COMMUNITY GEOGRAPHY, PLACE IDENTITY, ENVIRONMENTAL STEWARDSHIP: WHAT MOTIVATES VOLUNTEERISM AT ENVIRONMENTAL NONPROFIT ORGANIZATIONS?

by

Christina Wright Lopez, M.S.

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Committee Members:

Jason P. Julian, Chair

Russell C. Weaver, Co-Chair

Yongmei Lu

Kimberly M. Meitzen

DEDICATION

For River

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LIST OF ABBREVIATIONS

Abbreviation	Description
CBO	Community-based Organization
CBPR	Community-based Participatory Research
CG	Community Geography
EFA	Exploratory Factor Analysis
ENPO	Environmental Nonprofit Organization
ES	Environmental Stewardship
GIS	Geographic Information System
NLR	Nominal Logistic Regression
PAR	Participatory Action Research
PPGIS	Public Participatory Geographic Information System
SMGA	San Marcos Greenbelt Alliance
TST	Texas Stream Team

ABSTRACT

Environmental stewardship is a growing phenomenon in the United States wherein stewarding, or voluntarily caring for the environment, is a crucial asset and component to many environmental nonprofit and community-based organizations. Community geography, a research approach that emphasizes participatory research and partnerships between universities and nongovernmental organizations, can help understand what motivates environmental stewardship to help retain and recruit volunteers, and help geographers build theory on human-environment interactions. As such, this dissertation assessed environmental stewardship through a community geography lens with a focus on place and scale.

To that end, this dissertation advances our understanding of the personal, social, and place-based factors that motivate voluntary environmental stewardship in general and based on organization type. Research findings support evidence of a novel "First Law of Environmental Stewardship" hypothesis and revealed a possible systematic link between spatial/operational scale of an organization and the motivational scale of the individual volunteer. This dissertation also contributes to the community geography literature in a way that engages spatial thinking and draws on key spatial concepts. However, it is novel in that it (a) does not feature applied Geographic Information Systems (GIS) or Public Participatory GIS (PPGIS) as a central research component and (b) employs scale of community partners in evaluation.

I. INTRODUCTION

"A land ethic, then, reflects the existence of an ecological conscience, and this in turn reflects a conviction of individual responsibility for the health of the land."
— Aldo Leopold, *The Land Ethic*, 1949

Aldo Leopold, an American author, philosopher, and environmentalist, first discussed a land ethic and what it means to voluntarily care for and respect the land in his famous *A Sand County Almanac* (1949). Leopold's writing laid the foundation for what is known today as *environmental stewardship*. The concept of environmental stewardship acknowledges the existence of an ecological conscience, or the desire of people to act voluntarily on behalf of the environment. As the world grapples with the many challenges of the Anthropocene, an increasing number of Americans are turning to environmental stewardship (volunteerism) with environmental nonprofit organizations whose stewardship activities allow volunteers to enact their values (Close et al., 2016).

Environmental stewardship programs and activities manifest in many forms and many levels of complexity (Bennett et al., 2018). Some activities aim to remove litter, restore native species, provide environmental education, or engage in policy advocacy at various institutional and governmental levels. Most often, programs occur at environmental nonprofit organizations whose missions aim to benefit the natural environment. Community-based Organizations (CBOs) and Environmental Nonprofit Organizations (ENPOs) are two major avenues for participation in environmental stewardship programs. CBOs are typically small in staff and spatial extent (hence the descriptor *community-based*), and ENPOs tend to function at broader spatial scales (e.g., city, state, national, international) and with greater degrees of professionalization (e.g., Green, 2016). Despite differences in size and bureaucracies, however, both types of

organizations rely heavily on volunteer participation for their respective environmental missions (Close et al., 2016).

Considering environmental stewardship and its importance in how environmental organizations (both CBOs and ENPOs) function, this dissertation aimed to (1) create and leverage two community geography partnerships to (2) understand what drives volunteerism and (3) test hypotheses regarding the roles of scale and place in participation in CBOs and ENPOs. By synthesizing and augmenting the literature streams of community geography, environmental stewardship, and place identity, this dissertation attempted to understand the importance of place and scale in human-environment interactions and ES participation at multiple scales.

To that end, this dissertation was conducted in collaboration with and on behalf of two local partners based in San Marcos, Texas, USA: (1) a CBO, the San Marcos Greenbelt Alliance (SMGA), which functions at the city scale; and (2) an ENPO, the Texas Stream Team (TST), which operates at the scale of the state of Texas, but is headquartered in San Marcos, Texas. Both partners rely heavily on volunteers and community participation to implement action plans and affect change at a variety of spatial scales (Johnson et al., 2018; Krasny et al., 2014). Importantly, research has shown that the flow of volunteers and community participation in both CBOs and ENPOs is, in general, highly variable, as "reasons for volunteering are as diverse as the people who participate and the types of work they do" (Grese et al., 2001, p. 266). Among other things, weather, incentives, and event size affect rates of participation (Bennett et al., 2018; Merenlender et al., 2016; Wright et al., 2015).

While these factors are somewhat macroscopic in nature, and they are therefore

difficult for ENPOs/CBOs to manipulate in order to increase participation, studies that contribute to a deeper understanding of the comparably micro-level factors that motivate individual participation in ES programs will arguably offer these ENPOs/CBOs vital insights for retooling their targeting and outreach efforts. In other words, understanding the motivations of stewards may help ENPOs/CBOs to build organizational capacity by attracting and retaining larger, potentially more diverse, groups of stewards.

In addition, ENPOs and CBOs may benefit from considering both the quantity (frequency and magnitude) and quality of participation. Indeed, it is the quality of the participation that determines the quantity (Alender, 2016). The quality aspect stems from understanding what motivates volunteers and ensuring that "the extent to which a project's goals and activities … are relevant to the needs and interests of public participants" (Shirk et al., 2012, p. 4 cited in Alender, 2016). Some volunteers may be highly intrigued by learning new things and exploring (Grese et al., 2001). Thus, it is important to 1) understand whether learning opportunities are drivers of participation, and 2) provide opportunities for personal growth and skills that can be applied in other ways throughout their lives (Grese et al., 2001). Further, additional research aimed at understanding motivations for environmental stewardship will be critical to future policy and program design (Bennett et al., 2018; Chan et al., 2016; Wolf et al., 2013; Robinson et al., 2012).

Despite the value that can come from studying their volunteers and attempting to identify patterns in volunteer motivations, ENPOs and CBOs often lack the internal capacity or time to undertake research projects that are not directly connected to their strategic plans or grant-seeking activities (Close et al., 2016). Recognizing this challenge,

participants in the emerging subfield community geography can fill the gap (Robinson, 2010). Community geographers often partner with local communities and ENPOs/CBOs to help them carry out their missions of affecting positive community change and, in doing so, build organizational capacity (Hawthorne et al., 2014; Robinson, 2010).

Community geographers tend to use Public Participatory Geographic Information Systems (PPGIS) to assist CBOs in achieving their objectives (e.g., Columbus Community Geography Center and Syracuse Community Geography). While these collaborations have produced valuable benefits to participants (Block et al., 2018; Robinson et al., 2017; Hawthorne et al., 2014), the prominence of Geographic Information System-based applications gives the impression that community geography, as practiced, is inseparable from Geographic Information Systems (GIS). Indeed, one of the more high-profile community geography organizations is even called Citizen Science GIS (http://www.citizensciencegis.org).

Notwithstanding this historical (e.g., Feaster and English 2002) and empirical (e.g., Boll-Bosse & Hankins, 2018; Block et al., 2018; Hawthorne et al., 2014; Robinson 2010) marriage of community geography and GIS, at its core, community geography involves bringing spatial thinking and geographical analysis to bear on community-based participatory research (CBPR) and participatory action research (PAR) projects (Kindon & Elwood, 2009, p. 21; Pain, 2004). In that sense, researchers need not be GIS experts to be community geographers. Rather, community geography methodologies can be as mixed and diverse as the collaborators who come together to "conduct fieldwork, share observations and stories, [and] explore maps and geographic data to generate and answer questions…to understand and improve local areas" (Switzer et al. 2012, p. 334; also see

Hawthorne et al. 2014 and Block et al. 2018).

On that backdrop, this dissertation executed a mixed-methods community geography (as opposed to community GIS) study in partnership with an ENPO and CBO that both wish to understand the motivations and characteristics of their volunteers. At bottom, volunteering with an ENPO/environmental CBO is a conscious act of environmental stewardship, and environmental stewardship is intimately tied to the fundamental geographic concepts of *place* and *human-environment relations* (Amsden, Stedman, & Kruger 2013; Andersson et al., 2007; Barthel et al., 2010; Gooch 2003; Krasny & Tidball, 2012; Measham & Barnett, 2008). Scholars (e.g., Westphal [1995] and Still and Gerold [1997]) have found that "volunteers have strong inclinations to help the environment, especially in their own neighborhoods" (Grese et al., 2001, p. 266).

This dissertation reviewed interdisciplinary literature and leveraged survey data and interviews to answer a suite of questions related to volunteer participation, motivations, place identity, and broader patterns of civic engagement. Insofar as community geography "connects members of the public to the places they care about" (Switzer et al. 2012, p. 334), the results of the research are used to directly assist the two community partners in connecting with wider and more diverse community audiences, which can play an important role in building their organizational capacities.

Research Objectives

Community geography is about turning the research process on its head; local partners and collaborators—not the academic researchers—define the research questions and objectives (e.g., Robinson 2010; Hawthorne et al. 2014). With that disclaimer in mind, the overarching questions at issue in this proposed dissertation—which concern the

factors and *place-based* conditions and feelings that motivate local environmental stewardship—were identified in preliminary meetings with two community partners. The research objectives implicated in those meetings are as follows.

1. Texas Stream Team (TST) expressed a desire to:
   (a) identify volunteer motivations and retention techniques; and
   (b) create an action plan to attract a more diverse pool of citizen scientists.
2. The San Marcos Greenbelt Alliance (SMGA) communicated a desire to:
   (a) understand motivations of SMGA volunteers in order to provide SMGA with useful information for targeting and outreach; and
   (b) to understand whether participation in SMGA activities is linked to spillover effects, where volunteers put knowledge gained through SMGA to use in their home and/or community lives.
3. Due to the similarities in their objectives, this dissertation will draw on data collected in response to survey questions to contribute to theoretical knowledge on the individual, social, and place-based factors that correlate with environmental stewardship in an ENPO and/or CBO.

The following broad research questions were selected for investigation in this dissertation:

- What are the drivers for environmental stewardship participation, and do place-based processes play a role?
- Does the amount of participation (e.g., volunteer hours or volunteer events per year) vary systematically with selected individual, community, and/or volunteer event-related characteristics?

- What skills or insights do volunteers say they gained from participation with the organization?
- To what extent do volunteers use skills and insights gained from the organization's events in their daily lives?
- To what extent do volunteers share their volunteer experiences with family, friends, or other social contacts?

Overview of Research Approach

The dissertation is guided by the participatory action research (PAR) approach. PAR is uniquely situated in both a transformative and social constructivist interpretive framework because "P[A]R offers critical geographers … an epistemological framework within which to affect positive change and improve people's lives" (Robinson, 2010, p. 15). PAR has a long history in the social sciences in qualitative research (Kemmis & McTaggart, 2005). By definition, PAR posits that reality is socially constructed, i.e., "multiple realities are constructed through our lived experiences and interactions with others" (Creswell, 2013, p. 35).

A key tenet of PAR is that it "emphasizes knowledge for action … and knowledge is created by all of humanity" (Robinson, 2010, p. 15). In community geography, the PAR approach is used to conduct research on behalf of a community partner to affect positive community change. Although positive community change is the goal, PAR has been critiqued for not achieving such lofty goals and even incurring harm in some cases (Robinson, 2010; Schwandt, 1997). These critiques stem from observations that university involvement is usually 1) conducted on a semesterly basis that does not correspond to community partner timelines and 2) does not conclude with an evaluation

of the partnership. However, that is not to say PAR does not provide any benefits. Rather, critics assert that the two last "key stages" of the PAR approach— (1) evaluate action and process as a whole; and 2) identify options for further PAR with or without academic researcher(s) (see Table 1.1)—have simply not been widely applied in practice (Kindon et al., 2007).

Recognizing this critique, the research proposed herein aims to engage more directly with these often-missing pieces (see especially the description of "Phase 3" below). However, due to the COVID-19 outbreak in the early Spring of 2020, the community partners ceased volunteer (stewardship) activities. As such, a full evaluation of the partnership and quantification of "actionable change" was not within the scope of the dissertation timeframe.

Table 1.1 Key stages of the PAR process (source: Kindon et al., 2007).

Action	Establish partnership Create common agenda Collaboratively scope issues Agree on timeframe
Reflection	*Research design* *Ethics* *Power relations* *Knowledge construction process* *Representation* *Accountability*
Action	Build relationships Identify roles and responsibilities Establish a Memorandum of Understanding Collaboratively design research process and tools Discuss and identify desired outcomes
Reflection	*Research questions and design* *Relationships* *Information requirements*
Action	Implement research process Data collection Enable participation of others

	Collaboratively analyze data Begin planning action together
Reflection	*Research process* *Evaluate participation and representation of others* *Assess need for further research and action options*
Action	Plan resource-informed action
Reflection	*Evaluate action and process as a whole*
Action	Identify options for further PAR with or without academic researcher(s)

Overview of Dissertation Chapters

This dissertation is composed of several chapters, including three studies that were constructed as standalone publications. Note that some redundancy is present in the background, conceptual framing, and literature among these chapters. **Chapter II presents the background of environmental stewardship and community geography**. Here, I argue they share an agenda, and using the two in concert with one another would greatly build the body of knowledge. I present these research agendas, major challenges, and gaps in the literature, and suggest they coalesce to enhance both streams of literature. ES background, definition(s), and theoretical frameworks are presented, followed by CG's definition and, then, a weaving together of the ES and CG. I conclude with the notion that this novel research agenda creates an advantageous milieu for the university, community, and students in higher education who all benefit from civic engagement experiences.

Chapter III describes the first study— how organizations bring volunteers together in social and geographic space(s). This pilot study asserts that, as spaces or venues for environmental stewardship, environmental organizations vary in type, scale, and purpose in ways that help stewards to self-sort into the opportunities that are best aligned with their individual motivations and environmental concerns. The study revealed

meaningful between-organization differences in volunteer environmental stewards that collectively support a "First Law of Environmental Stewardship" hypothesis, whereby all stewards are related (by a desire to enhance the environment and help their communities), but stewards in the same organization are more related than stewards in different organizations. These findings expose some of the nuances of environmental volunteerism by highlighting connections between personal motivations, geographic scale, and organization type.

Chapter IV assesses the impacts of participation in stewardship programs and how participation creates new behavior changes and reinforces pro-environment behaviors. Three categories of changes in environmental behavior are assessed: Natural Areas, Environmental Activism, and Water Awareness. Findings demonstrate that participation in environmental stewardship was linked to pro-environmental changes in all categories of environmental outlooks and behavior for the survey respondents. Follow-up interviews allowed me to capture additional aspects of environmental stewardship not addressed in the survey. In all, the findings suggest that participation can lead to greater uptake in selected pro-environment actions, higher awareness of environmental issues, and a greater appreciation for natural amenities. This research is beneficial to the community partners as it demonstrates their efficacy and the efficacy of environmental stewardship programs to alter social norms.

The dissertation research culminates in the final study presented in **Chapter V, which hypothesizes the role of scale in sorting stewards.** Stewards' major motivational dimensions were uncovered via an exploratory factor analysis, which produced two well-defined factors that showed micro- and macro-scale motivations. Then, a nominal logistic

regression model predicted each volunteer's organizational affiliation (with either a small-scale community-based organization or a broad-scale environmental nonprofit organization) as a function of their motivations, controlling for socioeconomic and demographic variables. The small-scale organization volunteers were more likely to exhibit micro-motivations associated with self-improvement, socialization in dense social networks, and seeking immediate instrumental gains. Large-scale organization volunteers exhibited comparatively macro-motivations associated with social change, applying knowledge learned from dispersed social networks, and seeking long-term transformation to social institutions and values. The close correspondence between motivational and organizational scales suggests that nonprofits seeking to broaden their volunteer pools might wish to experiment with multiscalar programming, combining immediate, instrumental, place-based actions with bigger picture work in movement-building.

Finally, **Chapter VI offers a conclusion** of the research by summarizing how the dissertation applied fundamental geographic concepts of scale and place to provide new insights into how stewards self-sort and mobilize, after accounting for personal characteristics. The chapter reviews research outcomes for the community geography approach and theoretical contributions. Limitations of the dissertation and future research directions are also discussed.

II. BACKGROUND: COMMUNITY GEOGRAPHY AND ENVIRONMENTAL STEWARDSHIP

Introduction

Environmental stewardship (ES) is of recent scholarly interest in diverse fields of study whereas community geography (CG) is a newly formed subfield of geography that aims to build capacity and affect change in communities through partnerships. I argue they share an agenda and using the two in concert with one another would enhance the body of knowledge. I present these research agendas, major challenges, and gaps in the literature. In doing so, I suggest they coalesce to enhance both streams of literature by streamlining efforts and tackling civic engagement and environmental degradation. ES background, definition(s), and theoretical frameworks are presented followed by CG's definition and, then, a weaving together of ES and CG.

Community geography (CG) was defined in Robinson's 2010 dissertation as using community and university partnerships to "affect positive community change, in a variety of ways, whether it is to visualize challenges and assets … or more accurately identify geographic disparities" (Robinson, 2010, p. 6). CG, in Robinson's case, relied heavily on Public Participatory Geographic Information Systems (PPGIS) wherein communities create geospatial databases to understand patterns across space and time, leveraging these newfound understandings to promote change from within a community. As such, CG adopts Participatory Action Research (PAR) and uses mixed methodologies, community mapping, and radical geography (Hawthorne, Atchison, & LangBruttig, 2014, p. 221). PAR has experienced an increase in popularity within geography as it promotes "student-centered learning" and produces "socially relevant research" (Pain, 2003, 2004; Pain & Kindon, 2007; Kindon et al., 2007; Brydon-Miller et al., 2004, Jason et al., 2004;

Reason & Bradbury 2006). Outputs are highly visual, shared resources: Geographic Information Systems (GIS) maps and databases, online tools (web mapping), sketch maps, audio/video, imagery, oral histories, or written reports (Robinson & Hawthorne, 2018).

While CG has a straightforward, recently emerged definition, the definition of ES can be vast and far-reaching (Table 2.1). As such, it encompasses other related terms (Cockburn et al., 2018; Bennett et al., 2018; Bramston, Pretty, & Zammit, 2011; Wolf, Blahna, Brinkley, & Romolini, 2013). Consequently, there is no clear or consistent definition of ES in the literature (Cockburn et al., 2018, p. 3; Bennett et al., 2018). In further exploring the concept of ES, it becomes apparent how indelibly linked it is to geography, especially the "man-land" tradition (Robinson 1976).

Environmental Stewardship

Background

Stewardship, as understood by Americans, is thought to have begun in western culture with the American author, philosopher, scientist, ecologist, conservationist, and environmentalist Aldo Leopold. Leopold's philosophical concept of a land ethic has been widely cited in the environmental stewardship literature. As described in the popular publication *A Sand County Almanac*, Leopold poetically describes a land ethic as a moral framework for interacting with the natural environment which is produced from positive experiences with it (Leopold, 1949). Further, an individual that develops a land ethic would understand and accept humans as part of the larger ecological community, and that human actions affect the landscape and all its inhabitants (Leopold, 1949). To have a land ethic, then, is to care for the land, or to be a steward of it.

Since the advent of "land ethic" in 1949, the concept of stewardship as the

emergence of an underlying ethic has been researched extensively in environmental philosophy (Fernandes & Guiomar, 2016, p. 602). Outcomes of this research have found this underlying ethic may stem from an altruistic concern for current or future generations (Robinson, Bennett, King, & Murray, 2012), especially now as climate change challenges society's ability to adapt. Lastly, this ethic may develop from an understanding of what constitutes a "right" relationship with others, including the natural world (Chan et al., 2016).

Environmental stewardship involves individual or collective action on behalf of the environment due to a moral concern (Cockburn, Cundill, Shacckleton, & Rouget, 2018; Raymond et al., 2013; Welchman, 2012; Worrell & Appleby, 2000). These actions are the "suite of approaches, activities, behaviors, and technologies that are applied to protect, restore or sustainably use the environment" (Bennett et al., 2018, p. 603). As such, stewardship actions are further characterized by the scale, issue, activity, location, motivation(s), and levels of complexity.

ES refers to diverse actions: conserving specific areas of environmental interest, (re)planting vegetation, conserving and/or setting limits on the harvesting of natural products, reducing pollution or environmental hazards, regenerating degraded or neglected areas, constructing community gardens, and using the power of the pocket to purchase more sustainable items (Bennett et al., 2018, p. 597). Because of such diversity in actions, there is not a widely accepted or shared definition of the term environmental stewardship (Wolf et al., 2013, p. 16). However, the only known, agreeable description of environmental stewardship is "activities [that] entail social interactions on behalf of the environment, and the complexity of its forms mirrors the human condition" (Wolf et al.,

2013, p. 17). Other scholars amend the meaning to appease their own research objectives, add a preceding term, or provide an alternative nomenclature entirely as presented in Table 2.1. As an example, Fisher, Campbell, and Svendsen (2012) define ES as "civic groups that conserve, manage, monitor, advocate for, and educate about a wide range of quality of life issues in urban areas" (Fisher et al., 2012, p. 28). In this case, ES is attached to quality of life (presumably for humans) in a built environment. As will be discussed below, other academics add a preceding term to environmental stewardship to further define it during their investigations of stewardship.

Table 2.1 Various Terms of Environmental Stewardship

Environmental Stewardship Term	Examples
Civic Environmental Stewardship	Fisher et al., 2012; Romoli et al., 2012; Sheppard et al., 2017; Wolf et al., 2013
Local Environmental Stewardship	Bennet et al., 2018; Tidball and Krasny, 2007
Urban Environmental Stewardship	Fisher et al., 2012; Krasny, Russ, Tidball, and Elmqvist, 2014; Silva and Krasny, 2016; Svendsen and Campbell, 2008
Civic Ecology Practices	Tidball and Krasny, 2007; Krasny, Kalbacker, Stedman, and Russ, 2015; Krasny and Tidball, 2012; Krasny and Tidball, 2009b
Community Stewardship Actions	Close, Fisher, Yagatich, amd Galli, 2016
Citizen Science	Jordan, Ballard, and Phillips, 2012; Johnson, Campbell, Svendsen, and Silva, 2018

Environmental stewardship: civic, local, and urban.

Some authors have opted to further modify the term environmental stewardship by adding a term to provide context: civic environmental stewardship, local environmental stewardship, and urban environmental stewardship. Civic environmental stewardship research has been conducted by many scholars (see Fisher et al., 2012;

Romoli, Brinkley, & Wolf, 2012; Sheppard, Ryan, & Blahna, 2017; Wolf et al., 2013). Wolf and colleagues (2013) make a specific case for civic environmental stewardship as it differs from generic environmental stewardship because the "volunteer activity of individuals on public property rather than agency actions or land care conducted on one's personal property" (Wolf et al., 2013, p. 18). Here, Wolf and colleagues make the distinction that civic environmental stewardship involves caring for common or public resources. To effectively summarize the difference, one more example is provided. Sheppard et al. (2017) evaluated ecological monitoring in civic environmental stewardship within a particular location. They adapted the definition of civic environmental stewardship from Romolini et al. (2012) as "physical activities on behalf of the environment, conducted by volunteers, on public or quasi-public lands" (Sheppard et al., 2017, p. 89).

Bennett and colleagues (2018) call for a systematic definition of environmental stewardship, as well as an integrated framework to assess the elements of stewardship (to be discussed in the Current Conversation section). However, they believe the proper term to be *local* environmental stewardship because stewardship is inherently a local phenomenon as people steward the "environment that they are proximal to, connected to and, in some contexts, that they depend on for subsistence needs and livelihood" (Bennett et al., 2018, p. 598). Accordingly, the definition of local environmental stewardship is 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 contexts" (Bennett et al., 2018, p. 599). It is noteworthy that the term local environmental stewardship has been

used in the definition of civic ecology practices (Tidball & Krasny, 2007); this will be discussed in Alternative Nomenclature below.

Urban environmental stewardship may have had its emergence in the literature in 2012 as Fisher and colleagues (2012) built upon concepts of civic stewardship and local environmentalism to understand how civic groups at various scales are working to steward their city. Urban environmental steward became entwined with civic ecology in the literature shortly after its debut. Krasny and colleagues (2014) use the concept of urban environmental stewardship and civic ecology interchangeably. Civic ecology emerged in the 1980s when scholars noticed residents were taking on extra civic duties to green spaces in urban environments that were not currently cared for by their municipality. Krasny and colleagues adopted the term urban environmental stewardship as equating to civic ecology. Shortly thereafter, Silva and Krasny (2016) used urban environmental stewardship and civic ecology synonymously (Silva & Krasny, 2016). The term civic ecology evolved, and other terms are used to describe ES.

Alternative Nomenclature

Researchers Krasny, Tidball, along with a few others, have delved into what they call civic ecology practices. Civic ecology practices are "local environmental stewardship actions taken to enhance the green infrastructure and community well-being of urban and other human-dominated systems" (Tidball & Krasny, 2007, p. 268). Through their research, they have found 10 emergent principles of civic ecology practices that unpack the concept of stewardship and relate it to several underlying phenomena for stewarding a place or resource (Krasny, Kalbacker, Stedman, & Russ, 2015; Krasny & Tidball, 2012; Krasny & Tidball, 2009b).

Community stewardship actions were studied by Close and colleagues (2016) in terms of organizations and their interactions. These community stewardship actions are often geographically dispersed and may contribute to environmental improvement through diffused or delayed pathways (Close et al., 2016, p. 1). Thus, examining their overlap and gaps is important to comprehensive stewardship. Citizen science shares a meaning with ES wherein citizens volunteer to collect data that typically involves monitoring the environmental health of a resource (Jordan, Ballard, & Phillips, 2012), such as tree health (Johnson, Campbell, Svendsen, & Silva, 2018).

In synthesizing and summarizing the various terms around environmental stewardship, a discontinuity yet overarching connectivity appears in the literature. For the purposes of this literature and argument of using CG as a model to improve ES (in various contexts), the general term environmental stewardship will be applied. Because geography is a diverse field, and community geography may involve travel abroad to engage (Hawthorne et al., 2014), I contend that environmental stewardship is simply a set of voluntary behaviors and actions (Close et al., 2016) oriented toward care for the Earth (Romolini, Brinkley, and Wolf, 2012; Welchman, 2012).

Environmental Stewardship as a Body of Research: A Brief Overview

Recent scholarly interest has grown around ES and its other various terms (Fisher et al., 2012, p. 26) as it has become a growing movement in the United States (Close et al., 2016, p. 1). Alongside this growing interest, specific research needs have emerged. Although most of the research focuses on understanding the motivations of stewardship (more to follow), the complex phenomenon of environmental stewardship beckons profound knowledge from multiple disciplines: sociology, environmental psychology,

environmental economics, biology, chemistry, and other natural sciences (to monitor ecological outcomes), as well as geography, to name a few. Research needs will be explored, followed by major themes in the current literature: motivation and theoretical frameworks. This section concludes by providing the "conversation" of the literature to create the argument for CG as a way forward.

Research Needs

Understanding impacts, context, and scale(s) of environmental stewardship

The full potential of environmental stewardship is not well understood (Wolf et al., 2013, p. 13). Therefore, a deeper comprehension of the relationship between the natural environment and human systems is necessary (Marzluff & Ewing, 2008; Wolf & Kruger, 2010). Indeed, the impact of environmental stewardship is not definitive and has not been well-examined. Minute amounts of knowledge exist regarding the "impact these practices have on urban biodiversity, ecosystem services provision, individual health and well-being, or community cohesion" (Silva & Krasny, 2016, p. 158). However, a few studies have been able to quantify impacts on a small scale (Krasny & Tidball, 2012, p. 272) and are mostly focused on social impacts (e.g., environmental stewardship is typically a social gathering and people have been motivated to steward for the socialization).

Scale is a recurring theme in need of attention in ES which makes this problem fundamentally geographic. As stewardship actions occur across scales, it is particularly critical to analyze these scales, as well as cross-scale interactions, and to determine if stewardship actions are occurring at the appropriate scale at which the desired social and ecological outcomes can be achieved (Bennett et al., 2018, p. 604). Further, researchers have expressed the necessity for understanding environmental stewardship activities at a

landscape scale (larger scale than local) (Cockburn et al., 2018; Svendsen and Campell 2008; Svendsen 2009). For clarification, 'landscape scale' is a term commonly applied to a broad spatial scale, usually a distinct range of ecosystem processes and land uses (Ahern & Cole, 2012).

Bennett and colleagues (2018) have suggested four approaches to employ for a comprehensive understanding of the impacts of ES programs. These approaches have been tested and represented in just a few studies: (a) both intended and unintended outcomes (Larrosa, Carrasco, & Milner-Gulland, 2016); (b) potential benefits beyond the ES activity closure (Courtney, Mills, Gaskell, & Chaplin, 2013); (c) the distribution of the cost and benefits of stewardship initiatives between groups (Pascual et al., 2014); and (d) impacts across temporal and spatial scales for current and future generations (Chan & Satterfield, 2013).

Understanding what makes stewards steward

Since the unique nature of ES relies heavily on voluntary actions, understanding the motivations for acting, without monetary compensation, on behalf of the environment and/or stewarding a common resource is crucial for ES organizations to retain volunteers and increase participation (Johnson et al., 2018; Krasny, Russ, Tidball, & Elmqvist, 2014, p. 17; Merenlender, Crall, Drill, Prysby, & Ballard, 2016; Wright, Underhill, Keene, & Knight, 2015). This understanding is of unequivocal importance, and although progress has been made in the literature, it can be highly context-based and therefore, somewhat difficult to theorize and generalize across all forms and functions of ES.

Understanding and evaluating outcomes of environmental stewardship

Much research has focused on the context or merely the incidence of stewardship.

As such, few patterns emerge in the literature about who stewards and why. However, the actual outcome or results of such ES efforts have not been fully examined (Bennett et al., 2018; Rist, Campbell, & Frost, 2013; Sheppard et al., 2017). Bennett and colleagues argue that comprehensive understandings of all feedbacks, both positive and negative, are crucial for evaluating, and then adapting ES approaches. Further, integrating lessons learned and incorporating such lessons into the programs and policies can improve stewardship efforts; organizations can now do so with supporting evidence, i.e., data. (Bennett et al., 2018, p. 605).

In terms of not only improving the ecological outcomes (e.g., habitat improvement), the importance of understanding and evaluating outcomes is "critical for demonstrating project impacts to stakeholders, whether they are funders, interested individuals, or regulatory agencies" (Sheppard et al., 2017, p. 87). Lastly, demonstrating impacts can legitimize the stewardship effort (Bennett et al., 2018, p. 605).

The deficiency of outcome understanding stems from a lack of monitoring because ES organizations are typically small, poorly-funded, and "often lack access to the research capacity, funding, or tools needed to evaluate scientifically the environmental effectiveness of the measures they undertake" (Close et al., 2016, p. 1). As such, the primary means to conduct such monitoring is through partnerships with researchers at universities (Silva & Krasny, 2016). Berkes (2009) suggested several approaches, such as co-production of knowledge, participatory research, and collaborative monitoring, that create or facilitate partnerships between practitioners and scientists. The importance of partnerships and co-production of knowledge is also a key tenet of community geography.

Although research objectives, data collection, and monitoring procedures would be agreed upon by both the researcher and the organization, Sheppard and colleagues (2017) have identified three overarching objectives as a framework for monitoring outcomes: a) identification of ecological goals and indicators to measure progress towards these goals, b) systematic implementation of coordinated monitoring protocols and monitoring sites throughout the area being stewarded, and c) coordination of monitoring and evaluation efforts among multiple programs (Sheppard et al., 2017, pp. 93-94).

Current Gaps in ES Studies

The two major gaps in the literature are a) empirical research on outcomes and b) application(s) of an integrated framework. Wolf and colleagues (2013) conducted a pilot study with an attempt to determine outcomes they call environmental stewardship footprints. To begin, they obtained practitioners' perceptions from representatives of ES organizations. Most practitioners explained their motivations and a desire to act. However, little time and resources have been applied to understand the impact of these actions, and, therefore, a major need is to "evaluate the effectiveness … for delivering environmental stewardship programs and meeting system-wide sustaining goals" (Wolf et al., 2013, p. 25).

In 2017, Sheppard and colleagues found a need for monitoring of ecological outcomes with empirical data as most monitoring activities were qualitative and centered around one parameter: the survival of vegetation (Sheppard et al., 2017, pp. 93-94). The need for empirical research on outcomes (Wolf et al., 2013) was echoed and partially answered by Bennett et al. (2018). They stated, "the lack of an integrated framework for

environmental stewardship limits our ability to systematically analyze case studies, build theory, and produce practical guidance" (Bennett et al., 2018, p. 598). In this same publication, Bennett et al. (2018) proposed a comprehensive framework to assess all elements of stewardship including outcomes and leverage points for change. Lastly, though the absence of outcomes has been clearly stated in the literature, it is also evident by the deficiency of studies obtainable about stewardship outcomes in terms of positive environmental impacts.

What is known: Motivations and demographics of stewards

Two major categories of motivators are thought to drive volunteerism: intrinsic and extrinsic (Cecere, Mancinelli, & Mazzanti, 2014; Moskell, Broussard, & Ferenz, 2010). Intrinsic motivations can be characterized as 1) stemming from underlying ethics, values, morals, and beliefs (Chan et al., 2016; Fernandes & Guiomar, 2016; Leopold, 1949; Robinson et al., 2012) and 2) a need for self-determination and/or self-actualization (Cetas & Yasue, 2017; Maslow, 1943). Whereas extrinsic motivators are grouped as 1) the perceived balance and direct costs and benefits of natural resource protection (Lopes & Videira, 2013) and 2) externally provided rewards: social, physical, economic, or legal (Bennett et al., 2018). Table 2.2 provides examples from the literature. Multiple studies reveal intrinsic motivations are more often the principal motivator behind stewardship, and these types of motivations are more durable and long-lasting than extrinsic (Bennett et al., 2018, p. 603).

Trends in the demographics of stewards have surfaced in the literature. It has been found, thus far, that most stewards are more liberal, highly educated, and more female than male (Fisher et al., 2012; Johnson et al., 2018). Race also influences stewardship as

Hispanics and Asians are least likely to volunteer (Foster-Bey, 2008). Because stewardship is a "fluid phenomenon," meaning people can gain (or lose) the ability to steward (Bennett et al., 2018), age and time availability are limiting factors of environmental stewardship (Wilson, 2012).

Table 2.2 Examples of Intrinsic and Extrinsic Motivations

Intrinsic Motivations	References
Value-based	Asah and Blahna, 2012; Bruyere and Rappe, 2007; Measham and Barnett, 2008; Stedman and Ingalls, 2014; Stedman, 2002; Johnson et al., 2018
Self-actualization and Socialization	Amsden, Stedman, and Kruger, 2013; Andersson, Barthel, and Ahrné, 2007; Gooch, 2003; Barthel, Folke, and Colding, 2010; Measham and Barnett, 2008; Tidball, Krasny, Svendsen, Campbell, and Helphand, 2010; Tidball, 2012 Campbell and Smith, 2005; Campbell and Smith, 2006; Petter et al., 2013; Bradford and Israel, 2004
Extrinsic Motivations	**References**
Desire to follow social rules	Basurto, Blanco, Nenadovic, and Vollan, 2016; Hauzer, Dearden, and Murray, 2013
Economic and legal	Sorice et al., 2013; Wunder, 2007 (economic); Gandiwa, Heitkonig, and Lokhorst, 2013 (legal).

Theoretical Framework

The most commonly referenced theoretical framework for understanding environmental stewardship is Social-Ecological Systems (Cockburn et al., 2018; Bennett et al., 2018; Krasny & Tidball, 2012). The SES framework identifies 10 subsystem variables that affect the likelihood of self-organization (Ostrom, 2009), common-pool resource management, and acts as a modern-day rebuttal to the Tragedy of the Commons (Hardin, 1968; Ostrom, Gardner, Walker, & Walker, 1994). Krasny *et al.* (2015) were critiqued for using SES as a theoretical background in their research on civic ecology practices because it was scarce in social theory. To compensate, they used Practice

Theory which views practices, or actions of stewards, as the core unit of analysis, and strikes a balance between individual agency, behavior, and social, and institutional structures that may affect practices (Hargreaves, 2011; Krasny et al., 2015, p. 12).

Facing a similar issue in the application of SES, Cockburn and colleagues have expanded on the SES theory to include the "agency of individual human actors, the complex social-relational dynamics among actors, and the situatedness of actors within the social-ecological context" (Cockburn et al., 2018, p. 1). Indeed, the human actors, relationships, and feedbacks among social-ecological systems, specifically the context of environmental stewardship, are included in a new analytical framework for understanding the various elements of environmental stewardship offered by Bennett and colleagues (2018).

Current Conversation: The way forward

Bennett et al. (2018) has been highly referenced throughout this paper because of the culmination of information regarding environmental stewardship and the framework provided for future studies. In this pivotal publication, Bennett and colleagues sum up the current conversation of this body of research and suggest four specific ways to move the research forward. Bennett et al. (2018) stated, "most studies tend to focus their analysis either on a subset of the different factors that can support or undermine stewardship … or simply on whether or not action is being taken to steward the environment" (Bennett et al., 2018, p. 598). To that end, future research needs to:

1. Descriptively evaluate the elements of stewardship in case studies in various contexts to enable comparisons across scales to develop a more generalizable comprehension of the phenomenon;

2. Help (from researchers) inform decision-making and the design of environmental stewardship programs or interventions to improve the likelihood of success;
3. Assess the effectiveness of local efforts or external interventions that aid stewardship with monitoring and leverage points; and
4. Further question to build theory and insights from specific aspects of stewardships and test the presented framework (Bennett et al., 2018, p. 608).

That said, geography, particularly community geography is surely capable of assessing scalar implications of ES and partnering with ES organizations to aid in decision-making through monitoring and assessments.

Geographic Concepts in Environmental Stewardship

To justify CG as an applicable model to study ES, three major themes of geography emerge: space, scale, and sense of place. Geography is the science of space and the art of place with core geographic concepts such as location, region, human-environment interactions, and patterns across space and time, to name a few. And, because small ES organizations rarely have the resources to conduct research (Close et al., 2016), CG is well-suited to step in. The importance of local cultures and environments has been investigated in Krasny and Tidball (2012). Krasny and Tidball (2009a) have also noted that ES is a part of a larger ecology process, interacting at multiple scales. The concept of scales appears repeatedly throughout ES as a means to understand it and its effectiveness (Cockburn et al., 2018; Bennett et al., 2018, Sheppard et al., 2017; Wolf et al., 2013). A sense of place has been examined as a primary driving factor behind ES motivation (Amsden, Stedman, & Kruger 2013; Andersson et al., 2007; Barthel et al., 2010; Gooch, 2003; Krasny & Tidball, 2012; Measham & Barnett, 2008; Stedman, 2002; Stedman &

Ingalls, 2014).

Environmental Stewardship Studies that are "Community Geography"

Recent studies are recognizable as community geography projects wherein researchers from institutions partner with non-profits or grassroots organizations to build capacity and affect community change. *Evaluating the environmental effectiveness of grassroots environmental stewardship organizations in Maryland, USA* by Close et al. (2016) provided an alternative means for evaluation for watershed organizations that lack the capacity but wanted to self-evaluate. The scholars reviewed archival documents and year-end reports of organizations to see if their metrics met their objectives. They also surveyed program participants to determine if the values of the organization aligned with those that were partaking in the activities (Close et al., 2016).

Johnson and colleagues (2018) partnered with a local tree planting program in *Why count trees? Volunteer motivations and experiences with tree monitoring in New York City* to understand demographics, motivations, experiences, and levels of civic engagement for a community organization. Wolf and colleagues (2013) took this a step further intending to create a long-term partnership with local ES organizations to evaluate how well bottom-up stewardship activities contribute to the achievement of top-down institutional policy and program objectives for resource conservation; results of their first two pilot studies were published in *Environmental stewardship footprint research: linking human agency and ecosystem health in the Puget Sound region.*

The above ES studies can be categorized as CG; all use co-creation of knowledge through university-community partnerships. The notion of co-creation of knowledge is a cornerstone of CG and has been sparsely applied in ES studies (Dietz et al., 2010; Silva

& Krasny, 2016, p. 163). The partnerships that create a place and space for co-creation of knowledge have been summoned in the literature but have been limited in activity (see Chapin et al., 2011; Krasny & Tidball, 2012).

Geographic Research Trends: Toward Community Geography

In 2018, *The Professional Geographer* published a focus section, *Out in the World: Geographer's Complex Relationship with Civic Engagemen*t highlighting geographers' conduction of research around civic engagement, community geography, and participatory action research. This focus section aimed to summarize the history and challenges of geographers' civic engagement work and to validate current and future research objectives in civic engagement, including stewardship efforts (Barcus & Trudeau, 2018).

What is more, they validated the often "uncredited" (for tenure consideration) community service work by encouraging geographers to collaborate across institutions as well as the wider community to create a "mutually beneficial exchange of knowledge and resources in a context of partnership and reciprocity" (Barcus & Trudeau, 2018, p. 272). Geographers, with a long tradition of field work, public engagement, and radical approaches (Bunge, 1971; Harvey, 1984) with a recent "participatory turn" (Fuller & Kitchin, 2004), are well-suited to handle what is being referred to as a crisis of civic engagement in higher education (Barcus & Trudeau, 2018, p. 271; The National Task Force on Civic Learning and Democracy, 2012).

In short, *Out in the World: Geographer's Complex Relationship with Civic Engagement* demonstrates the shift in geographic research trends towards more civically engaged research that includes community geography and co-creation of knowledge

through critical service-learning (Mitchell, 2008), critical civic geography (Block, Hague, Curran, & Rosing, 2018), assessing student feedback on community-engaged projects (Rose, 2018), and creating a model for implementing civic engagement in the classroom (Gribb, 2018).

Advantageous for the University, Community, and Students in Higher Education

Community-university partnerships are not without their challenges (see Block et al., 2018; Robinson 2010). However, it is the goal here to demonstrate their advantages because "there are clear benefits to social geographers doing P[A]R, using legitimacy gained from academic status and ability to engage in 'scientific discourse' to actively work against inequality" (Fuller, 1999, cited in Pain, 2004, p. 659).

Incorporating PAR helps bring universities back to their original intent: "to be a conscience and critic of society" (Kindon & Elwood, 2009, p. 28). As such, institutions that practice PAR may experience several benefits. First, university-community relationships are typically improved because PAR requires the research to think critically about the partnership and how they might "take away from communities in which they are involved without giving back what they have learned in any meaningful manner" (Kassam & Tettey, 2003, p. 156 cited in Kindon & Elwood, 2009).

Secondly, nontraditional community members that have been systemically marginalized are encouraged and invited to participate which can widen our knowledge base because "mainstream understandings of knowledge and research, presenting by funding and publication requirements, exclude non-traditional ways of knowing" (Niks, 2004, p. 173). Indeed, maps produced by geographers in partnerships have served as "representations of [the community's] truths (Boll-Bosse & Hankins, 2018, p. 324). And

finally, the research is published in more accessible manners, not just academic journals, expanding the end-use value of the knowledge co-produced (Kindon & Elwood, 2009, p. 23).

Students enrolled in PAR-based courses allow involvement in "problem-solving situations and inquiry-based learning initiatives that enhance their critical thinking and applied research skills" (Kindon & Elwood, 2009, p. 25). As PAR involves working with the community in real-world situations, students can generate 1) soft skills, 2) career decisions, and 3) awareness through civic engagement (Kindon & Elwood, 2009; Block et al., 2018). Regarding the latter two, students who participated in a PAR course stated that "this was the moment I decided to become an urban planner" and "I never really thought about gentrification or how certain neighborhoods struggled until I came to this class" (Block et al. 2018, p. 286).

Conclusion

Both ES and CG are of current scholarly interest and have similar objectives. However, ES scholarship calls for an understanding of the impacts, outcomes, and motivations of stewardship. Recently, an integrated analytical framework and a solid, cohesive definition of local environmental stewardship have been put forth to aid as a way forward (Bennett et al., 2018). Community geography is an appropriate model to fill the much-needed approach of partnerships and knowledge co-creation to appease the overarching question: what are the social and ecological impacts of environmental stewardship? We understand, in very basic terms, the motivations behind such stewardship actions, but the theory of how these actions playout over space and time (and on different scales) is lacking.

Community geography is a congruous model to improve efforts of environmental stewardship. The unification of the two research agendas satisfies both a need for partnerships in ES and aligns with current shifts in geographic research as it embraces being a more civically engaged discipline. This novel research agenda creates an advantageous milieu for the university, community, and students in higher education that benefit from civic engagement experiences.

III. TOWARD A "FIRST LAW OF ENVIRONMENTAL STEWARDSHIP": HOW ORGANIZATIONS BRING VOLUNTEERS TOGETHER IN SOCIAL AND GEOGRAPHIC SPACE(S)

Environmental stewardship (ES) is a set of behaviors and actions (Close et al., 2016) oriented toward care for the Earth (Romolini, Brinkley, and Wolf, 2012), on a voluntary basis (Welchman, 2012). In the present era of unprecedented global climate change, ES is a rapidly growing phenomenon (Close et al., 2016) that is typically practiced by volunteers through environmental organizations. While ES literature regularly engages with the occurrence or incidences of stewardship among different population subgroups, there have been few if any attempts to understand the role(s) that these enabling environmental organizations play in influencing who stewards and why.

This study contends that, as spaces or venues for ES, environmental organizations vary in type, scale, and purpose in ways that help stewards to self-sort into the opportunities that are best aligned with their individual motivations and availabilities. Put another way, it can be argued that—when environmental stewardship is practiced through an organization—individual or collective moral concerns intersect with organization-specific attributes (e.g., scale of operation, mission, context) in ways that result in somewhat distinctive volunteer pools (e.g., Bennett et al., 2018; Johnson et al., 2018). Whereas any person or group who volunteers with an environmental organization might share the label "steward," the general category "steward" is made up of idiosyncratic actors who may or may not share certain individual attributes (e.g., demographic or socioeconomic characteristics). Borrowing from Waldo Tobler's famous First Law of Geography—i.e., everything is related, but nearer things are more related than distant things (Tobler, 1970)—I posit that all stewards are presumably related [by a general moral concern], but volunteers at the same environmental organization are more related

[in specific motivations and personal attributes] than volunteers at different organizations.

This paper pilot-tests such a "First Law of Environmental Stewardship" hypothesis using descriptive and inferential statistics from surveys of two partner environmental organizations located in Central Texas that were chosen based on their compatible pro-environmental missions but disparate spatial scales of operation. The exploratory analyses aim to answer several questions: Is the scale of the organization's reach associated with ES motivations? What role does the mission of an organization play? In other words, is the organization's mission or area of concern (e.g., planting trees in a city's park or monitoring the monarch migration) associated with who volunteers? And, lastly, what difference(s), if any, exists in the volunteer motivations within two different environmental organizations (i.e., are motivations more similar within organizations relative to between organizations)?

Background

Types of environmental stewardship organizations

Within the social sector, community-based organizations (CBOs) and environmental nonprofit organizations (ENPOs) both tend to have missions that include "social objectives" (Quarter et al., 2017) that aim to promote the common good through investments into environmental sustainability, community economic development, and a host of other areas. In that sense, the two types of organizations frequently share common goals. They might even share common roots, as an ENPO can grow from a CBO and local chapters of larger ENPOs can function in practice like CBOs (e.g., Young, Neumann, and Nyden, 2018). For these reasons, the lines between the two types of entities often become blurred, particularly when looking at their missions and the issue

areas in which they are active.

Generally speaking, however, the two types of institutions can often be distinguished by a key geographic concept: their spatial *scale* of operation. ENPOs, such as the Sierra Club and the World Wildlife Fund, for example, are typically most active at national or global scales, seek to influence major legislation or transform entrenched values and behaviors in society, and influence the mainstream dialogues on how we experience nature (Arora-Jonsson and Ågren, 2019; Milstein, McGaurr, and Lester, 2020). CBOs, on the other hand, tend to have a distinctively local focus on a particular cause (or set of causes) in a particular *place*, and they seek to transform conditions on the ground in that place (Molden et al., 2017; Amsden, Stedman, and Kruger, 2013; Stedman, 2002).

Both ENPOs and CBOs fall within the "third sector" of the economy, meaning that they operate outside of purely public (i.e., government) and purely private (e.g., profit-motivated) organizational structures (Hidayat and Stoecker, 2018). CBOs can be informal and rooted in social networks; or, they can be formally incorporated nonprofit organizations. According to the National Community-Based Organization Network, the key distinction between a traditional nonprofit and a CBO is that the latter is "driven by community residents in all aspects of its existence." Specifically, in a CBO:

- "The majority of the governing body and staff consists of local residents;
- The main operating offices are in the community;
- Priority issue areas are identified and defined by residents;
- Solutions to address priority issues are developed with residents; and

- Program design, implementation, and evaluation components have residents intimately involved, in leadership positions" (National Community-Based Organization, 2011).

In geographic terms, a CBO is a *place-based* entity because CBOs typically offer social programs or solutions to their *local* communities (Salamon, 1987) that in turn improve community sustainability and well-being (Chaskin, 2003; Chin and Webster, 2005). Many CBOs focus their efforts on local environmental quality (Roman, Campbell, and Jordan, 2018). Indeed, grassroots environmental CBOs play a meaningful role in the U.S. environmental [justice] movement, and environmental CBOs have intensified in numbers since this time, e.g., the 1960s (Silveria, 2001)—and several have grown into large ENPOs. Consequently, environmental CBOs and larger ENPOs are now at the forefront of local and global sustainability movements (Hidayat and Stoecker, 2018).

ENPOs focus most readily on environmental quality issues such as water quality, pollution, soil erosion, deforestation, endangered species, and climate change; and they work to promote and preserve environmental quality through community mobilization, lobbying, advocacy, petitions, and attracting media attention through protests and civil disobedience (Hall and Taplin, 2010; Lyakhov and Gliedt, 2017). ENPOs may focus efforts on a small spatial extent, i.e., a neighborhood or a city. For example, the National Wildlife Federation has a Mayoral Monarch Pledge that encourages cities to become involved in their nation-wide mission of Monarch conservation. However, most ENPOs focus on "influencing governments to enact policies that will encourage broader improvements" (Lyakhoy and Gliedt, 2017: 1450). As such, ENPOs seemingly aim to create broader-scale societal changes in forms such as government policy and public

awareness to address environmental quality issues (Handy, 2001); whereas CBOs, with an emphasis on local residents' participation, strive to make changes at home, in their local natural and built environment (Hidayat and Stoecker, 2018).

