladle, Jepson & Whittaker, 2005). Through the internet, people have access to like-minded individuals who can help them feel part of a pro-environmental culture (Brulle, 2014). But simultaneously, those who oppose environmental policy or reject environmental science can find others to support and reinforce their views, more than ever before (McCright & Dunlap, 2011).

Despite these challenges, research has elucidated some factors that are antecedents of pro-environmental behavior and potential areas of successful intervention. Most recent meta-analyses and theoretical models include some measure of environmental values or worldview as a significant determinant of pro-environmental behavior (Xiao, Dunlap, & Hong, 2019). This has been measured using survey tools such as the new environmental paradigm (Dunlap, Van Liere, Mertig, & Jones, 2000) and the connectedness to nature scale (Mayer and Frantz, 2004). These scales measure the extent to which one feels a part of nature, as opposed to an anthropocentric worldview in which one feels that man dominates over nature. Not surprisingly, people who have an environmental worldview are more likely to engage in pro-environmental behavior than their anthropocentric counterparts (Dunlap et al., 2000). Similarly, studies show that having frequent and meaningful outdoor experiences in early life can lead to more positive attitudes and values toward the environment as an adult (Chawla, 1998; Ewert,

Place, & Sibthorp, 2005; Palmer, Suggate, Robottom, & Hart, 1999; Stevenson et al., 2014). It is also clear that nature experiences are more impactful when supported by or shared with family members, friends, and role models (Chawla, 1998). However, instilling children with an environmental worldview and a feeling of connectedness to nature is challenging during an age when people are more and more disconnected from nature and live increasingly indoor lives (McCurdy, Winterbottom, Mehta, & Roberts, 2010). At the same time, access to natural places and nature-loving role models are not universal across all groups of people (Strife & Downey, 2009).

Gaps in the Literature

The problem of increasing pro-environmental behavior requires complex solutions that are tailored to the culture of specific groups of people. Yet much of the previous research has overlooked or under-emphasized the impact of social and cultural factors that can shape which antecedents of pro-environmental behavior and barriers to pro-environmental behavior are most important for a particular group. For example, the significant factors determining the pro-environmental behavior of an African American female from an urban region and high socioeconomic status are probably not the same as those of a white male from a rural region with low socioeconomic status.

Previous research has not taken the approach of framing the culture and demographics of the population as central to the research, aiming for depth rather than breadth. Additionally, much of the research on pro-environmental behavior has focused more on the private-sphere and direct consumptive behavior of an individual versus political and collective behavior that can greatly influence society and the culture of environmentalism and stewardship (Hargreaves, 2011; Steg & Vlek, 2009; Stern, 2000).

The focus on these behaviors must shift if the movement is to succeed (Jugert, Greenaway, Barth, Buchner, & Eisentraut, 2016; Lee, Kim, Kim, & Choi, 2014). The field needs more research that studies the pro-environmental behavior of different groups of people to learn what pro-environmental behavior looks like for them. This would allow researchers to learn how to adapt efforts and interventions to overcome a group's specific barriers, especially those that can lead to collective action and cultural shifts.

One particular group of people that has been under-studied in the literature are those from rural geographic areas (Larson, Stedman, Cooper, & Decker, 2015; Takahashi & Selfa, 2015). Early studies and environmental education efforts focused on urban youth due to the assumption that their physical disconnection from nature would make them less likely to exhibit pro-environmental behavior (Tidball & Krasny, 2010). However, this does not seem to be true; rural youth often exhibit similarly low pro-environmental behavior, despite their physical proximity to natural spaces (Larson, et al., 2015). Some studies show that rural students exhibit less direct pro-environmental behavior, have lower environmental knowledge, and lower environmental literacy compared to students from more urban schools (Chen et al., 2011; Williams, 2017). These findings could be due to a difference in the availability of resources to behave pro-environmentally (Chen et al., 2011), or a difference in values and worldviews (Huddart-Kennedy, Beckley, Mcfarlane, & Nadeau 2009; Rauwald & Moore, 2002). In contrast, other studies have found greater pro-environmental behavior and environmental sensitivity in rural students due to greater time spent outdoors in nature (Gallay, Marckini-Polk, Schroeder, & Flanagan 2016; Meyer, 2015), and a greater moral obligation to behave pro-environmentally (Berenguer, Corraliza, & Martin, 2005). Numerous other studies see no

correlation between urban versus rural residence and pro-environmental behavior (Arcury and Christianson, 1995; Halder et al., 2012; Lutz, Simpson-Housley & deMan, 1999). Clearly this is an area of the pro-environmental behavior research that requires further exploration.

Another weakness in both research and practice is the lack of synergy between environmental efforts and the recent emphasis on improving science, technology, engineering, and math (STEM) literacy. Major STEM initiatives have successfully garnered widespread support for educational programs aimed at improving the STEM literacy of American teachers and students (DeJarnette, 2012; Jolly, 2009). It might seem that improvements in science literacy would lead to improvements in environmental literacy, but this would require a concerted effort to weave environmental issues into STEM programming. Additionally, STEM initiatives tend to be valued based on their contribution to industry and the economy, which is not always congruent with the goals of the environmental movement (Atkinson & Mayo, 2010; Kennedy & Odell, 2014). Despite this strange dichotomy between the ways we perceive "science" versus "environment", public views of environmental science are intrinsically tied to those of science as a whole. As such, environmental science is likely plagued by many issues facing the sciences in general (Chang, Eagan, Lin, & Hurtado, 2011; Hazari, Sadler, & Sonnert, 2013). Research in the STEM realm has shown that science literacy and science identity are generally low, especially in females, people of color, and those with low socioeconomic status (Lee & Luykx, 2007; Miyake et al., 2010). At the same time, public distrust of science is high (Gauchat, 2012). If science is not broadly accepted, accessible, and relatable, people are not likely to trust or value what scientists have to say. This has

serious implications for environmental efforts, which require the public to know about environmental issues and trust in scientists' findings related to those issues, before they can overcome the other barriers preventing pro-environmental behavior.

One promising area of research that comes from the STEM field is the concept of science capital (Archer, Dawson, DeWitt, Seakins, & Wong, 2015), which was developed in order to help researchers assess the cultural factors that influence the science aspirations of young people. Derived from the concept of social capital, science capital is the sum of the science-related experiences that one builds up over a lifetime that influence certain social groups to participate in science, while others remain underrepresented. Science capital includes what you know about science, who you know that influences your views on science, your values and attitudes toward science, and your engagement with science in daily life (enterprisingscience.com). This concept has not been used to assess engagement in environmental science specifically, although its emphasis on culture could help to explain the tremendous variation in pro-environmental behavior research. The concept of environmental science capital is introduced in this study to help explain why some individuals or groups behave pro-environmentally, while others do not.

Significance of the Study

The concept of environmental science capital will help researchers to study pro-environmental behavior in a more holistic way that considers the individual's sociocultural background and life experiences. In practice, formal and informal educators will benefit from a deeper understanding of how to foster pro-environmental behavior in rural youth, because they can present lessons or programs that are more effective with

that specific population. Therefore the findings of this study will benefit society by building more pro-environmental citizens, especially among rural American populations. This could result in greater social and political support for the pro-environmental movement, benefitting the Earth and all its inhabitants.

Theory of Change

This study will use the Kollmus and Agyeman model of pro-environmental behavior as the theoretical framework. Through the exploration of numerous theoretical frameworks developed to explain the gap between the possession of environmental knowledge and awareness and displaying pro-environmental behavior, Kollmus and Agyeman (2002) analyzed the factors found to have some influence, positive or negative, on pro-environmental behavior. These factors include: demographic factors, external factors (institutional, economic, social and cultural) and internal factors (motivation, pro-environmental knowledge, awareness, values, attitudes, emotions, locus of control, responsibilities and priorities). Environmental knowledge, values, and attitudes together with emotional involvement make up a complex Kollmus and Agyeman call “pro-environmental consciousness”. This complex is embedded in the broader personal values and is shaped by personality traits as well as other internal or external factors. From this analysis, Kollmus and Agyeman developed a model (Figure 1.1) that incorporates all of these factors to illuminate the complexity of what shapes pro-environmental behavior (Kollmus & Agyeman, 2002).

The model indicates how the different factors influence each other and how they ultimately influence pro-environmental behavior. Figure 1.1 illustrates that both internal and external factors can directly lead to pro-environmental behavior (shown by two

narrow arrows), however, when both factors act synergistically (shown by one wider arrow) there is a greater positive influence. The model also depicts several possible barriers Kollmus and Agyeman found within their analysis as being the most important. The possible barrier of old behavior patterns is illustrated graphically with the largest barrier box to draw attention to old habits as a very strong barrier often overlooked in the pro-environmental behavior literature (Kollmus & Agyeman, 2002).

The Kollmus and Agyeman model of pro-environmental behavior is the framework for this research because it includes both the internal and external factors that we believe must be considered when studying the pro-environmental behavior of a specific population.

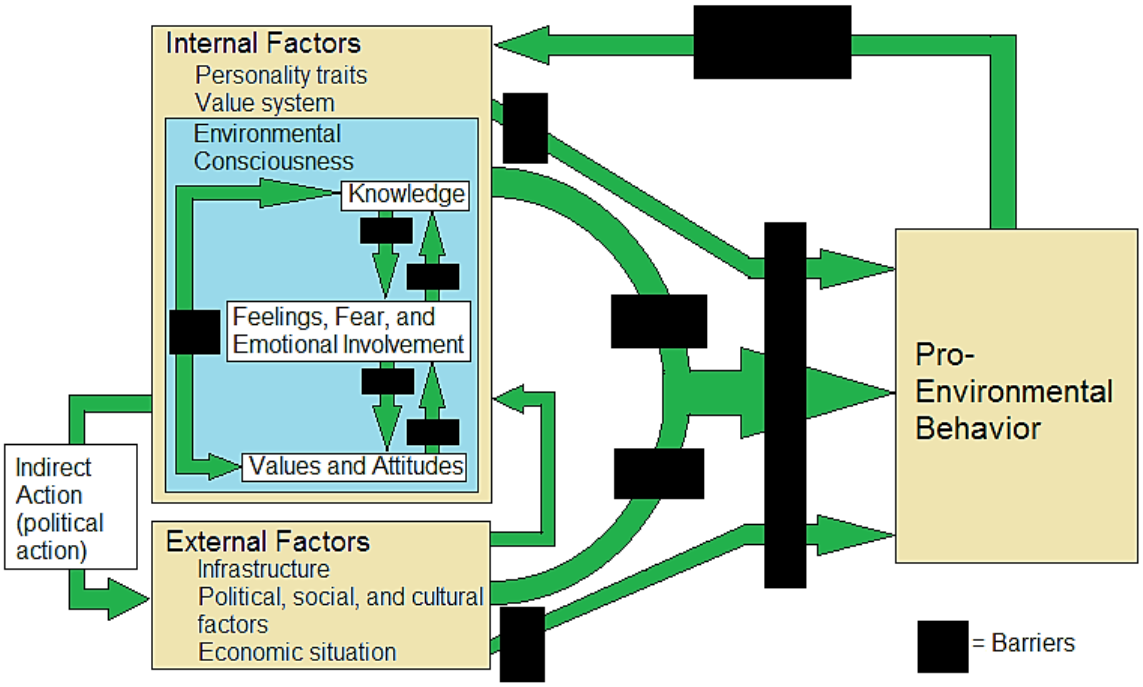


Figure 1.1. Model of Pro-Environmental Behavior (adapted from Kollmus and Agyeman, 2002).

Other recent theoretical frameworks (Bamberg & Moser, 2006; Klockner, 2015) place less emphasis on the external factors such as political ideology, social norms, economic situation, and culture. A framework that emphasizes culture is an ideal basis for the present research. Although it does not encompass all the factors that could impact pro-environmental behavior, the Kollmus and Agyeman model is more useful for conducting research that is relevant to a specific demographic population, so that actionable recommendations can be derived from the research to increase the pro-environmental behavior of the specific population being studied. The model also references indirect environmental actions and barriers to pro-environmental behavior, both of which are addressed in the present research.

This study's proposed theory of change attempts to build upon the model of pro-environmental behavior by theorizing that environmental science capital is the "missing middle" needed to overcome or address the barriers to pro-environmental behavior. Environmental science capital is added to our version of the model, along with two other variables that are not emphasized in science capital is added to the model because the present research on science capital demonstrates the ability of science capital to help underprivileged youth overcome barriers to aspirations and engagement in science (Archer, DeWitt, Dillon, Willis, & Wong, 2012; Archer et al., 2015). The present study will examine whether *environmental* science capital has a similar relationship with pro-environmental behavior. The variables of meaningful nature experiences and role models are added to the model because we hypothesize that these variables are potential drivers of pro-environmental behaviors in rural youth (Chawla & Cushing, 2007; Hungerford & Volk, 1990).

This proposed theory of change also divides pro-environmental behavior into individual actions that benefit the environment and collective actions that build environmental culture, politics, or workforce. Kollmus and Agyeman's model is the only known prominent theoretical model of pro-environmental behavior that represents both individual and collective forms of behavior and separates them on the model, although they call them "indirect environmental actions" and present them as a side effect more than a major outcome (Figure 1.1). Other frameworks either do not emphasize collective pro-environmental behavior at all, or combine all forms of pro-environmental behavior together (Bamberg & Moser, 2007; Hines, Hungerford, & Tomera, 1987; Klockner, 2015; Stern, Dietz, Abel, Guagnano, & Kalof, 1999). Since we see individual and collective pro-environmental behavior as equally important outcomes, and expect that they are influenced by different factors, Kollmus and Agyeman's model is applicable to conducting research that values both forms.

Our theory of change (Figure 1.2) posits that internal and external factors build an individual's environmental science capital, giving them the tools to overcome barriers preventing pro-environmental behavior. This study will examine environmental attitudes using the connectedness to nature scale (CNS), a widely-used tool for measuring one's feeling of connectedness to nature (Mayer & Frantz, 2004). Environmental concern, along with external factors such as race, ethnicity, gender, geographic region, socioeconomic status, and political affiliation build the environmental science capital of rural youth. Individuals with high environmental science capital have the means to exhibit pro-environmental behavior, but may not necessarily do so because of many barriers that exist in the gap between concern and action (Kollmus & Agyeman, 2002).

We hypothesize that meaningful nature experiences and the positive influence of family, friends, and mentors will help rural youth with high environmental science capital to "bridge the gap" and overcome barriers to pro-environmental behavior (Figure 1.2).

Purpose Statement

This study contributes to the pro-environmental behavior literature by introducing the concept of environmental science capital and using it to explore the factors influencing pro-environmental behavior in rural American youth. Using an explanatory sequential mixed methods design, data were obtained from 252 surveys of youth aged 13 – 22 from Franklin County, Missouri, Berkley County, West Virginia, and the state of Kansas. After the surveys, 35 youth were selected to participate in follow-up focus group interviews to further explain survey results.

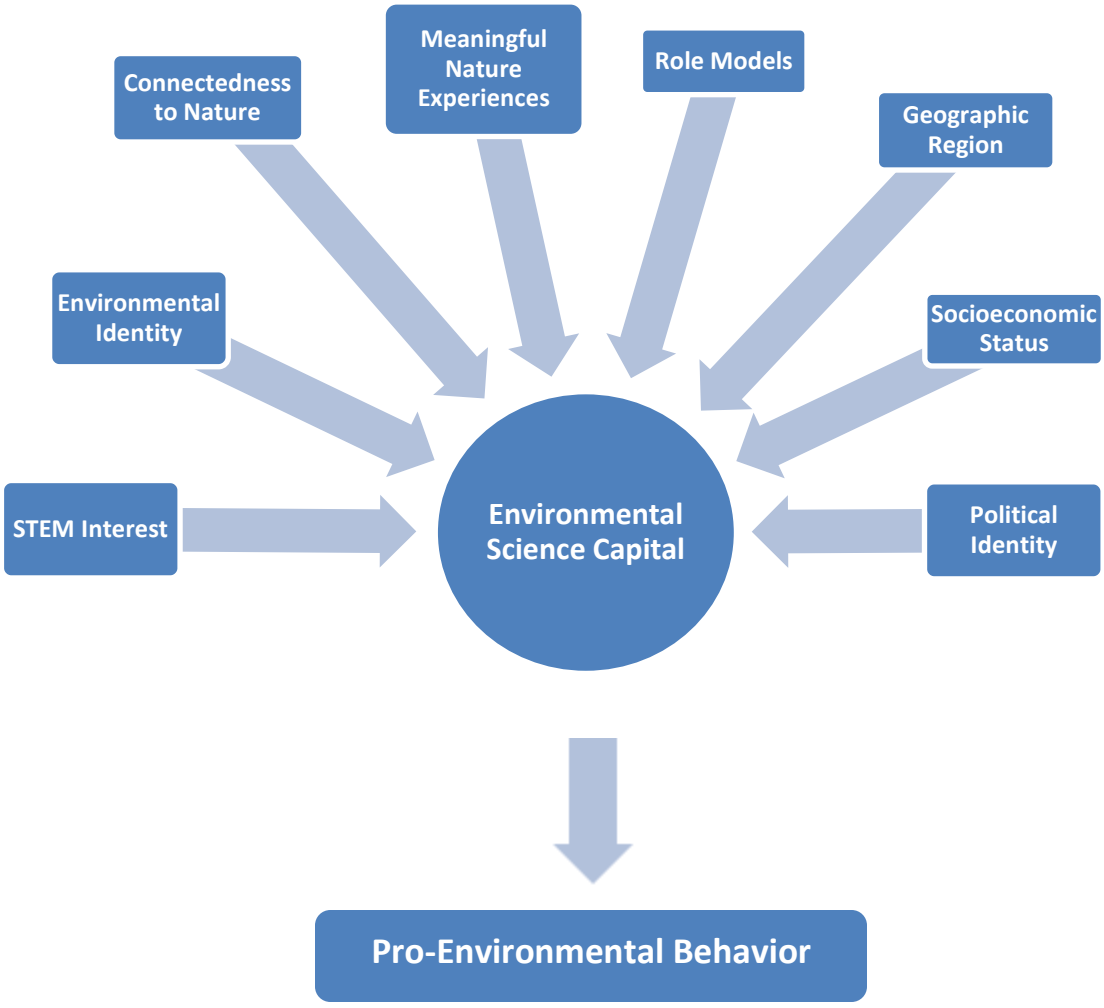


Figure 1.2. Theory of Change, Proposed Pro-Environmental Behavior Model incorporating Science Capital based on the Model of Pro-Environmental Behavior (adapted from Kollmus and Agyeman, 2002).

In the first quantitative phase of the study, surveys assessed how environmental science capital, interest in STEM and agriculture fields, meaningful nature experiences, role models, connectedness to nature, and environmental identity influence pro-environmental behavior. The results of those quantitative analyses informed the structure

of focus groups, which further explored the factors contributing to pro-environmental behavior in participants.

Research Questions

The quantitative phase of this study used surveys to address the following questions:

Research Question 1. How does the concept of environmental science capital (ESC) help to explain pro-environmental behavior (PEB) of rural youth in this study?

Sub-question 1a: What is the relationship between environmental science capital and pro-environmental behavior?

Sub-question 1b. Which aspects of environmental science capital best predict pro-environmental behavior?

Research Question 2. How do the following factors influence PEB in our sample populations?

- Meaningful Nature Experiences
- The Influence of Role Models
- Connectedness to Nature (CNS)
- Environmental Identity
- STEM Interest

Qualitative focus groups were conducted following analysis of the quantitative survey results. Research questions for focus groups are as follows:

Research Question 3. How do described experiences of freshman and sophomore college students enrolled in science courses help to explain patterns observed in quantitative surveys?

Sub-question 3a: What personal success stories emerge from descriptions of rural college students who have overcome barriers to environmental science capital and pro-environmental behavior?

Sub-question 3b: What life experiences do students perceive as most important in shaping their interests and environmental actions? What is the importance of role models?

Sub-question 3c: What themes emerge in the lived experiences of students with different courses, academic majors, or career plans?

Research Question 4. How do described experiences of high school STEM and environmental club participants help to explain patterns observed in quantitative surveys?

Sub-question 4a: How do their lived experiences and descriptions explain or contradict the findings from the quantitative study?

Accountability Statement

As with any successful group effort, the course of this research and writing has been shared by all. How one untangles all the contributions made by the three-member cohort is difficult to say the least. Each researcher helped develop the survey instrument and was responsible for administering the survey to their distinct populations. Each researcher uploaded their collected data into a shared spreadsheet and we were all together when we ran most of the statistical tests. Qualitative data were collected by each researcher from their respective focus groups. Coding took place as a group effort once comments were uploaded into a shared Google Drive spreadsheet and we discussed codes at our weekly meetings until we reached a consensus. Different chapters within the

document were spearheaded by different cohort members but the final product was a combined effort from everyone.

Beyond the duties shared by all members, each researcher contributed in distinct and unique ways. Michelle Donlan was able to carry out two focus groups to help offset the smaller number of surveys she was able to obtain. Michelle has also undergone the greatest review of the literature, developed the literature map, and is skilled at setting up the starting phases of various chapters due to her vast knowledge on the subject matter, especially in the realm of science capital. She was also instrumental in the development of the focus group protocol. Writing for this document has been an ongoing effort but the bulk of the formatting, layout, and editing for a single cohesive voice has been undertaken by Elizabeth Flotte. Elizabeth also took the lead in the production of the survey instrument and formatted, created spreadsheets, and generally took care of the documents needed for this cohort to be successful. Elizabeth contributed the most content to the pro-environmental behavior literature, especially as it relates to political views. Pat Silovsky has undertaken extra quantitative and qualitative data analysis duties beyond those conducted as a group. Pat has also contributed the most content to the literature review regarding outdoor recreation and rural experiences. She kept the group on track, particularly in the early stages, as she guided the development of this project by introducing the group to some seminal research which laid the foundations for our variables of interest.

CHAPTER 2: LITERATURE REVIEW

This study addresses the lack of pro-environmental behavior and unequal distribution of environmental science capital. To explore the factors that contribute to these phenomena in rural youth, a literature review was conducted. Search words included: pro-environmental behavior, environmental sensitivity, responsible environmental behavior, environmental identity, science identity, political identity, role models, meaningful nature experiences, outdoor experiences, environmental literacy, and science capital. ERIC, EBSCO, ProQuest, and Google Scholar databases were used.

Pro-Environmental Behavior

Pro-environmental behavior includes the actions that generate positive environmental impacts, promote environmental quality, and result in sustainable use of natural resources (Stern, 2000). This has been the ultimate goal of the environmental education field since its inception. Early goals of environmental education were developed according to recommendations from a meeting organized by the United Nations Education, Scientific, and Cultural Organization (UNESCO) to discuss the role of environmental education in addressing global environmental issues (UNESCO, 1977). In their final report, UNESCO provided a list of recommendations, goals, objectives, and guiding principles for environmental education (Tilbury, 1995; UNESCO, 1977).

The goals outlined in this report were:

> to foster clear awareness of, and concern about, economic, social, political and ecological interdependence in urban and rural areas; to provide every person with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment; to create new patterns of behavior of individuals, groups and society as a whole towards the environment (p. 26).

Prior to the UNESCO meeting, William Stapp (1969) stated that "Environmental education is aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to solve these problems, and motivated to work toward their solution" (Stapp et al., 1969, p. 24). Although some changes have been made over time, such as the shift toward a focus on sustainability (Tilbury, 1995) and sustainable development (Hopwood, Mellor & O'Brien, 2005), the goals of environmental education are largely the same as they were in the 1960's and 1970's.

Throughout the history of environmental education research, pro-environmental behavior has been a major theme, although it has had many names. This concept has been named pro-environmental behavior (Bamberg and Moser, 2007; Klockner, 2015; Stern et al., 1999), responsible environmental behavior (Hines et al., 1987), environmentally-responsible behavior (Kaplan, 2000), environmentally-friendly behavior (Dolnicar & Grun, 2009; Tindall, Davies, & Mauboules 2003), environmental sensitivity (Chawla, 1998), environmentally significant behavior (Stern, 2000), etc. It is also often studied as a subcategory of the broader goal of environmental literacy or ecoliteracy (McBride, Brewer, Berkowitz, & Borrie, 2013). Some studies consider only individual pro-environmental behavior such as recycling, purchasing eco-friendly products, trying to

conserve water, and using public transportation, while others also address collective pro-environmental behavior such as activism, engagement, and career aspirations that contribute to the culture of environmental stewardship. It is important to study both types of behavior because while individual action immediately benefits the environment, collective actions, such as voting for a particular environmental policy, can affect change on a very large scale – even at the level of industry or government. Since industry and government account for two-thirds of the United States' total energy consumption, the most effective actions are collective, such as when people organize to pressure industry and the government to act for the common good (Gardner & Stern, 2002).

Stern (2000) provides evidence that individual and collective pro-environmental behavior are separate phenomena with their own sets of predictors. In one study, factor analysis indicated that individual behavior, collective environmental citizenship behavior, and environmental policy support were statistically distinct and were correlated with different personal, social, and cultural attributes (Dietz, Stern, & Guagnano, 1998) and other studies have agreed that all types of pro-environmental behavior cannot be reliably combined into one concept (Stern, 2000). Yet these variables are not always separated in the literature, and often collective behavior are not measured at all. Thus, our review of the pro-environmental behavior literature provided below will include studies that distinguish between types of pro-environmental behavior, studies that combine them together, and studies that focus solely on individual behavior.

The determinants of pro-environmental behavior are so complex and multifaceted that statistical modeling and meta-analyses are useful to obtain a complete understanding of how one's life experiences, personality, social factors, and demographics may

influence pro-environmental behavior. Hines, Hungerford, and Tomera (1987) conducted one of the first major meta-analyses of pro-environmental behavior by reviewing the existing research and determining not only what variables were predictors of pro-environmental behavior, but also the strength of those relationships. They found four major determinants of pro-environmental behavior – attitudes toward the environment, locus of control, personal norms, and intention to act pro-environmentally. Recent reviews of the literature indicate that age, sex, race, geographic location, socioeconomic status, knowledge, cultural norms, and extrinsic motivation can also be important factors (Gifford & Nilsson, 2014; Stern, 2000). In much of the recent research on pro-environmental behavior, the factors that influence an individual's propensity to engage in individual and/or collective pro-environmental behavior are separated into internal and external categories (Gifford & Nilsson, 2014; Kollmus & Agyeman, 2002). The internal and external factors that are most consistently correlated with pro-environmental behavior are reviewed first. Examples of research specific to rural youth will be provided when available, since this is the demographic focus of the present study.

Within the category of internal factors, knowledge of environmental problems and solutions is considered a prerequisite for pro-environmental behavior (Frick, Kaiser, & Wilson, 2004). This is concerning because research of the past several decades has indicated that students, specifically, and Americans, in general, lack knowledge regarding environmental issues (Blum, 1987; Bodzin et. al, 2014; Gambro & Switzky, 1999). In a study of twelfth grade students, for example, "although environmental knowledge increased fairly steadily with parental levels of education, the level of knowledge, even at the highest level of education, remained disappointingly low" and although taking more

science classes generally resulted in higher environmental knowledge over time, students were only taking an average of two science classes in high school (Gambro & Switzky, 1999). As a result of these deficits, it is clear that environmental knowledge, also referred to as environmental literacy and/or ecological literacy, is low and should be improved. However, the assumption that knowledge leads to values and then to pro-environmental behavior has been very clearly disproven (Stern, 2000), so knowledge is included in pro-environmental behavior research but is rarely the focus of recent studies.

Pro-environmental values and beliefs are also considered a prerequisite for pro-environmental behavior, and this relationship is stronger than that of knowledge alone. Values, beliefs, and attitudes have been studied in the form of environmental concern, environmental sensitivity, environmental worldview, post-materialistic values, nature affinity, etc., and have been shown to significantly correlate with pro-environmental behavior (Dietz et al., 1998; Dunlap et al., 1992; Schultz, 2001). Contemporary studies of pro-environmental behavior include some sort of measurement of environmental values, worldview, concern, etc. The new environmental/ecological paradigm (NEP) is the most widely-used scale for measuring environmental values. This scale measures the extent to which one holds a pro-environmental worldview, feels that humans are deeply connected to the natural environment, and believes human activities can have dire environmental consequences (Dunlap & Van Liere, 1978; Dunlap et al., 1992). Even holding an environmental worldview does not necessarily result in pro-environmental behavior, so pro-environmental behavior research began to incorporate psychological behavior theory to help understand the gap between caring about the environment and engaging in pro-environmental behavior. This literature shows that although the NEP does not always

directly predict pro-environmental behavior (Scott & Willits, 1994) it is a reliable measure of environmental worldview, a key variable in theoretical models that predict pro-environmental behavior (Klockner, 2015; Stern et al., 1999). Mayer and Frantz (2004) believe the NEP is not an adequate measure of one's affective, experiential relationship to the natural world, for two reasons. First, it measures cognitive beliefs rather than affective experience. And secondly, it measures beliefs about humans in the aggregate, not the individual's personal relationship to nature (Mayer & Frantz, 2004). A commonly used alternative is the connectedness to nature scale, which will be discussed more below.

One example of the application of behavioral psychology to pro-environmental behavior research is the value-belief-norm (VBN) theory of environmentalism (Stern et al., 1999). The VBN was developed based on a review of studies explaining how environmental values lead to behavior. This theory states that individuals who have high biospheric and altruistic values and low egoistic values are more likely to have an environmental worldview, which leads to the development of pro-environmental personal norms. According to this theory, values and beliefs do not translate into pro-environmental behavior until personal norms are established. Even if one is aware of the problems facing the environment, holds environmental worldviews, and knows how to help protect the environment, they may not display pro-environmental behavior if they do not feel obligated to do so due to personal norms, habits or routines.

In addition to knowledge, values, and norms, locus of control is a significant factor influencing pro-environmental behavior (Hines et al., 1987; Stern et al., 1999). This is similar to the concept of self-efficacy, the belief that one has the ability to help the

environment if they try, and thus have some control over what happens to the environment. Individuals who lack these traits are more likely to feel overwhelmed or helpless in the face of environmental challenges and are thus less likely to exhibit pro-environmental behavior (Stern et al., 1999). Bamberg and Moser (2007) refer to a similar concept of perceived behavioral control in their meta-analysis of pro-environmental behavior research that builds upon the work of Hines, Hungerford, and Tomera by incorporating psychological action theory. Their work takes a more holistic look at pro-environmental behavior and applies what psychologists know about behavior in general. The concept of perceived behavioral control comes from psychological action theories such as the theory of planned behavior (Azjen, 1991) and the norm-activation theory (Schwartz & Howard, 1981). It describes one's belief in their ability to perform the behavior in question and also considers the difficulty or inconvenience of the behavior. Bamberg and Moser found that pro-environmental attitudes, personal norms, and perceived behavioral control were relatively equal predictors of intention to act pro-environmentally (Bamberg & Moser, 2007). Thus, individuals consider the difficulty of the behavior just as much as they consider their attitudes toward the behavior and their personal moral obligation to perform the behavior. Perceived behavioral control has continued to be an important variable in pro-environmental behavior research that is conducted from an environmental psychology lens (Klockner, 2015; de Leeuw, Valois, Ajzen, & Schmidt, 2015).

Klockner (2015) combined all of the relevant environmental psychology pro-environmental behavior theories into one model through a meta-analysis of 56 data sets. This model is called the comprehensive action determination model (CADM), as it is

meant to encompass all previous theories so that more robust conclusions can be drawn and the model can be used in a variety of situations. Based on his analysis, Klockner concluded that habits should be part of the model due to their direct influence on environmental behavior. The intention to act pro-environmentally is formed by attitudes, personal norms, social norms, and perceived behavioral control (Klockner, 2015). Thus, the most powerful interventions to increase pro-environmental behavior would likely focus on breaking old habits, improving social support for the behavior so that it becomes a social and personal norm, and increasing perceived behavioral control by educating people on how to act pro-environmentally and reducing the barriers to those actions. Interventions that build pro-environmental values influence pro-environmental behavior indirectly, through their effect on personal norms.

The meta-analyses described above are useful when measuring pro-environmental behavior because they identify potential predictors of and barriers to pro-environmental behavior that can be tested broadly in any population. This helps to clarify which variables are *generally* most important. However, demographics and external factors such as cultural, social, and economic situations are not represented in these models, unless indirectly through their relationship with norms. Yet these are crucial factors to consider when making suggestions for particular interventions or action strategies. If the goal of a study is to determine how to address the problem of low pro-environmental behavior, the demographics and external factors of the study population must guide the research. Gifford and Nilsson (2014) reviewed the demographic and external factors influencing pro-environmental behavior and found that age, gender, religion, political views, urban versus rural residence, proximity to environmental problem sites, social class, culture and

ethnicity build the personal and social norms upon which pro-environmental behavior are built (Gifford & Nilsson, 2014).

Age comparisons show that older people have more knowledge and ability to exhibit pro-environmental behavior (Gifford, 1982), while younger people are more concerned about environmental problems (Klineberg, McKeever, & Rothenbach, 1998). Gender comparisons show that females have more positive environmental attitudes and values (Meyer, 2015; Uitto & Saloranta, 2010; Zelezny, Chua, & Aldrich, 2000), despite the fact that males often have greater environmental knowledge. There is conflicting evidence as to whether these attitude and knowledge differences result in actual behavioral differences (Gifford & Nilsson, 2014). The research on the effect of religion is highly varied and seems to imply that religion influences how environmental concern is manifested in pro-environmental individuals, but does not predict the presence or absence of pro-environmental behavior (Gifford & Nilsson, 2014). Higher social class is generally correlated with greater pro-environmental behavior, at least in developed countries (Balderjahn, 1988; Laidley, 2011, Inglehart, 1997), except in the case of poorer citizens who are particularly concerned about local environmental problems that directly affect their communities (Brechin, 1999).

Pro-environmental Behavior and Rural Populations

The present study is particularly interested in the external factor of rural residence. There are conflicting results regarding whether rural residence influences pro-environmental behavior, despite the obvious difference in how rural and urban people experience the natural world. Some studies indicate that people living in larger cities are more likely to engage in pro-environmental behavior (Chen et al., 2011) due to the fact

that many types of pro-environmental behavior, such as recycling and using public transportation, are more available in urban settings. Williams (2017) found that rural students exhibit less pro-environmental behavior, lower knowledge, and overall lower environmental literacy scores than students from urban and suburban schools (Williams, 2017). In contrast, Hinds and Sparks (2008) and Meyer (2015) report greater pro-environmental attitude and behavior in rural students, compared to urban students. This is supported by a study comparing rural and urban students in Michigan which confirmed that rural students have higher baseline environmental sensitivity due to greater time spent outdoors engaged in "rural" activities such as hunting, fishing, and camping (Gallay et al., 2016). Berenguer, Corraliza, and Martín (2005) found moral obligation and the level of pro-environmental behavior to be higher among rural than urban residents, but the opposite was found for environmental concern. Not only do rural and urban residents exhibit different levels of environmental concern and behavior, but the type of concern also differs. Rural residents tend to be more anthropocentric and wish to protect the environment so that it can better fulfill human needs, while urban residents are more likely to display ecocentric values (Bjerke & Kaltenborn, 1999; Huddart-Kennedy et al., 2009; Rauwald & Moore, 2002). Still, numerous studies have observed no difference between the pro-environmental behavior of rural and urban residents (Arcury & Christianson, 1990; Halder et al., 2012; Lutz, Simpson-Housley & deMan, 1999).

Rural residence is closely tied to political values and other cultural factors that can influence pro-environmental behavior. Studies have shown that political conservativeness results in less environmental concern (Dunlap, Xiao, & McCright, 2001; MCright & Dunlap, 2011), although the degree to which this difference exists

depends on the framing of pro-environmental statements (Feinberg & Willer, 2013). Other cultural factors such as race, ethnic group, and immigrant status yielded highly variable and conflicting results (Gifford & Nilsson, 2014). One meta-analysis that places particular emphasis on demographic, external, and social factors is that of Kollmus and Agyeman (2002). In their review of pro-environmental behavior literature, they developed a model of pro-environmental behavior that displays internal and external factors as separate categories that can influence each other and have a synergistic effect on pro-environmental behavior when both are strong (Figure 1.1). Of all the reviewed studies and meta-analyses described here, the study Kollmus and Agyeman may be the most relevant for research that aims to result in actionable strategies that will work for a specific population, due to the emphasis on external factors and demographics.

Gifford and Nilsson (2014) concluded that:

> A person with a particular personal and social profile will be more likely to be concerned about the environment and to act on its behalf… such persons are likely to have spent time in nature as a child, to have accurate knowledge of the environment, its problems and potential solutions, to have an open, agreeable, and conscientious personality, to consider the future consequences of their actions, to feel in control of their behaviors, to harbor biospheric, post-material, liberal values and responsibility for environmental problems, to be among the upper half of the economic classes, to hold personal and descriptive norms about pro-environmental action, to adhere to a religion that teaches a stewardship orientation to the earth, and to spend time in non-consumptive nature activities (p. 151).

The above quote highlights some experiences and interventions that can alter one's path toward pro-environmental behavior. Specifically, Gifford and Nilsson mention spending time in nature as a child and participating in non-consumptive nature activities throughout life. The present study will refer to these as meaningful nature experiences. Further, studies show that meaningful nature experiences and the influence of role

models are the most self-reported factors in pro-environmental research. Given their importance, this research will focus on these two influential factors.

Connectedness to Nature Scale

Currently there are at least nine published assessment tools that measure connectedness to nature. Tam (2013) did empirical research to compare seven of these scales. His results showed "strong convergent validity and little incremental validity" so he concluded these scales can be considered "markers of the same underlying construct." Therefore, however connectedness to nature is measured, the research is showing that a reliable relationship exists between connectedness to nature and self-reported pro-environmental behavior. (Brugger et al., 2011; Clayton, 2003; Davis, Le, & Coy, 2011; Dutcher, Finley, Luloff, & Johnson, 2007; Nisbet, Zelenski, & Murphy, 2009).

