ABSTRACT

Title of Thesis: USING BEHAVIOR CHANGE AND SOCIAL-ECOLOGICAL FRAMEWORK TO INFORM RIPARIAN FOREST BUFFER OUTREACH IN THE MARYLAND UPPER POTOMAC WATERSHED

Hannah Boone, Master of Science, 2019

Thesis Directed By: Dr. Mitchell Pavao-Zuckerman
Department of Environmental Science & Technology

Land in the Maryland Upper Potomac watershed is predominantly privately held. Restoration efforts seek to improve water quality through the implementation of riparian forest buffers. However, outcomes rely on aggregated actions of the individual landowners within the watershed. An understanding of outreach strategies that promote riparian forest buffer adoption in a complex social-ecological system is needed. Employing qualitative methods, we integrated social-ecological and behavior change frameworks to better understand riparian forest buffer outreach and adoption in the Maryland Upper Potomac watershed. We conducted nineteen interviews with key stakeholders, followed by a quantification of main findings through landowner and practitioner questionnaires. Findings demonstrate that there is no "one size fits all" strategy. Rather, riparian forest buffer outreach needs interpersonal connections

between landowners and practitioners to build trust and account for context-specific ecological feedbacks. There is opportunity to further reinforce riparian forest buffers through activities that demonstrate and leverage norms, impacting adoption through social feedbacks.

USING BEHAVIOR CHANGE AND SOCIAL-ECOLOGICAL FRAMEWORK TO INFORM RIPARIAN FOREST BUFFER OUTREACH IN THE MARYLAND UPPER POTOMAC WATERSHED

by

HANNAH BOONE

Thesis submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Master of Science
2019

Advisory Committee:
Professor Mitchell Pavao-Zuckerman, Chair
Dr. Anne Hairston-Strang
Professor Michael Paolisso

Acknowledgements

This research would not have been possible without funding support from National Fish and Wildlife Foundation. I would like to thank my committee members for their thoughtful guidance and review through this process. In particular, thanks to Dr. Mitch Pavao-Zuckerman for grounding and guiding the scientific approach, Dr. Anne Hairston-Strang for identifying and facilitating the research opportunity, and Dr. Michael Paolisso for wisdom on ethnographic research methods. Thanks to undergraduates Sara Ramotnik and Emma Lipsky for their transcription work. This research would not have been possible without the many individuals who participated in the interviews and surveys, and special thanks for those who shared their networks, particularly Jamie Weaver, Bob Schwartz, and many others at Maryland Forest Service.

Table of Contents

Acknowledgements ii
Table of Contents iii
List of Tables iv
List of Figures v
List of Abbreviations vi
Chapter 1: Using behavior change and social-ecological frameworks to inform riparian forest buffer outreach in the Maryland Upper Potomac watershed 1
1.0 Introduction 1
1.1 Behavior Change Theory 2
1.2 Collective action in a social-ecological system 4
1.3 Research Questions 4
1.4 Case study: Riparian forest buffer outreach in the Maryland Upper Potomac watershed 5
2.0 Methods 10
2.1 Participant observation 11
2.2 Practitioner interviews 12
2.3 Landowner interviews 13
2.4 Practitioner survey 14
2.5 Outreach testing 15
3.0 Analysis 17
3.1 Interviews 17
3.2 Survey 17
3.3 Outreach testing 18
4.0 Results and Discussion 18
4.1 Overview of outreach models in Maryland Upper Potomac Watershed 18
4.2 Interpersonal communication is key 21
4.3 Interpersonal communication facilitates trust 24
4.4 Interpersonal communication leverages social-ecological feedbacks between landowner and their riparian zone 29
4.5 Cultural norms of riparian forest buffers 31
4.6 Norms of trust and reciprocity 35
4.7 Further evidence of norms and interpersonal communication from outreach events 36
5.0 Implications for riparian forest buffer outreach in the Maryland Upper Potomac watershed 38
6.0 Conclusions 39
Appendices 40
Bibliography 48

List of Tables

Table 1: Codes and sub-codes from behavior change and social ecological systems used in text analysis.

Table 2: Landowner self reported confidence before and after outreach events.

List of Figures

Figure 1: An overview of research methods that integrates behavior change and socio-ecological systems theory to understand riparian forest buffer outreach.