Highlighting these scalar properties and differences between environmental CBOs and ENPOs is useful for thinking about different organizations' footprints of change. Beyond these differences, however, the two organizational structures have much in common. Of critical importance, in addition to regularly sharing goals and interests, environmental CBOs and ENPOs have at least two common needs and strategic imperatives: (1) to perpetuate their existence, they need to demonstrate their efficacy; and (2) to be effective, they typically need active volunteers or *environmental stewards*. Concerning the former, CBOs and ENPOs need to highlight how their efforts result in change. Without documenting their abilities to affect change, both types of organizations are unlikely to attract external funding—and, without external funding, nonprofits rarely succeed (Bennett et al., 2018; Sheppard et al., 2017). Concerning the latter objective, nonprofit institutions at all scales rarely have adequate funding to carry out the full range of their objectives with their internal capacities. Even large ENPOs like Sierra Club, which are very well funded (Nisbet, 2018), rely heavily on volunteers to staff and run programs and field activities. For community-scale organizations, volunteers are often the only source of labor (Jacobs, 2018; Kittinger et al., 2016; Silva and Krasny, 2016).

Similarities and differences in the two organization types arguably allow for an assessment of the extent to which volunteers are motivated to engage in ES for reasons that relate to protecting and defending a specific *place*, versus reasons that relate to a broader-scaled *cause* or *need*. This idea is depicted graphically in Figure 3.1.

Specifically, the framework in Figure 3.1 argues that, in the main, community-based organizations (CBOs) tend to organize around specific places or local assets. For

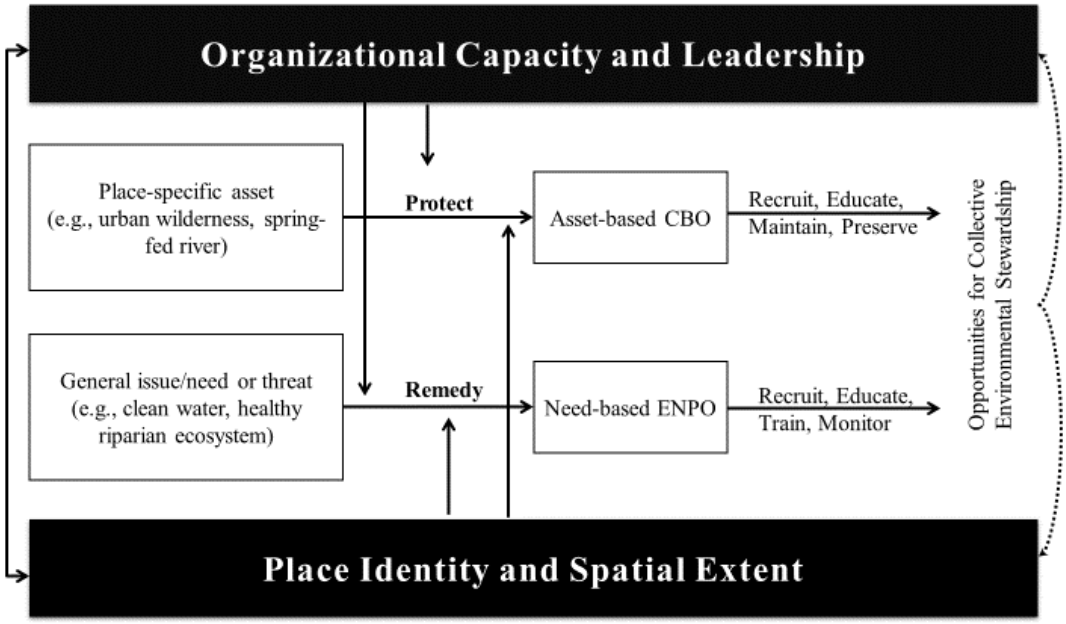

Figure 3.1. Differences in organization structure and the role of place and scale.

instance, the San Marcos River Foundation (https://sanmarcosriver.org/) was established to protect the spring flow that feeds the San Marcos River that runs through the city of San Marcos, Texas. The founders of the organization recognized that rapid population and economic growth might threaten San Marcos' unique natural amenities—including, among other assets, riverside parks and a large tract of urban wilderness that allowed groundwater recharge and subsequent spring flow—and it began working to *protect* these resources to ensure the San Marcos River never ceased flowing. In other words, unique environmental assets led to the creation of a CBO that, in turn, recruits and educates volunteers to maintain and preserve those assets.

On that backdrop, it is reasonable to suggest that *leadership* and *place-based*

identity (i.e., affection for unique local assets) influenced the formation of the San Marcos River Foundation. More formally (and broadly), the presence of unique environmental assets likely creates a potential for place-based identity/affection in individuals (Tuan, 1977; Uzzell et al., 2002; Garrah, Frei and Bennett, 2019). When that potential for place identity is activated in certain individuals or groups of individuals that possess organizational capacity and leadership qualities, there is a heightened potential for a CBO to form in order to *protect* those assets. Through the course of its work, the CBO then recruits community members who are also characterized by place-based identity. The ES opportunities afforded to those volunteers by the CBO have the potential to strengthen the degree of place identity in the volunteers who, in turn, might share their experiences with (and thus spread place identity to) other persons in their social networks (Garrah et al., 2019). As volunteer numbers increase, organizational capacity is built and reinforced. At the same time, word-of-mouth, social network-based volunteer recruitment, coupled with tangible localized outcomes, can reinforce a particular volunteer profile. In other words, stewards that are closely connected to one another in social or geographic space are likely to share characteristics that are distinguishable from stewards who volunteer with a different environmental organization.

The lower half of Figure 3.1 argues that these dynamics might play out differently for ENPOs, which tend to operate at broader *scales*. That is, whereas a CBO is locally focused—and often aimed to *protect* a particular *place* or place-based *asset*—an ENPO, like the Chesapeake Monitoring Cooperative (https://www.chesapeakemonitoringcoop.org/), often organizes around an *issue* or *need* that can apply at multiple scales. While the specific issue area or need might vary (e.g.,

clean water or clean air), any given issue or need is likely to be somewhat universalizing. For example, while the exact water resources, threats, and needs in Fresno, California are quite different from those in Flint, Michigan, both places are affected by water pollution and can benefit from educational resources and tools for monitoring pollution levels. In that sense, while place identity might motivate stewards to become involved with water quality monitoring in a particular location, it might play less of a forceful role in volunteering with an ENPO relative to a CBO. Under such circumstances, it is reasonable to expect stewards with a broad-focused ENPO to have motivations and characteristics that are different from stewards with a place-focused CBO (and vice versa).

Environmental Stewardship Research

Since ES refers to voluntary actions, understanding the motivations for acting—without monetary compensation—on behalf of the environment and/or stewarding a common resource is crucial for ES organizations' ability to retain volunteers and increase participation (Johnson et al., 2018; Krasny, Russ, Tidball, and Elmqvist, 2014b: 17; Merenlender et al., 2016; Wright et al., 2015). Although progress has been made in the literature on identifying general personal motivators for ES (e.g., Krasny et al., 2014a), motivations are highly context- and person-sensitive (Bennett et al., 2018), which suggests that the body of scholarship still has a long way to go to fully unpack the reasons that stewards steward.

To avoid reproducing a deep dive of the voluminous ES literature in this limited space, note that Bennett et al. (2018) recently performed a comprehensive review of ES research and identified four major research needs or gaps—observing that "most [ES] studies tend to focus their analysis either on a subset of the different factors

that can support or undermine stewardship … or simply on whether or not action is being taken to steward the environment" (Bennett et al., 2018: 598). Along those lines, the specific gaps that Bennett and colleagues identified, and the challenges they issued for ES researchers, include:

1. To descriptively evaluate the elements of stewardship in case studies in various contexts to enable comparisons across scales to develop a more generalizable comprehension of the phenomenon;
2. To inform decision-making and the design of environmental stewardship programs or interventions to improve likelihood of success;
3. To assess the effectiveness of local efforts or external interventions that aid stewardship with monitoring and leverage points; and
4. To build additional theory and insights from specific aspects of stewardships (Bennett et al., 2018, p. 608).

In responding to at least the first and fourth of these challenges, this research relies on case studies to build a foundation on which to understand who stewards and what motivates them. With respect to the latter, there are two major categories of motivators: intrinsic and extrinsic (Finkelstien, 2009). These two general concepts have been applied by numerous researchers to understanding volunteer motivations (Cecere, Mancinelli, and Mazzanti, 2014; Moskell, Broussard, and Ferenz, 2010). Intrinsic motivations can be characterized as stemming from underlying ethics, values, morals, and beliefs (Chan et al., 2016; Fernandes and Guiomar, 2016; Leopold, 1949; Robinson et al., 2012); and a need for self-determination and/or self-actualization (Cetas and Yasue, 2017; Maslow, 1943). By contrast, extrinsic motivators are subdivided

into 1) the perceived balance and direct costs and benefits of natural resource protection (Lopes and Videira, 2013; Gandiwa et al., 2013); and 2) externally provided social, physical, economic, or legal rewards (Bennett et al., 2018).

Multiple studies suggest that intrinsic motivations are predominant in ES (Bramston, Pretty, and Zammit, 2011), insofar as they might be more durable and long-lasting than extrinsic motivations (Bennett et al., 2018, p. 603). As such, previous studies that seek to understand volunteer motivations have found that helping the environment is typically the most frequently selected reason (an intrinsic motivator), and career advancement (an extrinsic motivator) to be the least frequent selection (Grese et al., 2001; Bruyere and Rappe, 2007; Alender, 2016).

Intrinsic and extrinsic motivators are built into key tools for understanding volunteerism, namely, the Functional Approach and the subsequent Volunteer Functions Inventory. The Functional Approach to understanding volunteering was created by Katz (1960) and later applied by Clary and Snyder (1999). Its purpose is to describe motivations that lead individuals to begin and continue volunteering and contains three underlying assumptions:

(a) it is a motivational perspective that directs inquiry into the personal and social processes that initiate, direct, and sustain action (Katz, 1960);

(b) people can and do perform the same actions because of different psychological functions (e.g., different people engage in the same volunteer activity but do so to fulfill different motives); and

(c) it suggests that important psychological events, such as embarking on a course of volunteer activities and then maintaining those activities over extended

periods of time**,** *depend on matching the motivational concerns* of individuals with situations that can satisfy those concerns (Clary and Snyder, 1999, emphasis added).

Table 3.1 The Volunteer Functions Inventory; (I) represents largely intrinsic motivations whereas (E) represents extrinsic motivations. Source: Clary and Snyder (1999).

Function	Conceptual Definition	Sample Survey Statement
Values (I)	Acts to express important values	I feel it is important to help the environment.
Understanding (I)	Desires to learn more about a subject and gain or use skills	I like to learn from others with more experience than me.
Enhancement (I)	Aims to improve psychologically through volunteering	I feel good when I volunteer.
Career (E)	Wants to network or gain career-related experience	I volunteer to advance in my career.
Social (I)	Participates to create and strengthen social relationships	I volunteer to meet people.
Protective (I)	Uses volunteer activities to reduce negative self-image or feelings	Volunteering makes me feel better about myself.

NB: I = intrinsic; E = extrinsic

In other words, people may volunteer for the same activity, but for different reasons. If they feel like the activity does not satisfy their motivation, then they will cease participation (Shirk et al., 2012; Bruyere and Rappe, 2007). Using the Functional Approach, Clary and Snyder (1999) developed the Volunteer Functions Inventory with six functions (Table 3.1).

Recalling the two major categories of motivations, intrinsic and extrinsic, all the functions in the inventory fall under the intrinsic motivator except for the career function, which is an extrinsic motivator (Table 3.1). This approach has been tested against other methods (Okun et al., 1998; Allison et al., 2002) and applied (as well as modified) in

several environmental volunteer/stewardship studies (Ryan 1997; Ryan et al., 2001; Martinez and McMullin, 2004; Yeung, 2004). As such, the Volunteer Functions Inventory is "the most widely used approach for studying and understanding motivations for volunteerism" (Bruyere and Rappe, 2007: 506). However, some studies (e.g., Ryan et al., 2001; Bruyere and Rappe, 2007), found two additional motivators that were not addressed by the inventory: "user" and "get outside". Further, Bruyere and Rappe (2007) found the protective and enhancement functions to be only "marginally represented" in their study. In fact, they "question where those previous results still hold true for today's environmental volunteers" (Bruyere and Rappe, 2007: 513).

Around the same time the Volunteer Function Inventory was created, Grese et al. (2001) assessed the psychological benefits of environmental volunteers. They used an exploratory sequential mixed method approach whereby they interviewed volunteers as well as several stewardship program leaders. The insights uncovered through the interviews allowed them to develop a survey instrument that was distributed to volunteers in different environmental organizations (Grese et al., 2001: 267). By conducting a factor analysis, four categories were formed: (1) helping the environment; (2) exploration (learning); (3) spirituality; and (4) personal and social (Grese et al., 2001). It is evident these four categories overlap with and can even fall into one or more of the six functions (Table 3.1). For example, Understanding can be equivalent to exploration, and helping the environment equates to Values. The emergent themes found by Grese et al. (2001) have been applied in subsequent motivational studies (e.g., Ryan et al., 2001; Alender, 2016; Johnson, 2018; Asah and Blahna, 2012) and are therefore adopted in this study.

In sum, there are existing tools and surveys in the ES scholarship that can be

brought to bear on the research questions posed at the outset of this paper. Past studies show "helping the environment" (Values) and "learning" (Understanding) as top reasons for ES motivation, and career motivations usually rank at or near the bottom for engaging in ES (Alender, 2016; Asah and Blahna, 2012; Brueyere and Rappe, 2007; Johnson et al., 2016; Ryan et al., 2001).

Methodology

This research was carried out using a community geography (CG) approach (see Lopez, 2020). Robinson (2010) defined CG as using community and university partnerships to "affect positive community change, in a variety of ways, whether it is to visualize challenges and assets … or more accurately identify geographic disparities" (Robinson, 2010: 6). To the extent that CBOs and ENPOs require external capacity to fulfill their missions and create socially beneficial change, CG is a mechanism for broadly trained geographers to play a change-making role, by applying Participatory Action Research (PAR) techniques in collaboration with CBO and ENPO community partners (see Kindon and Elwood, 2009; Pain and Kindon, 2007). As such, two community partners—one local scale CBO (San Marcos Greenbelt Alliance) and one broader-scale ENPO (Texas Stream Team)—served as collaborators in this study.

The CBO community partner is located in San Marcos, Texas, and aims to protect greenspace and natural areas within and around the city. Their organization of approximately 250 members is run exclusively by volunteers—there are zero paid staff members. The organization's primary stewardship program is the Trail Crew, a group of volunteers who maintain and build trails in over 1,200 total acres of natural area across the CBO's home city.

The ENPO community partner is headquartered in San Marcos, Texas, but operates throughout the state of Texas. They have many stewardship programs, but the focal program for this research was water quality monitoring (citizen science). The ENPO has trained over 10,000 volunteers to monitor surface water across the state of Texas, and approximately 400 of those volunteers monitor on a recurring, monthly basis.

Data and methods

Working with the two community partners, a survey was developed to understand the socio-demographics, motivations, and preferences of their volunteers (environmental stewards). The survey was approved by the Institutional Review Board of Texas State University on May 13, 2019 (project #6440) and was administered via the software Qualtrics over summer 2019. The 30-question, web-based survey was informed by the Volunteer Functions Inventory (Table 3.1). It consisted of five blocks with closed questions (Likert-scales) that dealt with the following topics:

- Volunteer Status: active or inactive, how long a volunteer.
- Volunteer Preferences: alone or with group, recognition, use of data, weather, rate of volunteerism.
- Motivations: learning, socializing, helping the community or environment, etc.
- Change in Environmental Outlook and Behavior: use of natural areas, environmental activism, and water consumption.
- About You: employment, gender, age, race/ethnicity, educational status, income, and political views.

Survey responses were analyzed in JMP Pro14 using a series of chi-squared tests of independence to identify relationships between categorical volunteering variables and

organization type (CBO or ENPO) (e.g., preferred volunteer group size and organization type) and a series of Mann-Whitney and Kruskal-Wallis tests to identify differences in numerical rankings/Likert scores across sociodemographic groups and organization type (CBO or ENPO). This overarching analytic strategy was used to pilot-test a broad, "First Law of Environmental Stewardship," hypothesis that CBO and ENPO volunteers will exhibit meaningful differences in their preferences, motivations, and characteristics. More specifically, the null hypotheses were tested:

H1: There are no differences in personal characteristics of CBO and ENPO volunteers;

H2: There are no differences in volunteer motivations between the CBO and ENPO; and

H3: There are no differences in volunteer preferences between the CBO and ENPO.

Results

Collectively across the two sites, the survey received 522 responses: 125 from the CBO and 397 from the ENPO. The overall response rate was approximately 12 percent. However, many responses were incomplete, which resulted in a total sample size of 377 records for which we received full responses. This section first describes the demographics of the CBO and the ENPO volunteers and uses descriptive statistical comparisons to engage with hypothesis H1 above. Next, the most frequently selected motivations are highlighted and the results from statistical tests carried out in relation to hypothesis H2 are presented. Finally, H3 is evaluated with tests relating to preferences for social setting, volunteer rates and recommendation, and the length of volunteer time.

Sociodemographics

The sociodemographics of the environmental stewards are largely similar when compared side-by-side (Table 3.2). Notably, though, the ENPO has significantly greater participation among females, people of color, and a wider distribution of ages than the CBO—consistent with the notion that the former operates at a broader, and therefore necessarily more heterogenous, geographic scale.

Table 3.2 Sociodemographics of Environmental Stewards

Stewards' Characteristics	Categories	CBO Survey Respondents (n = 122)	ENPO Survey Respondents (n = 255)
Gender	Male	54%	39%
	Female	44%	60%
	Other or Prefer not to say	1%	1%
Race/Ethnicity	White	92%	82%
	Hispanic	4%	5%
	Black or African American	--	2%
	Asian	--	1%
	American Indian or Alaska Native	--	>0.5%
	Two or more	2%	5%
	Other	2%	5%
Employment	Government or public	29%	23%
	Private	10%	15%
	NGO or nonprofit	8%	10%
	Self-employed	10%	8%
	Student	6%	13%
	Retired	38%	29%
Age	18-24	5%	13%
	25-34	8%	11%
	35-44	15%	16%
	45-54	14%	12%
	55-64	19%	26%
	65-74	31%	20%
	75-84	7%	4%
Educational Attainment	High school or less	1%	<1%
	Some college	14%	15%
	4-Year degree	29%	47%
	Doctorate/Professional	56%	37%

	Degree		
	Less than $10,000	7%	6%
	$10,000-$29,000	4%	9%
Household	$30,000-$49,000	10%	10%
Income	$50,000-$79,000	29%	22%
	$80,000 +	36%	34%
	Prefer not to say	16%	18%

Motivations

The top five motivations (of eleven possible choices; see Appendix 1 for the survey instrument) statements are shown in Table 3.3 for each partner organization, ordered by the percent of respondents that either strongly agreed or agreed with the statement. The top three motivations, all with agreement of at least 94 percent, are the same for both organizations: I want to help or enhance the environment; I want to help the community; and I want to get outside and connect with nature (Table 3.3). Drawing on the tools described in the previous section, the first two of these motivations are categorized as intrinsic, Value-based functions (see Table 3.1). The third motivation—I want to get outside and connect with nature—is also an intrinsic motivation; but it is associated with the Enhancement rather than the Value-based function (see again Table 3.1). The fourth-ranked choices differ for the two partners, in that ENPO stewards selected an additional Understanding motivation, whereas CBO stewards selected an additional Enhancement motivation (Table 3.3).

Table 3.3 Top Motivations by Organization

ENPO	% Agree/Strongly Agree	CBO	% Agree/Strongly Agree
I want to help or enhance the environment. *(I - Value)*	97%	I want to help or enhance the environment. *(I - Value)*	97%

I want to help the community. *(I - Value)*	96%	I want to help the community. *(I - Value)*	95%
I want to get outside and connect with nature. *(I - Enhancement)*	93%	I want to get outside and connect with nature. *(I – Enhancement)*	94%
I want to learn new skills or gain hands-on knowledge. *(I – Understanding)*	93%	I want to do something physically active. *(I – Enhancement)*	88%
I like learning from others with more experience. *(I - Understanding)*	82%	I like learning from others with more experience. *(I – Understanding)*	87%

Nine motivation statements were ranked differently by respondents at the two different partner sites. Table 3.4 presents chi-square test results that illustrate this statistical dependence between organization type and five of these personal motivations. For each of these five motivations, ENPO stewards ranked the statements higher (i.e., showed more agreement) relative to CBO stewards. Recall the ENPO is a need-based organization that focuses on broader scale issues and education to remedy such issues. The most significant differences were in the statements regarding meeting new people, learning from others with more experience, and sharing their own experiences, knowledge, or expertise with others (Table 3.4). Other differences were found in the desire to (1) learn new skills and (2) advance career.

Table 3.4 Motivations ENPO ranked higher than CBO and associated p-value

Motivation statement	% Agree/Strongly Agree, ENPO	% Agree/Strongly Agree, CBO	p	Function
I want to learn new skills or new knowledge.	93%	83%	<0.001	Understanding
I want to advance my career through gained experience or	47%	31%	0.013	Career

networking.				
I want to meet new people.	68%	39%	<0.001	Social
I like learning from others with more experience.[1]	81%	87%	<0.001	Understanding
I like sharing my experiences, knowledge, or expertise with others.	73%	71%	<0.001	Understanding

[1] For the ENPO, 52% strongly agree and 29% agree. For the CBO, 0% strongly agree and 87% agree.

Table 3.5 shows the remaining four significant differences in motivations between organizations. For these motivations, CBO stewards exhibited a greater propensity to agree with the statements relative to ENPO stewards. Recall that a CBO tends to be an asset-based organization that focuses on a place-specific resource and works to gather community support (recruitment, awareness, education) to protect this resource (Figure 1). With an extremely significant difference, CBO volunteers ranked "I want to engage with other people" much higher than ENPO volunteers. Other differences were found in the desire to (1) connect with nature; (2) do something physically active; and (3) have fun (Table 3.5).

Table 3.5 Motivations the CBO ranked higher than the ENPO and associated p-value

Motivation statement	% Agree/Strongly Agree, ENPO	% Agree/Strongly agree, CBO	p	Function
I want to engage with other people.	30%	83%	<0.001	Social
I want to get outside and connect with nature.	93%	94%	0.010	Enhancement
I want to do something physically active.	74%	88%	0.002	Enhancement
I want to have fun.	73%	84%	0.044	Enhancement

Motivation statements that exhibited no meaningful between-organization differences were "I want to help or enhance the environment" and "I want to help the

community." These null results indicate all stewards, regardless of organization, share these intrinsic, value-based motivators (Table 3.3). Yet, while all stewards are related in this way, stewards within each organization are more closely related than stewards between the two organizations.

Preferences

Table 3.6 shows the results from chi-square tests of independence between organization type (CBO or ENPO) and various volunteer preferences and expectations.

Table 3.6 Preferences by Organization

Preference	Most Common Response, ENPO	Most Common Response, CBO	p
Social Setting/Group Size*	With a partner (41%) and alone (33%)	Small group of 3 to 5 (53%)	<0.001
Maintain Volunteer Rate*	Likely (80%)	Likely (69%)	0.038
Decrease Volunteer Rate	Unlikely (61%)	Unlikely (61%)	0.422
Increase Volunteer Rate	Likely (59%)	Likely (68%)	0.418
Recommend Volunteering to Others*	Likely (89%)	Likely (88%)	0.042
Length of Volunteer Time *	1 to 3 years (39%)	5 years or more (36%)	0.042
Complete Outdoor Tasks in Unfavorable Weather	Likely (65%)	Likely (67%)	0.682

*p<0.05

Of these variables, preferred group size (social setting) was associated with the most meaningful between-group differences, with ENPO volunteers preferring to work with a partner or alone and CBO volunteers preferring to work in small groups. Other differences were stewards' intentions to (1) maintain their current volunteering rate; (2) recommend volunteering to others; and (3) their length of volunteer time (in years). Preferences that did not exhibit between-organization differences included: decrease volunteer rate, increase volunteer rate, and complete outdoor tasks in unfavorable

weather (Table 3.6).

Discussion

Sociodemographics

ENPO volunteers exhibited relatively more internal heterogeneity in sociodemographic characteristics compared to the relatively homogenous CBO volunteer pool (Table 3.2; for similar findings, see Greenleaf and Ries, 2020). This result is consistent with our expectation that, because the issue-based ENPO functions at a broader scale and larger spatial extent, it is more likely than a local-scale organization to reach more diverse stewards with broader interests (Figure 3.1). The CBO's relative lack of diversity is likewise consistent with the observation that it operates at a fine spatial resolution (the city of San Marcos), which, according to Tobler's First Law of Geography (Tobler, 1970), suggests that prospective volunteers from the same geographic community are likely to be more related than volunteers from across a larger spatial extent (e.g., the state of Texas).

In addition to being consistent with the expectations and conceptual underpinning from above (see especially Figure 3.1), the sociodemographic findings are highly compatible with a preponderance of the existing literature: namely, most stewards are more liberal than conservative, relatively highly educated and affluent, and disproportionately female (Fisher et al., 2012; Johnson et al., 2018; Domroese and Johnson, 2017; Crall et al., 2013). Importantly, research around the question(s) of diversity within organizations is lacking (Arora-Jonsson and Ågren, 2019).

Motivations

The survey results revealed that the top motivations for stewards in both

organizations were Value-based (Table 3.3): “I want to help or enhance the environment” and “I want to help the community” were the top two choices across the partner organizations. Differences emerged with the third-ranked motivation: “I want to get outside and connect with nature.” While, descriptively, both organizations ranked this item third (see Table 3.3), CBO stewards were slightly (and nonrandomly) more likely to agree, and less likely to disagree, with this statement. Notwithstanding this slight difference, however, the correspondence in “top three” motivations for stewards from both organizations supports the notion that all stewards are related. Yet, as follow-up chi-square tests revealed, stewards were more related within organizations than between organizations.

The ENPO

ENPOs typically function at broad scales and seek to educate the population at large (e.g., state, national, or global population) about one or more environmental issues. Further, through education, training, and monitoring, they aim to remedy those issues (Figure 3.1). In this study, ENPO volunteers were more likely than CBO stewards to want to learn new skills or gain new knowledge (Table 3.4). This finding is consistent with the assumption that ENPOs are issue/need-based and provide relatively general education and training that volunteers from various places can use to understand, monitor, and address environmental issues wherever they live or work. As such, the desire to learn and understand an environmental issue should be powerful for this group of stewards.

Career advancement through gained experience and networking is typically ranked near the bottom when presented as a motivation to steward (Asah and Blahna, 2012).

Consistent with this instructive finding from the literature, career advancement is not a top motivator for volunteers in either organization (Table 3.3). However, ENPO stewards did rank this motivation higher than CBO stewards (Table 3.4). Such a finding is also consistent with the expectations (Figure 1), and it allows the rejection of the null hypothesis that there are no differences in volunteer motivations between the CBO and ENPO (see H2).

Similarly, to the extent that ENPOs are often interested in changing policy or values at broad scales (see above), such organizations are likely more visible than CBOs in political processes, and therefore they may attract volunteers/stewards who are interested in affecting policy change. Affecting policy change typically requires exposure to power and powerful actors, which suggests that networking and experience ought to matter to ENPO volunteers. While the survey did not ask about networking with policy actors specifically, it did ask about networking in general. Namely, the extent to which respondents were motivated by a desire to meet new people was explored. In line with expectations, ENPO volunteers were more likely than CBO stewards to report being motivated by a desire to network with new people (Table 3.4). One possible implication of this finding is that ENPO volunteers see volunteering as a means to expand their professional networks in ways that generate new opportunities. One such opportunity is knowledge sharing. Not surprisingly, then, ENPO stewards were significantly more likely than CBO volunteers to agree with the statements "I like learning from others with more experience" and "I like sharing my experiences, knowledge, or expertise." These between-group differences offer further circumstantial evidence that ENPO stewards value the professional, career, and networking opportunities that arise from ES. Crucially,

though, this finding is not equivalent to saying that CBO stewards do not value networking. Rather, it might be the case that CBO stewards are less interested in establishing *new* network connections and more interested in creating denser connections within their *existing*/bounded networks or communities. The next section attempts to shed some light on this matter as it presents the results for CBO volunteers.

The CBO

A CBO is a *place-based* entity because CBOs typically offer social programs or solutions to their *local* communities (Salamon, 1987). Additionally, they are typically asset-based entities, since they focus on protecting unique community assets (Figure 3.1). The results support these assumptions, as detailed below.

In the first place, to return to the final finding from the preceding section, I propose that the differences observed in responses to the statement "I want to engage with *other* people" ($p<0.001$, Table 3.5; emphasis added) might be due, at least in part, to the term 'other.' Explicitly, it might be the case that CBO volunteers prefer dense, tightly bounded social networks to expansive networks characterized by weak social ties. That is, they want to engage with 'other' people in their networks, but they do not have a strong preference to meet 'new' people (Tables 3.4-5). Unfortunately, the survey was not designed to test this hypothesis directly—consequently, I encourage future research that can help resolve this matter.

Apart from social network preferences, results show that CBO stewards were more likely to want to "get outside and connect with nature" ($p=0.01$) than ENPO volunteers; and more likely to "want to do something physically active" ($p=0.002$, Table 3.5). Unlike the ENPOs, who were interested in knowledge-sharing, the CBO stewards appeared to be

more focused on actions and real experiences that help them bond with their community, e.g., they desire to engage with people and their physical environment (get outside and connect with nature). In addition, they simply "want to have fun" (p=0.04, Table 3.5) at a higher rate than ENPO volunteers. Again, this finding speaks to the notion of *community* in a community-based organization. The CBO stewards find enjoyment in physically being in their "assets," i.e., natural areas, and doing an activity (enhancing the environment and helping the community) with members of the community, together. Indeed, their sense of place or place identity may have been a driver for *action* (Gooch, 2003).

Figure 3.2 summarizes the key similarities and [statistically significant] differences between ENPO and CBO volunteers with the help of the Volunteer Functions Inventory (Table 3.1). In brief, stewards from both organizations are driven by their values to help the environment and the community. Secondary motivations were based on Enhancement for the CBO and Understanding for the ENPO (Green circle, Figure 3.2). For the ENPO (i.e., need- or issue-based organization; Fig. 1), the three functions that seemed to play the largest roles in volunteer motivations were (1) Understanding, (2) Career, and (3) Social. For the CBO (i.e., asset-based organization; Fig. 1), the two predominant functions were Social and Enhancement. Notably, while volunteers from both organizations stressed the importance of Social functions, I argue that Social functions operate differently in the two organizations, such that CBO volunteers prefer to strengthen existing social ties while ENPO volunteers prefer to make new social connections (Table 3.6).

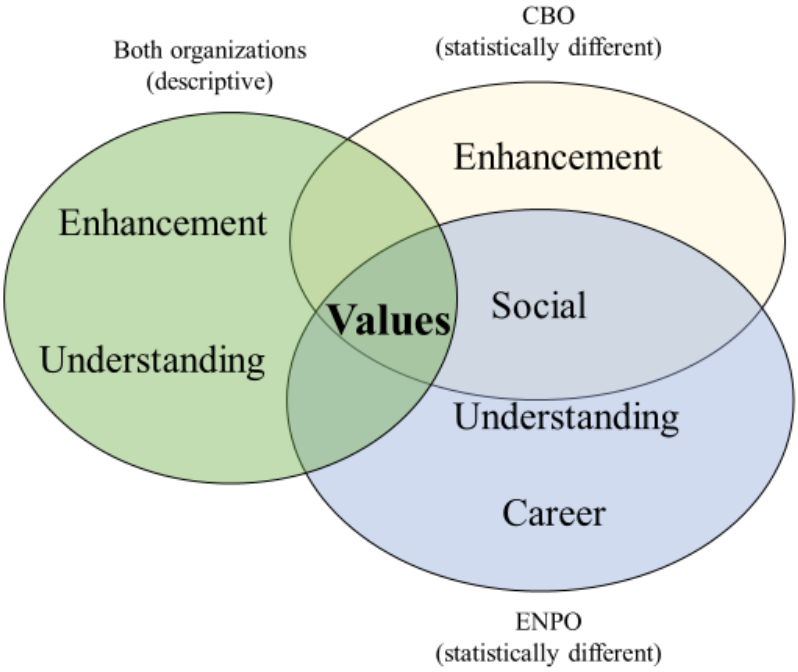

Figure 3.2. The Volunteer Functions Inventory as applied to the ENPO and the CBO.

Once again, then, all stewards appear to be related in their overarching, Value-based motivations of helping the environment and the community. However, ENPO stewards are more motivated by networking, knowledge, and societal change, whereas CBO stewards are more motivated by place, community, action, and comradery.

Preferences

Similar to the differences in motivations, the null hypothesis that there are no differences between the two organizations regarding volunteers' preferences was largely rejected. Namely, five of the eight areas of inquiry produced significant differences (Table 3.6). First, stewards at the CBO preferred to work with others in small group settings (3-5 people was considered small and 5-10 people was considered medium), whereas ENPO volunteers preferred to work alone or with a partner (Table 3.6). Indeed, recall from the previous discussion that CBOs are motivated by wanting to "*engage with*

other people" (Table 3.5) and ENPO volunteers wanted to "*meet new people"* (Table 3.4). This finding is consistent with the observation that CBOs are placed-based, and likely have more communal properties than broad-scale ENPOs.

Next, ENPO volunteers were more likely than CBO volunteers to maintain their current rates of volunteerism (p=0.04, Table 3.6) and recommend volunteering to others (p=0.02, Table 6). Again, because ENPOs attempt to ameliorate universal environmental issues (e.g., water quality, species decline, pollution), they may demonstrate more steady rates of volunteerism that draw on deeper (wider) volunteer pools. Relatedly, because CBOs operate at finer scales, it might be harder for CBOs (as opposed to broader ENPOs) to attract large, reliable amounts of funding. Lack of consistent funding for programs can lead to disorganization and loss of volunteers (Penner 2002). At the same time, CBOs will be more sensitive to fluctuations in community composition that change the demographics and motivations of those interested in participating (Wilson, 2012). Finally, because CBOs often like to work in group settings of relatively homogenous participants (Greenleaf, and Ries, 2020), stewards may not recommend volunteering to the general population in a desire to maintain exclusivity.

The length of time stewards volunteered also differed by organization: CBO volunteers had both more recent (less than 1 year) and experienced (5 years or more) volunteers, whereas ENPO stewards were more likely to report an intermediate volunteer term (1 to 3 years). In other words, the CBO may attract community-committed stewards who are "volunteers for life", as well as short-term stewards who "test the waters." The ENPO volunteers' intermediate service is arguably consistent with the idea that volunteering plays a key role in networking that has value beyond the short term, but

becomes less essential in the long term (i.e., once the volunteer gains the knowledge and experience necessary to move on). Shirk et al. (2012) posit that volunteerism is able to perpetuate if the steward is receiving an experience that matches their motivational concern. For the ENPO, perhaps a 1-3-year volunteer term is how long it takes to feel fully informed about the issue. If they no longer feel they are learning new information, they leave the ENPO and move on to gain new knowledge and new experiences elsewhere.

Limitations and Future Research

This pilot study was conducted using data from a community geography partnership. As such, the survey instruments were not necessarily designed to capture scale- and place-based differences in the organization type; rather, the surveys were designed to provide the community partners with both general and detailed information about their respective organizations. Further, a major limitation was the small sample size of one organization for each typology. The types of activities differ, for example, caring for green spaces and monitoring water quality, so biases may exist in the sample.

The demographics of the respondents may also have influenced motivations. The percentage of retirees was qualitatively higher for the CBO (38%) than the ENPO (29%) (Table 3.2). Geary and Ravenscroft (2019) found that retirees used volunteering to build their social networks, do meaningful work that helped the community, and engage in physical activity. These findings correspond to the results and should be further investigated in future research.

Future studies could include more precise statements regarding motivations. For example, instead of the statement "I want to help the community," the wording could be

altered to say: “I want to help my community or those who live nearby.” Future surveys could also focus more on the parameters discussed to distinguish the difference in organization type (Figure 1) instead of the Volunteer Functions Inventory that was used here as a reliable way to initially unpack the differences in motivations based on the functions. In addition, future research should employ (1) using more than one sample of each type of organization and (2) mixed-methods to include interviews from stewards at different organizations using the Layers of Place Meaning Framework (Williams, 2014) to better understand the role of place (identity) and stewardship.

Conclusion

Taken together, the patterns of results discussed in the preceding subsections allow the rejection of the null hypotheses that volunteers with the CBO and ENPO partners were characterized by the same (1) sociodemographic characteristics, (2) motivations, and (3) preferences. Rather, this paper identified meaningful between-organization differences in volunteer environmental stewards that collectively support the overarching alternative hypothesis—namely, that *all stewards are related* (by their desire to enhance the environment and help their communities), *but stewards in the same organization are more related than stewards in different organizations*. In this study, a “First Law of Environmental Stewardship” was animated by CBO volunteers who seem to be more motivated than their ENPO counterparts by place, community, action, and comradery; and ENPO volunteers who were more motivated by networking, knowledge, and power. Volunteers from both organizations, however, shared basic desires to improve the environment and their communities. In addition to elucidating the core alternative hypothesis, the findings also exposed some of the nuances of environmental volunteerism

by highlighting connections between personal motivations, geographic scale, and organization type.

IV. ASSESSING IMPACTS: PARTICIPATION IN STEWARDSHIP PROGRAMS CULTIVATES PRO-ENVIRONMENT BEHAVIOR

Introduction

Environmental stewardship (ES) involves voluntary individual or collective *actions* on behalf of the environment, largely due to a moral concern, that result in positive environmental impacts (Krasny 2020; Cockburn, Cundill, Shacckleton, & Rouget, 2018; Raymond et al., 2013; Welchman, 2012; Worrell & Appleby, 2000). ES actions are the "suite of approaches, activities, behaviors, and technologies that are applied to protect, restore, or sustainably use the environment" (Bennett et al., 2018, p. 603). ES actions are further characterized by the scale, issue, activity, location, motivation(s), and levels of complexity (Bennett et al., 2018).

Scholarship on ES has been on the rise in recent years, stemming at least in part from a growing interest in ES in the population (Falkner & Buzan, 2019), particularly in the United States (Close et al., 2016). Nevertheless, despite the popularity of the topic, empirical research on outcomes/impacts of ES programs is lacking, and there is often a disconnect among researchers who study this interdisciplinary phenomenon from individual disciplinary perspectives and traditions (Bennet et al., 2018; Enqvist et al., 2018; Van Putten et al., 2014). In other words, there is a need for more unified empirical scholarship on ES.

Toward those ends, this paper draws on an integrative framework proposed by Bennett and colleagues (2018) to assess the outcomes and impacts of ES programs at two partner nonprofit organizations. Three research questions guide the study: (1) To what extent do stewards (a) use skills and insights gained from ES participation in their daily lives and (b) share experiences with others in their social networks?; (2) What additional

skills or insights do environmental stewards say they gained from participation with the organization?; and (3) What, if any, differences exist in skill acquisition and knowledge sharing at organizations that operate at different spatial scales?

Addressing these questions with empirical data obtained from participants in partner environmental organizations will deepen our understanding of the environmental behavior changes and "spillover effects"—i.e., "an effect of an intervention on subsequent behaviors not targeted by the intervention" (Truelove et al., 2014, p.128)—that are linked to ES opportunities. Further, by working with partner organizations that operate at different spatial resolutions, this article will contribute to emerging scholarship on how organizational type and geographic extent/scale reach may affect changes in environmental behaviors (Johnson et al., 2019; Jasny et al., 2019).

Background

Relevant Literature

Scholarly research on ES has been on the rise in recent decades, as the phenomenon has gained momentum in the United States and other nations in the global North (Bruyere & Rappe, 2007; Close et al., 2016). Much of this work is aimed at understanding the *motivations* of persons engaged in ES, i.e., stewards (Bennett et al., 2018; Asah & Blahna, 2012; Van Riper et al., 2018). Because ES relies heavily on volunteerism, understanding what motivates people to steward is crucial for both (1) spreading pro-environmental norms and behaviors to other members of society (Udall et al., 2019) and (2) helping venues of ES opportunities—namely, environmental nonprofit organizations—enhance their capacities to recruit and retain stewards (Johnson et al., 2018; Krasny, Russ, Tidball, & Elmqvist, 2014, p. 17; Merenlender, Crall, Drill, Prysby, & Ballard, 2016; Wright, Underhill, Keene, & Knight, 2015; Crall et al., 2013).

That being said, spreading pro-environmental norms, increasing environmental behaviors, and building the capacities of stewardship programs and their parent organizations require more than knowledge on what *motivates* stewards. Namely, accomplishing these goals also requires evidence on the *impacts* of ES and the *efficacy* of ES programs—topics to which the literature has paid relatively less attention (Bennett et al., 2018). Put another way, the full potential of ES in terms of its broader societal impact is poorly understood (Wolf et al., 2013, p. 13, for a city-wide study, see Hidayat & Stoecker, 2018 and "Bee Cities" in Marshman et al., 2019), insofar as the outcomes and results of ES programs are rarely the subjects of academic or applied research available for public consumption (Lopez, 2020). Sheppard and colleagues, for instance, observed that if any outcome-oriented ES activities are occurring, they are largely qualitative and usually highly program-specific (Sheppard et al., 2017, pp. 93-94). As such, to push the ES literature toward a richer understanding of the relationships between social systems and the natural environment (Marzluff & Ewing, 2008; Wolf & Kruger, 2010), ES scholars must focus more attention on the collective "impact these [ES] practices have on urban biodiversity, ecosystem services provision, individual health and well-being, or community cohesion" (Silva & Krasny, 2016, p. 158).

Clearly, one consideration that is critical to the study of ES impacts is *scale*. Scholars suggest that special attention needs to be given to the scale of stewardship actions relative to the scale at which the desired outcomes can be achieved (Bennett et al., 2018, p. 604; Lopez, 2020). Wyborn and Bixler (2013) assessed various stewardship organizations in the large spatial extent of the Rocky Mountains and found that cross-scale interactions (see Peters, Bestelmeyer, & Turner, 2007) within three parameters of

scale (scale framing, scale dependency, and scale-dependent collaborative advantage) greatly impacted the effectiveness of the organizations' respective missions and desired outcomes. Bennett and colleagues (2018) argued that comprehensive understandings of all feedbacks at various scales, both positive and negative, are crucial for evaluating, and then adapting, ES approaches. Incorporating lessons learned at a variety of [interacting] scales into programs and policies can add significant value to steward programs and improve their efficacy (Bennett et al., 2018, p. 605). What is more, from an organizational/practical perspective, the significance of evaluating outcomes and applying adaptive management is "critical for demonstrating project impacts to stakeholders, whether they are funders, interested individuals, or regulatory agencies" (Sheppard et al., 2017, p. 87).

A barrier to any method of evaluation for environmental nonprofit organizations is that such organizations tend to be small, poorly-funded and "often lack access to the research capacity, funding, or tools needed to evaluate scientifically the environmental effectiveness of the measures they undertake" (Close et al., 2016, p. 1). As such, a promising and mutually beneficial line of ES research involves forming partnerships or collaborations between environmental nonprofit organizations and researchers at universities (Silva & Krasny, 2016). In the discipline of geography, these mutually beneficial research collaborations are increasingly referred to as *community geography* (see Chapter II; Robinson, 2010). Community geography involves undertaking research wherein objectives, data collection, and monitoring procedures are informed by community partners, such as environmental nonprofit organizations, based on their short- and long-term needs. Such collaborations have appeared in recent ES research (Martin,

2019; Close et al., 2016; Johnson et al., 2018). Community geography facilitates mutually beneficial research interventions that attend to partner capacity and programmatic needs while opening opportunities to advance ES scholarship via empirical case studies (Chapter II).

Along those lines, integrating the practice of community geography into ES scholarship offers an opportunity for putting a sharper focus on the outcomes and impacts of ES programs. This paper sets out to realize that opportunity. Before unpacking the approach in greater detail, however, recall that in addition to the need for research on ES outcomes, there is also a documented need to study ES from a more holistic and interdisciplinary perspective (Bennet et al., 2018). Toward that end, the next section briefly relates the conceptual framework that structures the research, which is drawn from a recent attempt to explicate the complex and interdisciplinary nature of environmental stewardship.

Conceptual Framework

According to Bennett and colleagues, "the lack of an integrated framework for environmental stewardship limits our ability to systematically analyze case studies, build theory, and produce practical guidance" (Bennett et al., 2018, p. 598). For that reason, Bennett et al. (2018) proposed a comprehensive analytical framework meant to synthesize the various elements of stewardship (Figure 1), including outcomes and leverage points for change. Bennett and colleagues (2018) challenged future researchers to engage with their integrative framework in studies that evaluate: (a) outcomes that are both intended and unintended (Larrosa, Carrasco, & Milner-Gulland, 2016); and (b) any benefits that may exist after the ES activity/program, meaning any "spillover effects" or

changes in environmental outlooks and behavior due to participation (Courtney, Mills, Gaskell, & Chaplin, 2013; Hargreaves, 2011; an example of another framework application in Plummer et al., 2020).

Taking up this challenge, we note that researchers have long suggested that environmental volunteerism may be associated with changes in environmental outlooks and behaviors that can *strengthen* the connection between people and their environment (Ryan, Kaplan, & Grese, 2001; Jordan, 1989; Ross, 1994). More specifically, working with and in natural areas may create an attachment to place and/or place meanings that manifest as pro-environmental behaviors (Ryan, 1997; Stedman, 2002; Stedman & Ingalls, 2014; Chow et al., 2019; Kudryavtsev, Krasny, & Stedman, 2012). Environmental behaviors are generally defined as any behaviors that promote sustainable use of natural resources, benefit the physical environment, and/or improve the quality of the natural environment (Larson et al., 2018).

Environmental behaviors come in many forms. Particular behaviors relevant to this study fall into three broad categories: lifestyle, citizenship, and social-environmental (Krasny, 2020). Lifestyle behaviors include daily behavior and consumer choices that reduce environmental degradation or enhance our relationship with the environment (Dietz et al., 2009). Citizenship behaviors involve attempting to influence policies and policymakers that prioritize environmental issues. Lastly, social-environmental behaviors consist of discussing and educating others in social network (friends and family) about environmental issues (Larson et al., 2015; Krasny, 2020).

Ryan et al. (2001) found that the skills learned and obtained from volunteerism led to the creation of native landscapes, general appreciation of natural areas, and

environmental activism (environmental behaviors). The implication is that stewardship activities can create a positive feedback loop, whereby the amount of "appreciation of and advocacy for local natural areas" (Ryan et al., 2001, p. 641) is increased due to participation in ES. More specifically, when volunteers participate in environmental programs, they are acting on opportunities for environmental behaviors. Performing those environmental behaviors, in turn, influences a steward's identity in ways that makes subsequent environmental behaviors more likely (Krasny, 2020, p. 64).

In addition to feedback effects, participation in ES programs also produces spillover behaviors that manifest when stewards apply ideas, skills, or insights gained from ES in different contexts—i.e., outside of the ES arena in which the knowledge was acquired (Nilssion et al., 2017). At times, spillover behaviors act as "cues" that enable stewards to perceive themselves as "environmentally conscious", which increases the probability they will perform environmental behaviors in the future (Cornelissen et al., 2008). Spillover behaviors also serve as a "foot-in-the-door", which allows stewards to replicate and expand environmental behaviors that facilitate their budding environmental identity (Nilsson, Bergquist, & Schultz, 2017; Krasny, 2020).

Thus, it is reasonable to assume that those who become involved as environmental stewards typically expand their participation in environmental programs, which reinforces their commitment to solving or mitigating environmental issues. The education and experience(s) obtained from stewardship programs might therefore be considered *transformative learning*, insofar as it can result in behavioral modification (Pisters et al., 2020; Leal et al., 2018; Mehmood et al., 2019).

To put these expectations in the context of the Bennett et al. framework (Figure

4.1), we contend that feedback relationships exist between actors, actions, and outcomes in ES programs hosted by environmental nonprofits. In that sense, *actors* can be viewed at the collective level, where individual actors self-select into, and then act as part of institutions.

The *actions* of actors are thus at least partially determined and/or constrained by the stewardship programs in which actors participate, which, in turn, are established by environmental nonprofits. Circling back to a key point from earlier, the *impacts* or *outcomes* from these program-specific actions, if any, will occur at different *scales* based on the extents or footprints of the environmental nonprofits and their stewardship programs (Wyborn and Bixler, 2013; Bennett et al., 2018).

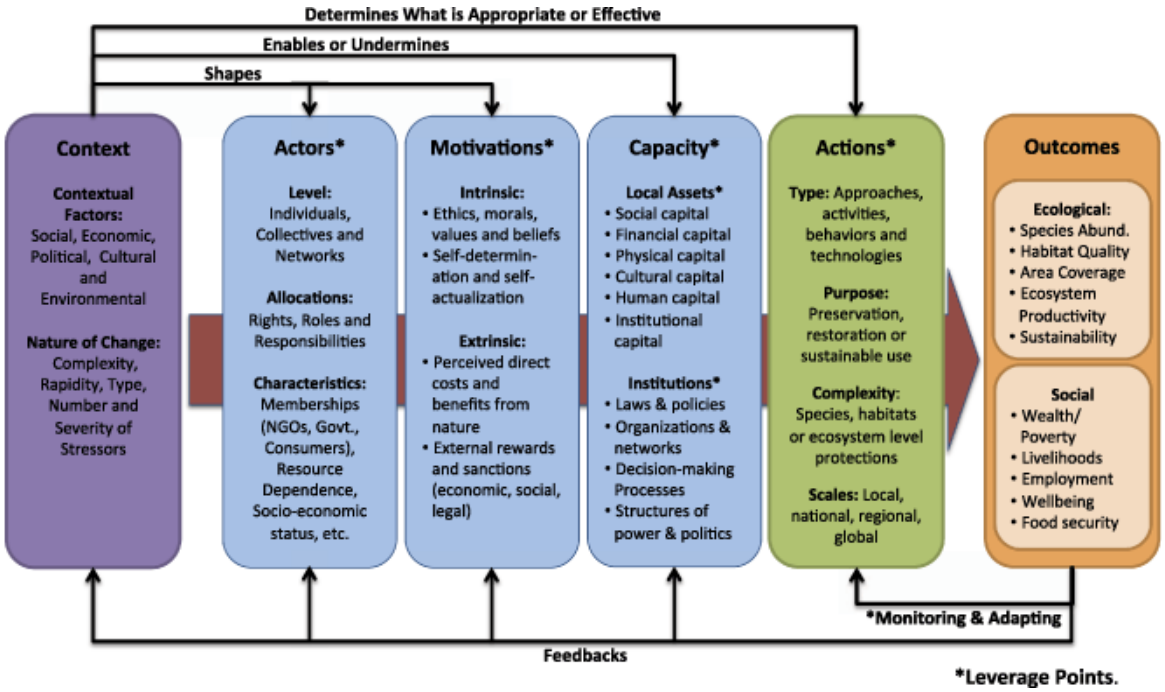

Figure 4.1. Bennett framework. (Source: Bennett et al. 2018, p. 605)

Putting all of these pieces together, I use the framework to advance ES scholarship by partnering with two environmental organizations (i.e., conveners of *actors*) to study how voluntary participation in ES programs at those nonprofits (i.e.,

program-sponsored *actions*) results in socially beneficial *outcomes*. To the extent that partnerships can be forged at multiple *scales* of analysis in order to study how (or if) outcomes vary by institutional reach and mission, these engaged projects can begin to fill in critical blanks in the current landscape of ES research (e.g., Bennett et al., 2018). The project described herein attends these objectives by partnering with two environmental nonprofits with stewardship programs—one that operates at the scale of the state of Texas, and one that operates at the scale of a small city (San Marcos, Texas)—to examine selected outcomes and differences in those outcomes by organization type.

Methodology

Guided by the principles and values of community geography (e.g., Robinson, 2010; Hawthorne et al., 2015), I invited two environmental nonprofits to participate in new research collaborations. After discussing shared interests and research possibilities, both organizations accepted the invitations and began generating lists of potential research questions that they would be interested in exploring.

CP1, Texas Stream Team, focuses on water quality awareness and water quality monitoring throughout the state of Texas. The organization was established in 1991 and has trained over 10,000 stewards to monitor water quality since that time. Currently, CP1 has five full-time staff members and three part-time student workers (paid). CP1 is dedicated to protecting over 30,700 kilometers of Texas waterways. The organization brings together community members, students, and educators to promote ES. To provide an example of their breadth, CP1 held 3,062 educational events and an average of 405 stewards monitored each month, spending 5,964 hours sampling 241 sites over two years (2016-2018).

CP2, San Marcos Greenbelt Alliance, is operated by approximately 20 part-time volunteers (unpaid) and was established in 1998 as a non-profit to serve the City of San Marcos, Texas. CP2's mission is to connect greenspaces and trails to improve access to natural space—and, by extension, enhance quality of life—for local residents. CP2 works primarily in three arenas: 1) *conservation*, to protect and conserve greenspace by working with stakeholders; 2) *stewardship*, to maintain the health of greenspaces through community participation; and 3) *outreach/education*, to promote awareness and understanding of the value of protecting and connecting greenspaces. Volunteers operate the organization in several capacities. For instance, the trail crew conducts most of the stewardship work, while the outreach and fundraising committees work behind the scenes, all to maintain and enhance more than 35 kilometers of trails in natural areas across the city.

While CP2 aims to connect people to places with alternative routes, watershed management is an added benefit of preserving natural areas. Natural areas can provide essential ecological services critical to urban ecological functioning and sustainability (Wolch, 2014; Irvine et al., 2009). For example, natural areas improve watershed health (Avril & Barten, 2007): the pervious cover from an absence of a heavily built-up environment allows for more water infiltration, reducing pollution from excessive runoff. Moreover, natural areas enable water retention and "natural" treatment systems to manage stormwater; trees canopies and root systems reduce stormwater flows and nutrient loads (i.e., fertilizer in the form of pollution) that can reach waterways (Bartens et al., 2008). Additional benefits of natural areas are a reduction of pollution, carbon emissions (Vaughn et al., 2014), and temperatures resulting from the Urban Heat Island

effect. These benefits are particularly relevant in CP2's service area. Namely, San Marcos, Texas is located in the heart of the Austin-San Antonio Corridor, a region that is one of the fastest-growing in the nation. The area is known as "flash flood alley" because of its high magnitude/frequency of floods and has the national record for flood-related deaths (Scott, 2016; Baker, 1975; Caran & Baker, 1986). As such, natural space preservation for flood mitigation is crucial in this region.

Data

Both community partners had a common research interest: they wanted to know what impact their programs have on people's daily lives. They were particularly interested in knowing whether stewards use the skills and insights gained from volunteering in their home lives and whether they share that knowledge with friends and families. Because each partner had a myriad of other research objectives, surveys were developed to address each respective partners' needs. However, both surveys included "core questions" that allowed us to explore outcomes for both organizations in a consistent (and comparative) way.

For both organizations, a 20-item survey instrument was created (Appendix A). Surveys were administered online via the Qualtrics platform during the summer of 2019 to each organization's volunteer database. For the purposes of this study, the survey items regarding changing environmental outlooks and behavior (i.e., *outcomes*) included a series of 13 statements about selected environmental behaviors. For each environmental behavior, respondents were asked to choose from the following responses: "I did this prior to involvement;" "Yes – I now do this;" or "No – I do not do this." In other words, the survey was designed to capture the degree to which volunteers practiced selected pro-

environmental behaviors or held pro-environmental outlooks (1) *prior to* their involvement with the nonprofit partner, (2) practiced pro-environmental behaviors or held pro-environmental outlooks *after* (i.e., *by way* of) their volunteer experience, or (3) have not and do not practice certain pro-environmental behaviors or hold certain pro-environmental outlooks. The specific environmental behaviors of interest to the partners fell into three content areas, which are summarized alongside their associated type of environmental behavior, as follows:

Natural Areas: Usage and Appreciation

- I visit natural areas and preserves. [Lifestyle behavior]
- I enjoy myself in the outdoors. [Lifestyle behavior]
- I take vacations to natural areas. [Lifestyle behavior]
- I feel at home in natural areas. [Lifestyle behavior]
- I explore new areas within nearby parks and preserves. [Lifestyle behavior]
- I invite others to explore natural areas with me. [Social-environmental behavior]

Environmental Activism

- I write letters about environmental issues. [Citizenship behavior]
- I tell my friends and family about environmental issues. [Social-environmental behavior]
- I sign petitions regarding environmental quality. [Citizenship behavior]
- I participate/attend local government decision-making meetings. [Citizenship behavior]

Water Awareness

- I reduce household water consumption indoors. [Lifestyle behavior]

- I reduce household water consumption outdoors. [Lifestyle behavior]
- I understand how watershed health affects water quality. [Lifestyle behavior]

Survey respondents were given the option at the end of the questionnaire to indicate their willingness to participate in face-to-face, individual interviews at a later date. To gain additional insights and diverse perspectives, interviews with willing participants complemented the survey by having a semi-structured, conversation-style. In total, I received 522 survey responses (~12% response rate) and conducted five follow-up interviews.

Research Questions and Methods

The data described in the previous section were used to answer the three research questions stated in the introduction and reproduced below for convenience.

(1) To what extent do stewards use skills and insights gained from participation in their daily lives and share experiences with their social networks?

To evaluate this question, we used McNemar tests to identify before and after changes in environmental behaviors (e.g., Weaver et al., 2016). This statistical test can be used for comparing paired responses and testing the null hypothesis that the numbers of volunteers reporting environmental behaviors experienced no change before and after participation in ES (Caronni & Sciumè, 2017). In other words, the test allows us to conceptualize participation in a stewardship program as something of a "treatment" that might have an "effect" on how volunteers (participants) use and appreciate natural areas, participate in environmental activism, and show awareness selected water [conservation] issues and practices (see above).

(2) What additional skills or insights do volunteers say they gained from participation

with the organization?

To address this question, insights were obtained through guided interviews (Litchman, 2009, p. 141) or semi-structured interviews (Qu & Dumay, 2011). The same question broad question (*What has involvement in CP1/CP2 changed in your life?)* was posted to all participants to help identify themes in a consistent and systematic manner. From there, in-conversation probes were used to provoke more elaborate responses (Qu & Dumay, 2011, p. 241). The interviews were recorded, transcribed, and data were analyzed using an open-coding approach, wherein no codes were pre-construct, themes and patterns were allowed to arise organically from textual data (Gibbs, 2007).

(3) What, if any, differences, existent in skill acquisition and knowledge sharing due to the scale of the organization?

To evaluate this question, a series of chi-square tests were applied to the "Yes – I now do this" responses to the pro-environmental behavior questions differed by organization. The chi-square statistic is used when the variable is measured at the nominal/categorical level and categories are mutually exclusive. The null hypothesis is that there are no differences in patterns of responses between the groups (Gray et al., 2017). Based on some of the earlier survey findings (Chapter III), stewards with broader scale environmental nonprofits tend to be more motivated by career, professional, networking, and policy advocacy opportunities than stewards at finer scale community-based organizations. At the same time, volunteers at local scale organizations tend to be more motivated by desires to make tangible, visible changes in their immediate communities. Based on these findings, we expect, in contrast to the null hypothesis, that volunteers with CP1 will become more likely to engage in advocacy (e.g., letter writing,

petition signing, and talking about issues with family and friends), whereas CP2 volunteers will become more inclined to engage in action (e.g., visiting natural areas, reducing water consumption, and going to local government meetings—NB: while attending local government meetings is certainly related to policy and advocacy, we assume that volunteers with community-scale organizations are more likely to engage in local political processes, whereas volunteers with broader/state scale organizations would be more likely to engage in state and national politics).

All statistical analyses described above were performed in JMP Pro 14, and qualitative coding was conducted manually using Microsoft word.

Results

The survey received 522 responses, of which 397 were from CP1 and 125 from CP2. Of those observations, 407 responses contained sufficient information for use in the chi-square tests described above. There were only 314 complete responses with sufficient information to study changes in environmental outlook and behavior portion. More precisely, because McNemar tests require paired data observations, several observations with only partial responses were unusable and omitted from the outcome-oriented analysis. Five interviews were conducted lasting approximately 30 minutes each. Because the option to participate in the study further (the last question asked on the survey) indicated interviews, only those that were accessible to the researchers, i.e., in San Marcos, Texas, were able to schedule interviews during the allotted time frame. As such, only environmental stewards from CP2 are presented in the interviews. This limitation will be expanded on later in the paper.

Research Question 1

McNemar tests revealed that both nonprofit partners appear to have experienced success in "moving the needle" toward pro-environmental behaviors among their volunteers. More specifically, with the exception of two lifestyle behaviors, all of the environmental behaviors about which respondents were questioned were associated with significant uptake following volunteer experiences (Table 4.1). The two statements that were the exception were: "I feel at home in natural areas" and "I enjoy myself in the outdoors." After involvement, 100% of respondents reported that they feel this way. Because of the lack of variation, McNemar tests for these items could not be fully implemented. However, despite the lack of the ability to quantify the statistical significance of this outcome, we note that it has extremely important practical significance—namely, after their stewarding experiences, stewards from both organizations unanimously claimed to feel at home in natural areas and enjoy the outdoors.

Table 4.1 McNemar test results for all categories of changes in environmental outlooks and behaviors

Category	Statement	P-value and descriptive interpretation After = # of responses that engage in behavior/total responses
Natural areas: Usage and Appreciation	I visit natural areas and preserves.	<0.001 After (n= 318/319) Before (n=274/319)
	I enjoy myself in the outdoors.	After involvement 100% of participants now enjoy themselves in the outdoors. (n=323)[1]
	I take vacations to natural areas.	<0.001 After (n=300/314) Before (n=237/314)
	I feel at home in natural areas.	After involvement 100% of participants now feel at home in natural areas. (n=321)[1]

	I explore new areas within nearby parks and preserves.	<0.001 After (n=311/319) Before (n=203/319)
	I invite others to explore natural areas with me.	<0.001 After (n=280/312) Before (n=177/312)
Environmental Activism	I write letters about environmental issues.	<0.001 After (n=112/298) Before (n=78/298)
	I tell my friends and family about environmental issues.	<0.001 After (n=302/317) Before (n=193/317)
	I sign petitions regarding environmental quality.	<0.001 After (n=224/306) Before (n=138/306)
	I participate/attend local government decision-making meetings.	<0.001 After (n=163/299) Before (n=90/299)
Water Awareness	I reduce household water consumption indoors.	<0.001 After (n=309/323) Before (n=220/323)
	I reduce household water consumption outdoors.	<0.001 After (n=306/314) Before (n=215/314)
	I understand how watershed health affects water quality.	<0.001 After (n=314/319) Before (n=174/319)

[1] All respondents now perform this activity, statistical significance not evaluated.

Research Question 2

Closed-ended surveys are appropriate for statistical analysis, but often leave key insights unrevealed. A secondary objective of this study was to attempt to capture some of these additional spillover effects/behaviors and feedbacks that have not been documented in the literature. The data obtained from five interviews toward these ends

were analyzed and coded into three categories of changes, with respect to: *perceptions* of natural areas and self (identity), *experiences* in natural areas, and *skills* learned through knowledge shared (see Discussion).

In changing their perceptions of natural areas, one interviewee reported seeing their local natural areas differently after working with CP2. The individual stated that the local natural areas are "something to preserve, to fight for, and to keep … [they will] make this a really special place for years to come." In changing the self-perception, one interviewee described how they had always considered themself an environmentalist, but "never really acted on it until getting involved" with CP2. By enacting their values through initial participation, they felt like "being involved with [CP2] has…opened the doors for me to be involved in the city" in other forms of activism. Another interviewee described a similar experience, wherein they said that after participation in a stewardship program: "I definitely have a better local identity … I feel I've connected a lot more to local issues."

Consistent with the survey results from above, most interviewees reported changes in the way they experience natural areas. For example, some stated they now seek out more remote natural areas for the solitude they bring: "I like to go to the ones that are remote enough and big enough so that you don't hear a car, see anyone, or have cell service." Others reported using their local trails more frequently. Several stated how involvement with CP2, particularly with trail-building, significantly changed their attitude(s) when recreating on trails: "I had no idea what it took to maintain the trails for these places" and "it sure has made a difference in my attitude towards a lot of stuff ... doing some of this work and seeing how much work a lot of people do; there's a lot of

people that do a ton of uncompensated work." Another interviewee simply remarked that understanding trail-building has "really made [the interviewee] appreciate volunteers."

Lastly, additional skills learned through knowledge exchanges while participating in a stewardship program were further expressed in the interviews. For example, an interviewee said, "I'm actually learning skills in trail crew that I could apply at my house." Another interviewee described how they were in fact using the skills they learned at home. Namely, the volunteer, in relating a story about going on a tour of a natural area with a botanist (a CP2 program), remarked: "When I got home and walked around my yard … and that is when I realized I had different trees. I thought I had nothing but hackberries and cedars pretty much, but after learning more from [CP2], I actually had some of those trees [from the natural area] growing in my own yard!"

Research Question 3

Scale, as a fundamental spatial concept, is frequently mentioned in ES research—but remains underexplored, especially as it relates to the social or spatial reach of ES outcomes (Chapter II). As such, this study attempted to differentiate changes in environmental outlooks and behavior based on two environmental organizations that function at very different scales. The operation of the scale (scale framing) also plays into the goals, missions, and anticipated reach of the respective organizations.

Table 4.2 reports on patterns of differences in responses to questions about environmental behaviors between the two partner organizations. Where nonrandom between-group differences in responses were observed, they were attributable to more changes than expected in CP2 (city-scale) compared to CP1 (state-scale). Concerning Natural Areas, statements about visiting natural areas, enjoying self in the outdoors,

taking vacations to natural areas, and feeling at home in natural areas were different between the two sets of respondents ($p<0.01$), while no meaningful differences were found in statements regarding exploring new areas and inviting others to explore (Table 4.2).

For the Environmental Activism category, nonrandom between-group differences were observed in the statements regarding telling friends and family about environmental issues ($p<0.01$, Table 4.2) and participating/attending local government decision-making meetings ($p<0.01$, Table 4.2). A slightly significant difference was observed between the two sets of respondents for the statement "I sign petitions regarding environmental quality" ($p=0.09$, Table 4.2). No differences were found in any of the Water Awareness responses.

Table 4.2 Chi-squared tests based on organization type

Category	Statement	% Agree or Yes, CP1	% Agree or Yes, CP2	p
Natural Areas: Usage and Appreciation	I visit natural areas and preserves.	18%	32%	0.005
	I enjoy myself in the outdoors.	14%	27%	0.004
	I take vacations to natural areas.	16%	32%	0.002
	I feel at home in natural areas.	16%	31%	0.007
	I explore new areas within nearby parks and preserves.	32%	39%	0.321
	I invite others to explore natural areas with me.	30%	40%	0.104
Environmental Activism	I write letters about environmental issues.	12%	16%	0.928
	I tell my friends and family about environmental issues.	29%	48%	0.002
	I sign petitions regarding environmental quality.	25%	36%	0.091
	I participate/attend local government decision-making meetings.	20%	36%	0.006
Water Awareness	I reduce household water consumption indoors.	27%	30%	0.615

	I reduce household water consumption outdoors.	29%	30%	0.858
	I understand how watershed health affects water quality.	45%	40%	0.384

Discussion

The investigation of research question 1 revealed that ES substantively altered stewards' environmental behaviors and contributed to the creation of new environmental behaviors (Table 4.1). Stated plainly, the ES programs at the partner organizations had a demonstrable *impact* on cultivating pro-environmental behavior in volunteer participants. Such outcome-oriented findings have been in relative undersupply in the literature (Wolf et al., 2013). More precisely, while the conceptual foundations of a feedback loop between stewardship and pro-environmental behavior have been well sketched out in theory, empirical evidence for that loop—especially evidence that also suggests individual environmental organizations play key and impactful roles in that loop—is largely absent from the literature. In community geography tradition, the results serve the dual purposes of documenting program impacts for the research partners, while also adding weight to extant ES scholarship on the links between volunteering and the expansion of environmental behaviors. With respect to the latter, we found that in each topical area under investigation in this study—Natural Areas, Environmental Activism, and Water Awareness—significant levels of change toward pro-environmental behaviors were associated with involvement in stewardship programs (Table 4.1).

Next, recall that both community partner organizations have missions that are oriented toward environmental stewardship *generally*, but are characterized by different *specific* areas of practice. CP1 (state-level) focuses principally on monitoring surface

water quality, while CP2 (city-level) is concerned primarily with maintaining natural areas. These differences are noteworthy insofar as participants from both organizations reported gaining skills or knowledge beyond the narrow focal areas of their host institutions. For example, volunteers at CP1 were found to experience positive changes (i.e., increased uptake) in environmental behaviors related to natural areas, just as volunteers with CP2 reported heightened water awareness. These "spillover effects" suggest that stewards ostensibly become broader, more well-rounded pro-environmental actors by virtue of their ES experiences, even when they receive direct instruction or training only in specific/narrow areas of focus (Truelove et al., 2014; Nilsson et al., 2017). One implication is that ES connects participants to like-minded people and ideas in ways that expand the individual stewards' overall environmental behavioral repertoires. In such circumstances, specific (narrow) ES opportunities function as "cues" for or precursors to future environmental behaviors that go beyond the knowledge directly acquired in ES-related training or education (Cornelison et al., 2018).

As an example of additional spillover effects from ES, respondents from both organizations were found to experience changes in lifestyle behaviors due to their volunteering. For example, respondents were more inclined, after their ES experience, to report that they "feel at home in natural areas" and "reduce household water consumption." Similarly, ES participation was associated with increases in citizenship behaviors for stewards, in the form of greater levels of environmental activism. Respondents were significantly more likely to say that, following their ES experience, they now sign petitions and participate in local government meetings (Table 4.2). Likewise, respondents' post-ES social-environmental behaviors were significantly more

oriented toward transmitting pro-environmental behaviors within their social networks—e.g., there was a significant post-volunteering increase in the number of stewards who agree with the following statements: "I tell my friends and family about environmental issues" and "I invite others to explore natural areas with me."

Taken together, the evidence from studying research question 1 suggests that the institutionally constrained actions (i.e., the actions available in stewardship programs at partner organizations) taken on by volunteer actors (stewards) produced something of a feedback loop. Namely, the actors, by virtue of engaging in ES actions, expanded their environmental behavioral repertoires and adopted more pro-environmental behaviors in more and diverse aspects of their lives. The benefits that might accompany those choices (e.g., potential positive health impacts from using and enjoying natural areas; potential for fulfilling social interactions that come from inviting others to explore natural areas and talking to friends and family about environmental issues; see Silva & Krasny, 2016) are likely to motivate stewards to engage in more ES in the future.

To add a richer perspective to these findings, the second research question sought to identify *specific* skills or knowledge gained from ES, beyond the environmental behaviors that the survey was designed to capture. A small number of post-survey interviews with stewards helped to clarify the picture of feedbacks, spillover effects, and unintended outcomes (Larrosa et al., 2016; Ryan et al., 2001; Courtney et al., 2013) that was painted in the results discussed above. The most common theme to emerge from the interviews was that ES seemingly changes *perceptions* of the self and the environment. For example, an interviewee reported seeing their local environment from a different perspective due to their ES experience. They described how local natural areas are

"something to preserve, to fight for, and to keep … [they will] make this a really special place for years to come." Involvement with an environmental organization provided another interviewee with a way to actualize their internalized values of environmentalism. They "never really acted on [their values] until getting involved" which "opened the doors…to be involved in the city" in other forms of activism—i.e., they got their "foot-in-the-door" (Nilsson et al., 2017). In other words, the interviews revealed that ES is potentially a vehicle through which stewards acquire and build "power within"—that is, power in the form of the confidence and knowledge to make individual decisions that contribute to broader societal (here, pro-environmental) changes that the stewards hope to see in the world (e.g., Green, 2016).

Collectively, the findings from research questions 1 and 2 hint at a virtuous circle of pro-environmental behavior. Individuals with internalized pro-environmental values seemingly seek out opportunities to act on those values (often, via environmental nonprofit organizations). Those actions allow stewards to accumulate additional pro-environmental values, knowledge, and behavior. That process of accumulation reinforces internal values and further motivates stewards not only to keep stewarding, but also to become more active in broader processes of social change aimed at enhancing and protecting the environment (both locally and globally).

That being said, such a virtuous circle is suggested from the results—not definitively established and comprehensively mapped out. Rather, there is much to explore in this arena, particularly with respect to how a steward's self-identity/perceptions of self-identity changed in relation to participation in stewardship programs. Because such experiences appear to lead to tangible, actionable changes in

behaviors, involvement with environmental stewardship programs may be considered *transformative learning*, which is characterized by "place-based sustainability initiatives [that] develop an ecological consciousness" (Pisters et al., 2019, p. 1). Future research on this topic will potentially allow for a better-*rounded* picture of the virtuous circle that I introduce above.

More immediately, the third research question asked what differences, if any, existed between the two organizations in terms of changes in environmental behaviors. All the significant differences we observed were due to volunteers with CP2 (the community scale organization) exhibiting higher rates of behavioral change (i.e., more instances of "Yes – I now do this") relative to volunteers at CP1 (the broader/state scale organization). In the Natural Areas part of the survey, stewards from CP2—who tend to do more hands-on, active work in natural areas—became more likely to "feel at home in natural areas." This finding was intuitive due to the hands-on, in situ character of the organization's work. However, in Environmental Activism, I anticipated that volunteers with CP1 would demonstrate more changes in letter writing, petition signing, and speaking with family and friends about environmental issues, given that the organization functions at a broad scale and is concerned with the universalizing (policy-relevant) issue of water quality. Yet, it was the volunteers at CP2 who demonstrated significantly greater uptake in speaking with friends and family about environmental issues, and a weakly significant increase in signing environmental petitions (Table 4.2). While this finding is not exactly what I expected, it is highly consistent with the notion that stewardship leads to "spillover effects," or an increase in environmental behaviors beyond the scope of the stewardship work itself. To that end, the null results in the Water Awareness section

demonstrate that although CP2's main mission is not directly centered around issues of water quality and conservation, 40% of stewards learned how watershed health affects water quality (Table 4.2).

As expected, CP2 volunteers were more inclined to attend local government meetings after volunteering. This increase in civic behavior was also evident in an interview, in which a CP2 steward stated that involvement "opened the doors" for them to become involved in city governance. Note again that no differences were observed in terms of understanding how watershed health affects water quality—volunteers from both organizations reported improved understanding in this arena, but the changes were not significantly different (Table 4.2).

In sum, the community geography-motivated engagement with Bennett and colleagues' (2018) ES framework found meaningful differences among actors' (stewards') environmental behaviors due to stewardship (actions). The evidence supports the notion that these behavioral changes exist in a feedback loop—stewarding provides skills, experience, and knowledge that motivate stewards to continue stewarding, to involve others in stewarding, and to become active in broader processes of social change. Notably, though, behavioral changes associated with stewarding exhibited some variation (albeit slightly) depending on the scale at which actions were performed—and, as such, the actions available to the stewards. Still, pro-environmental behaviors increased for participants in both partner organizations, irrespective of scale.

In addition to adding informative empirical evidence to ES scholarship on the feedback loop between stewarding and environmental behavior, these results have practical value for the partner organizations. To obtain funding, nonprofit ES

organizations typically need to monitor their programmatic outcomes and impacts, incorporate lessons learned (Bennett et al., 2018; Handy, 2001), and document their efficacy to funders (Sheppard, Ryan, & Blahna, 2017). To the community partners, empirical evidence of pro-environment behavioral change is an important testament to programmatic impacts and organizational efficacy. In other words, consistent with the aims of community geography, this study has the potential to contribute simultaneously to existing ES scholarship *and* the capacity of the nonprofit partners.

To use this latter observation as a point of departure, one implication of this research is that, to build ES theory, it is critical for researchers to collaborate with organizations who are at the frontline of ES work (Close et al., 2016; Johnson et al., 2018). Yet, environmental organizations, and any nonprofit or community-based organization for that matter, are often hesitant to partner with researchers given the history of nonprofits being research "subjects" rather than partners (Pain, 2004; Pain & Kindon, 2007; Kindon & Elwood, 2009; Kindon et al., 2007; Fuller & Kitchin, 2004). Community geography strives for reciprocity in research collaborations (Mohan, 2007). As a form of participatory action research, community geography encourages community partners to pose research questions, share their needs, and guide the research design so that the data produced directly benefits them (Robinson, 2010; Boll-Bosse & Hankins, 2018). Toward that end, the results show that the two community partner organizations appear to be running effective programs that produce impacts in the form of behavioral change. At the same time, I have shown that behavioral change is arguably most closely linked to empowerment—suggesting that the partners will be best served by designing and implementing programs that provide all volunteers with opportunities to do

empowering work, and not simple menial tasks that the organization lacks the internal capacity (or desire) to do.

Limitations and Future Research

The study, and especially the investigation of research question 2, was limited by the number and source of participants. I studied two organizations in Central Texas (USA), and all five follow-up interviews were conducted with volunteers from just one of those organizations (CP2) due to distance limitations and a low response to the request for interviews. Future research should strive to perform more interviews to engage more deeply with stewards' individual [perceptions of] volunteer experiences. Similarly, the partner organizations function at the city- and state-scale. Additional research that works in collaboration with hyperlocal- (e.g., a block club or neighborhood garden), national-, and global-scale institutions—and institutions that operate between and/or across those scales—is needed. Future research is also needed on the tangible (physical ecological) changes to the landscape. For example, is the quality of surface water across the state improving? Behavioral changes among stewards are only one (small) dimension of change.

Next, while differences in changes to environmental behavior in the two, differently scaled partner organizations, were observed, the study did not explore how these changes did or did not relate to the number of people conducting the stewardship activity at a particular *time*. For instance, CP2 brings volunteers together in greenspaces in small groups, while CP1 sends volunteers off to monitor surface water alone or with a partner. When people steward together, they build connections and stronger communities (Manzo & Perkins, 2006). These social connections can create or reinforce social norms

around environmentalism (Krasny, 2019), thereby jumpstarting or turbocharging the feedback loop described earlier. If such circumstances hold in institutions that operate at different scales of analysis, then it may be valuable for environmental organizations to restructure their programs so that volunteers are regularly engaged in small group activities. Once again, however, additional empirical work is needed to explore such a possibility.

Finally, the impacts of ES stand to be long-lasting and alter self-identity. Longitudinal studies of ES participants should explore this potential in the context of a transformative learning framework (Piesters et al., 2018) and/or by engaging more deeply with research on place identity and place meaning (Williams, 2014; Scannell & Gifford, 2017; Chow et al., 2019).

Conclusion

This study assessed changes in the environmental behaviors of environmental stewards at two partner nonprofits in Texas using surveys and interviews. I found that participation in ES was linked to various types of increases in pro-environmental behaviors for respondents from both partner organizations. This empirical evidence is consistent with the idea that ES plausibly exists in a self-reinforcing system of pro-environmental behaviors. That is, ES can create more well-rounded pro-environmental actors. Such an implication speaks to the important role that environmental nonprofits play in cultivating environmental citizenship. By documenting that role for two collaborating institutions, the findings served a further purpose that is essential to the spirit of community geography: each partner organization was provided empirical evidence of program impacts and efficacy. That evidence is available for the partners to

use in annual reports, funding applications, and promotional material—and it will serve as the basis for custom, partner-specific volunteer recruitment and retention action plans in the next phase of this research.

Overall, the findings suggest that ES can lead to greater uptake in selected pro-environment actions, higher awareness of environmental issues, and a greater appreciation for natural amenities. ES programs have spillover effects and outcomes that deliver social benefits beyond what the individual ES program intended. Thus, collective action—rooted in stewardship activities—cultivates our relationship with the natural world. These "win-win" behaviors can have a positive impact on the environment and human well-being alike (Kurisu, 2015).

V. WHAT INFLUENCES WHERE VOLUNTEERS PRACTICE ENVIRONMENTAL STEWARDSHIP? THE ROLE OF SCALE(S) IN SORTING STEWARDS

Introduction

Environmental stewardship (ES) is voluntary action by individuals or groups to "protect, restore, or sustainably use the environment" (Bennett et al., 2018, p. 603). Such behavior arises from environmental crises (Krasny & Tidball, 2012), moral imperatives (Jia et al., 2017), and/or in response to noticeable qualitative declines in specific spatially-based ecosystems (Connolly et al., 2013).

As the global community moves deeper into the Anthropocene – an epoch characterized by rapid urbanization and development, population growth, recurrent public health crises, racial injustice, and anthropogenic climate change (Locke & McPherason, 2018; Johnson et al., 2019; Weaver, 2020) – individual and collective actions to defend and enhance threatened ecosystems are taking on rising importance (Jasny et al., 2019; Bruyere & Rappe, 2007; Close et al., 2016, p. 1). This chapter examines collective ES as enacted through programs and activities sponsored by nonprofit organizations (e.g., litter clean-ups, water quality monitoring, greenspace maintenance, environmental education). Nonprofit stewardship organizations—which aim to have positive impacts on local ecosystems (Andersson et al., 2014)—rely heavily on public participation and key organizational partners to carry out their missions (Johnson et al., 2019). New research that investigates who volunteers in these stewardship programs and why may uncover patterns that can be leveraged both for ES theory-building and in organizational recruitment strategies. Taken together, such insights might prove critical for designing strategies to increase the density of ES participants, and the overall amount of ES behavior, in targeted areas over time (García-Valiñas, Macintyre, & Torgler, 2012).

Toward those ends, recent scholarship offers evidence of a "First Law of Environmental Stewardship," whereby all stewards share similar motivations—e.g., a strong desire to help the environment and one's community—but motivations for stewardship are more similar among volunteers within organizations than between organizations (Chapter III). One mechanism put forward to explain this pattern of motivational clustering relates to nonprofit organizations' scales of operation, or spatial footprints (Chapter III). For instance, community-based organizations that focus on protecting and preserving specific *places* arguably attract volunteers with motivations that are somewhat distinctive from volunteers at larger environmental nonprofits, where the focus might be on knowledge creation or policy advocacy around broader *issues* that affect many places simultaneously (Chapter III).

One implication of this argument is that there exists a continuum of organizations that range from purely place-based and mostly transactional to purely issue-based and more focused on broader-scale social-environmental transformation (e.g., Engler & Engler, 2016). In practice, it is unlikely that any given organization lies at either extreme on this continuum. Still, distinguishing between fine-scale, place-based organizations and broad-scale, issue-based organizations offers a useful starting point for unpacking the links between volunteer motivations and stewardship venues. Namely, it implicates a testable hypothesis about how stewards self-sort into different organizations: volunteers who are more motivated by near-term instrumental gains such as self-improvement, socialization, and engaging in physical actions are more likely to sort into place-based organizations, where they can pursue these objectives alongside members of their immediate communities; and volunteers who are more motivated by long-term transformations to

social institutions and social-environmental values are more likely to join broader-scaled, issue-based organizations, where they can learn and create knowledge as part of larger movements for social change. Stated alternatively, the overriding hypothesis is that patterns of volunteerism in stewardship programs are, on average, characterized by scale-matching—such that micro-motivations are determinants of stewardship at smaller community-based organizations, and macro-motivations are determinants of volunteerism at larger multijurisdictional environmental organizations.

The remainder of this chapter develops and then tests this hypothesis using a community geography approach. Volunteers at two partner organizations—San Marcos Greenbelt Alliance, a fine-scale community-based organization (CBO), and Texas Stream Team, a broader-scale environmental nonprofit organization (ENPO)—were asked why they volunteer with their respective programs (n=341). After collapsing the respondents' motivations into two major dimensions through exploratory factor analysis, a nominal logistic regression model predicted each volunteer's organizational affiliation (with either the CBO or ENPO) as a function of their motivations, controlling for a host of socioeconomic and demographic variables. The results reinforce the emerging "First Law of Environmental Stewardship" described above. CBO volunteers were more likely to exhibit micro-motivations associated with self-improvement, socialization, and immediate instrumental gains. And ENPO volunteers tended to exhibit comparatively macro-motivations associated with social change, building understanding, and seeking long-term transformation to social institutions and values. That motivational and organizational scales were reasonably matched in our study suggests that nonprofits looking to broaden their volunteer pools might wish to experiment with multi-scalar

programming, by combining immediate, instrumental, place-based actions with bigger picture work in movement-building. In other words, becoming more effective "hybrid organizations" (Engler & Engler, 2016) is one plausible strategy for environmental organizations to grow, diversify, and sustain their volunteer bases over time, better positioning them for long-term success.

Background

Environmental stewardship (ES) organizations are spatially and organizationally diverse (Svendsen & Campbell, 2008; Romolini et al., 2013). Many offer programs that coordinate and mobilize people for direct action on behalf of the environment, such as conserving and maintaining green spaces or restoring local brownfields (Romolini et al., 2013; Connolly et al, 2013; Locke et al., 2014). Others provide training, education, networking, and other opportunities for volunteers and members to participate in campaigns for major social and systems change (e.g., Campbell & Linzey, 2016). Yet, regardless of where any one organization falls along this spectrum from immediate place-based action to long-term societal transformation, all ES organizations are linked by a desire to prevent further environmental degradation (e.g., Bennett et al., 2018).

In that respect, all ES organizations are related. However, as Jasny et al. (2019) observed, some are more related than others. Indeed, environmental organizations with overlapping missions regularly work together as collaborators, providing evidence of homophily (e.g., "birds of a feather flock together") in the ES institutional landscape (McPherson et al., 2001). More recently, Chapter III found that the same might be true when the level of analysis shifts from organizations to individuals. That is, while all stewards tend to volunteer because of a desire to help the environment, self-reported

motivations of stewards reveal that volunteers within organizations are more alike than volunteers between organizations (Chapter III). Like Tobler's famous First Law of Geography—which states that everything is related to everything else, but nearer things are more related than distant things (Tobler, 1970)—the implication is that patterns of environmental volunteerism exhibit clustering. Persons with similar sets of motivations appear to be attracted to similar ES opportunities (Chapter III).

Insofar as ES work is regularly enacted through programs at environmental nonprofits (e.g., Hidayat & Stoecker, 2018), the above suggests that any given organization will contain volunteers with common motivations. In a more technical sense, variation in volunteer motivations within an organization will be small relative to variation in motivations between organizations. Whereas this finding might seem rather intuitive and therefore easy to dismiss, doing so would mean failing to engage with a critical unanswered question about environmental volunteerism: *how* do similar stewards end up at the same organizations? Posed another way, simply declaring that patterns of organization-based ES exhibit clustering in volunteer motivations and then not exploring *how* and *why* such an outcome manifests is to take the result as fixed and inevitable. However, it is precisely this "given" that ES scholars must investigate if we wish to intervene in the process in ways that grow and diversify the number of stewards in the population over time (Bennett et al., 2018). This study contends that the fundamental geographic concept of *scale* offers a promising framework for taking up this task.

Types of Environmental Stewardship Organizations

In a very broad sense, there are two basic types of stewardship organizations: grassroots, community-based organizations (CBOs) and higher-profile, wider-reaching

environmental nonprofit organizations (ENPOs). CBOs "tend to be membership-driven and *local*…and are often almost entirely voluntary in nature" (Green, 2016, p. 182 [emphasis added]). They work to advance the instrumental interests of their members or communities in the near term, winning tangible victories often through direct action (Green, 2016; also see Engler & Engler, 2016). By contrast, ENPOs "tend to be run by boards and professional staff" and have much larger geographic reaches (Green, 2016, p. 182). They tend to work in service to the broader "public interest, by running [campaigns]…or trying to influence public policy" (Green, 2016, p. 182). Thus, whereas CBOs focus locally and transactionally on winning instrumental victories for a close-knit membership within a compact geography, ENPOs typically focus more globally or regionally on transforming bigger picture values, policies, and institutions to rein in longer-term social and environmental systems change (e.g., Green, 2016; Engler & Engler, 2016).

In practice, no organization is a perfect fit for either of the preceding archetypes. For instance, an ENPO can evolve from a CBO through *scaling out*, which is the process of impacting a greater number of peoples or community, or by *scaling up*—impacting policy by working "to address root causes" that affect a large population (Lam et al., 2020; Moore et a., 2015, p. 79). More generally, at various times, and especially during the initial stages of organizational formation, the imposed lines between the CBOs and ENPOs become blurred (Hidayat & Stoecker, 2018). As such, a CBO-ENPO binary is necessarily oversimplified, meaning that the distinction should be thought of more as a fluid continuum rather than a rigid dichotomy. Nevertheless, a dichotomy provides a convenient starting point from which to investigate the role of *scale* in sorting (and

clustering) stewards into different organizations. In particular, it helps to implicate at least two scalar dimensions of ES: spatial and motivational.

Spatial Scale/Organizational Scale of Operation

Both CBOs and ENPOs pursue missions that involve advancing some combination of environmental and community well-being through, for example, "sustainability initiatives" that focus on environmental restoration, community economic development, and a plethora of other objectives (Quarter et al., 2017; Lam et al., 2020). Accordingly, CBOs and ENPOs regularly share goals and values. As introduced above, however, the two types of entities can often be distinguished by their spatial scales of operation. ENPOs (e.g., the National Wildlife Federation or Rainforest Alliance) are typically most active at national or global scales and seek to influence major legislation or transform entrenched values, norms, and behaviors in the global community (Dart, 2010; Hall & Taplin, 2010). Oppositely, CBOs typically retain (hyper)local foci on specific causes in specific *places*, and they seek to actively alter conditions on the ground in those places.

With this distinction in mind, a CBO might be thought of as a *place-based* entity that offers social programs or solutions to *local* communities (Salamon, 1987). These localized offerings can provide immediate instrumental value to their participants in terms of community sustainability, resiliency, and well-being (Chaskin, 2003; Chin & Webster, 2005). Many CBOs focus their efforts on improving local environmental quality (Roman, Campbell, & Jordan, 2018) as they seek to protect an asset that is of value to the local community. For instance, grassroots environmental CBOs play meaningful roles in the U.S. environmental [justice] movement, as they document local disparities and

mobilize local community members to advocate for specific changes to their neighborhoods (Hidayat & Stoecker, 2018). The number of such organizations has intensified since the 1960s, as social, racial, and environmental inequities have continued to worsen (Silveria, 2001).

While the range and variety of causes taken up by CBOs can be quite large and diverse given the unique, context-sensitive problems and threats that arise in different *places*, ENPOs are arguably more likely to tackle a smaller set of comparatively broader *issues* (e.g., water and air quality, pollution, soil erosion/conservation, deforestation, endangered species, and climate change) that affect a wide range of *places*. They work to promote environmental quality through education, reporting, lobbying, advocacy, petitions, and a number of other tactics (Hall & Taplin, 2010; Lyakhov & Gliedt, 2017). Blurring the lines between the two types, ENPOs can and do work in targeted spatial communities, just like CBOs (e.g., Green, 2016); however, most ENPOs focus on transforming social values and/or "influencing governments to enact policies that will encourage broader improvements" (Lyakhoy & Gliedt, 2017, p. 1450). As such, relative to CBOs, ENPOs are generally more active in longer-term strategic campaigns for social change, using various policy advocacy, public awareness, and education mechanisms to address environmental problems (Handy, 2001).

For their part, CBOs arguably place greater emphasis on direct action and local participation, as volunteers attempt to tangibly improve their immediate surroundings in the here and now (Hidayat & Stoecker, 2018). This simplified mapping between an organization's operational/spatial scale (i.e., local v. global) and the type of change it attempts to create (i.e., instrumental v. transformational [definitions to follow in the next

section]) begins to clarify the heretofore underexplored process of *how* and *why* stewards self-sort into ES organizations in ways that give rise to clustered patterns of motivations (see Chapter III). Namely, there appears to be a systematic link between *spatial/operational scale* at the level of the organization and *motivational scale* at the level of the individual volunteers.

Motivational Scale/Scale of Organizational Change Efforts

Early research suggested scale may be a factor in how a person relates to and works to protect a place (Cuba & Hummon, 1993). Adroin's (2009) study found a significant relationship between the scale of actions and the scale at which a volunteer held a place connection: "those with more local-scale place connections were significantly more likely to take [action] at a smaller scale and those with larger-scale place connections were significantly more likely to take action at a larger scale" (p. 496). Additionally, Lukas and Ardoin's (2014) study of watershed volunteers detailed how "some people noted being motivated by a particular location on the creek or restoration site, while others had a broader affinity for 'our local streams' or ''southern West Virginia'" (p. 65).

While it is beyond the scope of this project to comprehensively characterize and explain the [environmental] psychology of individual stewards, based on the reasoning and literature reviewed above, it is fair to argue that volunteers are motivated by demands for some combination of two general types of social-environmental change: (1) *instrumental* or *transactional* change, which refers to tangible benefits generated in one's immediate spatial and temporal contexts (e.g., successfully stopping a current fracking operation in a specific community); and (2) *symbolic* or *transformational* change that creates conditions and institutions to facilitate long-term shifts in social, cultural,

political, economic, and environmental values and behaviors (Engler & Engler, 2016).

As was the case in distinguishing between organizational types and spatial scales above, this simplified conceptualization is not a static dichotomy of change, but rather two endpoints of a dynamic continuum along which organizations move and shift as they mobilize different means for different ends at different times. Nonetheless, for present purposes, the simplified version of instrumental v. transformational change allows for a preliminary specification of *how* and *why* stewards sort themselves into CBOs or ENPOs. Explicitly, an organization's status as either a CBO or ENPO, as well as its attendant spatial scale of operation (fine/local or broad/global, respectively), acts as something of a signal to prospective volunteers.

Volunteers who are motivated by instrumental changes in their neighborhoods (and, thus, in their daily lives) in the near term will have a greater proclivity to seek out and join CBOs. Frequently, such persons possess a combination of place-based and interpersonal motivations, seeking not only to improve their local environments, but also to gain friendship and form personal relationships in the process (Katz & Rosenburg, 2005, p. 5). In the language of Clary and colleagues' (1999) Volunteer Functions Inventory (based on Katz's [1960] seminal Functional Approach to understanding volunteerism), CBO volunteers, generally speaking, possess intrinsic *Social* motivations above and beyond broader motivations to help their communities and improve their environments (Chapter III). Such volunteers also regularly have extrinsic motivations related to self-improvement—what Clary et al. (1999) called *Enhancement* motivations—meaning that volunteering is a method for achieving personal satisfaction. Taken together, networking, socializing, relationship-building, and self-improvement are all

varieties of instrumental gains that benefit volunteers in the specific places and times where they are pursued.

On the other side of the spectrum, volunteers wishing to contribute to long-term transformational change might be more inclined to seek out and participate in programs at ENPOs. In these organizations, volunteers who are moved primarily by *Values* (Clary et al., 1999)—such as living in harmony with nature, repairing degraded ecosystems, and being a force of positive social change (e.g., Weaver, 2020)—can work to advance those values at broader social and spatial scales. In addition to these value-based motivations, ENPO volunteers may also be moved by a genuine desire for *Understanding* (Clary et al., 1999)—that is, to learn more about the need(s) or issue(s) on which an ENPO works and discover how to intervene in those issue spaces to effect positive change.

In scholarship on social movements, organizations that instill and reinforce core values in their members, and that educate members on shared visions and theories of change, are said to engage in "frontloading." Frontloading is a form of purposeful education that, at the outset of volunteering, seeks to build members' shared *understanding* of environmental problems and solutions, equipping them with knowledge and tools to advance those solutions within and beyond the boundaries of the organization (Engler & Engler, 2016, pp. 71-72). As two examples, consider the Highlander Institute, of civil rights era fame, and the Community Environmental Legal Defense Fund's intensive Democracy School. Both frontloading efforts attempt to change participants' *understanding* of existing social institutions and power relations in ways that help them become agents of transformational social and environmental change in their communities (e.g., Campbell & Linzey, 2016).

While CBOs can certainly engage in frontloading for new volunteers and members, the observation that, in the main, ENPOs tend to be better staffed and funded than CBOs (Green, 2016) may act as a signal to prospective volunteers that they can better satisfy *value*- and *understanding*-based motivations at larger-scale organizations. Coupled with earlier observations, the upshot is that the fine-scale/place-based CBOs signal to prospective volunteers that such organizations are suitable spaces in which to pursue relatively *micro-motivations* (e.g., self-improvement, socialization, physical action) and experience *instrumental* gains and changes; whereas the broader spatial and operational scales of ENPOs signal to prospective volunteers that they are appropriate venues in which to fulfill comparatively *macro-motivations* (e.g., value affirmation and knowledge acquisition) as participants in longer-term movements for *transformational* social and environmental change. This potential linking of motivational scale to spatial/operational scale forms the crux of the conceptual framework and central hypothesis regarding how and why similar stewards come to volunteer in the same organizations.

Conceptual Framework and Hypotheses

Figure 5.1 adapts the framework proposed in Chapter III to illustrate the process by which stewards' primary motivations impel them to seek out either: (1) instrumental or transactional change as members of a place-based community-based organization (CBO); or (2) symbolic or transformational change as part of a broader need- or issue-based environmental nonprofit organization (ENPO).

The Chapter III framework is the rectangular system on the right-hand-side of Figure 5.1. It is fundamentally consistent with the logic and distinctions laid out above, as it proposes that stewardship organizations form in response to either (1) a specific place or

place-based asset, or (2) a broader, issue, need, or social-environmental problem. Given the fine-scale and place-specificity of the former, resulting organizations tend to take the form of CBOs, often aimed at preserving or protecting the place or asset in question. By contrast, because the latter type engages with comparatively sweeping issues that affect many places simultaneously, the resulting organizations take shape as broader-scale ENPOs. The missions of these organizations frequently involve remedying more macroscopic issues in pursuit of longer-term, transformational change. According to Chapter III's results, both the choice of entity and an entity's efficacy are affected by factors such as organizational leadership, capacity, and place identity.

Whereas the Chapter III framework is useful for explaining the relationship between spatial scale and organization type that was discussed above, it is limited in that it does not engage with volunteer motivations. Without incorporating motivations, the framework ostensibly implies that, once organizations form – either around a place/asset or broader issue/need – they recruit their stewards in a unidirectional way. Stewards, in this sense, are passive subjects who are recruited exclusively by active organizations. Organizations have all the agency in such circumstances.

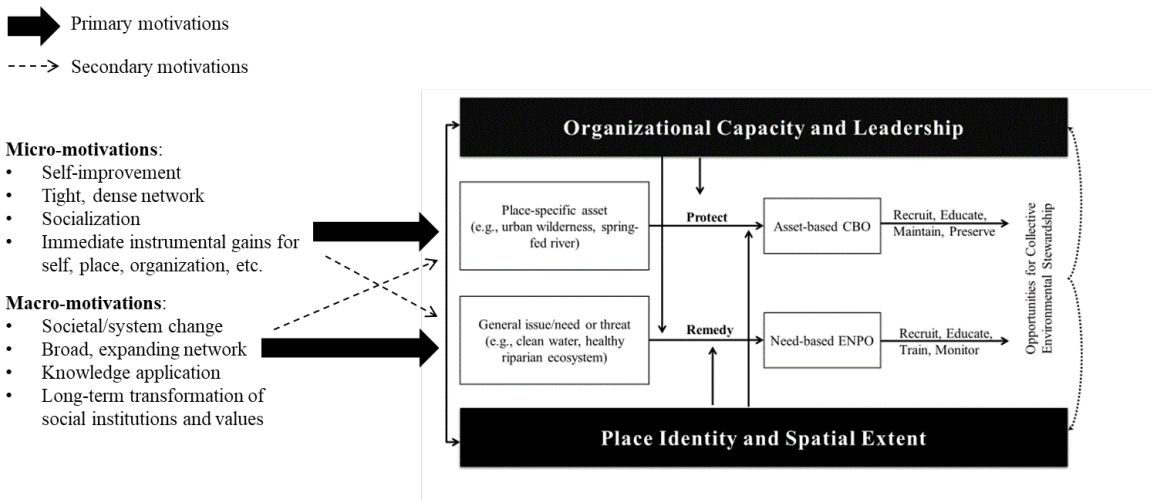

Figure 5.1. Adding motivation-based sorting to Chapter III's framework of environmental stewardship (adapted from Chapter III)

This implication is not altogether problematic. Indeed, organizations do actively recruit members and volunteers – such efforts are core functions of social sector entities (Wymer & Starnes, 2001). Yet, at the same time, prospective volunteers also actively seek out opportunities to fulfill their complex arrays of motivations (refer to the preceding section). Put another way, stewards also have agency – they participate in the processes that sort volunteers into organizations.

To account for the active flows from volunteers self-selecting into organizations, Figure 5.1 adds a motivation-based sorting process to the Chapter III framework (see the left-hand-side of the diagram). Consistent with earlier observations, Figure 1 proposes that volunteers for whom micro-motivations are stronger than macro-motivations are more likely to join comparatively micro-scale CBOs; and volunteers whose macro-motivations outweigh micro-motivations have greater predispositions toward larger ENPOs. The overarching hypothesis at work is that, on average, the spatial or operational scale of a stewardship organization will match the motivational scale of its volunteers,

and vice versa (i.e., micro-motivations predominate in fine-scale CBOs and macro-motivations in coarse-scale ENPOs). That is not to say that stewards concerned about local issues do not care about global problems (or vice versa). As shown in the diagram, all volunteers have at least some degree of macro-motives *and* some degree of micro-motives. The framework merely suggests that, on average, there will be relative correspondence between motivational and spatial/operational scales. This study tests this idea using a combination of exploratory factor analysis and nominal logistic regression with survey data obtained from partner organizations.

Methodology

Community Geography

The research for this chapter was conducted using a community geography approach, which is well suited for inquiries in environmental stewardship (Chapter II). Community geography brings scholars and community partners together to "affect positive community change" (Robinson, 2010, p. 6). Community geography often employs participatory action research (PAR) approach, whereby community partners have control over research objectives and questions. This study partnered with two community organizations to study ES and ES motivations, with the partners exerting meaningful influence on what questions were asked and answered. For the remainder of the chapter, the partners are identified with their operational scales for privacy purposes. Partner 1, San Marcos Greenbelt Alliance, is referred to as a community-based organization (CBO), and Partner 2, Texas Stream Team, is referred to as an environmental nonprofit organization (ENPO), per the preceding definitions.

The CBO partner operates at the scale of a mid-sized city and focuses on protecting an environmental asset of approximately 1,200 acres of natural areas, in which trails are created and maintained. It is an all-volunteer nonprofit organization, without paid staff, which relies on member dues (~250 members), grants, and donations for financial resources. The CBO works in three principal domains: *conservation* (protection of natural areas, i.e., saving them from development and exploitation), *stewardship* (preserving the health of functional ecosystems in natural areas with the work of volunteers), and *outreach* (educating the community on the value of natural areas conservation and connection). During the initial community partner meetings, the CBO listed three priority areas in which they would like this project to contribute new knowledge: (1) why volunteerism is inconsistent; (2) what motivates/attracts their current volunteers; and (3) implications for how to retain and grow their volunteer base.

The second partner is an ENPO that functions at the state-scale and works across Texas to ensure clean water for people and the environment. The ENPO currently has five staff members (full-time) and three student workers (part-time). It is funded in part through a federal Clean Water Act (CAC) §319(h) grant from the U.S. Environmental Protection Agency (EPA). Although the ENPO offers several programs, this project focused on the largest one: the citizen science water quality monitoring program. Through this program, the ENPO has trained over 10,000 citizen scientists to monitor water and environmental quality at over 400 sites across Texas.

The ENPO's mission is to protect water quality in Texas. It aims to bring together environmental stewards, community stakeholders, university researchers, environmental professionals, and students to advance values of environmental stewardship and create

and disseminate knowledge about water resources and water quality. Like the CBO, the ENPO wanted to know who their stewards are as they work with many across the state and to understand how to retain them, i.e., keep them on as monitors, and how to attract more public participation.

Data and Methods

Survey

Observe that the two community partners had similar overarching needs: to learn more about their volunteers and what motivates them, in order to grow and strengthen volunteerism. Data for these purposes were collected via two surveys that were based on existing instruments (e.g., Alender, 2016; Ryan et al., 2001) as well as specific input from the community partners. Core questions that were included on both surveys were used to test the framework and hypotheses explicated in the preceding section (see Appendix B for survey instrument). The surveys were administered online via Qualtrics during the summer of 2019. Emails were sent to both community partner's email distribution lists, which summed to approximately 3,500 volunteers. Two $25 Amazon gift cards were offered as incentives for participation in each survey. After the initial email invitation was sent, three reminder emails were sent two weeks apart. The survey had a response rate of nearly 11%, with 377 total responses.

Exploratory Factor Analysis

In total, the survey instrument asked respondents to rank, using a standard five-point Likert scale, their level of agreement with 12 statements about their motivations for volunteering with the partner organizations (see Appendix Table A1). The 12 motivational statements were drawn from instructive literature and grounded in Clary et

al.'s (1999) Volunteer Functions Inventory. Descriptive statistics for these variables are summarized in Appendix Table A1.

To evaluate the expectation that volunteer motivations might collapse into two main categories—micro-motivations and macro-motivations—an exploratory factor analysis (EFA) was used on the 12 motivation variables. EFA was carried out in the R statistical computing environment. Records with missing data were omitted from the analysis. The EFA was based on a polychoric correlation matrix since all motivation variables were ordinal in their data types, based on a Likert scale (Holgado-Tello et al., 2010). Factors were extracted using maximum likelihood estimation (Bollen 1989). Insofar as extracting the right number of factors is generally more of a priority than rotation (Johnson &Wichern, 2007), rotation was not used in this exploratory analysis.

Nominal Logistic Regression

Recall that prior research has demonstrated that people who volunteer with environmental organizations tend to share similar personal traits (e.g., they are relatively affluent and well-educated); but that volunteers with the same organization are more similar than volunteers at different organizations (Chapter III). It is hypothesized that, after controlling for these differences (similarities) in personal traits, volunteers in organizations that operate at different spatial scales will exhibit different clusters of motivations.

To evaluate this hypothesis, a nominal logistic regression (NLR) was used to predict volunteers' organizational affiliation (CBO or ENPO) as a function of their motivational factors and various control variables (e.g., Lawson & Montgomery, 2006). The analysis was performed in JMP Pro 14. In addition to the factor variables extracted

from responses to 12 motivational variables (see above), independent variables included: event/group size, rate of volunteerism, encouraging others to volunteer, certificates of appreciation/recognition, additional training and recognition for training, length of time a volunteer, commitment to complete tasks in unfavorable weather, pro-environmental behaviors, knowledge of watersheds and water quality, gender, household income, race, age, and political views (McDougle, Greenspace, & Handy, 2011). The full set of variables used in the model is summarized in Appendix Table A2. While acknowledging the "First Law of Environmental Stewardship" (Chapter III), the relationships between organization type and personal attributes are approached rather agnostically. That is, personal attributes are merely employed as controls, recognizing that stewards often hold many of these attributes in common. In the Discussion section that follows the Results, significant control variables are interpreted in ways that illustrate which personal attributes are most dissimilar between organizations, and not in ways that evaluate prespecified hypotheses.

Results

Sample Characteristics of Respondents

The survey yielded 122 responses from CBO volunteers and 255 responses from ENPO volunteers. Summary statistics are presented in Table 5.1, where they are broken out by organization. Consistent with the literature, the two samples share numerous characteristics. Participants from both organizations are similar in race/ethnicity (majority white), education (majority bachelor's degree or higher), and income (majority higher income earners). Yet, supporting the "First Law of Environmental Stewardship" summarized earlier, there are moderate between-organization differences in attributes

such as volunteer gender (CBO majority male, ENPO female), age (ENPO slightly younger), and political ideology (CBO more liberal).

Table 5.1. Sample characteristics of respondents

Socioeconomic characteristics	Description	Percentage	
		CBO Survey Respondents (n = 122)	ENPO Survey Respondents (n = 255)
Gender	Female	44%	60%
Race/Ethnicity	Caucasian race	92%	82%
	Nonwhite	8%	18%
Employment	Government or public	29%	23%
	Private	10%	15%
	NGO or nonprofit	8%	10%
	Self-employed	10%	8%
	Student	6%	13%
	Retired	38%	29%
Age	18-24	5%	13%
	25-34	8%	11%
	35-44	15%	16%
	45-54	14%	12%
	55-64	19%	26%
	65 +	38%	24%
Educational	Bachelor degree or higher	85%	84%
Household Income	Less than $10,000	7%	6%
	$10,000-$29,000	4%	9%
	$30,000-$49,000	10%	10%
	$50,000-$79,000	29%	22%
	$80,000 +	36%	34%
	Prefer not to say	16%	18%
Political Views	Liberal	76%	58%

Exploratory Factor Analysis (EFA) Results

The factor loadings from an EFA on the 12 motivation variables described earlier and summarized in Appendix Table A1 are presented in Table 5.2. A parallel analysis performed on the polychoric correlation matrix suggested a four-factor solution. However, only two of those factors were well-determined with three or more indicators

and eigenvalues greater than one. Thus, only two factors were retained. The motivation variables that loaded strongly onto factor 1 were: socialize, be physically active, have fun, meet new people, interact with like-minded people, spend time with their social network, learn from experienced others, and share my experience/knowledge. Factor 2 was defined by four indicators: help the environment, help the community, learn new skills/knowledge, and get outside and connect with nature (Table 5.2).

Table 5.2. Factor loadings for two defined factors: micro- and macro-motivations

Motivation Variable	Factor 1 Micro-motivations	Factor 2 Macro-motivations
Help the environment		0.997
Help the community	0.144	0.697
Learn new skills/knowledge	0.292	0.487
Socialize	0.621	
Get outside and connect with nature	0.450	0.559
Be physically active	0.540	0.370
Have fun	0.617	0.273
Meet new people	0.695	0.123
Interact with people	0.656	0.201
Spend time with social network	0.660	
Learn from experienced others	0.521	0.271
Share my experience/knowledge	0.611	0.132
Eigenvalues/SS loadings	3.361	2.402
Proportion Variation	0.280	0.200
Cumulative Variation	0.280	0.480

Regression Results

The results from estimating a nominal logistic regression model to predict volunteer affiliation with either the CBO or ENPO are summarized in Table 5.3. The "target" organization specified for the analysis was the CBO—thus, positive coefficients suggest that CBO volunteers tend to have higher values of relevant independent variables, while negative coefficients say that higher attribute values are more likely to come from ENPO

participants. Because I was relatively agnostic about the relationships between control variables and membership (Appendix Table A2), the principal finding of interest is that both motivational variables are statistically significant and, as expanded on in the next section, take on the expected relationships with the dependent variable. Prior to moving on, however, note that several of the findings related to control variables are consistent with both anecdotal knowledge of each organization, as well as with the summary statistics presented in Table 5.1.

With respect to diagnostics, the regression model achieved a pseudo-R^2 value of 0.73. Based on these results, the model appears to be a good fit.

Table 5.3. Nominal logistic regression results

Term	Estimate	Std Error	p-value
Intercept	1.1462	3.7822	0.7619
Group size [alone]	-2.1741	1.2858	0.0909
Group size [medium to large]	2.7630	1.3893	0.0467*
Group size [small group (3-5)]	5.4437	1.4692	0.0002***
Maintain volunteer rate [likely]	-3.8045	1.1532	0.0010*
Maintain volunteer rate [neither likely nor unlikely]	0.7031	1.1338	0.5352
Increase volunteer rate [likely]	1.5862	0.7550	0.0356*
Increase volunteer rate [neither likely nor unlikely]	-2.5512	1.0649	0.0166*
Decrease volunteer rate [likely]	2.0351	1.5432	0.1873
Decrease volunteer rate [neither likely nor unlikely]	-0.2238	1.0108	0.8247
Likely to encourage others to volunteer [no(0)]	3.7365	1.3486	0.0056*
Willing to volunteer in unfavorable weather	1.1952	1.2197	0.3271
Desires sequential training	0.6640	0.6611	0.3152
Desires recognition for training	-0.2778	0.5950	0.6405
Desires recognition for volunteerism	-1.4093	0.9126	0.1225
Certificate of appreciation [important]	-1.7593	1.2227	0.1502
Certificate of appreciation [moderately important]	-1.1002	0.7926	0.1651
Engages in environmental discussions [did prior to involvement]	-3.6472	1.2500	0.0035*
Engages in environmental discussions [no – do not do this]	2.2655	1.5339	0.1397
Signs environmental petitions [did prior to involvement]	-0.1072	0.7441	0.8854
Signs environmental petitions [no – do not do this]	-1.2084	0.9495	0.2031
Length of time a volunteer [1 to 3 years]	-0.1319	0.7213	0.8549
Length of time a volunteer [1 year or less]	0.9858	0.8468	0.2444
Length of time a volunteer [3 to 5 years]	-1.1738	1.0357	0.2571

Term	Estimate	Std Error	p-value
Gender [female]	-1.2777	0.5310	0.0161*
Race [nonwhite]	-1.8225	1.0944	0.0959
Age [18 - 24]	-4.1225	2.0207	0.0413*
Age [25 - 34]	-0.0191	1.3176	0.9884
Age [35 - 44]	1.7217	0.9959	0.0838
Age [45 - 54]	-0.4707	1.1580	0.6844
Age [55 - 64]	-0.0663	0.9196	0.9425
Affluent – High household income [0]	1.2588	0.6362	0.0479*
Factor 1 (micro-motivations)	3.1008	0.9615	0.0013*
Factor 2 (macro-motivations)	-2.0442	0.8314	0.0139*
Political [conservative]	-0.9965	0.9714	0.3050
Political [liberal]	1.8532	0.9386	0.0483*
Understands how watersheds affect water quality [no(0)]	1.1796	0.6723	0.0793
R	0.7270		
AICc	153.52		
BIC	252.878		
Sample Size / Number of Observations	183		

Flags for statistical significance in Table 5.3 identify the variables that ostensibly have value for distinguishing between CBO and ENPO members in the sample, holding all else constant. For example, the positive, significant coefficients in Table 5.3 appear to suggest that CBO volunteers, relative to ENPO volunteers, tend to: hold micro-motivations (p=0.0013), prefer a group setting of small (p=0.0002) or medium (p=0.0467), want to increase their amount of volunteer time (p=0.0356), be disinclined to encourage others to volunteer (p=0.0056), report lower incomes (p=0.0479), and identify as politically liberal (p=0.0483). The ENPO volunteers, by comparison, tend to: hold macro-motivations (p=0.0139), wish to maintain their same rates of volunteering (p=0.0010), report engaging in environmental discussions before getting involved with the ENPO (p=0.0035), and identify as female (p=0.0161). ENPO volunteers were also more likely to come from younger age groups (18-24 years of age) than CBO volunteers (p=0.0413).

Discussion

As hypothesized, exploratory factor analysis (EFA) revealed a fault line in volunteer responses that divided stewardship motivations into two main (scalar) categories, which were labeled macro- and micro-motives. Also as expected, after controlling for a wide range of personal attributes, the scale of volunteer motivation (micro- v. macro-) was a significant predictor of organizational affiliation. Indeed, the results supported the supposition that environmental stewardship (ES) is likely characterized by a process of scale matching, whereby volunteers with relatively strong *micro*-motivations are more likely to seek out *fine*- (*micro*-) scale community-based organizations (CBOs); and volunteers with stronger *macro*-motivations tend to seek out *broad*- (*macro*-) scale environmental nonprofit organizations (ENPOs). Core findings are discussed below.

The first well-determined factor extracted in the EFA related to macro-motivations. The indicators that loaded onto this factor dealt with helping the environment and one's community, as well as a desire to learn new skills and get outside and connect with nature. These *Values* and *Understanding* based motivations, as argued above, are related to a demand for broad societal change that creates long-term transformative shifts in mainstream society's environmental values and behaviors. Volunteers motivated primarily by these demands use ES as a means to express their Values and practice their humanitarian concern for others (Clary et al., 1999), rather than to realize immediate, transactional gains. As such, volunteers are likely to flow disproportionately to broader, better funded and larger reaching ENPOs, where they refine their *Understanding* of environmental problems and seek to learn and participate in solutions to social and environmental problems that transcend boundaries (Figure 5.1).

The second factor extracted in the EFA was interpreted as micro-motivations. Indicators that loaded onto this factor included local community engagement (e.g., via meeting and interacting with people), learning and sharing knowledge with others, spending time with family and friends, and being physically active and having fun. These actions often lead to self-improvement through strengthening community bonds and producing emotions such as joy from having fun and being active. In other words, volunteers who engage in these actions and experience these emotions receive instrumental and immediate benefits from participation in stewardship. That is, even though they volunteer to help advance a cause and/or effect change, volunteering is more personal and local for stewards with comparatively strong micro-motivations – it is less about broad-scale social transformation.

The notion that personal and tightly conscripted community benefits motivate some volunteers is consistent with the concept of affective labor. For example, Foster (2018) conducted a qualitative study of ES in the city of Philadelphia and found that, through volunteerism, participants formed attachments to their neighborhood (place), fellow volunteers (community), and nonhuman others (natural areas, abiotic features, and nonhuman species). Foster observed that participation in ES formed intense emotional attachments through *affective labor*, defined as engagement that "produces or manipulates affects such as a feeling of ease, well-being, satisfaction, excitement or passion" (Hardt & Negri 2004, p. 108) and creates "a sense of connectedness or community" (Hardt, 1999, p. 96, quoted in Foster, 2018). Through this lens, voluntary stewardship in one's own community is arguably "a means to build local identity, turning … strangers into a community" (Sommer, 2003, p. 182). Scholars contend that this sense

of connectedness or community is s a strong (micro-)motivation that is essential to sustaining participation (Foster, 2018; Fisher et al., 2011; Measham & Barnett, 2008; Neeves, 2009). Put another way, for some, all volunteering is local—such that stewardship is anchored in a specific place (Bennett et al., 2018), and related to volunteer functions of Social and Enhancement (Clary et al., 1999). As argued in this Chapter, these micro-scale motivations are better "matched" to the operational scale of CBOs, which work to protect local assets build local communities, as opposed to ENPOs that work across spatial boundaries (Figure 5.1).

The patterns of scale-matching described above were borne out in the study as expected. Regression results revealed a probable systematic link between spatial/operational scale of an organization (local CBO v. broader ENPO) and the motivational scale of the individual volunteer. After controlling for a wide range of variables, the factors representing micro- and macro-motivations were strongly associated with organizational affiliation in the hypothesized directions: stronger macro-motives predicted ENPO affiliation, while strong micro-motives predicted CBO affiliation (Table 5.3).

Overall, then, the analysis supports the notion that volunteers are likely to self-sort into stewardship organizations through a process that resembles scale-matching: those volunteers with a greater demand for near-term gratification tend toward CBOs, while volunteers seeking longer-term transformative change, on average, gravitate toward ENPOs (Figure 5.1). Evidence for this type of sorting arguably helps to explain how the "First Law of Environmental Stewardship" (Chapter III) arises. Explicitly, the results revealed that stewards from the sample shared many socioeconomic and demographic

characteristics. For instance, volunteers from both partner organizations were overwhelmingly white college graduates, a majority of whom held liberal political outlooks and lived in households with annual incomes at or above $80,000 (Table 5.1). Despite these similarities ("all stewards are related"), however, volunteers were more alike within organizations than between them in this study. As the ways in which the scale of volunteer motivations differed for stewards at the two organizations have already been detailed, some of the notable between-organization differences in control variables are discussed.

First, volunteers exhibited differences in preferred group size. CBO stewards, on average, expressed a preference for more intimate social settings, whereas working alone was preferred more in ENPO volunteers. These findings are highly consistent with the idea that stewards who are motivated by desires to socialize and interact with family and friends want to engage in personally rewarding community-building experiences. Next, plausibly due to their social/micro-motivations and subsequent attachments to place and community (Fosters, 2018; Sommer, 2003; Neeves, 2009; Ryan, 2005), CBO volunteers were also more likely than ENPO volunteers to report that they intend to increase the amount of time they commit to volunteering. Moreover, such volunteers were not likely to recommend volunteering to others. Taken together, these two findings suggest that CBO volunteers may want to socialize more, but with the same small community or group. That is, they may be reluctant to invite potential "outsiders" to their place-based organization. Such a finding has previously been established in the literature. Milton, for example, found that environmental volunteers cultivate "a love or enjoyment of nature [that] is often invoked to define a boundary ... establishing an emotionally united

community of insiders" (Milton, 2002, p. 56). As such, this "community of insiders" may be what is desired by the CBO volunteers: a tight, dense social network that works in a place to protect an asset that is *theirs* (Figure 5.1).

Lastly, relative to ENPO volunteers, CBO stewards were, on average, (1) less affluent and (2) more liberal. Many other studies have found environmental volunteers to be affluent and liberal (Johnson et al., 2018; Fisher et al., 2015). Although CBO volunteers from the sample were "less" affluent than ENPO volunteers, 45% reported incomes in the range of $30,000-79,999 (Table A2). Their "lower income" could be explained by age and status as retired, as 37% of CBO volunteers were over 65, compared to only 22% of ENPO volunteers in this age category (Table 5.1).

On the other side, ENPO volunteers were more likely than CBO volunteers to say that they will maintain their rate of volunteerism. Such a finding corroborates the hypothesis that ENPO volunteers are driven by a desire for long-term, transformational change and, as such, are "in it" for the long haul. By expressing a willingness to maintain their rate of volunteerism into the future, there is some evidence that ENPO stewards do not expect short-term gains from their participation, perhaps other than learning new skills. Along this same line, the ENPO members were more likely to be engaged in environmental discussions prior to their involvement with the organization. It can be assumed that this population of volunteers already had knowledge of and was concerned with environmental issues to the point of discussion and subsequent action (volunteerism) to attempt to remedy the issues which they can through collective efficacy at the ENPO. Again, Values and Understanding emerge as major functions as they are attracted to an organization that can provide such (wide-spread environmental) transformative changes

through understanding and environmental education (Figure 5.1).

Finally, ENPO volunteers were more likely than CBO volunteers to identify as female, and the former were younger (in 18-24 age range) (Tables 5.1 and 5.3). Generally speaking, women volunteer more than men (Simmons & Emanuele, 2007), and often at a younger age – whereas men volunteer more when they are older (Wilson, 2000). In this case, younger persons may be more inclined to volunteer on behalf of systemic environmental issues because they have been raised in an environment of heightened social awareness (e.g., the celebration of Earth Day, climate change and sustainability curricula, etc. [see McDougle, Greenspace, & Handy, 2011]). Drawing on findings by Rehberg (2005), the link between youth and ENPO volunteerism in the sample might corroborate emerging evidence that younger generations are currently more likely to demand—and want to participate in—campaigns for structural and systems change in society.

Taken together, the framework and results suggest that ES motivations may fall into at least two distinct (scalar) categories: micro- and macro-motivations. Identifying which of these two forces is stronger for a given volunteer appears to have at least some utility for predicting whether that person is more likely to join a local-scale CBO (micro-motivations are dominant) or a broader-scale ENPO (macro-motivations are dominant). Further investigation revealed interesting relationships between personal characteristics and which of the motivational categories tended to take on more importance for volunteers. For instance, stewards wishing to partake in the instrumental gains that come from socialization and local, place-based improvements tended to be older and less likely to invite others to engage in volunteerism at their CBO.

Stewards more interested in the long-term, transformative potential of learning about solutions to persistent social-environmental problems were younger and reported more resolve in maintaining their volunteerism. At bottom, stewards from both organizations expressed a strong desire to help the environment, and they shared several demographic and socioeconomic attributes. In these respects, they were alike. But, as argued to this point, they exhibited between-organization differences that cannot be explained by chance alone. Rather, it appears that the distinctive spatial scale(s) at which organizations operate to act as signals to prospective volunteers, who in turn match the scale of their dominant motivations (micro-/short-term v. macro-/long-term) to the menu of available organizations. The upshot for practice is that organizations wishing to *scale up* and *scale out* (i.e., expand and diversify; see Moore et al., 2015) should actively seek to blend community-scale actions that result in the immediate, instrumental gains with broader-scale actions that work towards long-term, transformational change, thus becoming "hybrid organizations" (Engler & Engler, 2017). In this manner, organizations signal to both the micro- and macro-motivated that the organization can deliver a quality experience that fulfills their unique individual desires (Shirk et al., 2012), creating the potential for an organization to maintain a large, dynamic volunteer pool and achieve multi-scale objectives.

Conclusions and Limitations

Evidence that volunteer motivations collapse into two main scalar dimensions—micro and macro—and that this motivational scale is a significant predictor of the type of organization at which one volunteers (fine-scale CBO or broad-scale ENPO) support the emerging "First Law of Environmental Stewardship" from Chapter III. Results show that

all environmental stewards from the sample shared certain overarching motivations; but stewards' motivations, and several personal attributes, were more alike within organizations than between organizations. The specific patterns uncovered might be described as a scale-matching process. Volunteers whose micro-motivations were stronger than macro-motivations were more likely to participate in the fine-scale CBO, and *mutatis mutandis* for ENPO volunteers. This finding indicates a systematic link may exist between volunteers' motivations and the spatial/operational scale of an organization suggests that, should they want to grow and diversify their volunteer bases, environmental organizations might find value in becoming explicitly and deliberately multi-scalar. That is, organizations may wish to experiment with ways for linking local, place-based actions that provide participants volunteers with meaningful instrumental gains in the here-and-now, to broader campaigns for transformational social change. These types of "hybrid organizations" arguably have the potential to deliver not only tangible victories in the present – they can also reimagine and build a more sustainable and just future (Engler & Engler, 2017).

While the study supported the conceptual framework put forward in Figure 5.1, the research was conducted from a community geography perspective and was not designed exclusively to study how scale influences ES. Therefore, the data were limited in two ways: (1) one of each type of organization was examined and (2) overall small sample size. This limitation is reflected in the lack of ability to conduct a "training set" to check for cross-validation in the nominal logistic regression. With survey data of a relatively small sample, it becomes difficult to perform this procedure with respect to the many independent variables used in this study's model. Nonetheless, it is acceptable in

social science research to perform analysis on a full set of survey responses (Kelley et al., 2003).

In that sense, future work might experiment with alternative research designs to study volunteer sorting processes. Likewise, consistent with the community geography ethos, the survey instruments were created and modified in collaboration with community partners. As such, there were only a handful of items that were in the same form and with the same options, when surveying participants at the two institutions. Researchers who approach this topic from a different vantage point may find value in administering a single survey instrument to members from multiple organizations.

Along those lines, future studies should strive to include more organizations that operate at multiple (e.g., community-, city-, regional-, state-, global-) spatial scales and use more spatially explicit survey items (e.g., "I want to help [my local] community" or "I want to help [my local] environment" other new statements could be created as well, for example: "I want to address the environmental issue of [clean water]" or "I want to address the [urban heat island effect] in my city"). In spite of these limitations, this study revealed a likely systematic link between spatial/operational scale of an organization and the motivational scale of the individual volunteer.

VI. CONCLUSION

The purpose of this dissertation was to explore environmental stewardship (ES) via a community geography (CG) approach and add to the knowledgebase on the role of scale and place in attracting environmental stewards to different types of environmental organizations. Toward those ends, I proposed and found evidence to support an emerging "First Law of Environmental Stewardship." I then uncovered evidence of a scale-matching process in ES participation, whereby stronger micro-motivations (i.e., motivations guided by a demand for instrumental changes in one's life or community) are linked to volunteering with community-based organizations; and stronger macro-motivations (i.e., motivations guided by a desire for transformational changes in culture and society) are likely to be associated with volunteering at broader-scale environmental nonprofit organizations.

By drawing on fundamental geographic concepts of scale and place, my research offers new insights into how stewards self-sort and mobilize, after accounting for their personal characteristics. In addition to these contributions, the dissertation also provided two community partners with comprehensive survey data and reports to aid in their respective objectives (Appendix C). In this concluding chapter, I summarize the research in terms of the outcomes with the (1) community geography approach and (2) theoretical contributions and discuss limitations and future research directions.

Community Geography

Community geography seeks to affect positive community change through community-university research collaborations that empower community partners (Robinson, 2010). One of the goals of this dissertation was to use community geography

to understand and potentially strengthen environmental stewardship (ES) practices. A total of four surveys were administered on behalf of two community partners. Community partners received detailed reports in winter 2019. The original intent and research plan included evaluations of the research partnership to see if the results were implemented in such a way that benefited the organization. This qualitative evaluation was projected to occur in Summer 2020. As the "Great Pause" began in mid-March 2020 because of the COVID-19 pandemic, these evaluations did not occur. Texas Stream Team (TST) switched to "survival mode" by translating to digital content and virtual events when possible. Some watershed groups also suspended water quality monitoring due to the sharing of testing kits. The San Marcos Greenbelt Alliance (SMGA) stopped holding trail crew volunteer days and have been functioning with only limited volunteers and focusing on maintenance. In brief, neither organization was in a position to consider strategies for volunteer recruitment and retainment at this time. However, one community partner, TST provided some specific comments on how the reports help. First, the survey helped "narrow down the main hurdles" to volunteers' inactivity, which included: lack of time, moved to another location, or lack of subgroup support. Second, the results also highlighted the need to discuss incentives for participation and the need for different types of recognition. Lastly, results show issues of diversity among participants, a concern of which TST was already aware.

As discussed in the Introduction and Background chapters, community geography partnerships are not without their struggles. The most challenging aspect of the two partnerships for this dissertation was the creation and administration of the survey instruments. Each organization eventually required two surveys to satisfy its objectives.

TST wanted to understand their volunteers (individual citizen scientists) and their partner organizations (watershed subgroups that were operated by other nonprofit organizations and city entities). Thus, two surveys were created to capture samples of both. The first survey, for citizen scientist volunteers, was informed by the literature and modified by TST staff mostly in terms of language and specific questions (for example, "are you aware of the Dataviewer?"). It was originally decided that TST staff would administer the surveys by supplying a link in their newsletter; but after only a 1% response rate, the partner and I agreed that I should send the survey out via email using Qualtrics. The second survey was to understand the partner organizations' needs and what, if any, resources are available to them. TST staff constructed this questionnaire and, after finding the Qualtrics email distribution method more successful, I handled the distribution of the partner survey.

The second community partner, SMGA wanted to understand why people volunteer and attempt to capture potential volunteers. Like the TST citizen science survey, I constructed basic questions informed by the literature that were then modified by SMGA. SMGA also added their specific questions, such as asking what public parks volunteers had visited (e.g., state and national parks). From the onset, it was decided that I would use their volunteer email distribution list and Qualtrics to administer the survey. One volunteer SMGA member, in an attempt to help disseminate the survey, forwarded the unique link he received via Qualtrics. This led to mass confusion and many people receiving an error, as the link was intended for one-time use. The second survey was a short questionnaire meant to capture those who had the potential or interest to volunteer but had not participated yet. Here, SMGA wanted to use their social media accounts

(Facebook and Instagram) to survey those "followers" who may already have an interest in the organization but have not fully recognized it. The questionnaire was created by SMGA and me. I created it in Google Forms, and SMGA communications manager posted the questionnaire regularly on their social media accounts. Given my experience detailed above, I recommend creating a data collection plan and communicating the process, as well as individual's roles, to the entire organization when conducting a community geography project.

A secondary challenge was time. As detailed in the introduction, participatory action research (PAR) and community geography projects typically hit a time limit and a proper evaluation cannot be conducted. Although this dissertation research plan included time for a short-term evaluation of the collaboration, more time is needed to determine any positive changes that came about due to the collaboration. With the onset of COVID-19, it is unknown the length of time needed to properly evaluate the outcomes. Both partner organizations would need to first return to normal operation, then if they have the capacity, implement changes based on the data. This could be a few years down the road. Because Texas State University does not (yet) have a community geography program, the length of time needed is not available to follow the collaborative research through all stages of the PAR approach (Table 1.1).

A final contribution from the combination of community geography and environmental stewardship is the ability to use adaptive management to improve efforts of environmental stewardship (Lopez, 2020). Adaptive management, a concept widely applicable to various fields of academic and nonacademic study, calls for the iterative approach to managing a resource and creating best management practices based on

monitoring and adaption, usually in collaboration with multiple groups (Holling, 1978; Sheppard et al., 2017). A barrier to adaptive management, or any other method of evaluation, for environmental nonprofit organizations, is that such organizations tend to be small, poorly-funded and "often lack access to the research capacity, funding, or tools needed to evaluate scientifically the environmental effectiveness of the measures they undertake" (Close et al., 2016, p. 1). As described in this dissertation, a promising and mutually beneficial line of ES research involves forming partnerships or collaborations between environmental nonprofit organizations and researchers at universities (Silva & Krasny, 2016)—or *community geography* partnerships.

Theoretical Contributions

The first study presented in this dissertation (Chapter III) analyzed data from volunteers with two community partner organizations. Consistent with conventional wisdom in the ES literature, volunteers in both organizations were relatively affluent, well-educated, and disproportionately identified as white. Yet, I uncovered meaningful between-organization differences in the (1) sociodemographic characteristics, (2) motivations, and (3) preferences of volunteers at the CBO and ENPO. Put another way, the findings supported an overarching hypothesis: that all stewards are related (by their desire to enhance the environment and help their communities), but stewards in the same organization are more related than stewards in different organizations. This "First Law of Environmental Stewardship" was animated by CBO volunteers who seem to be more motivated than their ENPO counterparts by place, community, action, and comradery; and ENPO volunteers who were more motivated by networking, knowledge, and power. However, volunteers from both organizations shared basic desires to improve the

environment and their communities. In addition to supporting the chapter's big picture alternative hypothesis, the findings also exposed some of the nuances of environmental volunteerism by highlighting connections between personal motivations, geographic scale, and organization type.

The second study, Chapter IV, assessed changes in the environmental behaviors of environmental stewards with both community partner organizations. I found that participation in ES was linked to various types of increases in pro-environmental behaviors for respondents from both partner organizations. This empirical evidence is consistent with the idea that ES plausibly exists in a self-reinforcing system of pro-environmental behaviors. That is, ES can create more well-rounded pro-environmental actors. Such an implication speaks to the important role that environmental nonprofits play in cultivating environmental citizenship. By documenting that role for two collaborating institutions, the findings served a further purpose that is essential to the spirit of community geography: each partner organization was provided empirical evidence of program impacts and efficacy. That evidence is available for the partners to use in annual reports, funding applications, and promotional material—and it served as the basis for custom, partner-specific volunteer recruitment and retention action plans in the future (Appendix C).

To date, relatively little research has focused on the outcomes of participating in ES. As such, this study made a noteworthy contribution by finding that ES—as practiced at environmental community-based and nonprofit organizations—can lead to greater uptake in selected pro-environment actions, higher awareness of environmental issues, and a greater appreciation for natural amenities. ES programs have spillover effects and

outcomes that deliver social benefits beyond what the individual ES program intended. This is an important measure of "frontloading," which may be an objective of a large environmental nonprofit organization, as discussed in Chapter V.

More specifically, Chapter V found evidence that environmental stewards' motivations collapsed into two main scalar dimensions—micro and macro—and that this motivational scale is a significant predictor of the type of organization at which one volunteers (fine-scale CBO or broad-scale ENPO). This finding strengthens the case for an emerging "First Law of Environmental Stewardship" from Chapter III. Namely, I uncovered patterns of a process that might be described as a sort of scale-matching. Volunteers whose micro-motivations were stronger than macro-motivations were more likely to be found in the volunteer pool of the fine-scale CBO, and *mutatis mutandis* for ENPO volunteers. This systematic link between volunteers' motivations and the spatial/operational scale of an organization suggests that, should organizations want to grow and diversify their volunteer bases, they might find value in becoming explicitly and deliberately multi-scalar. That is, organizations should experiment with ways for linking local, place-based actions that provide volunteers with meaningful instrumental gains in the here-and-now, to broader campaigns for transformational social change.

Along those lines, future studies should strive to include more organizations that operate at multiple (e.g., community-, city-, regional-, state-, global-) spatial scales and use more spatially explicit survey items (e.g., "I want to help [my] community" or "I want to help [my local] environment" other new statements could be created as well, for example: "I want to address the environmental issue of [clean water]" or "I want to address the [urban heat island effect] in my city"). Still, this study revealed a systematic

link between spatial/operational scale of an organization and the motivational scale of the individual volunteer.

In addition to the aforementioned contributions to ES scholarship, this dissertation provided empirical findings and technical reports for two community partners. What is more, the dissertation's coupling of ES with community geography highlights the potential of working in direct collaboration with frontline ES organizations in future research, to produce new—and, crucially, *actionable*—knowledge on why stewards steward, and how we might motivate more people to become stewards. Similarly, continuing to bring fundamental geographic concepts like place and scale to bear on ES studies will enhance our understanding of how voluntary stewardship is not merely an individual choice; but a collective action that plays out in different ways, with varying degrees of intensity and commitment, in different spatial and temporal contexts.

APPENDIX SECTION

APPENDIX A – CHAPTER V TABLES

Table A1. Motivation variables descriptive statistics

Survey Statement	Short Description	CBO Mean (Median)	ENPO Mean (Median)	Aggregate Mean (Median)
I want to help or enhance the environment.	Help the environment	4.74 (5)	4.87 (5)	4.83 (5)
I want to help the community.	Help the community	4.72 (5)	4.79 (5)	4.77 (5)
I want to learn new skills or gain hands-on knowledge.	Learn new skills/knowledge	4.26 (4)	4.61 (5)	4.50 (5)
I want to socialize.	Socialize	4.17 (4)	2.9 (3)	3.30 (3)
I want to get outside and connect with nature.	Get outside and connect	4.75 (5)	4.63 (5)	4.67 (5)
I want to do something physically active.	Be physically active	4.45 (5)	4.12 (4)	4.22 (5)
I want to have fun.	Have fun	4.32 (5)	4.10 (4)	4.17 (4)
I want to meet new people.	Meet new people	3.63 (4)	3.10 (3)	3.26 (3)
I want to interact with like-minded people.	Interact with people	3.80 (4)	3.69 (4)	3.73 (4)
I want to spend time with family or friends.	Spend time with social network	3.44 (4)	3.22 (3)	3.29 (3)
I like learning from others with more experience	Learn from experienced others	3.85 (4)	4.17 (5)	4.06 (4)
I like sharing my experiences, knowledge, or expertise with others.	Share my experience/knowledge	3.66 (4)	3.93 (4)	3.85 (4)

Table A2. Regression model variable descriptions

Variable name	**Description**	**Categories**	**Predominant Category / Mean [median] (sd) for CBO**	**Predominant Category / Mean [median] (sd) for ENPO**
Group Size	Number of people present at ES event	○ Alone ○ With a partner	Small group (53%)	With a partner (41%)

		○ Small group (3-5) ○ Medium to large group (10+)		
Factor 1	Micro-motivations	n/a	0.22 [0.35] (0.63)	-0.09 [0.02] (1.06)
Maintain volunteer rate	Maintain rate of volunteerism	Likert – Scale: (1) unlikely (2) neutral (3) likely	Likely (69%)	Likely (80%)
Encourage others to volunteer	Encourage and recommend volunteering to others	Likert – Scale: (1) unlikely (2) neutral (3) likely	Likely (88%)	Likely (89%)
Engages in environmental discussions	*Measures before and after changes:* Speak with friends and family about environmental issues/concerns	No, I do not do this. I did this prior. Yes, I now do this	I did this prior (48%)	I did this prior (67%)
Factor 2	Macro-motivations	n/a	-0.23 [0.25] (1.37)	0.10 [0.45] (0.88)
Certificate of Appreciation	Important to receive a certificate of appreciation for volunteerism	Likert – Scale: (1) not important at all (2) moderately important (3) important	Not important at all (62%)	Moderately important (49%)
Gender	self-reported gender; binary	○ Female ○ Male	Male (54%)	Female (61%)
Increase volunteer rate	Increase rate of volunteerism	Likert – Scale: (1) unlikely (2) neutral (3) likely	Likely (68%)	Likely (59%)
Affluent – High household income	Household Income per year	○ Less than $30,000 ○ $30,000 - $79,999 ○ $80,000 +	$30,000 - $79,999 (45%)	$30,000 - $79,999 (41%) $80,000 + (41%)

Understands how watersheds affect water quality [no(0)]	*Measures before and after changes:* Understand that watershed health affects water quality	No, I do not understand this. I understood this prior. Yes, I now understand this	I understood this prior. (59%)	I understood this prior to involvement. (54%)
Race	Self-reported race; collapsed to two	○ White ○ Nonwhite	White (93%)	White (84%)
Age	Select category that best describes age range	○ 18-24 ○ 25-34 ○ 35-44 ○ 45-54 ○ 55-64 ○ 65+	65+ (37%) 55-64 (20%)	55-64 (24%) 65+ (22%)
Decrease volunteer rate	Decrease rate of volunteerism	Likert – Scale: (1) unlikely (2) neutral (3) likely	Unlikely (61%)	Unlikely (61%)
Political	Political views	○ Liberal ○ Moderate ○ Conservative	Liberal (76%)	Liberal (58%)
Desires recognition for volunteerism	Importance of recognition for volunteerism (work)	Likert – Scale: (1) disagree (2) somewhat disagree (3) neutral (4) somewhat agree (5) agree	Somewhat disagree (39%)	Neutral – either agree nor disagree (51%)
Desires sequential training	Would like additional training	Likert – Scale: (1) disagree (2) somewhat disagree (3) neutral (4) somewhat agree (5) agree	Somewhat agree (60%)	Somewhat agree (53%)
Signs environmental petitions	*Measures before and after changes:* Signs petitions and	No, I do not understand this. I understood this prior.	I did this prior. (42%)	I did this prior. (47%)

	writes letters(?) about environmental issues/concerns	Yes, I now understand this		
Willing to volunteer in unfavorable weather	Likely to complete an outdoor task in unfavorable weather	Likert – Scale: (1) unlikely (2) neutral (3) likely	Likely (67%)	Likely (65%)
Length of time a volunteer	How long a volunteer (years)	o 1 year or less o 1 to 3 years o 3 to 5 years o 5 years or more	5 years or more (35%)	1 to 3 years (38%)
Desires recognition for training	Desires recognition for training	Likert – Scale: (1) disagree (2) somewhat disagree (3) neutral (4) somewhat agree (5) agree	Neutral (34%) Somewhat agree (32%)	Neutral (32%) Somewhat agree (31%)

Appendix B –Survey Instruments

Texas Stream Team Surveys

Understanding Volunteer Motivations - Texas Stream Team

Welcome to the Texas Stream Team Citizen Scientist survey!

Christina Lopez, a graduate student at Texas State University, is conducting a research study to environmental stewardship.
You are being asked to complete this survey because of your participation with an environmental stewardship organization.
Participation is voluntary. The survey will take approximately 10 minutes or less to complete. You must be at least 18 years old to take this survey.
We ask that you try to answer all questions; however, if there are any items that make you uncomfortable or that you would prefer to skip, please leave the answer blank. Your responses are anonymous and confidential.
By participating in this study, you will be assisting a collaborative team of researchers and nonprofit leaders in their efforts to better understand motivations of environmental stewardship, so that they may better capture

and retain volunteers, build organizational capacity, and continue to make positive environmental impacts.
Any identifiable information obtained in connection with this study will remain confidential and will be disclosed only with your permission or as required by law. The members of the research team, the funding agency, and the Texas State University Office of Research Compliance (ORC) may access the data. The ORC monitors research studies to protect the rights and welfare of research participants.
Your name will not be used in any written reports or publications which result from this research. Data will be kept for three years (per federal regulations) after the study is completed and then destroyed.
If you elect to participate in this survey, you can be entered to win one of two $25 Amazon gift cards.

If you have any questions or concerns, feel free to contact Christina Lopez or her faculty advisor: Christina Lopez, PhD Student, Department of Geography, cwr41@txstate.edu, 512.245.0325 Russell Weaver, Professor, Department of Geography, rcweaver@txstate.edu, 512.245.3903 This project 6440 was approved by the Texas State IRB on May 13, 2019. Pertinent questions or concerns about the research, research participants' rights, and/or research-related injuries to participants should be directed to the IRB chair, Dr. Denise Gobert 512-716-2652 – (dgobert@txstate.edu) or to Monica Gonzales, IRB Regulatory Manager 512-245-2334 - (meg201@txstate.edu).
If you would prefer not to participate, please do not fill out a survey. If you consent to participate, please complete the survey.

Please note that this survey will be best displayed on a laptop or desktop computer. Some features may be less compatible for use on a mobile device.

○ I consent, begin the study (1)

○ I do not consent, I do not wish to participate (2)

End of Block: Informed Consent

Start of Block: Volunteer Status

What is your current status as a citizen scientist volunteer?

- ○ Active (1)
- ○ Limited activity (2)
- ○ Inactive but plan to start monitoring again (3)
- ○ Inactive (please state why) (4)

_____

If you are active, how often do you monitor?

- ○ Once a week (1)
- ○ Once a month (2)
- ○ Every other month (3)
- ○ Once a quarter (4)
- ○ Twice a year (5)
- ○ Once a year (6)

How would you describe your monitoring site?

- ○ Accessible to the public (1)
- ○ On private property (2)
- ○ Not highly accessible but still on public property (3)

Have you heard of the Community Forum? Accessible here: https://tstcommunity.org/

- ○ Yes (1)
- ○ No (2)

Are you satisfied with the Community Forum? If not, please explain.

_____

End of Block: Volunteer Status

Start of Block: Volunteer Preferences

Do you prefer to perform tasks in a group or alone? Choose the option that best fits your most frequent choice.

- ○ Alone (1)
- ○ With a partner (2)
- ○ Small group (3-5) (3)
- ○ Medium group (6-10) (4)
- ○ Large group (10 or more) (5)
- ○ Large event (50+) (6)

How did you obtain your current Texas Stream Team kit?

- ○ Purchased my own (1)
- ○ From group leader (2)
- ○ Loaned from Texas Stream Team (3)

How satisfied are you when it comes to the process of accessing a test kit?

- ○ Extremely satisfied (1)
- ○ Somewhat satisfied (2)
- ○ Neither satisfied nor dissatisfied (3)
- ○ Somewhat dissatisfied (4)
- ○ Extremely dissatisfied (5)

In the future, how likely are you to ....

	Extremely likely (1)	Somewhat likely (2)	Neither likely nor unlikely (3)	Somewhat unlikely (4)	Extremely unlikely (5)
Continue volunteering at the same rate? (1)	○	○	○	○	○
Increase the amount of time you spend volunteering? (2)	○	○	○	○	○
Decrease the amount of time you spend volunteering? (3)	○	○	○	○	○
Recommend volunteering to others? (4)	○	○	○	○	○

Please indicate your level of agreement with the following statements about

how Texas Stream Team uses data collected by citizen scientist volunteers.

	Agree (1)	Somewhat agree (2)	Neither agree nor disagree (3)	Somewhat disagree (4)	Disagree (5)
The data collected for this project is used appropriately. (1)	○	○	○	○	○
I think the data collected are not being used to their full potential. (2)	○	○	○	○	○
It is important to me that our data are used for scientific publications. (3)	○	○	○	○	○
I like when data and/or results are shared with me. (4)	○	○	○	○	○
I like when environmental problems are addressed because of our data. (5)	○	○	○	○	○

How likely are you to monitor if the weather is unfavorable?

- ○ Extremely likely (1)
- ○ Somewhat likely (2)
- ○ Neither likely nor unlikely (3)
- ○ Somewhat unlikely (4)
- ○ Extremely unlikely (5)

Please indicate your level of agreement with the following statements.

I like "one-time" training events in order to participate. (1)	▼ Strongly agree (1) ... Strongly disagree (7)
I like to complete sequential training activities to increase my level of expertise. (2)	▼ Strongly agree (1) ... Strongly disagree (7)
I like to earn recognition or a reward for completing training activities, such as a rank for my expertise level or special event. (3)	▼ Strongly agree (1) ... Strongly disagree (7)
Opportunities for my role to grow or advance are important to me. (4)	▼ Strongly agree (1) ... Strongly disagree (7)
I feel that the staff would support me if I wanted to deepen my level of participation. (5)	▼ Strongly agree (1) ... Strongly disagree (7)

Which training or Texas Stream Team citizen scientist program/watershed

service do you want to see in your region? Please select all that apply.

- ☐ Watershed Characterization (1)
- ☐ Professional water quality monitoring (2)
- ☐ Watershed Protection Plan (WPP) development (3)
- ☐ Community outreach (4)
- ☐ Sustainable development consultations (5)
- ☐ Probe Core Water Quality Citizen Scientist Training (6)
- ☐ Advanced Water Quality Citizen Scientist Training (7)
- ☐ Riparian Evaluation Citizen Scientist Training (8)
- ☐ Macroinvertebrate Bioassessment Citizen Scientist Training (9)
- ☐ Educational events (10)
- ☐ Other (please specify) (11) _____

Would you be interested in a Quality Control Check refresher course?

- ○ Yes (1)
- ○ No (2)

What other water quality parameters would you like to see included? Please select all that apply.

- ☐ Parameters of emerging concern (1)
- ☐ Additional bacteria tests (2)
- ☐ Microplastics (3)
- ☐ Pharmaceuticals (4)
- ☐ Other: (5) _____

It is important to me to receive some form of recognition or appreciation for my work.

- ○ Agree (1)
- ○ Neutral (2)
- ○ Disagree (3)

	Extremely important (1)	Very importa nt (2)	Moderately important (3)	Slightly importa nt (4)	Not at all importan t (5)
Hand-written card (1)	○	○	○	○	○
Personalized email (2)	○	○	○	○	○
Volunteer appreciation event (3)	○	○	○	○	○
Certificate or token of appreciation (4)	○	○	○	○	○
Gifts such as stickers, t-shirts, and hats from organization (5)	○	○	○	○	○
Name recognition in newsletter(s) (6)	○	○	○	○	○
Name recognition in social media (Facebook, Twitter, etc.) (7)	○	○	○	○	○

	Strongl y agree (1)	Somewhat agree (2)	Neither agree nor disagre e (3)	Somewhat disagree (4)	Strongl y disagre e (5)

I want to help or enhance the environment. (1)	○	○	○	○	○
I want to help the community. (2)	○	○	○	○	○
I want to contribute to scientific knowledge. (3)	○	○	○	○	○
I want to learn new skills or gain hands-on knowledge. (4)	○	○	○	○	○
I want to learn more about water resources. (5)	○	○	○	○	○
I want to socialize. (6)	○	○	○	○	○
I want to get outside and connect with nature. (7)	○	○	○	○	○
I want to do something physically active. (8)	○	○	○	○	○
I want to have fun. (9)	○	○	○	○	○

I want to advance my career through gained experience or networking. (10)	○	○	○	○	○
I want to enhance my reputation in my community. (11)	○	○	○	○	○

Please indicate your level of agreement with the following phrases that complete this statement: "I am a citizen scientist volunteer with Texas

Stream Team because ...."

	Strongly agree (1)	Somewhat agree (4)	Neither agree nor disagree (5)	Somewhat disagree (2)	Strongly disagree (3)
I want to meet new people. (1)	○	○	○	○	○
I want to interact with like-minded people. (2)	○	○	○	○	○
I want to spend time with family or friends. (3)	○	○	○	○	○
I like learning from others with more experience. (4)	○	○	○	○	○
I like sharing my experiences, knowledge, or expertise with others. (5)	○	○	○	○	○

End of Block: Why do you volunteer?

Start of Block: Change in environmental outlook and behaviors

Has involvement in Texas Stream Team led to the following changes in

your life? Please select all that apply.

Visit natural areas and preserves (1)	▼ Yes - I now do this (1) ... N/A (4)
Enjoy myself in the outdoors (2)	▼ Yes - I now do this (1) ... N/A (4)
Take vacations in natural areas (3)	▼ Yes - I now do this (1) ... N/A (4)
Feel at home in natural areas (4)	▼ Yes - I now do this (1) ... N/A (4)
Explore new areas within nearby parks and preserves (5)	▼ Yes - I now do this (1) ... N/A (4)
Invite others to explore natural areas with me (6)	▼ Yes - I now do this (1) ... N/A (4)
Recreate in local waterways (7)	▼ Yes - I now do this (1) ... N/A (4)
Other (please specify) (8)	▼ Yes - I now do this (1) ... N/A (4)

Has involvement in Texas Stream Team led to the following changes in your life? Please select all that apply.

Write letters about environmental issues (1)	▼ Yes - I now do this (1) ... N/A (4)
Interest in protecting natural areas (2)	▼ Yes - I now do this (1) ... N/A (4)
Talk to friends and family about environmental issues (3)	▼ Yes - I now do this (1) ... N/A (4)
Discouraged about environmental degradation (4)	▼ Yes - I now do this (1) ... N/A (4)
Sign petitions regarding environmental quality (5)	▼ Yes - I now do this (1) ... N/A (4)
Participate / attend local government decision-making meetings (6)	▼ Yes - I now do this (1) ... N/A (4)
Other (please specify) (7)	▼ Yes - I now do this (1) ... N/A (4)

Has involvement in Texas Stream Team led to the following changes in your life? Please select all that apply.

	Yes - I now do this (1)	No - I do not do this (2)	I did this prior to involvement (3)	N/A (4)
Reduce household water consumption indoors (1)	○	○	○	○
Reduce household water consumption outdoors (2)	○	○	○	○
Understand how watershed health affects water quality (3)	○	○	○	○

End of Block: Change in environmental outlook and behaviors

Start of Block: About You

How long have you been a citizen scientist volunteer?

- ○ Less than 1 year (1)
- ○ 1 to 3 years (2)
- ○ 3 to 5 years (3)
- ○ 5 years or more (4)

Please describe your gender:

- ○ Male (1)
- ○ Female (2)
- ○ Prefer not to say (3)
- ○ Other (4) _____

What is your race/ethnicity?

- ○ White (1)
- ○ Black or African American (2)
- ○ Hispanic (8)
- ○ American Indian or Alaska Native (3)
- ○ Asian (4)
- ○ Native Hawaiian or Pacific Islander (5)
- ○ Two or more (6)
- ○ Other (please specify) (7)

_____

In what sector are you employed?

- ○ Government or public (1)
- ○ Private (2)
- ○ NGO or non-profit (3)
- ○ Self-employed (4)
- ○ Student (5)
- ○ Retired (6)
- ○ Disabled, not able to work (7)
- ○ Other (please specify) (8) _____

Do you currently have a job in the environmental/water field?

- ○ Yes (1)
- ○ No (2)

Which category best fits your age?

- ○ Under 18 (1)
- ○ 18 - 24 (2)
- ○ 25 - 34 (3)
- ○ 35 - 44 (4)
- ○ 45 - 54 (5)
- ○ 55 - 64 (6)
- ○ 65 - 74 (7)
- ○ 75 - 84 (8)
- ○ 85 or older (9)

Please describe your educational status:

- ○ Less than high school (1)
- ○ High school graduate (2)
- ○ Some college (3)
- ○ 2 year degree (4)
- ○ 4 year degree (5)
- ○ Professional degree (6)
- ○ Doctorate (7)

Which category best describes your household income?

- ○ Less than $10,000 (1)
- ○ $10,000 - $29,999 (2)
- ○ $30,000 - $49,999 (3)
- ○ $50,000 - $79,999 (4)
- ○ $80,000 + (5)
- ○ Prefer not to say (6)

What are your political views?

- ○ Extremely Liberal / Left (1)
- ○ Liberal (2)
- ○ Slightly Liberal (3)
- ○ Moderate, middle of the road (4)
- ○ Slightly Conservative (5)
- ○ Conservative (6)
- ○ Extremely Conservative / Right (7)
- ○ Do not know (8)
- ○ Prefer not to say (9)

End of Block: About You

Start of Block: Thank you!

Texas Stream Team would like to feature citizen scientists in newsletters and publish your provided photos. If you would like to be contacted by Texas Stream Team staff for the above reasons, please submit your information below.

○ Name (1) _____

○ Email (2) _____

If you would like to be entered to win one of two $25 Amazon gift cards, please submit the following information. Winners be contacted 2 to 4 weeks after the survey closes.

○ Name (1) _____

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End of Block: Thank you!

Start of Block: Welcome to the Texas Stream Team Partner Survey!

Welcome to the Texas Stream Team Partner survey!

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Please note that this survey will be best displayed on a laptop or desktop computer. Some features may be less compatible for use on a mobile device.

- ○ I consent, begin the survey (1)
- ○ I do not consent, I do not wish to participate (2)

End of Block: Welcome to the Texas Stream Team Partner Survey!

Start of Block: The Watershed

What is the status of your watershed?

- ○ Healthy (1)
- ○ At risk (2)
- ○ Impaired for a specific parameter (3)
- ○ I don't know (4)

Are there any Total Maximum Daily Loads or Watershed Protection Plans active in your watershed?

- ○ Yes (1)
- ○ Unsure (2)
- ○ No (3)

How many citizen scientists monitor the watershed?

- ○ None (1)
- ○ 1-5 (2)
- ○ 6-10 (3)
- ○ 11-15 (4)
- ○ 16-20 (5)
- ○ 21-30 (6)
- ○ 30 + (7)

What other water quality parameters would you like to see included? Please select all that apply.

- ☐ Parameters of emerging concern (1)
- ☐ Additional bacteria tests (2)
- ☐ Microplastics (3)
- ☐ Pharmaceuticals (4)
- ☐ Other (please specify) (5) _____

End of Block: The Watershed

Start of Block: The Group/Partner

What is your current status as a partner?

- ○ Active (1)
- ○ Inactive, please explain why? (2) _____

Are you a trainer?

- ○ Yes (1)
- ○ No (2)
- ○ Former (3)
- ○ No, but interested in becoming a trainer (4)

End of Block: The Group/Partner

Start of Block: Testing Kits

How many kits do you have in your inventory?

- ○ None (1)
- ○ 1-3 (2)
- ○ 4-6 (3)
- ○ 7-9 (4)
- ○ 10 + (5)

Where were the kits obtained?

- ○ Purchased by group (1)
- ○ Loaners from Texas Stream Team (2)
- ○ Purchased by an individual (3)
- ○ Other (please specify) (4) _____

What kind of kits are you using? Please select all that apply.

- ☐ Standard (Chem) Core Kit (1)
- ☐ Probe Core Kit (2)
- ☐ Advanced Kit (3)
- ☐ Other (please specify) (4) _____

Do you need more kits?

- ○ Yes (1)
- ○ No (2)

Please describe the quality and usage of your kits with the percentages

below.

	0 10 20 30 40 50 60 70 80 90 100
Usable, in good condition ()	
Usable, in poor condition ()	
Unusable due to condition ()	
Not being used (regardless of condition) ()	

Have you experienced difficulty in obtaining kits?

- ○ Yes (1)
- ○ Somewhat (2)
- ○ No (3)

Have you experienced difficulty in obtaining and managing kits?

- ○ Yes (1)
- ○ Somewhat (2)
- ○ No (3)

End of Block: Testing Kits

Start of Block: Funding

Do you need help with funding resources?

- ○ Yes (1)
- ○ No (2)

What are your funding sources? Please select all that apply.

- ☐ Self-funded (1)
- ☐ Grant funds, please specify: (2) _____
- ☐ School or university funds (3)
- ☐ State government funds (4)
- ☐ Federal government funds (5)
- ☐ Private-sector funds (6)
- ☐ ⊗ I don't know (7)

End of Block: Funding

Start of Block: Texas Stream Team Headquarters and Resources

Regarding your partnership with Texas Stream Team, how satisfied are

you?

- ○ Extremely satisfied (1)
- ○ Somewhat satisfied (2)
- ○ Neither satisfied nor dissatisfied (3)
- ○ Somewhat dissatisfied (4)
- ○ Extremely dissatisfied (5)

Do you utilize the Texas Stream Team online calendar to learn more about upcoming training events?

- ○ Yes (1)
- ○ No (Please state why) (2) _____

Do you plan to participate on the Community Forum?

- ○ Yes (1)
- ○ No (Please state why) (2) _____

Do you use the Dataviewer?

- ○ Yes (1)
- ○ No (Please state why) (2) _____

If you do use the Dataviewer, how satisfied are you with the content and usability?

- ○ Extremely satisfied (1)
- ○ Somewhat satisfied (2)
- ○ Neither satisfied nor dissatisfied (3)
- ○ Somewhat dissatisfied (4)
- ○ Extremely dissatisfied (5)

Would you like to receive one-on-one consultation on the Dataviewer or the Community Forum?

- ○ Yes (1)
- ○ No (2)

Please share any thoughts or comments regarding the Dataviewer or the Community Forum.

Which Texas Stream Team citizen science program/watershed services do you want to see in your region? Please select all that apply.

- ☐ Probe Core Water Quality Citizen Scientist Training (1)
- ☐ Macroinvertebrate Bioassessment Citizen Scientist Training (2)
- ☐ Riparian Evaluation Citizen Scientist Training (3)
- ☐ Advanced Water Quality Citizen Scientist Training (4)
- ☐ Professional water quality monitoring (5)
- ☐ Watershed Characterization (6)
- ☐ Watershed Protection Plan (WPP) development (7)
- ☐ Community outreach (8)
- ☐ Educational events (9)
- ☐ Sustainable development consultations (10)
- ☐ Other (please specify) (11) _____

What more would you like to see from Texas Stream Team?

_____

End of Block: Texas Stream Team Headquarters and Resources

Start of Block: Thank you!

If you would like to be contacted by Texas Stream Team staff to address any of your current needs, please provide your information.

○ Name (1) _____

○ Email (2) _____

End of Block: Thank you!

San Marcos Greenbelt Alliance Surveys

Understanding Volunteer Motivations - San Marcos Greenbelt Alliance

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Start of Block: SURVEY INSTRUCTION

Start of Block: Informed Consent

Welcome to the SMGA Survey!

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Please note that this survey will be best displayed on a laptop or desktop computer. Some features may be less compatible for use on a mobile device.

○ I consent, begin the study (1)

○ I do not consent, I do not wish to participate (2)

	Strongly agree (11)	Somewhat agree (12)	Neither agree nor disagree (13)	Somewhat disagree (14)	Strongly disagree (15)
I want to help or enhance the environment. (1)	○	○	○	○	○
I want to help the community. (2)	○	○	○	○	○
I want to help SMGA do more with less money. (3)	○	○	○	○	○
I want to learn skills or new knowledge. (11)	○	○	○	○	○
I want to learn more about water quality and/or native vegetation. (12)	○	○	○	○	○
I want to engage with other people. (13)	○	○	○	○	○
I want to get outside and connect with nature. (14)	○	○	○	○	○

I want to do something physically active. (15)	○	○	○	○	○
I want to have fun. (16)	○	○	○	○	○
I want to advance my career through gained experience or networking. (17)	○	○	○	○	○

Please indicate your level of agreement with the following phrases that

complete this statement: "I volunteer with SMGA because ...."

	Agree (1)	Somewhat agree (2)	Neither agree nor disagree (3)	Somewhat disagree (4)	Disagree (5)
I want to meet new people. (1)	○	○	○	○	○
I want to interact with like-minded people. (2)	○	○	○	○	○
I want to spend time with family or friends. (3)	○	○	○	○	○
I like learning from others with more experience. (4)	○	○	○	○	○
I like sharing my experiences, knowledge, or expertise with other volunteers. (5)	○	○	○	○	○

End of Block: Why do you volunteer with the San Marcos Greenbelt Alliance (SMGA)?

Start of Block: Volunteer Preferences

Do you prefer to perform tasks in a group or alone? Choose the option that

best fits your most frequent choice.

- ○ Alone (1)
- ○ With a partner (2)
- ○ Small group (3-5) (3)
- ○ Medium group (6-10) (4)
- ○ Large group (10 or more) (5)
- ○ Large event (50+) (6)

When do you prefer to volunteer? Please select all that apply.

- ☐ Sunday AM (1)
- ☐ Sunday PM (2)
- ☐ Monday AM (3)
- ☐ Monday PM (4)
- ☐ Tuesday AM (5)
- ☐ Tuesday PM (6)
- ☐ Wednesday AM (7)
- ☐ Wednesday PM (8)
- ☐ Thursday AM (9)
- ☐ Thursday PM (10)
- ☐ Friday AM (11)
- ☐ Friday PM (12)
- ☐ Saturday AM (13)
- ☐ Saturday PM (14)

In the future, how likely are you to ....

	Extremely likely (1)	Somewhat likely (2)	Neither likely nor unlikely (3)	Somewhat unlikely (4)	Extremely unlikely (5)
Continue volunteering at the same rate? (1)	○	○	○	○	○
Increase the amount of time you spend volunteering? (2)	○	○	○	○	○
Decrease the amount of time you spend volunteering? (3)	○	○	○	○	○
Recommend volunteering to others? (4)	○	○	○	○	○

How likely are you to complete an outdoor task if the weather is

unfavorable?

- ○ Extremely likely (1)
- ○ Somewhat likely (2)
- ○ Neither likely nor unlikely (3)
- ○ Somewhat unlikely (4)
- ○ Extremely unlikely (5)

	Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree (5)
I like "one-time" training events in order to participate. (1)	○	○	○	○	○
I like to complete sequential training activities to increase my level of expertise. (2)	○	○	○	○	○
I like to earn recognition or a reward for completing training activities. (3)	○	○	○	○	○
Opportunities for my role to grow are important to me. (4)	○	○	○	○	○
I feel that SMGA leaders would support me if I wanted to deepen my level of participation. (5)	○	○	○	○	○

I feel adequately trained for my volunteer position. (6)	○	○	○	○	○

How useful has your prior knowledge/experience/training been for your work with SMGA?

- ○ Extremely useful (1)
- ○ Very useful (2)
- ○ Moderately useful (3)
- ○ Slightly useful (4)
- ○ Not at all useful (5)

How well has SMGA used your knowledge and experience?

- ○ Extremely well (11)
- ○ Very well (12)
- ○ Moderately well (13)
- ○ Slightly well (14)
- ○ Not well at all (15)

I have received some form of recognition or appreciation for my work.

- ○ Strongly agree (14)
- ○ Somewhat agree (15)
- ○ Neither agree nor disagree (16)
- ○ Somewhat disagree (17)
- ○ Strongly disagree (18)

Please indicate your level of agreement with the following statements.

	Agree (1)	Somewhat agree (2)	Neither agree nor disagree (3)	Somewhat disagree (4)	Disagree (5)
It is important to me to receive some form of recognition or appreciation for my work. (1)	○	○	○	○	○
I would prefer not to receive any recognition or appreciation for my work. (2)	○	○	○	○	○

	Extremely important (1)	Very important (2)	Moderately important (3)	Slightly important (4)	Not at all important (5)
Hand-written card (1)	○	○	○	○	○
Personalized email (2)	○	○	○	○	○
Volunteer appreciation event (3)	○	○	○	○	○
Certificate or token of appreciation (4)	○	○	○	○	○
Gifts such as stickers, t-shirts, and hats from organization (5)	○	○	○	○	○
Name recognition in newsletter(s) (6)	○	○	○	○	○
Name recognition in social media (Facebook, Twitter, etc.) (7)	○	○	○	○	○

End of Block: Volunteer Preferences

Creating Native Landscapes. Has involvement in SMGA led to any of the following changes in your life? Please select all that apply.

	Yes - I now do this (1)	No - I do not do this (2)	I did this prior to involvement (3)	N/A (4)
I landscape with native plants. (1)	○	○	○	○
I help protect native plants wherever they occur. (2)	○	○	○	○
I create backyard wildlife habitats. (3)	○	○	○	○
I can recognize specific plants/animals. (4)	○	○	○	○
I can recognize unhealthy landscapes. (5)	○	○	○	○
I discourage my friends and neighbors from using invasive exotic species. (6)	○	○	○	○
Other (please specify) (7)	○	○	○	○

	Yes - I now do this (1)	No - I do not do this (2)	I did this prior to involvement (3)	N/A (4)
I visit natural areas and preserves. (1)	○	○	○	○
I enjoy myself in the outdoors. (2)	○	○	○	○
I take vacations to natural areas. (3)	○	○	○	○
I feel at home in natural areas. (4)	○	○	○	○
I explore new areas within nearby parks and preserves. (5)	○	○	○	○
I invite others to explore natural areas with me. (6)	○	○	○	○
I encourage children to explore the outdoors. (8)	○	○	○	○
Other (please specify) (7)	○	○	○	○

Environmental activism. Has involvement in SMGA led to any of the

following changes in your life? Please select all that apply.

	Yes - I now do this (1)	No - I do not do this (2)	I did this prior to involvement (3)	N/A (4)
I write letters about environmental issues. (1)	○	○	○	○
I work to protect natural areas. (2)	○	○	○	○
I tell friends and family about environmental issues. (3)	○	○	○	○
I sign petitions regarding environmental quality. (5)	○	○	○	○
I participate / attend local government decision-making meetings. (6)	○	○	○	○
Other (please specify) (7)	○	○	○	○

	Yes - I now do/understand this (1)	No - I do not do/understand this (2)	I did/understood this prior to involvement (3)	N/A (4)
I reduce household water consumption indoors and outdoors. (1)	○	○	○	○
I understand how watershed health affects water quality. (2)	○	○	○	○
I understand how important natural areas are to the recharge zone. (3)	○	○	○	○
I understand the integral part natural areas play in flood mitigation. (4)	○	○	○	○

End of Block: Change in environmental outlook and behaviors

Start of Block: About You

How long have you been a volunteer?

- ○ Less than 6 months (1)
- ○ More than 6 months but less than 1 year (2)
- ○ 1 to 3 years (3)
- ○ 3 to 5 years (4)
- ○ 5 years or more (5)

What are your volunteer duties? Please select all that apply.

- ☐ Trail Crew (1)
- ☐ Administration (2)
- ☐ Board Membership (3)
- ☐ Meeting Attendant (4)
- ☐ Outreach Committee Member (5)
- ☐ Fundraising Committee Member (6)
- ☐ Other (7) _____

Please describe your gender:

- ○ Male (1)
- ○ Female (2)
- ○ Prefer not to say (3)
- ○ Other (4) _____

What is your race/ethnicity?

- ○ White (1)
- ○ Black or African American (2)
- ○ Hispanic (8)
- ○ American Indian or Alaska Native (3)
- ○ Asian (4)
- ○ Native Hawaiian or Pacific Islander (5)
- ○ Two or more (6)
- ○ Other (please specify) (7)

_____

In what sector are you employed?

- ○ Government or public (1)
- ○ Private (2)
- ○ NGO or non-profit (3)
- ○ Self-employed (4)
- ○ Student (5)
- ○ Retired (6)
- ○ Disabled, not able to work (7)
- ○ Other (please specify) (8) _____

Which category best fits your age?

- ○ Under 18 (1)
- ○ 18 - 24 (2)
- ○ 25 - 34 (3)
- ○ 35 - 44 (4)
- ○ 45 - 54 (5)
- ○ 55 - 64 (6)
- ○ 65 - 74 (7)
- ○ 75 - 84 (8)
- ○ 85 or older (9)

What, if any, previous hiking/biking experience do you have?

- ○ Newbie (less than a year) (1)
- ○ Moderate (1 to 3 years) (2)
- ○ Much (5 to 10 years) (3)
- ○ Extensive (10 years or more) (4)
- ○ N/A (5)

Please describe your educational status:

- ○ Less than high school (1)
- ○ High school graduate (2)
- ○ Some college (3)
- ○ 2 year degree (4)
- ○ 4 year degree (5)
- ○ Professional degree (6)
- ○ Doctorate (7)

Which category best describes your household income?

- ○ Less than $10,000 (1)
- ○ $10,000 - $29,999 (2)
- ○ $30,000 - $49,999 (3)
- ○ $50,000 - $79,999 (16)
- ○ $80,000 + (4)
- ○ Prefer not to say (6)

What types of natural areas have you visited to hike/bike/recreate? Please

select all that apply.

- ☐ City parks/natural areas (2)
- ☐ State parks/natural areas (3)
- ☐ National parks/natural areas (4)
- ☐ International parks/natural areas (5)
- ☐ None (6)

Which natural areas in San Marcos do you prefer to visit? (most preferred greenspace/natural area at the top)

_____ Purgatory Creek (1)
_____ Spring Lake (2)
_____ Ringtail Ridge (3)
_____ Schulle Canyon (4)
_____ Blanco Shoals (5)
_____ Sessom Creek (6)

What are your political views?

- ○ Extremely Liberal / Left (1)
- ○ Liberal (2)
- ○ Slightly Liberal (3)
- ○ Moderate, middle of the road (4)
- ○ Slightly Conservative (5)
- ○ Conservative (6)
- ○ Extremely Conservative / Right (7)
- ○ Do not know (8)

End of Block: About You

Start of Block: Thank you!

Would you like to further participate in this study?

- ○ Yes (1)
- ○ Maybe - I'll consider it. (2)
- ○ No (4)

If so, please enter your name and email address.

○ Name (1) _____

○ Email (2) _____

If you would like to be entered to win one of two $25 Amazon gift cards, please submit the following information. Winners be contacted 2 to 4 weeks after the survey closes.

○ Name (1) _____

○ Email (2) _____

End of Block: Thank you!

Volunteer Interest Questionnaire

The San Marcos Greenbelt Alliance would like to know how to better accommodate your volunteer interests! Please complete the following short survey.

What We Do:

- Conservation: Protect and conserve greenspace by working with stakeholders.
- Stewardship: Maintain the health of greenspaces through community participation.
- Outreach / Education: Promote awareness and understanding of the value of protecting and connecting greenspace.

Informed Consent

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Russell Weaver, Professor, Department of Geography,
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If you would prefer not to participate, please do not fill out a survey.

If you consent to participate, please complete the survey.

1 **Do you agree to participate?** *Mark only one oval.*

- ◯ I consent, begin the survey.
- ◯ I do not consent, I do not wish to participate in the survey.

Volunteer Preferences

2. **How would you prefer to volunteer with SMGA? Please select all that apply.** *Check all that apply.*

- ☐ On the trails
- ☐ In the office
- ☐ In fundraising
- ☐ In outreach/communications
- ☐ On the
- ☐ board

Other: _____

3. **What times/days of the week would you prefer? Please select all that apply.** *Check all that apply.*

- [ ] Monday AM
- [ ] Monday PM
- [ ] Tuesday AM
- [ ] Tuesday PM
- [ ] Wednesday AM
- [ ] Wednesday PM
- [ ] Thursday AM
- [ ] Thursday PM
- [ ] Friday AM
- [ ] Friday PM
- [ ] Saturday AM
- [ ] Saturday PM
- [ ] Sunday AM
- [ ] Sunday PM
- [ ] Other: _____

4 **How much and often would you like to volunteer?** *Mark only one oval.*

- ( ) As my schedule allows
- ( ) Weekly
- ( ) Twice a month
- ( ) Monthly
- ( ) A few times a year
- ( ) Once a year
- ( ) Other: _____

Preferences

The following questions are designed to understand volunteers' setting preferences.

5. **How would you like to volunteer?**
Mark only one oval.

- ( ) Alone
- ( ) With a partner
- ( ) With a small group (5 to 10)
- ( ) With a large group (10 to 30) Large

event (50+)

6. **What age group would you most like to work with?** *Mark only one oval.*

- 15-25
- 25-35
- 35-45
- 45-55
- 55-65
- 65-75
- 75+
-

About You

Please let us a little bit about yourself.

7 **How would you describe yourself?** *Check all that apply.*

- Nature lover
- Hiker
- Biker
- Birder
- Casual stroller
- None of these
-
-

Other:

8. **Do you live in the City of San Marcos?** *Mark only one oval.*

- Yes
- No
- Outside city limits
-

Other:

9. **What other type(s) of activities do you enjoy while in the natural areas?** *Check all that apply.*

- [ ] Reading
- [ ] Writing
- [ ] Photography
- [ ] Listening to music
- [ ] Meditating/ Relaxing
- [ ] Dog walking
- [ ] Geocaching
- [ ] Gaming with augmented reality
- [ ] Other: _____

10. **Which category best describes your age?** *Mark only one oval.*

- ( ) 15-25
- ( ) 25-35
- ( ) 35-45
- ( ) 45-55
- ( ) 55-65
- ( ) 65-75
- ( ) 75+

11 **How often do you visit any of SMGA's natural areas? Natural areas can be found here: http://smgreenbelt.org/natural-areas/** *Mark only one oval.*

- ( ) Never been
- ( ) Daily
- ( ) Weekly
- ( ) Twice a month
- ( ) Monthly
- ( ) 6 times per year
- ( ) 3 times per year
- ( ) Other: _____

12 **In general, what motivates you to volunteer?**

Thank you!

We appreciate your interest in SMGA. For more information on volunteer opportunities, please visit http://smgreenbelt.org/volunteers/.

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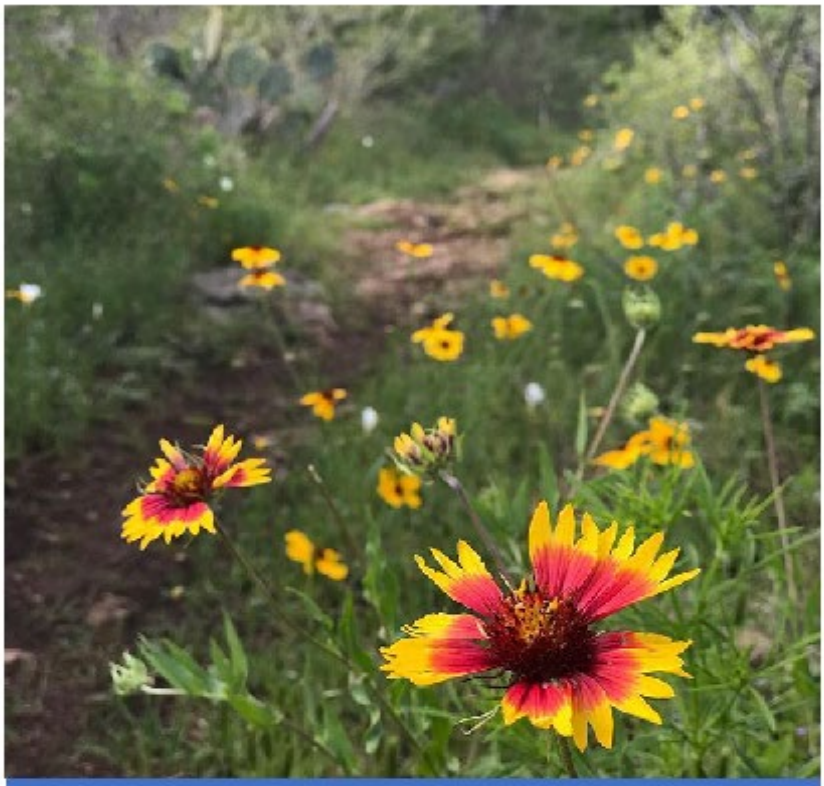
APPENDIX C – COMMUNITY PARTNER REPORTS



What Motivates Voluntary Environmental Stewardship?

A case study of the San Marcos Greenbelt Alliance

Christina Lopez, SMGA Research Fellow 2019-2020
Department of Geography at Texas State University

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EXECUTIVE SUMMARY

Project Overview

SMGA funded this research as part of the inaugural Research Fellow program which serves as an opportunity to fund student research that would benefit SMGA natural areas or its mission with the following broad research objectives:

- inventorying flora and fauna of the natural areas;
- evaluating the management and control of invasive and exotic species;
- assessing the benefits and values of our natural areas, including but not limited to ecological, mental/physical health, and cultural benefits and values; and
- enhancing awareness and education about the importance of protecting and connecting greenspace.

This research focused on the latter two by providing (1) an understanding of the values that drive stewards to participate and what additional values, skills, and/or insights they gain from participation, and (2) a Story Map to highlight a few of SMGA's stewards.

With these two broad objectives, several research questions guided this study that surveyed and interviewed current volunteers and attempted to capture potential volunteers.

Results

Highlights from the steward survey are presented in the infographic to the right.

SMGA's current stewards and *potential* stewards are largely motivated by their intrinsic values and ideals as well as the desire to socialize with their community.

Overall, SMGA has successfully matched motivational concerns of their current volunteer base, but can build their volunteer pool through providing additional, diverse opportunities for potential stewards to enact their motivational concerns.

1. INTRODUCTION

Environmental community-based organizations (CBOs), like the San Marcos Greenbelt Alliance (SMGA), rely heavily on volunteers and community participation to implement action plans and affect change at a variety of spatial scales (Johnson et al., 2018; Krasny et

al., 2014). Volunteers and community participation may come in flux: weather, incentives, and size of events may affect rates of participation (Bennett et al., 2018; Merenlender et al., 2016; Wright et al., 2015).While these factors are somewhat macroscopic in nature, and they are therefore difficult for environmental CBOs to manipulate in order to increase participation, studies that contribute to a deeper understanding of the comparably micro-level factors that drive or motivate individual participation in stewardship programs will arguably offer these CBOs vital insights for retooling their targeting and outreach efforts. In other words, understanding the motivations of stewards may help CBOs to build organizational capacity by attracting and retaining larger, potentially more diverse, pools of stewards.

Despite the value that can come from studying their volunteers and attempting to identify patterns, CBOs often do not have the internal capacity—or, especially, time—to undertake research projects that are not directly connected to their strategic plans or grant-seeking activities (Close et al., 2016). Recognizing this challenge, participants in the emerging subfield community geography attempt to help fill the gap. Specifically, community geographers partner with communities and CBOs to help them carry out their missions of affecting positive community change and, in doing so, build organizational capacity (Hawthorne et al., 2014; Robinson, 2010).

This report will detail the project's purpose, methodology, results, implications, and conclude with recommendations for SMGA.

2. PURPOSE

The purpose of this collaboration with SMGA was twofold: first, to understand motivations of SMGA volunteers in order to provide SMGA with useful information for targeting and outreach; and, second, to understand whether participation in SMGA activities is linked to spillover effects, whereby volunteers bring knowledge gained through SMGA to bear on their home and/or community lives. This latter objective can play a valuable role in SMGA's future grant-seeking efforts, as it will seek to show that knowledge and experience gained through SMGA has lasting effects outside of SMGA event/activity contexts.

To that end, this project asked the following 5 broad research questions:

1. What are the most common reasons volunteers give for participating in SMGA programs?
2. Does participation vary systematically with selected individual, community, and/or volunteer event-related characteristics?
3. What skills or insights, if any, do volunteers say they gained from SMGA participation?
4. To what extent do volunteers use skills and insights gained from SMGA events in their daily lives?
5. To what extent do volunteers share their SMGA experiences with family, friends, or other social contacts?

3. BACKGROUND

3.1 Environmental Stewardship

Environmental stewardship involves *voluntary* individual or collective action on behalf of the environment due to a moral concern (Cockburn, Cundill, Shacckleton, & Rouget, 2018; Raymond et al., 2013; Welchman, 2012; Worrell & Appleby, 2000). These actions are the "suite of approaches, activities, behaviors, and technologies that are applied to protect, restore or sustainably use the environment" (Bennett et al., 2018, p. 603). As such, stewardship actions are further characterized by the scale, issue, activity, location, motivation(s) and levels of complexity.
Scholarly writing on the concept of stewardship is thought to have taken off in western culture with the American author, philosopher, scientist, ecologist, conservationist, and environmentalist Aldo Leopold (Bennett et al., 2018). Leopold's concept of a land ethic has been widely cited in the environmental stewardship literature (Wolf et al., 2013, p. 17). In his seminal *A Sand County Almanac*, Leopold poetically describes a land ethic as a moral framework for interacting with the natural environment which is produced from positive experiences with it (Leopold, 1949). Further, an individual that develops a land ethic would understand and accept humans as part of the larger ecological community, and that human actions affect the landscape and all its inhabitants (Leopold, 1949). To have a land ethic, then, is to care for the land, or to be a steward of it.

It follows that stewardship, as a set of behaviors and actions that are oriented toward care for the land (Romolini, Brinkley, & Wolf, 2012), is a manifestation of Leopold's land ethic (1949). Stewardship has been researched extensively in environmental philosophy (Fernandes & Guiomar, 2016, p. 602). Outcomes of this research have found this underlying ethic may stem from an altruistic concern for current or future generations (Robinson, Bennett, King, & Murray, 2012), especially now as climate change challenges humanity's ability to adapt. Lastly, this ethic may develop from an understanding of what constitutes a "right" relationship with others, including the natural world (Chan et al., 2016).

Since the unique nature of environmental stewardship relies heavily on voluntary actions, understanding the motivations for acting, without monetary compensation, on behalf of the environment and/or stewarding a common resource is crucial for organizations' ability to retain volunteers and increase participation (Johnson et al., 2018; Krasny, Russ, Tidball, & Elmqvist, 2014, p. 17; Merenlender et al., 2016; Wright, Underhill, Keene, & Knight, 2015). This understanding is of critical importance and because motivations tend to be highly context- and person-sensitive (Bennett et al., 2018) a study such as this should prove beneficial for SMGA.

3.2 Assessing Motivations and the Functional Approach

There are two major categories of motivators: intrinsic and extrinsic as identified by Finkelstien (2009); these two general concepts have been applied to understanding volunteer motivations (Cecere, Mancinelli, & Mazzanti, 2014; Moskell, Broussard, & Ferenz, 2010). Intrinsic motivations can be further characterized as 1) stemming from underlying ethics, values, morals, and beliefs (Chan et al., 2016; Fernandes & Guiomar, 2016; Leopold, 1949; Robinson et al., 2012) and 2) a need for self-determination and/or self-actualization (Cetas & Yasue, 2017; Maslow, 1943). Whereas extrinsic motivators are grouped as 1) the perceived balance and direct costs and benefits of natural resource

protection (Lopes & Videira, 2013) and 2) externally provided rewards: social, physical, economic, or legal (Bennett et al., 2018).

Multiple studies reveal *intrinsic* motivations are more often the principle motivator behind stewardship, and these types of motivations are more durable and long-lasting than extrinsic (Bennett et al., 2018, p. 603). As such, previous studies that seek to understand volunteer motivations have found that helping the environment is typically the most frequently selected reason, i.e., an intrinsic motivator, and career advancement, i.e., an extrinsic motivator, to be the least frequented selection (Grese et al., 2001; Bruyere & Rappe, 2007; Alender, 2016).

The functional approach to understanding volunteering was originally created by Katz (1960) and later applied by Clary and Snyder (1999). Its purpose is to describe motivations which lead individuals to beginning and continuing volunteering and contains three underlying assumptions:

(a) It is a motivational perspective that directs inquiry into the personal and social processes that initiate, direct, and sustain action.
(b) People can and do perform the same actions because of different psychological functions (e.g., different people engage in the same volunteer activity but do so to fulfill different motives).
(c) It suggests that important psychological events, such as embarking on a course of volunteer activities and then maintaining those activities over extended periods of time**,** *depend on matching the motivational concerns* of individuals with situations that can satisfy those concerns (Clary & Snyder, 1999, emphasis added).

In other words, people may volunteer for the same activity for different reasons, and if they feel like the activity does not satisfy their motivation, i.e., the quality of the activity (Shirk et al., 2012), then they will cease participation (Bruyere & Rappe, 2007). Using the functional approach, Clary et al. (1994, 1996) developed the Volunteer Functions Inventory with six functions (Table 1).

Recalling the two major categories of motivations, intrinsic and extrinsic, all the functions in the inventory fall under the intrinsic motivator with the exception of the career function which is an extrinsic motivator (Table 1). This approach has been tested against other similar methods (Okun et al., 1998; Allison et al., 2002) and applied (as well as modified) in several environmental volunteer/stewardship studies (Ryan et al., 2001; Martinez & McMullin, 2004; Yeung, 2004). As such, the Volunteer Functions Inventory is "the most widely used approach for studying and understanding motivations for volunteerism" (Bruyere & Rappe, 2007, p. 506).

Function	Conceptual Definition	Sample Survey Statement
Values	Acts to express important values	I feel it is important to help the environment.
Understanding	Desires to learn more about a subject and gain or use skills	I like to learn from others with more experience than me.
Enhancement	Aims to improve psychologically through volunteering	I feel good when I volunteer.
Career	Wants to network or gain career-related experience	I volunteer to advance in my career.
Social	Participates to create and strengthen social relationships	I volunteer to meet people.

Table 1. The Volunteer Functions Inventory adapted from Clary and Snyder 1999, 157.

3.3 Additional Motivational Influences and Considerations

Recognition of stewards' work and changes in environmental outlooks and behaviors are sparsely assessed in the literature but may offer insights for SMGA. For example, Alender (2016) stated her research was the first to add questions of volunteer-collected data use satisfaction to a citizen science survey. In addition, Alender (2016) expanded on the forms of recognition, i.e., name recognition, social media mentions, paraphernalia, and a volunteer appreciation event. As this literature is undeveloped, there are mixed findings on recognition. Alender (2016) found 40% of respondents selected "neutral or undecided" when asked if recognition was important to them. A previous study, Roggenbuck et al. (2001), found that most volunteers preferred no recognition.

Environmental volunteerism may result in changes in environmental outlooks and behaviors that can strengthen the connection between people and their environment (Ryan et al., 2001; Jordan, 1989; Ross, 1994). As such, working with and in natural areas may create an attachment to place and/or place meanings that manifest as pro-environment behaviors (Ryan, 1997). Indeed, Ryan et al. (2001) found that the skills learned and obtained from volunteerism led to the creation of native landscapes, general appreciation of natural areas, and environmental activism. Further, the motivator of "social" was statistically significant with respondent's attachment to their volunteer site (Ryan et al., 2001). In sum, stewardship activities increase the amount of "appreciation of and advocacy for *local* natural areas" (Ryan et al., 2001, p. 641, emphasis added). The local aspect is important here as the need to preserve and monitor the well-being of local natural areas is often "overshadowed" by more "glamorous" efforts of conservation such as rainforest preservation or other wild landscapes (Ryan et al., 2001).

4. SCOPE AND METHODOLOGY

During summer 2019, a survey instrument was designed to answer the research questions

based on the literature and needs of SMGA through several meetings and email communications with board and committee members. To capture who may be interested but is not volunteering, a short questionnaire regarding volunteer interest was also developed. As such, two surveys were constructed: the Stewardship Survey (SS) and the Potential Volunteer Survey (PVS). Both surveys were approved by the Institutional Review Board on May 13, 2019 (project #6440).

The first survey (SS) was developed to understand current volunteer's demographics, motivations, and potential skills obtained or changes in environmental outlook or behavior. The 28-question, web-based survey was administered in the Qualtrics software. The first email request was sent to an email distribution list of 1143 (152 emails bounced) on July 1, 2019, followed by three reminder emails approximately every two weeks with the final email reminder sent August 15, 2019.

An incentive of winning one of two $25 Amazon gift cards was offered. The survey contained closed-ended responses with multiple choice and Likert-scale options and four blocks that inquire about:

- Motivations (2 questions, 15 statements): learning, social, environment, career advancement.
- Volunteer Preferences (10 questions): social setting, time, rate of volunteerism, weather, training and knowledge, and recognition.
- Change in Environmental Outlook and Behaviors (4 questions): native landscaping, appreciation and use of natural areas, environmental activism, and water awareness.
- About You (12 questions): length of participation, volunteer duties, gender, race, employment, age, hiking/biking experience, educational status, income, visits to other natural areas (scalar), preferred SMGA natural areas, and political views.

The second survey (PVS) mirrors the form of a short questionnaire as SMGA wanted to assess their *potential* volunteers, a lengthy survey was not necessary. As such, an 11-item questionnaire was crafted using Google Forms to assess volunteer preferences, including day and time, type of volunteer duties, and the use of the natural areas, i.e., how often they visit and what type of activities they enjoy, such as walking, birding, or biking. The last question was open-ended and asked: "In general, what motivates you to volunteer?" The PVS was posted on SMGA's social media accounts by SMGA periodically over the summer.

To capture narratives for the Story Map, SS respondents had the option to participate further in the form of an interview. Those interviewed could be asked to share a short story/narrative about their experiences with SMGA and favorite places in the natural areas. The purpose of the narratives was to create a place-based Story Map that shares the unique details of the flora and fauna of particular sites throughout the 1,200-acre natural areas. The Story Map is accessible to the public thereby enhancing awareness and connecting people to natural areas through the eyes of the stewards who work there.

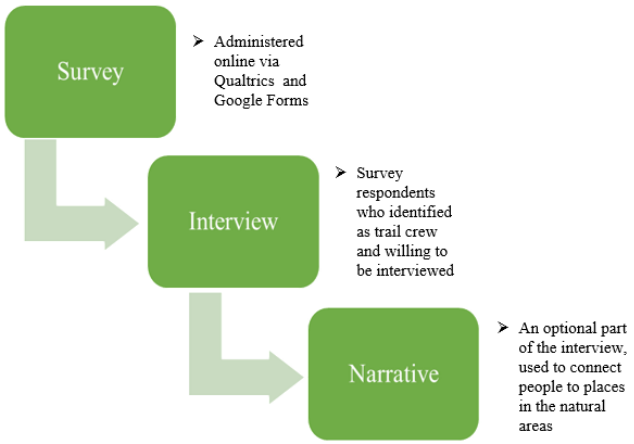


Figure 1. A conceptual diagram of the methodology flow

5. RESULTS

5.1 Steward Survey

Administered over summer 2019, the steward survey obtained 125 responses Three responses were excluded from analysis because these respondents self-reported they had not volunteered with SMGA. The survey was sent to 1143 email address of which 152 bounced, leaving 991 valid email addresses. The response rate was nearly 13 percent. Respondents were randomly selected to win one of two $25 gift cards: Barbara Jacobson (babarajacobson08@yahoo.com) and Phillip Quast (phillipquast@gmail.com).

5.1.2 Characteristics of Respondents

Table 2 describes the respondents' characteristics with demographics and political views. Stewards of SMGA are mostly white males, retired, and over the age of 50. Further, most stewards have a professional degree and a household income over $50,000 per year (median household income in San Marcos was $34,748 in 2017). Lastly, their political views are largely liberal.

Stewards' Characteristics	Categories	Survey Respondents (N = 122)
Gender	Male	54%
	Female	44%
	Prefer not to say	1%
	Other	1%
Race/Ethnicity	White	92%
	Hispanic	4%
	Two or more	2%
	Other	2%
Employment	Government or public	29%
	Private	10%
	NGO or nonprofit	8%
	Self-employed	10%
	Student	6%

	Retired	38%
Age	18-24	5%
	25-34	8%
	35-44	15%
	45-54	14%
	55-64	19%
	65-74	31%
	75-84	7%
Educational Attainment	Less than high school	1%
	High school	0%
	Some college	13%
	2-Year degree	1%
	4-Year degree	29%
	Professional Degree	43%
	Doctorate	13%
Household Income	Less than $10,000	7%
	$10,000-$29,000	4%
	$30,000-$49,000	10%
	$50,000-$79,000	29%
	$80,000 +	36%
	Prefer not to say	16%
Political Views	Extremely Liberal	11%
	Liberal	46%
	Slightly Liberal	13%
	Moderate	14%
	Slightly Conservative	1%
	Conservative	4%
	Extremely Conservative	2%
	Do not know	8%

Table 2. Descriptive characteristics of stewards/survey respondents.

Additional attributes of the volunteers are presented in the following two categories: (1) volunteer length of time and duties and (2) experience with natural areas.

(1) Volunteer length of time and duties

Most volunteers are trail crew or "other" (Figure 2). Trail crew volunteers have composed most of the volunteer categories in each time frame and have experienced the largest increased in new volunteers (participating between 6-12 months) as seen in Figure 2. The selection of "other" (n=32) received text entries that stated they had not volunteered yet or did not have any duties assigned (n=4). Further, others reported they were "supporters" of SMGA, some stated they have been involved in cleanups, pulled invasive plants or weeds, taken river samples, donated money, or served as a hike leader.

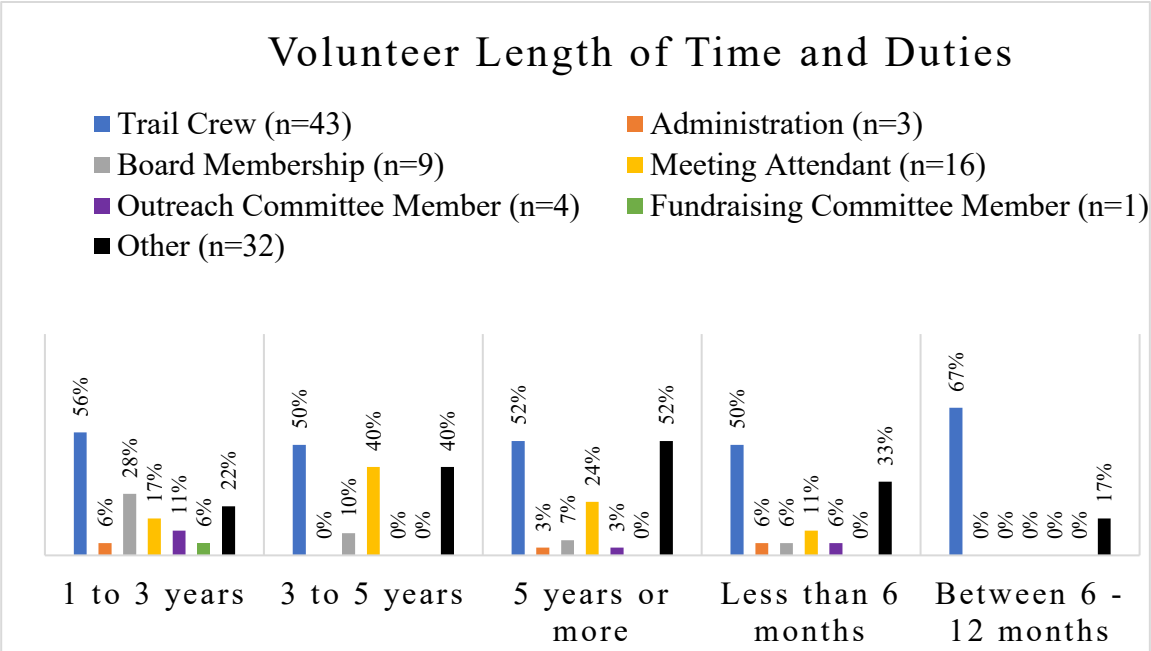


Figure 2. Volunteer length of time and duties

(2) Experience with natural areas

Volunteers were asked to share the length of time they have hiked or biked in natural areas. The majority of respondents (64 percent) had 10 or more years of experience interacting with natural areas. Less than 10 percent of respondents had less than five years' experience.

- Less than a year (n=3) 4%
- 1 to 3 years (n=4) 5%
- 5 to 10 years (n=22) 28%
- 10 years or more (n=51) 64%

When asked what types of natural areas they have visited to hike, bike, and/or recreate, the respondents have near equal, with the exception of international parks, experiences in parks on various scalar levels, meaning they have traveled to state parks as well as national parks.

- City parks (n=82) 29%
- State parks (n=80) 28%
- National parks (n=79) 28%
- International parks (n=42) 15%
- None (n=0) 0%

In brief, most volunteers work as the trail crew; they also compose the largest category of new volunteers (between 6 -12 months). Further, most have 10 or more years of experience in natural areas that range from city to national parks.

5.1.3 Motivations

Recall the first broad research question: "What are the most common reasons volunteers give for participating in SMGA programs?" The survey included two major categories for

reasons or motivations for volunteering: general and social. The general category contained 10 statements regarding desire to help the environment and community, learn new skills, connect with nature, and obtain experiences to advance one's career. Answer options were Likert-scale responses that ranged from "Strongly Agree" to "Strongly Disagree".

Table 3 descriptively details the respondent's selection regarding their agreement with the 10 statements. Predominant answers are highlighted for clarity. The top motivations that received a distribution of over 50 percent responses as "Strongly Agree" are the following statements: I want to get outside and connect with nature (85 percent); I want to help or enhance the environment (83 percent); I want to help the community (79 percent); I want to help SMGA do more with less money (56 percent); and I want to learn skills or new knowledge (52 percent). While respondents were largely agreeable (meaning they selected "Agree" or "Strongly Agree") to every statement, 41 percent of respondents did not agree or disagree with the statement "I want to advance my career through gained experience or networking."

Statement	Answers	Distribution
I want to help or enhance the environment.	Strongly agree	83%
	Agree	14%
	Neither agree nor disagree	2%
	Disagree	0%
	Strongly disagree	2%
I want to help the community.	Strongly agree	79%
	Agree	16%
	Neither agree nor disagree	4%
	Disagree	0%
	Strongly disagree	1%
I want to help SMGA do more with less money.	Strongly agree	56%
	Agree	24%
	Neither agree nor disagree	14%
	Disagree	5%
	Strongly disagree	1%
I want to learn skills or new knowledge.	Strongly agree	52%
	Agree	31%
	Neither agree nor disagree	14%
	Disagree	2%
	Strongly disagree	2%
I want to learn more about water quality and/or native vegetation.	Strongly agree	50%
	Agree	36%
	Neither agree nor disagree	12%
	Disagree	0%
	Strongly disagree	2%
I want to engage with other people.	Strongly agree	45%
	Agree	38%
	Neither agree nor disagree	12%
	Disagree	3%

	Strongly disagree	3%
I want to get outside and connect with nature.	Strongly agree	85%
	Agree	9%
	Neither agree nor disagree	5%
	Disagree	0%
	Strongly disagree	1%
I want to do something physically active.	Strongly agree	64%
	Agree	24%
	Neither agree nor disagree	8%
	Disagree	2%
	Strongly disagree	2%
I want to have fun.	Strongly agree	55%
	Agree	29%
	Neither agree nor disagree	12%
	Disagree	2%
	Strongly disagree	2%
I want to advance my career through gained experience or networking.	Strongly agree	14%
	Agree	17%
	Neither agree nor disagree	41%
	Disagree	10%
	Strongly disagree	17%

Table 3. Respondents' agreement with general motivations

Respondents were also asked to rate their agreement with 5 statements that were geared towards *social* motivations. These statements, as provided in Table 4, are not as readily agreeable as some of the general motivations, i.e., only two (I want to interact with like-minded people and I like learning from others with more experience) were ranked as "Strongly Agree" by more than 50 percent of respondents.

Statement	Answers	Distribution
I want to meet new people.	Strongly agree	28%
	Agree	40%
	Neither agree nor disagree	27%
	Disagree	4%
	Strongly disagree	1%
I want to interact with like-minded people.	Strongly agree	51%
	Agree	30%
	Neither agree nor disagree	18%
	Disagree	1%
	Strongly disagree	0%
I want to spend time with family or friends.	Strongly agree	28%
	Agree	27%
	Neither agree nor disagree	36%
	Disagree	5%
	Strongly disagree	4%
I like learning from others	Strongly agree	55%

with more experience.	Agree	32%
	Neither agree nor disagree	11%
	Disagree	1%
	Strongly disagree	0%
I like sharing my experiences, knowledge, or expertise with other volunteers.	Strongly agree	35%
	Agree	36%
	Neither agree nor disagree	22%
	Disagree	6%
	Strongly disagree	2%

Table 4. Respondents' agreement with social motivations

Overall, "I want to get outside and connect with nature" (85 percent) and "I want to help or enhance the environment" (83 percent) are the top motivators with over 80 percent of respondents reporting they strongly agree. The two weakest motivational statements that had more than 30 percent of respondents state they were neutral, i.e., did not agree or disagree, were "I want to advance my career through gained experience or networking" (41 percent) and "I want to spend time with family or friends" (36 percent).

5.1.4 Steward Preferences

The second broad research question asked if volunteer participation varies systematically with individual characteristics. First, to gain an understanding of how to better address the needs of stewards, the survey asked 11 questions regarding preferences around the (1) social setting, (2) preferred time, (3) rate of volunteerism, (4) weather, (5) training and knowledge, (6) recognition, and (7) natural areas. Each category of preference will be descriptively described below in sequence. If applicable, the number of respondents will also be provided with graphical depictions of the data. Second, a series of chi-squared tests were performed to determine if volunteer participation varies with volunteer attributes. The latter will be discussed after the descriptive preferences are presented.

(1) Social Setting

As detailed in Figure 3, most respondents (54 percent) prefer to work in a small group setting of three to five. A medium group was selected by 20 percent, followed by alone (14 percent) or with a partner (9 percent). Having a large group setting was only preferred by 2 percent, and a large event was preferred by zero respondents.

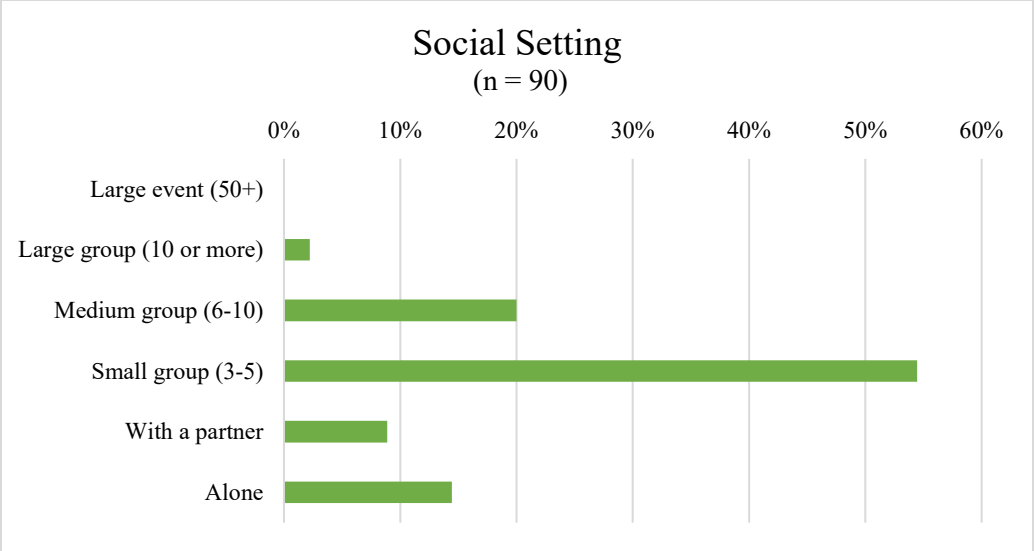


Figure 3. Preferred social setting

(2) Preferred Time

Alongside wanting to work in small groups, respondents showed a slight preference to working on the weekends in the mornings as demonstrated below.

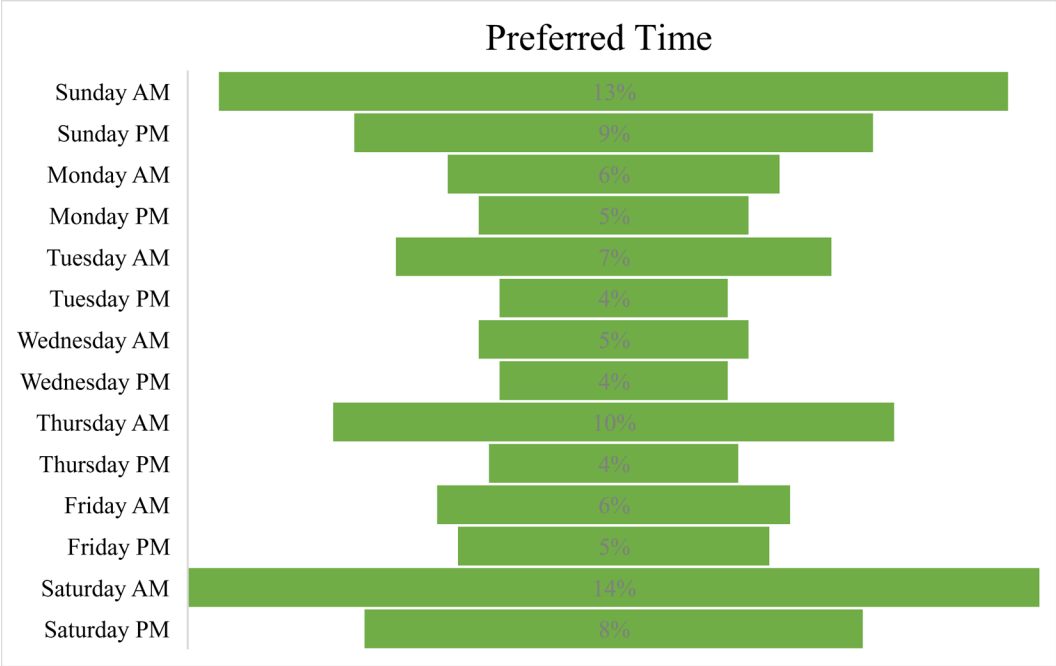


Figure 4. Preferred day and time for volunteer activities

Other than weekend mornings, Thursday mornings received 10 percent with Sunday afternoon following at 9 percent. It is helpful to know both the desired social setting (which is a small group) and preferred volunteer time so that SMGA can meet stewards' preferences. For example, if SMGA were to host a volunteer event on a Saturday morning, it may attract more people which may not be

preferable to the majority of volunteers. That is not to say the volunteers could not work in small groups (as preferred); this is an issue to be cognizant of for future planning.

(3) Rate of Volunteerism

The "rate of volunteerism" asked stewards how likely from "Extremely Unlikely" to "Extremely Likely" they are to continue volunteering at the same, increased, or decreased rate, as well as if they were likely to recommend volunteering to others. Respondents are largely extremely and somewhat unlikely to decrease the amount of time volunteering. When asked about the likelihood of increasing volunteer time, nearly half (48 percent) said they are somewhat likely to increase it whereas 20 percent said they are extremely likely to increase their volunteer time. Most respondents stated they will continue at the same rate with responses of somewhat likely (32 percent) and extremely likely (38 percent).

Lastly, 42 percent of respondents were extremely likely to recommend volunteering while zero were extremely *unlikely* to recommend volunteering with SMGA. Results are detailed in Figure 5; the number of respondents is also shown for each category.

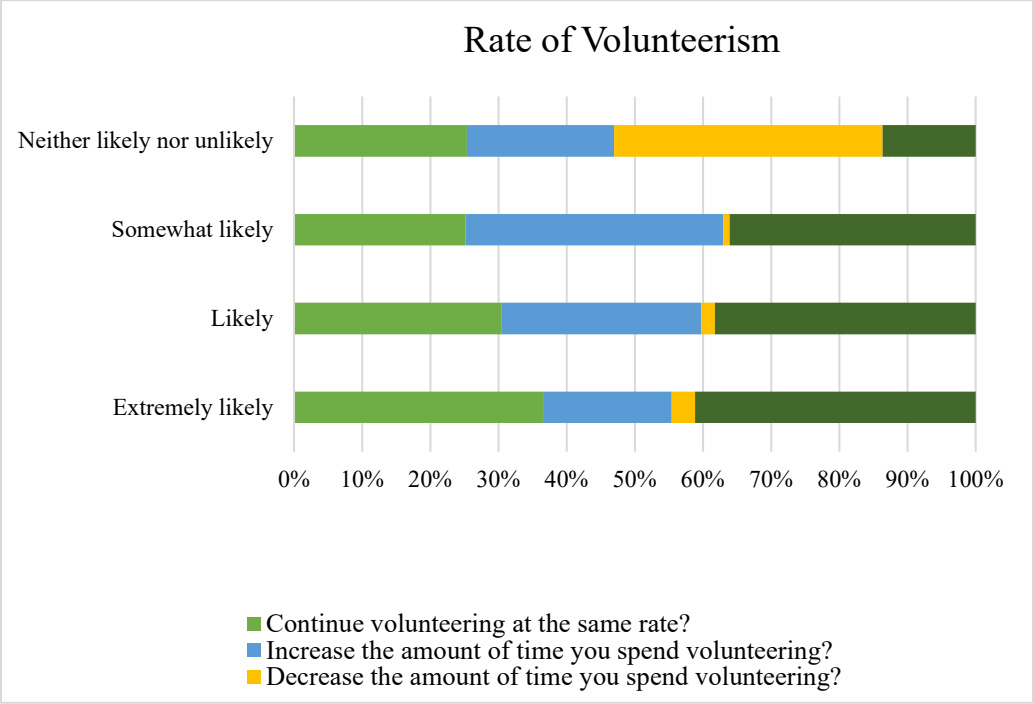


Figure 5. Rate of volunteerism

(4) Weather

As SMGA's volunteerism is largely centered around maintaining the trails in the natural areas, understanding stewards' preferences regarding (unfavorable) weather conditions can help SMGA anticipate turnouts. Stewards were asked: "How likely are you to complete an outdoor task if the weather is unfavorable?"

With 90 responses, 60 percent said they were "Somewhat likely" and 11 percent reported they are "Extremely likely" to complete an outdoor task in unfavorable

weather. Further, 17 percent were “Somewhat unlikely” and 6 percent reported to be “Extremely unlikely” to complete an outdoor task if the weather is unfavorable.

(5) Training and Knowledge

Stewards were asked about their agreement (“Agree”; “Neither Agree nor Disagree”; “Disagree”) with 6 statements pertaining to training and knowledge. With 89 responses, most respondents (over 60 percent) were agreeable to each statement except for “I like to earn recognition or a reward for completing training activities”. The responses for this statement were nearly evenly divided into thirds among the three options.

In sum, most stewards feel properly trained and supported by SMGA. However, not all agree regarding earning recognitions or rewards are important (Figure 6).

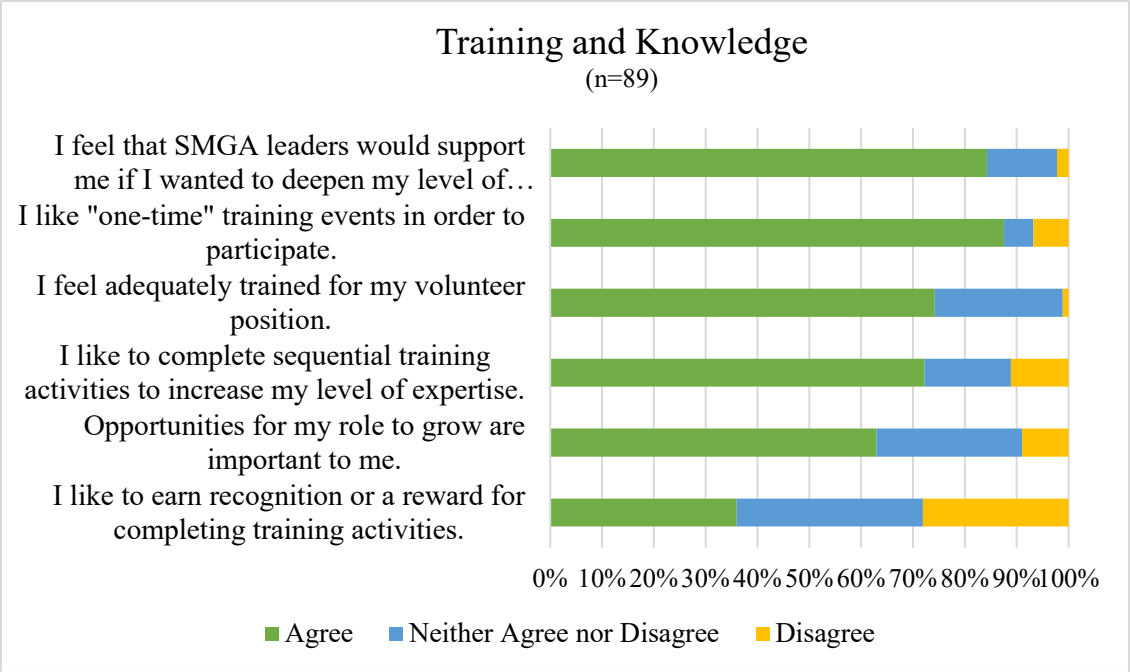


Figure 6. Perceptions of training and knowledge

(6) Recognition

Although recognition was a small portion of training and knowledge, this statement was focused on recognition for completing training. The next area of inquiry considers recognition from a general standpoint, including recognition for ongoing volunteerism. As depicted in Figure 7, no more than 10 percent of respondents found any type of recognition extremely important. Hovering around 10 percent, respondents reported name recognition in the newsletter, gifts (hats and t-shirts) from the organization, and a volunteer appreciation event to be very important. Ten to 25 percent of respondents found that all forms of recognition are moderately important. Further, over 50 percent of respondents found the following forms of recognition *not at all important*: name recognition on social media, certificate of appreciation, and a hand-written card. At a combined percentage of 47, a volunteer appreciation event was reported as moderate

to extremely important while certification of appreciation seems to be the least desirable form of recognition.

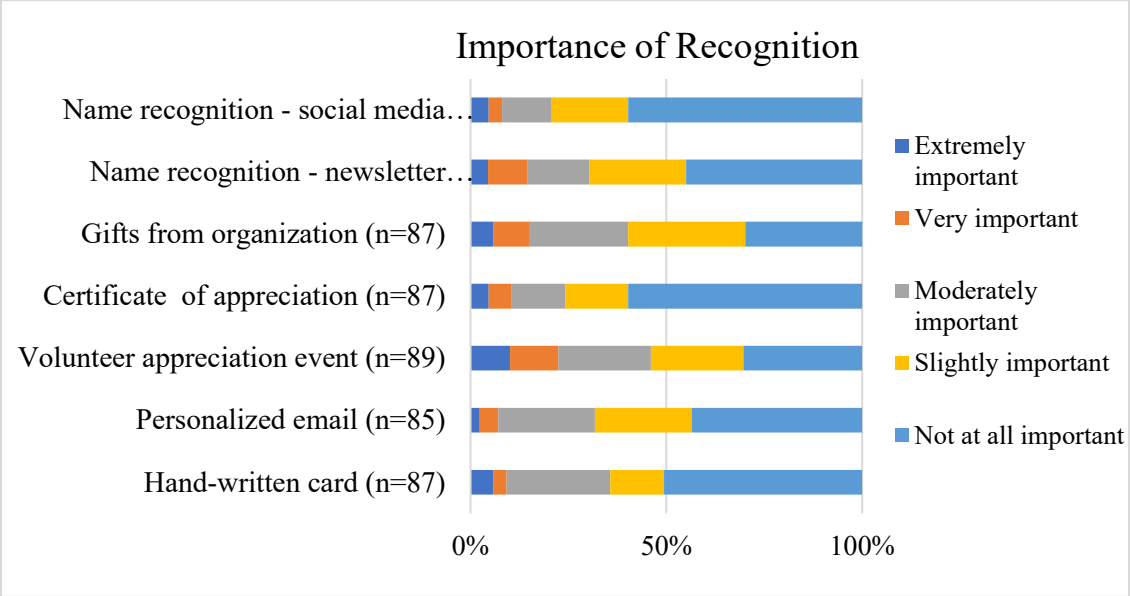
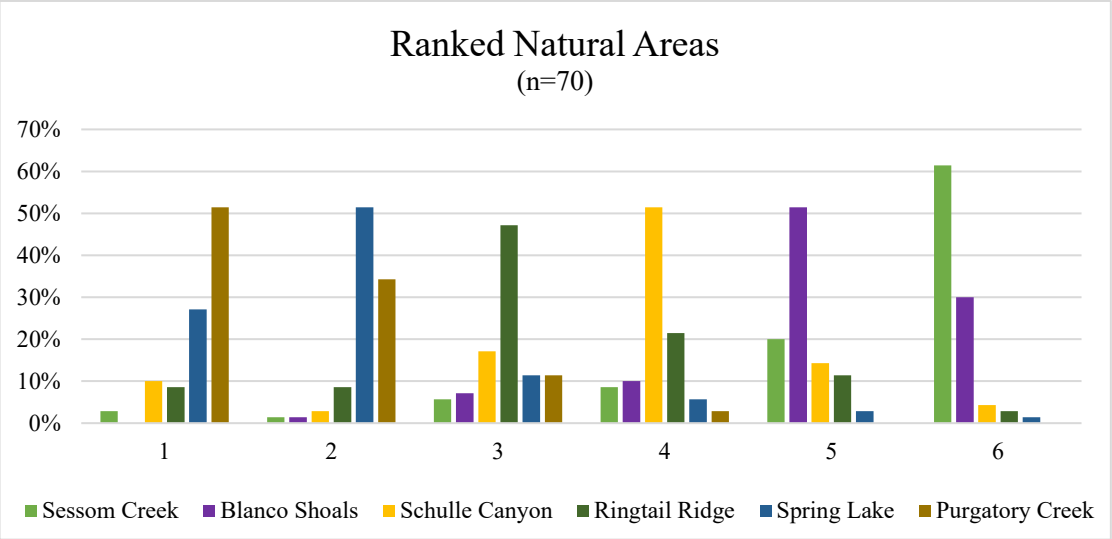


Figure 7. Importance of recognition

(7) Natural Areas

Survey respondents were asked to rank the SMGA natural areas they preferred to visit with 1 being their most preferred and 6 their least (Figure 8). With 70 respondents, Purgatory Creek Natural Area was ranked 1st by the majority (51 percent) and Spring



Lake Natural area ranked **Figure 8. Ranked natural areas by preference**

2nd (51 percent). Ringtail Ring was ranked 3rd by a near majority (47 percent) and Schulle Canyon was 4th (51 percent). With 51 percent, Blanco Shoals Natural Area

ranked 5th and Sessom Creek was ranked last with 61 percent.

To summarize volunteer preferences, the results show the following generalizations:

- stewards prefer to work in small groups of 3 to 5 (Figure 3);
- weekends, especially weekend mornings, may be a better time to schedule volunteer events (Figure 4);
- stewards are likely to continue their current rate of volunteering and even recommend volunteering to others (Figure 5);
- stewards are likely to complete outdoor tasks if the weather is unfavorable;
- SMGA volunteers feel properly trained and supported by the organization (Figure 6);
- there are mixed responses about recognition, a volunteer appreciation event was deemed important while the majority of the other forms of recognition were unimportant (Figure 7); and
- most volunteers prefer the natural areas in the following order with the first being the most preferable: Purgatory Creek, Spring Lake, Ringtail Ridge, Schulle Canyon, Blanco Shoals, and Sessom Creek (Figure 8).

To determine if volunteer participation varies systematically with individual characteristics, a series of chi-squared tests of independence were performed. Results showed a significant relationship between the following participation variables and volunteer attributes:

- The length of volunteer time and employment; [1] those who are no longer employed, i.e., retired, and those who work in the government/public sector may have volunteered longer (3 years or more) than those who are students or employed in the private sector.
- The length of volunteer time and household income; [2] volunteers with higher household incomes ($50,000 – $80,000+) may have volunteered longer (3 years or more) than those with lower household incomes.

5.1.5 Changes in Environmental Outlook and Behavior

To address the third through fifth broad research questions regarding what, if any, skills or insights stewards gain from participation in SMGA and how these skills and insights are shared with social networks, the survey included a four-part section that aimed to capture any changes in: (1) creating native landscapes, (2) appreciation of natural areas, (3) environmental activism, and (4) water awareness. Stewards were asked to assess if involvement in SMGA has led to any of the following changes in their lives through a series of statements with answer choices of "Yes – I now do this"; "No – I do not do this"; and "I did this prior to involvement."

(1) Creating Native Landscapes

Involvement in SMGA resulted with approximately 50 percent of respondents stating that they *now* (1) can recognize unhealthy landscapes, (2) discourage friends and neighbors

[1] $p < 0.01$
[2] $p < 0.05$

from using invasive exotic species, and (3) help protect native plants wherever they occur. Approximately 50 percent of respondents stated they landscaped with native plants and created backyard wildlife habitats *prior* to involvement.

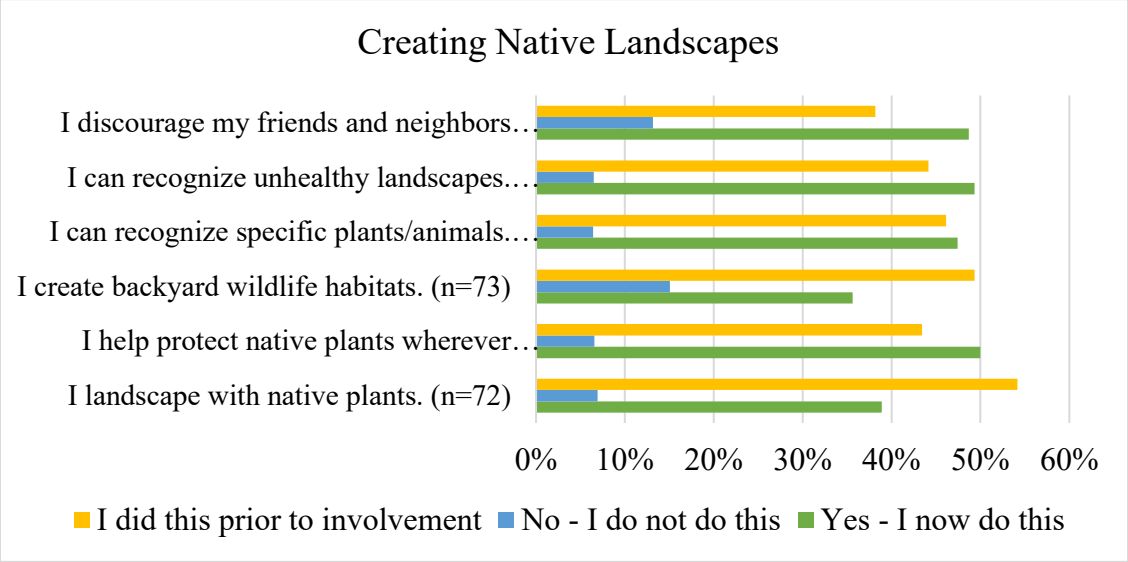


Figure 9. Creating native landscapes

(2) Natural Areas: Usage and Appreciation

The majority of respondents (50 to 73 percent) were engaged with natural areas prior to involvement with SMGA. For example, 73 percent stated they enjoyed themselves in the outdoors prior; whereas 27% stated they *now* enjoy themselves after involvement with SMGA. Zero respondents do not enjoy themselves in the outdoors. Further, 70 percent stated they felt at home in natural areas prior and 30 percent stated they felt at home in natural areas after involvement; zero respondents do not feel at home in

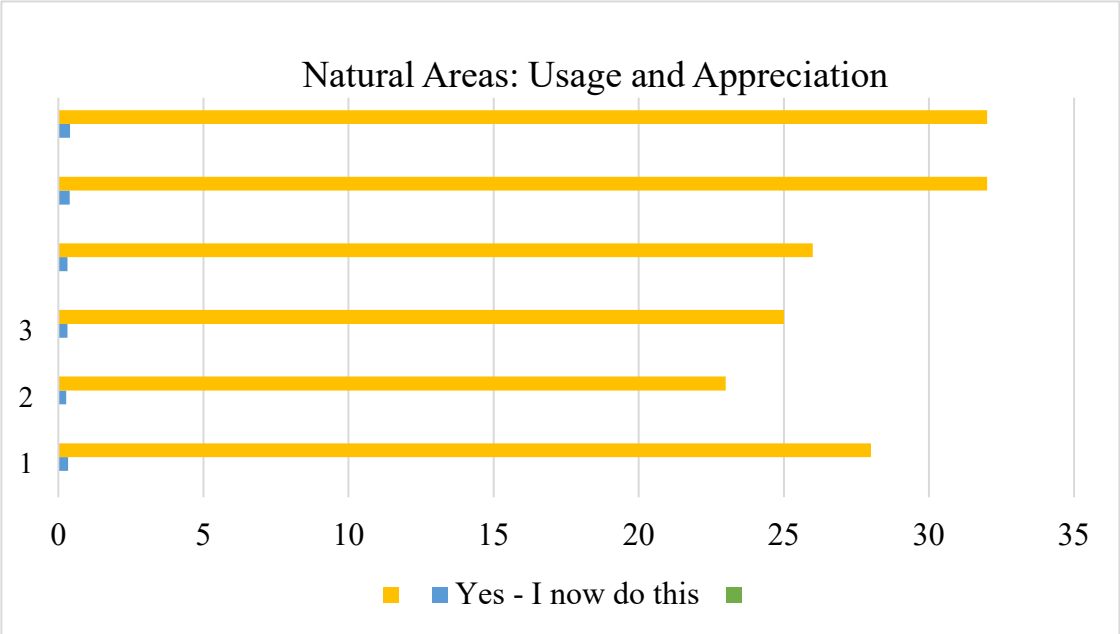


Figure 10. Natural areas: usage and appreciation

the natural areas. Again, because of involvement with SMGA, zero respondents do not visit natural areas and preserves; 66 percent did prior and 34 percent now do.

The statement with the most respondents stating they "now do this" was "I invite others to explore natural areas with me" (40 percent). Figure 10 graphically depicts this information, as evident by the yellow ("I did this prior to involvement.") surpassing the "Yes- I now do this" and the "No – I do not do this" statements.

(3) Environmental Activism

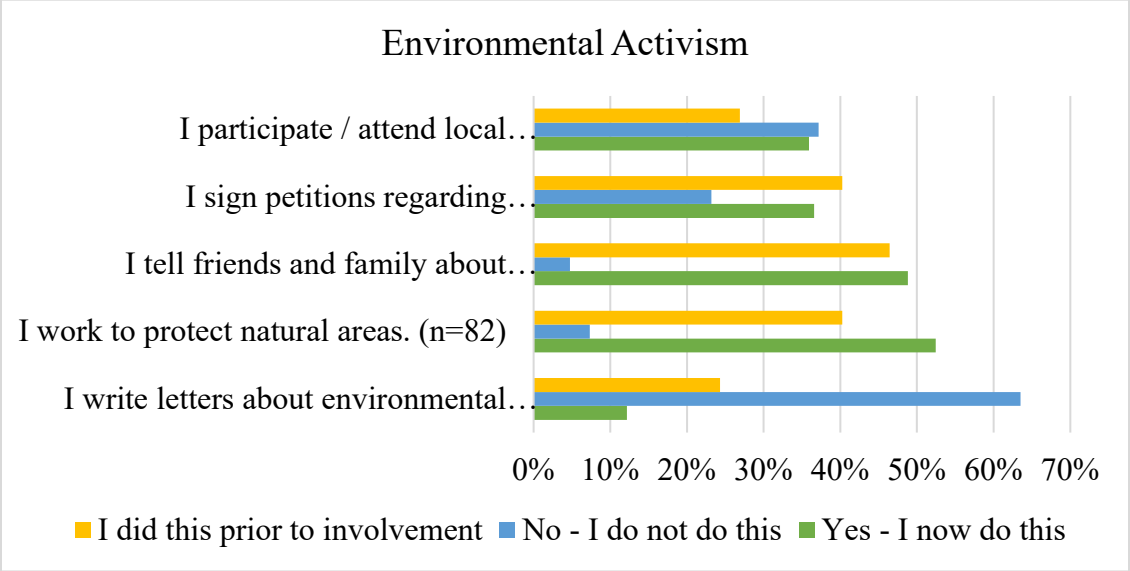


Figure 11. Environmental activism

Naturally, through involvement with SMGA, over 52 percent of respondents now work to protect natural areas than prior to involvement (40 percent). Along this same trend, 49 percent of respondents *now* tell friends and family about environmental issues whereas 46 percent did so prior. The statement "I participate / attend local government decision-making meetings" received little differences between those who did it prior to participation (27 percent), do it now (36 percent), and those who do not do it at all (37 percent).

Most respondents (64 percent) do not write letters about environmental issues.

The two statements with the highest percentage of change are "I work to protect natural areas" (52 percent) and "I tell friends and family about environmental issues" (49 percent).

(4) Water Awareness

Similar to results in Figure 10, Figure 12 demonstrates that most respondents understood the following statements related to water awareness prior to involvement. The statements where respondents now do/understand this are presented in Figure 12 in descending order. First, 44 percent now understand the integral part natural areas play in flood mitigation. Second, 41 percent now understand how important natural areas are to the recharge zones. Third, 40 percent now understand how watershed health affects water quality; and fourth, nearly 30 percent now reduce household water consumption.

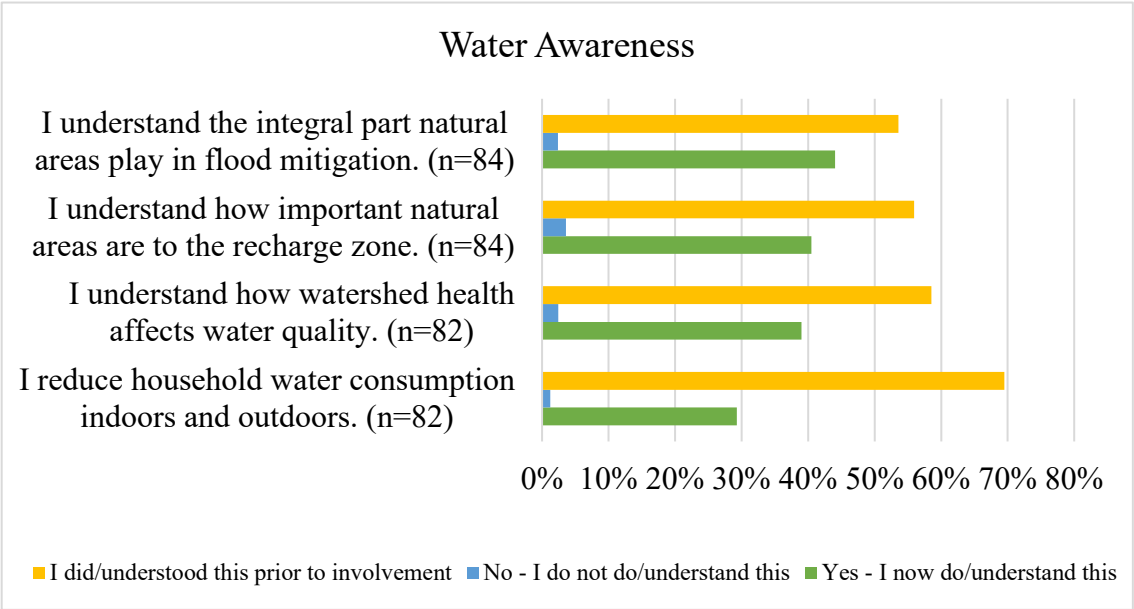


Figure 12. Water awareness

In conclusion, involvement in SMGA did lead to changes in environmental outlooks and behaviors. While in some categories the majority of the respondents were already engaged in these activities prior (as understandable), it is useful for SMGA to understand what, if any, changes have occurred in their volunteers. As such, the most notable changes can be generally described as the following:

- Most volunteers have gained insights and education around recognizing healthy landscapes and share that knowledge with their social networks (Figure 9);
- All respondents now feel at home and enjoy natural areas and 40 percent of respondents now invite others to explore natural areas with them (Figure 10);
- Nearly half of respondents now tell friends and family about environmental issues (Figure 11); and
- 40 to 45 percent of respondents now have gained insights and education about the role natural areas play in flood mitigation, watershed health, and recharging aquifers (Figure 12).

5.2 Potential Volunteer Survey

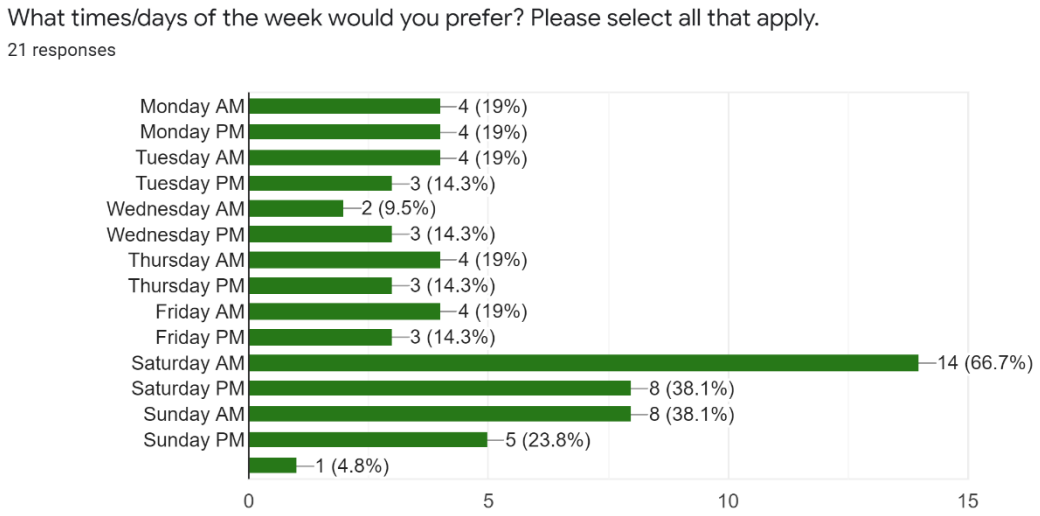
The Potential Volunteer Survey (PVS) was created to capture who may be interested in becoming involved with SMGA. The PVS was administered by SMGA and posted on social media accounts over the summer and received 21 responses. The 11-item questionnaire inquired about preferred days and times to volunteer, volunteer duties, and about the respondents. The last question was open-ended and asked: "In general, what motivates you to volunteer?" The results will be presented in the sequence in which they were asked and because there were 21 responses, the results will be presented in number of respondents, rather than percentages for clarity.

(1) Preferred Volunteer Duties

The first question asked: How would you prefer to volunteer with SMGA? Respondents were allowed to select multiple responses. Most respondents prefer to work on the trails (n=19), followed by outreach and communications (n=9). In the office, in fundraising, and on the board were selected three times each.

(2) Preferred Volunteer Day and Time

Most respondents preferred to volunteer on the weekends, with most selecting Saturday morning as the best time (n=14). Recall that most stewards would like to volunteer in



small groups of three to five; as such, a large event on Saturday Mornings may deter some active volunteers.

Figure 13. Preferred days and times of potential volunteers

(3) Volunteer Frequency

The PVS found that most people would like to volunteer as their schedule allows (n=11), some would like to dedicate a few times a year (n=4), and three said they would like to volunteer weekly. Twice a month and monthly both were selected once.

(4) Preferred Social Setting

Similar to results found in the SS, most people prefer to volunteer in a small group of three to five (n=17). Other options selected were alone (n=3) and with a partner (n=1). No one selected with a large group or with a large event.

(5) Preferred Age Group

PVS asked which age group they would prefer to work with. Two age groups, 35-45 and 55-56, were selected by seven respondents each. Two respondents selected the age groups 15-25 and 25-35 respectively. Lastly, the age groups 45-55 and 65-75 were each selected once. None selected the age group of 75 plus.

(6) Self-description

PVS asked participants to describe themselves as one or more of the following:

- Nature lover (n=19)
- Hiker (n=13)
- Biker (n=7)
- Birder (n=7)
- Casual stroller (n=6)
- Trail runner (n=1)
- Other* (n=1)

*text entered: always striving to learn more about my surroundings

(7) Residency Status

When asked if they lived in the city of San Marcos, 17 said yes, 2 are outside the city limits, 1 stated no, and 1 stated they lived in Malawi, Africa.

(8) Additional Activities

The PVS asked what other types of activities they enjoyed doing while in the natural areas; multiple selections were available. Most (n=11) selected photography, reading (n=9), listening to music and meditating/relaxing (n=8, respectively). Other selections include the following:

- Dog walking (n=5)
- Writing (n=4)
- Geocaching (n=3)
- Learning about native plants (n=1)
- Mountain biking (n=1)
- Running, hiking with family (n=1)
- Drawing (n=1)
- Gaming with augmented reality (n=0)

(9) Age

The PVS participants were asked to report which category best described their age.

- 15-25 (n=2)
- 25-35 (n=5)
- 35-45 (n=5)
- 45-55 (n=1)
- 55-65 (n=2)
- 65-75 (n=6)
- 75+ (n=0)

As detailed above, the two age groups with the most respondents were between ages 25-45 (n=10).

(10) Visits to Natural Areas

Participants were asked to select how often they visit any of SMGA's natural areas. Most (n=9) visit weekly, four visit twice a month, three visit 6 times per year, two visit daily, and one selected that they visit three times a year.

(11) Motivation to volunteer
Lastly, the PVS concluded with an open-ended question: "In general, what motivates you to volunteer?" The responses (n=18) were divided into two broad themes: sense of duty and community connections; these and sample statements are provided in Table 5.

Sense of Duty	Community Connections
I use the trail, so I should help maintain it.	Ability to produce results while meeting people with similar interests during a time that works with my busy work schedule.
I want to give back to something I find very valuable.	Wanting to be better connected to the people and places around me.
Give back to space that gives so much to me and to preserve for the future.	Making a positive contribution to the community.
Duty to give back and support environment.	I like serving people naturally.
Give back to the community, preserve natural green space.	To learn more about my community.
Mountain bike and jogging trails need serious help.	Help sustain access, trail maintenance, growth of greenspace acreage and trails, and education.

Table 5. PVS open-ended responses

5.3 Story Map

Seven interviews were conducted at Wake the Dead. Of these, four narratives were collected for the Story Map. Some interviewees were not as heavily involved with the trail crew or had yet to volunteer on the trail crew and were not able to provide relevant stories related to their volunteerism with SMGA. The Story Map can be edited as necessary. https://arcg.is/Cjri5

6. IMPLICATIONS OF RESULTS AND RECOMMENDATIONS

6.1 Attracting a more diverse pool of stewards

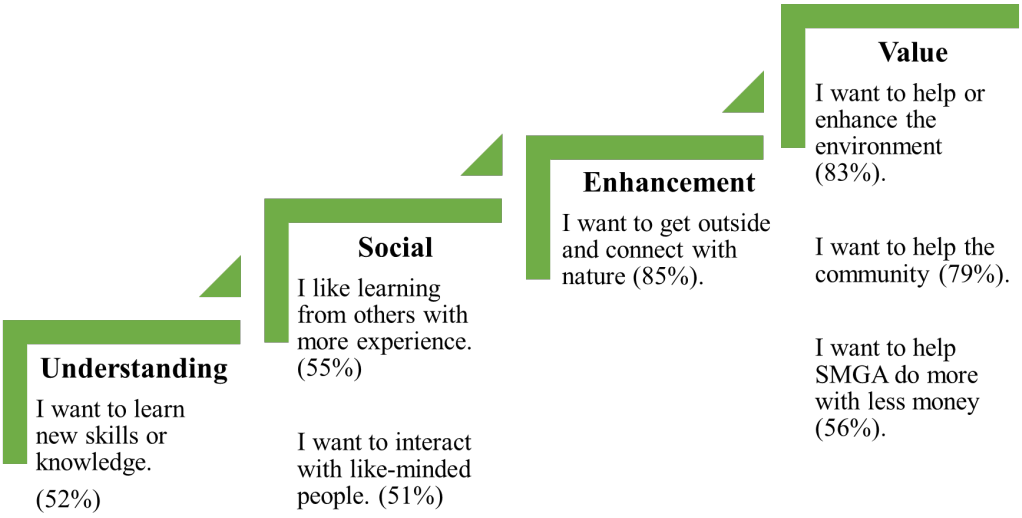
Based on the SS results, most stewards are white, of retirement age, and have higher incomes. Considering the results of the PVS, there is indeed an untapped source of potential volunteers that are of a different age group (i.e., mostly 25-45). However, it is important to

note these volunteers prefer to work on the weekends, more so on a Saturday morning. Results from both surveys indicate people prefer to work in small groups of three to five, rather than a large event.
Lastly, most *potential* volunteers use the trails for a variety of reasons, and most have a desire to maintain them through a sense of duty or gain community connections.

Recommendation: Create another workday on a Saturday morning while maintaining the traditional Thursday morning shift to keep groups small; advertise these workdays on the trailheads as well as on SMGA social media accounts – both are places to locate and harness these potential volunteers that use the trails and are attentive to SMGA's social media accounts.

6.2 Matching experience to motivation

Recalling that most stewards in general are attracted to volunteerism through intrinsic (or value-based) motivations, it is important for organizations such as SMGA to match the experience to the motivation. In other words, a quality volunteer experience should be provided that will satisfy the concern. This in turn will lead to higher rates of participation. According to the literature (see 3. BACKGROUND), several functions of volunteerism emerged as predominant categories: values, understanding, enhancement, career, and social (Table 1). By comparing the top percentages of "strongly agree" motivational



statements to these functions, SMGA can first understand, then better satisfy their stewards' concerns.

Figure 14. Motivations and corresponding functions

Although the motivation with the highest percentage of agreement relates to the Enhancement function (85 percent strongly agree), three motivational statements with high percentages of agreement may be attributable to the function Value. Further, volunteer motivations are less strongly linked to the functions of Social and Understanding (Figure 14). Compare Figure 14 to Table 1; the Career function is not present in the former. Understandably this could be due to the age range and employment status (retired) of the

current stewards. As such, SMGA could focus more on the Values of both current and potential stewards (Table 5).

Related to the PSV results, when asked "In general, what motivates you to volunteer?" Potential stewards' responses were summarized as two broad categories: sense of duty and community connections (Table 5). These correspond to the functions of Values (sense of duty) and Social (community connections). In short, stewards and *potential* stewards are likely motivated by intrinsic functions with Value and Social playing a stronger role. Because the rate of volunteerism is relatively stable (Figure 5), this may indicate that SMGA is able to match the motivational concern of current stewards.

A final consideration related to matching experiences to motivations is evident in the function Understanding. Fifty-two percent of SS respondents stated they participate with SMGA to learn new skills or knowledge. Based on the results from section 5.1.5 Changes in Environmental Outlooks and Behavior, SMGA fulfilled these motivational concerns as more than half of stewards reported that they *now* can recognize unhealthy landscapes. Further, around 40 percent *now* understand, through their involvement with SMGA, (1) the integral part natural areas play in flood mitigation, (2) how important natural areas are to the recharge zones, and (3) how watershed health affects water quality.

Recommendation: Similar to the first recommendation, SMGA can help (potential) stewards' express their values and feel enhanced (by nature) through creating more frequent, and possibly diverse, volunteer opportunities, i.e., advertise the plethora of tasks trail crew completes to attract those to may want to build trails, remove invasive species and plant natives, water trees, etc. This could equate to the additional Saturday morning workday as previously presented. Additionally, SMGA could consider hosting activities at the stewards' favorite natural areas: Purgatory Creek and Spring Lake. Fostering a sense of community by interacting with like-minded people in a certain place (i.e., a favorite natural area) may help stewards reach their motivational concerns and strengthen bonds with the place as well as with SMGA as an organization.

7. CONCLUSION

This study addressed two of the broad objectives of SMGA: assessing the benefits and values of the natural areas and enhancing awareness and education about the importance of protecting and connecting greenspace. In doing so, the research uncovered steward motivations, preferences, and sociodemographic characteristics. Further, the study was also able to capture potential stewards through the use of a short questionnaire.

Overall, SMGA has successfully matched motivational concerns of their current volunteer base but can build organizational capacity and their volunteer base through providing additional, diverse opportunities for potential stewards to enact their motivational concerns that are largely linked to Values and Socialization.

These results should provide valuable insights for SMGA in terms of outreach and attempts to attract and retain a diverse network of stewards. Results will be of particular use to the Outreach Committee as they can help guide decision-making and best use of resources and funding. As this report is only one interpretation of the results, SMGA may find additional insights and value. The full responses for both surveys can be accessed via the linked

provided on page 29.

Acknowledgements

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TEXAS STREAM TEAM WATER QUALITY

THE MEADOWS CENTER FOR WATER AND THE ENVIRONMENT

TEXAS STATE UNIVERSITY

TEXAS STREAM TEAM

TEXAS STREAM TEAM

Citizen Scientist Survey Results

407 TOTAL RESPONSES

Sent out during summer 2019, the survey had a 15% response rate.

73% MONITOR MONTHLY

Most monitor their sites on a monthly basis; 7% monitor once a week.

GROUP SIZE IS IMPORTANT

Most want to monitor either alone (33%) or with a partner (41%).

NO RECOGNITION

Over 51% of those surveys felt neutral about receiving recognition or appreciation for their volunteerism.

THANK YOU

87% STRONGLY AGREE — HELPING THE ENVIRONMENT

"I want to help or enhance the environment" is the top motivator.

DATA ARE USED PROPERLY — 65% AGREE

Citizen scientists agree their collected data are appropriately used.

30% NOW — TALK ABOUT ENVIRONMENTAL ISSUES

Because of involvement with Texas Stream Team, 30% now talk with family and friends about environmental issues.

WATERSHED HEALTH AFFECTS WATER QUALITY — 46% NOW

46% now understand this because of involvement with Texas Stream Team.

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. INTRODUCTION

Environmental nonprofit organizations (ENO), like Texas Stream Team (TST), rely heavily on volunteers and community participation to implement action plans and affect change at a variety of spatial scales (Johnson et al., 2018; Krasny et al., 2014). Volunteers and community participation may come in flux: weather, incentives, and size of events may affect rates of participation (Bennett et al., 2018; Merenlender et al., 2016; Wright et al., 2015).While these factors are somewhat macroscopic in nature, and they are therefore difficult for ENOs to manipulate in order to increase participation, studies that contribute

to a deeper understanding of the comparably micro-level factors that drive or motivate individual participation in stewardship programs will arguably offer these ENO vital insights for retooling their targeting and outreach efforts. In other words, understanding the motivations of stewards may help ENOs to build organizational capacity by attracting and retaining larger, potentially more diverse, pools of stewards.

Despite the value that can come from studying their volunteers and attempting to identify patterns, ENOs often do not have the internal capacity—or, especially, time—to undertake research projects that are not directly connected to their strategic plans or grant-seeking activities (Close et al., 2016). Recognizing this challenge, participants in the emerging subfield community geography attempt to help fill the gap. Specifically, community geographers partner with communities and ENOs to help them carry out their missions of affecting positive community change and, in doing so, build organizational capacity (Hawthorne et al., 2014; Robinson, 2010).
This report will detail the project's purpose, background/guiding literature, methodology, and descriptive and inferential results.

2. PURPOSE

The purpose of this community geography partnership with TST was twofold: first, to understand motivations of TST volunteers in order to provide TST with useful information for targeting and outreach; and, second, to understand whether participation in TST activities is linked to spillover effects, whereby volunteers bring knowledge gained through TST to bear on their home and/or community lives. This latter objective can play a valuable role in TST's future grant-seeking efforts, as it will seek to show that knowledge and experience gained through TST has lasting effects outside of TST event/activity contexts.
To that end, this project asked the following 6 broad research questions:

7. What are the socio-demographics of the Citizen Scientists?
8. What are the most common reasons (motivations) volunteers give for participating?
9. What are their preferences and desires for training programs and recognition?
10. What skills or insights, if any, do volunteers say they gained from TST participation?
11. Do participation, preferences, and motivations vary systematically with selected individual characteristics?
12. What, if any, statistically significant changes in environmental outlook and behaviors have occurred in Citizen Scientists due to their involvement with TST?

Research questions 1-4 are answered in 5.1 DESCRIPTIVE RESULTS and research questions 5 and 6 are answered in 6.1 INFERENTIAL RESULTS.

3. BACKGROUND

3.1 Environmental Stewardship

Environmental stewardship involves *voluntary* individual or collective action on behalf of the environment due to a moral concern (Cockburn, Cundill, Shacckleton, & Rouget, 2018;

Raymond et al., 2013; Welchman, 2012; Worrell & Appleby, 2000). These actions are the "suite of approaches, activities, behaviors, and technologies that are applied to protect, restore or sustainably use the environment" (Bennett et al., 2018, p. 603). As such, stewardship actions are further characterized by the scale, issue, activity, location, motivation(s) and levels of complexity.
Scholarly writing on the concept of stewardship is thought to have taken off in western culture with the American author, philosopher, scientist, ecologist, conservationist, and environmentalist Aldo Leopold (Bennett et al., 2018). Leopold's concept of a land ethic has been widely cited in the environmental stewardship literature (Wolf et al., 2013, p. 17). In his seminal *A Sand County Almanac*, Leopold poetically describes a land ethic as a moral framework for interacting with the natural environment which is produced from positive experiences with it (Leopold, 1949). Further, an individual that develops a land ethic would understand and accept humans as part of the larger ecological community, and that human actions affect the landscape and all its inhabitants (Leopold, 1949). To have a land ethic, then, is to care for the land, or to be a steward of it.

It follows that stewardship, as a set of behaviors and actions that are oriented toward care zfor the land (Romolini, Brinkley, & Wolf, 2012), is a manifestation of Leopold's land ethic (1949). Stewardship has been researched extensively in environmental philosophy (Fernandes & Guiomar, 2016, p. 602). Outcomes of this research have found this underlying ethic may stem from an altruistic concern for current or future generations (Robinson, Bennett, King, & Murray, 2012), especially now as climate change challenges humanity's ability to adapt. Lastly, this ethic may develop from an understanding of what constitutes a "right" relationship with others, including the natural world (Chan et al., 2016).

Since the unique nature of environmental stewardship relies heavily on voluntary actions, understanding the motivations for acting, without monetary compensation, on behalf of the environment and/or stewarding a common resource is crucial for organizations' ability to retain volunteers and increase participation (Johnson et al., 2018; Krasny, Russ, Tidball, & Elmqvist, 2014, p. 17; Merenlender et al., 2016; Wright, Underhill, Keene, & Knight, 2015). This understanding is of critical importance and because motivations tend to be highly context- and person-sensitive (Bennett et al., 2018) a study such as this should prove beneficial for Texas Stream Team.

3.2 Assessing Motivations and the Functional Approach

There are two major categories of motivators: intrinsic and extrinsic as identified by Finkelstien (2009); these two general concepts have been applied to understanding volunteer motivations (Cecere, Mancinelli, & Mazzanti, 2014; Moskell, Broussard, & Ferenz, 2010). Intrinsic motivations can be further characterized as 1) stemming from underlying ethics, values, morals, and beliefs (Chan et al., 2016; Fernandes & Guiomar, 2016; Leopold, 1949; Robinson et al., 2012) and 2) a need for self-determination and/or self-actualization (Cetas & Yasue, 2017; Maslow, 1943). Whereas extrinsic motivators are

grouped as 1) the perceived balance and direct costs and benefits of natural resource protection (Lopes & Videira, 2013) and 2) externally provided rewards: social, physical, economic, or legal (Bennett et al., 2018).

Multiple studies reveal *intrinsic* motivations are more often the principle motivator behind stewardship, and these types of motivations are more durable and long-lasting than extrinsic (Bennett et al., 2018, p. 603). As such, previous studies that seek to understand volunteer motivations have found that helping the environment is typically the most frequently selected reason, i.e., an intrinsic motivator, and career advancement, i.e., an extrinsic motivator, to be the least frequented selection (Grese et al., 2001; Bruyere & Rappe, 2007; Alender, 2016).
The functional approach to understanding volunteering was originally created by Katz (1960) and later applied by Clary and Snyder (1999). Its purpose is to describe motivations which lead individuals to beginning and continuing volunteering and contains three underlying assumptions:

(a) It is a motivational perspective that directs inquiry into the personal and social processes that initiate, direct, and sustain action.
(b) People can and do perform the same actions because of different psychological functions (e.g., different people engage in the same volunteer activity but do so to fulfill different motives).
(c) It suggests that important psychological events, such as embarking on a course of volunteer activities and then maintaining those activities over extended periods of time**,** *depend on matching the motivational concerns* of individuals with situations that can satisfy those concerns (Clary & Snyder, 1999, emphasis added).

In other words, people may volunteer for the same activity for different reasons, and if they feel like the activity does not satisfy their motivation, i.e., the quality of the activity (Shirk et al., 2012), then they will cease participation (Bruyere & Rappe, 2007). Using the functional approach, Clary et al. (1994, 1996) developed the Volunteer Functions Inventory with five functions (Table 1).
Recalling the two major categories of motivations, intrinsic and extrinsic, all the functions in the inventory fall under the intrinsic motivator with the exception of the career function which is an extrinsic motivator (Table 1). This approach has been tested against other similar methods (Okun et al., 1998; Allison et al., 2002) and applied (as well as modified) in several environmental volunteer/stewardship studies (Ryan et al., 2001; Martinez & McMullin, 2004; Yeung, 2004). As such, the Volunteer Functions Inventory is "the most widely used approach for studying and understanding motivations for volunteerism" (Bruyere & Rappe, 2007, p. 506).

Table 1. The Volunteer Functions Inventory adapted from Clary and Snyder 1999, 157.

Function	Conceptual Definition	Sample Survey Statement

Values	Acts to express important values	I feel it is important to help the environment.
Understanding	Desires to learn more about a subject and gain or use skills	I like to learn from others with more experience than me.
Enhancement	Aims to improve psychologically through volunteering	I feel good when I volunteer.
Career	Wants to network or gain career-related experience	I volunteer to advance in my career.
Social	Participates to create and strengthen social relationships	I volunteer to meet people.

3.3 Additional Motivational Influences and Considerations

Recognition of stewards' work and changes in environmental outlooks and behaviors are sparsely assessed in the literature but may offer insights for TST. For example, Alender (2016) stated her research was the first to add questions of volunteer-collected data use satisfaction to a citizen science survey. In addition, Alender (2016) expanded on the forms of recognition, i.e., name recognition, social media mentions, paraphernalia, and a volunteer appreciation event. As this literature is undeveloped, there are mixed findings on recognition. Alender (2016) found 40% of respondents selected "neutral or undecided" when asked if recognition was important to them. A previous study, Roggenbuck et al. (2001), found that most volunteers preferred no recognition.

Environmental volunteerism may result in changes in environmental outlooks and behaviors that can strengthen the connection between people and their environment (Ryan et al., 2001; Jordan, 1989; Ross, 1994). As such, working with and in natural areas may create an attachment to place and/or place meanings that manifest as pro-environment behaviors (Ryan, 1997). Indeed, Ryan et al. (2001) found that the skills learned and obtained from volunteerism led to the creation of native landscapes, general appreciation of natural areas, and environmental activism. Further, the motivator of "social" was statistically significant with respondent's attachment to their volunteer site (Ryan et al., 2001). In sum, stewardship activities increase the amount of "appreciation of and advocacy for *local* natural areas" (Ryan et al., 2001, p. 641, emphasis added). The local aspect is important here as the need to preserve and monitor the well-being of local natural areas is often "overshadowed" by more "glamorous" efforts of conservation such as rainforest preservation or other wild landscapes (Ryan et al., 2001).

4. SCOPE AND METHODOLOGY

During summer 2019, a survey instrument was designed to answer the research questions based on the literature and needs of TST through several meetings and email communications with TST staff. The Institutional Review Board approved the survey on May 13, 2019 (project #6440).

The Citizen Scientists survey was developed to understand volunteer's demographics,

motivations, and potential skills obtained or changes in environmental outlook or behavior. The 30-question, web-based survey was administered in the Qualtrics software. The first email request was sent to an email distribution list of 3,041 (364 emails bounced) on July 31, 2019, followed by three reminder emails approximately every two weeks with the final email reminder sent September 11, 2019. The response rate was 15%.

An incentive of winning one of two $25 Amazon gift cards was offered. Jessica Reed (reed.jessica727@gmail.com) and Tamara Stroud (tams122080@live.com) were the winners; contacted on January 7, 2020. The survey was closed December 18, 2019.

Comprised of five blocks, the survey was structured with closed questions and Likert-scales to ask the following:

- Volunteer Status (4 questions): active or inactive, characteristics of testing site.
- Volunteer Preferences (12 questions): alone or with group, recognition, use of data, weather, rate of volunteerism.
- Motivations and Use of Data (3 questions with 21 statements): learning, socializing, contribution to science, helping the community, use of data, shared results, etc.
- Change in Environmental Outlook and Behavior (3 questions with 16 statements): use of natural areas, environmental activism, and water consumption.
- About You (9 questions): length of participation, employment, gender, age, race, educational status, income, and political views.

Results are first descriptively described; these address research questions 1-4. Then, to answer the remaining research question, a series of statistical tests were conducted to determine what, if any, of the following relationships exists among the following variables.

- A series of chi-squared tests of independence to identify relationships between categorical sociodemographic and volunteering variables (e.g., age and preferred volunteer group size);
- A series of Mann-Whitney and Kruskal-Wallis tests to identify differences numerical rankings/Likert scores across sociodemographic groups; and
- McNemar tests to see if volunteering changed behaviors or issue awareness (e.g., began environmental activism after volunteering but did not engage in the practice beforehand).

Raw data are accessible via the link in Appendix C.

5. DESCRIPTIVE RESULTS

5.1 About the Citizen Scientist

5.1.1 Socio-demographics of Survey Respondents

The Citizen Scientist survey asked respondents a series of questions related to their socio-demographics: gender, race/ethnicity, age, education, household income, political views, and employment status and type (Table 2). The majority are female, white, aged 55-74 years, well-educated with high incomes and liberal political views. They do not work in the environmental/water-related field as they are mostly retired. This socio-demographic profile of environmental volunteers aligns with previous studies. However, one exception

is the age. In most studies, the age of the volunteers is slightly younger (35-40).

Table 2. Socio-demographics of Survey Respondents

Socio-Demographics	Categories	Count	Survey Respondents (%)*
Gender	Male	96	39%
	Female	150	60%
	Prefer not to say/other	3	1%
Race/Ethnicity	White	209	82%
	Hispanic/Latino	13	5%
	Black or African American	4	2%
	Asian	3	1%
	American Indian or Alaska Native	1	>0.5%
	Two or more	12	5%
	Prefer not to say/other	13	5%
Age	18-24	31	13%
	25-34	26	11%
	35-44	40	16%
	45-54	29	12%
	55-64	63	26%
	65-74	48	20%
	75-84	9	4%
Education	High school or less	2	<1%
	Some college	38	15%
	4-year degree	115	47%
	Doctorate/Professional degree	91	37%
Household Income	Less than $10,000	15	6%
	$10,000 - $29,999	22	9%
	$30,000 - $49,999	24	10%
	$50,000 - $79,999	55	22%
	$80,000 +	84	34%
	Prefer not to say	46	18%
Political Views	Conservative	39	16%
	Slightly Conservative	14	6%
	Moderate	33	13%
	Slightly Liberal	38	15%
	Liberal	80	33%
	Prefer not to say	29	12%
	Do not know	12	5%
Employment in environmental/water - related field?	Yes	65	27%
	No	179	73%
Employment	Government or public	58	23%

Private	38	15%
NGO or non-profit	24	10%
Self-employed	19	8%
Student	31	13%
Retired	71	29%
Disabled	1	<1%
Other	6	2%

*May not add to 100% due to rounding.

5.1.2 Status of Citizen Scientists, Site Description, Monitoring Frequency

Citizen Scientists were asked how long they have been a volunteer, what their status is (active/inactive), how they would describe their monitoring site, and how often they monitor.

Length of Time a Volunteer

With 238 citizen scientists reporting, 55 or 23% were monitoring for less than a year; 93 or 39% reported 1 to 3 years; 33 or 14% selected 3 to 5; and 57 or 24% had been monitoring for 5 years or more.

Status

Survey respondents were asked if they were actively monitoring (Figure 1). With 337 responses, over 55% (or 184) said they were actively monitoring. Of these, 12% (or 39) stated their activity was "limited." Other reported to be "inactive but plan to start monitoring again" (18% or 62). Finally, some reported to be inactive (27% or 91). If this option was selected, respondents were asked to please state why.

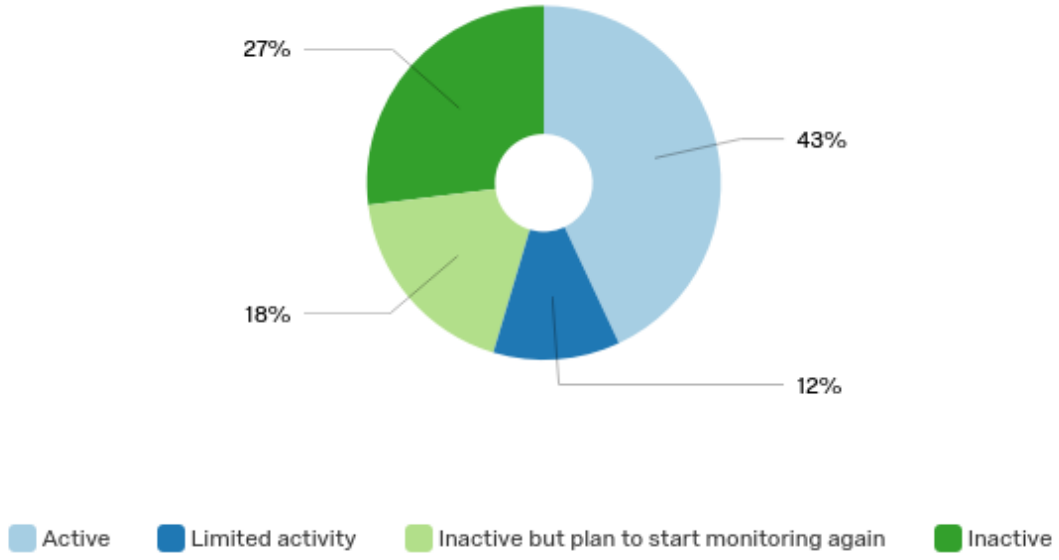


Figure 1. Status of Citizen Scientists

Of the 91 Citizen Scientists that reported to be inactive, 88 comments were received (Appendix A). The comments generally fall into a few categories of explanation: Time (29), Needing a location to monitor (13), Technical / Need support (13), Miscellaneous (12), Health reasons (8), Moved (8), and Need training (5). Table 3 provides example

comments for each category. A complete list of comments can be found in Appendix A.

Table 3. An example of comments received to explain inactivity

Time	Need a location	Technical / Need support	Miscellaneous	Health Reasons	Moved	Need Training
My job prevents me from volunteering.	I was never given an area, nor the kit, and no one ever contacts me.	Required to find partner for funding.	High school year ended	Loss of mobility	Moved and changed career	Haven't gone through training yet
Full time job limited ability to remain consistent	Never received an area to monitor, attempted to make contact several times for assignment but never heard back.	Fort Worth Nature Center could not provide the test kit needed.	Doing water quality monitoring with probes and keeping the data to myself.	I have had a bilateral knee replacement and have not been physically able to access site.	I recently moved out of state and don't know if there is a way to get active again in my area.	I have not had opportunity for training yet.
Taking a break to care for baby	Two of us took the course for Atascosa County but were never contacted	Poor quality of support / organization	What is a citizen scientist volunteer?	Took a break for health reasons	Don't monitor because I don't live on the lake anymore.	Missed initial training and waiting for next available

Site Description

Citizen scientists were asked how they would describe their monitoring site when provided with the following options: accessible to the public, on private property, or not highly accessible but still on public property. The majority reported their sites to be accessible to the public (63% or 159). The two remaining options were selected with equal frequency: on private property (19% or 47) and not highly accessible but still on public property (19% or 47).

Monitoring Frequencies

Citizen Scientist reported they monitor a with the following frequencies:

- Once a month —73%
- Once a year — 10%
- Once a week — 7%
- Once a quarter — 5%
- Every other month — 4%
- Twice a year — 2%

Because a combined 45% of responses reported to be inactive, it is beneficial to view the length of time a citizen scientist volunteer with the volunteer status. Figure 2 provides an indication of how long citizen scientists have actively volunteered; or when inactivity may increase. For example, citizen scientists that have volunteers 3 years or more tend to remain consistently active.

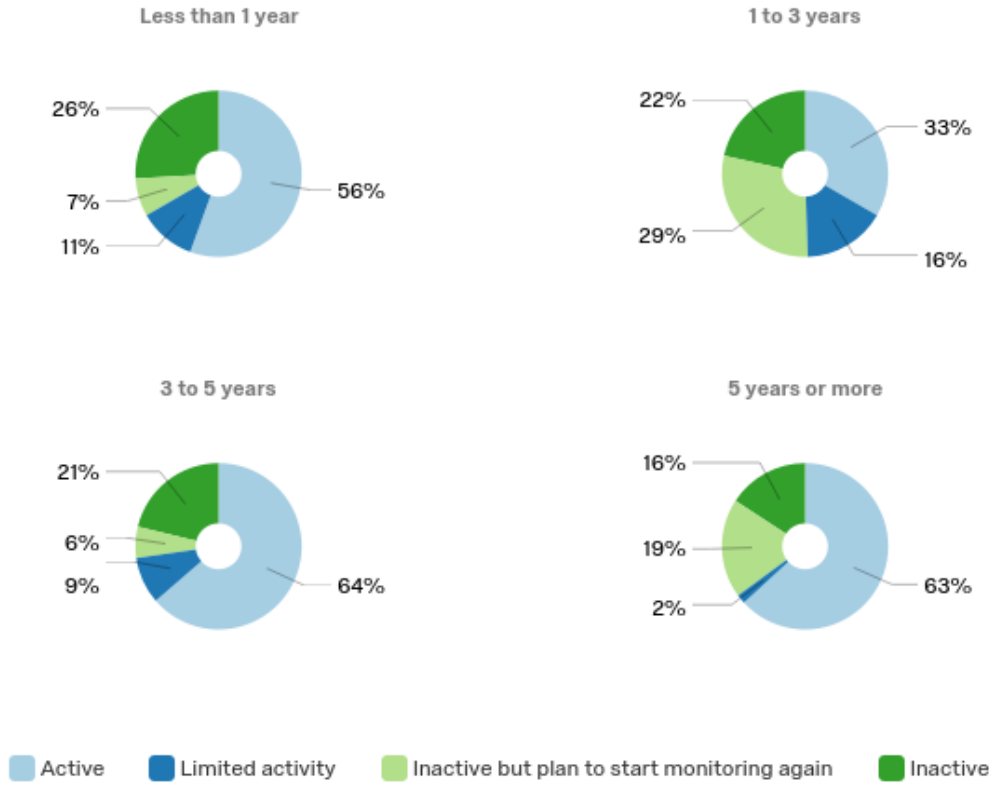


Figure 2. Volunteer length of time and volunteer status

The largest group of inactive citizen scientist are those who have volunteered less than a year. Although this is purely a descriptive analysis, Texas Stream Team staff may find this

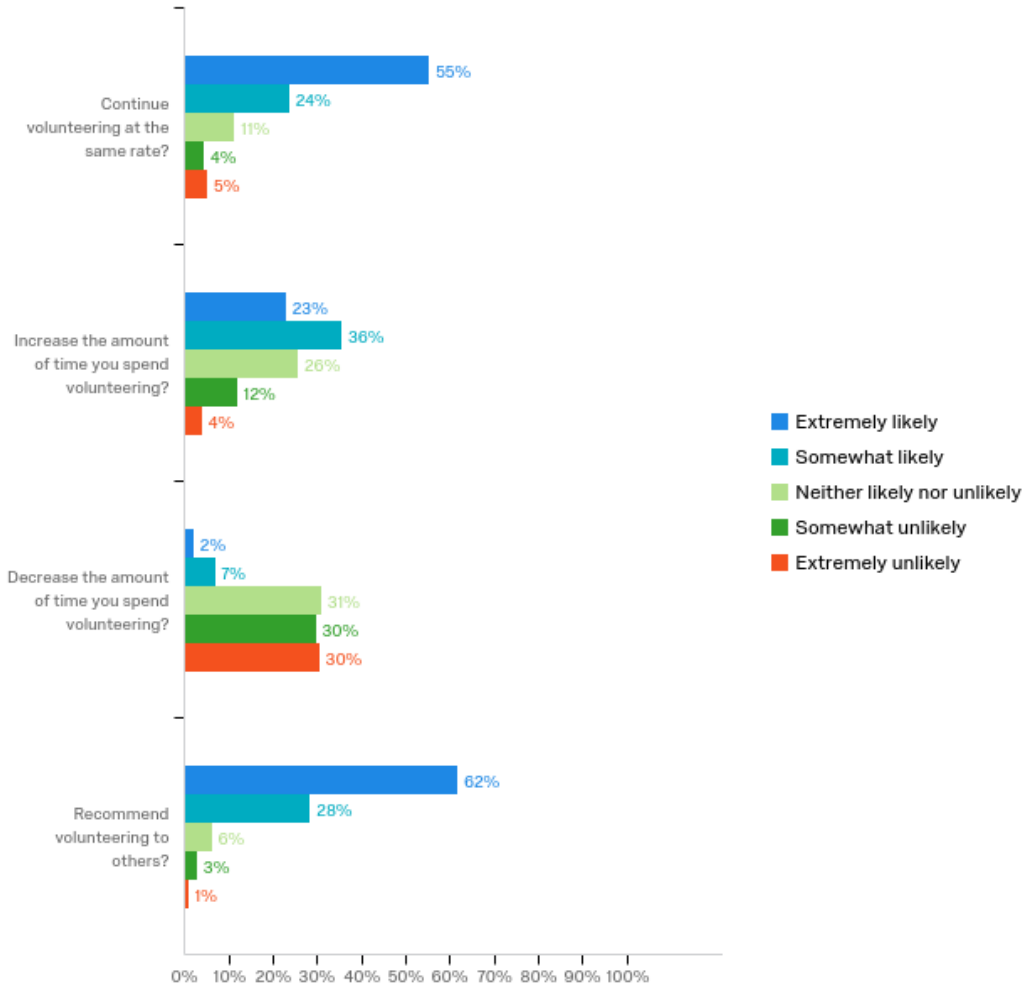
apparent trend, alongside the comments reported to explain inactivity, useful for understanding how to retain volunteers.

5.2 Preferences of Citizen Scientists

The survey included several items to gage preferences: rate of volunteerism, social setting, weather, recognition, preferred training, and desired additional programs and parameters. These are descriptively presented below in sequence.

5.2.1 Rate of Volunteerism

Citizen scientists were asked to select their preferred rate of continued volunteerism, if at all, and if they would recommend volunteering to others. The four questions received an average of 249 responses. As depicted in Figure 3, 55% are extremely likely to continue



volunteering at the same

Figure 3. Rate of volunteerism

rate, which is probably monthly. Nearly 60% (combining extremely and somewhat likely)

indicated they may increase their volunteer time. Most are not likely to decrease volunteer time; and most recommend volunteering to others.

5.2.2 Social Setting/group size

Social setting is the number of individuals that are participating in the citizen scientist/volunteer event or program. Depending on the citizen scientists' motivations (more to follow), the social setting may attract or deter volunteerism. Most citizen scientists prefer to conduct their duties with a partner (41%) or alone (33%). A small percentage, i.e., 3%, prefer to volunteer with a medium or large group.

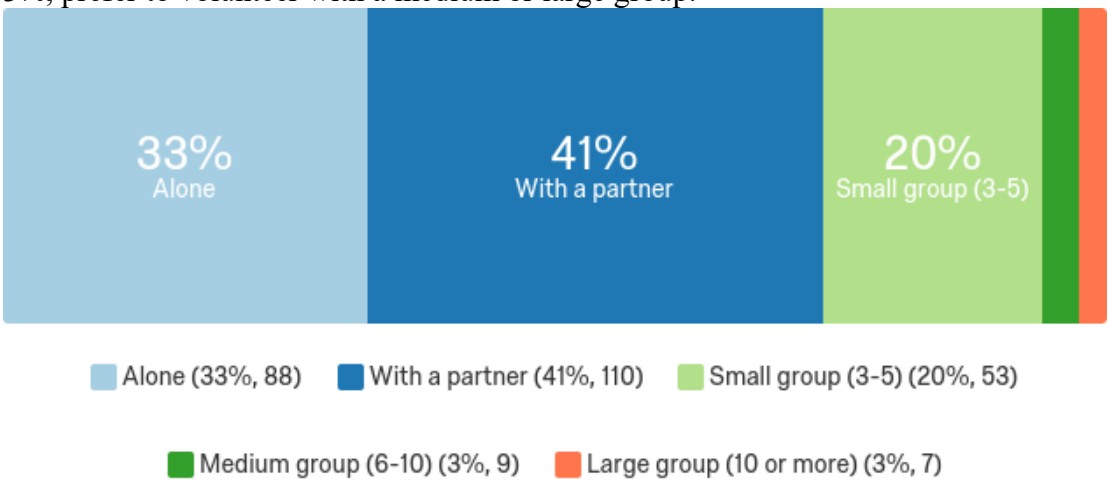


Figure 4. Preferred social setting/group size

5.2.3 Weather

Most citizen scientist monitor outside. Weather can be unreliable and at times poor. As such, understanding if citizen scientists will still conduct their duties if they weather is unfavorable is beneficial. The survey asked how likely they were to still monitor if the weather is unfavorable. Of 262 responses, most citizen scientists for Texas Stream Team (64%) reported they are either extremely to somewhat likely to monitor in unfavorable weather. The responses are as follows:

- Extremely likely — 27%
- Somewhat likely — 37%
- Neither likely nor unlikely — 9%
- Somewhat unlikely — 20%
- Extremely unlikely — 7%

5.2.4 Recognition

Citizen scientists may volunteer for different reasons, one of which may be recognition for service and volunteerism related to career-building. Alternatively, they make feel more inclined to continue their service if they are recognized for it. As such, the survey attempted to understand if recognition is important in general and what types of recognition are regarded as important.

The survey presented the statement: "It is important for me to receive some form of recognition or appreciation for my work." Responds options were agree, neutral, or disagree. With 262 responses, the majority (51%) were neutral. A quarter (25%) actually

disagreed with the statement while 23% agreed. That said, results indicate that over 75% of citizen scientists do not necessarily find recognition or appreciation important. The following question presented different forms of recognition (Figure 5) such as name recognition, gifts, certificates, volunteer appreciation event, and personalized communication. Response options were extremely important, very important, moderately important, slightly important, and not important at all. Because each category received low frequency of responses (i.e., less than 10%), categories were combined for clarity to extremely important, moderately important, and not important at all. Number of responses for each type of recognition averaged 259 (standard deviation 1.4).

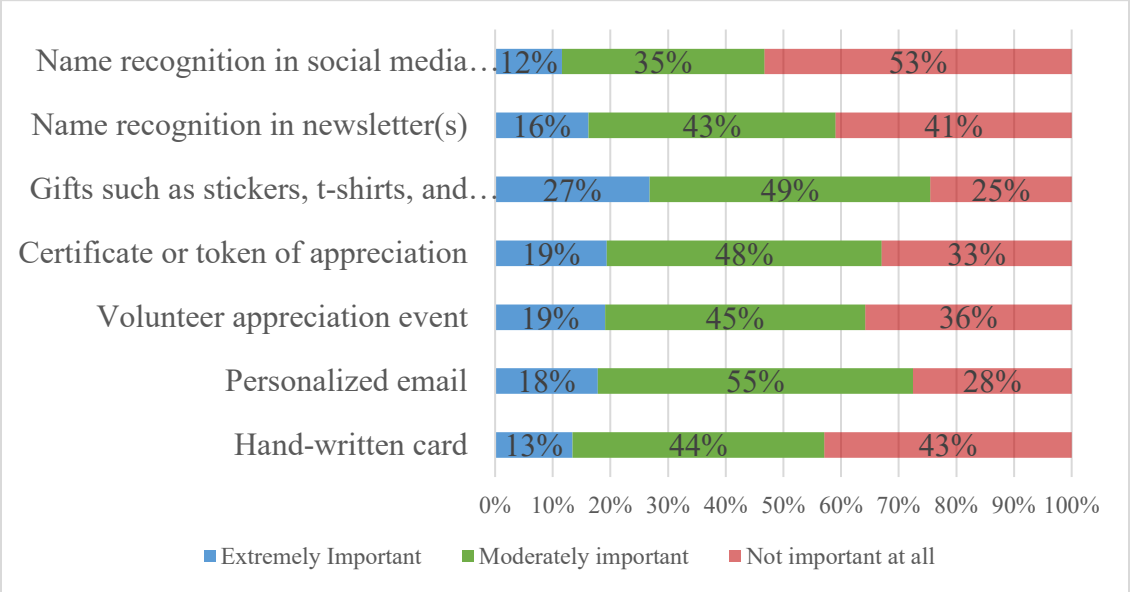


Figure 5. Types of recognition and importance

As shown in Figure 5, the type of recognition ranked as "extremely important" with the highest percentage is gifts. A personalized email received the most agreement as "moderately important" followed by gifts. Lastly, most citizen scientists (53%) agree that name recognition in social media is not important at all, followed by a hand-written card. In sum, gifts may be the most appreciated form of recognition.

5.2.5 Training and Level of Participation

Citizen Scientists were asked how they felt about their level of participation, expanding their role, training, and rewards for training (Figure 6). Regarding training to participate, most (52%) like the "one-time" training events. Further, most (53%) like to complete additional trainings to increase their level of expertise. Once these trainings are complete, most (55%) are not interested in receiving recognition nor a reward. When asked if they feel as though "staff would support me if I wanted to deepen my level of participation," 76% either agreed or strongly agreed. This is a good indication that the citizen scientists feel supported by Texas Stream Team staff. Lastly, 64% reported they either agree or strongly agree that opportunities for their role(s) to grow are important.

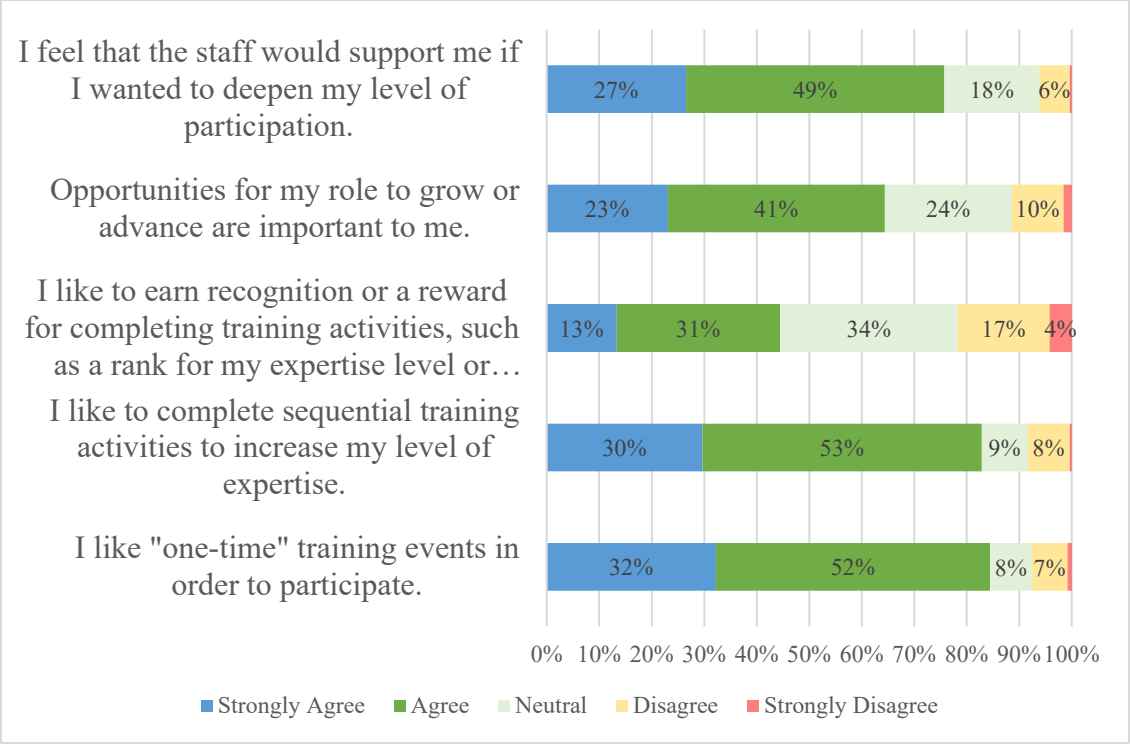


Figure 6. Training and level of participation

Citizen Scientists were also asked if they would be interested in a Quality Control Refresher course. With 260 responses, 72% reported "yes" and 28% reported "no."

5.2.6 Desired Programs and Parameters

Respondents were asked what training or Texas Stream Team Citizen Scientist program/watershed service they would like to see in their region as well as what additional water quality parameters they would like to see included.

Citizen Scientists were able to select as many training or Texas Stream Team Citizen Scientist program/watershed service as they liked (Figure 7). The most frequented selections were: Advanced Water Quality Citizen Scientist Training (178 selections), Riparian Evaluation Citizen Scientist Training (161), and Community outreach (146).

Respondents were also able input comments as "other." Comments received are the following:

- In Leakey Texas
- Angler protocols for reporting species
- Clean up events. Native animal and plant population stimulation events
- we have very little support and even have a hard time getting supplies
- I conduct most of these trainings myself with adult and student volunteers
- I have a 'poor-man's copyright' I will SHARE with TSU & you "ENVIRONMENTAL ARTISTS & ASSCTS." & "VOLUNTEER ECOLOGY RANGERS" especially for kids and youths

- Riparian restoration training
- Kiosks at the beach and parks near the lakeshore that show watersheds and the effect of activities in the watershed
- Have TCEQ work with on problems and let the public know what's going on
- Social events
- HGAC Core Water Quality Monitoring

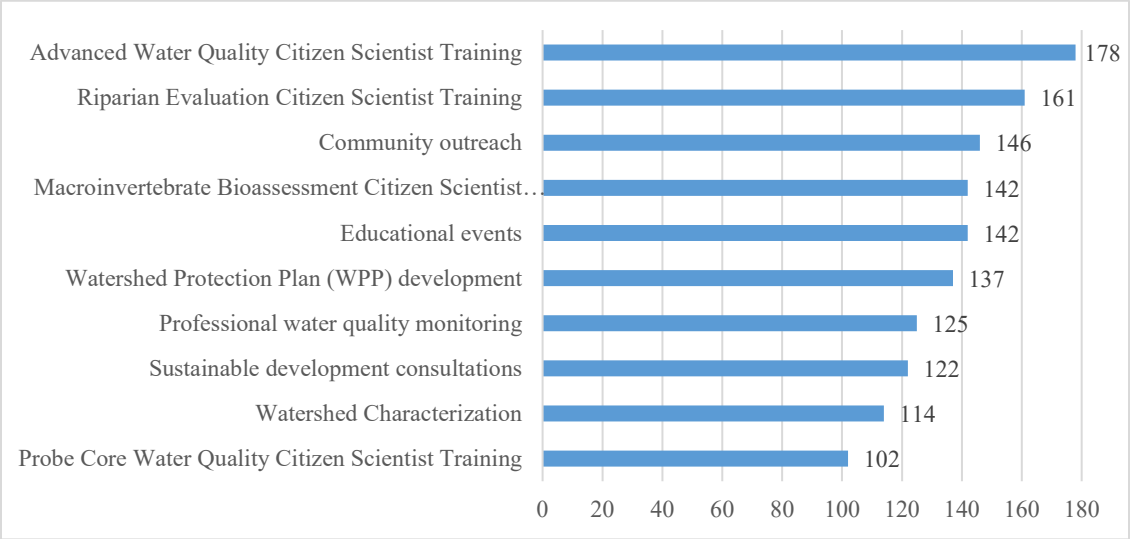


Figure 7. Additional training or program/watershed service(s) desired

Citizen Scientists were asked which additional water quality parameters (microplastics, pharmaceuticals, parameters of emerging concern, and additional bacteria tests) they would like to see included; they were able to select multiple responses. The most frequent being microplastics (195) followed by additional bacteria tests (175), parameters of emerging concern (170), and pharmaceuticals (157).

5.3 Motivations and Use of Data

Citizen Scientists volunteer their time to environmental efforts for various reasons. As discussed in 3. BACKGROUND, there are five major functions that may drive environmental volunteerism: Values, Understanding, Enhancement, Career, and Social. That said, it is important for the volunteer experience to match or appease their volunteer objective. To understand why people participate as Citizen Scientists for Texas Stream Team, a series of motivational statements were presented in two broad categories: general and social. Further, as participation in citizen science aims to collect data are a large scale, we asked Citizen Scientists how they felt about the usage of the data they collected. These two inquiries are important to assess in concert. For example, if a volunteer is a Citizen Scientist because they are motivated to help contribute to scientific research, but they do not feel the data are being used appropriately, they may cease participation.

5.3.1 Motivations

The first category presented a series of general motivations that assess all five functions. The statements were presented in the following form: Please indicate your level of

agreement with the following phrases that complete this statement: "I am a citizen scientist volunteer with Texas Stream Team because ...."

Table 4. General motivations

Statement	Answers	Count	Survey Respondents (%)*
I want to help or enhance the environment.	**Strongly Agree**	**228**	**87%**
	Agree	26	10%
	Neither Agree nor Disagree	6	2%
	Disagree	0	-
	Strongly Disagree	1	<1%
I want to help the community.	**Strongly Agree**	**210**	**81%**
	Agree	40	15%
	Neither Agree nor Disagree	8	3%
	Disagree	1	<1%
	Strongly Disagree	1	<1%
I want to contribute to scientific knowledge.	**Strongly Agree**	**214**	**83%**
	Agree	39	15%
	Neither Agree nor Disagree	4	2%
	Disagree	1	<1%
	Strongly Disagree	1	<1%
I want to learn new skills or gain hands-on knowledge.	Strongly Agree	179	70%
	Agree	60	23%
	Neither Agree nor Disagree	18	7%
	Disagree	2	<1%
	Strongly Disagree	0	-
I want to learn more about water resources.	Strongly Agree	182	70%
	Agree	56	22%
	Neither Agree nor Disagree	16	6%
	Disagree	4	2%
	Strongly Disagree	1	<1%
I want to get outside and connect with nature.	Strongly Agree	182	71%
	Agree	57	22%
	Neither Agree nor Disagree	15	6%
	Disagree	3	3%
	Strongly Disagree	1	<1%
I want to do something physically active.	Strongly Agree	122	47%
	Agree	71	27%
	Neither Agree nor	48	19%

	Disagree		
	Disagree	11	4%
	Strongly Disagree	7	3%
I want to have fun.	Strongly Agree	117	45%
	Agree	71	28%
	Neither Agree nor Disagree	54	21%
	Disagree	9	3%
	Strongly Disagree	7	2%
I want to advance my career through gained experience or networking.	Strongly Agree	76	30%
	Agree	43	17%
	Neither Agree nor Disagree	70	27%
	Disagree	24	9%
	Strongly Disagree	44	17%
I want to enhance my reputation in my community.	Strongly Agree	46	18%
	Agree	45	17%
	Neither Agree nor Disagree	87	34%
	Disagree	29	11%
	Strongly Disagree	52	20%

*May not add to 100% due to rounding.

The first three statements in Table 4 are bold; these statements have over 80% of respondents strongly agreeing to them. The top statement for motivation is “I want to help or enhance the environment.” Second is “I want to contribute to scientific knowledge” and third is “I want to help the community.” All statements received a majority of survey respondents strongly agreeing except for the statement: “I want to enhance my reputation in my community.” This statement received a majority of respondents reporting to neither agree nor disagree (34%). Recall most Citizen Scientists do not want recognition for their work.

Research on Citizen Science motivation and environmental volunteerism in general has found that the social function may play a strong role in motivating people to volunteer. As such, the series of statements in Table 5 attempt to unpack if socializing is indeed a strong factor. Similar to Table 4, these statements were presented in the same format: Please indicate your level of agreement with the following phrases that complete this statement: "I am a citizen scientist volunteer with Texas Stream Team because ...."

Table 5. Social motivations

Statement	Answers	Count	Survey Respondents (%)*

I want to socialize.	Strongly Agree	30	12%
	Agree	47	18%
	Neither Agree nor Disagree	93	36%
	Disagree	49	19%
	Strongly Disagree	39	15%
I want to meet new people.	Strongly Agree	33	13%
	Agree	67	26%
	Neither Agree nor Disagree	85	33%
	Disagree	32	13%
	Strongly Disagree	37	15%
I want to interact with like-minded people.	Strongly Agree	70	28%
	Agree	99	40%
	Neither Agree nor Disagree	39	16%
	Disagree	23	9%
	Strongly Disagree	20	8%
I want to spend time with friends or family.	Strongly Agree	59	24%
	Agree	49	20%
	Neither Agree nor Disagree	70	28%
	Disagree	37	15%
	Strongly Disagree	35	14%
I like learning from others with more experience.	**Strongly Agree**	**132**	**52%**
	Agree	77	30%
	Neither Agree nor Disagree	16	6%
	Disagree	16	6%
	Strongly Disagree	12	5%
I like sharing my experiences, knowledge, or expertise with other volunteers.	Strongly Agree	104	41%
	Agree	80	32%
	Neither Agree nor Disagree	33	13%
	Disagree	21	8%
	Strongly Disagree	15	6%

*May not add to 100% due to rounding.

While the majority of Citizen Scientists (52%) responded they strongly agree they like learning from others with more experience, the predominate response to "I want to socialize" was neither agree nor disagree (36%). Neither agree nor disagree was the most frequented response to other statements: "I want to meet new people" (33%) and "I want to spend time with friends or family" (28%).

Because most strongly agree they "want to contribute to scientific knowledge" (83%), "learn new skills" (70%), and "learn more about water resources" (70%) (as presented in

Table 4), the function Social may not be as strong for Texas Stream Team Citizen Scientists.

Motivations and The Volunteer Functions Inventory

With consideration to the Volunteer Functions Inventory (Table 1), Citizen Scientists fall largely within the Understanding function followed by Values and Enhancement. For example, the following statements received more than 90% agreement (either strongly agree or agree) and are categorized as the function(s):

- Understanding – *Desires to learn more about a subject and gain or use skills*.
    - I want to contribute to scientific knowledge. 98%
    - I want to learn new skills or gain hands-on experience. 93%
    - I want to learn more about water resources. 92%
- Values – *Acts to express important values.*
    - I want to help or enhance the environment. 97%
    - I want to help the community. 96%
- Enhancement – *Aims to improve psychologically through volunteering*.
    - I want to get outside and connect with nature. 93%

These motivational functions are all classified as intrinsic. Recall intrinsic motivations steam from underlying ethics, values, morals, and beliefs need for self-determination and/or self-actualization. On the other hand, extrinsic motivations are generally externally provided rewards: social, physical, and/or economic. This is probably why most Citizen Scientists feel neutral about recognition and rewards (Figure 5); they are motivated by intrinsic functions. Multiple studies reveal *intrinsic* motivations are more durable and long-lasting than extrinsic (Bennett et al., 2018). This "stability" is demonstrated in TST Citizen Scientists as 55% are extremely likely to continue volunteering at the same rate (Figure 3).

5.3.2 Use of Data

Most Citizen Scientists collect data on a monthly basis. As such, many want to know how the data will be used. The survey asked five statements regarding how they feel about the data collected (Figure 8). Graphically depicted in Figure 8, 65% surveyed agree that "the data collected for this project are used appropriately." Further, 98% either agree or somewhat agree that they like when environmental problems are addressed because of the data they provided. Citizen Scientists also largely like when data/results are shared with them and used in scientific publications. Lastly, 25% of respondents either disagree or somewhat disagree that the data are **not** being used to their full potential.

Knowing that a major motivation for Citizen Scientists is helping contribute to scientific knowledge (Table 4) and that Citizen Scientists think the data are being used appropriately (Figure 8), Texas Stream Team staff should feel satisfied that they are meeting the motivational needs of their volunteers.

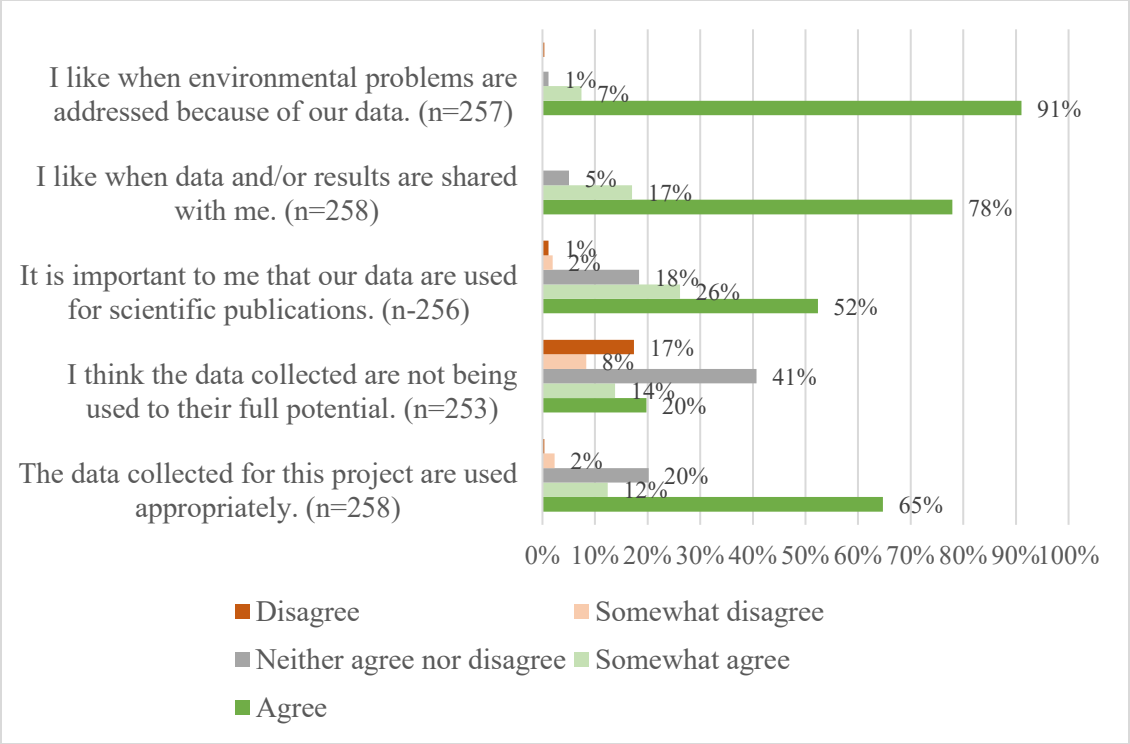


Figure 8. Statements regarding the use of data and agreeability

5.4 Community Resources

Citizen Scientists were asked about their supplies (testing kits) and resources (related to Texas Stream Team, i.e., the Community Forum) as well as their satisfaction with each item.

5.4.1 Testing Kits

Survey respondents were asked how they obtained their current Texas Stream Team kit. Response options and associated responses are the following: Purchased on my own (12% or 28); From group leader (39% or 92); or Loaned from Texas Stream Team (49% or 114). As most people loan a kit from a group leader in a shared setting, Citizen Scientists were asked how satisfied they are when it comes to accessing a test kit. The majority (67%) are either extremely or somewhat satisfied (Figure 9); 17% felt neutral and 17% were either somewhat or extremely dissatisfied.

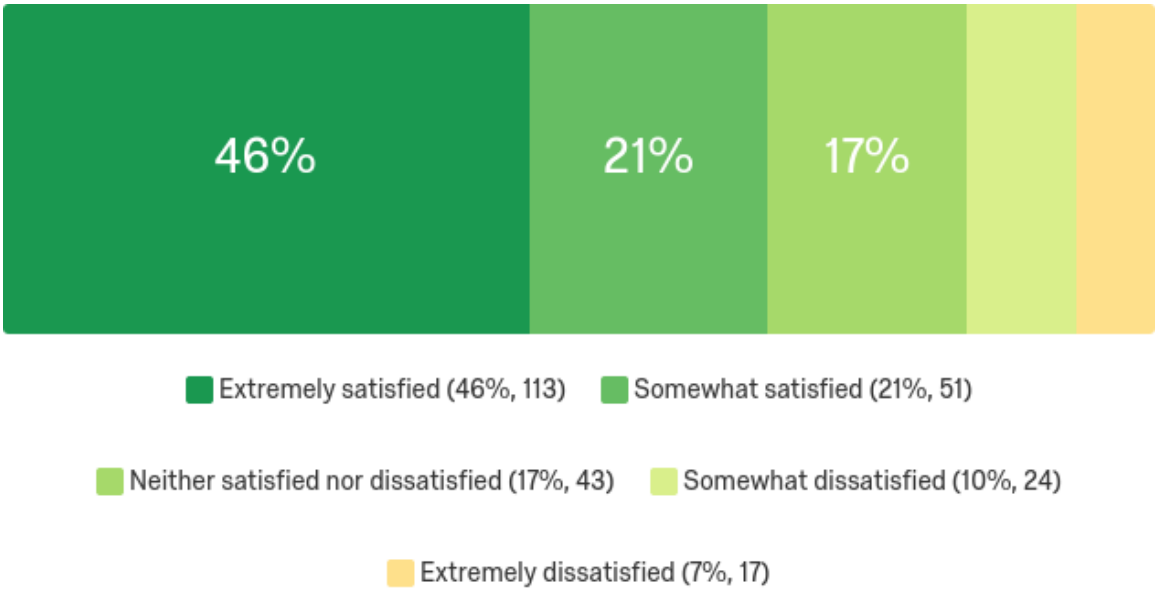


Figure 9. Reported satisfaction of accessing a test kit

5.4.2 Community Forum

Citizen Scientists were first asked if they had heard of the Community Forum. With 324 responses, 84% said no while 16% said yes.

The open-ended question was asked: "Are you satisfied with the Community Forum?" With 50 comments received, 38 were categorized as "Not available" because they said they do not use it or have never heard of it; 10 said "yes" they were satisfied; and 2 said "no" they were not satisfied.

Some of the lengthy comments that have merit or suggestions Texas Stream Steam Staff may find useful are:

- Yes, it is very informative
- have not used often- not very relevant, also it is just another forum to keep track of, along with newsletter
- No, it is not used very often by citizen scientists whom I would wish to see content from.
- I am dissatisfied with my own involvement in the forum. If there were a way to pull the forum more into the forefront of my daily routine, that could help. Perhaps an app...
- Good training videos for refreshing processes.

5.5 Changes in Environmental Outlook and Behavior

Citizen Scientists were asked if their involvement in Texas Stream Team had led to any changes in their lives in three areas: (1) natural areas and waterways, (2) environmental activism, and (3) water awareness. Response options were: "Yes, I now do this"; "No – I do not do this"; or "I did this prior to involvement." These results can help TST staff to

understand if participation in TST activities is linked to spillover effects, whereby volunteers bring knowledge gained through TST to bear on their home and/or community lives. This can play a valuable role in TST's future grant-seeking efforts, as it will seek to show that knowledge and experience gained through TST has lasting effects outside of TST event/activity contexts. Alternatively, it can also help in outreach efforts as the "I did this prior" indicates the type of activities people who volunteer with TST enjoy.

5.5.1 Natural Areas and Waterways

Citizen Scientists were asked to respond to the statements in Figure 10 indicating if this was something they did before or after involvement with TST. As displayed in Figure 10, the majority of respondents did participate in the following activities prior to involvement. The most frequent activity prior to involvement was enjoying one's self in the outdoors.

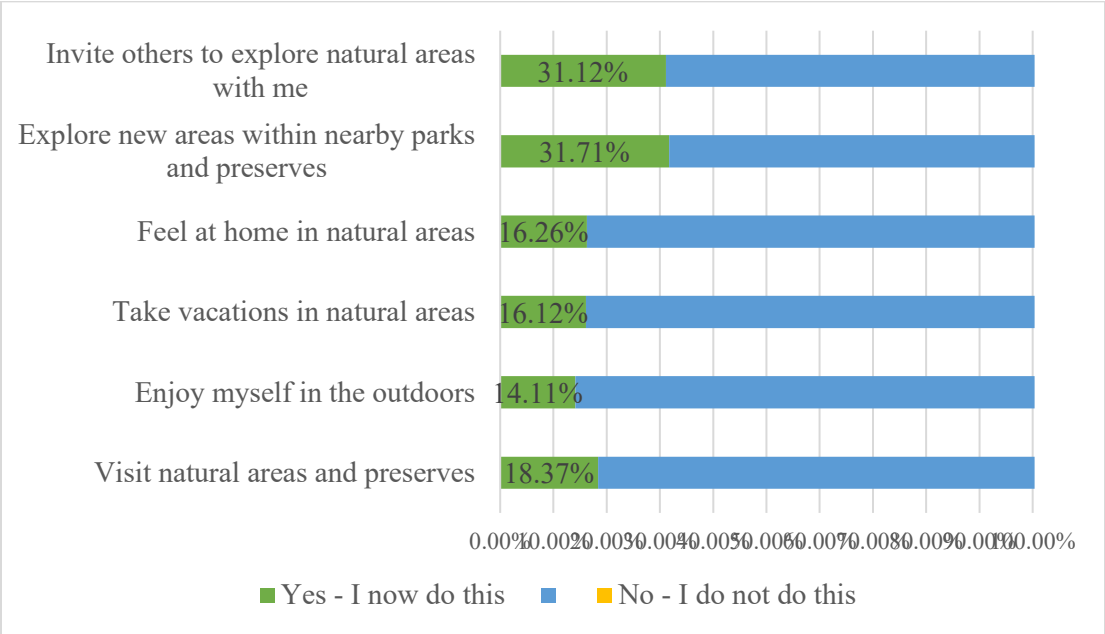


Figure 10. Natural Areas and Waterways activities

Notice the statements "Feel at home in natural areas" and "Enjoy myself in the outdoors" do *not* have a response of "No – I do not do this." This indicates that after involvement with TST, all now feel at home in natural areas and visit natural areas and preserves. Further, over 30% of Citizen Scientists now invite others to explore natural areas with them. The "spillover" effects of involvement with TST is demonstratable with this finding.

5.5.2 Environmental Activism

Environmental activism can be considered an expanded form of stewardship, wherein voluntary action on behalf of the environment is conducted in the political and social realm. Prior to involvement, many Citizen Scientists were relatively active with their interest in protecting natural areas and talking to friends and family as their common activities (Figure 11). After involvement with TST, approximately 30% are now: (1) discouraged about environmental degradation (used as a proxy for environmental awareness); (2) talk to friends and family about environmental issues; and (3) express interest in protecting natural

areas. Further, 25% now sign petitions regarding environmental quality.

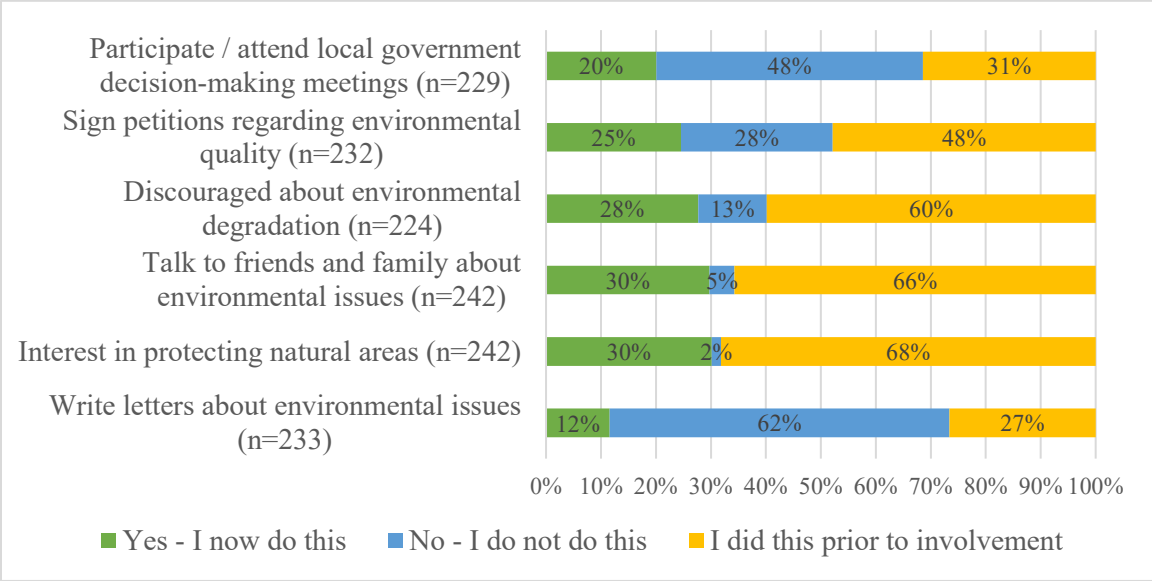


Figure 11. Environmental Activism activities

5.5.3 Water Awareness

The majority of Citizen Scientists were already aware of how watershed health affects water quality, and they were reducing water consumption (Figure 12). However, after involvement with TST, 46% were able to gain an understanding of how watershed health affects water quality. Further, over 26% now reduce household indoor and outdoor water consumption.

In some, involvement in TST has led to changes in people's lives and impacted their social networks through the following avenues:

- Inviting others to explore natural areas and exploring new natural areas;
- Feeling at home and enjoying self in the outdoors
- Promoting environmental activism and awareness: sign petitions, talk to friends and family about environmental issues; and
- Understanding how watershed health affects water quality; and
- Reducing water consumption.

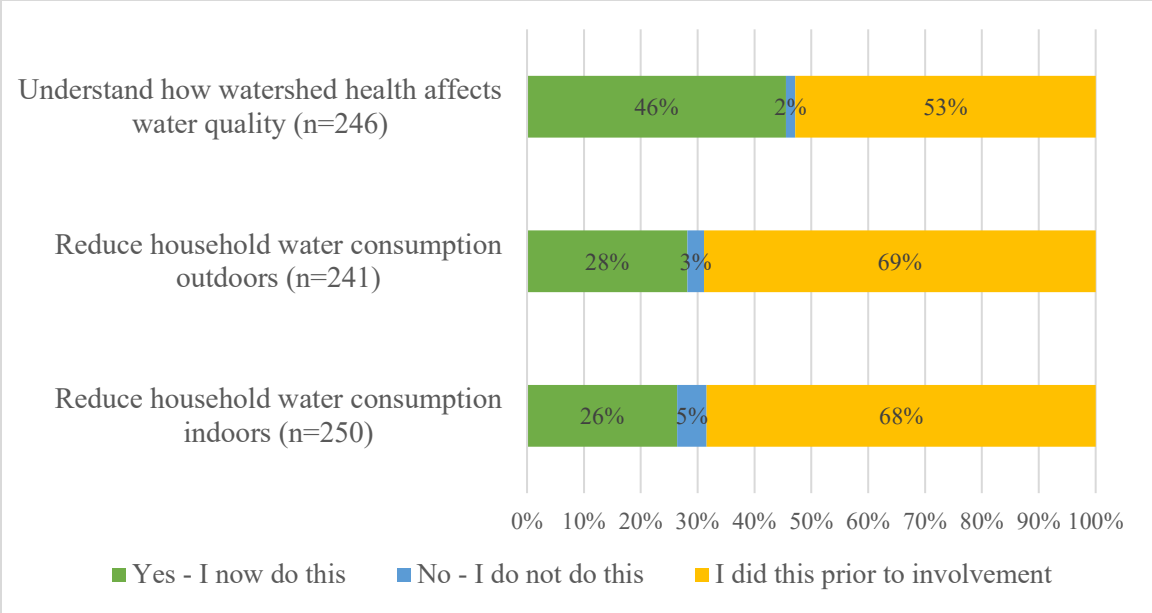


Figure 12. Water Awareness activities

6. INFERENTIAL RESULTS

This section aims to provide TST staff with a deeper understanding of their Citizen Scientists by identifying inferential relationships through a series of statistical tests. These tests are constructed to answer the remaining broad research questions: Do participation, preferences, and motivations vary systematically with selected individual characteristics? and What, if any, statistically significant changes in environmental outlook and behaviors have occurred in Citizen Scientists due to their involvement with TST?

6.1 Citizen Scientists Characteristics and Volunteer Variables

First, a series of chi-squared tests of independence were conducted to identify relationships between categorical sociodemographic and volunteering variables (e.g., age and preferred volunteer group size). Table 6 details any relationships found between variables with the appropriate *p*-value. If no statistically significant relationship was found, NS for "nonsignificant" is present. An interpretation of the significant results is found below the table, addressed in sequence, with the associated alphabetical footnote. Some categories (groups) were combined due to small numbers in each group, e.g., race is now white and nonwhite and status is active and inactive (recall: before it was active, limited activity, inactive but plan to start again, and inactive).

Note: Two participant characteristics (employment in the water/environmental-related field and political views) and three volunteer variables (decrease volunteer rate, recommend volunteering to others, and complete tasks in unfavorable weather) were not found to be significantly associated with any volunteer variables and are, therefore, not included in Table 6.

Table 6. Citizen Scientists characteristics and volunteer variables

	Gender	Race (white or nonwhite)	Employment	Age	Education	Household Income
Status (active or inactive)	P < 0.01[a]	NS	P < 0.01[b]	P < 0.01[c]	NS	NS
Years a Volunteer	P < 0.05[d]	NS	P < 0.05[e]	P < 0.0001[f]	P < 0.0001[g]	P < 0.01[h]
Social Setting (preferred group size)	NS	NS	P < 0.05[i]	P < 0.05[j]	NS	NS
Maintain Volunteer Rate	P < 0.05[k]	P < 0.05[l]	NS	P < 0.05[m]	NS	NS
Increase Volunteer Rate	P < 0.05[n]	NS	NS	P < 0.05[o]	NS	NS

[a] Females reported a status of inactive more than males.
[b] Employees in the government/public sector tended to be more inactive while retirees are more active than expected.
[c] The age groups containing 34-54 are less active and the age group of 65+ are more active than expected.
[d] Females reported to be a volunteer for a shorter length of time (less than 1 year and 1 to 3 years) than males (3 to 5 years and 5 years or more) than expected.
[e] Private/Self-employed and Retired have volunteered for 3-5 or 5 years more whereas Students, Government/Public, and NGO/Nonprofit tend to have volunteered for 1 to 3 years or less than 1 year.
[f] **Extremely significant/strong relationship**. The younger the age, the less time volunteered. Those over 55 tend to have volunteered for 5 years or more.
[g] **Extremely significant/strong relationship.** The higher the educational status, the more time they have spent as a volunteer. Those with some college tend to have volunteered for less than 1 year and those with doctorate/professional degrees tend to have volunteered 3-5 years or 5 or more years.
[h] Generally, there is a relationship between the household income and the amount of time volunteered: those with lesser incomes have volunteered for less time. However, those with second highest income category ($50,000-79,000/year) tend to have longer volunteer lengths of time (3 to 5 years) than expected. Those reporting to be in the highest income category ($80,000+/year) tend to have volunteered 1 to 3 years or less than 1 year.
[i] Those employed in the Government/Public sector tend to prefer to have many people in the social setting (a medium to large group); Retirees tend to prefer alone or with a partner; Students tend to prefer a medium to large group or with a partner.
[j] Age groups 18-24 prefer a partner; 25-34 prefer a small group; 35-44 prefer alone or with a partner; 45-54 prefer small groups; 55 -64 prefer a medium to large group; and 65 + prefer to perform their volunteer task(s) alone.
[k] Females tend to be more neutral and unlikely to continue to volunteer at the same rate than expected.
[l] Nonwhite people tend to be more unlikely to maintain the rate of volunteerism than expected.
[m] Age groups 18-24 are unlikely to maintain; 25-34 neutral; 35-54 likely to maintain; 55-64 neutral to unlikely; and 65+ were likely to maintain.
[n] Females are more unlikely to increase rate of volunteerism and males more neutral than expected.
[o] Younger age groups reported to be more neutral or likely to increase their volunteer rates and older age

groups were more unlikely to increase volunteer rates than expected.

In Table 6, the strongest or most significant relationship were between the variables Age and Years a Volunteer and Education and Years a Volunteer. Age and education typically correlate, as such, these two findings are reinforcing the predominant type of volunteer as presented in Table 2. Along these lines, it is known that the majority of Citizen Scientists are white. Table 6 presents problematic evidence: nonwhite people are more unlikely to maintain their rate of volunteerism. With nonwhite people comprising only 18% of the current volunteer pool, it may be beneficial to further investigate why they are possibly considering ending their tenure with TST.

6.2 Citizen Scientists Characteristics and Motivations

To ascertain what, if any, relationships exists among the Citizen Scientists' characteristics (soicodemographics) and their reported motivation for participating, a series of Mann-Whitney and Kruskal-Wallis tests [3] to identify differences numerical rankings/Likert scores across sociodemographic groups. This was completed for general motivations (Table 7) and social motivations (Table 8).

Table 7 does not include variables with which no significant relationships were found: Political Views and the statements: "I want to help the community" and "I want to contribute to scientific knowledge." An interpretation of the significant results is found below the table, addressed in sequence, with the associated alphabetical footnote.

Table 7. Citizen Scientists characteristics and general motivations

I volunteer with this organization because:	Gender	Race (Nonwhite or White)	Employ-ment	Employment in Water/ Environment	Age	Education	Household Income
I want to help or enhance the environment.	$P < 0.05$[a]	NS	NS	NS	NS	NS	NS
I want to learn new skills or gain hands-on knowledge.	$P < 0.01$[b]	NS	$P < 0.05$[c]	NS	$P < 0.05$[d]	$P < 0.01$[e]	$P < 0.05$[f]
I want to learn more about water resources.	NS	NS	NS	NS	$P = 0.0531$[g]	$P < 0.01$[h]	$P < 0.01$[i]
I want to get outside and connect with nature.	NS	NS	NS	NS	NS	$P < 0.01$[j]	NS

[3] Rank-based nonparametric tests that are used to determine if there are statistically significant differences between two or more groups of an independent variable (volunteer characteristics) on an ordinal (ranked) dependent variable (statements of motivation).

I want to do something physically active.	NS	NS	NS	NS	P < 0.05[k]	NS	NS
I want to have fun.	NS	NS	NS	NS	P < 0.05[l]	P < 0.01[m]	NS
I want to advance my career through gained experience or networking.	NS	P < 0.01[n]	P <.0001[o]	P <.0001[p]	P <.0001[q]	P < 0.01[r]	P < 0.01[s]
I want to enhance my reputation in my community.	NS	P < 0.05[t]	P <.0001[u]	P <.0001[v]	P <.0001[w]	P < 0.01[x]	P < 0.01[y]

[a] Females ranked this motivation higher than males.
[b] Females ranked this motivation higher than males.
[c] Students and NGO/nonprofit employees ranked this motivation higher than other employment sectors.
[d] The two youngest age groups (18-24 and 25-34) ranked this higher than other age groups.
[e] Those with Some College ranked this higher than those with 4-year or doctorate/professional degrees.
[f] Inversely related to income: those with household incomes less than $10,000/year ranked this higher, ranking declined with higher incomes.
[g] A weak significant relationship. Those aged 18-34 years ranked higher.
[h] Those with Some College ranked this motivation higher than those with degrees.
[i] Those with reported incomes of $30,000-49,000/year ranked this highest. Those with higher incomes ranked it low.
[j] Some College ranked higher than those with degrees.
[k] Those aged 18-34 years ranked higher.
[l] Those aged 18-34 years ranked higher.
[m] Those with Some College ranked this motivation higher than those with degrees.
[n] Nonwhite Citizen Scientists ranked this higher than white Citizen Scientists.
[o] **Extremely significant/strong relationship.** Students and NGO/nonprofit employees ranked this motivation higher than other employment sectors.
[p] **Extremely significant/strong relationship.** Those employed in Water/Environmental-related fields ranked this higher than those who are not employed in this field.
[q] **Extremely significant/strong relationship.** Age group 18-24 ranked highest, declines with age.
[r] Those with Some College ranked this motivation higher than those with degrees.
[s] Ranked higher by those with lower incomes, declines as incomes becomes higher.
[t] Nonwhite Citizen Scientists ranked this higher than white Citizen Scientists.
[u] **Extremely significant/strong relationship.** Students and NGO/nonprofit employees ranked this motivation higher than other employment sectors.
[v] **Extremely significant/strong relationship.** Those employed in Water/Environmental-related fields ranked this higher than those who are not employed in this field.
[w] **Extremely significant/strong relationship.** Rank directly declines with age.
[x] Those with Some College ranked this motivation higher than those with degrees.
[y] High rankings decline as income becomes higher, i.e., those with lesser incomes ranked this motivation higher than those with higher incomes.

The findings in Table 7 generally point to the "stage of life" being a primary driver behind different types of motivation. Those who are younger, students, of lesser incomes tend to agree more with statements regarding learning, advancing career, and enhancing (or maybe in this case, building) a reputation in the community. These findings are generally agreeable with what is currently known about motivations. Interestingly, nonwhite Citizen Scientists rank career advancement and reputation enhancement higher than white Citizen

Scientists. Speculatively, this may be due to historically lower numbers of people of color in environmental fields. As such, they may use volunteering with TST to "get a foot in the door" of the environmental field.

Table 8 depicts results from the same participant variables, but with the social motivations. Political Views, Gender, and "I want to interact with like-minded people" were not found to have any significant relationship with other variables; they are not included in Table 8.

Table 8. Citizen Scientists characteristics and social motivations

I volunteer with this organization because:	Race (Nonwhite or White)	Employment	Employment in Water/Environment-related field	Age	Education	Household Income
I want to socialize.	$P < 0.05$[a]	$P < .0001$[b]	NS	$P < .0001$[c]	$P < 0.01$[d]	$P < 0.01$[e]
I want to meet new people.	$P = 0.059$[f]	$P < 0.01$[g]	$P = 0.0527$[h]	NS	NS	NS
I want to spend time with family or friends.	NS	$P < 0.05$[i]	NS	$P < 0.05$[j]	NS	NS
I like learning from others with more experience.	NS	$P < 0.01$[k]	NS	$P < 0.05$[l]	NS	NS
I like sharing my experiences, knowledge, or expertise with others.	NS	$P < 0.01$[m]	$P < 0.01$[n]	$P = 0.0584$[o]	NS	NS

[a] Nonwhite Citizen Scientists ranked this motivation higher than white Citizen Scientists.
[b] **Extremely significant/strong relationship**. Students ranked this motivation higher than the other employment sectors.
[c] **Extremely significant/strong relationship.** The age group 18-24 (probably students) ranked this higher than other age groups.
[d] Those with Some College ranked this motivation higher than those with degrees, again, probably students.
[e] Those with lesser incomes (probably students) ranked this motivation higher than those with a greater income.
[f] A weak significant relationship. Nonwhite Citizen Scientists ranked this motivation higher than white Citizen Scientists.
[g] Students and NGO/nonprofit employees ranked this motivation higher than other employment sectors.
[h] A weak significant relationship. Those employed in Water/Environmental-related fields ranked this higher than those who are not employed in this field.
[i] Students ranked this higher than all other employment sectors.
[j] Those aged 18-24 years ranked this higher than other age groups.

[k] The NGO/nonprofit employment sector ranked this higher than other employment sectors.
[l] Age groups 18-24, 25-34, and 45-54 ranked this higher than the other age groups. 65+ ranked this lower than all other age groups.
[m] The NGO/nonprofit employment sector ranked this higher than other employment sectors; Retired had the lowest ranking.
[n] Those employed in Water/Environmental-related fields ranked this higher than those who are not employed in this field.
[o] A weak significant relationship. Those aged 25-34 ranked this high; those 65+ ranked it the lowest.

Table 8 indicates that younger Citizen Scientists are more motivated by a Social function (Table 2) than those that are Citizen Scientists who are older and/or more established in their careers. Regarding career, interestingly, those in the NGO/nonprofit sector are wanting to (a) meet new people, (b) learn from others, and (c) share their knowledge and expertise with others. What is still unknown, is what truly motivates the retirees. They did not rank any motivation higher than any other group and make up nearly 30% of TST's Citizen Scientists volunteer pool.

6.3 Citizen Scientists Characteristics and Training

Citizen Scientists were asked how they felt about training in terms of completing additional training, earning a recognition or reward for training, opportunities to grow/expand role within the organization. Like the above section (6.2), a series Mann-Whitney and Kruskal-Wallis tests were conducted to identify differences numerical rankings/Likert scores across sociodemographic groups and statements relating to training (Table 9). The variables Gender, Education, and Household Income were not found to be significantly associated with any of the statements. Further, the statement "I like one-time trainings in order to participate" was not found to be associated with any variables and is therefore not included in Table 9.

Table 9. Citizen Scientists characteristics and training

	Race (Nonwhite or White)	Employment	Employment in Water/Environment-related field	Age	Political Views
I like to complete sequential training activities to increase my level of expertise.	NS	NS	NS	NS	P < 0.01[a]
I like to earn recognition or a reward for completing training activities.	NS	P <.0001[b]	P < 0.01[c]	P <.0001[d]	NS

Opportunities for my role to grow are important to me.	NS	P <.0001[e]	P < 0.01[f]	P <.0001[g]	NS
I feel like staff would support me if I wanted to deepen my level of participation.	P < 0.05[h]	P < 0.05[i]	NS	P < 0.05[j]	NS

[a] Conservatives ranked this statement higher than Liberals and Moderates.
[b] **Extremely significant/strong relationship**. Those employed in the Government/public and NGO/nonprofit sectors ranked this statement higher than those in other employment sectors.
[c] **Extremely significant/strong relationship.** Those employed in Water/Environmental-related fields ranked this higher than those who are not employed in this field.
[d] **Extremely significant/strong relationship.** Age group 18-24 ranked this the highest; declines as age increases.
[e] **Extremely significant/strong relationship.** Students ranked this higher than all other employment sectors.
[f] Those employed in Water/Environmental-related fields ranked this higher than those who are not employed in this field.
[g] **Extremely significant/strong relationship.** Age group 18-24 ranked this the highest; declines as age increases.
[h] Nonwhite Citizen Scientists ranked this motivation higher than white Citizen Scientists.
[i] Students ranked this higher than all other employment sectors.
[j] Age group 18-24 ranked this the highest; declines as age increases.

For the first time, political views were significantly associated with a volunteer attribute/statement. Conservatives ranked their desire to complete additional training higher than those who reported to be moderate or liberals. TST staff may have an insight as to why this could be the case based on working with their Citizen Scientists.

Those employed in government/public and NGO/nonprofit sectors and in water/environmental-related fields and those aged 18-24 preferred to earn recognition for completing training activities. Recall from Figure 5, different types of recognition are viewed as more important than others. Further, those who felt the opportunity for their roles to expand as important were students, in the water/environmental-related field, and aged 18-24. Lastly, those who felt supported by the TST staff to expand/deepen their participation were nonwhite (this is very important due to the low amount of nonwhite participants), students, and those aged 18-24. In sum, the young Citizen Scientist prefer to earn recognition, expand their roles, and feel supported by TST staff.

6.4 Citizen Scientists Characteristics and Use of Data and Recognition

Statements relating to the use of data collected (Figure 8) were compared with the sociodemographic/participant variables. Only two weakly significant relationships were found.

(1) "It is important to me that are data are used for scientific publications" has a weak relationship with Gender. Males ranked this as more important than females (p=0.0572).

(2) "I think the data collected are **not** being used to their full potential" has a weak

relationship with Education. Those with 4-year degrees ranked this higher, i.e., meaning they agree more with the statement that those with some college or doctorate/professional degree holders (p=0.059).

The survey also inquired about different types of recognition and how important they are to Citizen Scientists. Gender, Education, Political Views, and Personalized Emails were not found to have a significant relationship or role. Because the survey asked the level of importance to be ranked, i.e., answer options were: Extremely important (5), very important (4), moderately important (3), slightly important (2), and not important at all (1), the interpretation of Table 10 results will include the mean level of importance. Citizen Scientists ranked most types of recognition as moderately important (Figure 5). As such, in reporting the following results I do not want to misguide TST: the groups that report significant relationships with the types of recognition still rank these types as largely moderately important.

Table 10. Citizen Scientists characteristics and recognition

	Race (Nonwhite or White)	Employment	Employment in Water/Environmental-related field	Age	Household Income
Name recognition in social media	P<0.05[a]	P<.0001[b]	P<0.05[c]	P<0.05[d]	NS
Name recognition in newsletter.	NS	P<.0001[e]	P<0.01[f]	P<0.05[g]	P<0.05[h]
Gifts (stickers/hats/shirts)	NS	P<0.01[i]	P<0.05[j]	P<0.01[k]	NS
Certificate/token of appreciation.	P<0.05[l]	P<0.01[m]	P<0.05[n]	P<0.01[o]	P<0.05[p]
Volunteer appreciation event	NS	P<.0001[q]	P<0.05[r]	P<0.01[s]	P<0.05[t]
Hand-written card	NS	P<.0001[u]	P<0.01[v]	NS	NS

[a] Nonwhite Citizen Scientists ranked this higher than white Citizen Scientists; mean rank is 2.4 (slightly important to moderately important).
[b] **Extremely significant/strong relationship**. Those employed in the Government/public and NGO/nonprofit sectors ranked this higher than those employed in other sectors; mean rank is 2.3 (slightly important).
[c] Those employed in the water/environmental-related fields ranked this higher than those who are not; mean rank is 2.2 (slightly important).
[d] Ages 25-44 ranked this higher than those of other ages, but at a mean rank of 2.2 (slightly important).
[e] **Extremely significant/strong relationship**. Those employed in the Government/public and NGO/nonprofit sectors ranked this higher than those employed in other sectors; mean rank is 2.6 (slightly important to moderately important).
[f] Those employed in the water/environmental-related fields ranked this higher than those who are not; mean rank is 2.5 (slightly important to moderately important).

[g] The Age group 35-44 ranked highest, but with a mean of 2.7 (slightly to moderately important).
[h] Those with a household income of $10,000-29,000 ranked this higher than other income categories with a mean of 2.9 (moderately important).
[i] Those employed in the Government/public sectors and Students ranked this higher than those employed in other sectors; mean rank is 3 (moderately important).
[j] Those employed in the water/environmental-related fields ranked this higher than those who are not; mean rank is 3 (moderately important).
[k] The age group 18-24 ranked this higher than others at a mean of **3.5 (moderately to very important**).
[l] Nonwhite Citizen Scientists ranked this higher, but with a mean of 2.8 (slightly to moderately important).
[m] Students ranked this highest with a mean of 2.8 (slightly to moderately important).
[n] Those employed in the water/environmental-related fields ranked this higher than those who are not; mean rank is 2.6 (slightly important to moderately important).
[o] The age group 18-24 ranked this higher than others at a mean of 2.8 (slightly to moderately important).
[p] Those with a household income of $10,000-29,000 ranked this higher than other income categories with a mean of 3 (moderately important).
[q] **Extremely significant/strong relationship**. Government/public sector ranked highest, but with a mean of 2.9 (moderately important). Those who are retired ranked it the lowest (1.7 – not important at all to slightly important).
[r] Those employed in the water/environmental-related fields ranked this higher than those who are not; mean rank is 2.7 (slightly important to moderately important).
[s] 2Those in the age group 25-34 ranked highest with a mean of 2.7 (slightly to moderately important) while those 65+ ranked it the lowest at 1.7 (not important at all to slightly important).
[t] Those with a household income of $10,000-29,000 ranked this higher than other income categories with a mean of 3 (moderately important).
[u] **Extremely significant/strong relationship**. Students ranked this highest with a mean of 3 (moderately important).
[v] Those aged 18-24 ranked highest with a mean of 2.7 (slightly to moderately important) and those 65+ ranked lowest 1.7 (not important at all to slightly important.

Employment type played a strong role with the type of recognition and ranked importance. It was mostly Government/public sector and students who thought recognition to be important. The highest ranked was Gifts (3.5) by those who are 18 to 24 years of age (denoted above in blue). This information can be used by TST staff for decision-making purposes and appropriate funding allocation for types of appreciation. For example, though no one sociodemographic group ranked a personalized email higher than any other (meaning all rankings are generally equal), it is still considered moderately important to 55% and extremely important to 18% (see Figure 5). As such, use Table 10 and Figure 5 in concert to determine most appropriate types of recognition per group.

6.5 Changes in Environmental Outlooks and Behavior

The last portion of the survey asked about changes in environmental outlooks and behavior. This information is extremely useful for TST because it can clearly quantify how involvement in TST changes behaviors and values. Three categories (Natural Areas and Waterways, Environmental Activism, and Water Awareness) with 16 statements asked respondents to report if they did the behavior prior to involvement, if they do it now due to involvement, or if they do not do it at all.

A series of McNemar tests[4] were conducted to see if volunteering changed behaviors or issue awareness (e.g., began environmental activism after volunteering but did not engage in the practice beforehand). The difference between behaviors before and after, i.e., involvement in TST did indeed lead to changes is statistically significant with 99.99% confidence (Table 11). Two statements: "I enjoy myself in the outdoors" and "I feel at home in natural areas" are not able to evaluate statistically because all respondents now perform this activity.

Table 11. Changes in environmental outlooks and behavior

Natural Areas and Waterways	I visit natural areas and preserves.	<.0001
	I enjoy myself in the outdoors.	After involvement 100% of participants now enjoy themselves in the outdoors. (n=246)[1]
	I take vacations to natural areas.	<.0001
	I feel at home in natural areas.	After involvement 100% of participants now enjoy themselves in the outdoors. (n=244)[1]
	I explore new areas within nearby parks and preserves.	<.0001
	I invite others to explore natural areas with me.	<.0001
	I recreate in local waterways.	<.0001
	I am interested in protecting natural areas.	<.0001
Environmental Activism	I write letters about environmental issues.	<.0001
	I tell my friends and family about environmental issues.	<.0001
	I am discouraged about environmental degradation.	<.0001

[4] The McNemar test is a nonparametric test for paired nominal data and is used to find change in proportion for the paired data, or if a treatment, here involvement in TST, had any impact.

	I sign petitions regarding environmental quality.	<.0001
	I participate/attend local government decision-making meetings.	<.0001
Water Awareness	I reduce household water consumption indoors.	<.0001
	I reduce household water consumption indoors.	<.0001
	I understand how watershed health affects water quality.	<.0001

[1] All respondents now perform this activity, statistical significance not evaluated.

Table 11 statistically demonstrates how TST impacts individual behavior that may have "spillover effects" that also change values in the broader society. For one example of individual changes that are an objective of TST, most people who have participated as Citizen Scientists now understand how watershed health affects water quality. The fact that now most people invite others to explore natural areas with them and that they discuss environmental issues with friends and family provides evidence of how TST reaches broader society indirectly through their Citizen Scientist trainees.

7. CONCLUSION

This community geography partnership aimed to create a relationship with TST, understand their needs, and provide data for actionable change and informed decision-making. Over the course of more than a year, TST has graciously worked with me to develop and distribute the Citizen Scientists survey. The survey received 407 responses and provided ample data for the task(s) at hand. Although these data are provided descriptively, then analyzed for relationships and interpretations are provided, it is TST staff that will have the best interpretation of them as they are the experts. The next step is to review these data summaries together and to decide an action plan or a way forward based on TST staff recommendations.

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Thank you to Texas Stream Team staff, Jenna Walker, Aspen Navarro, Valerie Villarreal, and Claudia Campos, for agreeing to this partnership and working with me. I appreciate your time, expertise, and patience. Thank you to all the Texas Stream Team Citizen Scientists volunteers who participated in the survey. And thank you to my advisor, Dr. Russell Weaver, for guiding me through this process.

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TEXAS STREAM TEAM PARTNER SURVEY REPORT

- 83% of partners are actively monitoring.
- Most watersheds have 1 to 5 monitors.
- Most partners are not in need of new testing kits.
- Half of partners need help with funding resources.
- 41% of partners are “extremely satisfied” with their partnership with Texas Stream Team.

Introduction
This report details descriptive results from the Partner Survey. The results include every question from the survey and raw data are accessible via the link on page 8. The survey was administered via Qualtrics during summer 2019. The first email notification was sent July 25, 2019. Follow-up reminders were sent on August 8 and 22. A final reminder was sent September 5, 2019. The survey was sent to 148 email addresses, 10 bounced. Of these, 37 responses (some partial) were recorded. The response rate was 25%.

About the Partner
Status: active or inactive
With 30 responses, 25 (83%) are active and 5 (17%) are inactive. If respondents selected inactive, they were asked to explain why. The text entered is the following:

- I had a Stream Team testing the Medina River within Bandera County from 2010 to 2014
- Partner quit
- Not informed enough but willing to participate
- Completed five years actively providing information, but at 82 am unable to get to the stream any longer
- Temporarily retired

Trainer Status
Fifteen respondents (50%) reported to be trainers, 10 (33%) said they were not trainers, and 1 said they are a former trainer. Four respondents (13%) said they are not currently a trainer, but are interested in becoming one.

Citizen Scientists
Partners were asked how many citizen scientists were monitoring in the watershed. With 29 responses, most watersheds (10) have 1 to 5 monitors. Six partners reported they have 6 to 10 and over 30, respectively. Five partners reported to have zero citizen scientists monitoring their watershed. This information is graphically depicted in Figure 1.

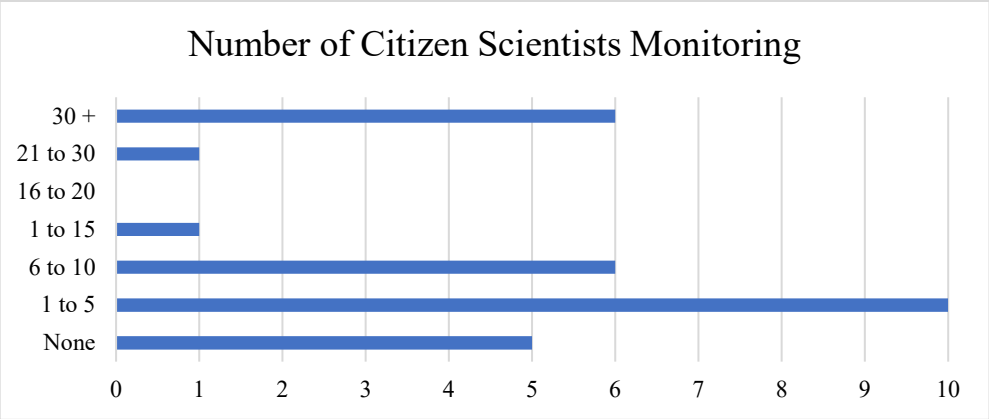

Figure 1. Number of Citizen Scientists Monitoring

Watershed

<u>Status</u>

Of the 31 responses received, nearly half (48%) reported their watershed to be "impaired for a specific parameter." Nine reported their watershed is "at risk"; five reported it as "healthy"; and two reported they did not know.
Partners were asked: "Are there any Total Maximum Daily Loads or Watershed Protection Plans active in your watershed?"
Thirty partners responded with the following selections: Yes – 20 (67%); Unsure – 7 (23%); and No – 3 (10%).

Additional Water Quality Parameters
Partners were also asked what other water quality parameters they would like to see. Partners were able to select multiple responses and input comments. The most frequented selection was additional bacteria tests. Responses are graphically depicted in Figure 2.

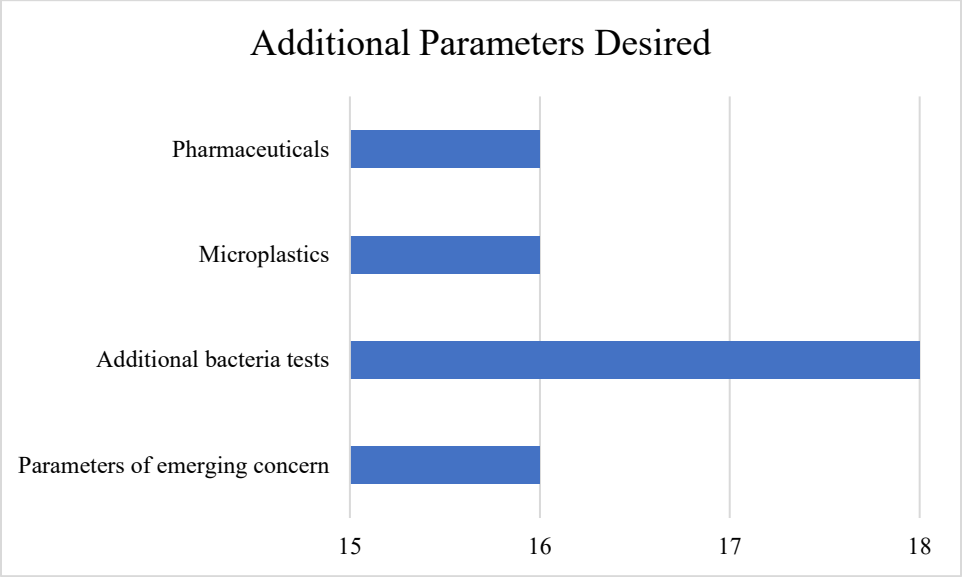

Figure 2. Additional Parameters Desired

Respondents provided five suggests for additional parameter: (1) more habitat characteristics, (2) freshwater mussels, benthic macroinvertebrates, (3) discharge at more sites and on tributaries; hydrologic status of isolated pools (connected, isolated, or dry); (4) nitrogen and phosphorus; and (5) sunscreen present in the water during heavy summer days.

Testing Kits and Funding Resources

Testing Kits

Number of Kits
Partners were asked about the number of testing kits they have in their inventory. Five partners reported they do not have any kits. Nine partners have 1 to 3 kits and eight report to have 4 to 6. One reported to have 7 to 9 kits. Lastly, five partners report to have over 10 kits.
Partners were asked if they need more kits. With 27 responses, most (17) said no, they do not need more kits. Ten partners reported yes, they do need more kits.

Condition of Kits

Partners were asked to evaluate the condition of their kits by reporting the percentage of kits in the following conditions: usable, in good condition (80%); usable, in poor condition (17%); unusable due to condition (40%), not being used, regardless of condition (32%).

Type of Kits

Thirty-seven partners reported that the types of kits they use as the following:

- Standard (Chem) Core Kit (24 or 65%)
- Probe Core Kit (6 or 16%)
- Advanced Kit (3 or 8%)
- Others (comments):
    - Extech Exstik II
    - Four tests kits for E. Coli
    - 4 kits are over 20 years old and used for trainings, 3 probe – difficult to maintain, best issued to single long term reliable monitor
    - The LCRA kits are mostly chem tests, with pH and conductivity probes. Our E. coli "kits" from Austin Watershed Protection has materials to test with the quanti-tray method.

Obtainment and Management of Kits

Partners were asked to report how they obtained their kits. Of the response options (purchased by group, loaners from Texas Stream Team, purchased by individual), the majority selected "other." Ten comments were given to specific what they meant by other.

Purchased by group – 9; Loaners from Texas Stream Team – 4; Purchased by individual – 2

Comments: grant from different entities, loaners (purchased by institution), purchased by a city department, purchased by TPWD, university funds for student education, city, a combination of all the above, purchased by our own grant funds, purchased by the city, and donated by LCRA.

Twenty-six partners responded when asked if they have had difficulty in obtaining and managing kits. For obtaining kits, the majority (19) said they did not experience difficulty; five reported to somewhat have difficulty, and one responded reported difficulty. For managing kits, the majority (14) reported no; eleven said somewhat, and one reported they did have difficulty in managing kits.

Funding Resources

With 28 responses, half reported they do not need help with funding resources and the other half reported they do need help with funding.

When asked what their funding sources are, partners were able to select multiple responses (Figure 3) and input text comments. Most (13) selected self-funded followed by grant funds (8). Five reported they did not know the funding source(s). Other sources of funds provided by respondent comments are: municipal funds, 319 grants, San Antonio Prop 1 program, Ark-Tex Council of Governments and a little Clean Rivers from Sulphur River Basin Studies, the local groundwater conservation district supports

reagents needs on a reimbursable basis, NAS, CMP, Lion's club and one grant from university, and city.

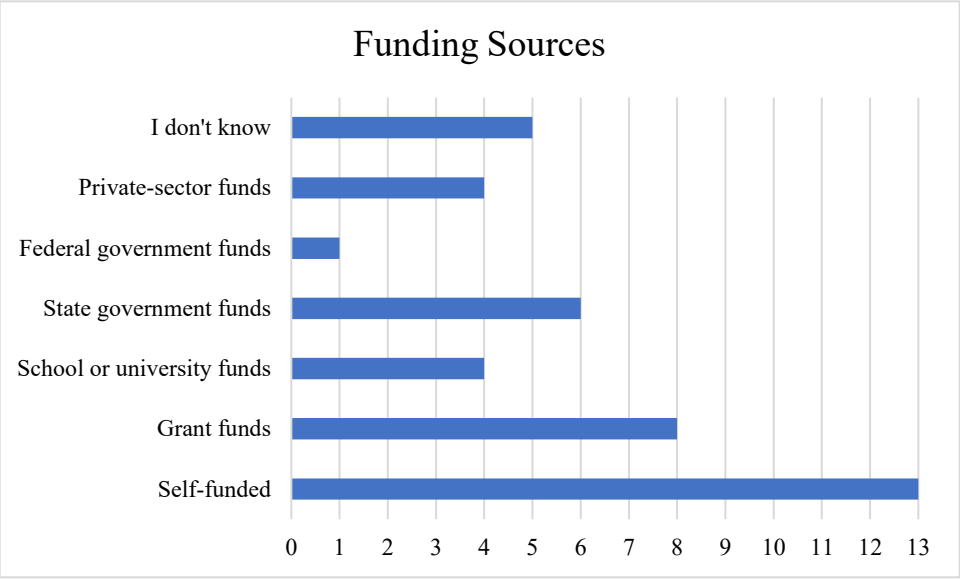

Figure 3. Funding Sources

Partnership with Texas Stream Team

The following section reports findings regarding how partners feel about the partnership with Texas Stream Team and what they would like to see from Texas Stream Team. The latter portion of the section reports findings regarding how partners are using resources provided by Texas Stream Team.

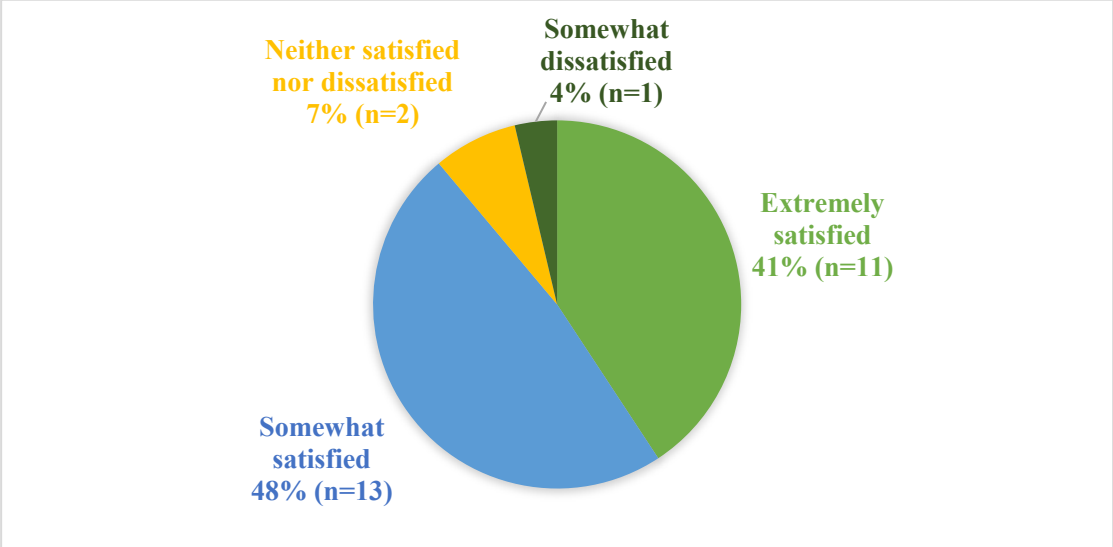

Figure 4. Reported Satisfaction with Texas Stream Team

With 27 responses, partners reported their partnership with Texas Stream Team to be largely somewhat to extremely satisfactory (Figure 4). One partner reported to be

dissatisfied, and no partners selected "extremely dissatisfied."

Partners were asked the open-ended question: "What more would you like to see from Texas Stream Team?" Responses fall in two general categories: staff support and technical support. Table 1 contains all reported comments.

Staff Support	Technical Support
More organization	Time consuming to get new sites up and running, and long delay in getting data updated in dataviewer
Report on what is happening (testing, treatment) in the Medina River	
Faster email communication	
More organized approach to managing data, kits, volunteers, etc.	
More public education outreach with locals	Automatic graphing and charting from Dataviewer data
More consistent engagement from the program at the school, better response from program when replacement chemicals are needed	
Presence in San Antonio	

Table 1. Comments from partners regarding what they would like to see from Texas Stream Team

Additional Programs/Watershed Services

Partners were asked which additional Texas Stream Team citizen science/watershed services they would like to see in their region. As respondents were able to select multiple responses, Figure 5 depicts the results; community outreach was the most frequented selection.

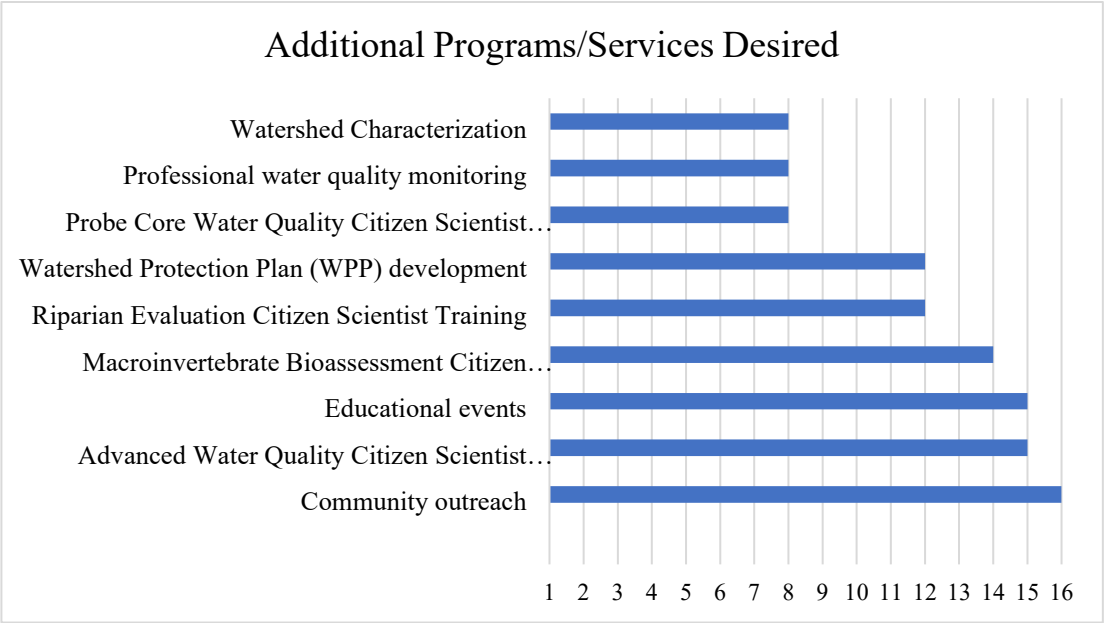

Figure 5. Additional Programs/Services Desired

Use of Texas Stream Team Resources

Online Calendar

With 27 responses, most (17 or 63%) do not use the calendar; 10 (or 37%) reported they do use the calendar. Partners were asked to explain why they did not use the calendar; the comments are as follows:

- I wasn't aware of the training calendar.
- We look to see about advanced trainings, but we host trainings in our region
- Have not tried it yet.
- I am just starting to use it because I think its fairly new
- Usually call the stream team contact if we need to schedule something
- Texas is a big state. I can't travel to most of them except those I host or those nearby. I utilize to put my events online.
- Don't think about it
- We train our volunteers ourselves to ensure continuity in communication and management
- was not aware until now
- New to the partnership. Was unaware of the opportunity.
- I'm new to the program.
- No longer sampling
- unaware of the online calendar
- Just recently found out about it. We typically host trainings several times a year for monitors specifically looking to join our group. Most trainings listed are quite far from our area, and there were not many advanced trainings (which as a trainer I would be interested it) listed the few times I looked.

Community Forum

Partners were asked if they plan to participate on the Community Forum. Twenty-seven partners responded; 13 reported yes and 14 reported no. If they reported no, partners were asked to please explain why. As demonstrated by the comments below, there seems to be confusion as to what the Community Forum is.

- Have not tried it yet
- Time
- Did not know about the community forum
- Answer is really a maybe … Wouldn't go to it unless have a reason to
- I'm honestly not sure what this is.
- No travel funds, federal job restrictions
- Unaware. Also, if its in San Marcos, that could be a barrier for me.
- Don't know what that is
- I would like to learn a little bit more about it and how it can be used. I think it could be a good resources, but need to see more about it.

Dataviewer

Partners were asked if they use the Dataviewer. With 26 responses, the majority (15 or 58%) reported they did not; 11 (42%) reported they did use the Dataviewer. If partners selected no, they were asked to provide explanatory comments. The reported comments below indicate partners are aware of this, don't know how to use it, or use their own platform.

- Have been unable to learn how
- I plan to start using it next month, as per instructions with Alexander soon.
- unaware
- I am unaware of this resource.
- I'm new to the program
- we will once we have more monitors
- Don't have much use for it.
- I've used it, but not regularly. I'm unsure why.
- We look at it for historical sites and to see sites state-wide, and we send our data to be included, but we host our region-specific data on a separate site.
- We've historically had trouble uploading and viewing our data. We created our own dataviewer instead.
- Our group coordinates monitors in large area with multiple watersheds and dozens of monitors. We roll our monitors data into a dataviewer we developed that also includes other data for the region. We do send out data to the Meadows Center for inclusion in the dataviewer though.

If partners selected yes, they were asked how satisfied they are with the content and the usability. Sixteen partnered responded with their levels of satisfaction (Figure 6). No partners selected “Extremely satisfied” or “Extremely dissatisfied.”

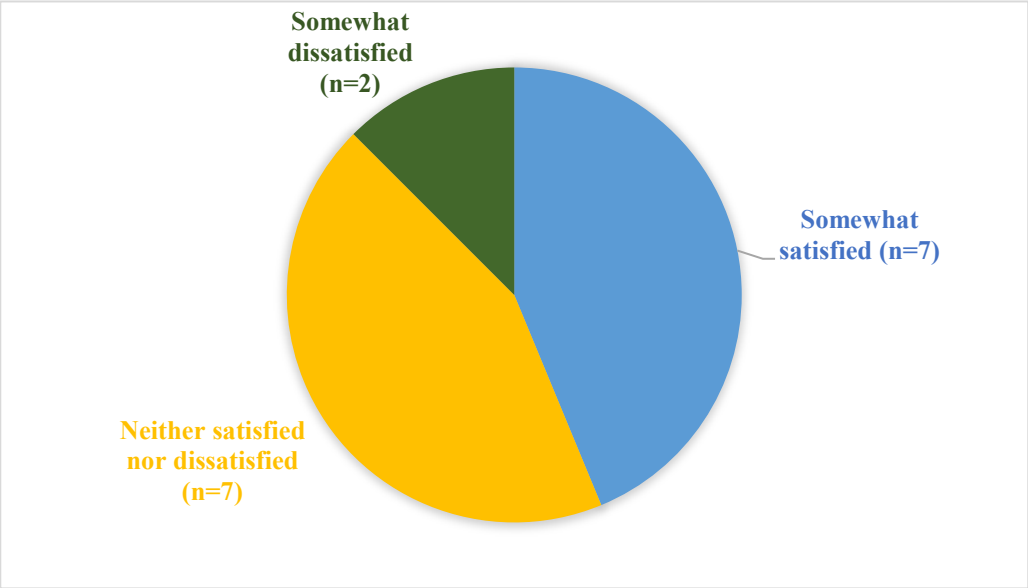

Figure 6. Reported Satisfaction with Dataviewer

Partners were asked if they would like to receive a one-on-one consultation on the Dataviewer or the Community Forum. Twenty-six partners responded: 12 stating yes and 14 stating no.

Six partners provided contact information. They are provided below in addition to other relevant information in Table 2.

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