One of the most widely used measures is Mayer and Frantz's (2004) connectedness to nature scale (Brugger et al., 2011; Cervinka et al 2012; Corralize & Bethelmy 2011; Olivos & Aragones 2011; Zhang et al., 2014). This scale has been used around the world and translated into several languages (Navarro, Olivos & Fleury-Bahi 2017; Pasca, Aragones & Coello, 2017). According to Mayer and Frantz (2004), the CNS was developed based on the views of Aldo Leopold, particularly his “contention that people need to feel they are a part of the broader natural world if they are to effectively address environmental issues”. The CNS-R (Frantz, Mayer, & Sallee, 2013) is a shorter version suitable for use with children and low-income adult samples. The CNS-R has also been shown to predict self-reported pro-environmental behavior across multiple populations, including college students, children, and a general adult population (Frantz,

Mayer, Gordon, & Handley, 2010; Frantz, Mayer, & Sallee, 2013; Gordon, Frantz, & Mayer, 2012).

Pasca, Aragones and Coello (2017) did an analysis of the CNS using item response theory and found seven items presented appropriate indices of discrimination and difficulty, in addition to a good fit. The remaining items of the scale were redundant or didn't discriminate well between individuals with different levels of connectedness. By reducing the scale to seven items, they demonstrated a slightly higher reliability than Mayer and Frantz (2004) obtained in their original 14-item scale. The new 7-item scale is more “reliable, easier to administer, and correctly measures connectedness insofar as the scores obtained actually discriminate between individuals who are connected and those who are not” (Mayer & Franz, 2004). These researchers even went so far as to say that item 11 ("Like a tree can be part of a forest, I feel embedded within the broader natural world") would be the best option in the event that it is necessary to measure connectedness with a single item.

Perrin and Benassi (2009) argue that the CNS scale measures cognitive beliefs and not emotional connections. Their confirmatory factor analysis showed that participants responded similarly to the items with the word feel and the items that used cognition words. Based upon content analysis of scale items that include no emotional component (e.g., I think., I consider., I imagine.) and their suggestion of a cognitive interpretation of the word feel, Perrin and Benassi concluded that the one-factor CNS taps into is a cognitive connection to nature, not an emotional connection to nature.

Meaningful Nature Experiences

In their review of prior research on pro-environmental behavior, Chawla and Cushing (2007) found that half to more than 80% of the respondents identify childhood experiences of nature as a significant experience. Childhood experiences includes a variety of activities such as free play, hiking, camping, fishing and berry picking. Respondents also mentioned influential family members or other role models equally often or second in importance which is in agreement with other research and will be discussed more below. Other common answers are experiences in organizations like the scouts or environmental groups, witnessing the destruction or pollution of a valued place, and reading books about nature and the environment (Chawla and Cushing, 2007). Although this research has been criticized because it looks backwards to distant childhood experiences rather than focusing on contemporary conditions for young people (Scott, 1999) no conflicting evidence has been presented. Chawla and Cushing (2007) further argue that the fact that similar formative experiences are identified by descriptive qualitative studies and large correlational surveys, in a variety of cultures, by secondary school students as well as older populations, gives these findings weight. (Chawla & Cushing, 2007)

Similarly, a study with Wisconsin High School students found that the outdoors and environmental influences were major influences on respondents' level of environmental sensitivity, an important precursor to both environmental literacy and environmentally responsible behavior (Sivek, 2002). During the study's focus group, the most frequently mentioned subcategories to emerge under environmental influences were accessibility to or frequency of visits to outdoor areas and opportunities for in-depth

learning and/or involvement. Negative experiences (such as the Exxon Valdez oil spill and loss of a cherished natural area) were also mentioned as important influences, whereas, media, in general, appeared to have relatively low influence. Results from the study's paper and pencil survey found several strong influences including having ready access to the outdoors (96%), spending time outdoors (95%), seeing bad things happen to the environment (78%) and spending time outdoors alone or with a few friends (67%). Moderate influences included work or volunteer experiences with animals, having wild animals as pets and books and other print media (Sivek, 2002).

Outdoor recreation, an example of a meaningful nature experience, is often cited as the most influential activity that contributes to an individual's environmental activism with hunting and fishing being mentioned by more than a third of the respondents. Tanner (1980) investigated the backgrounds of members of environmental organizations to try and find antecedents to environmental activism. When he found recurring accounts of "childhood hours spent outdoors" he formed the hypothesis that these may be critical experiences for environmental activism and sent open-ended surveys to staff of several prominent environmental organizations. When people explained the sources of their environmental career choice, activism, or environmental concern or interest, similar answers recurred: positive experiences in natural areas, adult role models, environmental organizations, education, negative experiences of environmental degradation, books and other media, and on-the-job experience. Peterson (1982) surveyed environmental educators and found similar results. 77% of Peterson's samples were males and 45% of these mentioned hunting and fishing as their outdoor activity.

Current research on wildlife recreation and pro-environmental behavior within rural New York residents found that wildlife recreationists (hunters and birdwatchers) were four to five times more likely than non-recreationists to engage in conservation behaviors (Cooper, Larson, Dayer, Stedman, & Decker, 2015). These behaviors include donating to support local conservation efforts, enhancing wildlife habitat on public lands, advocating for wildlife recreation and participating in local environmental groups. They also found that there was an additive effect with hunter-birdwatchers as having the greatest likelihood of engaging in all types of conservation behavior. Although wildlife recreationists were more likely to engage in conservation behavior, the study also found that engagement in environmental lifestyle behavior (recycling, energy conservation and green purchasing) were roughly comparable among all types of wildlife recreationists and non-recreationists (Cooper et al., 2015).

Influence of Role Models

Research findings on meaningful nature experiences and role models suggest that both childhood experiences in nature and the examples of parents, teachers and other role models are key "entry-level variables" for responsible environmental behavior. (Chawla & Cushing, 2007). An example of an entry-level variable could be membership in an environmental club or organization. Being involved in these clubs or organizations allows youth to gain increased knowledge about environmental issues and learn environmental action skills – the skills referred to as “ownership” and “empowerment” variables (Chawla & Cushing, 2007). Chawla and Cushing highlight several characteristics of effective programs: an extended duration of time, opportunities to learn and practice

action skills, and success in achieving some valued goal where their efforts are taken seriously by others (Chawla & Cushing, 2007).

Sivek (2002) assessed the influences on environmental sensitivity in Wisconsin high school students and found that while time spent outdoors was the most frequently mentioned influence on environmental sensitivity, role models was the second (Sivek, 2002). The qualitative phase of this study found that students' responses about role models fell into five subcategories: teacher or their environmental club advisor, parents, relatives, friends and others (such as actors or politicians). The greatest number of students reported teacher or their environmental club advisor. When asked about their role model's traits, student responses fell into four subcategories: knowledge, open-minded, action/involved in environmental matters and friendly/personable. The most frequently mentioned trait was friendly/personable (Sivek, 2002). The quantitative phase of this study found that male teachers accounted for 44% of role models while parents and other relatives accounted for 42% of role models ranked as most important. Only 13.7% ranked unrelated people other than male teachers as most important role model influence (Sivek, 2002). The present study uses Sivek's survey instrument of role models and role model traits.

In terms of influence of family and friends, recent research indicates that positive parental attitudes and support contribute to the concept of science capital. Therefore, science-related experiences and activities contribute to this concept of science capital, especially when they are experienced with significant family members. Further, the results from ASPIRES, a prominent longitudinal study that explored the development of children's science attitudes and aspirations, found that parental attitudes to science play

an important role in shaping children's science aspirations. In fact, Archer and her colleagues found that parental attitudes to science, experiences of school science, and student self-concept in science were the variables that had the strongest relationship with students' aspirations (Archer et al., 2012). Students with "high science capital" tend to do science-related activities in their spare time and have family/friends (particularly parents) who work in science-related jobs (Archer et al., 2015). Thus, the influence of family, friends, mentors and roles models can help build self-efficacy, create positive shared outdoor experiences and assist with capital perhaps including environmental science capital. It is not known whether similar shared experiences in nature contribute to higher environmental science capital specifically. However, it is known that shared experiences in nature with family, friends, and mentors have a positive influence on pro-environmentalism (Chawla & Cushing, 2007).

Meaningful Nature Experiences and Role Models in Rural Youth

For rural students, one positive shared outdoor experience often viewed as the archetypical rural activity is hunting. Hunting game for recreation is an image often associated with visions of the family farm and the stereotypical rural way of life. Rural upbringings can foster an increase in hunting, especially for males (Stedman & Heberlein, 2001). In one study, wildlife recreationists – both hunters and birdwatchers – were four to five times more likely than non-recreationists to engage in conservation efforts and those that participated in both had the greatest likelihood of engaging in all types of conservation behaviors (Cooper et al., 2015). Thus, hunting may be a meaningful nature experience that is particularly important in forming the pro-environmental behaviors of rural youth, especially when it is shared with friends, family, or mentors.

Johnson, Bowker, and Cordell (2001) explored outdoor recreation constraints of race, gender and rural dwelling. Some potential factors that may lead to constraints for rural populations include lower tax revenues and incomes and restricted access to hunting and fishing areas. A series of logistic regressions from a national recreation survey was used to model the probability that individuals perceive certain constraints to participating in outdoor recreation activities. Results from the survey found that rural residence does not appear to be an important factor among participants and non-participants in outdoor recreation constraints. The only constraint shown significance in rural populations is "not enough time" equation (Johnson et al., 2001).

Science Capital

A recent conceptual tool for understanding the production of classed patterns in the formation and production of children's science aspirations is science capital (Archer et al., 2015). Science capital is the sum of all the science-related knowledge, attitudes, experiences and resources that an individual builds up through their life. This includes what science they know about, what they think about science, the people they know who have an understanding of science, and the day to day engagement with science (House of Commons Science and Technology Committee, n.d.). Archer and her colleagues advocate the extension of the Bourdieusian notion of capital beyond the arts by including science capital. This is not without criticism. While Jensen and colleagues praise the work being done to address social inequality in science education, they argue that adding "science capital" to Bourdieu's existing range of concepts is unnecessary. They go on by saying that there is just as good an argument for "sports capital," "numeracy capital, "and many other domain-specific "capitals" as for "science capital." Their main concern is by

introducing “science capital”, it may undermine a focus on the ways in which inequalities and injustice in science education are coterminous with other forms of systemic inequality (Jensen & Wright, 2015). Despite this criticism, we use science capital in this present study as a framework in looking at the uneven distribution of science aspirations.

Archer and her colleagues coined the term science capital during Kings College’s ASPIRES project, a five year longitudinal study (conducted between 2009 – 2013) exploring science aspirations and engagement among 10 to 14 year olds – a critical age period for forming science aspirations. The ASPIRES project was funded by the UK’s Economic and Social Research Council (ESRC) as part of its Targeted Initiative on Science and Mathematics Education. For this study, Archer and her colleagues used the Bourdieusian conceptual framework to study how the interplay of family habitus and capital can make science more “thinkable” for some children (white, middle class) than others. They then use family habitus rather than family identity or family context to “better encompass a broad spectrum of family resources, practices, values, cultural discourses, and “identifications” of “who we are” (Archer et al., 2012). Archer further explains that it provides a lens for attempting to situate and contextualize individual child and parent identities (and orientations to science) within the family environment – for examining the extent to which the everyday family landscape shapes, constrains, or facilitates aspirations and engagement in science through the combination of attitudes, values, practices, and ways of being that they engage in (Archer et al., 2012).

The results of this study examining how "thinkable/natural" or "unthinkable/unusual" science aspirations and engagement within students aged 10 -14 were:

- Analyses highlighted the importance of social class in facilitating or constraining children's potential science aspirations and identifications, even though the overwhelming majority of children in the sample reported liking science.
- Middle-class family habitus, capital, and a child's identification with science were in alignment in favor of science. The result was particularly powerful, with families able to foster and capitalize on their child's interest, enabling them to occupy a strong and privileged position from which to potentially pursue these aspirations further.
- Within most working class families, science was less "familiar", being more "peripheral" to parents' and children's everyday lives.
- Despite these clearly classed patterns, our analyses also highlighted the nondeterministic nature of habitus, with examples of children "going against the grain" and of home expectations. This agency worked both ways, with some children resisting a strong science "steer" from home and others proactively choosing science despite little awareness or science resources at home.

Ultimately, they found that most young people, from primary through secondary, find school science interesting. However, interest in science does not translate into post-16 participation and careers – with only 15% of 10-14 year olds interested in becoming a scientist (King's College London, n.d.).

As part of this larger ASPIRES project, Archer pulled survey and longitudinal interview data from Black African/Caribbean students and their parents to examine why science careers are less thinkable for Black students. Additionally, they presented a case study of two young Black women who bucked the trend and aspired to science careers. Results from this study suggests although the "being/doing" (liking science, but seeing science careers as not for me) is common across all students, it is particularly problematic

and exacerbated in the case of Black students (Archer, Dawson, et al., 2015). Archer and her colleagues suggest three implications for science education based from their analysis:

1. There is an urgent need to find ways to break the pervasive science = scientist link.
2. Challenges need to be made to the popular association between science and "braininess."
3. There is a need for a better and fairer (re)distribution of all forms of capital, including science capital, across society.

Archer and her colleagues further went on to conceptualize science capital and explained how they translated this into a survey tool with the "wish to help science educators and delivery organizations to be able to delineate what they are seeking to change through their practice and why and to assess to what extent they have been successful, or not, in these efforts" (Archer et al., 2015). Using logistic regression, 14 questions (12 individual items plus two larger questions) were identified as the strongest predictors of whether a student would fall into the high or low group on the outcome variable of future science affinity plus recognition. The twelve individual items are:

- A science qualification can help you get many different jobs?
- When you are NOT in school, how often do you talk about science with other people?
- One or both of my parents think science is very interesting.
- One or both of my parents have explained to me that science is useful for my future.
- I know how to use scientific evidence to make an argument.
- When not in school, how often do you read books or magazines about science?
- When not in school, how often do you go to a science center, science museum or planetarium?
- When not in school, how often do you visit a zoo or aquarium?
- How often do you go to after school science club?

- My teachers have specifically encouraged me to continue with science after GCSEs.
- My teachers have explained to me science is useful for my future.
- It is useful to know about science in my daily life.

The two larger questions concerned who students speak with about science and who they know who has a job using science (Archer et al., 2015).

This research study uses this recent concept of science capital because it explores social inequities in the distribution of capital and how it impacts engagement and aspirations within science. It particularly looks at those from more socially disadvantaged backgrounds and how it can increase their access to science related knowledge, resources, and social capital (Archer et al., 2012).

Environmental Science Capital of Rural Youth

Within this study, the focus is on rural populations and an expanded definition of science capital to include environmental science capital – meaning sciences within the environment such as biology, ecology, agriculture, animal science, environmental science and natural resource management. By expanding science capital to include the environmental sciences, hopefully this study will characterize and define environmental science capital of rural youth.

CHAPTER 3: METHODOLOGY

This study used a mixed methods design that incorporated both quantitative and qualitative approaches. Quantitative approaches examine relationships among variables whereas qualitative approaches explore meaning and understanding individuals or groups ascribe. The rationale for using a mixed methods design is that this form of inquiry provides a more complete understanding of a research problem than either approach alone (Creswell, 2014). Thus, this technique allows researchers the potential of answering both "how" and "how much" questions (Brinkmann & Kvale, 2015). This study used an explanatory sequential mixed methods design. This design involves a two-phase project in which the researchers collect quantitative data in the first phase, analyze the results, and then use the results to plan (or build onto) the second, qualitative phase (Creswell, 2014). The quantitative phase is the emphasis of this approach, with the qualitative phase providing a supporting role. The qualitative methods seek to add depth and meaning to the quantitative results. Figure 3.1 is a visual model of the explanatory sequential mixed method design used in this study.

The challenges of using mixed methods designs in general are the need for extensive data collection, the time-intensive nature of analyzing both quantitative and qualitative data and the requirement for the researcher(s) to be familiar with both forms of research (Creswell, 2014).

Figure 3.1. The Visual Model of the Explanatory Sequential Mixed Method Design *(Creswell, 2014).*

The challenge of using an explanatory sequential mixed methods design is to plan adequately what quantitative results to follow up on and what participants to gather qualitative data from in the second phase (Creswell, 2014). To address this challenge, Creswell suggests looking at extreme or outlier cases, significant predictors, and significant results relating variables, insignificant results, or even demographics in the quantitative results to build the second qualitative phase. For example, we found identity to have a significant relationship with pro-environmental behavior, therefore, we focused on identity during our qualitative focus groups. Another challenge of the explanatory mixed methods approach is not considering and weighing all the options for following up on the quantitative results such as focusing on personal demographics and overlooking important explanations (Creswell, 2014). Creswell suggests drawing on the same sample for both phases of the study in order to prevent minimizing the importance of one phase building on the other (Creswell, 2014). In this study, we used a subset of the same sample for the qualitative phase of the study as was used in the quantitative phase.

As with any study design, validity and reliability must be addressed. Since this is a mixed methods design, both quantitative and qualitative data must be checked for validity and reliability. There are additional concerns with the explanatory mixed

methods design such as the researcher(s) not following up with all of the potential quantitative findings (Creswell, 2014). This will be noted in the limitations section. Strategies for addressing validity are triangulating different data sources and using member checking (Creswell, 2014). Triangulation occurred when looking at the findings from both the quantitative survey and qualitative data. Member checking occurred when asking participants if researchers captured their responses and thoughts during the focus group discussions. Strategies for addressing reliability include checking transcripts and cross-checking codes (Creswell, 2014). Throughout the qualitative data analysis all participant responses were compiled in a shared document. The researchers cross-checked codes by coordinating and communicating code definitions to achieve inter-coder agreement. More details about the validity and reliability of the quantitative data are addressed later along with the survey description.

Sampling Procedure

For the quantitative and qualitative phases of the study, the researchers sought out rural youth with access to various types of environmental experiences. Participants were selected from high schools, colleges, or educational clubs in Franklin County, Missouri, Berkeley County, West Virginia, and throughout the state of Kansas. These groups were chosen for study based on the likelihood that respondents would be mostly rural and within the age range of 13 – 22 years old. Within those areas, researchers selected individuals who were part of an academic program, club, or college course with a strong environmental science focus, when possible. Surveys questioned the respondents regarding their age and rural residence in order to confirm the assumption that they are rural youth. Students were allowed to self-report whether they consider their hometown

to be rural, suburban, or urban. Zip codes were also collected to check the students' perception of rural versus the US Census Bureau method of defining rural residence.

Self-reported rural residence was compared to the Census Bureau definition of "rural" as not existing in an urbanized area or an urban cluster. Urbanized areas include regions with 50,000 or more people, while urban clusters contain between 2,500 and 50,000 people (www.census.gov). Delineations of area boundaries are defined by census blocks that are dependent on population density. Thus, when considering two towns with the same population, one that is not in close proximity to any large cities may have "rural" status while a town with the same population that is nearer to a large city could be defined as an "urban cluster".

For the quantitative phase of the study, researchers administered at least 100 surveys to each of the three different study populations (described below), up to a maximum of 350 total participants. The sampling procedure is quasi-experimental because the researchers sampled all willing individuals that met our criteria from previously formed groups such as a classroom or participants of a particular program (Creswell, 2014). The sampling unit was 52 from the West Virginia population, 100 from the Missouri population, and 100 from the Kansas population, for a combined total of 252 participants. This sample size is sufficient because it ensured that enough of the participants fit the age and rural residence parameters so that meaningful inferences can be made from the data. It is assumed that this is enough surveys to account for demographic variations and provide a complete picture of the factors influencing pro-environmental behavior in the populations studied. Surveys addressed the dependent variables of pro-environmental behaviors (PEB) to determine how it is influenced by the

independent variables of age (A), gender (G), race (R), geographic region (GR), Hispanic ethnicity (H), socioeconomic situation (SE), political identity of self and family (PA), connectedness to nature scale (CNS), environmental identity (IDE), meaningful nature experiences (MNE), influence of role models (RM), STEM interest (INT) and environmental science capital (ESC). These variables will be addressed using survey questions. See Appendix A for survey questions.

For the qualitative phase of the study, researchers conducted focus groups. Along with focus group data, qualitative data were also collected by asking three open-ended questions on the quantitative survey. Similar to the quantitative sampling, the sampling procedure for the qualitative was also quasi-experimental meaning researchers sampled all willing individuals that met the criteria from previously formed groups (classroom and program). Participants were selected not because of convenience and availability, but because they are considered "information-rich" individuals (Creswell, 2014). Information-rich is defined by containing, providing, or possessing a great deal of information and having easy access to information - especially information considered important for full participation in society or politics (Oxford definition). Participants were deemed information-rich based on their direct experiences either being a student in an environmental class and/or participating in a club or environmental competition. For example, for the Kansas portion of the study, participants were considered information-rich based on the selection process employed by their ECO-Meet coach to win a spot on a coveted ECO-Meet team. Team members for the Colgan/St. Mary's High School ECO-Meet team must rank in the top 12 to qualify for an ECO-Meet team after competing with others in a "mini-ECO-Meet" devised by the coach. In essence, these students must really

want to compete in this program and they must agree to study and practice for the ECO-Meet competition.

For focus group interviews, the sampling unit was eight from Spring Mills High School Science Club (West Virginia), seven from the 4H Animal Science Club (West Virginia), nine from Colgan St Mary's High School ECO-Meet team (Kansas), and 11 from the East Central College Introduction to Animal Science class (Missouri), for a total of 35. This sample size was sufficient because with 35 information-rich individuals, saturation was achieved and no new insights or themes were revealed. Themes of interest from the literature review included motivation, environmental identity, meaningful nature experiences, role models, environmental science capital and pro-environmental behaviors. Focus group questions were determined based on the themes that arose after analysis of the quantitative data such as the relationship between identity and pro-environmental behavior.

Population 1: West Virginia – Berkeley County High School Students & 4H STEM Clubs

Spring Mills High School is the fourth high school in the Berkeley County West Virginia school system. It is a relatively new school which opened in the fall of 2013 to address overcrowding. The student body was formed from about one-half of the student body of each of Martinsburg High School and Hedgesville High School. Their vision statement is to "utilize technology and data to facilitate a collaborative and engaging learning environment. Our students will become lifelong learners with the critical thinking skills necessary to enter the global 21st century workplace." Students surveyed

include two 9th grade Earth and Space Science classes, one 9th grade Environmental class and the Spring Mills High School Science Club.

Along with the Spring Mills Science Club, two other STEM clubs were surveyed, the Berkeley County 4H STEM Club and the Berkeley County 4H Soaring Eagles – which is an Animal Science Club. The Berkeley County 4H STEM club fosters and educates youth members interested in the areas of science, technology, engineering, and math. 4-H is delivered by a community of more than one hundred public universities across the nation that provides experiences where young people learn by doing. 4H is in every county and parish in the country—through in-school and after-school programs, school and community clubs and 4H camps (4H website, n.d.). The Berkeley County 4H is delivered by the West Virginia University Extension. Participants complete hands-on projects in areas like health, science, agriculture and citizenship, in a positive environment where they receive guidance from adult mentors and are encouraged to take on proactive leadership roles.

Berkeley County is in the Eastern Panhandle region of West Virginia (Figure 3.2). As of the Census of 2010, the racial makeup of the county was 87.8% white, 7.1% black or African American, 0.8% Asian, 0.3% American Indian, 1.2% from other races, and 2.6% from two or more races. Those of Hispanic or Latino origin made up 3.8% of the population. The median income for a household in the county was $52,857 and the median income for a family was $64,001. Males had a median income of $45,654 versus $34,239 for females. The per capita income for the county was $25,460. About 7.0% of families and 10.1% of the population were below the poverty line, including 13.2% of those under age 18 and 6.5% of those age 65 or over.

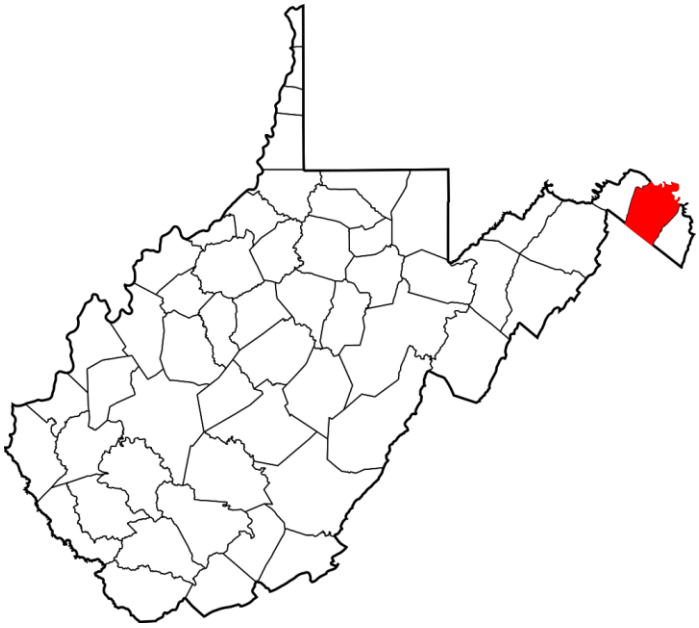


Figure 3.2. West Virginia map highlighting Berkeley County (http://www.nationalatlas.gov/).

Population 2: Kansas – ECO-Meets, Agriculture Classes, and Environmental Clubs

Kansas ECO-Meets have a mission statement of: To challenge and inspire an interest, appreciation and understanding of the natural sciences and the state of Kansas environment through interscholastic competition. ECO-Meets have been in existence since 1991 and are a unique environmental competition in Kansas testing students from grades eight to twelve on their knowledge of Kansas' plants and animals. Much of the competition takes place outdoors so experiences in nature are inherent in the event and make for ideal survey respondents. Sixty-six survey respondents were ECO-Meet participants from the following six regional ECO-Meets depicted in Figure 3.3- Girard, Hays, Milford, Olathe, Salina, and Wichita.

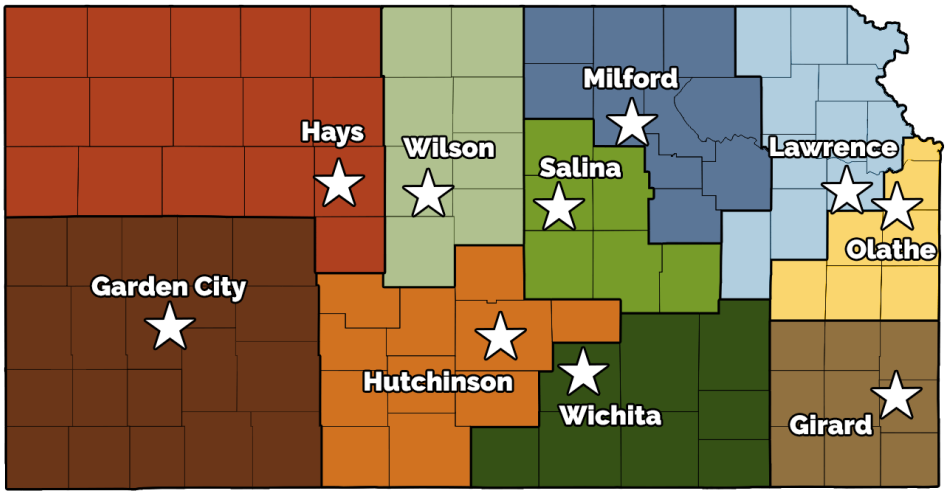


Figure 3.3. Kansas Eco-Meets by regions (www.kansasecomeet.org)

Overall, schools from eleven counties were included in the survey response. Those counties were Allen, Cloud, Crawford, Geary, Johnson, Mankato, Republic, Riley, Saline, and Sedgwick counties.

Since each ECO-Meet covers multiple counties in Kansas, the size of schools participating in an ECO-Meet ranges from 1A to 6A (KSHSAA classifications, 2018). ECO-Meet respondents were distributed between five 6A (largest) schools, three 5A schools, zero 4A schools, one 3A school, one 2A school, and five 1A schools (smallest). According to the 2010 Census, the racial makeup of the Kansas population in general is 83.8% of the population is white, 5.9% is African American, 1.0% American Indian or Alaska Native, 2.4% Asian American, 0.1% Native Hawaiian and other Pacific Islander, 3% from two or more races and 3% other. Ethnically 10.5% of the total population is of Hispanic or Latino origin.

Along with ECO-Meet respondents, students from the Introduction to Agriculture class and the Animal Science class at Maize High School in Maize, Kansas were

surveyed. Maize High School is a fully accredited public high school located in Maize, Kansas, serving students in grades 9-12. It is a 5A school located in Sedgwick County in south central Kansas with a student population of approximately 1,500. The racial makeup of Sedgwick County is 68.1% white, 9.3% Black, 1.3% Native American or Alaskan Native, 4.6% Asian, 14.6% Hispanic, and 3.7% two or more races. The median household income is $52,841, the per capita income is $27,583 and 14.2% of persons are living in poverty.

Eco Club, the environmental club at the Topeka Zoo, was the last youth group surveyed in Kansas. Eco Club provides an opportunity for children and teens interested in the environment to meet and share ideas and interests on how to positively impact the planet. Though the Topeka Zoo is only a medium-sized zoo, it houses over 250 animals in a number of exhibits, including one of the first indoor tropical rain forests in the United States. Topeka is the capital city of Kansas and situated in northeast Kansas in Shawnee County. The racial make-up of Shawnee county is 66.4% white, 11.0% Black, 16.1% Hispanic, 1.5% Asian. 0.8% Native American, and 3.5% two or more races. The estimated median household income was $45,054 and the estimated per capita income was $25,602.

Population 3: Missouri – East Central College Students

East Central College (ECC) is a public open access institution in Union, Missouri providing associate degrees and technical certificates to its service region since 1968. According to the college website (eastcentral.edu) ECC is supported by the college district, which includes most of Franklin County and portions of Crawford, Gasconade,

St. Charles, Warren, and Washington counties. This includes ten public school districts: Crawford County R-1, New Haven, St. Clair R-13, Sullivan C-2, Union R-11, Washington, Franklin County R-2, Lonedell R-14, Spring Bluff R-15 and Strain-Japan R-16. ECC's service region extends beyond its taxing district to the entire east-central region of Missouri, which includes the aforementioned counties as well as Osage, Maries, Phelps, and Dent counties (Figure 3.4).

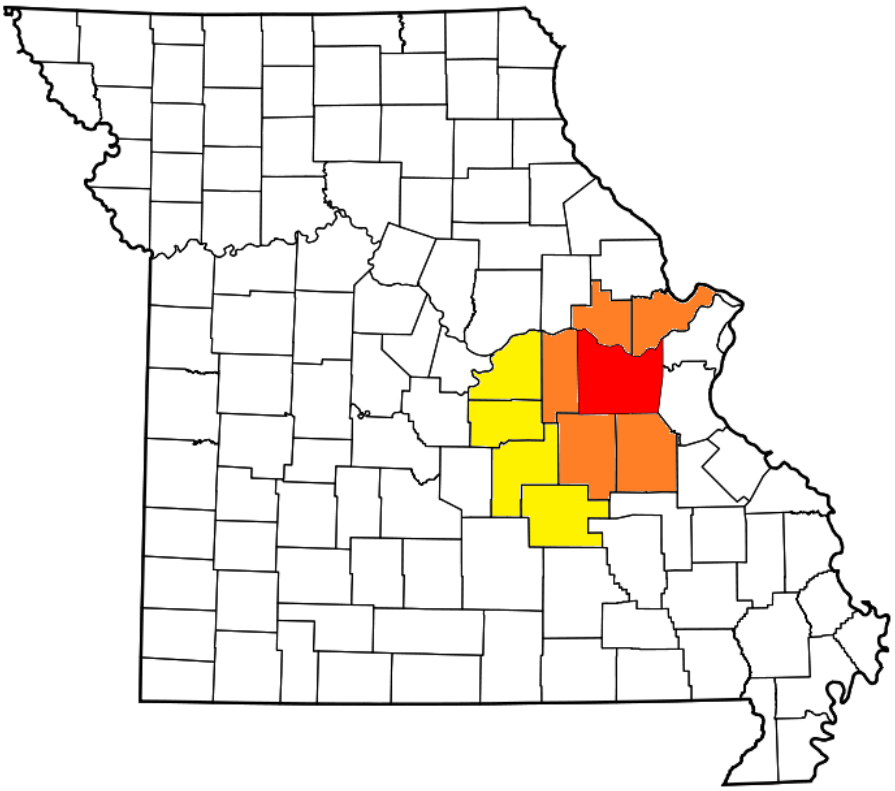


Figure 3.4. Map of East Central College district and service region.

Red indicates the home county of East Central College (Franklin). Orange indicates counties that are at least partially in the East Central College District (From top right, going counter-clockwise: St. Charles, Warren, Gasconade, Crawford, Washington). Yellow counties that are not in the East Central College district, but are part of the service region (From indicates top to bottom: Osage, Maries, Phelps, Dent). Red and orange counties are also part of the service region (adapted from Wikimedia commons image, Retrieved from: https://commons.wikimedia.org/wiki/File: Map_of_Missouri_highlighting_Franklin_County.svg).

In 2017, ECC was comprised of 2,897 students, 45% full-time and 55% part-time, 39.6% male and 60.4% female. Its students are 0.5% American Indian/ Alaskan Native, 0.9% Asian, 1% Black or African American, 2% Hispanic, 0.1% Native Hawaiian/Pacific Islander, 0.9% Unknown, 1.4% Two or more races, and 93.2% white. Table 3.1 shows the demographics of the counties served by the college. 93% of first-time, full-time students receive financial aid, 53% receive Pell Grant aid, and 13% receive other types of Grant aid. The 2017-2018 tuition was $2,592, $3480, and $4896 for in-district students, out-of-district students, and out-of-state students, respectively (eastcentral.edu, n.d.). The tuition of the college is meant to remain relatively low compared to the state of Missouri so that it is considered affordable for students in the rural communities surrounding the college.

As shown in Table 3.1, Franklin County is the home of East Central College, and is the most populated county in the service region, except for St. Charles County, which has been omitted due to the fact that ECC only serves a very small portion of that county and the rest is served by St. Charles' own community college district. Of the remaining counties, the population averages 31,587 people, 45.58 people per square mile, median household income of $43,986, 95.73% white, with 83.68% of 25+ year olds holding a high school degree and 16.49% holding a Bachelor's degree or higher (US Census Bureau, n.d.). All peripheral counties considered in Table 1 meet the qualifications to be considered "rural" or "urban cluster" according to the US Census Bureau, so it is assumed that the sample will contain many individuals with a rural background.

Table 3.1

Demographics of Counties in the East Central College Service Region

County	Pop. at 2017 census	White (%)	Black or African American (%)	Asian (%)	Two or more races	Hispanic or Latino	% of 25+ yr. olds high school grad	% of 25+ yr. olds Bachelor degree	Median household income	Population per mi^2
Home County										
Franklin	103,330	96.6	1	0.5	1.4	1.7	87.2	19.7	$50,895	110
In district, in service region										
Warren	34,373	94.5	2.3	0.5	2.1	3.3	85.8	18.2	$51,509	75.9
Gasconade	14,726	97.3	0.5	0.5	1.3	1.4	86	16.4	$45,505	29.4
Crawford	24,102	96.9	0.5	0.3	1.5	2	78.3	12.5	$36,983	33.3
Washington	25,002	95.4	2.4	0.3	1.4	1.4	77	8	$36,701	33.2
Out of district, in service region										
Osage	13,662	98.3	0.4	0.2	0.8	0.9	90.3	19.1%	$54,119	23.0
Maries	8,867	96.3	0.7	0.6	1.6	1.3	82.6	14	$40,542	17.4
Phelps*	44,744	90.6	2.4	3.7	2.4	2.5	87	27.9%	$41,603	67.2
Dent	15,480	95.7	0.6	0.8	1.8	1.8	78.9	12.6	$38,020	20.8

Note: Table includes counties served exclusively by East Central College. St. Charles County is excluded because only a small portion of that county is within the ECC service region. The remainder of the county has its own community college district.

Only the top 5 race/ethnicity classifications are shown. Data are from the United States Census (Retrieved from www.census.gov).

* indicates Phelps county as a potential outlier due to the presence of a public 4-year University in that county.

Variables

For the quantitative portion of the study, the survey questions were based on the variables below (Table 3.2). The variables of interest were determined based on the literature reviewed. Survey questions were obtained from previous research when possible. When new questions were developed, they were closely based on other questions found in the literature. Since this is an explanatory sequential mixed methods design, the findings from the first quantitative phase informed the measures for the follow-up qualitative phase.

Methods of Data Collection

The quantitative phase of the study focused on factors that influence pro-environmental behavior within rural populations. A survey was used for the collection of quantitative data. The advantage of a survey is that it can generalize from a sample, is cost effective and produces a generally quick turnaround. The survey was cross-sectional – taking a "snapshot" at one point in time (Fink, 2017). For the qualitative phase of the study, topics explored were environmental identity, meaningful nature experiences, role models, and pro-environmental behavior. The qualitative phase focused on these topics because they have shown significance in previous research or in the quantitative analysis. Open-ended questions on the quantitative survey and focus group interviews were used for collecting the qualitative data. All data were added to a shared spreadsheets and analyzed by each member of the group. Statistical analyses were performed using SAS Studio.

Table 3.2

Variables of Interest in the Present Study

Variable and Code	Definition	Type
Individual Pro-Environmental Behavior (PEB_I)	Actions that directly improve the environment, such as recycling, purchasing eco-friendly products, choosing public transportation, etc.	Dependent
Collective Pro-Environmental Behavior (PEB_C)	Actions that promote environmental culture, workforce, or politics, such as voting pro-environmentally, participate in environmental careers, publically supporting the environment, etc.	Dependent
Connectedness To Nature Scale (CNS)	The connectedness to nature scale measures to what degree people feel part of nature.	Independent
Environmental Identity (IDE)	A sense of identity that transcends the individual and encompasses one's position as part of a living ecosystem. Includes identities related to science, the outdoors, nature, and environmentalism.	Independent
Meaningful Nature Experiences (MNE)	An experience with nature that one interprets to have a serious, important, or useful quality.	Independent
Role Models (RM)	A person looked to by others as an example to be imitated.	Independent
STEM Interest (INT)	Interest in the fields of Science, Technology, Engineering, and Mathematics. Science includes both physical and life sciences, such as environmental and agricultural sciences.	Independent
Environmental Science Capital (ESC)	Sum of the environmental science-related experiences that one builds up over a lifetime. Environmental science includes agriculture, animal care, fisheries and wildlife, ecology, botany, limnology, and other sciences dealing with the environment.	Independent
Socioeconomic Situation (SE)	A combination of social and economic factors.	Independent
Political Identity (PA)	The membership in, participation in, or support of, a particular political party, group, or candidate.	Independent
Gender (G)	Identification as male/masculine, female/feminine or something else, and association with a (social) role or set of behavioral and cultural traits, clothing, etc; a category to which a person belongs on this basis.	Independent

Race (R)	A grouping of humans based on shared physical or social qualities into categories generally viewed as distinct by society.	Independent
Geographical Region (GR)	Self-described or defined using Census Bureau definition - rural refers to all population, housing, and territory not included within an urban area. Two urban areas are recognized: Urbanized Areas (UAs) of 50,000 or more people; and Urban Clusters (UCs) of at least 2,500 and less than 50,000 people.	Independent
Hispanic (H)	Relating to Spain or to Spanish-speaking countries, especially those of Latin America.	Independent
Age (A)	A period of a human life measured by years from birth.	Independent

The qualitative phase of the study involved focus groups conducted with a subset of the participants. A total of 35 individuals participated in focus groups. Two focus group were conducted with participants from Berkeley County, West Virginia. The first consisted of eight participants from the Spring Mills High School Science Club at their High School in Berkeley County, West Virginia on Monday, February 25, 2019. The second consisted of seven participants from the 4-H Animal Science Club at their meeting place Shepherd Whey Farm on Friday, March 15. Participants for the Kansas portion of the study were from Colgan St. Mary's High School in Pittsburg, Kansas. Nine individuals took part in a one hour focus group on Wednesday, March 20, 2019 in the conference room at their high school. For college students, focus groups were conducted with 11 students from an Introduction to Animal Science course on East Central College campus on Monday, April 8th, 2019 in their normal classroom.

Description of Survey Instrument

A paper and pencil survey was developed through adoption and modification of questions previously used in the literature and tested for reliability and validity. The first introduction section consists of several questions on student information such as age, race, gender identity, how they would describe the place they live (urban vs. rural). The next section is the 7-item connectedness to nature scale (Mayer & Frantz, 2004). The next section consists of 18 Likert-scale questions about meaningful experiences. These questions were developed from various sources (Nature of Americans Report, Sivek 2002, plus some original questions for modern rural youth). The next two sections deal with Role Models and is from Sivek's (2002) study and includes 12 questions about role models, followed up with seven questions about traits of role models. The next section is nine original questions about environmental identity. Then there are twelve STEM interest questions derived mostly from Wallace (2018). Pro-environmental behavior questions were obtained from Fah and Sirisena (2014). Three open-ended questions were added to provide qualitative data. One question focuses on meaning nature experiences: "Which of your experiences has been most meaningful? What about it was so meaningful?" The other two focuses on role models: "If you stated that an unrelated adult who you know personally or a public figure who you do not know personally was an important influence on your connectedness to nature, who were you referring to?" And "Of all the role models who have influenced your connectedness to nature, which role models would you consider to be the most important?" See Appendix A for a list of all survey questions and their sources and Appendix B for a copy of the survey instrument.

Several steps were taken to protect the validity and reliability of the survey instrument. Survey questions obtained from previous research were only used if they were shown to have validity in previous studies. However, a threat to the internal validity is the combined instruments and modification of survey items. This may impact the validity and reliability of the original instruments. To minimize this impact, when questions had to be modified, they were written as similarly as possible to questions from previous research that showed validity. These questions, in addition to the few new questions that were developed, were tested for validity and reliability after survey analysis using the Cronbach alpha tests. Due to the characteristics of individuals, the uniqueness of the setting, and the timing of the research, researchers cannot generalize beyond the study population. Additional experiments will need to be conducted for groups with different characteristics, new settings or future settings (Creswell, 2014).

Description of Focus Group Protocol

A focus group protocol was developed to gain further insights into patterns observed in survey data. (Appendix C). This protocol was developed using Krueger's "Designing and Conducting Focus Group Interviews (2002). Questions were few in number and open-ended to elicit the views and opinions of the participants. The types of questions included: introductory, follow-up, probing, and closing. Notes were also taken during the focus group to record observed behaviors. During the focus group, participants began by writing their answers down before sharing to encourage the participants to self-reflect, to share individual perspectives, and feel comfortable giving in-depth responses. Participants were then guided through a pre-selected set of questions and the facilitator captured notes on major themes that arose. At the end of the focus group, the facilitator

shared the themes that arose allowing the participants to determine whether they agreed with the facilitator's interpretation of themes for member checking. Written responses were collected and added as documentation for triangulation.

Data Analysis Procedures

For the quantitative portion of the study, descriptive and inferential statistics were calculated. Descriptive statistics are used to describe the basic features of the data in a study. They provide simple summaries about the sample and the measures and are a logical first step in data analysis. Inferential statistics make inferences about populations using data drawn from the population. Inferential statistical tests used in this study include univariate linear regression, multivariate linear regression, one-way Analysis of Variance (ANOVA), and two-sample t-test.

A linear regression is an appropriate analysis when the goal of research is to assess the extent of a relationship between a dichotomous or interval/ratio predictor variable on an interval/ratio criterion variable. This technique was used for the category means of connectedness to nature, STEM interest, environmental identity, meaningful nature experiences, role models, and environmental science capital. One-way ANOVA is an appropriate statistical analysis when the purpose of research is to assess if mean differences exist on one continuous dependent variable by an independent variable with two or more discrete groups. This technique was used for all questions with categorical data, and for each individual question in the broader independent variable categories. The only exception would be for questions with only two answer choices, for which the two-sample t-test was used. The assumption of normality and homogeneity of variance will be assessed for ANOVA and regression test results when significance is indicated. For all of

the tests described here, the alpha value was 0.05, so tests returning a $p<0.05$ were deemed statistically significant.

For certain tests, correlation coefficients were also calculated. A multiple regression analysis provides the relative prediction of one variable among many in terms of the outcome (Creswell, 2014). Correlation quantifies the degree to which two variables are related. By computing a correlation coefficient (r) that tells you how much one variable tends to change when the other one does. When r is 0.0, there is no relationship. When r is positive, there is a trend that one variable goes up as the other one goes up. When r is negative, there is a trend that one variable goes up as the other one goes down.

For the qualitative part of the study, both qualitative data from the open-ended questions on the survey and focus groups were analyzed. The analysis process was adapted from Creswell (2014). First, all participant responses (open-ended questions and focus group discussions) were compiled in a shared document. After all responses were compiled, researchers read over all the responses to get a sense of the "big picture" and reflected on its overall meaning. Researchers then identified themes by starting with the broad concepts of meaningful nature experiences, role models, connectedness to nature, STEM interest, environmental identity, environmental science capital and pro-environmental behavior. Researchers then started to identify patterns within these concepts. Researchers also noted the frequency of themes that were mentioned by participants and recorded quotes to illustrate those major themes and patterns. These themes and patterns further informed the interpretation of quantitative data. Results were captured in tables (Appendix D).

Limitations of Study

The data collected in the quantitative portion of the study were self-reported and thus could be subject to socially desirable answering behavior. To reduce the effects of social desirability, the questionnaires ensured full confidentiality and the respondents were asked to state their own opinions and to answer all questions honestly. There was no contact between the researchers and the participants that could lead to any type of emotional response caused by sympathy or antipathy to the participants' answers. For the survey instrument, several instruments were combined (connectedness to nature scale and environmental science capital) and some survey items were modified. This may impact the validity and reliability of the original instrument.

For the qualitative portion of the study, the intent was to describe the particular themes of rural secondary school and college students within Berkeley County, West Virginia, Franklin County, Missouri, and Crawford County, Kansas, which presents limitations to generalizability outside of this study. Additional cases of participants with the same characteristics of similar programs could be studied for potential generalizability. However, to repeat a case study's findings in a new case study setting requires good documentation of qualitative procedures, such a protocol for documenting the problem in detail and the development of a thorough case study database (Creswell, 2014).

For the explanatory mixed methods study design, there are challenges in terms of validity and reliability that must be addressed. One such challenge is not following up on all of the quantitative results needed in order to explain findings. Creswell (2014) warns that if this occurs then important explanations may be overlooked compromising overall

findings. Although researchers were careful to follow up on results deemed significant, more quantitative findings could be addressed in future studies.

Other limitations to the study include discrepancy between age groups of populations in science capital research and the adequacy of the connectedness to nature scale (CNS) in measuring one's affective, experiential relationship to the natural world. Previous research on science capital, such as the ASPIRES longitudinal study, focused on youth ages 10 – 14, while this present study focuses on youth ages 13– 22. At present no studies on science capital focusing on rural populations have been found.

Ethics and Human Relations

Because this research involves collecting data from young people, care must be taken to protect research participants and personal disclosure, trust must be developed with research participants, the integrity of research must be promoted, and misconduct must be guarded and new problems that emerge must be coped with (Creswell, 2014).

Prior to the study, the researchers applied for approval from the Institutional Review Board (IRB) at the University of Missouri – Saint Louis and obtained the necessary permissions to gain access to the sites and to study participants (Appendix E). Researchers conveyed the purpose of the research to participants and obtained the necessary informed consent from participants. Additional parental consent was obtained from participants below the age of 18. At the start of surveys or focus groups, the researchers expressed to participants that they may decline to participate or cease participation at any time with no consequences. They were also assured that their privacy and confidentiality would be maintained by properly storing information and sharing data per the requirements of the institutional IRB. During data collection and analysis,

researchers avoided the exploitation of the participants and collection of any potentially harmful information.

Researchers obtained access to their study participants through teachers, club leaders, and coaches. For the Berkeley County West Virginia students and STEM Club participants, approval and recruiting of participants was through Dr. Robert Myers, Principal of Spring Mills High School, Spring Mills High School Science Teacher, Mrs. Angela Hollida, Mr. Michael Withrow, Berkeley County 4H Extension Officer and various 4H STEM Club leaders, Mr. and Mrs. Charles Engle, Mrs. Nikki Welch and Ms. Heather Riker Johnson.

For Kansas ECO-Meets, students were asked to participate in the survey by their ECO-Meet coach. Since IRB approval was received after the 2018 ECO-Meet season, coaches from the 2018 season were contacted by email and asked if they would be willing to gather permission slips and administer the survey to students from their ECO-Meet teams. Thirty-two coaches were contacted and thirteen coaches returned surveys for this research. Those returning surveys were Evan Brandt (Shawnee Mission North HS), PJ Born (Shawnee Mission South HS), Chris Ollig (Blue Valley North HS), Denise Scribner (Goddard HS), Matt Mosher (Salina South HS), Alison Pfeifer (St. Xavier Catholic HS), Tarry Weese (Miltonvale HS), Curt Parry (Pike Valley HS), Cindy Thompson (Riley Co. HS), Noah Bush (Manhattan HS), Donna Maus (Colgan/St. Mary's Catholic HS), Jody Hadachek (Rock Hills HS), and Bailey Myers (Crest HS). Self-addressed stamped envelopes were mailed to each coach for the return of the surveys. A total of 66 ECO-Meet participants took the survey. This was short of the desired 100 surveys of ECO-Meet participants so additional high school students involved in similar

curriculums were recruited. Jay Super, ECO-Meet coach at Maize High School did not have an ECO-Meet team in 2018 due to a restructuring of the science program, so Mr. Super offered to survey his Intro to Agriculture class and Animal Science class. These courses provide an introduction to the flora and fauna of Kansas similar to an ECO-Meet. Another non ECO-Meet group that was surveyed was the Eco Club at the Topeka Zoo. The purpose of Eco Club is to increase environmental awareness similar to the curriculum of ECO-Meet. Dennis Dinwiddie, Education coordinator at the Topeka Zoo surveyed the club. Eco Club presents a wider range of ages but only secondary students' responses were recorded.

Contact with college students was obtained through East Central College science course instructors. Each instructor who was contacted agreed to participate in the study. Consent forms and surveys were administered during regular class times to ensure that surveys were returned. The instructors included Keith Pulles and Parvadha Govindaswamy from the Biology department, Isaiah Kellogg from Engineering, and Matthew Monzyk from Chemistry. Surveys were administered in the regular classroom at a time convenient to the instructor. Instructors determined the time and location for the survey administration and Elizabeth Flotte delivered and collected the surveys.

CHAPTER 4: RESULTS

The aim of this mixed methods study was to explore the concept of environmental science capital and to investigate how environmental science capital, connectedness to nature, STEM interest, environmental identity, meaningful nature experiences, and role models influence the pro-environmental behavior of rural youth. The first phase of this explanatory sequential mixed methods study involved the administration of a survey measuring these variables, along with demographic information. In the second phase, focus groups were conducted to build upon the findings of the quantitative phase. We will present the results in a similar order, with the first section reviewing the results of the quantitative phase and the second section reviewing the results of the qualitative phase.

Phase I: Quantitative Results from Surveys

Quantitative data were collected using paper surveys and analyzed using SAS Studio. Surveys included between 15 and 19 questions on demographics and program-specific information, depending on the study population. There were 101 Likert-style questions assessing the independent and dependent variables, and 3 open-ended questions regarding their most meaningful nature experience, identifying role models who are unrelated adults or public figures, and their most important role model.

Study Population Overview

Participants were students between the ages of 13 – 22 and were affiliated with a school or club in Franklin County, Missouri, Berkeley County, West Virginia, or the state of Kansas. Participants were chosen based on their participation in a science club or class, with preference for those that focus on environmental science. Students at East Central

College in Franklin County, Missouri were chosen based on enrollment in science courses that have an inherent environmental focus or would provide access to a variety of science majors. Following is a list of courses that were surveyed, with the likely academic major of those students in parentheses: Introduction to Animal Science (agriculture), Human Anatomy and Physiology I (health science), General Ecology (various majors), Environmental Science (various majors), General Chemistry II (STEM majors), and Introduction to Circuit Theory (Engineering). Participants from Berkeley County, West Virginia were chosen based on their enrollment in an environmental science class, high school science club, 4H STEM club, or 4H Animal Science club. Participants from Kansas were chosen based on their participation in a class, club, or ECO-Meet competition. Survey dates, times, locations, and response rates are shown in Table 4.1. A total of 252 surveys were collected, with an overall response rate of 57.80%.

The 252 surveyed participants included 100 individuals from Kansas, 100 from Missouri, and 52 from West Virginia (39.86%, 39.86%, and 20.63%, respectively). The average age of the population was 17.31 years (±2.16 SD), with 43.60% of the population in the 16 to 18 year age range. The participants were 55.56% female, 87.25% white, and 45.60% rural (Table 4.2). Further details about the population demographics are provided in Table 4.2. The distribution of age, gender, race, and self-identified geographic region are graphically represented in Figures 4.1 and 4.2.

Table 4.1

Survey Response Rates for Study Populations and Sub-Populations

Subpopulation	Date	Location	Surveys Received	Response Rate
College Students - Missouri				
Human Anatomy and Physiology I	01/24/19	East Central College Union, MO	32	100%
Introduction to Animal Science	01/28/19	East Central College Union, MO	10	100%
General Chemistry II	01/28/19	East Central College Union, MO	11	100%
General Ecology	01/31/19 02/07/19	East Central College Union, MO	24	88.89%
Environmental Science	01/31/19	East Central College Union, MO	13	61.9%
Introduction to Circuit Theory	02/04/19	East Central College Union, MO	10	83.33%
High School Students – West Virginia				
Spring Mills High School Science Class	02/14/19	Spring Mills High School Spring Mills, WV	35	41%
Spring Mills High School Science Club	02/14/19	Spring Mills High School Spring Mills, WV	8	53%
4H STEM Club	02/08/19	United Methodist Church Martinsburg, WV	2	8%
4H Animal Science Club	02/10/19	Shepherd's Whey Farm Martinsburg, WV	7	100%
Secondary Students - Kansas				
Junction City High School Eco-Meet Team	01/28/19	Milford Nature Center, Junction City, KS	1	25%
ECO-Club, Topeka Zoo	01/29/19	Topeka Zoo, Topeka, KS	22	73.33%
Goddard High School Eco-Meet Team	1/30/19	Goddard High School, Goddard, KS	2	66.67%
St. Xavier High School Eco-Meet Team	2/9/19	St. Xavier High School, Junction City, KS	5	62.5%

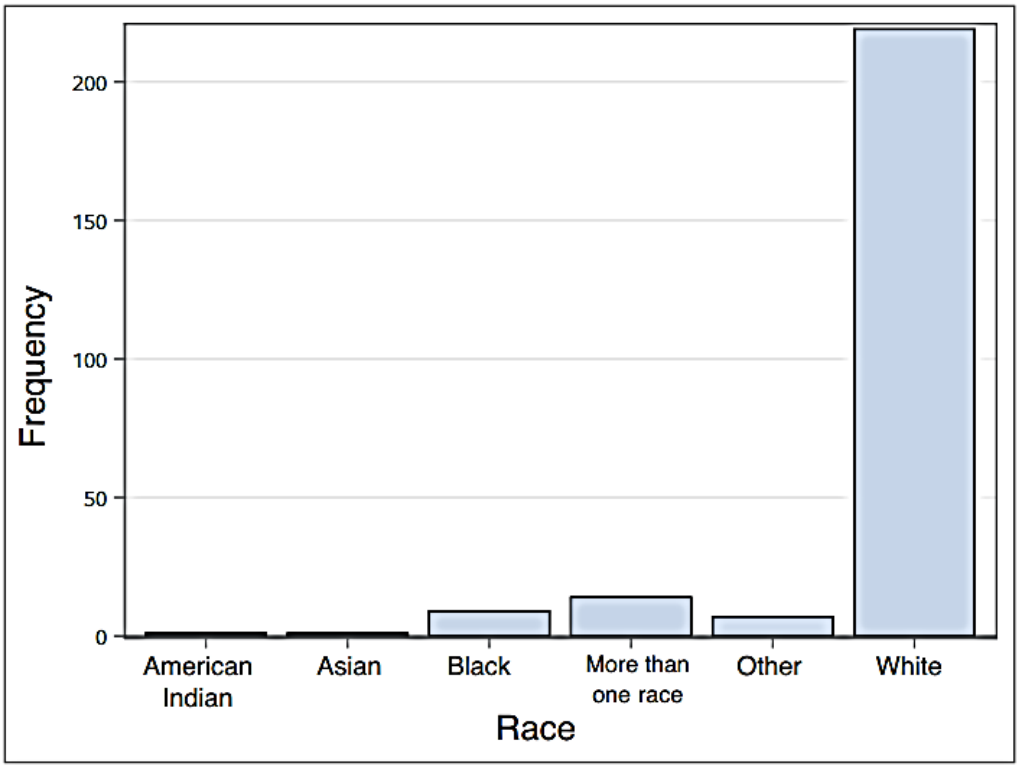
Shawnee Mission North High School Eco-Meet Team	2/4/19	Shawnee Mission High School, Overland Park, KS	11	68.7%
Shawnee Mission South High School Eco-Meet Team	2/1/19	Shawnee Mission South High School, Overland Park, KS	5	45.45%
Pike Valley High School Eco-Meet Team	2/18/19	Pike Valley High School, Scandia, KS	4	100%
Crest HS Eco-Meet Team	2/1/19	Crest High School, Colony, KS	2	50%
Miltonvale High School Eco-Meet Team	2/22/19	Miltonvale High School, Miltonvale, KS	4	100%
Salina South High School Eco-Meet Team	2/20/19	Salina South High School, Salina, KS	1	25%
Manhattan High School Eco-Meet Team	2/14/19	Manhattan High School East Campus, Manhattan, KS	3	37.5%
Colgan/ St. Mary's High School Eco-Meet Team	1/30/19	Colgan St. Mary's High School, Pittsburg, KS	12	100%
Rock Hills High School Eco-Meet Team	2/15/19	Rock Hills High School, Mankato, KS	2	66.67%
Maize High School Animal Science Class	2/27/19	Maize High School, Maize, KS	3	12%
Maize High School Introduction to Ag Class	2/27/19	Maize High School, Maize, KS	9	31%
Riley County High School Eco-Meet Team	2/28/19	Riley Co High School, Riley, KS	10	58.8%
Blue Valley North High School Eco-Meet Team	2/11/19	Blue Valley North High School, Leawood, KS	4	50%
		Total	**252**	**57.80%**

Note: Times are not included because they are not available for some subpopulations.

Table 4.2

Summary Demographic Data

Demographic Characteristic		Number of Respondents	
Variable	Response	Count	Percentage
State	Kansas	100	39.68%
	Missouri	100	39.68%
	West Virginia	52	20.63%
Age	13 to 15 years old	60	24.00%
	16 to 18 years old	109	43.60%
	19 to 22 years old	81	32.40%
Gender	Female	140	55.56%
	Male	108	42.86%
	Non-binary	1	0.40%
	Prefer not to say	1	0.40%
	Self-describe	2	0.79%
Race	American Indian or Alaska Native	1	0.40%
	Asian	1	0.40%
	Black or African American	9	3.59%
	More than one race	14	5.58%
	Other	7	2.79%
	White	219	87.25%
Hispanic	No	228	92.31%
	Yes	19	7.69%
Self-Identified Geographic Region	Rural	114	45.60%
	Suburban	105	42.00%
	Urban	31	12.40%
Political Identity	Do not know	74	30.58%
	Republican	68	28.10%
	Independent	36	14.88%
	Democrat	41	16.94%
	Other	20	8.26%



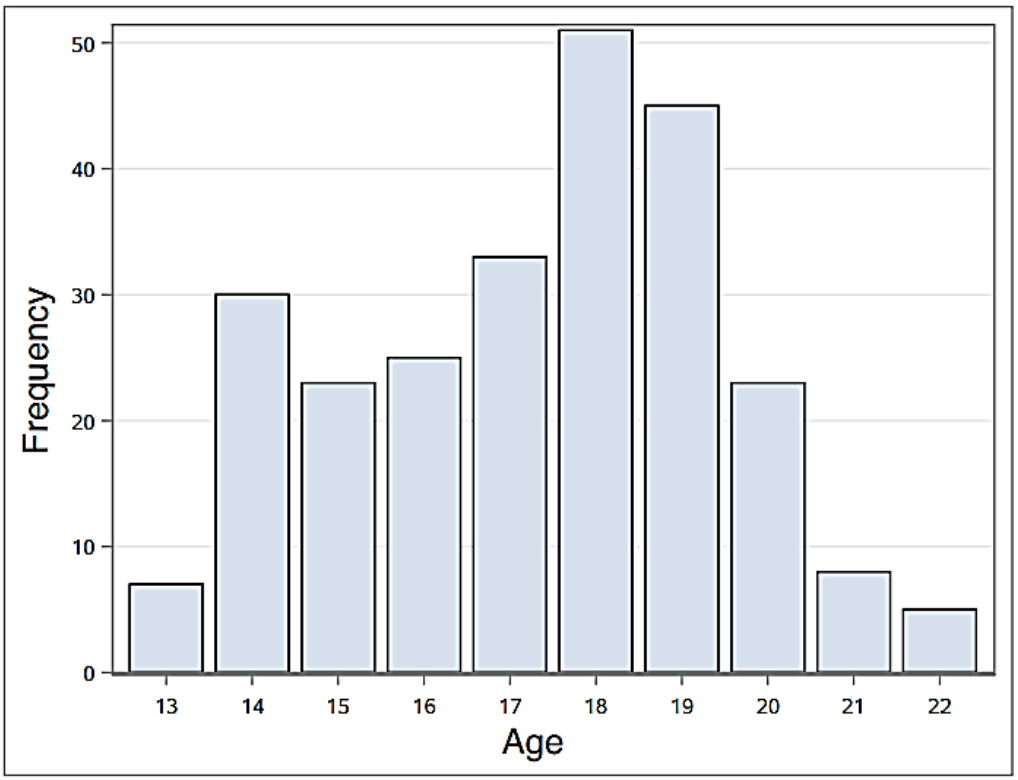
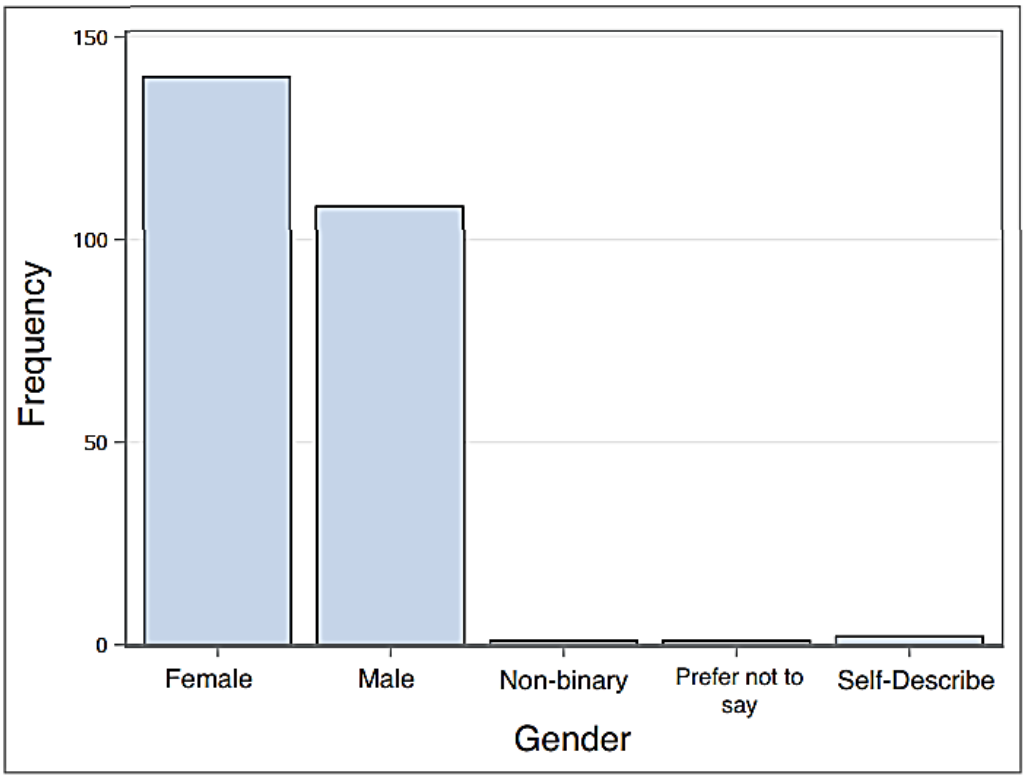


Figure 4.1. Demographics of Study Population by Age and Race.



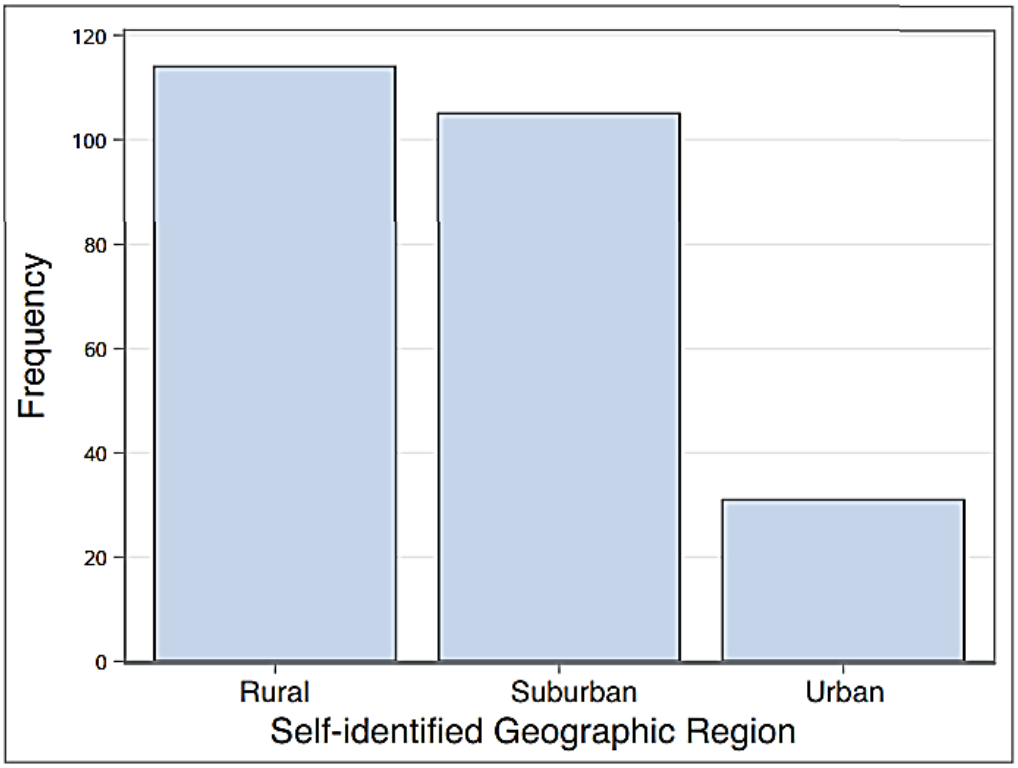


Figure 4.2. Demographics of Study Population by Gender and Self-identified Geographic Region.

Relationships between Independent Variables and Pro-Environmental Behavior

In addition to the demographic survey questions, the survey included seven Likert-style questions assessing six independent variable categories, with seven questions for connectedness to nature, 18 for meaningful nature experiences, 19 for role models, nine for environmental identity, 12 for STEM interest, and 21 for environmental science capital. Cronbach's alpha tests indicated that all variable categories had internal consistency due to alpha scores above 0.7, so these constructs were analyzed individually and within variable groups. The alpha values were 0.837, 0.852, 0.856, 0.808, 0.786, and 0.856 for connectedness to nature, meaningful nature experiences, role models, environmental identity, STEM interest, and environmental science capital, respectively. These questions were compared to the individual's mean score for 15 pro-environmental behavior questions, seven of which measured individual pro-environmental behavior while eight measured collective pro-environmental behavior.

Initially, we were interested in two sub-categories within our dependent variable of individual pro-environmental behavior and collective pro-environmental behavior. However, analyses of the survey data did not demonstrate differences in how these two sub-categories of pro-environmental behavior relate to the independent variables. When we used simple linear regressions to analyze the relationships between independent variable category means and the dependent variables of individual pro-environmental behavior, collective pro-environmental behavior, and combined (individual and collective pro-environmental behavior), we did not see different results based on the type of pro-environmental behavior (Table 4.3). P-values and R^2 values were similar regardless of the dependent variable analyzed.

Table 4.3.

Results of Simple Linear Regressions for Independent Variable Category Means by Each Type of Pro-Environmental Behavior

	Individual PEB		Collective PEB		Combined PEB	
	p-value	R^2	p-value	R^2	p-value	R^2
Environmental Science Capital	<0.0001	0.34	<0.0001	0.27	<0.0001	0.25
STEM Interest	<0.0001	0.31	<0.0001	0.3	<0.0001	0.35
Environmental identity	<0.0001	0.33	<0.0001	0.35	<0.0001	0.37
Connectedness to Nature	<0.0001	0.08	<0.0001	0.08	<0.0001	0.1
Meaningful Nature Experiences	<0.0001	0.17	<0.0001	0.13	<0.0001	0.18
Role Models	<0.0001	0.09	0.0001	0.05	<0.0001	0.04

Additionally, the Cronbach's alpha for the mean of all pro-environmental behavior questions (0.890) was stronger than that of the individual (0.757) or collective (0.837) subsets alone. Thus, the entire set of pro-environmental behavior is a more reliable construct than either sub-category of pro-environmental behavior. Due to the results of the Cronbach's alpha tests, we used all 15 questions in our pro-environmental behavior variable for the rest of the analyses presented in this chapter. Descriptive statistics and one-way ANOVA tests were calculated for each survey question to examine the relationship between each question response and pro-environmental behavior. The results of all of these analyses are provided in Appendix D.

When answering the individual survey questions about connectedness to nature, meaningful nature experiences, role models, environmental identity, STEM interest, and environmental science capital, participants were able to indicate their agreement to a statement based on a 5-point scale with the following options: strongly disagree, somewhat disagree, no opinion, somewhat agree, strongly agree. Meaningful nature experiences and the first set of role models questions had answer choices on a 5-point scale ranging from “Not at all Important” to “Very Important” and the second set of role model questions ranged from “Does not describe my role model at all” to “Describes my role model very well”. Pro-environmental behavior questions had a 5-point scale ranging from “Never” to “Always”. In each case, participants checked a box and that information was recorded as a “1” for the first box (Not at all Important, Strongly Disagree, Never) up to a “5” for the fifth box (Very Important, Strongly Agree, Always), before entering the data into a spreadsheet. Answer choices of 1, 2, 3, 4, and 5 represent the five categories that were compared in each ANOVA tests. Appendix D shows the results of the one-way ANOVA tests for each survey question.

Following is an example of how all variables in Appendix D were analyzed. Figure 4.3 demonstrates an example of the relationship between responses to the first environmental science capital question (ESC1) and participant mean score for pro-environmental behavior. Responses of 1, 2, 3, 4, or 5 meant “strongly disagree”, “somewhat disagree”, “no opinion”, “somewhat agree”, and “strongly agree”, respectively. When individual participant responses to the first environmental science capital question are compared to their average score in the mean pro-environmental behavior category using a one-way ANOVA test, it is evident that there is a relationship

between the two variables. When observing the bar graph of the data, that relationship seems to be positive; as agreement with the statement increases, pro-environmental behavior increases.

In this case, the dependent variable in the one-way ANOVA test was the participant's mean score for pro-environmental behavior, and the independent variable was the participant's response to the survey question "Learning about the environment helps prepare me for my future job". A bar graph showing the pro-environmental behavior score for those who answered 1, 2, 3, 4, or 5 to this question is shown in Figure 4.3. The one-way ANOVA test returned a p-value <0.0001, indicating that there is a statistically significant difference between the pro-environmental behavior means of participants in each ESC1 response category.

When analyzing the ANOVA results for individual questions, Levene's Test for Homogeneity was used to test for homogeneity of variances. In this example, the Levene's test returned a p-value of 0.2991. Because this number is above 0.05, we accept the null hypothesis that variances are equal, thus fulfilling an assumption for the ANOVA test. In all cases where ANOVA results yielded a Levene's Test p-value below 0.05, the Welch's ANOVA p-value was reported. In this case, the original p-value stands. The assumption of normality is also evidenced by the relatively normal distribution displayed in the quantile-residual plot and residual-percent plots (not shown).

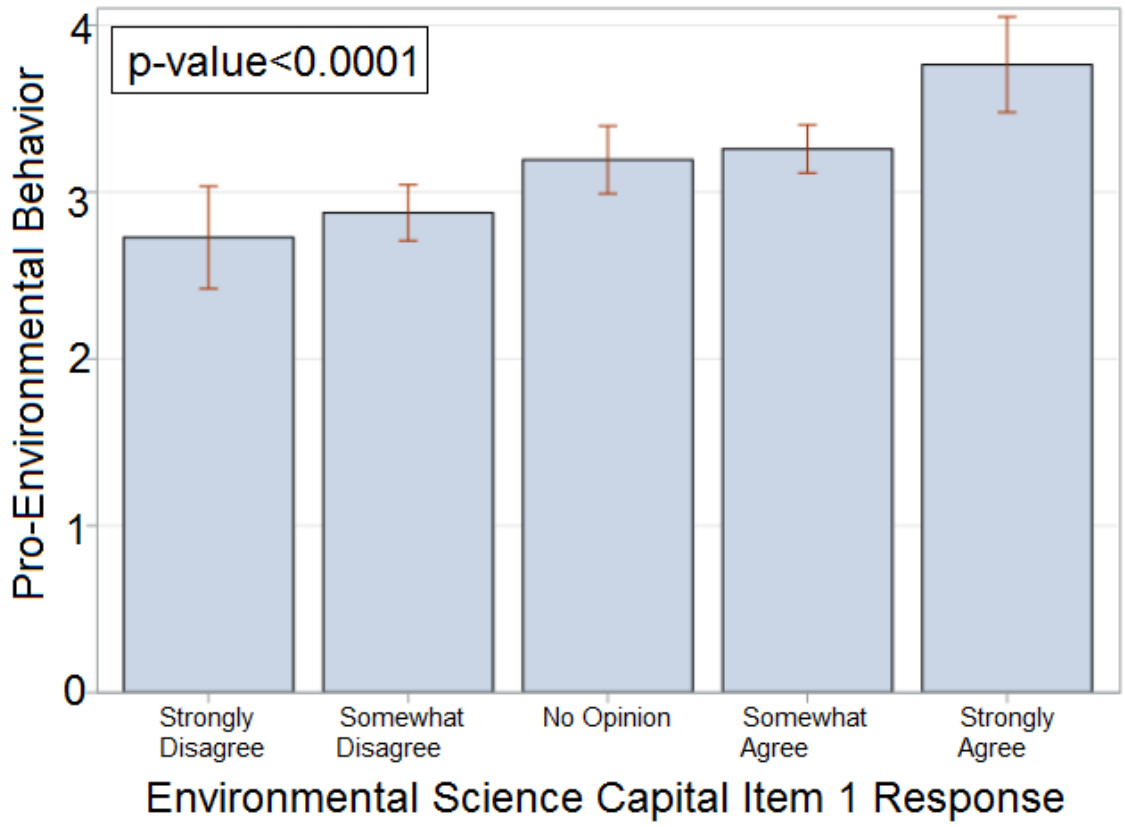


Figure 4.3. Relationship between Participant Response to Environmental Science Capital Survey Question 1 and Mean Score for Pro-Environmental Behavior. Error bars represent a 95% confidence interval (One-Way ANOVA $p < 0.0001$, $N = 248$).

Scores from the independent variable categories of connectedness to nature, environmental identity, STEM interest, environmental science capital, role models, and meaningful nature experiences as measured through self-reported survey responses were averaged to calculate each participant's mean score for all six categories. Linear regressions were used to examine the relationship between these combined scores for the six independent variable categories and the dependent variable of pro-environmental behavior (Table 4.3, Figures 4.4 – 4.6). Table 4.4 contains the summary statistics for each

independent variable category. The means for each category are above three, indicating that on average, responses were on the positive side.

Although the univariate model is statistically significant for all six independent variables and their relationship to pro-environmental behavior, the R^2 values are highest for environmental science capital, STEM interest, and environmental identity. Comparatively, connectedness to nature, meaningful nature experiences, and role models explain less of the variation in how respondents reported their pro-environmental behavior.

Table 4.4.

Summary Statistics for Independent Variable Category Means

Variable	Mean	Std Dev	Minimum	Maximum	N
Connectedness to Nature	3.72	0.76	1.00	5.00	252
STEM Interest	3.75	0.70	1.00	5.00	249
Environmental Identity	3.42	0.61	1.92	4.83	250
Environmental Science Capital	3.68	0.60	1.76	4.90	249
Role Model	3.30	0.85	1.00	5.00	252
Meaningful Nature Experiences	3.68	0.64	1.24	5.00	252

It is possible that interactions between these independent variables could result in statistically significant p-values even if the given variable is not an important contributor to the overall relationship when all variables are taken into account. Thus, as a follow-up to these univariate tests, a multivariate linear model that also includes demographic variables, was necessary to understand how these variables interact to facilitate pro-environmental behavior.

Fit plots show that while the variables STEM interest, environmental identity, environmental science capital, and connectedness to nature have positive relationships with mean pro-environmental behavior, the distributions of STEM interest and environmental identity are closest to the fitted regression line, with R^2 values of 0.37 and 0.37. Environmental science capital fits less strongly with an R^2 of 0.24 and connectedness to nature even less at an R^2 of 0.10.

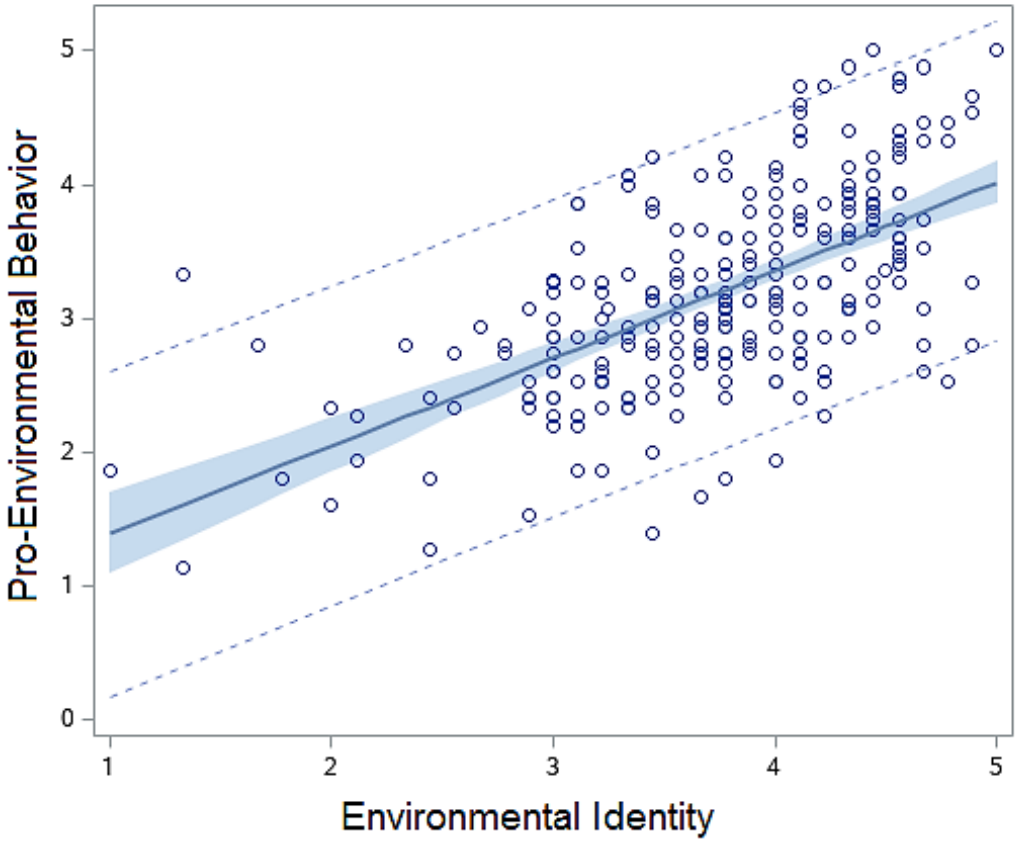


Figure 4.4. Fit Plot for Univariate Analysis of the Relationship between Pro-Environmental Behavior and Environmental Identity. N = 247, R^2 = 0.37.

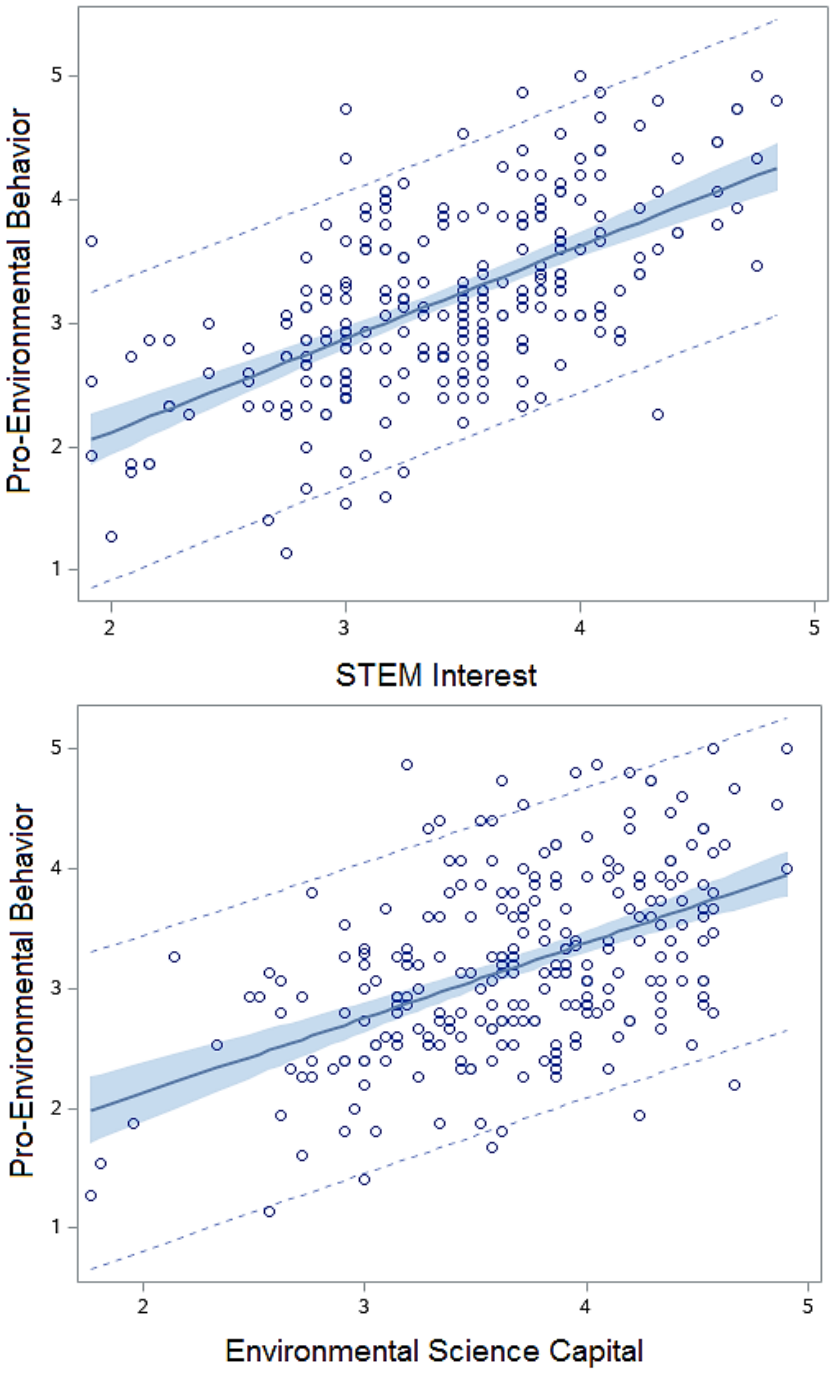


Figure 4.5. Fit Plots for Univariate Analyses of the Relationship between Pro-Environmental Behavior and STEM Interest and Environmental Science Capital. N = 246 and R^2 = 0.37 for STEM Interest. N = 247 and R^2 = 0.25 for Environmental Science Capital.

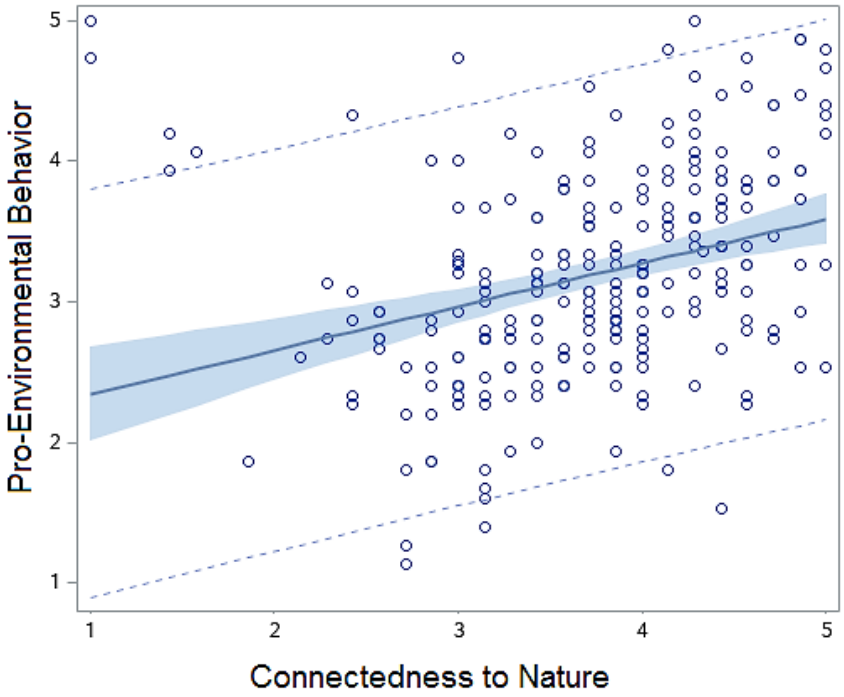


Figure 4.6. Fit Plot for Univariate Analysis of the Relationship between Pro-Environmental Behavior and Connectedness to Nature. N = 248, R^2 = 0.09.

Once the relationship between all independent variables and pro-environmental behavior had been examined using univariate analyses, the next step was a multivariate linear regression including all important variables from the linear model. All of the six major independent variable categories were used in the model, but some of the demographic data could not be used in the analysis, and some needed to be transformed in order to add those data to the linear model. Below is a summary of how each demographic variable was analyzed and the reasoning for why and how it was included in the multivariate linear regression model.

Age, Gender, Race, and Ethnicity

Age was entered into the regression directly because it was collected as an ordinal variable. Hispanic ethnicity was already a dichotomous variable and did not require any change. Gender was expressed in the model as male or female because the low number of individuals who did not choose male or female were excluded from this analysis. The variable of race was also not included because of the low number of participants who were not white. Thus, this study is unable to explore the effects of race or the perspectives of those who do not identify as male or female.

Political Identity

The survey contained four different questions to address participant political identity. However, only one of those questions was present on the survey for every population, due to the differences in age between populations. All three study populations were asked to indicate their political affiliation with the options of "Republican", "Independent", "Democrat", "Other" or "I don't know". We assumed that enough students over the age of 12 would identify with one of these categories that we could draw some inferences from political identity data. For the youngest of the participants, we expect that some of them may simply be identifying as they know their family or community members would identify, but that is likely how their own political identity would also be formed, at least at this young age. Older participants at the college level were also asked three additional questions that were presumed not age appropriate for the younger participants. College students were asked to indicate their political ideology regarding social issues, with the answer choice options of "conservative", "moderate", or "liberal". They were also asked to indicate their political ideology regarding economic

issues, with the same answer choice options. Last, college students were asked to indicate the extent to which their own political ideology was more or less conservative than their parents, on a 5-point scale from “much less politically conservative” to “much more politically conservative”.

When the political party affiliation question responses were compared to scores for pro-environmental behavior using a one-way ANOVA test, there is a significant relationship ($p<0.0001$). A bar graph of these data, excluding the “I don’t know” and “Other” responses, indicates that those who identify as “Democrat” have the highest pro-environmental behavior, followed by Independents in the middle, and Republicans with the lowest pro-environmental behavior. When adding this variable to the multivariate linear regression model, participants who chose any answer other than “Republican”, “Democrat”, or “Independent” for political party affiliation were excluded from the analysis. This was done in order to not exclude independents, but also not emphasize them in the analysis because independent is a broad category including liberal, conservative, and moderate groups. Also, dividing in this way resulted in two groups with a larger sample size (68 Republican and 77 Non-Republican). This is supported by comparing the mean pro-environmental behavior scores of these groups (Figure 4.7), which shows that the pro-environmental behavior mean for Independents is closer to the Democrat mean than the Republican mean. Thus, the data were divided into “Republican” and “Not Republican” categories, which pools Democrats and Independents together. The “Republican” variable was added to the model as Republican = 1, and Non-Republican = 0.

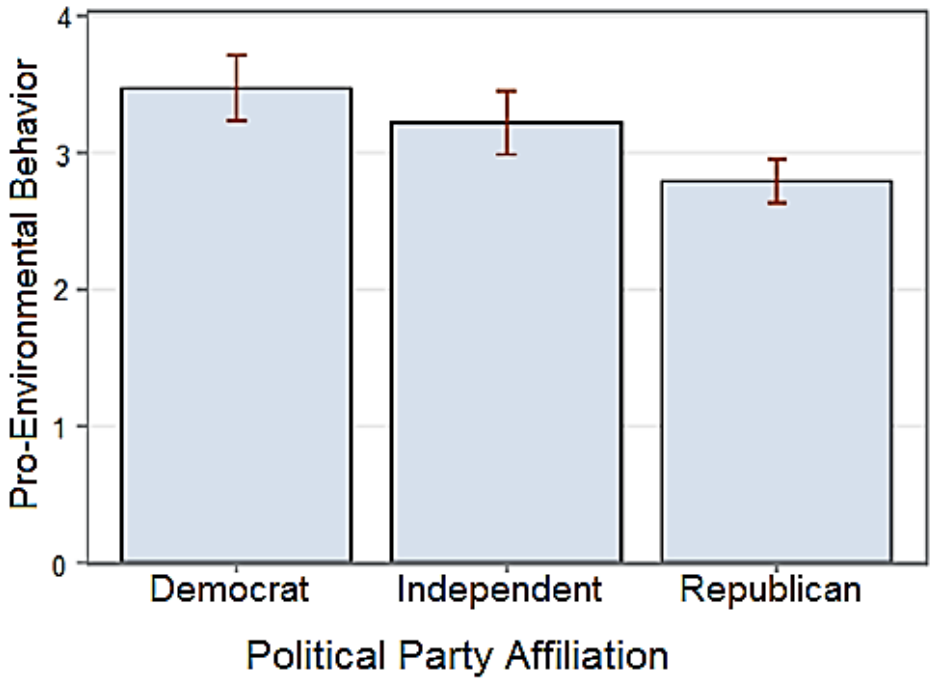


Figure 4.7. Relationship between Political Party Affiliation and Pro-Environmental Behavior. Error bars represent a 95% confidence interval.

Political ideology regarding social issues and political ideology regarding economic issues were both significant when compared to pro-environmental behavior using a one-way ANOVA test (P = 0.004 and P = 0.017, respectively, N = 93 for both tests). In both cases, the mean pro-environmental behavior score is highest for those who identify as liberal and lowest for those who identify as conservative. Participants who indicated that they are somewhat less politically conservative or much less politically conservative than their parents had slightly higher pro-environmental behavior scores than those who indicated that they were somewhat more politically conservative than their parents or shared political views that were more or less the same as their parents (P = 0.05, N = 96). Interestingly, none of the 96 respondents indicated that they were much more politically conservative than their parents. All of these political identity questions

demonstrate a tension between having a politically conservative or Republican political identity and pro-environmental behavior.

Collecting additional data on the older Missouri population allowed for additional insights into the political identities of the population in general, especially when comparing responses to the political party question with responses to the ideology questions. Only 55 of the participants in the college population chose a political party, with 31 Republicans, 13 Independents, and 11 Democrats. The remaining 45 either chose "Other" or "I don't know" or did not answer the question. In the "Other" category, three participants wrote in "Libertarian", and there was one occurrence of each of the following: "politically unaffiliated liberal", "no party affiliation", "anarchist", "democratic socialist", and "issue-by-issue". This is also the part of the survey that had the most unsolicited notes written in the margins, as if participants wanted to make sure the reader knows that they do not identify with the options provided. For example, "neutral in all political and government matters", "government will lead to our downfall", "not into politics" and "conservative but geez not a radical nutcase that believes everything that supports my views" were written into the margins of four different surveys.

Conversely, 93 of the 100 participants responded to both political ideology questions. There were 27 conservatives, 47 moderates, and 19 liberals regarding social issues. There were 30 conservatives, 43 moderates, and 20 liberals regarding economic issues. Based on these data, it appears that there are a substantial number of politically moderate youth who do not identify with a particular political party. Also, more participants identified as "liberal" than "Democrat", but the same pattern is not seen with

conservatives and Republicans. It is possible that conservative, moderate, or liberal ideology is a better measure of political identity for the youth in this study. However, political party affiliation was the only political identity measurement collected for all participants, including the younger West Virginia and Kansas populations. Thus, only the political party affiliation question was added to the multivariate linear regression to avoid reducing the sample size of the overall model.

Geographic Region

On the survey, participants were able to self-identify as rural, urban, or suburban, and also provided their zip code so that we could determine their geographic region in other ways, if needed. While analyzing the data, we quickly noticed that participants from the same zip code often self-identified differently, with one seeing their zip code as "urban", for example, while others saw the same zip code as "suburban". We also recognize that "rural" may not have the same meaning in Kansas as it does in West Virginia. Due to the subjective and relative nature of these terms, we used the zip code for each participant and entered it into a database to indicate whether the US Census Bureau considers that zip code to be an "urbanized area", an "urban cluster", or a rural area. These distinctions varied widely from how one self-identified, especially across states. For example, many Missourians who saw themselves as rural are considered to be in "urban clusters" and many West Virginians who saw themselves as suburban are considered "urban" by Census Bureau standards (Figure 4.8).

One-way ANOVA tests were used to examine the relationship between geographic region and pro-environmental behavior. The relationship is not significant regardless of whether self-identified or Census Bureau definitions are used ($p = 0.23$ for

self-identified; p = 0.2419 for US Census Bureau definition). However, it is possible that a more nuanced way of classifying rural identity is necessary to truly explore the influence of this variable. We were interested in determining whether the variable was significant when part of a multivariate analysis, so we changed it to a dichotomous variable and added it to the model. When viewing the mean scores for pro-environmental behavior for urban, urban cluster, and rural participants, urban cluster and rural are more similar (Figure 4.9). Thus, urban cluster and rural were pooled in the "Rural" category for this analysis, with urban individuals in the "Non-Rural" category. The "Rural" variable was added to the model as Rural = 1 and Non-Rural = 0.

Socioeconomic Status

Survey questions for socioeconomic status (SES) were obtained from the National Center for Educational Statistics, which asks five different questions to indirectly determine socioeconomic status. Participants are asked to indicate how many books are in their home, with increasing categories that count on a 1 – 4 scale, whether they have a computer at home (0 = no, 1 = yes), whether they have a list of up to 5 different appliances in their home, the level of their father's education using Likert-style questions from 1 – 4, and the level of their mother's education from 1 – 4. All of these responses are totaled, with possible totals ranging from 0 – 18. In order to analyze these data using a t-test, participant responses were categorized into low, medium, and high. The National Center for Educational Statistics categorizes low as a score of 0 - 5, medium as 6 - 13, and high as 14 - 18.

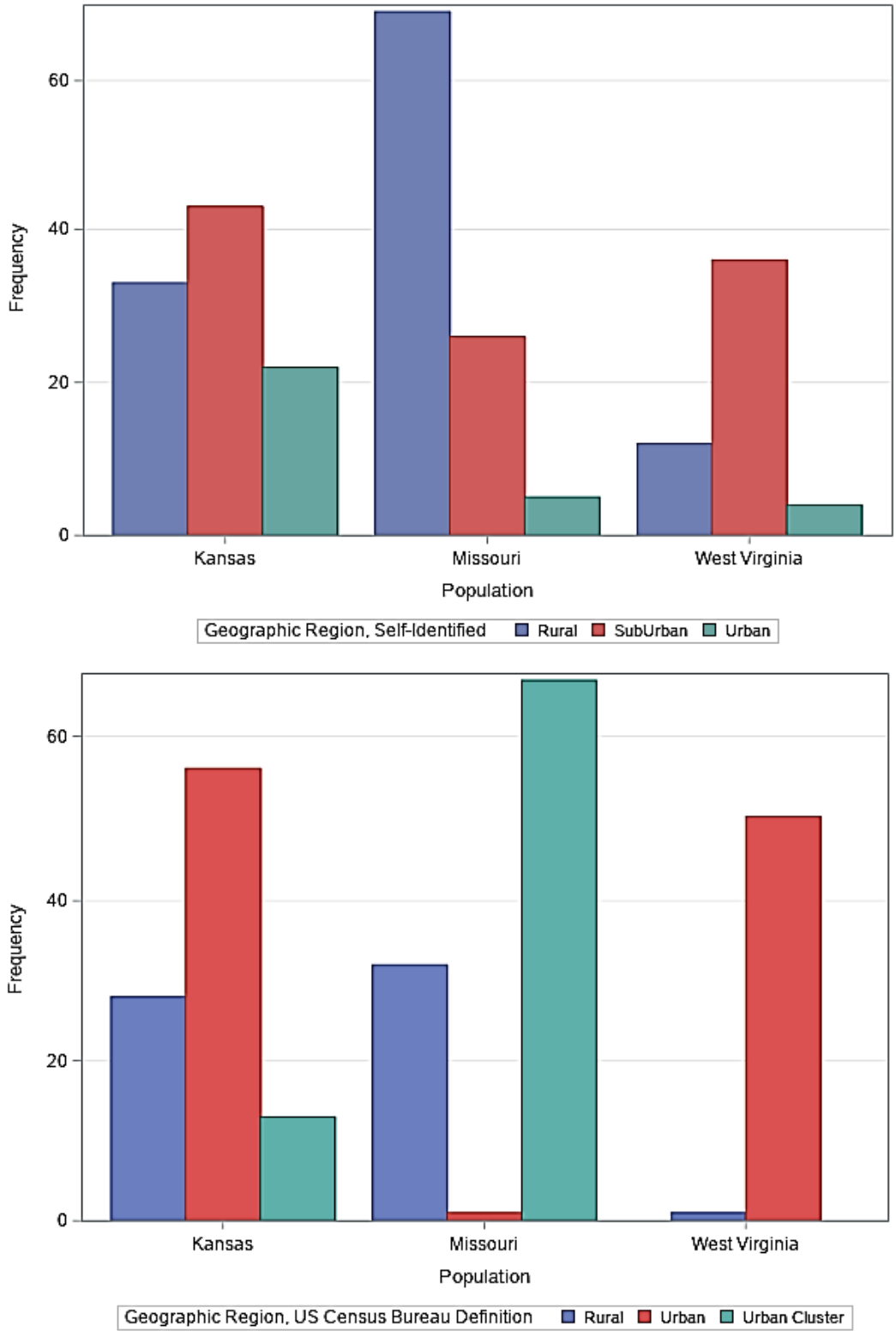


Figure 4.8. Geographic Region by Population (State) According to US Census Bureau versus Participant Self-Identification.

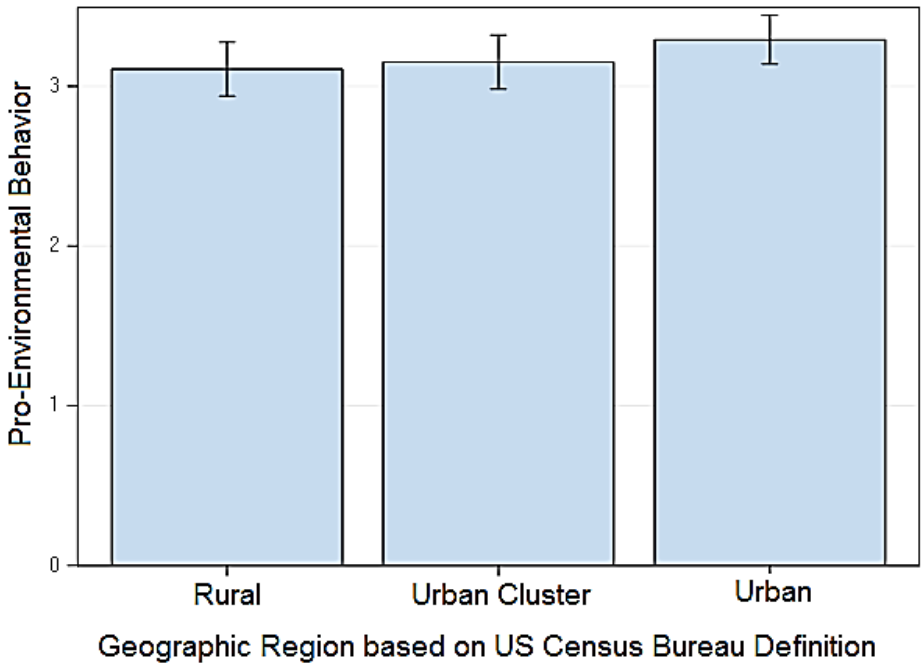


Figure 4.9. Relationship between Pro-Environmental Behavior and Geographic Region, as Defined by the US Census Bureau. Error bars represent a 95% confidence interval.

None of the participants in this study scored below a 5 (Figure 4.10), so scores were placed into medium and high categories. A t-test that compared the two categories shows no significant difference in their Pro-Environmental Behavior, due to a p-value of 0.4260 (Figure 4.11). However, it is possible that differences would be observable if there were respondents with low socioeconomic status. The lack of respondents with low socioeconomic status is a limitation of this study and prevents us from making inferences regarding the influence of this variable.

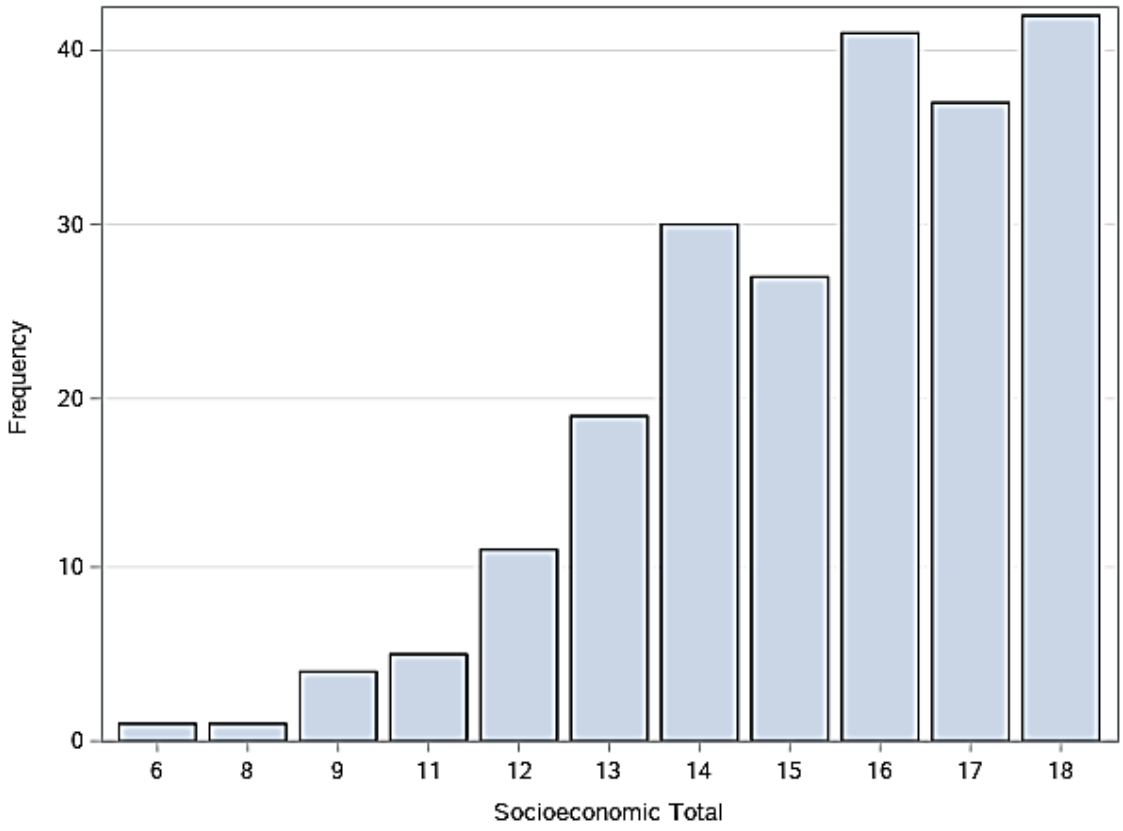


Figure 4.10. Frequency of Socioeconomic Totals. Socioeconomic total is a count of responses to questions regarding number of books in the home (1-4), computer in the home (0-1), amenities in the home (0-5), mother schooling (1-4) and father schooling (1-4) up to a total of 18 maximum.

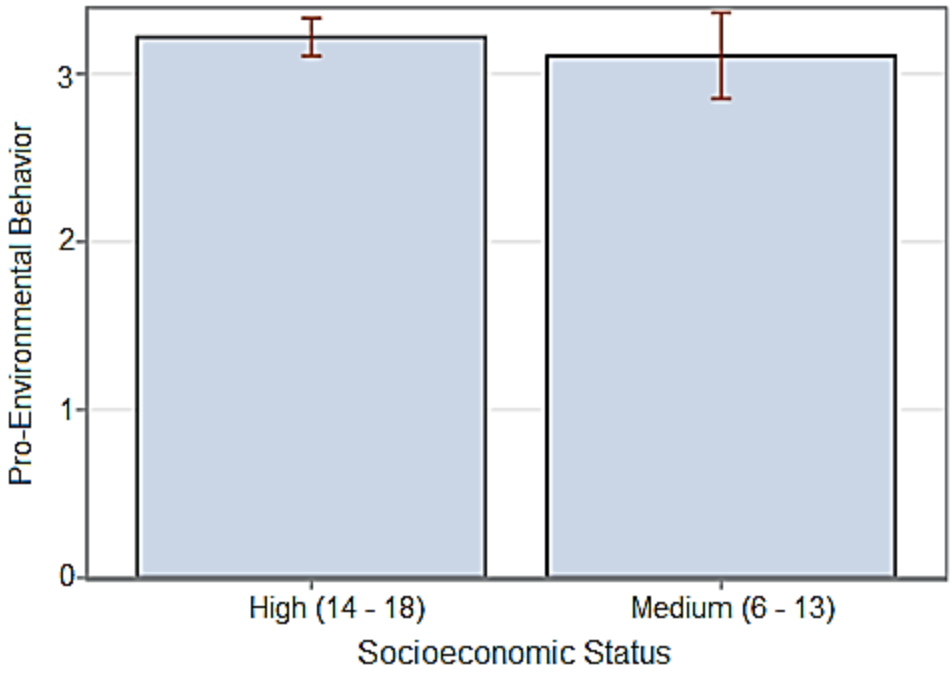


Figure 4.11. Relationship between Socioeconomic Status and Pro-Environmental Behavior (p = 0.4260, N = 217)

Socioeconomic status was not added to the multivariate linear regression model because a large number of participants skipped or answered "do not know" to one or more of the socioeconomic status questions. Thus, we could not calculate an overall SES score for many participants. Including this variable in the model would have greatly reduced the sample size of the overall regression.

Academic Major

The study population of college-age students were asked some additional questions regarding their education that were not relevant or appropriate for the younger populations. These were not added to the multivariate linear regression model because they would greatly reduce the overall sample size. However, the results are of interest

when interpreting the results from the overall study. College students were asked to indicate the number of years that they had been in college and their academic major. While number of years in college did not have a significant relationship with pro-environmental behavior when analyzed using a one-way ANOVA test (p= 0.30), there was a significant relationship between academic major and pro-environmental behavior (p = 0.008) When comparing the pro-environmental behavior score means for those in each academic major, it is evident that Biology majors had the highest pro-environmental behavior and Agriculture majors had the lowest pro-environmental behavior (Figure 4.12). Results from this analysis indicate that differences in the experiences, knowledge, attitudes, identities, or interests of students in various major tracks may lead to differences in pro-environmental behavior.

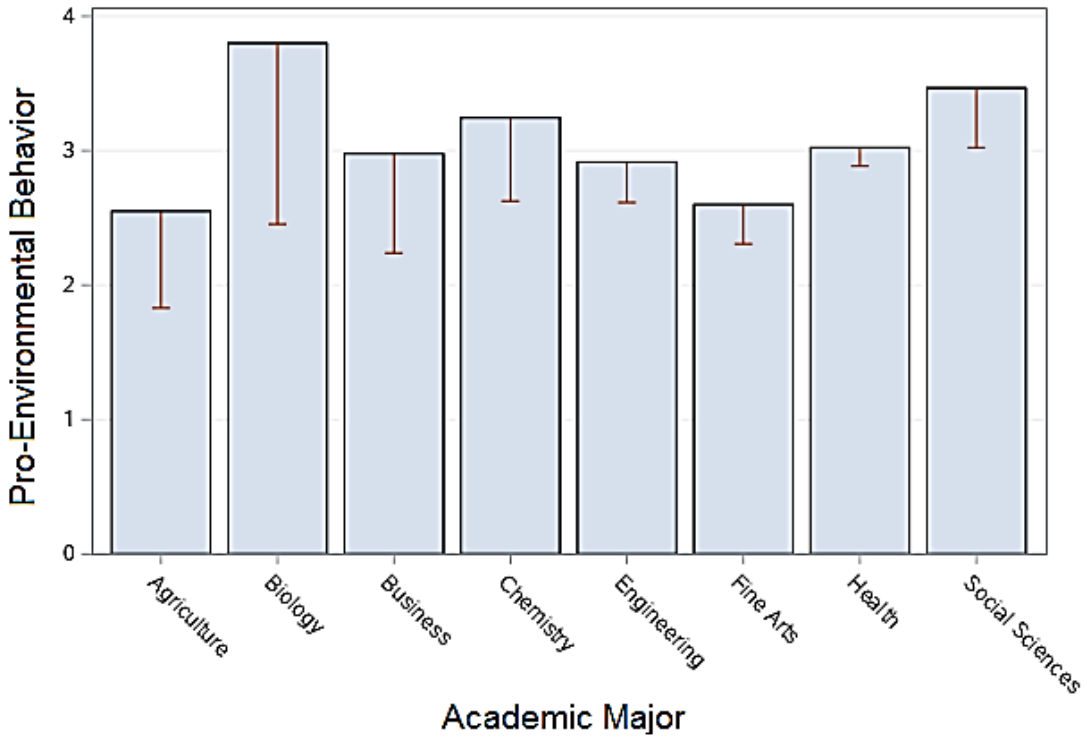


Figure 4.12. Relationship between Academic Major and Pro-Environmental Behavior.

Results of the Multivariate Linear Regression Model

After analyzing the influence of each variable using univariate methods, we build the multivariate linear regression model. Other than the six mean categories, we included age, geographic region based on the Census Bureau definition (Rural = 1), political identity (Republican = 1), gender (Female = 1), and Hispanic ethnicity (Hispanic Ethinicity = 1) in the multivariate linear regression. The results (Table 4.5) indicate that the model is significant ($p < 0.0001$) and that the independent variables included explain 50.52% of the variation in pro-environmental behavior, as projected by the model. The adjusted R^2 of 0.51 is used because this is a multivariate analysis. The Slope of Relationship column (Table 4.5) provides information regarding the extent and direction of the relationship of each variable to pro-environmental behavior, the standard error for that relationship, the significance of that relationship (t and p-value), the relative importance of each variable (Standardized Estimate), and the potential for collinearity (Variance Inflation). The values returned indicate that only political identity ($p < 0.0001$), environmental identity ($p < 0.0001$), STEM interest ($p < 0.0001$), and environmental science capital ($p = 0.0126$) are significant contributors to the model.

Standardized estimates show that the greatest contribution comes from STEM interest (0.308) then environmental identity (0.28844), then political identity (-0.20163), and environmental science capital (0.157). Note that the relationships are positive for environmental identity, STEM interest, and environmental science capital but negative for political party affiliation. This means that as environmental identity, STEM interest, and environmental science capital increase, so does pro-environmental behavior.

Table 4.5.

Results of Multivariate Linear Regression Model

Variable	Slope of Relationship	Standard Error	t Value	p-Value	Standardized Estimate	Variance Inflation Factor
Intercept	0.65663	0.42248	1.55	0.1215	0	0
Age	-0.0393	0.0214	-1.84	0.0677	-0.10974	1.67981
Gender	0.01169	0.07286	0.16	0.8727	0.00788	1.13478
Hispanic Ethnicity	-0.16952	0.12498	-1.36	0.1764	-0.06421	1.05401
Political Identity	-0.33052	0.0817	-4.05	<.0001	-0.20163	1.16829
Geographic Region*	0.0027	0.09311	0.03	0.9768	0.0018	1.815
Connectedness to Nature	-0.06082	0.05326	-1.14	0.2548	-0.06259	1.4131
Environmental Identity	0.30555	0.07274	4.2	<.0001	0.28844	2.21752
STEM Interest	0.37846	0.07646	4.95	<.0001	0.308	1.82126
Environmental Science Capital	0.19719	0.07839	2.52	0.0126	0.157	1.83206
Role Models	0.02236	0.04593	0.49	0.6269	0.02569	1.30968
Meaningful Nature Experiences	0.08157	0.07448	1.1	0.2746	0.06845	1.83681

*Note: Geographic region uses the US Census Bureau definition of “rural”.

However, being Republican results in lower pro-environmental behavior than not being Republican. Variance Inflation values are low, indicating that interaction effects are not a problem in this model.

The plot of observed by predicted values also shows a good fit between the model and the data (Figure 4.13). The assumptions of normality and constant variance are met,

as shown by a lack of homoscedasticity in the residual plots, and the presence of a normal distribution in the Q-Q plot and residual distribution plot. Compared to results of univariate analyses, the importance of environmental identity, STEM interest, and environmental science capital are confirmed by this model, while the connectedness to nature scale, role model and meaningful nature experience variables are no longer significant. Those three variables lost their significance when included in the multivariate model. This is not surprising as these were the three independent variables with the lowest R^2 values when analyzed individually (Table 4.3). Their individual significance could have been due to slight interactions with other variables in the model, rather than having a direct effect on their own.

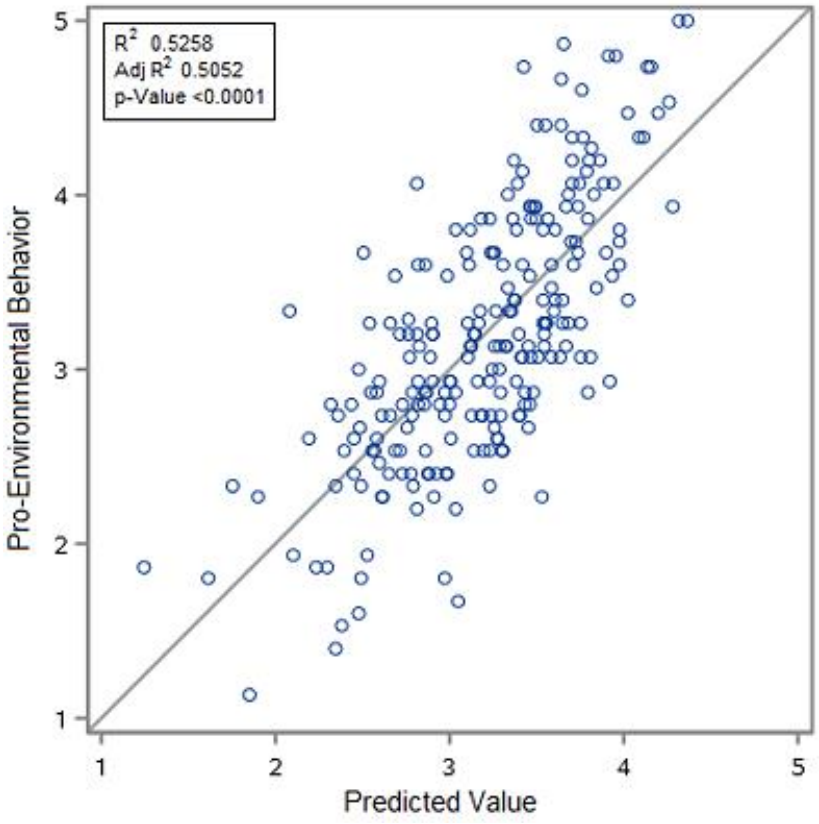


Figure 4.13. Observed versus Predicted Values from Multivariate Linear Model.

Meaningful Nature Experiences

Meaningful nature experiences and role models did not appear to be important contributors to the model, but that may be due to the way that these variables were measured. Unlike the other independent variables that assessed attitudes or values by asking participants to rank their agreement with a set of statements, the questions that make up these variables were written with the specific intent to compare to previous studies. For example, the meaningful nature experiences questions involved a list of activities (exploring the outdoors alone, time spent working with animals, learning about the environment in school, etc.) and participants were asked to rank how important those activities were in influencing their feeling of connectedness to nature. The initial intent was to determine which experiences were most important to participants, and not to create a mean score for a construct that would be put into a multivariate linear regression model. Individuals with a high mean score in the overall meaningful nature experiences category have had many different types of experiences that they deem important. Comparatively, someone who has had a few very important experiences would have a low overall score in this category, but those few types of experiences might have influenced them just as much as the many types of experiences influenced the person with a high meaningful nature experiences score. Thus, this question is more useful for characterizing what experiences are important rather than describing the extent of one's meaningful experiences in nature as a broader construct.

Although the meaningful nature experiences mean was not a significant contributor to the model, most of the individual questions had significant relationships with pro-environmental behavior. When analyzed using one-way ANOVA tests, most

experiences had statistically significant relationships with pro-environmental behavior. Individual survey items that do not show a statistically significant relationship with pro-environmental behavior were directly related to hunting and fishing. Specifically, hunting with others (MNE 11), hunting alone (MNE12), and fishing alone (MNE 14) did not have significant relationships with pro-environmental behavior but fishing with others (MNE 13) did show a significant relationship.

This was very surprising as earlier studies linked hunting and fishing to antecedents of pro-environmental behavior (Peterson, 1982). In our own survey, 35 written answers given by participants specifically mentioned hunting and fishing as meaningful nature experiences. For these reasons, it seems these archetypical rural activities deserved further analysis. To analyze whether there was a specific relationship between these experiences and pro-environmental behavior, analysis of variance was conducted after the data was adjusted using an indicator variable for hunting and fishing. Respondents were given a "1" if their answers to any of the four hunting and fishing questions were either a "4" (important) or "5" (very important). Other responses were coded as a zero. A category of "ALL" was created for those who had a "1" for all four questions and a category of "BOTH" was created if they only indicated importance for hunting and fishing while with others.

From our respondents, people who fish showed higher environmental science capital (ESC) means, connectedness to nature (CNS), and science identity than those who did not fish. (Table 4.6) The ESC mean for those participants that hunt or both hunt and fish was higher than for those who did not participate in these activities. The CNS mean was also significantly higher for those who fish and the subset of those that fish and hunt,

either alone or with others. The Science Identity mean was significantly higher for those that fish as well as those who both hunt and fish, but not for those that only responded with hunting.

Another surprising result is the gender of those respondents who indicate hunting and fishing is an important activity. More females than males (52%) indicated that fishing (with others) was an important or very important meaningful experience. Females accounted for 49% of those who viewed fishing alone as a meaningful nature experience. Indeed, 38% of all those who found both hunting and fishing a meaningful nature experience were female. The research of Stedmen & Heberlein (2001) indicated that rural upbringings can foster an increase in hunting, especially for males, but females in our study valued hunting with others (39%) or by themselves (38%) as important experiences.

These numbers are startling when compared to the nationwide number of females that fish and hunt. Of the subset of Americans that fish, 27% are female. (USFWS, 2016) Of the subset of Americans that hunt, only 10% are female (USFWS, 2016). Even more restrictive is that only 7% of all females in the U.S. fish and only 1% of all females hunt. (USFWS, 2016). In this context, the fact that 52% of our respondents who value fishing and 39% of those who value hunting as a meaningful experience (39%) were female is unexpected.

The higher than normal percentage of female fisherpeople may explain why the category of fishing with others (MNE 13) initially showed a significant relationship with PEB. Females tend to display more pro-environmental behavior and report stronger environmental attitudes and concern than men (Meyer, 2015; Blocker & Eckberg, 1997;

Uitto & Saloranta, 2010). There may also be traits that are associated with fishing that are different from those associated with hunting that leads to this difference in PEB.

The non-significant correlation between hunting and PEB might reflect the more anthropocentric view that many rural residents possess. Often rural residents see the environment as existing to fulfill their human needs (anthropocentric view) and do not put the needs of the environment above their human needs (ecocentric view)(Bjerke &Kaltenborn, 1999; Ruawald & Moore, 2002; Huddart-kennedy, Beckley, McFarlane, & Nadeau, 2009). The new environmental paradigm (NEP) developed by Dunlap &Van Liere, (1978) taps "primitive beliefs" about the nature of the earth and humanity's place in it making it an accepted measurement of the ecocentric view (Dunlap, Van Liere, Mertig & Jones, 2000). Using the NEP instead of the connectedness to nature scale may have yielded a different correlation or made clear that anthropocentric views were an important reason why hunters did not have high PEB.

Role Models

The role model questions on the survey were designed to assess which role models are most important to the participants and what qualities those role models possess. This causes a similar issue to that described above with meaningful nature experiences, in which a high mean score denotes that the person has many types of role models that they deem important, not that role models were important in forming their values and attitudes in general. So this variable also does not provide a useful averaged value. However, responses to these questions demonstrated that fathers/stepfathers were the most important role models, with the highest mean of 3.98.

Table 4.6

P-values for ANOVA analysis of Hunting and Fishing Questions regarding Meaningful Nature Experiences

Variable	CNS Mean	ESC Mean	STEM Identity
Hunting w/others	0.4555	.0002	0.1001
Fishing w/others	0.0072	<.0001	0.0130
BOTH Hunting and Fishing w/ Others	0.0872	<.0001	0.0275
Hunting Alone	0.3748	0.0028	0.1452
Fishing Alone	0.0535	0.0007	0.0105
ALL Hunting and Fishing with others or alone	0.0142	0.0001	0.0028

However, mother/step-mother was not far behind with a mean of 3.85. After that, the following role models' mean rating of importance from highest to lowest is: female teacher (3.68), female friend (3.57), male friend (3.55), male teacher (3.47), other male relative (3.32), other female relative (3.18), other unrelated known male (2.92), other unrelated known female (2.84), public male figure (2.72) and public female figure (2.45). For traits of role models, friendly/personable had the highest mean of 4.45 and knowledgeable had the lowest mean of 4.03.

Phase II: Qualitative Data Analysis

The goal of the qualitative phase of this mixed methods study was to build upon the quantitative findings for a greater depth of understanding. Qualitative data were obtained through open-ended questions on the quantitative survey and qualitative focus

group discussions. Since previous research studies show meaningful nature experiences and role models as significant predictors of pro-environment behavior, these were the variables the open-ended questions addressed on the quantitative survey. The open-ended questions were:

Open-Ended Survey Questions

1. Which of your experiences has been most meaningful? What about it was so meaningful?
2. If you stated that an unrelated adult who you know personally or a public figure who you do NOT know personally was an important influence on your connectedness to nature, who were you referring to?
3. Of all the role models who have influenced your connectedness to nature, which role models would you consider to be the most important?

This initial focus on meaningful nature experiences and role models in the open-ended portion of the survey helped to characterize the lived experiences of our participants. However, our focus shifted to environmental identity and STEM interest for the qualitative focus groups. This shift was necessary because environmental identity and STEM interest were the most important variables in our multivariate analysis, yet we had not yet directly collected qualitative data on these variables. Thus, qualitative focus group discussions were conducted to obtain more details regarding the participants' environmental identity, pro-environmental behavior, and how they believe their club and/or science course has influenced their pro-environmental behavior.

While a focus group protocol and questions were developed (Appendix C), researchers asked questions and follow up/probing questions depending on the

participants' flow of conversations. This allowed the participants to lead the discussion. However, some questions were asked in all focus group discussions to examine similarities and differences among groups. Participants were also asked to answer certain questions individually to allow for time for self-reflection without the influence of their friends and peers. Researchers followed up with these questions during the group discussion to gain further insight. These questions were:

Opening Focus Group Questions

1. What is your very favorite thing to do when you think about playing in the outdoors and nature?
2. Is there someone you enjoy spending time with outdoors and/or in nature? Who and why?
3. Do you consider yourself:
    a. A "science" person? Yes ____ No ____
    b. An "outdoors" person? Yes ___ No ____
    c. A "nature" person? Yes ____ No ____
    d. An "Environmentalist?" Yes ___ No ____
    e. Why or why not?
4. Has this club/course helped you with taking actions for the environment (recycling, trash pick-up, voting, public support, etc.)?
5. Do you feel more confident to tackle environmental problems after participating in (name of club/course)? What about (club/course) made you feel more comfortable?

Four different focus groups were conducted: the Spring Mills High School Science Club, the 4H Animal Science Club, the Colgan/St Mary's ECO-Meet Team, and the East Central College Introduction to Animal Science course. Details about each focus group are provided below.

Spring Mills High School Science Club

This focus group occurred on Monday, February 25th at Spring Mills High School with their Science Club**.** Eight out of the fifteen students enrolled in Science Club participated in the focus group. The focus group lasted approximately an hour. The first half of the focus group involved the collection of written responses assessing certain facets of the participants' science identity.

4H Animal Science Club

This focus group occurred on Friday, March 15, 2019 at the Shepherd's Whey Farm in Berkeley County, West Virginia. The focus group lasted approximately an hour. The first half of the focus group involved the collection of written responses assessing certain facets of the participants' science identity.

Colgan St. Mary's High School ECO-Meet Team

This focus group took place on March 20, 2019 in the conference room at Colgan/St. Mary's High School in Pittsburg, Kansas. Nine of the 12 students that returned surveys participated in the focus group which lasted approximately one hour. Participants began by writing down answers to several questions regarding their time outdoors and how they view their science identity.

East Central College Introduction to Animal Science Class

This focus group took place on Monday, April 8th, 2019 in the regular classroom meeting location for the Introduction to Animal Science course at East Central College. Ten students took part in the focus group, which lasted approximately one hour.

Participants began by writing down answers to several questions regarding their time outdoors and how they view their science identity.

Qualitative Findings

Participant responses from both open-ended questions from quantitative survey and qualitative focus group discussions were compiled in one shared document. From that document, researchers sorted responses using the research variables (connectedness to nature, meaningful nature experiences, role models, STEM interest, environmental identity, environmental science capital and pro-environmental behavior) as broad categories. Once responses were sorted, each researcher identified patterns and themes from participant responses. Themes were communicated and agreed upon between researchers to gain inter-coder agreement. Sixteen themes were identified and described below along with representative quotes. A short table of themes is provided in this chapter (Table 4.7) and a full table with themes and quotes can be found in Appendix F. The study populations were chosen based on the assumption that individuals who participate in science or environmental clubs or courses would exhibit high levels of environmental science capital. This was evident in many of the responses regarding their day-to-day interactions with science and the environment and certain experiences that not all youth can access. In general, the participants have access to environmental clubs, learning experiences inside and outside of the classroom, and environmental media, all of which were cited by the participants as important.

Table 4.7

List of Themes from Qualitative Analysis

Theme One
Environmental clubs, learning experiences, and media can provide a social avenue for building environmental science capital.
Theme Two
Outdoor recreation, working outdoors and/or with animals, and solitary experiences tend to connect participants with nature.
Theme Three
Participants often exhibit awareness of environmental problems, yet engagement in pro-environmental behavior is lacking or limited to individual actions.
Theme Four
Participants tend to lack environmental identity or experience conflicts related to their environmental identity.

Theme 1: Environmental clubs, learning experiences, and media can provide a social avenue for building environmental science capital.

When asked about their most meaningful experiences, participants often mentioned the clubs or groups in which they participate, inside or outside of school. For example, an ECO – Meet participant from Goddard High School alluded to the importance of being a contributing member of the ECO-Meet team at their school.

> Just being able to contribute to the ECO-Meet team. Making stronger bonds with friends, old and new.

Boy and Girl Scouts were specifically called out by many participants as being particularly meaningful. One member of the Riley County High School ECO-Meet team

described how experiences as a Boy Scout were impactful because of the social experience and memories formed with others.

> Boy Scouts has been pretty impactful and I think spending time in outdoor areas with my friends falls into that. The memories you gain with that is what makes it important.

Another ECO-Meet participant from Shawnee Mission North High School suggested meaningful experiences is just implied with being a Boy Scout.

> Being an eagle scout. I think enough is said there.

Environmental clubs provide significant learning experiences. In fact, participants frequently described certain experiences as meaningful simply because of their educational value. While it was not surprising that participants enjoyed these experiences, it was surprising how often educational (rather than recreational) experiences were mentioned. Some participants, such as an ECO-Meet participant from Shawnee Mission North High School identified their innate love of learning as the catalyst for their meaningful experiences.

> I don't think there's been any one thing. I'm naturally very curious and I love learning. Science is always changing, so there's constantly something new to learn. I also grew up appreciating the small details of nature.

One ECO-Meet participant from Manhattan High School mentioned learning about environmental issues in school, partly because of the social aspect of learning alongside classmates. This sentiment was reflected in various other quotes regarding meaningful nature experiences.

> Learning about the environment in school. It was the most meaningful because we got to learn every aspect of environmental issues and got to learn with peers.

Sometimes, participants mentioned specific school field trips that were meaningful, such as the description of a Biology class field trip described by an ECO-Meet participant from Colgan/St. Mary's High School.

> Outdoor field trips with Biology class to go water wading in creeks. I got to spend time with friends and experience the beauty of God's work while learning more about the natural environment.

In addition to the day-to-day, hands-on exposure with environmental clubs and learning experiences, exposure to environmental media was also important for participants. Sometimes, media was mentioned as a meaningful experience.

> Books that I have read. This is meaningful because, for me, books allow me to envision a new and better world. Books allow for the world to be seen from another person's perspectives. This includes nature and the feelings surrounding it.

Other times, media had the effect of educating the participant on an environmental issue and inspiring them to care about the issue. An East Central College student in a Chemistry class described one such example regarding pollution.

> I believe the most meaningful experiences are seeing how humans have damaged the Earth with your own eyes. Reading about it vs. seeing it makes it feel so much more real. I had recently watched a movie and an underwater scene showed pollution and dumped cargo crates from boats. The pollution had little to do with the movie but it really made you think.

Sometimes, the environmental media was powerful enough to inspire participants to act. One East Central College student in an Animal Science class explained how environmental media inspired them to choose their career path.

> When I first saw the before and after of Antarctica's melting ice caps, my career was decided.

Social experiences, such as with clubs, are meaningful to participants because they can bond and form memories with others. Two participants from the Topeka Zoo ECO-Club share their thoughts on how outdoor experiences have become family traditions and that during these times, they feel present.

> Fishing and visiting zoos with my family, because both of those things have been kind of like traditions for my whole life and so I have strong connections to them.

> The most meaningful were the experiences with my friends and family because it is a time we can disconnect from technology and be in the moment.

Two participants from the East Central College Anatomy and Physiology class mentioned using time outdoors as a way to bond and build stronger relationships.

> Spending time in the outdoors with my family, because it brings us closer in our relationship with each other because we have all learned, experienced, and created memories concerning the same event.

> Spending time outdoors with friends and family. It is meaningful because it forms a bond by interacting with each other.

Theme 2: Outdoor recreation, working outdoors and/or with animals, and solitary experiences tend to connect participants with nature.

When recalling meaningful outdoor experiences, participants described both consumptive and non-consumptive types of outdoor recreation. As an example of a non-consumptive activity, a participant from East Central College Animal Science course explained how being outdoors benefits her well-being.

> The most important and meaningful experiences to me are the ones that keep you craving more. I love camping, sleeping on the ground in a tent because it's relaxing. I crave camping/hiking/anything outdoors. I have very low vitamin D so alongside taking vitamin D pills, something that helps me get along stress free is spending most of my time outdoors. To breathe fresh air in and feel nature swallowing you feels like a dream.

Along with non-consumptive recreational activities, participants also mentioned consumptive activities such as hunting and fishing. One participant from East Central College Anatomy and Physiology class mentioned the significance of providing for your family while also benefitting wildlife.

> Hunting with others; because you are taking from nature to feed your family while also allowing nature to flourish due to less overpopulation of animals.

Another East Central College Animal Science student relays how their childhood experiences and family influenced their connectedness to nature through hunting, working outdoors and fishing.

> Spending time hunting, working, and fishing outdoors alone and with family is what I feel has influenced my connectedness to nature the most. I've been outdoors all my life and was taught to sit back and enjoy/appreciate nature since I was young. Being out there gives you a sense of purpose in your life.

Participants described working outdoors and/or with animals as meaningful experiences that connect them to the environment. An ECO-Meet participant from Salina South High School mentioned how this started their interest in conservation.

> Time spent working with animals was the most meaningful to me because it sparked my passion for the environment. It started my interest in conservation and how I could do my part to help.

Another ECO-Meet participant from St. Xavier High School expressed their love for animals and how that love of animals inspired their career choice.

> Working outdoors and with animals because I love being outdoors and I love animals. I have a job where I work outside and we see a lot of wild animals. I love seeing these beautiful creatures.

Other participants just expressed the intrinsic appreciation of animals. One West Virginia 4H Animal Science member happily exclaimed her joy of taking care of animals.

> Taking care of goats, dogs and cats. That's my life!

When analyzing participant responses, we noticed that both the solitary and social aspects of these experiences are important. Some experiences are more meaningful when they occur alone, and some are more meaningful when shared with others. Further, participants describe the different benefits gained from solitary experiences versus those that occur with others.

Although there has been a focus on friends and family with prior research on connectedness to nature, many participants described solitary experiences as being meaningful. An East Central College student describes a sense of calmness and belonging when spending time alone in nature.

> Going on a hike and then fishing by myself was probably most meaningful. Walking through the woods to the pond was a unique experience for me. There were no sounds except for my footsteps and the birds. It made me feel calm and like I belonged there.

An ECO-Meet participant from Shawnee Mission South High School agrees by adding that the connection to nature is deeper and more personal when experienced alone.

> Spending time outdoors alone is a great way to connect to nature on a deeper and more personal level.

Some participants mentioned they enjoyed spending time outdoors alone to disconnect from "life" and reconnect to nature. A Spring Mills Hill School student in West Virginia mentioned being able to enjoy the beauty of nature without distractions.

> Spending time outdoors alone has made me feel very connected to nature because it's nothing but me and my surroundings. There is no distractions to take me away from the beauty of nature.

Another student from the Colgan/St. Mary's High School ECO-Meet team shared that same sentiment of being able to de-stress and disconnect.

> Time spent outdoors while alone has allowed me to particularly examine the world around me without thinking of other needless stress. It is primarily a disconnecting experience.

Although many of the nature experiences described by participants are regular occurrences in their lives, sometimes participants described unique or awe-inspiring experiences that brought them closer to nature or changed their perspective. Some participants described experiences that may seem mundane but had quite an impact.

> When I was little my cousins and I would pick up toads to look at them.

> I have had a baby bird 'fly' out of its nest and land on me ...TWICE! Once a baby cardinal and once a baby Robin. It showed me up close the true beauty of nature. It demands respect, but also unity with all creation.

In contrast, some participants mentioned experiences in faraway locations and/or exotic wildlife.

> I have been to Puerto Rico and was able to see the rainforest and several other awesome places that made me fall in love with the outdoors.

> Yellowstone and seeing the geysers. And buffalo that stop traffic.

Theme 3: Participants often exhibit awareness of environmental problems, yet engagement in pro-environmental behavior is lacking or limited to individual actions.

It is clear that participants have positive feelings toward nature and the environment. Numerous participant responses also indicated that participants generally have an awareness of environmental issues and are inspired to act on those issues. One participant noted that change begins with awareness while another participant states how small actions add up. Both quotes are from Colgan/St. Mary's High School students.

> After seeing all the trash in the environment, you start to hear the stories about pollution everywhere. That awareness is where change starts.

> I think being in ECO-Meet/Science club has helped me because now I'm more aware of how much the environment and all organisms that live within are affected by our careless actions, and that my small steps to help do amount to something.

Some participants mentioned that tackling these environmental issues as a group made them feel more confident. For example, a Spring Mills High School student contributes school and peer support for this increased self-efficacy.

> I feel more able to confront environmental problems when supported by friends and school organization.

Despite this apparent motivation to act, participant responses often indicated a lack of engagement with pro-environmental behavior. However, when participants did describe their pro-environmental behavior, it was usually limited to individual actions opposed to collective actions. A participant from Spring Mills High School in West Virginia offers this list of her actions.

> I mainly follow the common advice: don't litter, reduce your energy, don't use plastic if you can, use degradable [items], reuse things, etc.

Theme 4: Participants tend to lack environmental identity or experience conflicts related to their environmental identity

Given the populations studied and their exposure to science clubs, science courses, and day-to-day exposure to science, it is no surprise that participants in this study indicated science identity and relevancy. Qualitative results confirmed this initial assumption. One East Central College student in an Animal Science course explained why they are a science person during the focus group interview.

> I'm a science person because I always ask why, how, what, who and when. I love learning about our world and hopefully how to make a difference and sharing humanity's ecological footprint.

A participant from Spring Mills High School in West Virginia mentioned that science is important because of its relevance to society.

> I'm interested in science because it helps other people.

This sentiment was echoed in the statement of another East Central College Animal Science student.

> The more you examine an object's state, makeup, and origins, the more complex it becomes. Science is the most powerful tool humanity has at its disposal.

Another participant from Spring Mills High School acknowledges that science and technology is relevant even beyond a science career.

> I'm not interested in a science job but using science and technology within my job.

Although science, in general, seems to be accessible to the population in this study, and participants seem to be pro-science, we were especially interested in *environmental* science and whether attitudes and behaviors toward the environment are influenced by archetypal "rural" experiences. Open-ended survey responses revealed the importance of outdoor recreation and working outside and/or with animals to the study participants.

These findings highlight the gap between pro-environmental attitudes and collective pro-environmental behavior in this population. Although this gap could exist for a multitude of reasons, one potential reason stands out in participant responses in this study. Participants often indicated that they lack an environmental identity or that their environmental identity exists in tension with the other identities that they hold. Two East Central College students offer reasons as why they do not identify as environmentalists.

> I don't practice any rituals that are environmentally friendly. I believe we should all get on board to help the planet but I don't actively recycle or anything like that.

> I do not see myself as an environmentalist, simply because it is not my main priority all the time. I do things that help the environment, but I do a

lot of things that hurt it too.

One participant from Spring Mills High School suggested that advocacy is a part of being an environmentalist.

> I don't consider myself an environmentalist because while I don't do harmful things to the environment, I don't often speak up about environmental issues to other people.

One participant from East Central College student even expressed a rather anti-environmentalist sentiment.

> I'd say I'd probably take diesel trucks and cow farts over being subconsciously nervous about the environment.

This lack of environmental identity exists despite a generally high level of science identity. Thus, the two types of identities have different meanings for participants. We learned more about these meanings by noticing the types of language that participants used to describe these identities, along with "outdoors" and "nature"-related identities. In the following themes, participants expand more on how they identify or not with being a: science person, outdoors person, nature person and environmentalist.

When participants described why they see themselves as being "science" people, they often described conventional traits of scientists that suggest "braininess." For example, one student from Spring Mills High School said he liked science because he was logical. A 4H Animal Science member said she saw herself as being a "science" person because she wants to know how things work and recalls the objective nature of science.

> I want to know why things work and facts versus opinions!

Other participants mentioned that they saw themselves as “science” people because they liked science activities such as experimenting and the challenges that come with those activities. The challenge with this conventional stereotype of scientist being “brainy” is that some participants don’t identify with “brainy” or “clever.” For example, one student expressed their frustration with participating in science.

> I don't because I am horrible at science and I think it takes me longer to understand it, either that or I was never taught it well. It stresses me out a bit and it’s hard for it to keep my focus long enough for me to understand it.

When describing themselves as “outdoors” people, participants described more active experiences such as camping, hiking and exploring. One participant from East Central College mentions their craving for the outdoors.

> I crave to be outdoors 24/7. When I'm inside all I can think about is going outside.
> Camping was mentioned often as a popular outdoor activity.

Both of these quotes are from members of the 4H Animal Science club, however, one participant evokes adventure by expressing overcoming fear.

> Me and my family go camping every year up and down the east coast.

> I like camping but I’m kind of afraid of camping!

Similar to an outdoors identity, participants also used action terms when describing environmentalists. However, participants framed these action terms around advocacy. Examples of these advocacy terms include: passionate, speak up, encourage, protect and responsibility. During the Spring Mills High School focus group, participants

discussed that they see themselves as “environmentalists” because they advocate behavior through their club.

> [Spring Mills Science Club] encourages us to use other options, such as eco-options as a consumer.
>
> Encourage family members such as not to waste water.

Another student recognizes that her Mom is an environmentalist due to her passion and that her Mom engages her daughter through conversations.

> Mom is passionate about it [environment] and talks to me.

When describing themselves as “nature” people, participants used words such as: beauty, art, peace, harmony and happiness as the enjoyable aspects of nature. One student from the Spring Mills High School explains that she is a “nature” person because she draws inspiration from nature for her art.

> I’m an artist and I get inspired by nature. I draw from it and how it makes people feel good.

Two other students from East Central College expand on this image of a “nature” identity as someone that values the “nurturing” concepts of nature such as harmony, peace of mind and internal happiness.

> Nothing is more beautiful than nature in complete harmony.
>
> Something about the outdoors brings me peace of mind and internal happiness.

CHAPTER 5: DISCUSSION

This chapter discusses the quantitative and qualitative results of this study within the context of environmental science capital and pro-environmental behavior. We present the major findings of this study and examine the ways in which the present study supports or contradicts the current literature on pro-environmental behavior in order to better understand the study populations. This chapter also addresses implications for educational practitioners, limitations of this study, and recommendations for future research. The findings of this study build upon the science capital research by helping to define and characterize the environmental science capital of rural youth.

Determinants of Pro-Environmental Behavior

This study explored how a variety of factors influence the pro-environmental behavior of rural American youth aged 13 - 22 who participate in environmental clubs, competitions, or courses. We assessed the determinants of pro-environmental behavior by surveying youth from Kansas, West Virginia, and Missouri and measuring pro-environmental behavior, STEM interest, environmental identity, socioeconomic status, political identity, geographic region, role models, meaningful nature experiences, and connectedness to nature. Multivariate linear regression analysis indicated that STEM interest, environmental identity, and political identity are the major determinants of pro-environmental behavior in the study population (Table 4.5).

STEM Interest

Although the relationship between STEM interest and pro-environmental behavior may seem obvious in the context of this study, STEM interest is not typically a

variable considered in the pro-environmental behavior literature. The education research regarding STEM issues is generally separate from that of environmental issues; STEM research aims to increase participation in technical careers, while pro-environmental research aims to increase environmentally sustainable behaviors. We were interested in the overlap between these two fields, so we based our STEM interest variable off of questions from a study exploring citizen science identity (Wallace, 2018) that explored the concept of conservation and environmentally-minded STEM (CEmSTEM). CEmSTEM is a useful way of measuring interest in people who aspire to STEM careers for environmental reasons. CEmSTEM questions and traditional STEM questions were combined in our STEM interest section of our survey. Having a high STEM interest means that students are interested in science careers, believe in the ability of science to solve environmental problems, and are externally motivated to participate in STEM-related or agricultural careers. Wallace (2018) demonstrated that citizen science projects increase STEM interest levels, and this study demonstrates that higher STEM interest levels are related to higher pro-environmental behavior. This finding is encouraging because it suggests that certain STEM-related educational programming can lead to environmental behavior change.

Environmental Identity

Our research indicates that environmental identity is the second most important factor influencing pro-environmental behavior and political identity is third. Although initial studies of pro-environmental behavior focused on attitudes and values, recent studies show that identity may be more important (Gatersleben, Murtagh, & Abrahamse, 2014). Falk (2011) cites that most studies of identity have focused upon the qualities

related to the big divisions of humanity such as race, religion, or national origin (higher-order identities), however, his work contends that lower-order identities have a great impact on day-to-day decision making, including those involving leisure decisions like visiting a museum (Falk & Storksdieck, 2005). Lower-order identities may include one's sense of being a member of a family, a good friend, or even a valued employee. (Falk, 2011). In this context, environmental identity would behave as a lower-order identity and influence the day-to-day behaviors to act pro-environmentally to a greater degree. One could argue that deciding to act pro-environmentally is similar to the process of making leisure decisions. Neither decision is being forced upon a person nor is no one held accountable for these decisions through laws or policies.

The environmental identity section of the survey measured how participants identify regarding various subtypes of environmental identity, from "outdoorsy person" to "environmentalist" to "someone with unique knowledge about nature". This set of questions was original to this study and was developed because self-identification and being seen as a "science person" by others was shown to have importance within the science capital literature. The aim of these questions was to identify which types of identity were important in *environmental* science capital, as opposed to general science capital. When each survey item was analyzed separately, the categories of environmental identity that had the three highest means were: someone who values protecting the environment (4.26), someone who values the conservation of nature (4.13) and an outdoorsy person (4.02). The categories with the two lowest means were: "someone with unique knowledge about nature" (3.35) and "someone who has a special relationship with the land" (3.32). This suggests the concerning trend of youth lacking vernacular

knowledge and a decreased sense of place. David Orr defines vernacular knowledge as the "knowledge that people have of their places" and notes that while some areas of knowledge are increasing (such as the more lucrative sciences), others are decreasing such as Aldo Leopold's science of land health (Orr, 2004).

The results of the multivariate linear regression analysis guided the design of focus group interviews. After quantitative analysis revealed the importance of identity, focus groups were conducted to learn more about the relationship between identity and pro-environmental behavior. The survey could not explain why participants might see themselves as science people and outdoorsy people, for example, but not as environmentalists. Qualitative data helped to further explore this phenomenon. This was the primary goal of the focus group interviews conducted after the quantitative data were analyzed, for that very reason. Qualitative analysis also explored responses to open-ended survey questions, though these focused on meaningful nature experiences and role models. All participant responses were recorded and coded, resulting in the emergence of 16 themes. Four of those themes related to STEM interest, environmental identity, and political identity:

- Participants tended to have a strong science identity and perceive science as relevant to their lives.
- Participants often lacked environmental identity or experienced conflicts related to their environmental identity.
- Participants generally seemed aware of environmental problems and motivated to solve them.
- Participants tended to participate in individual pro-environmental actions, rather than collective actions.

These themes indicate that the study population has high levels of science interest and identity. This is not a surprising result, given that participants were chosen

based on their participation in science clubs or courses. During the focus group discussions, participants were asked why they do (or do not) identify as a science person, nature person, outdoors person, and environmentalist. Out of the total 35 focus group participants, 30 identified as a nature person, 29 identified as a science person, 28 identified as outdoors person and 20 identified as environmentalists. This supported our quantitative findings that fewer participants identified as environmentalist which ranked in the bottom three lowest means (3.35). More importantly, participant responses to these questions helped to elucidate what being a "science" person means to them, versus "nature", "outdoors", or "environmentalist". The language used in those responses demonstrate that "science" carries a (brainy/logical) identity, "nature" is more about how it makes the person feel, "outdoors" is for activities and enjoyment, while "environmentalist" is all about pro-environmental action.

Although many participants of this study identified as "scientists" some participants did not. Those students said, "I don't really like all the formulas and equations but I like animals, anatomy, and the nature aspect." and "I don't because I am horrible at science and I think it takes me longer to understand it, either that or I was never taught it well. It stresses me out a bit and it's hard for it to keep my focus long enough for me to understand it." With these participants it is demonstrated that in order for these individuals to engage with science, the scientist = braininess link is a barrier (Archer et al. 2015). From their quotes, it is shown that they enjoy some aspects of science but this limited mindset of science is preventing them from identifying as scientists. The focus group questions pertaining to identity also shed light on why

participants might exhibit low pro-environmental behavior scores, despite their apparent positive attitudes toward nature, the outdoors, science, and the environment.

Multiple participant responses indicated a lack of environmental identity or conflicts with environmental identity and other identities that they hold. Either these conflicts were related to the fact that the person does not engage in pro-environmental behaviors, or it was a conflict with their rural or agricultural identity. This is demonstrated by the striking difference between these two quotes: "(I am a scientist because) I have always been fascinated with trying to see why things are the way they are" and " I'd say I'd probably take diesel trucks and cow farts over being subconsciously nervous about the environment". This is supports that science capital and *environmental* science capital are separate concepts with different antecedents.

We also found that the participants were generally aware of environmental problems and motivated to solve them. Respondents often indicated a passion for protecting the planet and knowledge that they've gained on how to do so. Yet, many participants described a lack of engagement with pro-environmental behavior, and those who did describe their pro-environmental behavior described individual rather than collective actions.

These results demonstrate the knowledge-action gap that is well documented in the literature. Despite their awareness and motivation to solve environmental problems, participants do not exhibit high levels of engagement with environmental issues. Given the previously described relationships between pro-environmental behavior and political or environmental identity, it is possible that tensions between environmental identity and rural/agricultural or political identity contribute to that gap.

While examining focus group responses, we also noticed that participants used different language to describe different types of identity. Participants were asked if they see themselves as a "science person", an "outdoors person", a "nature person", and an "environmentalist". As a probing question, they were asked why they do or do not identify in these ways. The language that participants used in their responses helped to characterize the identities of these types of people, from the participants' perspectives. The following themes emerged from analysis of participant language when describing their identities:

- Participants often described "science" people as being smart, logical, and clever.
- Participants often described "outdoors" people as being active and adventurous.
- Participants often described "environmentalists" as being action and advocacy based.
- Participants often described "nature" people as enjoying nature because it offers beauty, peace, harmony, and happiness.

Most participants identified in more than one of the above ways, but their language when describing *why* they identify in that way was most telling. They identified as science people because they are logical and inquisitive. They identified as outdoors people because they enjoy recreational activities outdoors. They identified as nature people because of a deep connection or feeling gained from being outside in nature. Those who identified as environmentalists did so because they feel the need to protect the environment, but when participants did not identify as environmentalists it was because they do not typically engage in pro-environmental behavior.

Analysis of identity language revealed not only a difference between these identities, but also a special requirement of action or advocacy in the case of

environmental identity. For example, whether participants viewed themselves as scientists seemed to be based upon innate qualities or interests. Yet, whether people viewed themselves as environmentalists was most often based on what actions (or lack thereof) they take toward the environment. It seems that participants believe they cannot be "environmentalists" unless they are contributing substantially to the solving of environmental problems. Simultaneously, the survey results indicate that participants are less likely to behave pro-environmentally if they lack an environmental identity. This suggests a positive feedback cycle between environmental identity and pro-environmental behavior. In essence, having an environmental identity leads one to behave pro-environmentally, but the act of engaging in pro-environmental behavior leads to the development of a pro-environmental identity.

Our findings related to identity and pro-environmental behavior support the theory that the lack of past engagement in pro-environmental behavior is itself a barrier to future engagement in pro-environmental behavior. Previous studies have alluded to the importance of developing social, cultural, and personal norms when seeking behavior change (Gifford and Nilsson, 2014), and even the Kollmus and Agyeman study (2002) shows old behavior patterns as the greatest barrier preventing the flow from environmental knowledge to environmental action. These studies characterize this problem as an issue with breaking old habits or a threat to motivation but we posit that past behaviors pose a threat to identity.

More research is necessary in order to determine the most significant barriers to pro-environmental behavior in rural American youth. This problem requires more research into the pro-environmental behavior of rural youth in general, investigation of a

positive feedback cycle between identity and behavior, and further exploration of the rural-environmental and political-environmental tensions. However, it is clear from this study that any activities or experiences that involve reducing these tensions, building environmental identity, or engaging youth in pro-environmental behavior could be effective avenues for increasing environmental science capital. Exploring what activities or experiences are successful in building environmental science capital is important for all youth, even those who are seemingly pro-science and pro-environmental. Because as this study demonstrates, even rural American youth with high *science* capital may not have high enough *environmental* science capital to facilitate engagement in pro-environmental behavior.

Political Identity

Political Identity was the only demographic variable that had a significant relationship with pro-environmental behavior. In fact, it was the third most significant variable in the multivariate linear regression analysis. The pro-environmental behavior score for those who identified as having a Democrat or Independent political affiliation was significantly higher than the pro-environmental behavior of those who identify as Republican. The Missouri subpopulation answered two additional questions regarding political identity that were also significantly correlated with pro-environmental behavior. When participants were asked to indicate their political ideology regarding social and economic issues, having a liberal ideology resulted in greater pro-environmental behavior. The relationship between relatively liberal (versus conservative) political identity has been demonstrated in previous studies (Dunlap, Xiao, & McCright, 2001; McCright & Dunlap, 2011). This finding could be a result of the way environmental

issues have been politicized in the media, or it could be based upon the tendency of people who are politically conservative to have less environmental concern and hold less ecocentric worldviews (Dunlap et al., 2000). Given the importance of political identity in this study, it would have been useful to utilize a metric for ecocentric worldview, such as the new environmental paradigm, to test whether political conservatives are experiencing cognitive dissonance between their environmental and political identities, or whether they are simply less ecocentric.

Our findings regarding political identity and low collective pro-environmental behavior support Chawla and Cushing's (2007) advocacy for a political model of environmental education. With collective actions being more effective, Chawla and Cushing (2007) identify antecedents of political action. They include: Democratic parenting style, collaborative decision-making in everyday life, teachers creating opportunities for open discussion, and family members as critical role models for public issues, prosocial values and social justice. The most effective way for youth to learn about government and politics is to engage with public issues at the local level where they can see their efforts are taken seriously by others.

> "Behaviors with the largest potential of benefits for the environment require political engagement. Although private actions for the environment are important the most effective actions are collective, when people organize to pressure government and industry to act for the common good" (Gardner & Stern, 2002.)

Characteristics of Environmental Science Capital

We define environmental science capital as the sum of all of the environmental science-related experiences that one builds up over a lifetime. We are interested in the

potential of this term to help explain why certain people are more likely to engage in environmental issues and behave pro-environmentally. The term "environmental science capital" is introduced in the present study, and is based upon the concept of science capital. The concept of science capital is defined as what you know about science, who you know that influences your views on science, your values and attitudes toward science, and your engagement with science in daily life (Archer et al., 2015). One of our major goals was to explore this concept and characterize the environmental science capital of rural American youth in this study.

Quantitative analysis indicated that certain aspects of environmental science capital are particularly important determinants of pro-environmental behavior. For example, having an interest in science and the environment builds environmental science capital. Having a science or environmental identity builds environmental science capital. Since the most important independent variables contributing to pro-environmental behavior in this study were identity and interest, it is clear that those aspects of environmental science capital facilitate pro-environmental behavior. We also included a set of questions in our survey in the environmental science capital category, which included questions based off of Archer's (Archer et al., 2015) science capital questions. Many individual questions within this category demonstrated significant relationships with pro-environmental behavior, and the category mean was significant when measured as a univariate or in multivariate analysis.

Other aspects of environmental science capital would include the people you know who influence your views on environmental science and the daily engagement that you have with environmental science. These two types of capital were indirectly assessed

using individual questions and the set of role models and meaningful nature experiences questions. As previously explained, both the role models and meaningful nature experiences question categories were not designed well to calculate meaningful category means. Thus, qualitative methods were more helpful than quantitative methods when analyzing the importance of these variables. Qualitative thematic analysis resulted in the emergence of the following themes related to environmental science capital:

- Environmental clubs or groups provide meaningful experiences for participants.
- Learning, both in school and outside of school, is a meaningful and enjoyable experience.
- Environmental media is a source of meaning and inspiration for participants.
- Outdoor recreational activities such as hunting, fishing, camping, and hiking connect participants to nature.
- Working outdoors and/or with animals connects participants to nature and builds their identities and interests.
- Participants feel a sense of peace, solitude, calmness, and connectedness to nature when in nature alone.
- Social experiences in nature are meaningful to participants because they can bond and form memories with others.
- Unique close-encounters with nature inspire wonder in participants.

These themes describe activities or experiences that build the environmental science capital of the participants in this study. From these themes, we can assume that it is important that rural youth have access to environmental clubs, media, and educational opportunities. Outdoor experiences are valuable to these participants, including outdoor recreational activities and time spent working outdoors and/or with animals. Regular access to both social experiences and nature experiences in solitude are important, but it is also beneficial for youth to have occasional unique up-close encounters with nature.

Revised Conceptual Model

After our research, we revisited our conceptual model proposed in Chapter One (Figure 5.1). The variables supported by the quantitative results and qualitative findings remain while variables not supported by results and findings were removed. The variables environmental science capital, environmental identity, STEM interest and political identity (highlighted in purple) are supported through quantitative results and the variables connectedness to nature, meaningful nature experiences, and role models (highlighted in orange) are supported through qualitative findings. With the quantitative findings, the numbers within the arrows represent the strength of the relationship based on Pearson's Correlation Coefficients. Since qualitative findings are not backed by statistical tests, we cannot claim relationships, however, participant responses suggests a relationship. This is shown by arrows outlined with dashed lines.

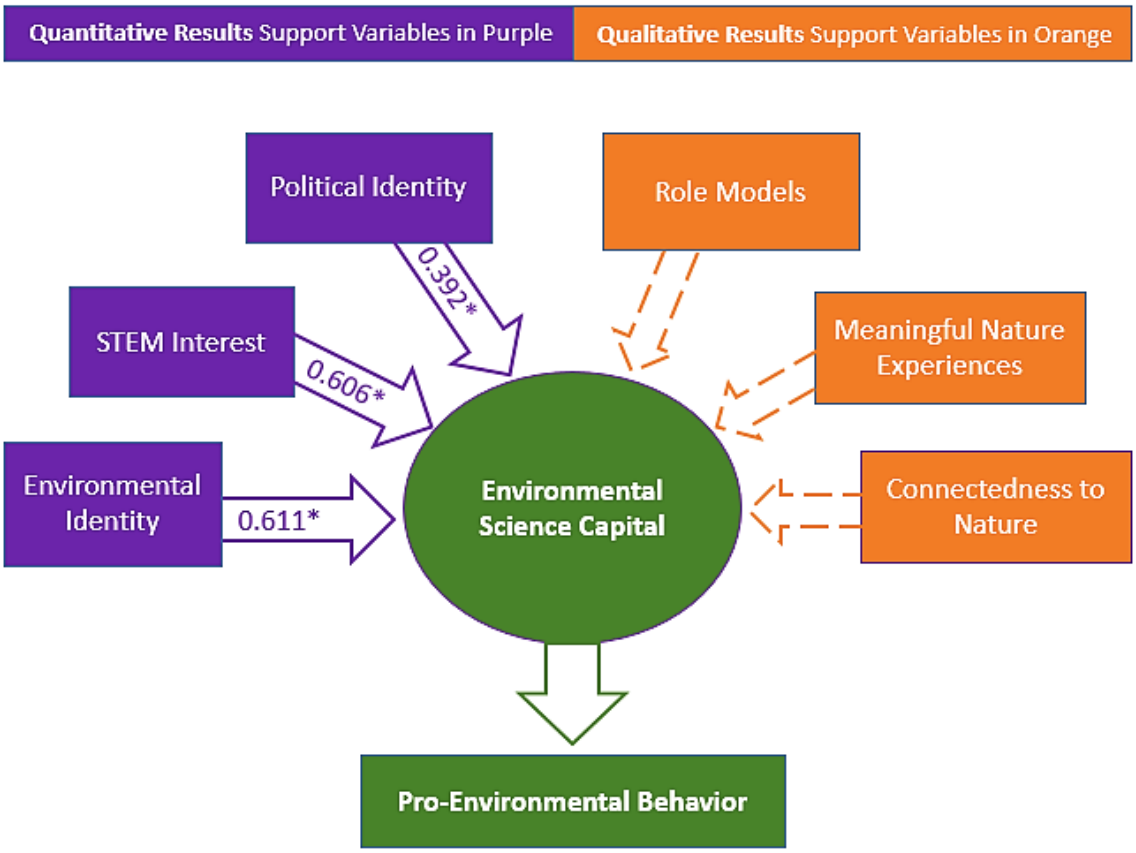


Figure 5.1. Revised Conceptual Framework Based on Study Findings.

Purple boxes represent findings from quantitative analysis and orange boxes represent findings from qualitative analysis. Numbers within purple arrows indicate Pearson's Correlation Coefficient between the variable and pro-environmental behavior. The relationship between green shapes is conceptual.

Variables marked with * have significance of $p<0.0001$.

Conclusions

Based on the quantitative results and qualitative findings, here are the conclusions that address our research questions.

1. *How does the concept of environmental science capital help to explain pro-environmental behavior of rural youth in this study?* The recent concept of science capital is a theoretical lens to examine the differential patterns of aspiration and

educational participation of science among youth. Similarly, our proposed expanded concept of *environmental* science capital can help explain the pro-environmental behavior of rural youth in this study by shedding light on why this population engages or (does not engage) within the *environmental* sciences.

a. *What is the relationship between environmental science capital and pro-environmental behavior?* Based on the quantitative results, there is a positive relationship between environmental science capital and pro-environmental behavior.

b. *Which aspects of environmental science capital best predict pro-environmental behavior?* Quantitative results suggest that STEM interest and environmental identity may be the best predictors of pro-environmental behavior. Although the univariate analysis shows statistical significance for all six independent variables in this study, the R^2 values are highest for STEM interest and environmental identity. Additionally, multivariate analysis shows that the greatest contribution comes from STEM interest (0.308) then environmental identity (0.28844). This suggests that as STEM interest and environmental identity increase, so does pro-environmental behavior.

2. How do the following factors influence PEB in our sample populations?

- Meaningful Nature Experiences

  The meaningful nature experience (MNE) mean score was significant with PEB within the univariate analysis with a positive relationship between MNE and PEB. Meaningful nature experiences were not significant in the multivariate analysis with PEB.

- The Influence of Role Models

  Influence of role models was significant in the univariate analysis, showing a positive relationship with PEB, but was not significant in the multivariate analysis.

- Connectedness to Nature (CNS)

  Connectedness to nature (CNS) mean score was significant with PEB in the univariate analysis with a positive relationship between CNS and PEB. The CNS score was not significant in the multivariate analysis.

- Environmental Identity

  Environmental identity was significant with PEB in both the univariate analysis and the multivariate analysis. This relationship was positive and accounted for 29% of the variance in the multivariate analysis making it the second most significant variable in the multivariate analysis.

- STEM Interest

  STEM interest was significant with PEB in both the univariate analysis and the multivariate analysis. STEM interest was the greatest contributor to PEB in the multivariate analysis at 31% of the variance accounted for by STEM interest.

3. *How do described experiences of freshman and sophomore college students enrolled in science courses help to explain patterns observed in quantitative surveys?* Quotes from college students confirmed that this group of participants had high science identity and interest as expected and indicated in quantitative surveys. However, some students indicated a lack of pro-environmental behavior or environmental identity.

a. *What personal success stories emerge from descriptions of rural college students who have overcome barriers to environmental science capital and pro-environmental behavior?* They did not describe overcoming barriers to pro-environmental behavior, but their responses provided insights into what those barriers might be. For example, tensions between environmental identity and rural

identity were evident from participant responses. Past behaviors seem to also act as a barrier to pro-environmental behavior.

b. *What life experiences do students perceive as most important in shaping their interests and environmental actions? What is the importance of role models?* Participants generally described their interests in science or nature as intrinsic qualities that they possess. When they did mention activities or experiences that influenced them, they mentioned solitary and social experiences in nature, especially hunting, fishing, or working outdoors with animals. Often their role model was a father figure who took them hunting or fishing.

c. *What themes emerge in the lived experiences of students with different courses, academic majors, or career plans?* Qualitative findings are relatively consistent across academic major or course, aside from the agriculture students who seemed to stick out from the rest. They provided thoughtful responses to open-ended survey questions that sounded quite pro-nature, despite their lower pro-environmental behavior scores.

4. *How do described experiences of high school STEM and environmental club participants help to explain patterns observed in quantitative surveys?* When describing high school STEM and environmental club experiences: participants use different language for different identities, express tension between their environmental identity with other self- described identities, list individual actions opposed to collective environmental actions and enjoy both solitary and shared nature experiences. These described experiences add depth and “color” to the quantitative results.

a. *How do their lived experiences and descriptions explain or contradict the findings from the quantitative study?* Participants' self-described experiences relating to STEM interest and environmental identity support the quantitative results of these two variables having a significant relationship with pro-environmental behavior. Although meaningful nature experiences and role models were not significant in the multivariate analysis, participants did describe shared experiences and support of friends and family. Due to this contradiction, we believe that the low significance is due to the way that these two variables were measured in our survey instrument.

Implications for Practitioners

Based on the quantitative results and qualitative findings, here are four implications for practitioners which could include formal and non-formal educators, environmental and/or science club leaders and community leaders.

Provide Frequent Experiences with Support from Parents and Peers

Research on science capital shows that daily experiences and support from parents and peers can contribute to an increase in science aspirations and participation among youth. This study supports that, similar to science capital, frequent experiences and support from family and peers also increases aspirations and participation in *environmental* science among this study population. These daily experiences of being a part of environmental clubs and taking an environmental science class coupled with shared experiences with family and friends contribute to making participating in *environmental* sciences a norm. Our recommendation for practitioners is to include

parents/guardians, siblings, and influential others within your programming in order to build this shared supportive culture.

Encourage Place-Related Connections

Another recommendation for practitioners is to emphasize sense of place into educational programing. Sense of place incorporates both place attachment, how strongly people are attracted towards places, and place meaning, the reasons for attraction. In fact, Kudryavtsev, Stedman and Krasny (2012) posit that the strongest influence on pro-environmental behavior via a place-related connection may be through a combination of place attachment and ecological place meaning.

Provide Solitary Experiences

Shared experiences in nature are viewed as meaningful in past research and supported in this research, however, many participants also mentioned spending time in nature alone. For these participants, being alone in nature allowed them to disconnect and to have a deeper more personal connection to nature. Perhaps this is due to the desire to unplug from our ever-increasing busy lives. Our recommendation is to incorporate these solitary experiences in educational programs such as setting aside time for self-reflection in a solitary yet comfortable space.

Move Beyond Individual Behavior to Collective Behavior

During our focus groups, participants expressed more individual actions for the environment such as not littering, recycling, and reducing energy and water consumption. While this is encouraging, collective actions have more impact. Our recommendation is to encourage and demonstrate more collective actions such as: addressing and engaging

in local environmental issues, voting for environmental policies and writing letters to their representatives. One increasingly popular activity that has the potential to address local community issues and build science/environmental engagement is citizen science, also referred to as community science.

Ease Tensions with Environmental Identity

Within this research, we found that participants hold different identities simultaneously, however, they use different language to describe these identities. For example, when talking about being a "science" person, language that evokes "braininess" and "logical" is often used versus when they express being a "nature" person. For a "nature" person, they use language that suggests more "heart" and "warmth" such as calm, happiness and harmony. Surprisingly, we found significant tension between participants' environmental identity with some other identities that they hold such as a rural and/or political identity. Much like how the link between "braininess" and scientist is a barrier, this tension between identities can prevent youth from engaging within the *environmental* sciences and/or pro-environmental behaviors. Solutions to this challenge is beyond the scope of this study. However, embracing and demonstrating a "both/and" mindset and setting clear ground rules of respect can help set the tone within clubs and classes.

Acknowledgement of Limitations

This study was limited by the following:

- The results of this study cannot be generalized beyond the study population since sampling was not random.
- There was a lack of respondents with low socioeconomic status and racial diversity so the effects of race and socioeconomic class could not be studied.

- While every effort was made to replicate survey questions from published survey instruments, some questions were modified for our population. Our survey combined questions from different survey instruments and it may be that the reliability and validity of the original survey instruments was impacted.
- The ages of our respondents were typically older than the respondents of the published science capital research. This discrepancy may have an impact on comparisons of our findings to the previous science capital research.
- A more robust connectedness to nature scale may have produced different results. Due to the desire to keep the number of questions manageable, the shorter connectedness to nature scale was used. More published research exists using the longer new ecological paradigm (NEP) scale and it is possible that a different measure of connectedness to nature would have yielded different outcomes.
- As with any self-reported survey, respondents may answer questions in a way that is not truthful but makes them look more favorable. There is also the possibility that some question meanings were not clear and the information collected was not valid.
- The quantitative data set is large and many more relationships from this data have not been thoroughly studied due to time constraints.

Future Research

Based on the findings of this study, future research might include a study that looks at how the factors we examined (STEM interest, environmental identity, socioeconomic status, political identity, geographic region, role models, meaningful nature experiences, and connectedness to nature) influence the pro-environmental behavior of a random sample of American youth. This would allow for generalization of these results to better examine environmental science capital in American youth.

Research might also examine the new environmental paradigm scale to assess an ecocentric worldview in opposition to the connectedness to nature scale. We propose this might lead to a greater understanding of the differences we discovered between those that

hunt as opposed to those individuals that fish when looking at pro-environmental behavior.

Future research could explore how practitioners in formal and informal education could emphasize collective pro-environmental behavior (i.e. addressing and engaging in local environmental issues, voting for environmental policies and writing letters to their representatives) in an effort to assess the impact of these collective behaviors on environmental science capital and pro-environmental behavior.

Another issue that could be explored is the different identities that were observed in this study. We found tension between the different identities held by rural youth (scientist, nature person, outdoors person and environmentalist) and the other identities they hold such as rural or political party member. Research into effective strategies to break the stereotypes of "brainy scientists" and "environmental activist" could increase the environmental science capital and pro-environmental behavior of American youth.

Rural identity is of particular interest because defining rural for this study was a far more complicated subject than it appears on the surface. The popular definition of rural put forth by the US Census Bureau is quantitative in nature and defines rural in terms of the number of people in a given area but by this definition, our survey respondents "misidentified" their geographic residence as "rural" 22% of the time and over half (53%) incorrectly identified their place of residence as rural or urban.

If respondents believe they live in a rural area, are they rural? This is the question brought to light by discussions for this research. Rural is not easy to define and educators, legislatures, and other policy makers have struggled with this question of "What is rural?" for decades (Rios, 1988). Rural means different things to different people and doesn't

look the same in all parts of the country (Rios, 1988). Someone from "rural" Kansas does not live the same experience as someone from "rural" West Virginia, yet people from both areas feel what it is to be rural. Some qualitative features of past definitions of rural have been simple life, agricultural lifestyle, smallness, homogeneity, and even dullness, but according to Blakely (1984), these also fail to describe much of rural America.

Though time prevented us from probing deeper into this topic of ruralness, it is our belief from this study that the definition of rural must include both qualitative and quantitative elements. The belief that a person lives in a rural area impacts their viewpoints just as firmly as if they live in a rural area by zip code. Rural encompasses a mindset and lived experiences as well as a person's physical location. For our study, we concluded that the self-identified designation of rural spoke more of the mindset of being rural and probably gave us a better insight into what the participant believed than just using the Census Bureau definition. Rural, we believe, is an identity and it is likely that a rural identity should be explored in future research instead of looking strictly at geographic location.

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APPENDIX A – TABLE OF SURVEY QUESTIONS

Connectedness to Nature Scale

The questions below measured the independent variable of connectedness to nature in all study populations.

Instructions: "Connectedness to Nature Scale: Check the box to indicate the extent to which you agree with the following statements regarding your feeling of connectedness to nature:"		
Item Number	Question, with answer choices ranging from "strongly disagree" to "strongly agree":	Source and Rationale
CNS1	I think of the natural world as a community to which I belong.	The original 13-item scale developed by Mayer and Frantz (2004). This is the reduced 7-item scale of Pasca, Aragones, and Coello (2017) after an analysis using item response theory to produce a higher quality instrument.
CNS2	When I think of my life, I imagine myself to be part of a larger cyclical process of living.	
CNS3	I often feel a kinship with animals and plants.	
CNS4	I feel as though I belong to the Earth as equally as it belongs to me.	
CNS5	I often feel part of the web of life.	
CNS6	I feel that all inhabitants of Earth, human and non-human, share a common 'life force'.	
CNS7	Like a tree can be part of a forest, I feel embedded within the broader natural world.	

STEM Interest related to conservation, environmentalism, and agriculture

The questions below measured the independent variable of STEM Interest in all study populations.

Instructions: "STEM Interest: Consider your views on the Environment, Agriculture, and STEM (Science, Technology, Engineering, and Mathematics) and indicate the extent to which you agree with the following questions:"		
Item Number	Question, with answer choices ranging from "strongly disagree" to "strongly agree":	Source and Rationale
INT1	STEM is useful if it can help conservation efforts.	Questions were used to evaluate high school student

INT2	One of the most important uses of STEM is to improve/solve issues such as climate change.	interest in a type of STEM that is founded in conservation and environmental-mindedness (CEmSTEM) in a dissertation study of citizen science, mobile learning, and STEM interest (Wallace, 2018). INT9 was modified from the original version with the addition of "or agriculture".
INT3	I am interested in a STEM career that will help the environment.	
INT4	I am only interested in a STEM career if I can help the environment.	
INT5	STEM innovations are important even if they harm the planet.	
INT6	STEM careers are interesting because they have the potential to positively impact the environmental problems in our world.	
INT7	I am interested in careers that use science to help the environment.	
INT8	I am NOT interested in the environmental aspects of STEM or agriculture.	
INT9	Agricultural innovations are important even if they harm the planet.	These are original questions that are modifications of the above questions to address agriculturally-based CEmSTEM.
INT10	I am interested in careers that use agriculture to help the environment.	
INT11	Solving environmental issues such as climate change is one of the most important issues in agriculture.	
INT11	I am interested in careers that use agriculture to help the environment.	
INT12	I am only interested in an agriculture career if I can help the environment.	

Meaningful Nature Experiences

The questions below measured the independent variable of Meaningful Nature Experiences in all study populations.

Instructions: "Meaningful Experiences: Think about the experiences that have influenced your connectedness to nature. Indicate the importance of the following factors in influencing your connectedness to nature:"		
Item Number	Question, with answer choices ranging from "not at all important" to "very important" (except for MNE19, which is open-ended):	Source and Rationale
MNE1	School trips to outdoor areas.	These are factors that emerged from qualitative research (Sivek 2002) when participants were asked about the most important influences on their environmental sensitivity. Most important were accessibility/ frequency of visits to outdoor areas, followed by role models, and last was school. These questions were derived to ask about those experiences, while role models have their own section.
MNE2	Spending time in outdoor areas with my family.	
MNE3	Spending time in outdoor areas with my friends.	
MNE4	Exploring the outdoors alone.	
MNE5	Learning about the environment in school.	
MNE6	School trips to an indoor place where you learn about nature (such as a zoo, aquarium, or museum).	
MNE7	Family trips to an indoor place where you learn about nature (such as a zoo, aquarium, or museum).	
MNE8	Participation in environmental clubs.	
MNE9	Time spent working outdoors (such as farming, logging, gardening, landscaping, construction, etc.)	These are original questions were added to those above to address experiences that are common with rural youth in particular, such as hunting, fishing, or being outdoors for agriculture or forestry-related work.
MNE10	Time spent working with animals.	
MNE11	Time spent hunting with others.	
MNE12	Time spent hunting alone.	
MNE13	Time spent fishing with family.	
MNE14	Time spent fishing alone.	
MNE15	Books that I have read.	These are original questions added to those above in order to assess what important
MNE16	Visual media that I have watched (such as television shows or movies).	
MNE17	Music that I have listened to.	

MNE18	Information from internet sources (such as science websites, YouTube, Facebook and other social media, podcasts, etc.).	experiences modern youth may be having through media.
MNE19	Which of your experiences has been most meaningful? What about it was so meaningful? Please explain below.	This is an open-ended question similar to the interview question from Sivek 2002.

Influence of Role Models

The questions below measured the independent variable of Role Models in all study populations.

Instructions: "Role Models: Think about the people in your life who have influenced you. Indicate the importance of the following types of role models in influencing your connectedness to nature:"		
Item Number	Question, with answer choices ranging from "not at all important" to "very important"	Source and Rationale
RM1	Male teacher.	Sivek (2002) asked about the importance of specific role models in influencing one's environmental sensitivity, using the same questions and scale shown here.
RM2	Female teacher.	
RM3	Father or stepfather.	
RM4	Mother or stepmother.	
RM5	Other male relative.	
RM6	Other female relative.	
RM7	Male friend.	
RM8	Female friend.	
RM9	Other unrelated male adult who I know personally.	
RM10	Other unrelated female adult who I know personally.	
RM11	Male public figure who I do NOT know personally (such as a celebrity, author, musician, athlete, politician).	These are original questions added to those above in order to address the influence of public figures who participants would not necessarily think of when asked the above questions, but still may be important.
RM12	Female public figure who I do NOT know personally (such as a celebrity, author, musician, athlete, politician).	
RM13	If you stated that an unrelated adult who you know personally or a public figure who	

	you do NOT know personally was an important influence on your connectedness to nature, who were you referring to? Please explain further below.	
RM14	Of all the role models who have influenced your connectedness to nature, which role models would you consider to be the most important? Please explain below.	This is an open-ended question asking for further detail regarding the most important role models to obtain depth similar to a Sivek question which had the participants rank role models from most to least important (2002).

Qualities of Role Models

The questions below measured the independent variable of Role Model qualities in all study populations.

Instructions: "Think about your most important role model(s). To what extent do the following traits describe your most important role model(s)?"		
Item Number	Question, with answer choices ranging from "does not describe my role model at all" to "describes my role model very well":	Source and Rationale
RM15	They are friendly and personable.	These questions and answer choices are identical to those of Sivek, 2002, except for the removal of the words "and nature" at the end of RM16 to simplify the question.
RM16	They are knowledgeable about the environment.	
RM17	They are passionate about the outdoors.	
RM18	They let me make up my own mind on environmental matters.	
RM19	They are open-minded.	
RM20	They are active in problem-solving.	
RM21	They tell me what's right or wrong.	

Environmental Science Capital

The questions below measured the independent variable of environmental science capital in all study populations.

Instructions: "Environmental Science Capital: Indicate the extent to which you agree with the following statements:"		
Item Number	Question, with answer choices ranging from "strongly disagree" to "strongly agree":	Source and Rationale
ESC1	Learning about the environment helps prepare me for my future job.	These are environmental versions of Archer's science capital questions (Archer et al., 2015) that could be tailored toward the environment or nature.
ESC2	There are many different types of environmental jobs.	
ESC3	When I am NOT in school, I often talk about the environment with other people.	
ESC4	One or both of my parents/guardians think nature is very interesting.	
ESC5	One or both of my parents/guardians enjoy spending time outdoors.	
ESC6	One or both of my parents/guardians spend time sharing nature with me.	
ESC7	When I am NOT in school, I often read books or magazines about nature.	
ESC8	When I am NOT in school, I often watch videos or visit websites about nature.	
ESC9	I enjoy outdoor activities (such as hunting, fishing, wildlife observation, camping, hiking, biking, climbing, nature photograph, etc.).	
ESC10	It is useful to know about the outdoors in my daily life.	
ESC11	I can do outdoor activities near my home.	These are original questions written to address potential barriers to engagement in nature-based experiences.
ESC12	I have access to equipment that allows me to recreate outdoors (hunting/fishing equipment, etc.)	
ESC13	I feel welcome in outdoor places such as nature centers, parks, conservation areas, and wildlife refuges.	
ESC14	It is difficult for me to get to a zoo, science center, or aquarium.	
ESC15	I feel comfortable spending time outdoors in nature.	
ESC16	It is hard to find places near my home where I can go and learn about science.	
ESC17	My friends like to spend time outdoors.	
ESC18	My friends see me as an outdoorsy person.	

ESC19	My family has special places where we like to go in nature.	
ESC20	My parents are afraid of me meeting strange people outdoors.	These questions address the same factors as above, but come from the Nature of Americans Report (2017).
ESC21	I don't like to go outdoors because I am afraid of things that might hurt me.	

Types of Environmental Identity

The questions below measured the independent variable of Identity in all study populations.

Instructions: "Identity: Indicate the extent with which you agree with the statement "I see myself as…""		
Item Number	Question, with answer choices ranging from "strongly disagree" to "strongly agree":	Source and Rationale
IDE1	…an outdoorsy person.	These are original questions aimed at determining how an individual identifies with environmentalism, stewardship, science, etc., to determine the relative importance of different types of environmental identity in facilitating pro-environmental behavior.
IDE2	…a science person.	
IDE3	…someone who has a special relationship with the land.	
IDE4	…someone who values the conservation of nature.	
IDE5	…an environmentalist.	
IDE6	…someone who is good with technology.	
IDE7	…someone with unique knowledge about nature.	
IDE8	…someone who has a special connection with animals.	
IDE9	…someone who values protecting the environment.	

Common Demographic Questions Administered to all Study Populations

Item	Question	Answer Choices	Source
A1	What is your age in years?	Write-In (years)	n/a
G1	What is your gender identity?	1 = Male 2 = Female 3 = Non-binary/Third Gender 4 = Prefer to Self-Describe 5 = Prefer not to say	n/a
R1	What is your race?	1 = American Indian or Alaska Native 2 = Asian 3 = Black or African American 4 = Native Hawaiian or other Pacific Islander 5 = White 6 = More than 1 Race 7 = Other	n/a
H1	Are you Hispanic or Latino?	0 = No 1 = Yes	n/a
UR1	What is your zip code?	Write-In	n/a
UR2	How would you describe the place where you live?	1 = Urban (a city or large town) 2 = In between (suburbs/ a medium-sized town) 3 = Rural (a small town/ the country)	n/a
UR3	What is your high school size? For example, 1A. (High-school student only)	Write-In	n/a
SE1	About how many books are there in your home?	1 = Few (0-10) 2 = Enough to fill one shelf (11-25) 3 = Enough to fill one bookcase (26-100) 4 = Enough to fill several bookcases (100+)	NAEP

SE2	Is there a computer at home that you use?	0 = No 1 = Yes	NAEP
SE3	How many of the following things do you have in your home? Consider whether you have these in your home and add up the total. List: Access to the internet, Clothes dryer just for your family, Dishwasher, More than one bedroom, Your own bedroom. Total: _____	Write-In (Total Number)	NAEP, modified to a total of items.
SE4	How far in school did your mother go?	1 = She did not finish high school. 2 = She graduated from high school. 3 = She had some education after high school. 4 = She graduated from college. 5 = I don't know.	NAEP
SE5	How far in school did your father go?	1 = He did not finish high school. 2 = He graduated from high school. 3 = He had some education after high school. 4 = He graduated from college. 5 = I don't know.	NAEP
PA1	What is your political party affiliation?	1 = Republican 2 = Independent 3 = Democrat 4 = Other: _____ 5 = I don’t know	Dunlap et al., 2001
PA2	When you reach voting age, do you plan to vote in elections? (High-school student only)	0 = No 1 = Yes	n/a

PA3	How would you describe your political ideology regarding social issues? (College student only)	1 = Conservative 2 = Moderate 3 = Liberal	Dunlap et al., 2001
PA4	How would you describe your political ideology regarding economic issues? (College student only)	1 = Conservative 2 = Moderate 3 = Liberal	Dunlap et al., 2001
PA5	How does your political ideology compare to that of your parents? (College student only)	1 = Compared to my parents/guardians, I am much more politically conservative. 2 = Compared to my parents/guardians, I am somewhat more politically conservative. 3 = My political views and those of my parents are roughly the same. 4 = Compared to my parents/guardians, I am somewhat less politically conservative. 5 = Compared to my parents/guardians, I am much less politically conservative.	

Questions Specific to High School Students – Kansas

Item	Question	Answer Choices	Source
HSS1	For how many years have you participated in ECO-Meet?	1 = This is my first year in ECO-Meet. 2 = This is my second year in ECO-Meet. 3 = This is my third year in ECO-Meet. 4 = This is my fourth year in ECO-Meet. 5 = This is my fifth year in ECO-Meet.	n/a
HSS2	Following are some examples of programs that you may have participated in. Total: _____	Write-In (Total Number)	n/a

Questions Specific to High School Students – West Virginia

Item	Question	Answer Choices	Source
HSS3	For how many years have you participated in this STEM club?	1 = Less than 1 year 2 = At least 1 year, but less than 2 3 = At least 2 years, but less than 3 4 = At least 3 years, but less than 4 5 = At least 4 years, but less than 5 6 = 5 years or more	n/a
HSS4	Following are some examples of programs that you may have participated in. How many of these programs have you participated in? Total: _____	Write-In (Total Number)	n/a

Questions Specific to College Students – Missouri

Item	Question	Answer Choices	Source
CSS1	How many years have you been in college?	1 = This is my first taking college courses. 2 = This is my second year. 3 = This is my third year. 4 = This is my fourth year. 5 = I have been in college for 5 or more years.	n/a
CSS2	Following are some examples of programs that you may have participated in. How many of these programs have you participated in, currently or in the past? List: High School Science Competitions, Student	Write-In (Total Number)	n/a

	Government, Environmental Clubs, Agricultural Judging, STEM Club, Scholar Bowl, 4H Projects, Robotics Club. Total: _____		
CSS3	Indicate your academic major or primary area(s) of academic interest, currently or in the future. If you have multiple academic focuses, you may check all that apply.	1 = Science – Physics or Engineering 2 = Science – Biological or Life Sciences 3 = Science – Chemistry 4 = Science – Environmental Science 5 = Science – Agriculture or Animal Science 6 = Science – Health (Nursing, Pre-Med, Pre-Nursing, etc.) 7 = Social Science (Psychology, Sociology, Education) 8 = Business or Career Technical Education 9 = Humanities (English, Spanish, Journalism) 10 = Fine Arts 11 = Undecided 12 = Other (Please Explain Below)	n/a

Dependent Variable – Pro-Environmental Behavior Questions

Instructions: "Pro-Environmental Behavior: Indicate how often you perform the following behaviors:"		
Item Number	Question, with answer choices ranging from "never" to "always":	Source and Rationale
PEB1	I turn off lights when I am not in the room.	Questions from Fah and Sirisena (2014), measuring environmental literacy in high school students. Some questions were slightly
PEB2	I talk to people who I notice doing something that harms the environment in an effort to persuade them stop the activity (for example, try to talk a friend into	

	recycling a soda can instead of throwing it in the trash).	modified for clarity and simplification.
PEB3	I make an effort to reduce the amounts of goods I consume.	
PEB4	I set a positive environmental example for my friends to follow.	
PEB5	I support candidates for political office who are concerned about environmental problems.	
PEB6	If I see an aluminum can on the ground when I'm out walking, I pick it up and take it with me.	
PEB7	I recycle plastic bottles when I am done using them, instead of throwing them in the trash.	
PEB8	I avoid purchasing products that have negative impact on the environment.	
PEB9	I talk to my family and friends about what they can do to help solve environmental problems.	
PEB10	I purchase one product over another product because it is packaged in reusable, returnable or recyclable containers or packages.	
PEB11	I make a point of reading articles (newspaper, magazine, or web articles) about the environment.	
PEB12	I post my views about environmental issues on social media.	PEB14 was added as a question specific to rural individuals. The other questions are refinements of questions from Fah and Sirisena that were not relevant to Americans or were identified as weak questions due to low response of all participants.
PEB13	If I saw someone who is not following hunting or fishing regulations, I would report it to the proper authorities.	
PEB14	I try to make responsible environmental decisions when caring for my (or my family's) land.	
PEB15	If necessary, I would write a letter or sign a petition for an environmental cause.	

APPENDIX B – SAMPLE ENVIRONMENTAL SCIENCE CAPITAL SURVEY

ENVIRONMENTAL SCIENCE CAPITAL SURVEY

Survey # _____

DEAR STUDENT,

Please do not write your name on this survey. I will keep track of your survey using the Survey # written on this packet. I will know the name associated with the Survey #, but your name will not appear on any documents related to this project to protect your confidentiality and privacy.

Please read each question **carefully** and answer **honestly**. Negative opinions and comments are just as helpful as positive ones. However, if you do not know an answer or feel uncomfortable answering, feel free to leave that question blank.

If you require additional information or have questions, please contact me at the number listed below.

Elizabeth Cantrell
Email: Elizabeth.cantrell@eastcentral.edu
Phone: (314)458-7412

Student Information – East Central College Students

What is your age in years? _____

What is your gender identity?

- ☐ Male
- ☐ Female
- ☐ Non-binary/Third Gender
- ☐ Prefer to Self-Describe:_____
- ☐ Prefer not to say

What is your race?

- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or other Pacific Islander
- ☐ White
- ☐ More than 1 Race
- ☐ Other

Are you Hispanic or Latino?

- ☐ No
- ☐ Yes

What is your zip code? ___ ___ ___ ___ ___

How would you describe the place where you live?

- ☐ Urban (a city or large town)
- ☐ In between urban and rural (suburbs/ a medium-sized town)
- ☐ Rural (a small town/ the country)

How many years have you been in college?

- ☐ This is my first year taking college courses.
- ☐ This is my second year.
- ☐ This is my third year.
- ☐ This is my fourth year.
- ☐ I have been in college for 5 or more years.

Following are some examples of programs that you may have participated in. How many of these programs have you participated in, currently or in the past? (For example, if you have only done Scholar Bowl, your answer is 1. If you have done Scholar Bowl, Science Olympiad, and 4H, your answer is 3).

High School Science Competitions

Student government	Scholar Bowl
Environmental Clubs	4H Projects
Agricultural judging	Robotics Club
STEM Club	Boy/Girl/Cub Scouts

Total: _____

Indicate your academic major or primary area(s) of academic interest, currently or in the future. If you have multiple academic focuses, you may check all that apply.

- ☐ Science – Physics or Engineering
- ☐ Science – Biological or Life Sciences
- ☐ Science – Chemistry
- ☐ Science – Environmental Science
- ☐ Science – Agriculture or Animal Science
- ☐ Science – Health (Nursing, Pre-Med, Pre-Nursing, etc.)
- ☐ Social Science (Psychology, Sociology, Education)
- ☐ Business or Career Technical Education
- ☐ Humanities (English, Spanish, Journalism)
- ☐ Fine Arts
- ☐ Undecided
- ☐ Other (Please Explain Below):

_____

_____

_____

Are you interested in helping us further by participating in a focus group? If yes, please provide your student email address below. By providing your email address, you are not signing up to participate in the focus group. You are simply indicating your interest. If you are selected to participate, you will receive further information from the researcher. These focus groups will involve a group of 2 or more students discussing their own opinions and experiences with the researcher. **Your participation is voluntary** and would last less than one hour.

Student Email Address:

Connectedness to Nature Scale

Check the box to indicate your agreement with the following statements regarding your feeling of connectedness to nature.	Strongly Disagree	Somewhat Disagree	No Opinion	Somewhat Agree	Strongly Agree
I think of the natural world as a community to which I belong.	☐	☐	☐	☐	☐
When I think of my life, I imagine myself to be part of a larger cyclical process of living.	☐	☐	☐	☐	☐
I often feel a kinship with animals and plants.	☐	☐	☐	☐	☐
I feel as though I belong to the Earth as equally as it belongs to me.	☐	☐	☐	☐	☐
I often feel part of the web of life.	☐	☐	☐	☐	☐
I feel that all inhabitants of Earth, human and non-human, share a common 'life force'.	☐	☐	☐	☐	☐
Like a tree can be part of a forest, I feel embedded within the broader natural world.	☐	☐	☐	☐	☐

Meaningful Experiences

Think about the experiences that have influenced your connectedness to nature. Indicate the importance of the following factors in influencing your connectedness to nature:	Not At All Important				Very Important
School trips to outdoor areas.	☐	☐	☐	☐	☐
Spending time in outdoor areas with my family.	☐	☐	☐	☐	☐
Spending time in outdoor areas with my friends.	☐	☐	☐	☐	☐
Exploring the outdoors alone.	☐	☐	☐	☐	☐
Learning about the environment in school.	☐	☐	☐	☐	☐
School trips to an indoor place where you learn about nature (such as a zoo, aquarium, or museum).	☐	☐	☐	☐	☐
Family trips to an indoor place where you learn about nature (such as a zoo, aquarium, or museum).	☐	☐	☐	☐	☐
Participation in environmental clubs.	☐	☐	☐	☐	☐
Time spent working outdoors (such as farming, logging, gardening, landscaping, construction, etc.)	☐	☐	☐	☐	☐
Time spent working with animals.	☐	☐	☐	☐	☐
Time spent hunting with others.	☐	☐	☐	☐	☐
Time spent hunting alone.	☐	☐	☐	☐	☐
Time spent fishing with family.	☐	☐	☐	☐	☐
Time spent fishing alone.	☐	☐	☐	☐	☐
Books that I have read.	☐	☐	☐	☐	☐
Visual media that I have watched (such as television shows or movies).	☐	☐	☐	☐	☐
Music that I have listened to.	☐	☐	☐	☐	☐
Information from internet sources (such as science websites, YouTube, Facebook and other social media, podcasts, etc.).	☐	☐	☐	☐	☐

Which of your experiences has been most meaningful? What about it was so meaningful? Please explain below.

Role Models

Think about the people in your life who have influenced you. Indicate the importance of the following types of role models in influencing your connectedness to nature:	Not At All Important				Very Important
Male teacher.	☐	☐	☐	☐	☐
Female teacher.	☐	☐	☐	☐	☐
Father or stepfather.	☐	☐	☐	☐	☐
Mother or stepmother.	☐	☐	☐	☐	☐
Other male relative.	☐	☐	☐	☐	☐
Other female relative.	☐	☐	☐	☐	☐
Male friend.	☐	☐	☐	☐	☐
Female friend.	☐	☐	☐	☐	☐
Other unrelated male adult who I know personally.	☐	☐	☐	☐	☐
Other unrelated female adult who I know personally.	☐	☐	☐	☐	☐
Male public figure who I do NOT know personally (such as a celebrity, author, musician, athlete, politician).	☐	☐	☐	☐	☐
Female public figure who I do NOT know personally (such as a celebrity, author, musician, athlete, politician).	☐	☐	☐	☐	☐

If you stated that an unrelated adult who you know personally or a public figure who you do NOT know personally was an important influence on your connectedness to nature, who were you referring to? Please explain further below.

Of all the role models who have influenced your connectedness to nature, which role models would you consider to be the most important? Please explain below.

Think about your most important role model(s). To what extent do the following traits describe your most important role model(s)?	Does Not Describe My Role Model At All				Describes My Role Model Very Well
They are friendly and personable.	☐	☐	☐	☐	☐
They are knowledgeable about the environment.	☐	☐	☐	☐	☐
They are passionate about the outdoors.	☐	☐	☐	☐	☐
They let me make up my own mind on environmental matters.	☐	☐	☐	☐	☐
They are open-minded.	☐	☐	☐	☐	☐
They are active in problem-solving.	☐	☐	☐	☐	☐
They tell me what's right or wrong.	☐	☐	☐	☐	☐

Environmental Science Identity

Indicate the extent with which you agree with the statement "I see myself as…"	Strongly Disagree	Somewhat Disagree	No Opinion	Somewhat Agree	Strongly Agree
…an outdoorsy person.	☐	☐	☐	☐	☐
…a science person.	☐	☐	☐	☐	☐
…someone who has a special relationship with the land.	☐	☐	☐	☐	☐
…someone who values the conservation of nature.	☐	☐	☐	☐	☐
…an environmentalist.	☐	☐	☐	☐	☐
…someone who is good with technology.	☐	☐	☐	☐	☐
…someone with unique knowledge about nature.	☐	☐	☐	☐	☐
…someone who has a special connection with animals.	☐	☐	☐	☐	☐
…someone who values protecting the environment.	☐	☐	☐	☐	☐

STEM Interest

Consider your views on the Environment, Agriculture, and STEM (Science, Technology, Engineering, and Mathematics) and indicate your agreement with the following questions:	Strongly Disagree	Somewhat Disagree	No Opinion	Somewhat Agree	Strongly Agree
STEM is useful if it can help conservation efforts.	☐	☐	☐	☐	☐
One of the most important uses of STEM is to improve/solve issues such as climate change.	☐	☐	☐	☐	☐
I am interested in a STEM career that will help the environment.	☐	☐	☐	☐	☐
I am only interested in a STEM career if I can help the environment.	☐	☐	☐	☐	☐
STEM innovations are important even if they harm the planet.	☐	☐	☐	☐	☐
STEM careers are interesting because they have the potential to positively impact the environmental problems in our world.	☐	☐	☐	☐	☐
I am interested in careers that use science to help the environment.	☐	☐	☐	☐	☐
I am NOT interested in the environmental aspects of STEM or agriculture.	☐	☐	☐	☐	☐
Agricultural innovations are important even if they harm the planet.	☐	☐	☐	☐	☐
I am interested in careers that use agriculture to help the environment.	☐	☐	☐	☐	☐
Solving environmental issues such as climate change is one of the most important issues in agriculture.	☐	☐	☐	☐	☐
I am only interested in an agriculture career if I can help the environment.	☐	☐	☐	☐	☐

Environmental Science Capital

Indicate the extent to which you agree with the following statements:	Strongly Disagree	Somewhat Disagree	No Opinion	Somewhat Agree	Strongly Agree
Learning about the environment helps prepare me for my future job.	☐	☐	☐	☐	☐
There are many different types of environmental jobs.	☐	☐	☐	☐	☐
When I am NOT in school, I often talk about the environment with other people.	☐	☐	☐	☐	☐
One or both of my parents/guardians think nature is very interesting.	☐	☐	☐	☐	☐
One or both of my parents/guardians enjoy spending time outdoors.	☐	☐	☐	☐	☐
One or both of my parents/guardians spend time sharing nature with me.	☐	☐	☐	☐	☐
When I am NOT in school, I read books or magazines about nature.	☐	☐	☐	☐	☐
When I am NOT in school, I watch videos or visit websites about nature.	☐	☐	☐	☐	☐
I enjoy outdoor activities (such as hunting, fishing, wildlife observation, camping, hiking, biking, climbing, nature photography, etc.)	☐	☐	☐	☐	☐
It is useful to know about the outdoors in my daily life.	☐	☐	☐	☐	☐
I can do outdoor activities near my home.	☐	☐	☐	☐	☐
I have access to equipment that allows me to recreate outdoors (hunting/fishing equipment, etc.)	☐	☐	☐	☐	☐
I feel welcome in outdoor places such as nature centers, parks, conservation areas, and wildlife refuges.	☐	☐	☐	☐	☐
It is difficult for me to get to a zoo, science center, or aquarium.	☐	☐	☐	☐	☐
I feel comfortable spending time outdoors in nature.	☐	☐	☐	☐	☐
It is hard to find places near my home where I can go and learn about science.	☐	☐	☐	☐	☐
My friends like to spend time outdoors.	☐	☐	☐	☐	☐
My friends see me as an outdoorsy person.	☐	☐	☐	☐	☐
My family has special places where we like to go in nature.	☐	☐	☐	☐	☐
My parents are afraid of me meeting strange people outdoors.	☐	☐	☐	☐	☐
I don't like to go outdoors because I am afraid of things that might hurt me.	☐	☐	☐	☐	☐

Pro-Environmental Behavior

How often do you perform the following behaviors?	Never				Always
I turn off lights when I am not in the room.	☐	☐	☐	☐	☐
I talk to people that I notice doing something that harms the environment in an effort to persuade them to stop the activity (for example, try to talk a friend into recycling a soda can instead of throwing it in the trash).	☐	☐	☐	☐	☐
I make an effort to reduce the amounts of goods I consume.	☐	☐	☐	☐	☐
I set a positive environmental example for my friends to follow.	☐	☐	☐	☐	☐
I support candidates for political office who are concerned about environmental problems.	☐	☐	☐	☐	☐
If I see an aluminum can on the ground when I'm out walking, I pick it up and take it with me.	☐	☐	☐	☐	☐
I recycle plastic bottles when I am done using them, instead of throwing them in the trash.	☐	☐	☐	☐	☐
I avoid purchasing products that have negative impact on the environment.	☐	☐	☐	☐	☐
I talk to my family about what they can do to help solve environmental problems.	☐	☐	☐	☐	☐
I purchase one product over another product because it is packaged in reusable, returnable or recyclable containers or packages.	☐	☐	☐	☐	☐
I make a point of reading articles (newspaper, magazine, or web articles) about the environment.	☐	☐	☐	☐	☐
I post my views about environmental issues on social media.	☐	☐	☐	☐	☐
If I saw someone who is not following hunting or fishing regulations, I would report it to the proper authorities.	☐	☐	☐	☐	☐
I try to make responsible environmental decisions when caring for my (or my family's) land.	☐	☐	☐	☐	☐
If necessary, I would write a letter or sign a petition for an environmental cause.	☐	☐	☐	☐	☐

Demographic Questions – ECC Students

About how many books are there in your home?

- ☐ Few (0-10)
- ☐ Enough to fill one shelf (11-25)
- ☐ Enough to fill one bookcase (26-100)
- ☐ Enough to fill several bookcases (100+)

Is there a computer at home that you use?

- ☐ No
- ☐ Yes

How many of the following things do you have in your home? Consider whether you have these in your home and add up the total. For example, if you only have a dishwasher, the total is 1. If you have all of the following in your home, the total is 5.

Access to the Internet
Clothes dryer just for your family
Dishwasher
More than one bathroom
Your own bedroom

Total: _____

Do you plan to vote in the next election?

- ☐ No
- ☐ Yes

How far in school did your mother go?

- ☐ She did not finish high school.
- ☐ She graduated from high school.
- ☐ She had some education after high school.
- ☐ She graduated from college.
- ☐ I don't know.

How far in school did your father go?

- ☐ He did not finish high school.
- ☐ He graduated from high school.
- ☐ He had some education after high school.
- ☐ He graduated from college.
- ☐ I don't know.

What is your political party affiliation?

- ☐ Republican
- ☐ Independent
- ☐ Democrat
- ☐ Other: _____
- ☐ I don't know

How would you describe your political ideology regarding social issues?

- ☐ Conservative
- ☐ Moderate
- ☐ Liberal

How would you describe your political ideology regarding economic issues?

- ☐ Conservative
- ☐ Moderate
- ☐ Liberal

How does your political ideology compare to that of your parents?

- ☐ Compared to my parents/guardians, I am much more politically conservative.
- ☐ Compared to my parents/guardians, I am somewhat more politically conservative.
- ☐ My political views and those of my parents are more or less the same.
- ☐ Compared to my parents/guardians, I am somewhat less politically conservative.
- ☐ Compared to my parents/guardians, I am much less politically conservative.

Thank you for your participation in this research study!

APPENDIX C – SAMPLE FOCUS GROUP QUESTIONS FOR QUALITATIVE PHASE OF STUDY

Opening Questions:

- What are some of your favorite things to do in your free time?
- What is your very favorite thing to do when you think about playing in the outdoors and nature?
- Is there someone you enjoy spending time with outdoors and/or in nature? Who and why?

Motivation:

- What motivated you to join (STEM Club/ECO-Meet/course)?
    - Probe - What made this interesting/memorable?
    - Probe - What's your favorite thing about (STEM Club/ECO-Meet/course)? What made that special?
    - Probe - What would you change about (STEM Club/ECO-Meet/course) if you could?
- Did someone encourage you to join?
    - Probe - Why did they want you to join?
    - Probe - Does this matter to you?
    - Probe - Have you encouraged someone to join (sibling, friend)? Why?

Identity:

- Do you consider yourself a "science" person? A "nature" person? An "outdoors" person? "Environmentalist"? Why or why not?
    - Probe – What kinds of things makes a person a "science", "nature" or "outdoors" person? What about an "environmentalist"?

    - Probe – Do your friends and family see you as a "science person"? Is this important to you?
    - Probe – Has (STEM Club/ECO-Meet/course) made you think about science/environment differently?
- Has the place you grew up influenced how you see yourself as a "science" person, etc.?
    - Probe - How?
    - Probe – What local places did you go to (farm, park, backyard, zoo, science museum, etc.)?
- Are you interested in science careers? Careers about nature and/or the environment?
    - Probe – What do you want to do?
    - Probe - Have you volunteered?
    - Probe – Do you know someone who has a career in science and/or about the environment?
    - Probe – Have they inspired you to pursue a similar career?
    - Probe – Has (STEM Club/ECO-Meet/course) influenced this interest?

Meaningful Nature Experiences:

- Have you ever had a time in the outdoors that you will never forget?
    - Probe – What made it memorable?
    - Probe – Who was with you?
- Is there any place outdoors that is special to you?
    - Probe – What makes it special?

  - Probe – How often do you go there?
  - Probe - Is there someone you go with?
- Have these experiences inspired you to help the environment?
  - Probe – In what ways?
  - Probe - Has (STEM Club/ECO-Meet/course) helped you with taking actions for the environment (recycling, trash pick-up, voting, public support, etc.)?
  - Probe - Do you feel more confident to tackle environmental problems after participating in (STEM Club/ECO-Meet/course)? What about (STEM Club/ECO-Meet/course) made you feel more comfortable?
  - Probe - Has participating in (STEM Club/ECO-Meet/course) made you think about science/environment differently? How?

Role Models:

- Is there someone you enjoy spending time with outdoors and/or in nature? Who and why?
  - Probe - What activities? What makes these activities special?
- Do you have a role model? Who is it?
  - Probe – What makes someone a "good" role model?
  - Probe – Do you see yourself as being a role model such as with siblings and friends?
- Has someone in your life encouraged your interest in science/nature? Who and why?

  - Probe - Has anyone in your life helped you build confidence in taking actions towards the environment? Who and why?
  - Probe - What about these people influenced you?

Closing Questions:

- Of all the things we discussed, what to you is the most important?
- All things considered, what do you believe has been the most important influence on your attitude and/or actions towards the environment?
- Is this an adequate summary?
- Have we missed anything?

APPENDIX D. DESCRIPTIVE STATISTICS AND ONE-WAY ANOVA RESULTS PER QUESTION

Descriptive Statistics for Demographic Questions and Relationships between each Question and the Dependent Variables tested using One-Way ANOVA

N	Mean	Std Dev	Min	Max	PEB_I		PEB_C		Combined PEB	
					p-value	N	p-value	N	p-value	N
Gender										
248	0.56	0.50	0	1	0.0016	251	0.0153	252	0.0002	248
Race										
251	5.01	0.64	1	7	0.9082	250	0.8752	251	0.6063	247
Geographic Region (Self-Described)										
250	2.33	0.69	1	3	0.4373	249	0.2795	250	0.2295	246
Number of Books in the Home										
245	3.04	0.97	1	5	0.0195	245	0.0077	245	0.0016	244
Political Party										
244	3.04	1.65	1	6	0.0015	242	<.0001	242	<.0001	241
Mother’s Education										
244	3.45	0.92	1	5	0.3933	244	0.3876	244	0.324	243
Father’s Education										
244	3.36	1.00	1	5	0.709	244	0.8338	244	0.7695	243
Activity Count										
242	1.64	1.85	0	20	0.0815	241	0.0656	242	0.0434	240
Years in ECO-Meet										
93	1.75	1.43	0	9	0.6323	92	0.5822	93	0.4264	91
Years in Club										
40	2.30	1.86	1	6	0.9418	40	0.9896	40	0.9817	40
Years in College										
100	1.70	0.92	0	6	0.2701	100	0.2373	100	0.2972	100
Academic Major										
100	6.70	3.66	1	12	0.0382	99	0.1246	99	0.0658	99
Social Ideology										
100	2.06	0.86	1	4	0.0079	93	0.0079	93	0.004	93

Economic Ideology										
100	2.04	0.89	1	4	0.0483	93	0.0163	93	0.0166	93
Parent Ideology										
96	3.30	0.80	2	5	0.0159	96	0.1737	96	0.0501	96

PEB_I and PEB_C refer to individual and collective pro-environmental behavior, respectively. Combined PEB refers to both PEB_I and PEB_C, combined into one variable.

Descriptive Statistics for Independent Variable Questions and Relationships between each Question and the Dependent Variables tested using One-Way ANOVA

Variable	N	Mean	Std Dev	Min	Max	I_PEB		C_PEB		Combined PEB	
						p-value	N	p-value	N	p-value	N
CNS1	252	4.01	0.97	1	5	<.0001	251	0.0010	252	.0001	248
CNS2	252	3.69	1.03	1	5	0.0002	251	0.0002	252	<.0001	248
CNS3	252	4.06	1.09	1	5	0.0225	251	0.0122	252	0.0017	248
CNS4	252	3.60	1.13	1	5	0.0006	251	<.0001	252	<.0001	248
CNS5	251	3.59	0.99	1	5	0.0022	250	<.0001	251	0.0037	247
CNS6	251	3.67	1.13	1	5	0.1820	250	0.1664	251	0.0039	247
CNS7	252	3.41	1.09	1	5	<.0001	251	<.0001	252	<.0001	248
MNE1	252	4.04	1.04	1	5	0.0557	251	0.2995	252	0.1024	248
MNE2	252	4.31	0.94	1	5	0.0371	251	0.0438	252	0.0329	248
MNE3	249	4.41	0.80	1	5	0.0016	248	0.027	249	0.004	245
MNE4	252	4.06	1.02	1	5	0.0002	251	<.0001	252	<.0001	248
MNE5	251	3.99	1.08	1	5	<.0001	250	<.0001	251	<.0001	247
MNE6	251	3.98	1.01	1	5	<.0001	250	0.0027	251	0.0004	247
MNE7	251	3.89	1.05	1	5	<.0001	250	0.0002	251	<.0001	247
MNE8	251	3.34	1.21	1	5	<.0001	250	<.0001	251	<.0001	247
MNE9	252	4.04	1.06	1	5	<.0001	251	0.0001	252	<.0001	248
MNE10	252	4.27	1.02	1	5	<.0001	251	0.0005	252	<.0001	248
MNE11	251	2.87	1.46	1	5	0.5631	250	0.7296	251	0.6306	247
MNE12	249	2.57	1.46	1	5	0.409	248	0.4201	249	0.4695	245
MNE13	252	3.48	1.31	1	5	0.0124	251	0.0386	252	0.0396	248
MNE14	250	3.08	1.44	1	5	0.4774	249	0.6819	250	0.4186	246

MNE15	252	3.35	1.29	1	5	<.0001	251	<.0001	252	<.0001	248
MNE16	252	3.70	1.15	1	5	<.0001	251	<.0001	252	<.0001	248
MNE17	252	3.29	1.45	1	5	0.0246	251	0.0256	252	0.0009	248
MNE18	252	3.71	1.11	1	5	<.0001	251	<.0001	252	<.0001	248
RM1	252	3.48	1.31	1	5	0.0563	251	0.1731	252	0.1943	248
RM2	251	3.68	1.19	1	5	<.0001	250	0.005	251	0.0019	247
RM3	251	3.98	1.34	1	5	0.0046	250	0.2656	251	0.3612	247
RM4	251	3.85	1.27	1	5	0.0029	250	0.1913	251	0.0697	247
RM5	251	3.32	1.35	1	5	0.1586	250	0.8843	251	0.6055	247
RM6	250	3.18	1.36	1	5	0.0133	249	0.1005	250	0.0266	246
RM7	249	3.5	1.36	1	5	0.2274	249	0.5315	249	0.7465	245
RM8	249	3.57	1.41	1	5	0.0261	248	0.069	249	0.0223	245
RM9	249	2.92	1.50	1	5	0.0383	248	0.3108	249	0.2549	246
RM10	249	2.84	1.44	1	5	0.001	248	0.024	249	0.0033	246
RM11	248	2.72	1.47	1	5	0.0034	247	0.0013	248	0.0030	245
RM12	247	2.45	1.41	1	5	0.0016	246	0.0067	247	0.0007	244
RM15	251	4.45	0.76	1	5	0.0144	250	0.0368	251	0.0031	248
RM16	251	4.03	1.10	1	5	0.0007	250	0.0001	251	0.0001	248
RM17	250	4.08	1.07	1	5	0.0034	249	0.0009	250	<0.0001	247
RM18	249	4.14	0.97	1	5	<.0001	248	0.0001	249	<0.0001	246
RM19	251	4.26	0.86	1	5	0.0046	250	0.0081	251	0.001	248
RM20	249	4.31	0.88	1	5	0.0203	248	0.2167	249	0.244	246
RM21	249	4.07	1.11	1	5	0.7745	248	0.3638	249	0.6757	246
IDE1	249	4.02	1.03	1	5	0.0017	248	0.0514	249	0.0143	246
IDE2	249	3.69	1.24	1	5	<0.0001	248	<0.0001	249	<0.0001	246
IDE3	249	3.32	1.16	1	5	<0.0001	248	<0.0001	249	<0.0001	246
IDE4	247	4.13	1.01	1	5	<0.0001	246	<0.0001	247	<0.0001	245
IDE5	248	3.37	1.14	1	5	<0.0001	247	<0.0001	248	<0.0001	245
IDE6	249	3.66	1.15	1	5	0.0073	248	0.0016	249	0.0102	246
IDE7	248	3.35	1.16	1	5	<0.0001	247	<0.0001	248	<0.0001	245
IDE8	249	3.90	1.16	1	5	<0.0001	248	<0.0001	249	<0.0001	246
IDE9	248	4.26	0.93	1	5	<0.0001	247	<0.0001	248	<0.0001	245
INT1	250	4.24	0.86	1	5	<0.0001	249	<0.0001	247	<0.0001	250
INT2	249	3.91	0.93	1	5	<0.0001	248	<0.0001	246	<0.0001	249

INT3	250	3.03	1.17	1	5	<0.0001	249	<0.0001	247	<0.0001	250
INT4	249	2.65	1.17	1	5	<0.0001	248	<0.0001	246	<0.0001	249
INT5	248	3.42	1.13	1	5	0.0221	247	0.0933	245	0.0196	248
INT6	250	3.91	0.95	1	5	<0.0001	249	<0.0001	247	<0.0001	250
INT7	249	3.21	1.19	1	5	<0.0001	248	<0.0001	246	<0.0001	249
INT8	250	3.53	1.25	1	5	0.0003	249	<0.0001	247	<0.0001	250
INT9	250	3.45	1.15	1	5	0.0027	249	0.0267	247	0.0021	250
INT10	249	3.07	1.20	1	5	0.0058	248	0.0036	246	0.0029	249
INT11	249	3.78	1.06	1	5	<0.0001	248	<0.0001	246	<0.0001	249
INT12	250	2.97	1.19	1	5	0.003	249	0.0006	247	0.0001	250
ESC1	251	3.25	1.20	1	5	<0.0001	250	<0.0001	251	<0.0001	248
ESC2	248	4.49	0.72	1	5	<0.0001	247	<0.0001	248	<0.0001	246
ESC3	250	2.86	1.27	1	5	<0.0001	249	<0.0001	250	<0.0001	248
ESC4	250	3.56	1.28	1	5	<0.0001	249	<0.0001	250	<0.0001	248
ESC5	250	4.12	1.10	1	5	0.0003	249	0.0046	250	0.0027	248
ESC6	249	3.53	1.33	1	5	0.0038	248	0.0281	249	0.0255	247
ESC7	250	2.39	1.26	1	5	<0.0001	249	<0.0001	250	<0.0001	248
ESC8	250	3.01	1.39	1	5	<0.0001	249	<0.0001	250	<0.0001	248
ESC9	250	4.45	0.87	1	5	<0.0001	249	<0.0001	250	<0.0001	248
ESC10	250	4.05	1.04	1	5	<0.0001	249	<0.0001	250	<0.0001	248
ESC11	249	4.16	1.10	1	5	<0.0001	248	<0.0001	249	<0.0001	247
ESC12	250	4.04	1.28	1	5	0.0987	249	0.6974	250	0.4680	248
ESC13	250	4.35	0.87	1	5	<0.0001	249	0.0001	250	<0.0001	248
ESC14	250	3.48	1.36	1	5	0.1028	249	0.0017	250	0.0025	248
ESC15	250	4.44	0.80	1	5	0.0199	249	0.0350	250	0.0219	248
ESC16	249	3.49	1.21	1	5	0.2726	248	0.0914	249	0.148	248
ESC17	249	3.78	1.10	1	5	0.014	248	0.2753	249	0.0559	248
ESC18	249	3.39	1.26	1	5	<0.0001	248	<0.0001	249	<0.0001	248
ESC19	249	3.34	1.35	1	5	<0.0001	248	0.0104	249	0.0016	248
ESC20	248	3.10	1.39	1	5	0.652	247	0.1642	248	0.4462	247
ESC21	248	4.17	1.01	1	5	0.1326	247	0.3792	248	0.1788	247

CNS refers to connectedness to nature scale, MNE refers to meaningful nature experiences, RM refers to role models, IDE refers to environmental identity, INT refers to STEM interest, and ESC refers environmental science capital.

Descriptive Statistics for Dependent Variable Questions

Variable	N	Mean	Std Dev	Min	Max
PEB1	248	4.3629032	0.8031787	1	5
PEB2	248	3.108871	1.1972649	1	5
PEB3	247	3.2267206	1.1321317	1	5
PEB4	247	3.3765182	1.1511461	1	5
PEB5	246	3.4268293	1.1503024	1	5
PEB6	247	3.4817814	1.2521007	1	5
PEB7	247	3.4696356	1.3213726	1	5
PEB8	247	2.7125506	1.109074	1	5
PEB9	247	2.4574899	1.2708483	1	5
PEB10	247	2.7935223	1.322829	1	5
PEB11	247	2.6639676	1.3207372	1	5
PEB12	247	1.9433198	1.2513513	1	5
PEB13	246	3.1869919	1.3633667	1	5
PEB14	247	3.9757085	1.0854811	1	5
PEB15	247	3.6315789	1.2321468	1	5

PEB refers to pro-environmental behavior.

APPENDIX E. INSTITUTIONAL REVIEW BOARD APPROVAL LETTER

Office of Research Administration

One University Boulevard
St. Louis, Missouri 63121-4499
Telephone: 314-516-5899
Fax: 314-516-6759
E-mail: ora@umsl.edu

DATE:	December 13, 2018
TO:	Michelle Donlan
FROM:	University of Missouri-St. Louis IRB
PROJECT TITLE:	[1333153-2] Environmental Science and Culture: Exploring the Factors Contributing to the Environmental Science Capital and Pro-Environmental Behavior of Rural Youth
REFERENCE #:	
SUBMISSION TYPE:	Revision
ACTION:	APPROVED
APPROVAL DATE:	December 13, 2018
EXPIRATION DATE:	December 13, 2023
REVIEW TYPE:	Full Committee Review

This proposal was approved by the University of Missouri-St. Louis IRB for a period of one year starting from the date listed above. The University of Missouri-St. Louis IRB must be notified in writing prior to major changes in the approved protocol. Examples of major changes are the addition of research sites or research instruments.

An annual report must be filed with the committee. This report should indicate the starting date of the project and the number of subjects since the start of project, or since last annual report.

Any consent or assent forms must be signed in duplicate and a copy provided to the subject. The principal investigator is required to retain the other copy of the signed consent form for at least three years following the completion of the research activity and the forms must be available for inspection if there is an official review of the UM-St. Louis human subjects research proceedings by the U.S. Department of Health and Human Services Office for Protection from Research Risks.

This action is officially recorded in the minutes of the committee.

If you have any questions, please contact Carl Bassi at 314-516-6029 or bassi@umsl.edu. Please include your project title and reference number in all correspondence with this committee.

APPENDIX F. CODES AND REPRESENTATIVE QUOTES FROM QUALITATIVE ANALYSIS

Qualitative Codes and Representative Quotes

Theme 1: Environmental clubs, learning experiences, and media can provide a social avenue for building environmental science capital.

Environmental Clubs:

ECO-GD-3: Just being able to contribute to the ECO-Meet team. Making stronger bonds with friends, old and new.

ECO-SMS-6: Being an eagle scout. I think enough is said there.

ECO-COL-9: I think the most meaningful experience has been the environmental clubs I have been a part of. They gave me a deeper understanding of nature and have taught me so much.

ECO-RL-9: Boy Scouts has been pretty impactful and I think spending time in outdoor areas with my friends falls into that. The memories you gain with that is what makes it important.

ECO-TZ-28: My most meaningful experience would be me being a part of ECOClub. It's taught me so much about the environment and how we can improve it and our lives as well. I've also met some of my closest friends there.

ECO-TZ-29: Teen camp and EcoClub and Volunteering at the zoo. Getting to make new friends and learn about nature and animals at the same time.

FOC-4H-AS: Scout group (boys and girls) because I learn a lot about nature and how to survive. It's useful and good to know. We find sticks for fire and walking and tracking.

FOC-SMHS-SC: It's [science club] good for merits, accomplishments used for scholarships.

ECC-EC19: I participated in a group called Habitat Helpers when I was a kid. I probably would never go outdoors today if I wasn't exposed to outdoor life so much then.

FOC-COL-1: I feel much more comfortable in nature in general after participating in ECO-Meet. I think the biggest thing for me was being immersed in nature through the scavenger hunt event.

FOC-COL-8: I think so. For starters, I think being around people with a similarly outdoorsy kind of mindset is encouraging because now I know that I'm not the only one that's that way. I know that, if I wanted to start a march for the environment, I would have a bunch of kids my age to help me

Learning Experiences:

MNE-4H-AS: Aquarium visits. Being able to see it in action and learn

MNE-SMHS: Watching videos and school trips. The videos can give you lots of information and so can zoos etc. on school trips.

MNE-SMHS: Past science teachers have made an effort to teach us about the environment

MNE-SMHS: The schools field trips are the most meaningful because I learned the most from them.

ECO-MVHS-4: Eco-meet. We took tests and learned about animals and things

ECO-MAN-2: Learning about the environment in school. It was the most meaningful because we got to learn every aspect of environmental issues and got to learn with peers.

ECO-COL-1: Outdoor school trips have been the most meaningful because I was able to learn so much with my class.

ECO-COL-6: I love exploring the outdoors alone or with my grandma. She is very knowledgeable about nature, and I always learn something new when I go out with her.

ECO-COL-9: I think the most meaningful experience has been the environmental clubs I have been a part of. They gave me a deeper understanding of nature and have taught me so much.

ECO-MZ-1: Going to a dairy farm because I learned how milk processing work

ECO-MZ-7: In 8th grade for social studies we went outside and we searched for things outside. Like plants, feathers, just cool things. It was meaningful because we got to explore.

ECO-RL-1: I really enjoyed the Omaha Zoo. It was cool seeing all the different habitats and what lives in each one.

ECO-TZ-7: I love just exploring the woods and studying animals. I like to study how they change.

ECO-TZ-13: Learning about the environment in school because almost all the kids in my class don't care about the environment.

ECO-TZ-20: Learning about the effects of climate change in a school environment

ECO-TZ-32: Coming to ECOClub and learning new things each time I come.

FOC-4H-AS: Learn about life cycles

FOC-4H-AS: Learning about trees and edible mushrooms

ECC-AP2: Going to field trips at the zoo and seeing different animals and learning about them.

ECC-AP5: I love to spend time outside because it is beautiful especially with my family and friends. I love going to the zoo and aquariums to learn about animals. I love to learn about stuff like that whether I'm with friends, family, or a school.

ECC-AP17: I think that being outside with a class, family, and friends is very key for learning and growing. Also, having some time to yourself to discover is important. Farming and hunting are ideal for getting food, providing jobs and resources for all humans and animals

ECC-EC1: School and family trips to indoor/outside places. It made learning so much going to the zoo or museum

ECC-EC8: Learning about the environment in class has really changed my outlook of the earth, and how important it is that we take care of it

ECC-EN7: Hunting and fishing with my family, because those times spent taught me a lot.

ECC-EN8: Learning about the environment because it forms a base to preserve the earth as a young child.

ECC-EC9: School trips, playing outdoors alone and with people and reading have helped me a lot with my imagination and learning process.

ECC-EC17: I think actually being involved in nature/learning about nature indoor or outdoor has been the most meaningful w/learning about the environment

FOC-ECC-02: Ecology (a course) helped me see and understand what I will be doing in my hopefully future career working in conservation.

FOC-COL-9: I felt like I could talk to people better and have a more logical discussion with people after I engaged and learned more about the environment.

Media:

MNE-SMHS: Music makes me feel connected to people and just the world around me

MNE-SMHS: Music helps me a lot in life and inspires me.

MNE-SMHS: School trips to outdoor areas were very important to me but I feel as though media and the internet is important to convey information as well.

MNE-SMHS: I feel that the books I have read greatly impacted me. Not only do they implicate different ideas of the actual "nature" aspect and how it works, but it gives me an advancement in what I'm actually learning about. I strongly believe books are power that give me the best information that is easier to comprehend.

MNE-SMHS: Books that I have read. This is meaningful because, for me, books allow me to envision a new and better world. Books allow for the world to be seen from another person's perspectives. This includes nature and the feelings surrounding it.

ECO-CHS-2: Listening to music. It is very important to me as a person. It gives me hope on a better life.

ECO-COL-4: Youtube. I follow a girl that has inspired me to love nature.

ECO-RL-5: Documentaries and posts on social media really grab my attention because they're so interesting.

ECO-BV-2: In my free time, I tend to watch a fair amount of YouTube, often finding myself engrossed in Hank Green's quirky, witty, and idiosyncratic attitude and demeanor on the platform. Videos of interesting animals, etc. Most of my recommended are chemistry/biology videos being so meaningful because in the little time I have to myself, they are the way that I tend to spend it.

ECO-JC-1: Reading books that nature setting is magical because of how preserved it is.

ECC-AS10: When I first saw the before and after of Antarctica's melting ice caps, my career was decided.

ECC-CH10: I believe the most meaningful experiences are seeing how humans have damaged the Earth with your own eyes. Reading about it vs. seeing it makes it feel so much more real. I had recently watched a movie and an underwater scene showed pollution and dumped cargo crates from boats. The pollution had little to do with the movie but it really made you think.

ECC-AP1: The most meaningful for me is the music that I have listened to because music usually causes some sort of emotion. It could be motivational to the point where you want to help the environment and make a difference. Music has shaped my life and personality in so many ways because it helped me get through a deep dark depression

in my life and all the stressors in my life. Music keeps me motivated to go on with my daily life.

ECC-AP20: Ted Talks because the informant is well educated and can effectively portray complex ideas in a more understandable way.

ECC-EN1: Watching nature documentaries helped me see there was more out there.

Social Experiences

MNE-4H-AS: The most meaningful thing to me is spending time with friends and family. This is because I feel like the time is more meaningful.

MNE-4H-STEM: Experiences with my friends. They're the only ones that truly get me

FOC-SMHS-SC: My friends because they are fun to hang around with

FOC-SMHS-SC: My family, it gives me a sense of security

ECO-STX-2: Spending time outside with my friends. I love my friends.

ECO-SMN-5: Being outdoors with my friends is the most meaningful. Getting to spend time with my friend just looking and walking around outside.

ECO-SMN-7: Spending time outside with my family and friends. I believe it's good to bond in the outdoors.

ECO-COL-5: Outdoor with family, growing closer to family

ECO-RL-3: Spending time outdoors with my family has been the most meaningful to me. I have the most childhood memories from times like those.

ECO-RL-4: Spending time with family outdoors because I am getting to be with my family.

ECO-TZ-14: Fishing and visiting zoos with my family, because both of those things have been kind of like traditions for my whole life and so I have strong connections to them.

ECO-TZ-37: The most meaningful were the experiences with my friends and family because it is a time we can disconnect from technology and be in the moment.

ECC-AS4: Anytime spent with family is meaningful, mostly camping somewhere and taking float trips because we don't get to do that all the time.

ECC-CH8: Spending time outdoors with my family has been meaningful. I enjoy getting to see nature up close.

ECC-CH20: Spending time with family/friends outdoors, because you get to see how they respond and their tricks for stuff, either right or wrong.

ECC-AP13: Spending outdoor time with my friends because people usually have deeper talks. This brings us closer.

ECC-AP14: Spending outdoors time with my family. During this time we spend at our farm, my father shows my family so much about nature and the animals living in it.

ECC-AP15: Spending time with my family going to the zoo, walking the nature trail, going to museum, and camping in our backyard. These are meaningful because I got to spend time with my family in the outside environment.

ECC-AP16: Most meaningful experiences to me have always had something to do with my family. I love camping. All these things are meaningful because I basically grew up outside. My family and I used outside as a way to escape reality and enjoy each other.

ECC-EC3: Exploring the outdoors with a friend is very meaningful because you get to experience something great with someone else

ECC-AP23: Spending time outdoors with friends and family. It is meaningful because it forms a bond by interacting with each other.

ECC-AP25: Spending time in the outdoors with my family, because it brings us closer in our relationship with each other because we have all learned, experienced, and created memories concerning the same event.

Theme Two: Outdoor recreation, working outdoors and/or with animals, and solitary experiences tend to connect participants with nature.

Outdoor Recreation:

ECO-MVHS-1: Hunting has definitely helped me appreciate nature because of the realization of how it works together.

ECO-MAN-3: Spending time outdoors seems to be the most meaningful. You get to see how the circle of life works and where you fit in.

ECO-COL-12: I think that camping/exploring has inspired me most to love the environment. The beauty/intricacy of the natural world swept me away from a young age.

ECO-RL-2: Hunting and fishing with my family and by myself. I feel these experiences have taught me most about the outdoors.

ECO-RL-6: Hunting and fishing because I think that it helps people to enjoy the outdoors

ECO-RL-8: I like hunting and fishing with my dad, that means a lot to me.

ECO-BV-4: Hunting with my friend brought me closer to him and the nature around life and death.

FOC-COL-8: Hiking, no doubt. Just enjoying the sights and sounds of nature makes me feel so small. There's just something about it, I'm not sure what.

FOC-SMHS-SC: Camping, me and my family go camping every year up and down the east coast.

ECC-AS2: The most important and meaningful experiences to me are the ones that keep you craving more. I love camping, sleeping on the ground in a tent because it's relaxing. I crave camping/hiking/anything outdoors. I have very low vitamin D so alongside taking vitamin D pills, something that helps me get along stress free is spending most of my time outdoors. To breathe fresh air in and feel nature swallowing you feels like a dream.

ECC-AS7: Hunting or fishing, because it allows us to get very close to nature.

ECC-AS9: Spending time hunting, working, and fishing outdoors alone and with family is what I feel has influenced my connectedness to nature the most. I've been outdoors all my life and was taught to sit back and enjoy/appreciate nature since I was young. Being out there gives you a sense of purpose in your life.

ECC-CH5: For deer season opening weekend, my family and I take a week long camping trip. I feel it is important that others experience this type of event as well because standing in the still quiet forest and watching the forest and how untouched it is, is a very important experience.

ECC-CH11: I love finding the quietest area of wherever I am exploring. This is mostly when I am out hunting but I like the thought of being in a place that few people have been at.

ECC-AP4: Being outdoors such as camping, hiking, exploring, or just relaxing allows individuals to discover the true beauty of this earth. Hiking is really eye opening.

ECC-AP7: Hunting with others; because you are taking from nature to feed your family while also allowing nature to flourish due to less overpopulation of animals.

ECC-AP18: I was always raised to hunt. I think more about the animals than necessarily the plants and trees. Plants and trees don't interest me. I like the animals and hunting them.

ECC-EC6: Going fishing. Catching a fish on my own and letting it go is a beautiful feeling and sight.

ECC-EN10: Hunting and fishing with my family, because those times spent taught me a lot.

ECC-EN10: I have always gone outdoors with my father, also hunting and fishing have strengthened my desire to be outdoors. Was very involved with FFA in high school - ties to farming in the family.

ECC-EN11: Fishing with family, it gets you involved in the outdoors and you do it with people you love.

ECC-EN12: Hunting alone. When I am hunting I tend to see wildlife that would not otherwise see. This experience intrigues me about the natural world.

ECC-EC18: Fishing with family, when we go fishing in the morning we have to wait for the trout bell to go off so we spend a lot of time watching different animals

<u>Working Outdoors and/or with Animals:</u>

ECO-MVHS-2: Time spent working outdoors. I would rather be outside instead of inside and I love the outdoor and having to do hands on activities.

ECC-AS6: Working outside in the weather, it taught me a new appreciation for the elements.

ECC-AP3: I think spending time working outdoors has been really meaningful to me. The earth is treated so badly at this time. Animals are starting to be endangered because of how we treat it. It is so delicate and being able to work outside and pick up trash, take care of the land and make it beautiful again is really amazing.

ECC-CI4: Working outside. Makes you feel like you are more connected with nature.

ECC-CI7: It would be farming because maintaining land helps me connect with nature and all other life forms.

MNE-4H-AS: Taking care of goats, dogs and cats. That’s my life!

MNE-4H-AS: Working with my now dead rabbit. He taught me how to really be responsible, and he helped me find more positive things in the world.

ECO-STX-1: Working outdoors and with animals because I love being outdoors and I love animals. I have a job where I work outside and we see a lot of wild animals. I love seeing these beautiful creatures.

ECO-STX-1: Honestly, spending time with animals because it helped me realize my passion truly for animals.

ECO-SMS-2: Spending time working with animals made me realize I wanted to do that for a living.

ECO-SALS-1: Time spent working with animals was the most meaningful to me because it sparked my passion for the environment. It started my interest in conservation and how I could do my part to help.

ECO-MZ-3: My aunts farm and learning about all the animals farming on my family farm because I have been able to learn about the environment

ECO-BV-3: The time I have spent working with animals have gave me the chance to find what I want to do and what animals mean to me.

FOC-4H-AS: We had several animals including a pig. We learned a lot.

FOC-4H-AS: Feeding our baby goats.

ECC-AS5: Working with animals firsthand and seeing just how unique and lively each individual was.

ECC-AS8: Time spent working with animals, both alone and with family and friends have been most meaningful. What made it so meaningful were the new friendships and memories made with these experiences.

ECC-CH19: Working with animals because I love animals.

ECC-AP12: Spending time outside taking care of animals with my family gave me a greater appreciation for our world.

ECC-AP19: Out of the above options I would have to choose spending time outdoors with my family, friends, and alone. My family is very active in farming and the equine industry, being such means that the majority of my childhood was spent outside, helping and playing. Now that I'm older I see the outdoors as my "escape" from pressures of life.

ECC-EC5: Time spent raising and showing animals at the fair. Because I had a special bond all the time, but knew also that I would have to let them go at the end of the week.

ECC-EC7: Time spent working with animals is the most meaningful because I once had a goat when I was 12 years old. I took care of the goat from birth until it grew up. Unfortunately, my family killed it because there was an event. I felt as if I lost something that day. I cried a lot and I didn't even eat it.

ECC-EN5: Time spent working with animals because I love animals.

Solitary Experiences:

MNE-SMHS-SC: Spending time outdoors alone has made me feel very connected to nature because it's nothing but me and my surroundings. There is no distractions to take me away from the beauty of nature

ECO-STX-4: Exploring the outdoors alone. It helps me to focus on the nature.

ECO-SMN-1: Walking alone in the woods and just observing things. It feels cleaner, older. I enjoy that. Last summer I went to the arboretum and sat and drew for a long time.

ECO-SMS-9: Spending time outdoors alone is a great way to connect to nature on a deeper and more personal level.

ECO-COL-2: Time spent outdoors while alone has allowed me to particularly examine the world around me without thinking of other needless stress. It is primarily a disconnecting experience.

ECO-COL-7: Experiencing nature by myself, because I don't have as many distractions so I can really enjoy and observe the beauty of nature.

ECO-COL-11: I think that any time I am alone in nature it means more to me and affects me more.

ECO-TZ-35: Exploring the outdoors alone, I love to see nature and think with it around me

ECC-CH2: I find when I am alone in nature, hunting or exploring, I am given more time to appreciate and feel connected to the nature around me

ECC-CH7: The most meaningful has been exploring the outdoors alone. I like to walk through the woods near my house along the creek. It relaxes me and I feel more connected to nature.

ECC-CH13: Exploring the outdoors alone because when I do this activity I am allowed to relax in a way. I really enjoy exploring nature as I can feel like myself the most and reflect on my life.

ECC-CH18: I think hunting alone has had a very meaningful impact on me. I just get to be alone with my thoughts and nature. Takes my mind off of everything else

ECC-AP24: Time spent hunting alone. I spend anywhere from 200 to 400 hours each year hunting all types of animals. During this time itis my time to recollect on my thoughts and enjoy myself.

ECC-EC2: The most meaningful experience is exploring the outdoors alone. Its just so peaceful.

ECC-EN6: Exploring the outdoors alone has been the most meaningful. The solitude allows me to have a greater connection to the earth.

ECC-EN12: Hunting alone. When I am hunting I tend to see wildlife that would not otherwise see. This experience intrigues me about the natural world.

ECC-CI6: Going on a hike and then fishing by myself was probably most meaningful. Walking through the woods to the pond was a unique experience for me. There were no sounds except for my footsteps and the birds. It made me feel calm and like I belonged there.

Wonder-Inspiring Experiences:

MNE-4H-AS: Going to Spruce Knob learning center showed the sheer beauty of nature and she impacted that humans have on it

MNE-SMHS: Going to the Baltimore aquarium was the most meaningful because I felt very close to nature seeing all the animals up close and their different habitats

ECO-GD-2: When I was little my cousins and I would pick up toads to look at them.

ECO-SMN-9: Hiking mountains in Vermont!! It's such an untouched area that I get to share with my family.

ECO-SMS-10: I feel like the experiences I have faced outdoors because you actually get to see nature and not just hear what someone else has said, but experience it yourself.

ECO-COL-3: Outdoor field trips with biology class to go water wading in creeks. I got to spend time with friends and experience the beauty of God's work while learning more about the natural environment.

ECO-COL-8: I have had a baby bird 'fly' out of its nest and land on me ...TWICE! Once a baby cardinal and once a baby Robin. It showed me up close the true beauty of nature. It demands respect, but also unity with all creation.

FOC-4H-AS: I watched a hawk grab a sparrow

FOC-4H-AS: Yellowstone and seeing the geysers. And buffalo that stop traffic.

FOC-4H-AS: Seeing a black snake in my garage

ECC-CH12: Going to Mt. Hood in Oregon and looking out at the forest gave me a new appreciation for the scale of our world.

ECC-CI3: Backpacking in the mountains. The scope of the views let me see more natural spaces than ever before. Even though I don't feel "connected" with nature, I understand its importance and how it should be protected.

ECC-EC11: I was at the beach during sunset watching seagulls and pelicans fly overhead, and little clams burying in the sand. I realized how beautiful the world is (or can be) and it made me feel really peaceful.

ECC-EC20: I have been to Puerto Rico and was able to see the rainforest and several other awesome places that made me fall in love with the outdoors.

Theme Three: Participants often exhibit awareness of environmental problems, yet engagement in pro-environmental behavior is lacking or limited to individual actions.

Awareness:

FOC-4H-AS: Pay attention to waste, increase awareness

FOC-4H-AS: Know where our food sources come from

ECC-AP26: Participation in environmental clubs has made me more aware of how we need to take care of the planet.

FOC-ECC-06: Yes (the course) made me realize that I don't need to waste gas traveling places that I don't have to go, and other actions I can take to save waste from being made.

FOC-ECC-09: I would say they (courses) increased my interest and passion for wildlife conservation.

FOC-ECC-09: I'm not sure that they made me more "comfortable" per se, more-so just increased my concern

FOC-COL-1: I think it has made me more aware of things that occur in nature and has made me more likely to want to pick up trash, etc.

FOC-COL-2: Yes it has. After seeing all the trash in the environment, you start to hear the stories about pollution everywhere. That awareness is where change starts.

FOC-COL-3: ECO-Meet has made me more aware of the environment and appreciation of what it can do.

FOC-COL-5: Yes; I feel like I'm much more aware of the world around me. I try to be more environmentally conscious.

FOC-COL-6: Yes. It has helped me learn more about human activity that harms the environment so that I can avoid these issues since I'm aware.

FOC-COL-7: Yes. I think being in ECO-Meet/Science club has helped me because now I'm more aware of how much the environment and all organisms that live within are affected by our careless actions, and that my small steps to help do amount to something.

FOC-COL-9: Yes, I feel like learning about the world and the damage that humans cause it has made me want to help the environment more than ever.

FOC-COL-2: Yes. The fact that environmental problems are affecting all lives and that no change/action lead to future and more problems.

FOC-COL-3: Yes, because it gave me more knowledge about the environment and its problems

FOC-COL-4: Yes, I do. This is because I know more about the environment and how fragile it is. During ECO-Meet scavenger hunts it made me realize how much trash and litter is in our land.

FOC-COL-5: Yes. I have more facts to back me up, and I know more about what kinds of species can be affected, and just how many there are.

FOC-COL-6: Yes. Especially that I have learned about harmful plants, venomous snakes, and many precautions to take when being in the wild outdoors. It has also given me a motive to protect the environment.

FOC-COL-7: Yes, I think so. It made me feel more involved in the environment, so I felt more motivated to help.

<u>Individual Actions:</u>

FOC-SMHS-SC: I love nature. I am not outdoors often. But I enjoy seeing nature’s beauty. I recycle and don’t litter.

FOC-4H-AS: Composting

FOC-4H-AS: Composting, too.

FOC-SMHS-SC: We are preparing to plant trees

FOC-SMHS-SC: Whenever I see trash lying around I pick it up and recycle

FOC-SMHS-SC: We have been more involved with spreading science awareness and enthusiasm but I do things on my own like recycle, more conscious of environment, etc.

FOC-SMHS-SC: We are planting trees

FOC-SMHS-SC: My actions and emotions have not changed [since joining science club]

FOC-SMHS-SC: Reminder of importance of recycling and picking up trash

FOC-SMHS-SC: Encourage us to use other options, such as eco-options as a consumer

FOC-SMHS-SC: Encourage family members such as not to waste water

FOC-SMHS-SC: We encourage little ones to pursue science through STEM/STEAM night at the local elementary schools. It's where we set up stations and demonstrate science to kids.

FOC-SMHS-SC: We received a grant to plant trees at the school.

FOC-SMHS-SC: We have a competition with the St. Joseph's HS (private school in Martinsburg WV – also in Berkeley County) about recycling.

FOC-SMHS-SC: I mainly follow the common advice: don't litter, reduce your energy, don't use plastic if you can, use degradable [items], reuse things, etc.

FOC-ECC-06: Yes, Environmental Science (a course) taught me that the world is declining in health, so we at home recycle waste that can be, and take other actions that would save us from wasting more material.

FOC-ECC-07: (environmentalist) Although I don't go around the world cleaning oceans and wildlife environments, I do recycle and care about the environment. I don't like seeing people littering.

FOC-ECC-09: I do small things to help out like never leave water running, always pick up my trash and never litter, pick up other people's trash as well.

Theme Four: Participants tend to lack environmental identity or experience conflicts related to their environmental identity.

Environmental Identity Language:

FOC-ECC-01 No, I (don't see myself as an environmentalist because) I don't practice any rituals that are environmentally friendly. I believe we should all get on board to help the planet but I don't actively recycle or anything like that.

FOC-ECC-03: (in reference to courses helping with PEB) Honestly, no. I've always been someone who wanted to take care of the environment. I personally believe it is something you can't be taught. You gotta have it in you to do these things. To be compassionate

FOC-ECC-04: I am an environmentalist in the fact that I believe everyone has the responsibility to take care of the land. My hesitation to take that label comes from the fact that many "environmentalists" think modern farming practices are too destructive.

FOC-ECC-06: (environmentalist) I do not see myself as an environmentalist, simply because it is not my main priority all the time. I do things that help the environment, but I do a lot of things that hurt it too.

FOC-ECC-07: (environmentalist) Although I don't go around the world cleaning oceans and wildlife environments, I do recycle and care about the environment. I don't like seeing people littering.

FOC-ECC-08: Ecology (a course) has helped me learn that protecting the environment isn't as hopeless as it seems when you watch the news.

FOC-SMHS-SC: I don't consider myself an environmentalist because while I don't do harmful things to the environment, I don't often speak up about environmental issues to other people.

FOC-SMHS-SC: Mom is passionate about it [environment] and talks to me. FOC-SMHS-SC: We have been more involved with spreading science awareness and enthusiasm but I do things on my own like recycle, more conscious of environment, etc.

FOC-SMHS-SC: I will be voting in the next election

FOC-SMHS-SC: Encourage us to use other options, such as eco-options as a consumer

FOC-SMHS-SC: Encourage family members such as not to waste water

FOC-SMHS-SC: I feel more able to confront environmental problems when supported by friends and school organizations

FOC-SMHS-SC: The more I learn the more I feel confident. Things that you don't know a lot about are commonly taken as scary or intimidating.

FOC-SMHS-SC: I mainly follow the common advice: don't litter, reduce your energy, don't use plastic if you can, use degredables, reuse things, etc.

Nature Identity Language:

FOC-ECC-02: (nature person) Nothing is more beautiful than nature in complete harmony

FOC-ECC-03: (nature person) something about the outdoors brings me peace of mind and internal happiness.

FOC-ECC-04: (nature person) While I like nature for what it has given me, I am a nature person by responsibility not by choice.

FOC-ECC-05: (nature person) I see myself as somewhat of a nature person only because animals are outside in nature. Checking soil contents or crops would be the only thing In nature I'd really do.

FOC-ECC-07: I am most an outdoors/nature person, because I love going floating on beautiful spring-fed rivers and exploring nature.

FOC-SMHS-SC: I love nature. I am not outdoors often. But I enjoy seeing nature's beauty. I recycle and don't litter.

FOC-SMHS-SC: I'm an artist and I get inspired by nature. I draw from it and how it makes people feel good.

FOC-SMHS-SC: It's nice to separate from things.

FOC-SMHS-SC: Nature is beautiful. I like sight-seeing.

Outdoor Identity Language:

FOC-ECC-03: (outdoors person) I crave to be outdoors 24/7. When I'm inside all I can think about is going outside.

FOC-ECC-06: (outdoors person) the outdoors is a place that is not made by man, and is all natural. Seeing different structures like mountains or forests is the best experience and beauty of this world.

FOC-ECC-07: I am most an outdoors/nature person, because I love going floating on beautiful spring-fed rivers and exploring nature.

FOC-4H-AS: Camping, me and my family go camping every year up and down the east coast.

FOC-4H-AS: I like camping but I'm kind of afraid of camping!

Science Identity Language:

FOC-ECC-02: (I am a scientist because) I have always been fascinated with trying to see why things are the way they are. I'm more of a biological or ecological person.

FOC-ECC-03: (science person) I like to know why things work and what they do. I like watching growth of things over time. I like experimenting.

FOC-ECC-07: (science person) If there was a maybe box I would have checked that. I don't really like all the formulas and equations but I like animals, anatomy, and the nature aspect.

FOC-ECC-04: (science person) The more you examine an object's state, makeup, and origins, the more complex it becomes. Science is the most powerful tool humanity has at its disposal.

FOC-ECC-05: (science person) I'd rather spend a day doing samples or running experiments than doing not entertaining things. I'd much prefer running around after cows and pigs than stuck in a building.

FOC-ECC-08: I'm a science person because I always ask why, how, what, who and when. I love learning about our world and hopefully how to make a difference and shrink humanity's ecological footprint.

FOC-ECC-09: (science person) I don't because I am horrible at science and I think it takes me longer to understand it, either that or I was never taught it well. It stresses me out a bit and it's hard for it to keep my focus long enough for me to understand it.

ECO-COL-6: Science is always changing, so there's constantly something new to learn. I also grew up appreciating the small details of nature.

FOC-SMHS-SC: I enjoy science and I enjoy learning.

FOC-SMHS-SC: I'm very logical

FOC-4H-AS: Because want to know why things work, facts vs. opinions

FOC-4H-AS: Learn about life cycles

FOC-SMHS-SC: There are many aspects to science, many parts.

FOC-SMHS-SC: A lot of people are interested in science because they like the challenge.

FOC-SMHS-SC: Science is a diverse subject. There's something for everyone.

FOC-SMHS-SC: I'm interested in science because it helps other people

FOC-SMHS-SC: It's [science club] good for merits, accomplishments used for scholarships.

FOC-SMHS-SC: I’m not interested in a science job but using science and technology within my job.

FOC-SMHS-SC: Yeah science in general, I mean it’s not just limited to science club. Science makes more confident.

FOC-SMHS-SC: There are many aspects to science, many parts.

FOC-4H-AS: You use science to take care of animals

FOC-SMHS-SC: Science is a diverse subject. There’s something for everyone.

FOC-SMHS-SC: I’m interested in science because it helps other people

FOC-ECC-01: I like that science has the potential to change the world in more ways than one and I appreciate scientific research.

ECO-SMN-11: Science is always changing, so there's constantly something new to learn. I also grew up appreciating the small details of nature.

APPENDIX G. DATA ANALYSIS PLAN

Quantitative Data Analysis

Variable Table:

Variable Name and Code	Measurement	Question # on Survey (Appendix B)
Dependent Variables		
Individual Pro-Environmental Behavior (PEB_I)	Note: On Survey, we don't divide these two variables. (Direct vs. Indirect)	PEB1-PEB15
Collective Pro-Environmental Behavior (PEB_C)	Note: On Survey, we don't divide these two variables. (Direct vs. Indirect)	PEB1-PEB15
Independent Variables		
Connectedness To Nature Scale (CNS)	1= Strongly Disagree 2 = Somewhat Disagree 3 = No Opinion 4 = Somewhat Agree 5 = Strongly Agree	CNS1-CNS7
Environmental Identity (IDE)	1= Strongly Disagree 2 = Somewhat Disagree 3 = No Opinion 4 = Somewhat Agree 5 = Strongly Agree	IDE1-IDE9
Meaningful Nature Experiences (MNE)	Likert Scale 1 to 5 1 = "Not at all important" 5 = "Very important"	MNE1-MNE19
Role Models (Influence of Family, Friends, Mentors and Role Models) (RM)	Likert Scale 1 to 5 1 = "Not at all important" 5 = "Very important" Likert Scale 1 to 5 1 = "Does not describe my role model at all" 5 = "Describes my role model very well":	RM1-RM20

STEM Interest (INT)	1= Strongly Disagree 2 = Somewhat Disagree 3 = No Opinion 4 = Somewhat Agree 5 = Strongly Agree	INT1-INT12
Environmental Science Capital (ESC)	1= Strongly Disagree 2 = Somewhat Disagree 3 = No Opinion 4 = Somewhat Agree 5 = Strongly Agree	ESC1-ESC21

Demographic Variables (D)

Socioeconomic Situation (SE) - Books in Home	1 = Few (0-10) 2 = Enough to fill one shelf (11-25) 3 = Enough to fill one bookcase (26-100) 4 = Enough to fill several bookcases (100+)	D1
Socioeconomic Situation (SE) - Computer in Home	0 = No 1 = Yes	D11
Socioeconomic Situation (SE) - Items in Home	Write In	D12
Socioeconomic Situation (SE) - Mother's Education Level	1 = She did not finish high school. 2 = She graduated from high school. 3 = She had some education after high school. 4 = She graduated from college. 5 = I don't know.	D14
Socioeconomic Situation (SE) Father's Education Level	1 = He did not finish high school. 2 = He graduated from high school. 3 = He had some education after high school. 4 = He graduated from college. 5 = I don't know.	D15
Political Affiliation (PA) - Political Affiliation	1 = Republican 2 = Independent 3 = Democrat 4 = Other: _____ 5 = I don't know	D16
Political Affiliation (PA) - Voting Note: High School students only	0 = No 1 = Yes	D13

Political Affiliation (PA) - Social Ideology Note: College students only	1 = Conservative 2 = Moderate 3 = Liberal	D17
Political Affiliation (PA) - Economic Ideology Note: College students only	1 = Conservative 2 = Moderate 3 = Liberal	D18
Political Affiliation (PA) - Ideology Different than Parents Note: College students only	1 = Compared to my parents/guardians, I am much more politically conservative. 2 = Compared to my parents/guardians, I am somewhat more politically conservative. 3 = My political views and those of my parents are roughly the same. 4 = Compared to my parents/guardians, I am somewhat less politically conservative. 5 = Compared to my parents/guardians, I am much less politically conservative.	D19
Gender (G)	1 = Male 2 = Female 3 = Non-binary/Third Gender 4 = Prefer to Self-Describe 5 = Prefer not to say	D2
Race (R)	1 = American Indian or Alaska Native 2 = Asian 3 = Black or African American 4 = Native Hawaiian or other Pacific Islander 5 = White 6 = More than 1 Race 7 = Other	D3
Geographical Region (GR) - Zip Code	Write In	D5
Geographical Region (GR) - Rural, Suburban or Urban	1 = Urban (a city or large town) 2 = In between (suburbs/a medium sized town) 3 = Rural (a small town/the country)	D6

Geographical Region (GR) - School Size Note: High school students only.	Write In	D7
Hispanic (H)	0 = No 1 = Yes	D4
Age (A)	Write In (years)	D1

Descriptive Statistics

Descriptive statistics are used to describe the basic features of the data in a study. They provide simple summaries about the sample and the measures.

One way frequency table for:

- IV2 (Gender)
- IV3 (Race)
- IV5 (Geographical Region)
- IV7 (Hispanic)
- IV8 (Socioeconomic Situation Books in Home)
- IV9 (Socioeconomic Situation Computer in Home)
- IV10 (Socioeconomic Situation Items in Home)
- IV11 (Socioeconomic Situation Mother Ed. Level)
- IV12 (Socioeconomic Situation Father Ed. Level)
- IV13 (Political Affiliation Political Party)
- IV14 (Political Affiliation Voting)
- IV15 (Political Affiliation Social Ideology)
- IV16 (Political Affiliation Economic Ideology)
- IV17 (Political Affiliation Ideology different than Parents)

These categories are all nominal.

Means can be figured for:

- IV1 (Age)

This data is ratio data.

Inferential Statistics

Inferential statistical analysis infers properties of a population, for example by testing hypotheses and deriving estimates. It is assumed that the observed data set is sampled from a larger population.

Ho= Dependent variable is similar across levels of independent variable (IV)

Ha= Dependent variable is different across levels of independent variable. Alpha = 0.05

1. DV1 = f (Age)

Test: Simple linear regression
A linear regression is an appropriate analysis when the goal of research is to assess the extent of a relationship between a dichotomous or interval/ratio predictor variable on an interval/ratio criterion variable.

Age is recorded in years and that is ratio data. Individual pro-environmental behavior will be an average of the Likert values (scale of 1-5) and can be treated as interval data in the case of attitude surveys.

2. DV1 = f (Gender)

Test: One-way ANOVA
One-way ANOVA is an appropriate statistical analysis when the purpose of research is to assess if mean differences exist on one continuous dependent variable by an independent variable with two or more discrete groups. The dependent variable in this analysis is dependent variable, and the discrete groups of independent variable (insert categories of groups). The assumption of normality and homogeneity of variance will be assessed.

Gender is recorded as one of five choices so this is nominal or categorical data. DV1 is interval data so ANOVA is indicated for this test.

3. DV1 = f (Race)

Test: One-way ANOVA [DV1 is interval data, Race is nominal]

4. DV1 = f (Geographical Region)

Note: There is no test. Zip code is asked to confirm if county is rural or urban.

5. DV1 = f (Geographical Region)

Test: One-way ANOVA [DV1 is interval data, Geographical Region is nominal]

6. DV1 = f (Geographical Region)

Note: There is no test. School size is asked to confirm if rural or urban.

7. DV1 = f (Hispanic)

Test: t-test

8. DV1 = f (Socioeconomic Situation)

Test: One-way ANOVA [DV1 is interval data, Socioeconomic Situation is nominal]

9. DV1 = f (Socioeconomic Situation)

Test: One-way ANOVA [DV1 is interval data, Socioeconomic Situation is nominal]

10. DV1 = f (Socioeconomic Situation)

Test: One-way ANOVA [DV1 is interval data, Socioeconomic Situation is nominal]

11. DV1 = f (Socioeconomic Situation)

No Test.

12. DV1 = f (Socioeconomic Situation)

Test: One-way ANOVA [DV1 is interval data, Socioeconomic Situation is nominal]

13. DV1 = f (Political Affiliation)

Test: One-way ANOVA [DV1 is interval data, Political Affiliation is nominal]

14. DV1 = f (Political Affiliation)

Test: One-way ANOVA [DV1 is interval data, Political Affiliation is nominal]

15. DV1 = f (Political Affiliation)

Test: One-way ANOVA [DV1 is interval data, Political Affiliation is nominal]

16. DV1 = f (Political Affiliation)

Test: One-way ANOVA [DV1 is interval data, Political Affiliation is nominal]

17. DV1 = f (Political Affiliation)

Test: One-way ANOVA [DV1 is interval data, Political Affiliation is nominal]

18. DV1 = f (Connectedness to Nature Scale)

Test: Correlation Regression [DV1 is interval data, Connectedness to Nature Scale is also interval]

19. DV1 = f (Environmental identity)

Test: Correlation Regression [DV1 is interval data, Environmental identity is also interval]

20. DV1 = f (Meaningful Nature Experiences)

Test: Correlation Regression {DV1 is interval data, Meaningful Nature Experiences is also interval]

21. DV1 = f (Role Models)

Test: Correlation Regression {DV1 is interval data, Role Models is also interval]

22. DV1 = f (STEM Interest)

Test: Correlation Regression {DV1 is interval data, STEM interest is also interval]

23. DV1 = f (Environmental Science Capital)

Test: Correlation Regression [DV1 is interval data, Environmental Science Capital is also interval]

24. DV2 = f (Age)

Test: Simple linear regression [DV2 is interval data, Age is ratio data]

25. DV2 = f (Gender)

Test: One-way ANOVA [DV2 is interval data, Gender is nominal]

26. DV2 = f (Race)

Test: One-way ANOVA [DV2 is interval data, Race is nominal]

27. DV2 = f (Geographical Region)

Note: There is no test. Zip code is asked to determine if county is rural or urban.

28. DV2 = f (Geographical Region)

Test: One-way ANOVA [DV2 is interval data, Geographical Region is nominal]

29. DV2 = f (Geographical Region)

Test: One-way ANOVA [DV2 is interval data, Geographical Region is nominal]

30. DV2 = f (Hispanic)

Test: One-way ANOVA [DV2 is interval data, Hispanic is nominal]

31. DV2 = f (Socioeconomic Situation)

Test: One-way ANOVA [DV2 is interval data, Socioeconomic Situation is nominal]

32. DV2 = f (Socioeconomic Situation)

Test: One-way ANOVA [DV2 is interval data, Socioeconomic Situation is nominal]

33. DV2 = f (Socioeconomic Situation)

Test: One-way ANOVA [DV2 is interval data, Socioeconomic Situation is nominal]

34. DV2 = f (Socioeconomic Situation)

No Test.

35. DV2 = f (Socioeconomic Situation)

Test: One-way ANOVA [DV2 is interval data, Socioeconomic Situation is nominal]

36. DV2 = f (Political Affiliation)

Test: One-way ANOVA [DV2 is interval data, Political Affiliation is nominal]

37. DV2 = f (Political Affiliation)

Test: One-way ANOVA [DV2 is interval data, Political Affiliation is nominal]

38. DV2 = f (Political Affiliation)

Test: One-way ANOVA [DV2 is interval data, Political Affiliation is nominal]

39. DV2 = f (Political Affiliation)

Test: One-way ANOVA [DV2 is interval data, Political Affiliation is nominal]

40. DV2 = f (Political Affiliation)

Test: One-way ANOVA [DV2 is interval data, Political Affiliation is nominal]

41. DV2 = f (Connectedness To Nature Scale)

Test: Correlation Regression [DV2 is interval data, Connectedness to Nature Scale is also interval]

42. DV2 = f (Environmental identity)

Test: Correlation Regression [DV2 is interval data, Environmental identity is also interval]

43. DV2 = f (Meaningful Nature Experiences)

Test: Correlation Regression [DV2 is interval data, Meaningful Nature Experiences is also interval]

44. DV2 = f (Role Models)

Test: Correlation Regression [DV2 is interval data, Role Models is also interval]

45. DV2 = f (STEM Interest)

Test: Correlation Regression [DV2 is interval data, STEM Interest is also interval]

46. DV2 = f (Environmental Science Capital)

Test: Correlation Regression [DV2 is interval data, Environmental Science Capital is also interval]

47. DV2=f (DV1)

Test: paired t-test [DV1 is interval data and DV2 is interval data]

To examine the research question, a dependent sample t test will be conducted to examine if mean differences exist on dependent variable1 and dependent variable2. Dependent sample t test for paired means is an appropriate statistical analysis if each of the two samples can be matched on a particular characteristic.

Variable Table for High School Students Only – ECO Meet

IV/DV	Variable Name and Code	Measurement
IV24	High School Specific HSS1	1 = This is my first year in ECO-Meet. 2 = This is my second year in ECO-Meet. 3 = This is my third year in ECO-Meet. 4 = This is my fourth year in ECO-Meet. 5 = This is my fifth year in ECO-Meet.
IV25	High School Specific HSS2	Write In (Total Number)

1. DV1 = f (HSS1)

Test: One-way ANOVA [DV1 is interval data, HSS1 is nominal]

2. DV1 = f (HSS2)

Test: One-way ANOVA [DV1 is interval data, HSS2 is nominal]

3. DV2 = f (HSS1)

Test: Simple linear regression [DV2 is interval data, HSS1 is ratio data]

4. DV2 = f (HSS2)

Test: Simple linear regression [DV2 is interval data, HSS2 is ratio data]

Variable Table for High School Students Only – STEM Club

Variable Name and Code	Measurement
High School Specific HSS3	1 = Less than 1 year 2 = At least 1 year, but less than 2 3 = At least 2 years, but less than 3 4 = At least 3 years, but less than 4 5 = At least 4 years, but less than 5 6 = 5 years or more
High School Specific HSS4	Write In (Total Number)

1. DV1 = f (HSS3)

Test: One-way ANOVA [DV1 is interval data, HSS3 is nominal]

2. DV1 = f (HSS4)

Test: One-way ANOVA [DV1 is interval data, HSS4 is nominal]

3. DV2 = f (HSS3)

Test: Simple linear regression [DV2 is interval data, HSS3 is ratio data]

4. DV2 = f (HSS4)

Test: Simple linear regression [DV2 is interval data, HSS4 is ratio data]

Variable Table for College Students Only

Variable Name and Code	Measurement
College Student Specific CSS1	1 = This is my first taking college courses. 2 = This is my second year. 3 = This is my third year. 4 = This is my fourth year. 5 = I have been in college for 5 or more years.
College Student Specific CSS2	Write In (Total Number)
College Student Specific CSS3	1 = Science – Physics or Engineering 2 = Science – Biological or Life Sciences 3 = Science – Chemistry 4 = Science – Environmental Science 5 = Science – Agriculture or Animal Science 6 = Science – Health (Nursing, Pre-Med, Pre-Nursing, etc.) 7 = Social Science (Psychology, Sociology, Education) 8 = Business or Career Technical Education 9 = Humanities (English, Spanish, Journalism) 10 = Fine Arts 11 = Undecided 12 = Other (Please Explain Below):

1. DV1 = f (CSS1)

Test: One-way ANOVA [DV1 is interval data, CSS1 is nominal]

2. DV1 = f (CSS2)

Test: Simple linear regression [DV1 is interval data, CSS2 is ratio data]

3. DV1 = f (CSS3)

Test: One-way ANOVA [DV1 is interval data, CSS3 is nominal]

4. DV2 = f (CSS1)

Test: One-way ANOVA [DV2 is interval data, CSS1 is nominal]

5. DV2 = f (CSS2)

Test: Simple linear regression [DV2 is interval data, CSS2 is ratio data]

6. DV2 = f (CSS3)

Test: One-way ANOVA [DV2 is interval data, CSS3 is nominal]

Qualitative Data Analysis

For the qualitative portion of the study, open-ended questions will be asked on the quantitative survey and focus groups will be conducted. Notes will also be taken during the focus group to record observed behaviors. During the focus group, participants will begin by writing their answers down before sharing to encourage the participants self-reflect and to feel comfortable giving in-depth responses. Participants will be guided through a pre-selected set of questions and the facilitator will take notes on major themes that arise. At the end of the focus group, the facilitator will share the themes that have arisen with the participants to determine whether they agree with the facilitator's interpretation of themes. Researchers will then identify themes and subthemes from the literature review and emerging from open-ended questions and focus groups. These themes will further inform the interpretation of quantitative data.