Figure 2: The two prominent models of outreach used by outreach practitioners in the Maryland Upper Potomac watershed

Figure 3: Communication channels for identifying landowners mentioned by practitioners in interviews and rated among survey respondents. These types of referrals form the basis of the social diffusion model for outreach.

Figure 4: Communication channels for identifying landowners mentioned by practitioners in interviews and rated among survey respondents. These types of advertisements form the basis of the social marketing model for outreach.

Figure 5: Communication channels for message delivery mentioned by practitioners in interviews and rated among survey respondents.

Figure 6: Elements of outreach strategy mentioned by practitioners in interviews and rated by practitioners in the survey.

Figure 7: Survey responses to “how important are the following benefits in influencing landowner decision-making regarding buffers?”

List of Abbreviations

CREP	Conservation Reserve Enhancement Program
NRCS	Natural Resources Conservation Service
FSA	Farm Service Agency
N	Nitrogen
P	Phosphorus

Chapter 1: Using behavior change and social-ecological frameworks to inform riparian forest buffer outreach in the Maryland Upper Potomac watershed

1.0 Introduction

Land in the Chesapeake Bay watershed is largely privately held. Spanning from West Virginia to New York, the watershed is large and comprised of heterogeneous landowners in both agricultural and non-agricultural residential contexts. Widespread restoration efforts seek to improve the health of the estuary; however, the outcome of those efforts relies on the aggregated behaviors of private landowners whose land segments comprise the broader watershed. Moreover, the management of riparian zones is complex in that water quality of a given riparian zone is dependent on activities upstream, and watershed-scale restoration requires actions at the residential scale (Naiman, 2013). Benefits of residential-scale restoration activities are therefore benefits to the broader community, necessitating collective action among landowners (Barnaud et al., 2018). However, the aggregated adoption of riparian zone management activities in the Chesapeake Bay is well below regional goals (*Buffering the Bay: A Report on the Progress and Challenges of Restoring Riparian Forest Buffers in the Chesapeake Bay Watershed*, 2014). An understanding of how outreach can facilitate behavior change in complex social-ecological systems is needed in order to impose watershed restoration at scale.

1.1 Behavior Change Theory

Behavior change theory can inform watershed restoration in the context of private land, and has been increasingly used as a theoretic framework for understanding conservation adoption and pro-environmental behaviors (e.g. Fielding et al. 2005; Metcalf et al. 2019). Behavior change theory seeks to explain influences of human knowledge, attitudes, and, eventually, behavior, and how interventions can promote a desired behavior (Ajzen, 1991; Mckenzie-Mohr, 2000; Rogers, 2003). In the environmental and natural sciences, two primary models are used to contextualize human behavior change: social diffusion (Rogers, 2003) and social marketing (Mckenzie-Mohr, 2000). Social diffusion focuses on communication channels to describe the flow of information and the subsequent behavior change or adoption. According to the social diffusion model, interpersonal relationships are key communication channels, and the use of a trusted messenger plays an important role in promoting the adoption of a desired behavior. Here we define trust as "the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trust or, irrespective of the ability to monitor or control that party" (Mayer et al., 1995). In the social diffusion model, the trusted messenger is usually an accepted member of society with established connections to landowners (Rogers, 2003).

Social marketing, on the other hand, emphasizes behavioral intervention, usually through "change agents" or, as we refer to them in this study, outreach practitioners, to promote a desired behavior. The social marketing model segments

audiences based on traits or shared values, and, based on those shared traits, designs messaging content that communicates benefits of the desired behavior. (Mckenzie-Mohr, 2000; Kotler & Armstrong, 2015; Wright et al., 2015). Message delivery is a key element of social marketing, where characteristics of the messenger and the way information is received influence the effectiveness of message delivery, and therefore, adoption of the desired behavior (Ajzen, 1992). The most important characteristic of the messenger is credibility, or to the perceived expertise and trustworthiness of the communicator (Ajzen, 1992). Thus, where social diffusion relies on trusted messengers within the community to spread information regarding the desired behavior, social marketing establishes outreach practitioners as trusted messengers to disseminate information and promote the desired behavior.

Under both models, norms of the target population are important for both understanding the social acceptance of the desired behavior and for promoting behavior change. In social diffusion theory, norms "define a range of tolerable behavior and serve as a guide or a standard for the members' behavior in a social system… An idea that is incompatible with the value and norms of a social system will not be adopted as rapidly as an innovation that is compatible" (Everett M. Rogers, 2003). In social marketing, norms can be used as a tool to promote a desired behavior; normative appeals have been shown to be an effective form of message content in environmental outreach (Metcalf et al., 2019; Onel, 2017). While behavior change theory, specifically models of social diffusion and social marketing, inform interactions between the outreach practitioner and landowner, a social-ecological

framework is needed to understand social-ecological feedbacks that reinforce the desired behavior.

1.2 Collective action in a social-ecological system

A social-ecological systems framework can inform behavior change in complex social-ecological systems through the identification of system attributes that facilitate collective action (Ostrom, 2009). The framework describes the direct and indirect relationships among actors, the governance system, and resources that contribute to the likelihood of collective action in efforts to achieve a sustainable social-ecological system. While behavior change theory aims to explain drivers of individual's behavior and how outreach can affect those drivers, the social ecological system framework encompasses multiple scales of decision-making and governance across social and ecological boundaries, and acknowledges social and ecological feedbacks that influence individuals' willingness to engage in collective action. Importantly, in order for actors to engage in collective action there must be norms of reciprocity and trust among peers, where returning benefits for benefits is the socially accepted form of behavior (Ostrom, 2000). The framework recognizes the social, ecological, and political context in which the system situated.

1.3 Research Questions

Together, behavior change theory and social-ecological system framework can help to understand people as actors in land management decision-making and how they can be influenced through behavior change interventions that derive from governance practices across multiple scales. Both frameworks highlight interactions

among actors (primary resource users and landowners), the governance system, and resources, as well as the feedbacks that further reinforce changes to the system made by actors. Actions within these frameworks take place in a context of market incentives, policy/regulations, and the greater social, ecological, political setting. In this study we apply these theories on social-ecological systems behavior change as context for understanding outreach practices for private land restoration. We ask the following research questions:

1. What does the combination of behavior change theory and social-ecological system framework reveal about outreach?
2. What specific interactions are most important for driving behavior change in the context of private land restoration?

We answer these questions using a mixed-methods, ethnographic approach from anthropology including participant observation, in-depth interviews, and surveys of outreach practitioners and private landowners.

1.4 Case study: Riparian forest buffer outreach in the Maryland Upper Potomac watershed

We present a case study of outreach efforts to impose behavior change in riparian zone management on private lands in the Maryland Upper Potomac watershed, which spans Allegany, Frederick, Garrett, Montgomery, and Washington counties. The desired behavior is the voluntary implementation of riparian forest buffers, or reforestation of land adjacent to a perennial or intermittent stream. Riparian forest buffers are used primarily for the improvement of water quality, but other co-benefits such as wildlife or pollinator habitat, recreation, and aesthetics are

also promoted. To improve water quality, riparian forest buffers serve as a final front to treat water nitrogen (N), phosphorus (P), and sediment before it enters waterways (Newbold et al., 2010). This strip of mixed vegetation of at least 35 feet can trap and take up N in surface or shallow groundwater via root uptake, thus reducing the amount of nutrients entering the adjacent stream (e.g. Lowrance et al., 1984; Mayer et al., 2007) Additionally, denitrification occurs in the anaerobic floodplains of riparian forest buffers, removing additional N from agricultural runoff. Forests can reduce 50% of N loads due to denitrification in the poorly drained soils riparian forest buffers (Hanson et al, 1994). Streambank stabilization and sediment trapping in vegetation reduces sediment and sediment-bound P pollution from erosion. A combined grass and woody established buffer can trap up to 97% of sediment running off of agricultural land (Lee et al. 2003).

Efforts in the Maryland Upper Potomac Watershed are situated within the broader context of Chesapeake Bay watershed. The US EPA established Total Daily Maximum Loads, calling for a for a watershed-wide 25% reduction in N, 24% reduction in P and 20% reduction in sediment (US EPA, 2010). A Watershed Implementation Plan among all Bay jurisdictions - Delaware, Maryland, New York, Pennsylvania, