Indicators of Volunteer Retention in Environmental Stewardship Programs

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Ashley Reichard

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Abstract

Volunteers have been an integral part of urban greenspace management in Minnesota since the inception of the first formal training program in 1977. Since then, many specialized training programs have developed in order to address specific aspects of vegetation management in urban spaces. The framework of environmental literacy illustrates seven elements of environmental education that can be utilized to better understand the success of a program's curriculum as well as understanding the individual volunteer. This research aimed to understand how volunteers are currently engaging in programs and if predictors of increased frequency and duration of volunteerism can be uncovered. To do this, a survey was developed to address six elements of environmental literacy and was distributed to six Minnesota environmental stewardship programs. The results found that age, employment status, education level, value motivation, and personality characteristics of extraversion and openness were predictors of increased retention in programs. The results found that volunteers living in the 11-County Metro area of Minnesota and those with the personality characteristic of extraversion were likely to volunteer more frequently.

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Introduction

Brief History of Environmental Stewardship

A recent proposal made by Bennett et al. defines environmental stewardship as "the actions taken by individuals, groups or networks of actors, with various motivations and levels of capacity, to protect, care for or responsibly use the environment in pursuit of environmental and/or social outcomes in diverse social-ecological context" (2017). Urban forestry is one element of environmental stewardship with a heavy focus on planting projects and tree inventory data collection (Conway, 2016). With ambitious planting goals in mind, many American municipalities are finding that residential lawns hold a majority of the urban tree canopy (McPherson, 1998). Municipalities encourage residents to focus on private tree care needs, especially replanting projects to positively impact overall urban forest coverage (Conway, 2016). A study conducted in partnership with Trees Fresno found that there was higher satisfaction by the private resident when the owner planted the tree as compared to a voluntary organization planting the tree (Sommer et al, 1994).

One of the challenges of analyzing environmental stewardship is the variation in terminology that encompasses the psycho-social importance of urban green stewardship to an individual (Ordóñez et al., 2015). Common terminology focuses on the individual volunteer, and includes: attitudes, barriers, beliefs, benefits, concerns, enhancement, identify, knowledge, motivation, perceptions, personality, preferences, satisfaction,

services, understanding, and values (Sommer et al., 1995; Finkelstein, 2008; Bramston, Petty & Zammit, 2010; Brossard, Lewenstein & Bonney, 2012; Torgerson & Edwards, 2012; Asah & Blahna, 2013; Ordóñez et al., 2015; Dresner et al., 2015; Anderson, Maher & Wright; 2018). Regardless of variation, each of these terms describes the individual who can then practice pro-environmental behaviors that affect the larger-scale environment and community in which they volunteer and/or live. Moskell & Allred (2013) proposed an ecological model of urban forest stewardship which can easily be adjusted to the broader urban environment through terminology modifications (see Figure 1).

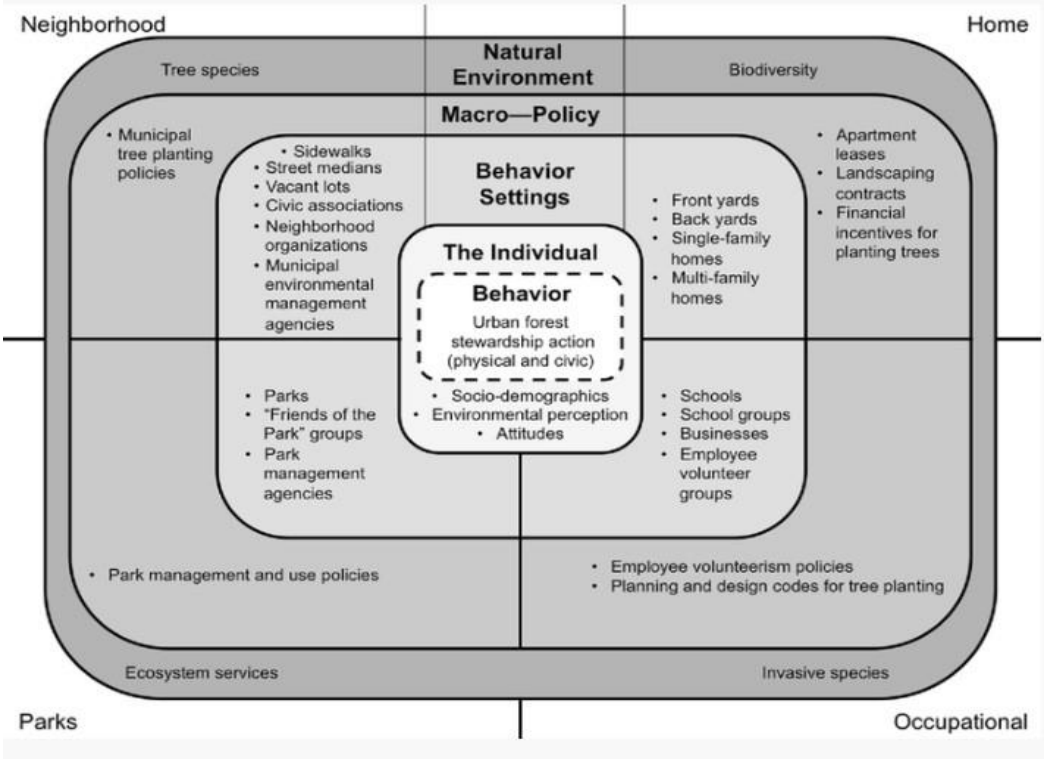

Figure 1: Proposed ecological model of urban forest stewardship (Moskell & Allred, 2013).

One critique of the ecological model of urban forest stewardship is the two domains of behavior, physical and civic, illustrated by Moskell & Allred (Figure 1). The physical domain (e.g. planting, invasive plant species removal, seed collection) and the civic domain (e.g. lobbying, decision-making, providing financial support) reflect two aspects of an individual's behavior. According to Svendsen and Campbell, "urban land stewardship is a strategy that includes elements of direct action, self-help, and often education and community capacity building" (2008). In order to share knowledge and create a more knowledgeable community, outreach is a primary component. Outreach in programs is defined as providing services to populations that do not have access to those services, which in many cases the service would be information sharing. During the exploration of the Minnesota environmental stewardship programs, each of the four emphasizes some degree of public outreach in their volunteer action description. Therefore, it would be worth revising the ecological model designed by Moskell & Allred to list behaviors as being physical, civic, and outreach.

Program	Public Outreach Action Description
Forest Pest First Detector	"...volunteers can answer questions from the public…"
Master Gardener	"...answering phone line inquiries from the public, teaching classes and workshops…"
Master Naturalist	"...education or interpretive projects... and program support."
Tree Care Advisor	"...teaching community classes, hosting Q&A booths... organizing city tree inventories, and organizing additional programming..."

Table 1. Minnesota programs with volunteer descriptions emphasizing outreach.

Environmental Literacy

Beginning in 1977, the term "environmental education" was established by the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the next decade was spent further defining this term. This definition encompasses the world's education of environmental issues in terms of "knowledge, skills, attitudes, motivations, and commitment to work individually and collectively" as well as awareness, evaluation ability, and participation in environmental activities (Hollweg et al., 2011). Due to current theory and practice, the body of knowledge surrounding environmental education has become further refined, which is reflected in the synonymous term, "environmental literacy". One of the most recent frameworks established around environmental literacy was developed by Debborah Simmons and her writing team in 1995. This framework includes seven distinct elements of environmental education that were found in use from existing program frameworks. The seven elements are: affect (e.g. attitudes, motivations), ecological knowledge, socio-political knowledge, knowledge of environmental issues, skills, determinants of environmentally responsible behavior (e.g. locus of control), and behavior (Simmons, 1995). Although the focus of Simmons' research was K-12 environmental education, these elements overlap with current research around volunteers in environmental stewardship programs (e.g. Still & Gerhold, 1997; Clary et al., 1998; Clary & Snyder, 1999; Ryan, Kaplan & Grese, 2001; Ricard, 2005; Hartig, Kaiser & Strumse, 2007; Moskell, Allred & Ferenz, 2010; Asah & Blahna, 2012; Zhang et al., 2015; Hyde et al., 2016).

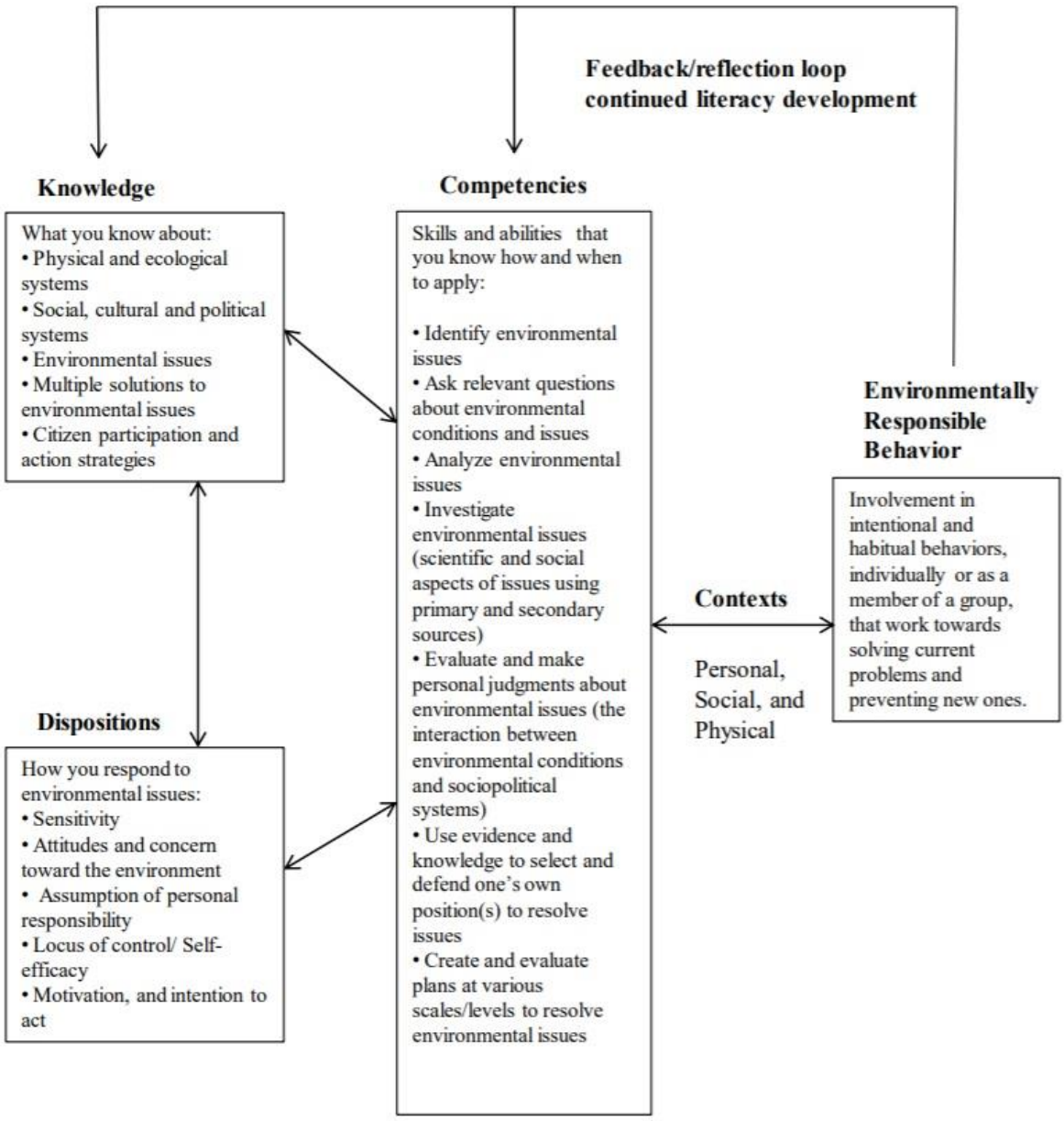

Figure 2: The domain of environmental literacy (Hollweg et al., 2011).

Environmental literacy parallels the study of environmental sociology, or the relationship between human societal structure and function relating to the environment,

which began to grow in the 1970s (Moskell & Allred, 2013). Although research focus varies, the core of environmental sociology includes studies regarding the use of natural resources, issues caused by large-scale degradation, societal awareness of environmental problems and public concerns over environmental problems (Dunlap & Marshall, 2007). The only published adult-centric research conducted with environmental literacy at its core was completed by Dresner at al. and noted that relationships exist between frequency of volunteering and attitudes of connection to sites (Dresner, et al., 2015).

Behaviors

At a broader level, it has been found that an increased frequency of volunteering is related to site connection (Dresner et al., 2015). Site connection, also referred to as place attachment, is best highlighted by Amsden, Stedman and Kruger: "...a weekend spent maintaining a trail or serving as a backcountry caretaker in that same forest may foster an identity as a steward or protector" (Amsen, Stedman, & Kruger, 2013). In this sense, place attachment allows for an individual to create a sense of meaning by engaging in an activity, socializing with others, and creating memorable experiences which allow the individual to view themselves in terms of their surrounding environment. In terms of engagement and retention in non-profit organizations, Chen et al. noted that recruitment success and increased retention is likely related to the training experience (Chen et al., 2010). In particular, the instructor's role, curriculum, and training facility were noted as factors that increased effectiveness of training for participants which parallels previous research (Chen et al., 2010). In this regard, training targets place attachment concepts

around creating shared experiences in specific locations which can explain the increased retention.

Research focused on volunteer retention in environmental stewardship programs is limited. Still and Gerhold found the participants in older programs reported that 20% had been involved as a member for one year or less, 44% for two to four years, 15% for five to seven years, 13% for eight to ten years, and 7.5% had been members for more than 10 years (Still & Gerhold, 1997). Ryan et al. found that 30% of environmental stewardship volunteers reported being involved for one year and two years was the median length of involvement (2001). The discussion of this study did note that volunteer retention should not be the focus of program coordinators; instead this focus should be directed toward offering regular and frequent volunteer opportunities that can promote the volunteer's commitment. Looking outside of environmental stewardship, one study conducted by Van Vianen, Nustad, and Voskuul found that the mean tenure of volunteers was 7 years (2008).

Regular and frequent volunteer opportunities help create a sense of connection to communities and are often tied to volunteers that engage on a more habitual level with repeat opportunities (Hyde et al., 2016). In other words, at the organizational level, programs must maximize involvement through frequent volunteer opportunities (Penner, 2002). When reporting on frequency in regards to environmental activities, volunteers historically reported participating between two to three times a year or roughly an average of three times per year (Ryan et al., 2010; Hyde et al., 2016).

Motivation varies throughout an individual's lifetime, but can be a key component of retention. According to Clary et al., when volunteers participate in opportunities that align with initial motivations, these individuals are more likely to continue participating (Clary et al., 1998). Multiple studies have found motive strength did not correlate to time spent helping or length of service, although it did find that altruistic concerns were more strongly related to greater volunteer retention (Finkelstein et al., 2005; Finkelstein, 2008).

Affect (Attitudes and Motivation)

Motivation, or the reasoning behind an individual's decision to engage with a volunteer program, has historically been the most studied indicator of commitment and retention (Clary, et al., 1998; Clary & Snyder, 1999; Ryan, Kaplan, & Grese, 2001; Moskell, Allred, & Ferenz, 2010; Asah & Blahna, 2012; Hyde, et al., 2016). While variation among studies has occurred, the common motivations studied with regard to environmental stewardship programs and activities include: values, enhancement, social, protective, understanding, and career (Still & Gerhold, 1997; Clary et al., 1998; Clary & Snyder, 2001; Ryan et al., 2001; Bramston, Petty & Zammit, 2011; Asah & Blahna, 2012). These six categories of motivation can be measured through the Volunteer Functions Inventory (VFI), which was developed by Clary et al. as a standard tool for assessing volunteer motivation (Clary et al., 1998). In 2017, a systematic review was published that analyzed 666 studies across four languages that utilized the complete VFI process or a single scale of the VFI. This review found that values is one of the highest

scoring factors of motivation, followed by understanding, enhancement, social, and career with protective being the lowest scoring factor (Chacón et al., 2017).

When looking at studies that did not utilize the VFI as a tool, similar results were still obtained. Still and Gerhold incorporated twelve reasons for volunteering in a randomly distributed survey and found that the desire for neighborhood improvement either in terms of beautifying the neighborhood, general neighborhood improvements, or improving the environment was the greatest importance to respondents (Still & Gerhold, 1997). Similarly, Asah and Blahna utilized 24 reasons for volunteering which were categorized into the larger headings of community, career and learning, escape and exercise, socialization, to defend or enhance the ego, and the environment. Of these six categories, caring for the environment was found to be the most important motivator (Asah & Blahna, 2012).

Over the course of multiple studies, results have consistently shown that *values* and *understanding* are primary motives for initial engagement in volunteer activities (Clary et al., 1998; Finkelstein, 2008; Chacón et al., 2017). *Values* is defined as the individual volunteer's expression or action that is influenced by principles or standards of behavior important to the individual, which we often described as altruistic or humanitarian concern (Chacón et al., 2017). Individual survey items categorized as value indicators include but are not limited to: concern over those less fortunate, important to help others, concerns about a particular issue or group, feeling of compassion toward others in need (Clary et al., 1998). *Understanding*, also defined as learning or

exploration, refers to a volunteer seeking out information about the world and/or learning skills in order to take action (Ryan, Kaplan, & Grese, 2001). Individual survey item statements categorized as understanding include, but are not limited to: learning new skills, opportunity to try new things, learning about specific plants/animals, gaining a new perspective on things, and exploring own strengths (Clary et al., 1998).

Enhancement is defined as the individual's motivation being centered around self-development or generally feeling better about oneself (Chacón et al., 2017). In the VFI, individual survey items categorized as enhancement include but are not limited to: volunteering makes me feel important, volunteering makes me feel needed, volunteering makes me feel better about myself (Clary et al., 1998). *Social* is defined as social adjustment which is an individual's need to cope with social standards and values around making or maintaining relationships. Individual survey items categorized as social include but are not limited to: people I'm close with want me to volunteer, my friends volunteer, and people I now share an interest in community service (Clary et al., 1998). A common theme throughout current literature notes the social motivation is the primary predictor of volunteer retention or duration (Ryan et al., 2001; Gottlieb & Gillespie, 2008; Asah & Blahna, 2012). It has been found that the social motive has been a reliable indicator of continued engagement in volunteer programs (Finkelstein, 2008).

Career is defined as enhancing knowledge in order to enter or prepare for professional or academic work in a specific field. This utilitarian approach is related to individual survey items that include but are not limited to: volunteering can help me get a

foot in the door at a place where I would like to work, volunteering allows me to explore different career options, and volunteering experience will look good on my resume (Clary et al., 1998). *Protective* is defined as protecting one's ego, reducing personal guilt over feeling more fortunate than others, or escaping from negative feelings or problems (Chacón et al., 2017). The VFI survey items that reflect the protective category include but are not limited to: by volunteering I feel less lonely, volunteering helps me work through my own personal problems, and volunteering is a good escape from my own troubles (Clary et al., 1998).

Aside from the six primary categories of motivation, it is also important to consider the attitudes toward environmental programs and their perceived impact and benefits on urban greenspaces. By understanding attitudes, an increased support toward funding and personal involvement can be reached. According to a literature review conducted by Zhang, et al., most studies have examined attitudes in relation to the overall aesthetic of urban greenspaces linked to perceptions of associated benefits (Zhang, et al., 2007). This review regarded the research surrounding benefits of trees found that the highest ranked benefit perceived by the public was the ability of trees to shade and cool surroundings followed by feeling calmer (Zhang, et al., 2007). A study conducted in Fredericton, Halifax, and Winnipeg, Canada found that the top positive attitudes related to urban forests included aesthetics, air quality, and shade (Ordóñez, et al., 2015). It has also been found that public attitudes toward trees and greenspaces are generally positive, specifically more than 90% of citizens involved appreciated urban trees when choosing where to live (Zhang, et al., 2007).

Ecological Knowledge

Ecological knowledge is not clearly defined, although it can be reduced down to knowledge related to earth's ecosystems. In regards to environmental stewardship programs, ecological knowledge can refer to interdependent relationships in ecosystems, the roles of water in earth's processes, climate change and the effect of human activities, adverse human impacts on ecological systems, and humans as agents for protection and restoration (Hollweg, et al., 2011). The National Science Board conducts a biennial survey asking Americans to answer nine true-or-false or multiple choice factual knowledge questions about basic science knowledge (Science and Engineering Indicators 2018, 2018). According to 2016 results, Americans correctly answered on average 5.6 out of 9 items which is in line with historic ranges that sit between 5.6 and 5.8 correct responses (Science and Engineering Indicators 2018, 2018). Internationally, there is no standard of assessing overall ecological knowledge and there currently exists no framework for assessing and understanding ecological knowledge.

One study conducted in 1998 tested The Birdhouse Network (TBN) participant's knowledge and attitudes related to cavity-nesting birds (Brossard, Lewenstein, & Bonney, 2012). This research concluded that only 32.7% of respondents in the treatment group could give an acceptable explanation of what a scientific study was. To assess knowledge, participants were provided ten statements which they would either agree or disagree. The responses were assessed with a scale from 0 to10, 0 indicating no knowledge and 10 indicating high knowledge. From this, researchers found that from pre-

test to post-test, the control TBN group increased their knowledge of bird biology by one full point in mean scores (Brossard, Lewenstein, & Bonney, 2012).

Knowledge of Environmental Issues

Traditionally, knowledge of environmental issues can fall into one of two categories. The first being knowledge of environmental problems that arise from the cause and effect of natural biophysical processes and and the second being environmental issues that occur due to human conflicts and human interventions/impacts such as climate change, environmental quality, human health, land use, biodiversity, and sustainability (Hollweg, et al., 2011).

Socio-Political Knowledge

As defined by McKeown-Ice and Dendiger, this type of knowledge refers to "the socio-political-cultural foundations of environmental education as the ideas or concepts from the social sciences that are prerequisites to understanding or analyzing environmental issues (McKeown-Ice & Dendinger, 2008). Zhang et al. found that individuals under 56 were more likely to assign responsibility of financing urban forestry to local, state, and federal government, whereas individuals over 56 were more likely to assign this responsibility to the local and state government (Zhang et al, 2007). In regards to environmental stewardship, research has focused primarily on measuring the attitudes or perceptions the public and volunteers have about their city's management of greenspaces. Still and Gerhold found that current and potential volunteers rated their

urban forest as being in poor condition, noting that care and management of existing trees was a priority and urgent need for their communities (1997).

Determinants of Environmentally Responsible Behavior

In 1884, Sir Francis Galton applied the lexical hypothesis to personality noting that concepts describing personality were important to a group of people and therefore became embedded into the language. Having failed to reach academic audiences at this time, research related to personality ceased to continue. A reemergence of interest to extract words describing an individual's inner state arose in 1926 with Ludwig Klagues, followed by Franziska Baumgarten (1933), and then Gordon Allport and Henry Odbert (1936) (Pervin & John, 1999). The words gathered amounted to a complete list of almost 18,000 descriptors of personality which were then condensed down to four general categories before Raymond Cattell began to refine this even further, eventually creating the 16 Personality Factors or 16PF questionnaire (Pervin & John, 1999).

In 1961, Ernest Tupes and Raymond Christal simplified the factors outlined by Cattell to create what we now know as the five-factor model, or in their words "five relatively strong and recurrent factors and nothing more of any consequence" (Tupes & Christal, 1999). Replication of this structure continued throughout the 1960s and into the 1980s, with personality psychologist Lewis Goldberg dubbing the five primary personality dimensions as the "Big Five" (previously referred to as the five-factor model) due to the five extremely broad dimensions of personality that summarized a multitude of distinct characteristics (Pervin & John, 1999; Lönnqvist, et al., 2007). The five factors

included in this model are: extraversion vs. introversion, agreeableness vs. antagonism, conscientiousness vs. lack of direction, neuroticism vs. emotional stability, and openness vs. closedness to experience (John & Srivastava, 1999, Pervin & John, 1999).

Following the structure of the Big Five Inventory, multiple tools for assessing personality were developed. In 1983, the first tool known as the Adjective Check List (ACL) was created to measure personality using 300 different terms which ultimately matched the Big Five Inventory almost perfectly (Pervin & John, 1999). The 44-item Big Five Inventory was developed by Oliver John, E. Donahue, and R. Kentle in 1991, which was primarily developed as a brief and efficient inventory tool. In 1992, Lewis Goldberg developed the Trait Descriptive Adjectives (TDA), which consisted of 100 unipolar trait descriptions that eventually was refined to match the Big-Five dimensions. Concurrently, Paul Costa and Robert McCrae developed the NEO Personality Inventory (NEO PI), influenced by the 16PF, which measured three broad personality dimensions of neuroticism, extraversion, and openness (Pervin & John, 1999). After realizing that the NEO system was similar to the Big Five Inventory, matching three of the five dimensions, the team revised their tool to further encompass the same five dimensions titling this version the 240-item NEO Personality Inventory, Revised or the NEO PI-R (Pervin & John, 1999). Due to complaints about the lengthy nature of the revised tool, Costa & McCrae provided a shorter, 60-item tool known as the NEO-FFI.

Overall, a lack of preference for long-form systems such as the NEO PI, the NEO PI-R and the ACL existed making these tools obsolete in comparison to the shorter tools.

In general, the TDA, NEO-FFI, and the BFI are the most commonly used questionnaire tools to analyze personality (Pervin & John, 1999). While descriptive differences do exist for each of these tools, overall they all reflect the Big Five Inventory making them very similar. The Big Five Inventory tool is the most commonly used especially when time limitations exist due to the fact that it only takes five minutes to complete in comparison to 15 minutes it takes to complete both the NEO-FFI and the TDA (Pervin & John, 1999).

Big-Five Inventory Tool and Analysis

The Big-Five Inventory (BFI) is comprised of 44 short statements that elaborate slightly in order to elicit more consistent responses versus single adjective items (John, Donahue, & Kentle, 1991). The survey respondent ranks each statement using a five part Likert scale starting at 1, strongly disagree, and ending with 5, agree strongly. Scoring of each survey response contains both positively-keyed items, those that agree with the dimension it is categorized under, and negatively-keyed items (reverse-scored), those that reflect the opposite of the dimension it is categorized under. All reverse-scored items have their number value (1-5) subtracted from 6 to recode these items. Each short statement is categorized under each of the five personality dimensions and the scores are averaged (Pervin & John, 1999).

Extraversion vs. Introversion

The first factor is related to extraversion, and gauges an individual's preference toward outgoing or solitary activities, as well as the energy needed to participate in specific

activities (John & Srivastava, 1999). If an individual is ranked high in extraversion, their survey responses are linked with behaviors that could be described as domineering, active, and outgoing (Vantilborgh, et al., 2013). Low extraversion, or introversion, is linked with behaviors that could be described as reserved. Within the BFI, sample items related to high extraversion include: I feel comfortable around people, I start conversations, I think before I speak or act (reversed), and I have no intention of talking in large crowds (reversed) (John & Srivastava, 1999). Multiple research studies have found that volunteers are likely to score high on extraversion, noting the enjoyment of social interactions necessary in volunteering (Carlo et al., 2005; Lönnqvist et al., 2007; Omoto, Snyder, & Hackett, 2010; Vantilborgh et al., 2013). While extraversion is a predictor for volunteering, it is worth noting that extraversion has been found to be one of the most consistent predictors of burnout (Bakker et al., 2006).

Agreeableness vs. Antagonism

The second factor is related to agreeableness, which addresses an individual's tendency to be cooperative and compassionate. If an individual is ranked high in agreeableness, their survey responses are linked with behaviors that could be described as the value to get along with others, a need to find social harmony, and altruistic concerns (Pervin & John, 1999, Vantilborgh et al., 2013). Across studies, agreeableness has been found to be a primary predictor of volunteerism (Carlo et al., 2005; Lönnqvist et al., 2007; Vantilborgh et al., 2013). Low agreeableness, or antagonism, is linked with behaviors that could be described as self-interested or unfriendly. Vantilborgh, et al. hypothesized

and confirmed that agreeableness is positively linked to the relational psychological contract, meaning that volunteers with high agreeableness value mutual respect between non-profit organizations and volunteers (Vantilborgh, et al., 2013). Within the BFI, sample items related to high agreeableness include: I sympathize with others' feelings, I make most people feel at ease, I am not really interested in others (reversed), and I am not interested in other people's problems (reversed) (John & Srivastava, 1999). Davis et al. conducted three separate research studies focused on dispositional empathy which related to an agreeable personality in both hypothetical and practical situations (1999). Results for each of the three studies support the hypothesis that volunteers with higher dispositional empathy will likely be more willing to engage initially in volunteer activities.

Conscientiousness vs. Lack of Direction

The third factor is related to conscientiousness, that is, an individual's tendency to be organized, dutiful, efficient, and aimed for achievement (Vantilborgh, et al., 2013). If an individual is ranked high in conscientiousness, their survey responses are linked with behaviors that could be described as self-disciplined and being in control of impulses. Low conscientiousness, or lack of direction, is linked with behaviors that could be described as spontaneous and unorganized. Within the BFI, sample items related to high conscientiousness include: I am always prepared, I follow a schedule, I leave my belongings around (reversed), and I often forget to put things back in their proper place (reversed) (John & Srivastava, 1999). Of the Big-Five personality factors,

conscientiousness has been the least likely to predict volunteer behaviors. Limited research has found that high conscientiousness reflects those less likely to volunteer, unless in a paid work context where it has been found to be positively correlated with helping behaviors (Vantilborgh et al., 2013). As Lönnqvist et al. similarly found, conscientiousness tends to be related to a sense of duty and often is connected to research participants or those that participate very little with service (2007).

Neuroticism vs. Emotional Stability

The fourth factor is related to neuroticism, or an individual's tendency to experience unpleasant emotions and to become excitable and reactive (Pervin & John, 1999). If an individual is ranked high in neuroticism, their survey responses are linked to behaviors that could be described as angry and motivated by anxiety or high vulnerability to stress. Bakker et al. found that neuroticism appeared as one of the most consistent predictors of burnout for volunteers, particularly for those that had many negative experiences when volunteering (Bakker et al., 2010). Low neuroticism, or emotional stability, is linked with behaviors that could be described as calm and free from negative feelings. Within the BFI, sample items related to high neuroticism would include: I get stressed out easily, I worry about things, I am relaxed most of the time (reversed), and I seldom feel blue (reversed) (John & Srivastava, 1999). In a study focusing on AIDS activism, emotional stability was found to be a marginally significant predictor in civic engagement (Omoto, Snyder, & Hackett, 2010).

Openness vs. Closedness to Experiences

The last factor is related to openness, which reflects an individual's tendency to be adventurous, artistic, curious, and to try a variety of experiences (Vantilborgh, et al., 2013). If an individual is ranked high in openness, their survey responses are linked to behaviors that could be described as intellectually curious, creative, and being sensitive to beauty. Low openness, or closedness to experience, is linked with behaviors that could be described as less aware of their feelings and having an unwillingness to learn new things. Within the Big-Five Inventory, sample items related to high openness include: I am quick to understand things, I am full of ideas, I am not interested in abstractions (reversed), and I do not have a good imagination (reversed) (John & Srivastava, 1999). Research has found that volunteers tend to score high on openness which is often linked to prosocial values and the need to seek opportunities where individual curiosity exists (Carlo et al., 2005; Vantilborgh et al., 2013).

The most common research efforts have been made to establish and utilize a model that acts as a mediator between a volunteer's personality and the influence on the volunteer's actions (Thompson & Bunderson, 2003; Carlo, et al., 2004; Vantilborgh, et al., 2013). The psychological contract model posits that an individual's personality and their beliefs toward a volunteer organization can be categorized in one of three psychological contracts: the transactional contract (e.g. tangible or material stimulus), the relational contract (e.g. recognition for work, autonomy), and the ideological contract (e.g. organizational commitment and action around mission) (Vantilborgh, et al., 2013). According to Vantilborgh et al., Belgian volunteers were found to score high on agreeableness affixed to altruism which likely is connected to the ideological contract and

the relational contact which notes that volunteers are less likely to perceive their work as a transactional contract (Vantilborgh et al., 2013). These contracts are subjective in nature but are hypothesized to mediate personality traits and volunteer engagement or time donation based on the volunteer's perception of an organization. Motives continue to be a primary mediator for personality and volunteer actions (Clary et al., 1998; Carlo, et al., 2005).

It is crucial to acknowledge the barriers that exist for individuals that do not initially get involved with formal volunteer programs as well as those that leave programs. Demographic information for an individual is the more common starting point in order to determine one's place in the social hierarchy and the associated role they play. By understanding demographic factors, an individual can reflect on the availability of resources, level of social integration within their community, cultural resource availability, life cycle stage, and community size and location before choosing to volunteer (Sundeen, Raskoff, & Garcia, 2007). A common reason for not initially engaging with formal volunteer programs involves scarcity of resources such as mental and physical limitations, lack of skills or expertise, money, time, and/or transportation (Willens & Dury, 2017; Pillemer et al., 2010). Aging individuals have cited common barriers to environmental volunteer involvement as lack of expertise or knowledge, unawareness of opportunities, and the perception these opportunities were not as socially fulfilling (Pillemer et al., 2010).

Brady et al. developed a conceptual model that divides the reasons not to participate in politics into three categories: "I can't", or I do not have the time, money, or

skills to participate, “I don’t want to”, or lacking interest or perception that their participation would not be valued or utilized, and “Nobody asked”, meaning that potential participants felt isolated or outside of a recruitment network (Brady et al., 1995). These categories are reflected in research specific to volunteering that often note scarcity of resources, lack of interest, and lack of connection are barriers for potential volunteers (Hockenberry Meyer, 2004; Sundeen, Raskoff, & Garcia, 2007; Ramdianee, 2014; Willems & Dury, 2017; Anderson, Maher, & Wright, 2018; Haski-Leventhal et al., 2018). One research example related to lack of resources involved the University of Minnesota Extension Master Gardener volunteers, where 79% of volunteers that left the program did so due to lack of time and personal reasons (Hockenberry Meyer, 2004).

When considering demographics in the discussion of barriers and constraints to volunteerism, common themes have been linked amongst multiple studies. Individuals that are either younger or older have noted more constraints to volunteering such as feeling unwelcome, inadequate transportation and poor timing of organized activities as compared to middle-aged individuals (Sundeen, Raskoff, & Garcia, 2007; Pillemer, et al., 2010; Torgerson & Edwards, 2012; Anderson, Maher, & Wright, 2018). In regards to income, Torgerson and Edwards found that those with lower income and those in rural areas were more likely to experience perceived barriers due to lack of transportation linked to overall safety as opposed to work and daycare issues (Torgerson & Edwards, 2012). Another barrier relates specifically to the female gender, with respondents across studies noting they do not feel as welcome and that safety is a concern in terms of travel and site access (Sundeen, Raskoff, & Garcia, 2007; Torgerson & Edwards, 2012). It

should also be noted that a lack of anonymity exists in rural areas that often increase motivation for an individual to participate in community activities (Torgerson & Edwards, 2012).

Skills

Skill, or competency, is the ability of an individual to utilize knowledge and apply it in terms of problem solving. This means an individual must understand and analyze environmental issues, understand the relationship between the environment and socio-political systems, use evidence and knowledge to solve problems, and create plans to implement solutions (Hollweg et al., 2011). In terms of current research, this element of environmental literacy often takes form as citizen science project accuracy. In 1994, Bloniarz & Ryan analyzed the agreement rate between volunteers and trained arborists in regards to tree identification, finding that the agreement percentages were between 91% and 96% depending on species (1996). Similarly, Bancks, North, & Johnson found that there was a 97% agreement between volunteers and university researchers in regards to tree identification at the genus level, 64% agreement at the species level, and 85% agreement on measurement of DBH (Bancks, North, & Johnson, 2018). A study conducted by Crall et al., involved training volunteers on invasive species identification, GPS use, plot implementation, and plot setup and compared their accuracy to that of a professional (2011). The results determined that professionals identified species correctly 88% of the time compared to 72% of the time for volunteers. However, this research also did find that there was no difference between professionals and volunteers when asked to

estimate cover of invasive species within plots (Crall et al., 2011). Overall, Kosmala et al., analyzed recent citizen science projects and found that volunteer accuracy is dependent upon task difficulty, but noted improved accuracy is dependent upon continued experience with a project (2016).

Volunteer Stages

Research regarding volunteer stages can be an important concept for program organizers and communities alike to consider as it alludes to how an individual may be engaged with a program over time and the potential change in perceived benefits an individual may experience. According to Haski-Leventhal & Bargal, a volunteer may go through five different phases with specific transitions when involved with formal volunteer programs (2008). The first stage, the nomination phase, refers to the interaction between the program and the potential volunteer which is often characterized by high ambiguity as the potential volunteer is unsure of the programmatic expectations and their ability to fulfill them. This stage is followed by the organizational entrance transition where the individual selects the organization, begins training, and starts to volunteer. The second stage is the newcomer phase which refers to the period when a volunteer first begins to assimilate into the organization. Volunteers at this stage often give limited help due to the individual still learning and experiencing ambiguity in the role as they try to find their place. One study completed by Hyde et al. found that volunteers in the newcomer phase, or novice phase, were likely to be motivated by the social component of volunteerism (Hyde et al., 2016). At this stage, volunteers are also exposed to the social

pressure of volunteering which can explain continued volunteerism after the first year of involvement (Hyde et al., 2016). The accommodation transition refers to the period when a volunteer evolves from being a newcomer to a more experienced and skilled volunteer within the program. This is one of two places where turnover occurs; volunteers at this point may choose to leave early due to not fitting in, having unfavorable attitudes, or the lack of sustainability between the individual and organization.

The third volunteer stage is the emotional involvement phase in which one feels enthusiastic and that they are doing their work skillfully and successfully. Typically at this stage, a program will experience their most highly motivated individuals that now understand their role in the organization and how they can make positive changes. After this point, volunteers will experience the affiliation transition where they have developed higher skills and are now becoming a more central member within the organization. This leads to the established volunteering stage where volunteers know how their work fits into their schedule and what exactly is expected of them. This point is where volunteers will either experience burnout and will exit the program after a long period of time or the volunteer will pursue self-renewal. Burnout is common for both volunteers and paid-workers when the stress of participating or fatigue becomes too much and the individual benefits do not outweigh the barriers involved. Self-renewal refers to the volunteer taking on new roles and responsibilities that help the individual find new energy and meaning in their work. If a volunteer decides to self-renew, they loop back to the emotional involvement phase, while a volunteer that experiences burn-out may retire completely. It is important to note that retirement from a program is not only linked to burnout or

emotional burden. It is common for volunteers to leave their role when they are no longer physically able to perform the tasks requested. Regardless of why a volunteer leaves an organization, this is still an emotional step for exiting volunteers as feelings of sadness, confusion and difficulty detaching from the situation or organization may occur (Haski-Levanthal & Bargal, 2008).

Minnesota Environmental Stewardship Programs

Volunteerism has an abundant history in our lives, spanning from informal volunteerism (e.g. assisting neighbors) to formal volunteerism that incorporates some degree of education to accomplish the volunteer actions (e.g. Master Gardener Program). Within the realm of volunteer opportunities for environmental programs, one can acknowledge not-for-profit organizations, neighborhood or community group programs, and university-related or extension programs (Finkelstein & Brannick, 2007). For the purposes of this research, the focus was on university-related and extension environmental stewardship programs.

The four Minnesota environmental stewardship programs included in this research include the Forest Pest First Detector Program, the Master Gardener Program, the Master Naturalist Program, and the Tree Care Advocate Program. Each program targets a specific aspect of the broader vegetative needs within Minnesota to improve the collective ecosystems and bring awareness to the public at large. Each program acts independently to create distinct training curricula, define education and volunteer hour requirements, and designs systems to collect data. These individual programs receive

funding from an array of sources to support environmental stewardship program longevity and success. Overlap does exist between programs in terms of eligible volunteer hours that can be reported by the individual to more than one program.

Forest Pest First Detector is a University of Minnesota Extension program created in 2008 that trains volunteers to identify and report cases of suspected tree and forest pests, diseases, and invasive plant observations. Along with reporting forest-pest related activities, volunteers can answer questions from the public and conduct site visits as necessary (Forest Pest First Detector, n.d.).This program ties together the University of Minnesota Extension, the Minnesota Department of Agriculture, and the Minnesota Department of Natural Resources in order to help these agencies control the spread of invasive pests and plants. As of 2019, Forest Pest First Detector training includes roughly 2.5-3 hours of online training and seven hours of in-person training, totalling 9.5-10 hours of initial training to prepare participants for their volunteer tasks. There is currently no information listed on the Forest Pest First Detector website that indicates if volunteers are required to fulfill annual volunteer or education hours to remain active.

The University of Minnesota Master Gardener program is coordinated by the University of Minnesota Extension and has strong ties to the Department of Horticultural Science at the University of Minnesota. Program priorities focus on horticultural skills, preserving and expanding pollinator habitat, plant biodiversity, clean water, local food, climate change and nearby nature (e.g. partnering with local community groups). The nation-wide Master Gardener program's inception began at Washington State University in 1972 and was later introduced to Minnesota in 1977 with a principal class of 25

students (About the Master Gardener Volunteer Program, n.d.). The Minnesota program has since grown to more than 2,300 active volunteers in nearly every county in the state. Training consists of a 48 hour core-course where participants are educated in the following topic areas: critical thinking and navigating culture, soils, entomology, botany, diagnostics, trees & shrubs, herbaceous plants, lawn care, plant pathology, weeds, wildlife, integrated pest management, vegetables, and fruits (About the Master Gardener Volunteer Program, n.d.).

After volunteers have completed the Master Gardener Core Course they must complete an internship year which includes completing 50 hours of volunteer activities. Thereafter, volunteers are asked to complete 25 volunteer hours annually to remain active in the program (Become a Master Gardener Volunteer, n.d.). Minnesota Master Gardeners can fulfill their volunteer hour requirements in many ways, but common options include answering phone line inquiries from the public, teaching classes and workshops, and representing the program at county and state fair booths. In addition to fulfilling volunteer requirements, Master Gardeners must also complete 5-12 hours of continuing education depending on county program requirements.

The Minnesota Master Naturalist Program began in 2005 through a five year National Science Foundation grant and currently resides in the University of Minnesota Extension system.The 40 hour training course consists of a general overview for Minnesota's three biomes: Big Woods, Big Rivers; Prairies and Potholes; and North Woods, Great Lakes (About the Minnesota Master Naturalist, n.d.). The Master Naturalist's program mission is to "promote awareness, understanding and stewardship of

Minnesota's natural environment by developing a corps of well-informed citizens dedicated to conservation education and service within their communities." Once volunteers have completed the Master Naturalist Training Course, these individuals are asked to complete 40 hours of volunteer service per year (About the Minnesota Master Naturalist, n.d.). Volunteers are encouraged to participate in citizen science-based projects such as stewardship projects (e.g. invasive species removal), education or interpretive projects, citizen science projects, and program support.

The Minnesota Tree Care Advisor program was created in 1992 as a way to educate participants on tree and shrub care. This program was a part of a two-year pilot project funded by the USDA Forest Service and is now housed as a program through the University of Minnesota's Department of Forest Resources (About the Minnesota Tree Care Advocate Program, n.d.). The 40 hour Tree Care Advisor core course covers many topics that include but are not limited to best planting practices, tree and shrub identification, proper pruning practices, storm damage data collection, and landscape plant selection (Become a Tree Care Advisor, n.d.). After this initial training, Tree Care Advisors are asked to complete 25 hours of volunteer work and complete four hours of continuing education each calendar year to remain an active volunteer. Tree Care Advisor volunteers can take part in any activity that is related to trees and shrubs, so many reported volunteer hours include teaching community classes, hosting question and answer booths, participating in planting events with other organizations (e.g. Tree Trust, Great River Greening), organizing city tree inventories, and organizing additional programming in their communities.

In 2013, this program transitioned to the title of the Tree Care Advocate Program that acted as the umbrella title for the Tree Care Advisor program and the newly created Citizen Pruner program (Our Programs, n.d.). The Citizen Pruner program is a community-based program that educates and trains the community volunteers on how to correctly prune trees in public spaces (e.g. boulevards, parks, public lots) (Citizen Pruner, n.d.). Citizen Pruner training consists of a single class that includes information about pruning safety, cleaning tools, restricted species (e.g. species that have pruning constraints due to insect/disease), and a field pruning portion to practice skills (Our Programs, n.d.). Initial training time varies from 3-8 hours based on the tasks that volunteers will be asked to accomplish in their communities. Communities that prefer volunteers to remove only tree suckers and sprouts can accomplish the training in three hours, while communities that prefer volunteers do more advanced structural pruning require eight hours of training. Post-training, Citizen Pruner volunteers are asked to complete a competency assessment in order to ensure volunteers know where to find information that will assist them during the volunteer experience. Citizen Pruner volunteers are required to complete ten hours of volunteer work or attend three city/county hosted events annually to remain active. The local city or community contact arranges for volunteer pruning events throughout the calendar year to provide volunteers with adequate opportunities to complete their required hours. Every three years, volunteers are asked to take the competency assessment again in order to ensure they are up-to-date on new information and to refresh their knowledge related to pruning.

In 2016, The Tree Care Advocate program created its third sub-program, the Tree Steward Program, which is an additional community-based program. Volunteers are trained on city requested tree care topics which typically includes best planting practices, watering, pruning, and monitoring young tree health (Tree Steward, n.d.). The Tree Steward Program is also competency-based, requiring volunteers to complete an assessment post-training to become an active Tree Steward volunteer. Similar to the Citizen Pruner program, Tree Stewards are asked to complete ten hours of volunteer work or attend three city/county hosted events annually to remain active. Tree Steward volunteers typically complete their required hours through participating in community planting events, pruning public trees, and participating in invasive plant removal projects. Every three years, volunteers are required to re-take the competency assessment to ensure they are up-to-date on the latest research related to their volunteer tasks.

Research Outline

The purpose of this research was to better understand behaviors in terms of volunteer retention in Minnesota environmental stewardship programs and to gain a perspective of what factors may influence increased retention. To add to the body of knowledge in regards to overall retention, it was determined that the current frequency and duration of volunteerism in Minnesota environmental stewardship programs was critical information. Due to the varying geographic makeup of Minnesota and potential for specific barriers to volunteerism, it was deemed important to know if there is a difference in frequency and duration between volunteers in the 11-County Metro

compared to volunteers in Greater Minnesota. We were also interested to see if there was a difference in frequency and duration when comparing gender, age, employment status, education level, and living with children under the age of 18 at home.

Next, a goal of this research was to understand retention in regards to the individual volunteer. During the literature review, a common theme in retention was related to frequency. For this reason, the question of whether the increased frequency of volunteerism explains overall retention was included in this study. In addition, this research tested if there was a relationship between retention and the number of environmental stewardship programs an individual was involved in as well as general volunteer efforts throughout an individual's lifetime. In line with the ample existing research about volunteer motivations, we wanted to better understand affect and if motivation predicts increased retention and frequency.

There were three elements of environmental literacy related to knowledge. We were interested in the current ecological knowledge and knowledge of environmental issues that volunteers have across programs. In order to understand these elements of environmental literacy, we scored responses for six questions, three that address ecological knowledge and three that address environmental issues, to gain a baseline understanding of volunteer's knowledge and perceptions. Socio-political knowledge and perceptions are another element of environmental literacy that was explored through three additional survey questions.

Finally, we explored determinants of environmentally responsible behaviors. To do this we looked at whether a difference in frequency and duration exists when comparing gender, age, employment status, education level, and living with children under the age of 18 in the home. This type of information is intended to better understand if barriers to volunteering exist which can then be compared to perceived barriers that an individual notes in a separate survey response. To provide a better understanding of barriers, we intend to explore the perceived barriers based on a volunteer's location, age, and gender to see if any differences exist. Additionally, this research aimed to understand the personality of environmental stewardship volunteers as that information has not been researched to date. Specifically, we wanted to understand which of the five dimensions of personality volunteers scored highest on and to explore if there were relationships among the Big Five personality traits and frequency of volunteer engagement, as well as the influence on duration of volunteerism.

Materials and Methods

Survey Development and Assessment

The single research survey included 30 items that focused on various aspects of environmental literacy. The first 19 survey questions were influenced by the KAP framework and the last 11 questions were demographic information (Appendix A). Respondents were provided the opportunity to complete the optional Big-Five Personality Inventory mid-survey (Appendix B).

The KAP (knowledge, attitudes, practice) Framework was developed by Karlyn Eckman at the University of Minnesota (2013). This method focuses on a respondent's knowledge, attitude, and practice or behavior around a specific topic or project. Ideally, the KAP study should be conducted twice, once before a project is started and again one to two years after the project is completed (2013). For the purpose of this research project, the knowledge, attitude, and practice elements of the KAP method were incorporated into the survey to provide a snapshot of current Minnesota environmental stewardship volunteers. The purpose for incorporating survey questions about knowledge, attitudes, and practice was to determine volunteer behaviors and values of currently engaged volunteers.

At the beginning of the survey, participants were asked to answer six questions related to their individual ecological knowledge and knowledge of environmental issues. Additionally, these questions encouraged participants to consider the six different aspects of their environmental knowledge: general planting practices, trees, soils, water quality, wildlife, and invasive insects. The next three questions were focused on understanding the individual's socio-political perspective based on their experience residing in their community. The three questions focused on who the participant thought cared for the public land in their community, the overall condition rating of vegetation in the community, and the individual's primary concern over the state of vegetation in their community. Participants were then asked to reflect on their motivation by checking up to three reasons why they volunteer in their preferred programs.

The survey then focused on the participant's behavior as a volunteer. This section asked not only what type of activities they participated in, but also how long they had been involved with environmental stewardship programs, how often in a year they volunteer with those programs, and how long they had volunteered in any type of program (did not have to be a pro-environmental volunteer opportunity). At this point, participants were asked if they would be interested in taking a supplemental personality survey (the Big-Five Inventory). If so, they would move on to the 44-item Big-Five Inventory. If not, they would skip ahead to the demographic portion of the survey which included 11 items.

Recruitment

For the scope of this research, active volunteers in selected Minnesota environmental stewardship programs were invited to participate in the research. Active volunteers include those that had completed a training program prior to participating in the survey. Three of the four programs asked to participate in this study included the Forest Pest First Detector Program, the Master Naturalist Program, and the Minnesota Tree Care Advocate Program. Due to the large-scale nature of the Minnesota Master Gardener Program, specific counties were selected to participate in the survey.

In Minnesota, there are 89 local Extension offices or Master Gardener program groups. For the scope of this research project with limited time and staff availability, seven Master Gardener county groups were selected based on their location in the state of Minnesota. Location selection was based on whether the Master Gardener group was

located in the 11-County Metro (Anoka, Carver, Chisago, Dakota, Hennepin, Isanti, Ramsey, Scott, Sherburne, Washington, and Wright) or in Greater Minnesota (counties located outside of the immediate metro area). The 11-County Metro counties that participated were Anoka, Dakota, Hennepin, and Ramsey and the Greater Minnesota counties that participated were Blue Earth, McLeod, and Olmstead. These counties were selected due to having a volunteer coordinator position staffed at the time of the survey distribution that could share the study with current volunteers. The selection of counties in these two groups was meant to better understand potential differences between rural and urban individuals involved with the Master Gardener Program.

We confirmed that the standard recruitment method for participation across all programs took place via e-mail communication. The survey and research explanation was provided to program coordinators or local Master Gardener group coordinators. These program coordinators then distributed the survey to all members directly through email to active volunteers to solicit participation. The email provided information regarding the project and a survey link through the University-supported Qualtrics website and collected anonymous responses. This allowed for individuals to self-select for participation. Surveys were primarily distributed digitally, however three surveys were mailed to volunteers in Olmstead County upon request. All data collection for this project was completed over a 10 month span between June of 2017 and March of 2018. Due to the secondary nature of contact with volunteers across the six programs, the number of volunteers contacted is unknown.

Results

After the 10 months of survey collection was complete, a total of 257 surveys were returned for analysis. The results found that respondents were primarily female (71.6%) followed by males (26.1%), and 6% preferred not to answer. Most commonly the volunteers were Caucasian, between the ages of 55 and 74, living in the 11-county metro area, and reported living in their community for more than 20 years. Volunteers reported holding a graduate degree (Bachelor's degree or a Master's degree) and either worked full time or was retired. Most commonly, volunteers reported being married; 8% of all volunteers have children under the age of 18 at home. For full demographics details, please refer to Table 2.

Demographic Value		Frequency	%
		257	
Gender	Male	67	26.07%
	Female	184	71.60%
	Prefer Not To Answer	6	2.33%
Age*	25-34 years old	15	5.84%
	35-44 years old	14	5.45%
	45-54 years old	39	15.18%
	55-64 years old	86	33.46%
	65-74 years old	89	34.63%
	75 years and older	13	5.06%
Race*	Caucasian/white	249	96.89%
	American Indian/Alaskan Native	3	1.17%
Ethnicity*	Not Hispanic or Latino	246	95.72%
	Hispanic or Latino	2	0.78%
Highest Degree	High school graduate, diploma, or equivalent (GED)	4	1.56%
	Trade/technical/vocational training/certificate	11	4.28%
	Some college	21	8.17%
	Associates degree	11	4.28%
	Bachelor's degree	114	44.36%
	Graduate school degree	96	37.35%
Employment Status*	Not employed outside of the home	13	5.06%
	Employed, part-time	39	15.18%
	Employed, full-time	87	33.85%
	Retired	117	45.53%
Years living in your community	Less than 2 years	14	5.45%
	2-5 years	24	9.34%
	6-10 years	19	7.39%
	11-20 years	56	21.79%
	20 years or more	144	56.03%
Marriage status*	Single	21	8.17%
	Living with a partner	17	6.61%
	Married	185	71.98%
	Separated	2	0.78%
	Divorced	14	5.45%
	Widowed	9	3.50%
	Would rather not say	7	2.72%
Children under 18 living at home*	Yes	21	8.17%
	No	233	90.66%
Where do you reside/perform most volunteer activities*	11-County Metro	180	70.04%
	Greater Minnesota	74	28.79%

Table 2. Summary of volunteer demographic responses.

**Indicates limited responses were not given and therefore omitted from the table while percentages were still accounted for.*

Behaviors

Question 1: What is the current frequency and duration of volunteerism?

Through this survey, it was found that 46% of volunteers reported participating more than twice a month with any type of volunteer activity (not limited to environmental stewardship). In comparison, volunteers typically participated twice a year to once a month with activities related to environmental stewardship (Figure 3). These activities included but were not limited to planting events, plant sales, city celebrations (e.g. Arbor Day, Earth Day). In terms of yearly participation and retention in environmental stewardship programs, there appears to be a fairly even distribution amongst participation lengths with the largest grouping of 24.5% reporting an average of 10-20 years of continued engagement (Figure 4).

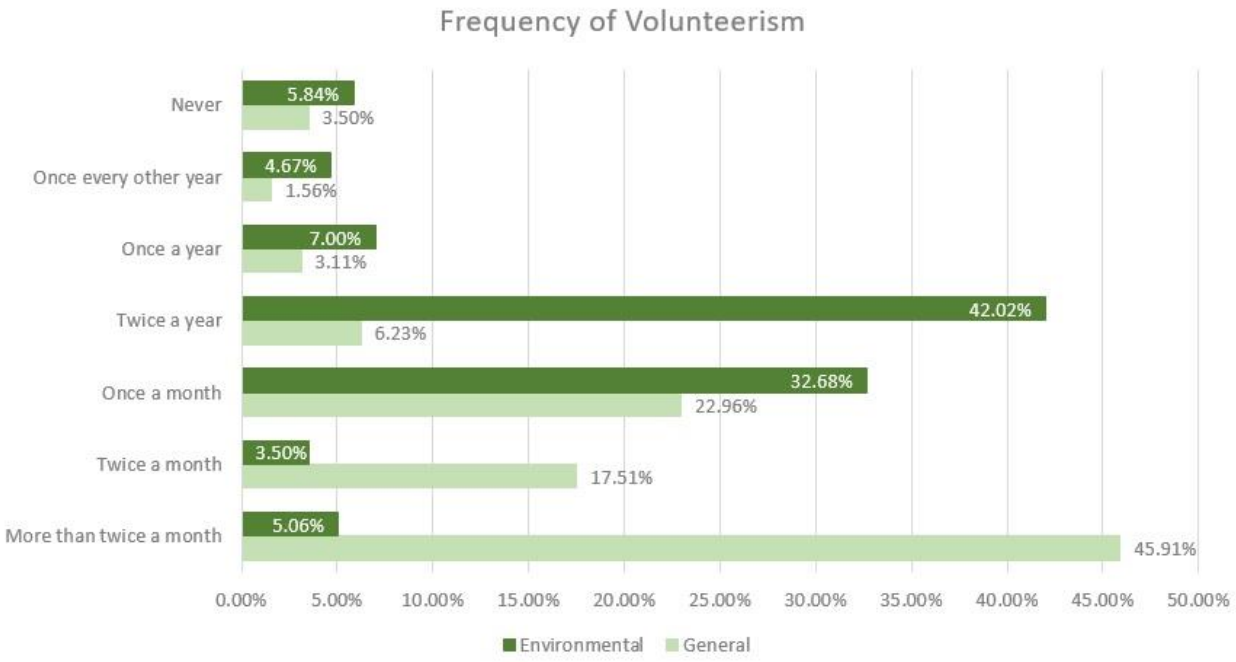

Figure 3. Frequency of general volunteerism and environmental volunteerism, n=257.

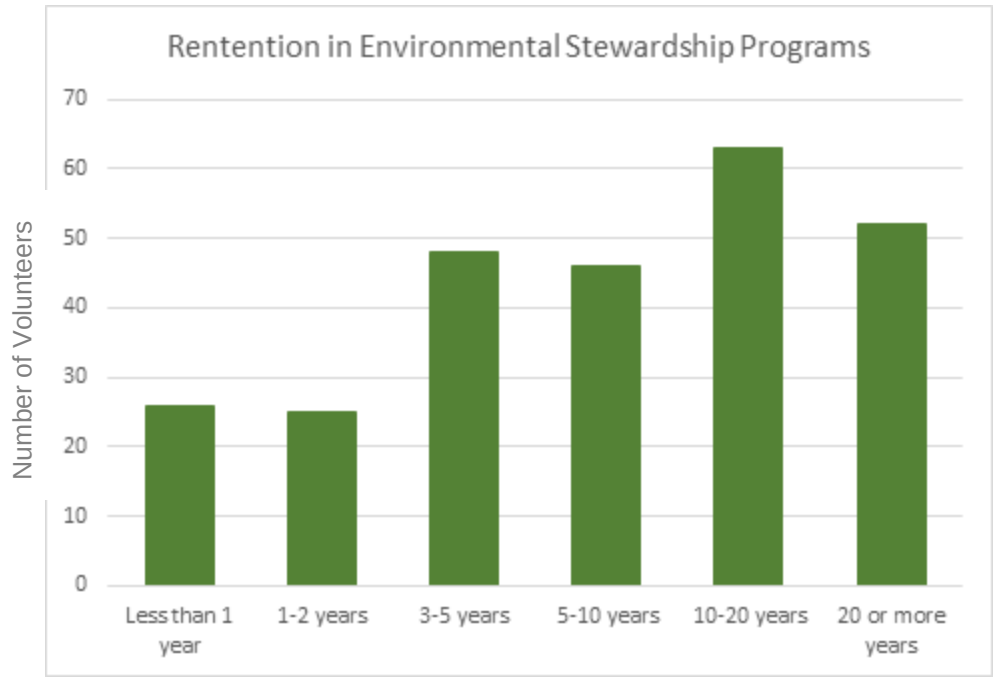

Figure 4. Reported retention in environmental stewardship programs, n=257.

Question 2: Is there a difference in frequency and duration between volunteers in the 11-county metro compared to volunteers in greater Minnesota?

In regards to where volunteers resided or performed most of their volunteer activities, there was a significant difference in the frequency of environmental stewardship volunteering between the 11-county metro and greater Minnesota (*p=.012)*. To further analyze these results, the Wilcoxon rank sum test was utilized and determined that volunteers in the 11-county metro tended to have a higher frequency of participation in these activities than those in greater Minnesota (*W=5173, p=.0019)*. It is worth noting that there was also a significant difference in general volunteer frequency (*p=.043*) based on location but no significance in regards to duration (*p=.865*).

Question 3: Is there a difference in frequency and duration of volunteerism when comparing gender, age, employment status, education level, and living with children under the age of 18 at home?

For this question, the Pearson's Chi-squared test was used in order to determine if there were significant differences for each of the demographic variables in regards to frequency of environmental volunteerism, frequency of general volunteerism, and duration of participation. Table 3 outlines the results for each of these variables. When looking at frequency of general volunteerism, gender (*p=0.038)* and location (*p=.012)* were significantly dependent. Similarly, frequency of environmental stewardship volunteerism results also indicated dependence on gender (*p=.0005)* and location (*p=.043).* Not surprisingly, duration of volunteerism was found to be dependent on age (*p=0.009),* as well as employment status (*p=0.0025)* and education level (*p=.007).*

Variable	Frequency of environmental volunteerism	Frequency of general volunteerism	Duration of environmental volunteerism
Gender	0.03948*	0.0004998**	0.1214
Age	0.1849	0.05547	0.008996**
Employed vs. not employed	0.2039	0.007996**	0.002499**
Education level	0.918	0.2969	0.006997**
Children under 18 at home	0.6792	0.4533	0.5547
11-county metro vs. greater Minnesota	0.01199*	0.04348*	0.8651

Table 3. Pearson's Chi-squared test results between demographic variables and the frequency and duration of volunteering reported.
*$p \leq 0.05$
**$p \leq 0.01$

Question 4: Does an individual's behavior predict their retention in environmental stewardship programs?

To answer this question, we had to assign a more representative scoring protocol for the responses in order to analyze this association. For frequency, we converted the scores into the number of times per year a volunteer reported participating. For the number of programs an individual was involved in, we converted each response to a score from 0-6 based on the participating Minnesota programs. For duration, we used the mid-point of the responses. From here, we tested the linear association and used both Spearman and Pearson correlation coefficients to measure the strength. The results revealed that all four behaviors did have a linear association, however each association was weak to moderate meaning that no clear predictions about retention based on an individual's behavior could be made (see Table 4).

	p-value	Spearman	Pearson
Frequency of general volunteerism x retention	4.36e-07**	0.327	0.314
Frequency of environmental volunteerism x retention	0.0092**	0.237	0.161
Number of programs involved in x retention	0.001**	0.221	0.218
Number of years volunteering in general x retention	1.59e-11**	0.45	0.45

Table 4. Linear association between behaviors and retention in environmental stewardship programs.

*$p \leq 0.05$
**$p \leq 0.01$

Affect

Question 5: Does motivation predict increased retention?

In the survey, volunteers were asked to select up to three motivations out of the list of twelve that best described why they take part in environmental stewardship volunteer opportunities. The twelve items correlated to the five motivation factors of value, understanding, enhancement, social, and reflection. To analyze the data, we had to fit a proportional odds ratio logistic regression model using the five motivation factors as explanatory variables and retention as the response. As described by Guangwei Weng, the statistics consultant for this project, value is the only significant factor with a positive estimated coefficient, meaning if two subjects have factors x_1 and x_2 and they only differ in the value factor (i.e. x_1 shows value factor and x_2 does not), then at any level of retention j,

$$\frac{P(Y > j|x_1)/P(Y \leq j|x_1)}{P(Y > j|x_2)/P(Y \leq j|x_2)} = \exp(0.71)$$

which means that individuals with the value factor are likely to show longer retention than individuals with no value factor when holding all other factors constant. Subsequently, we assessed the proportional odds ratio assumption by comparing it with a multinomial logistic regression model and t-test which found that the assumption is not significantly violated.

Table 5 illustrates the 2:1 odds ratio of a motivation factor not being present in the data for those who had volunteered 10 or more years in environmental stewardship programs. From this we can conclude that if a volunteer notes being motivated by value, then we would expect that the observed percentage would rise from 28% to 50%. However, the observed percentage of respondents not selecting the value motivation does

not fit into the 95% confidence interval unlike the other motivation factors represented in the survey. Therefore we can determine that volunteers that are motivated by values are likely to volunteer for longer periods of time within formal volunteer programs. In addition, Figure 5 presents the observed and modeled motivation factor presence for each category of duration.

Motivation Factor	Odds Ratio	Confidence Interval	Expected % 10+ years (No)	95% Confidence Interval %	Observed % 10+ years (No)
Value	2.04	(1.22 to 3.39)	50%	(38% to 63%)	28%
Understanding	1.86	(0.72 to 2.48)	48%	(26% to 55%)	48%
Enhancement	-0.89	(-0.55 to 1.43)			39%
Social	1.23	(0.71 to 2.16)	38%	(26% to 52%)	44%
Reflection	1.58	(0.74 to 1.86)	44%	(27% to 48%)	85%

Table 5. Odds ratio of motivation factors for volunteers that reported participating for 10 or more years.

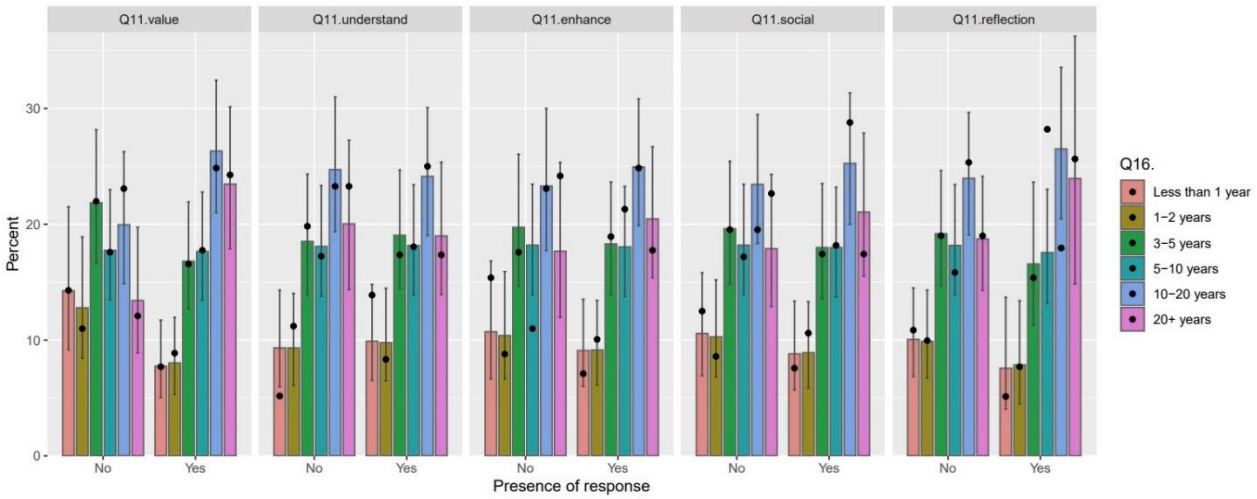

Figure 5. Motivation modeled percentages, observed percentage dot, and 95% confidence interval.

Ecological Knowledge

Question 6: How knowledgeable are trained volunteers about ecological concepts?

In this survey, volunteers were asked to answer three questions about general ecological knowledge: planting considerations, young tree care, and soil additions. It is worth noting that two of the six programs do address all of these concepts in training, while the other four traditionally do not address all of these. The first question asked volunteers to select all aspects they believe should consider prior to planting in the landscape. There were seven possible considerations provided as well as an "other" section where respondents could provide more considerations. All of the provided considerations are factors that should be considered when planting, but the "other" option provides volunteers the possibility to address other aspects that were not provided. The responses were scored in three categories: somewhat knowledgeable, meaning volunteers selected between one and three considerations, knowledgeable, meaning volunteers selected between four and six considerations, and very knowledgeable, meaning volunteers selected or provided seven or more considerations. A minority of volunteers were somewhat knowledgeable (3.4%), while the majority of volunteers were knowledgeable (74.0%), and 22.6% of volunteers were very knowledgeable.

The second question related to ecological knowledge asked volunteers to select the post-planting maintenance options that help young trees survive during the establishment period. Four methods in which one could increase young tree establishment success were provided as well as an "other" option where respondents could provide additional methods. Again, for this question responses were scored and placed in

categories to determine if they were somewhat knowledgeable (they had selected one to two considerations), if they were knowledgeable (they selected three to four considerations), or if they were very knowledgeable (they selected or provided five or more considerations). We found similar results as prior in that a minority of volunteers were somewhat knowledgeable (7.5%), while a majority of volunteers were knowledgeable (86.0%), and 6.5% were very knowledgeable.

The final question related to ecological knowledge addressed the application of soil additions to create the healthiest soil for vegetation. For this question, volunteers were asked to select one of the four provided additions or to provide their own answer. The purpose of this question was to understand the preferred soil addition based on the education volunteers had previously received in training. The options provided were: fertilizers, mulch, soil amendments (e.g. maures, earthworm castings, peat moss), and water. Overall, we found a fairly even distribution of responses between mulch (20.4%), soil amendments (24.2%), and water (31.3%). There were 17.7% of respondents that selected "other". Of this group, 9.8% recommended compost as their preferred amendment. It is worth noting, that a majority of the remaining "other" responses were recommending that possible soil additions were dependent on the site and current soil conditions.

Knowledge of Environmental Issues

Question 7: What is the current knowledge volunteers have in regards to the environmental issues commonly observed in Minnesota urban greenspace?

The next three questions in the survey asked respondents to select either the impact vegetation had on the landscape or the impacts that invasive species have on the vegetation in order to better understand the overall knowledge of environmental issues in urban greenspaces. The first question was related to water quality, more specifically what the respondent believed was the most important impact that vegetation has on water quality. For this question, five options were provided as well as an "I don't know" category. We found that the largest impact selected was related to a plant's roots assisting to slow rainwater movement and reducing the volume of runoff. Details for the responses to this question can be found in Table 6.

Vegetation impact on water quality	Responses
"Roots and the surrounding soil can slow rainwater movement and reduce the volume of runoff"	48.7%
"Strategic placement of vegetation can help reduce the amount of soil erosion caused by heavy rainstorms"	33.2%
"Tree canopy intercepts rainfall and reduces the amount of water reaching the ground at any one time"	5.3%
"Trees can take up trace (very small) amounts of chemicals and convert them to less harmful substances"	4.1%
"Vegetation can transpire water, or take up and hold water, from the soil until it is later released"	5.3%
I don't know	3.4%

Table 6. Response rate for vegetation impacts on water quality.

The next question assessing knowledge of environmental issues was specifically related to the impact of vegetation on native wildlife. Respondents were again asked to

select one of the five effects provided or to select “I don’t know”. Over half of all responses noted the largest impact native vegetation has is in regards to increasing native wildlife. Additional responses for this question are available in Table 7.

Vegetation impact on wildlife	**Responses**
“An increase in native vegetation will increase native wildlife. For instance, birds, insects, and frogs”	57.4%
“Both live and dead trees provide shelter for wildlife”	12.1%
“Increased vegetation attracts a more diverse pool of wildlife”	22.6%
“Vegetation provides increased opportunities for me to view wildlife, such as birds”	0.8%
“Wildlife feed on a variety of vegetation (e.g. acorns, crabapples)”	4.5%

Table 7. Response rate for vegetation impacts on wildlife.

The final question addressing environmental issues was related to invasive pests and their impact on the native vegetation in the urban landscape. For this question, respondents were asked to select all options that apply alongside an option to provide additional impacts (Table 8). Six proposed impacts were provided and this question was scored in terms of the volunteer being somewhat knowledgeable (selecting one to two impacts), knowledgeable (selecting three to four impacts), and very knowledgeable (selecting five to six impacts). In comparison to previous scored questions, we found that 57.7% of respondents were somewhat knowledgeable, 20.8% were knowledgeable, and 20.0% were very knowledgeable about the impacts of invasive pests on native vegetation.

By selecting more impacts, volunteers are demonstrating that they are considering the multiple impacts on which vegetation has on the wildlife and that there isn't a single way in which these impacts occur.

Invasive Pest impact on native vegetation
"Humans are often associated with invasive pest dispersal"
"Invasive pests are able to adapt quickly to suit new conditions"
"Invasive pests can live in a wide range of environmental conditions"
"Invasive pests commonly disperse far and quickly"
"Native vegetation species have not evolved with the invasive pests and are unable to 'fight' successfully"
"They reproduce quickly making it difficult to eradicate"

Table 8. Invasive pest impact on vegetation options provided.

Socio-Political Knowledge and Perceptions

Question 8: What are the general perceptions Minnesota environmental stewardship volunteers have about their urban greenspaces and the management of these spaces?

To address the socio-political knowledge of volunteers, we asked a series of questions to gain a better understanding of their perceptions about urban greenspace management in Minnesota communities. We first asked respondents who they believe is responsible for planting and maintaining vegetation on public land within their community. This question allowed respondents to select multiple options to gain a better understanding of all facets of vegetation and greenspace management. Nearly every respondent selected more than one option. We found that 246 volunteers noted that a city

department was responsible for the vegetation care and upkeep (e.g. forestry departments, parks and recreation departments, public works departments). In addition, 176 of the respondents noted that state and county agencies were responsible for vegetation care. Of all respondents, 100 noted that local residents are also responsible for the care of plants in the urban environment, 82 noted that contracted companies were responsible, and a mere 5 respondents noted that vegetation cares for itself.

The next question asked respondents to rate the overall maintenance of vegetation within their community. Responses showed that over half of all volunteers felt that 70% or more of their urban greenspace was in excellent condition. Table 9 provides the percentages of respondents and their condition assessment of their community's urban greenspace.

Condition Rating	**Percentage**
90%+ are in excellent condition	12.8%
About 70% are in excellent condition	41.1%
About 50% are in excellent condition	26.4%
About 30% are in excellent condition	12.8%
About 5% or less are in excellent condition	5.3%

Table 9. Volunteer perception of urban greenspace condition.

Finally, in regards to the socio-political knowledge and perceptions that volunteers have, we asked what the primary concern about the state of vegetation in their community was. The survey question provided six concerns as well as an option that states the individual does not have any concerns about the state of vegetation.

Respondents were able to select more than one concern if they saw fit. We found that the primary concern with 104 responses was the loss of trees at an alarming rate due to insect pests and diseases. Subsequently, moderate concerns included concern over non-native plantings entering the landscape (58 responses), neighborhoods lacking mature trees (56 responses), and personal property being affected by invasive species (50 responses). The lowest concern was that a tree would fall on the individual's property (17 responses) and 48 respondents noted that they do not have any concerns about the state of vegetation in their community.

Determinants of Environmentally Responsible Behaviors

Question 9: Is there a difference in perceived barriers between volunteers in the 11-county metro compared to those in greater Minnesota? Are there any differences between age and gender?

To test this, we used the Welch Two Sample t-test and the Chi-square test to determine if there were differences in each specific barrier. The results determined that there was no significant difference in barriers based on a volunteer's location and no significant difference based on gender. Parallel to the previous research, we know that the age of a volunteer can also be a determinant of involvement. Using the same tests, we found there were indeed different barriers that the different age groups experienced (refer to Table 10). The only significant barrier for those that were older were physical limitations ($p=.0035$), whereas younger people tended to experience more barriers such as access to affordable childcare ($p=.0005$), time restrictions ($p=.0285$), transportation

factors (*p=.008)*, travel distance (*.025)*, and perceiving a lack of organization in the events they are interested in (*p=.005)*.

Barrier	**p-value**	**Age Range Impacted**
Affordable childcare	0.0004998**	Younger
Lack of organization in events/planning	0.004998**	Younger
Physical limitations	0.003498**	Older
Time restrictions	0.02848*	Younger
Transportation factors	0.007996**	Younger
Travel distance	0.02499*	Younger

Table 10. Pearson's Chi-squared test results assessing the impact of age and perceived barriers.
*$p \leq 0.05$
**$p \leq 0.01$

Question 10: Is there a relationship between Big Five personality traits with the frequency and duration of volunteerism in environmental stewardship programs?

An optional portion of the survey was for an individual to complete the Big Five Inventory in order to better understand if specific personality types were more inclined to volunteer often and for longer periods of time. Using the recommended Big Five Inventory scoring instructions (Appendix B), we were able to convert the full 44-item responses to scores for each personality factor. Again, we had to fit a proportional odds ratio logistic regression model using the five personality factors as explanatory variables and frequency and retention as the responses separately. As a result, it was found that the only significant predictor of frequency of participation in environmental stewardship

volunteer activities was extraversion. Similarly, extraversion and openness were significant predictors of retention in environmental stewardship programs. Neither of these tests significantly violated the assumption after using the multinomial logistics regression model and t-test.

Discussion

Frequency of volunteer activities on a yearly basis has been fairly consistent among past research, with our results eliciting a similar response. Volunteers in Minnesota environmental stewardship programs reported being involved between twice a year and once a month. We were unable to determine an average number due to the large variation in these categories (two to twelve times a year), but these results lead us to believe that there is wide variation in frequency similar to what past research has found. Referencing the largest category of responses, we found that volunteering two times a year was the most common and aligns with research that indicates volunteers mainly participate between two and four times a year. In order to align with previous methodology and conclusions, frequency of involvement was not broken down by age.

In regards to retention in these programs, the median length of involvement was the option for 5-10 years. However, it is worth noting that retention categories were fairly evenly distributed: less than one year (10.1%), one to two years (9.7%), three to five years (18.7%), five to ten years (17.9%), ten to twenty years (24.5%), and twenty or more years (20.2%). Past research has found that duration of involvement is typically concentrated around two to four years, but general volunteerism research has found a

mean participation of seven years. This would lead us to believe that Minnesota environmental stewardship volunteers tend to participate for longer periods of time than previously reported. The six programs that participated in this research conduct regular and structured training as well as providing or advertising regular volunteer opportunities. This structure within the training courses and opportunity advertising is likely to have an impact on the retention length as noted previously (Chen et al., 2010; Hyde et al., 2016).

Minnesota has two very distinct geographic groupings, the 11-county metro area where the population is larger and more condensed and the surrounding greater Minnesota area where cities are typically smaller in population and more spread out. Due to this factor, our research was interested in if those two different distributions of populations experienced different rates of volunteer frequency and retention. We found that there was no difference based on duration, which leads us to believe that regardless of the amount of opportunities available, volunteers are still willing to engage long-term with programs. The biggest difference was in the frequency of volunteering, both in general and with environmental stewardship programs; volunteers in the 11-county metro participated more frequently. It is also worth noting that national data reports the Minneapolis-St. Paul-Bloomington area has the highest rate of volunteering in the United States (Volunteering in America, 2018).

One possible reason for this is that administrative staff for all six of the Minnesota programs are primarily located within the 11-county metro or are located within other larger cities in the state (e.g. Rochester). This often influences where volunteer events are planned and hosted due to the immediate access to sites by administrative staff and a

high-density of program volunteers being located within the metro area. In addition, many of the non-profits that volunteers and programs engage with are also located within the 11-county metro meaning those opportunities would be more widely available. However, it should be noted that this may not be the only reason for differences in frequency. Individuals that live in these two different types of locations are often adhering to different sets of cultural norms and resources. For example, rural people are more culturally conservative than urban people, one-third of college-educated Americans move out of rural areas to urban locations, and amenity-based rural economies can become vulnerable to economic fluctuations (Litchter & Brown, 2011). While this research does not provide information to support this, future research may consider the differences in geographic and cultural norms and its impact on volunteer engagement.

Retention in environmental stewardship programs was found to be linked to age, employment status, and level of education. Age is no surprise when considering duration within programs; those that are older have had more years to stay engaged and involved in a program. In regards to employment status, we found that 45.1% of volunteers reported being retired and 33.9% reported working full time. In comparison, the U.S. Bureau of Labor Statistics found that 21.4% of volunteers reported no longer being in the labor force, 31.1% reported work part time, and 26.3% reported working full time (2016). While these numbers are not drastically different from the data collected in this research, there does seem to be more employed and retired volunteers participating in environmental stewardship programs compared to those working part time that only accounted for 15.2% of responses. Education level is highly concentrated toward higher

education degrees. This research found that 44.4% of volunteers had a Bachelor's degree and 37.4% had a graduate degree, meaning that 81.7% of volunteers had achieved a high level of education. In comparison, the U.S. Bureau of Labor Statistics reported that 38.8% of volunteers had achieved a Bachelor's degree or higher (2016).

One of the primary questions this research aimed to answer was if specific volunteer behaviors impacted retention in environmental stewardship programs. The behaviors we wanted to test against duration were frequency in environmental volunteerism, general volunteerism, number of programs involved in, and number of years volunteering in general. All four interactions showed there was a linear association, however the results found that the association was either weak or moderate in the case of the number of years volunteering in general versus duration. These results lead us to believe that individual behaviors do influence the duration of engagement within a program, but these are not the only reasons for continued retention.

Motivation has been a main area of research to understand exactly why volunteers are inclined to engage in volunteer activities. This research determined that people who reported the value motivation showed longer retention in programs compared to those who did not report this factor. Values, again, are defined as the individual's action that is influenced by principles of behavior important to the individual, often described as altruistic (Chacón et al., 2017). Within this research, the survey question related to motivation included the following items related to value: out of concern for losing natural areas to development and to protect natural places. When using the proportional odds ratio logistics model and using a t-value of 2.0 as a threshold for significance, we found

that the t-value for the value motivation was 2.7852 meaning significance exists for this factor. All other motivation factors were not significant with all values being below 2.0 as a threshold. These results parallel previous research related to motivation, attributing value as a primary indicator of increased retention.

For the purpose of this research, we limited the amount of questions around ecological knowledge due to the varying training experience volunteers complete for different programs. For this reason, questions were focused on general concepts related to planting considerations, post-planting tree maintenance, and soil amendments. Overall, volunteers were found to be knowledgeable in terms of understanding that multiple considerations must be made when selecting a species and a planting site. This is important because of the complex system a plant must live in and it demonstrates that volunteers have been trained to consider multiple factors prior to planting to ensure success. The majority of volunteers noted there were at least four or more considerations to make prior to planting in order for successful establishments and survival. Similarly, the majority of volunteers were knowledgeable in regards to tree maintenance with 86.0% of volunteers noting that maintaining and assisting trees post-planting is a key factor to ensuring those trees grow to maturity and provide the multitude of benefits that most volunteers have been trained to understand.

When addressing soil additions, it appears that volunteers have been trained to utilize natural additions to provide the best support to vegetation when planting (e.g. mulch, soil amendments such as manure, water). Again, it is worth noting that 9.8% of respondents noted adding compost when planting and other responses included knowing

the site and soil conditions prior to selecting a soil addition. Based on these responses, we can tell that volunteers are likely to use additions that are naturally going to occur in the landscape post-planting. Overall, based on these questions about ecological knowledge, we can see that volunteers have synthesized the training information regardless of the program source to think about vegetation care in a broad way and to consider many possibilities when planning for establishment and success.

Another important factor that is addressed with all of the environmental stewardship programs involved is to consider the outside factors that influence how our urban ecosystems work. With a changing climate and the increased possibility for flood events, water quality and stormwater management are popular considerations when working with vegetation management. Volunteers primarily consider how roots of vegetation can impact the speed and volume of water runoff as well as using plants to reduce soil erosion. To this end, we have a good understanding that program training across the board specifically addresses how plants and their roots can help mitigate potential flooding and manage rainwater runoff in the landscape in the urban areas. Wildlife continues to draw attention, so addressing the impacts vegetation has on wildlife was important to include in this research. We found that volunteers primarily considered the use of native vegetation to increase native wildlife as well as diversify native wildlife.

Invasive species management is a complex system and continually evolving based on our knowledge of the species and potential effects of climate change that may increase or decrease issues with specific invasive species. For this reason, we asked volunteers to select why invasive pests are a problem for native vegetation. All of the

provided answers were possible explanations, but as we found, volunteers were generally somewhat knowledgeable on the impacts. This would lead us to believe that while programs train volunteers about specific invasive species, they may not go into great detail as to why invasive species can be potentially harmful. Based on these responses, we would recommend that programs talk about invasive species more on a broad level in order to help volunteers understand exactly why and how they are considered invasive. This would broaden the overall understanding and impact invasive species have on native vegetation.

The socio-political knowledge portion of environmental literacy can be quite complex and region specific. For the purpose of our research, we were interested to understand general perceptions volunteers have about the management of vegetation in public spaces. Based on the question of who is responsible, volunteers often noted more than one agency or person that should be involved in vegetation management. This would lead us to believe that volunteers understand the complex nature due to having personal, city, county, state, and federal agencies involved in this process. This would also lead us to believe that a trained volunteer could explore all managing entities if there were an issue or area of concern in their community. We also asked respondents to rate the overall maintenance of vegetation in their community. The largest category reported they view their community's management being roughly 70% in excellent condition followed by 50% in excellent condition. This would lead us to believe that volunteers observe there is room for improvement, but not being pessimistic based on their training and knowledge.

This would be an area for community staff to consider the overall perception of the land that they manage and how residents perceive management.

Finally, we asked volunteers what their primary concern was in regards to the existing vegetation. Many of the provided responses for selection were based around trees due to the large biomass and potential destructiveness to property and life. The primary concern was related to invasive pests and pathogens which lead us to believe that volunteers are considering outside impacts on the urban landscape over the existing and future vegetation and condition. This is important because it provides insight that volunteers are considering the future in terms of what may happen and less of what is happening. There are positives and negatives to this thinking, however it does reveal that volunteers are thinking long-term about the community-wide impacts and less about the short-term, private property impacts.

Perceived barriers is another consideration when working with volunteers. For the purpose of this research, we sought to understand if younger and older volunteers experience more constraints to volunteering as compared to middle-aged individuals. This research found similar trends. While we did not uncover barriers in regards to gender, income, or geographic location, we did find that older volunteers reported experiencing physical limitations when participating in volunteer activities. Due to the more active, movement-based nature that many environmental programs need volunteers for, it is no surprise that this would be a reported barrier. Focusing on younger volunteers, this age group also reported barriers that would prevent them from participating more frequently, specifically barriers related to time and transportation. Additionally, the

barriers reported in this research reflected previous research that note a perceived lack of organization within programs was a limiting factor for participation. Overall, we did determine that even though there were barriers based on age, we did not observe any notable significance related to gender and location which have previously been found to be notable barriers for volunteers.

Barriers are an area that should be taken into consideration from the administrative side of programs. Oftentimes, programs are interested in diversifying their volunteer population. In order to do this, volunteer coordinators and managers must understand which barriers exist for the populations they are trying to reach and then make systematic changes in order to overcome these barriers and create more inclusive programming. For example, consider transportation barriers and time restrictions for younger volunteers. Program coordinators could make the effort to provide training courses and volunteer opportunities at more widely available times and along easy to access public transportation routes; opportunities in various locations could make involvement more accessible to individuals.

The final piece of this research was to determine the impact of personality on volunteer behaviors. The purpose for including personality in this research was because there is currently no published research on this topic related to environmental volunteerism although there is a broad knowledge in regards to other types of volunteerism. The results found that extraversion was the only significant predictor of increased frequency which reflects previous research that has found that frequency or participation in volunteer activities can be predicted by a volunteer exhibiting

extraversion as a personality trait. When considering personality's impact on retention, there are currently no studies that provide insight into this. Therefore, we pursued this idea by using the same model and threshold and found that two personality factors were significant predictors of retention: extraversion and openness. Given that there is no research that we can compare this information to, future research may be able to broaden the body of knowledge around personality and retention.

By better understanding personality, volunteer coordinators and program directors could use this information to design volunteer opportunities and structure training courses in a way that supports each personality type. It is also a way to potentially focus more direct attention to those personality types that are most prominent in their volunteer population. Again, there currently is no other study focused on personality's impact on retention, so further research would be recommended to better understand this impact. Another avenue of research would be on personality differences that exist in certain demographic groups. This could potentially provide the opportunity for administrative staff to target specific demographics that are currently underrepresented in the programs that may exhibit certain personality types.

Due to the limited time-frame of this study, a small portion of volunteers engaged in Minnesota environmental stewardship programs were surveyed. A main factor in this was the limited communication access given that information had to be provided through program coordinators that may not have the time or resources to provide timely and frequent reminders of the survey opportunity. Given more time and direct access to

contact lists, we would likely be able to procure a more comprehensive snapshot of trends that volunteers exhibit within these programs.

In addition, due to the limited time frame and in an effort to reduce response burden, we were unable to directly assess all seven elements of environmental literacy. This research was able to address all elements of environmental literacy aside from skills. Based on this limitation, it would be recommended that future research encapsulate all seven elements of environmental literacy in order to provide a comprehensive assessment of environmental literacy. The challenge is that when assessing skills across programs, you must have a comprehensive understanding of the initial training content to assess skills that all volunteers have been educated on.

Conclusion

This research is aimed at determining which indicators can help predict increased retention in environmental stewardship programs. The results determined that age, employment status, and education level can help predict increased duration in these programs. Another predictor was related to volunteers noting motivations related to values was a predictor of increased retention which parallels the previous research related to motivations. The final predictor uncovered was related to volunteers having personalities that exhibited extraversion and openness which have both been previously found to be predictors of volunteerism. To address increased frequency of volunteering, we found that those who lived in metro areas and those who had extraversion as a personality factor were more likely to engage more frequently. Finally, this research

determined that frequency of volunteering does not clearly predict retention in environmental stewardship programs.

Based on previous research and the results found in this study, there is room for further research in regards to the impact personality has on the frequency and duration of volunteer engagement in environmental stewardship programs. Another gap in knowledge is the understanding of the skills volunteers obtain across multiple programs. Some implications that volunteer coordinators and managers may consider are specifically related to elements of environmental literacy. In regards to behaviors, program staff can address barriers to access training and volunteer opportunities in order to diversify the pool of volunteers they engage. Through this research, it was determined that volunteers are concerned over the loss of vegetation due to insects and disease but in general were somewhat knowledgeable about environmental issues. A suggestion would be to focus more training and education around specific environmental issues such as how and why invasive pests and diseases negatively impact the native and local vegetation. Overall, consideration of all components of environmental literacy should be made by volunteer coordinators and managers to provide a more comprehensive educational experience.

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Appendix A

KAP Influenced Survey Tool – Ashley Reichard, Master's Research, Urban & Community Forestry, UMN

Knowledge:

GENERAL: What factors do you think should be considered when planting into the landscape? Please select all that you think apply.

- ❑ Adequate growing space
- ❑ Planting depth
- ❑ Soil compaction
- ❑ Soil type
- ❑ Sun exposure
- ❑ Species of plant
- ❑ Sun exposure
- ❑ I don't know
- ❑ Other (specify):

TREES: What do you think young trees require regularly within the first 5-10 years to successfully grow into a mature landscape tree? Please select all that you think apply.

- ❑ Ample soil space for roots to grow into the landscape
- ❑ Protection from stem damage due to animals or landscape equipment
- ❑ Pruning every 1-3 years
- ❑ Watering on a regular schedule with increased doses in drought
- ❑ I don't know
- ❑ Other (specify):

SOILS: Which of the following soil additions do you think creates the healthiest soil for growing vegetation?

1. Fertilizers (e.g. manures, urea)
2. Mulch
3. Soil amendments (e.g. gypsum, earthworm castings, peat moss)
4. Water
5. I don't know
6. Other (specify):

WATER QUALITY: What do you think is the most important effect that vegetation (trees, shrubs, and other plants) has on water quality?

1. Roots and the surrounding soil can slow rainwater movement and reduce the volume of runoff
2. Strategic placement of vegetation can help reduce the amount of soil erosion caused by heavy rainstorms
3. Tree canopy intercepts rainfall and reduces the amount of water reaching the ground at any one time
4. Trees can take up trace (very small) amounts of chemicals and convert them to less harmful substances
5. Vegetation can transpire water, or take up and hold water, from the soil until it is later released
6. I don't know

WILDLIFE: What do you think is the most important effect that vegetation has on wildlife?

1. An increase in native vegetation will increase native wildlife. For instance, birds, insects, and frogs
2. Both live and dead trees provide shelter for wildlife
3. Increased vegetation attracts a more diverse pool of wildlife
4. Vegetation provides increased opportunities for me to view wildlife such as birds
5. Wildlife feed on a variety of vegetation (e.g. acorns, crabapples)
6. I don't know

INVASIVES: Why are invasive pests (e.g. Emerald Ash Borer, the Asian Longhorned Beetle) a problem for native vegetation in the urban landscape? Please select all that you think apply.

- ❑ Humans are often associated with invasive pest dispersal
- ❑ Invasive pests are able to adapt quickly to suit new conditions
- ❑ Invasive pests can live in a wide range of environmental conditions
- ❑ Invasive pests commonly disperse quickly and to far distances
- ❑ Native vegetation species have not evolved with the invasive pests and are unable to "fight" successfully
- ❑ They reproduce quickly making it difficult to eradicate
- ❑ I don't know

Attitudes:

Who do you believe is responsible for planting and maintaining vegetation on public land within your community? Please select all that you think apply.

- ❑ City forestry/parks and recreation/public works department
- ❑ Local residents
- ❑ None – vegetation cares for itself
- ❑ Outside companies that are contracted by the city
- ❑ State or county agencies (the Minnesota DNR, watershed districts, etc.)
- ❑ Other. Please specify:

How would you rate the over-all maintenance of the vegetation in your community?

1. 90%+ are in excellent condition
2. About 70% are in excellent condition
3. About 50% are in excellent condition
4. About 30% are in excellent condition
5. About 5% or less are in excellent condition

What is your primary concern about the state of the vegetation in your community? Please select all that apply.

- ❑ A tree will fall onto your property (house, car, etc.)
- ❑ Community members are planting non-native species that are interfering with native species
- ❑ The city is losing trees at an alarming rate due to insect pests and diseases
- ❑ The community is lacking wildlife sites for birds, squirrels, bees, etc.
- ❑ Your neighborhood is lacking mature trees that provide a range of benefits
- ❑ Your property will be overcome by invasive species
- ❑ I do not have any concerns about the state of vegetation

What is your primary reason for taking part in volunteer opportunities? Please up to three options that apply to you.

- ❑ Learning a new skill
- ❑ Opportunity to try something new
- ❑ Out of concern for losing natural areas due to development
- ❑ To do something tangible
- ❑ To do something useful
- ❑ To experience a sense of oneness with the natural world
- ❑ To feel a sense of community
- ❑ To feel good about myself
- ❑ To meet new people
- ❑ To protect natural places

- ❑ To reflect
- ❑ To spend time with friends or family

Practices:

Where do you most commonly seek information to properly care for trees, shrubs and other plants on your property or in your neighborhood?

1. By entering my question in a search engine
2. Directly from my city forester/parks and recreation/public works department
3. Friends, family members, or neighbors
4. From a local plant/tree care company. Please specify:
5. From a state or federal agency (the Minnesota DNR, the Forest Service, etc.)
6. From an educational institution
7. From my city's website
8. I don't seek out tree care information

What activities do you currently participate in that care for the environment in your community (environmental stewardship)? Please select all that apply.

- ❑ I do not currently take park in any environmental events.
- ❑ Assisting with planting events
- ❑ Assist with aftercare for the vegetation (mulching, watering, providing protection from animals, etc.)
- ❑ I am involved in citizen scientist projects
- ❑ I assist with outreach by providing information to the public at fairs, booths, online forums, nature centers, etc.
- ❑ I attend invasive species removal events (e.g. buckthorn removal)
- ❑ Sitting on an open space committee, a tree board, an environmental commission, etc.
- ❑ Other (for instance, sweeping gutters in your neighborhood):

Please check off any of the environmental stewardship volunteer programs below that you have completed training for and are currently involved in as of January 2017:

- ❑ Citizen Pruner
- ❑ First Detector
- ❑ Master Gardener
- ❑ Master Naturalist
- ❑ Tree Care Advisor
- ❑ Tree Steward
- ❑ None of the above

On average, how often do you attend environmental stewardship related public events such as public lectures, Arbor Day celebrations, community tree plantings, plant sales, citizen pruner events, etc.?

1. Once every other year
2. Once a year
3. Twice a year
4. Once a month
5. Twice a month
6. More than twice a month
7. Never

How many years have you been involved in environmental stewardship activities?

1. Less than 1 year
2. 1-2 years
3. 3-5 years
4. 5-10 years
5. 10-20 years
6. 20+ years

How often do you currently volunteer? (Does not have to be related to environmental stewardship)

1. Once every other year
2. Once a year
3. Twice a year
4. Once a month
5. Twice a month
6. More than twice a month
7. Never

How many years have you been involved in any type of volunteer activity?

1. Less than 1 year
2. 2 years
3. 3-5 years
4. 5-10 years
5. 10-20 years
6. 20+ years

Barriers/Constraints:

How do you prefer to receive information about environmental practices (such as planting and pruning information) from your city? Please select all that apply.

- ❑ Direct contact from city staff
- ❑ E-mail
- ❑ From the city's website
- ❑ Newsletters (digital or physical)
- ❑ Social media (Twitter, Facebook, etc.)
- ❑ Text message
- ❑ Workshops
- ❑ Other (please specify):

What prevents you from assisting your community in caring for the environment and public vegetation? Please select all that apply.

- ❑ There are not factors that prevent me from assisting care for public trees
- ❑ Affordable childcare
- ❑ Lack of organization in events/planning
- ❑ Physical limitations
- ❑ Time restrictions
- ❑ Transportation factors (e.g. bus line availability, needing a ride)
- ❑ Travel distance
- ❑ Other (specify):

Personality:

We would like to learn more about the individuals that take part in environmental stewardship opportunities and what personality factors these individuals exhibit. If you are interested in answering a supplementary survey that will take five minutes or less, please fill out the next page. If you are not interested in the supplementary survey, please continue to Demographics to complete the survey.

Demographics:

1. What is your gender?

    a. Female
    b. Male
    c. Prefer not to answer

2. What is your age?

   a. Under 18
   b. 18-24
   c. 25-34
   d. 35-54
   e. 55-74
   f. 75 years or older

3. How would you describe yourself?

   a. American Indian or Alaska Native
   b. Asian
   c. Black or African American
   d. Native Hawaiian or Other Pacific Islander
   e. White

4. Are you Hispanic or Latino?

   a. No, I am not Hispanic or Latino
   b. Yes, I am Hispanic or Latino

5. What is the highest degree or level of school you have completed?

   a. Some high school
   b. High school graduate, diploma or equivalent (GED)
   c. Some college
   d. Trade/technical/vocational training/certificate
   e. Associate degree
   f. Bachelor's degree
   g. Graduate school degree

6. As of January 2017, what is your current employment status?

   a. Employed, part time
   b. Employed, full time
   c. Not employed outside the home
   d. Retired

7. How many years have you lived in your community?

   a. Less than 2 years
   b. 2-5 years
   c. 6-10 years
   d. 11-20 years
   e. 20+ years

8. What is your marital status?

   a. Single
   b. Living with a partner
   c. Married
   d. Divorced
   e. Separated
   f. Widowed
   g. Would rather not say

9. Do you have children under the age of 18 living at home?

   a. Yes
   b. No

10. Where do you reside/perform most of your volunteer activities?

   a. 11-County Metro Area (Anoka, Carver, Chisago, Dakota, Hennepin, Isanti, Ramsey, Scott, Sherburne, Washington, Wright counties)
   b. Greater Minnesota

11. I am volunteering as a part of a…

   a. Club
   b. Corporate group
   c. Faith based group
   d. On my own
   e. Service group
   f. School/educational group
   g. Some other type of group

Appendix B

Big-Five Inventory - Full 44 Item

Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who *likes to spend time with others*? Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement.

1	2	3	4	5
Disagree Strongly	Disagree a little	Neither agree nor disagree	Agree a little	Agree strongly

I am someone who…

1. _____ Is talkative
2. _____ Tends to find fault with others
3. _____ Does a thorough job
4. _____ Is depressed, blue
5. _____ Is original, comes up with new ideas
6. _____ Is reserved
7. _____ Is helpful and unselfish with others
8. _____ Can be somewhat careless
9. _____ Is relaxed, handles stress well.
10. _____ Is curious about many different things
11. _____ Is full of energy
12. _____ Starts quarrels with others
13. _____ Is a reliable worker
14. _____ Can be tense
15. _____ Is ingenious, a deep thinker
16. _____ Generates a lot of enthusiasm
17. _____ Has a forgiving nature

18. _____ Tends to be disorganized
19. _____ Worries a lot
20. _____ Has an active imagination
21. _____ Tends to be quiet
22. _____ Is generally trusting
23. _____ Tends to be lazy
24. _____ Is emotionally stable, not easily upset
25. _____ Is inventive
26. _____ Has an assertive personality
27. _____ Can be cold and aloof
28. _____ Perseveres until the task is finished
29. _____ Can be moody
30. _____ Values artistic, aesthetic experiences
31. _____ Is sometimes shy, inhibited
32. _____ Is considerate and kind to almost everyone
33. _____ Does things efficiently
34. _____ Remains calm in tense situations
35. _____ Prefers work that is routine
36. _____ Is outgoing, sociable
37. _____ Is sometimes rude to others
38. _____ Makes plans and follows through with them
39. _____ Gets nervous easily
40. _____ Likes to reflect, play with ideas
41. _____ Has few artistic interests
42. _____ Likes to cooperate with others
43. _____ Is easily distracted
44. _____ Is sophisticated in art, music, or literature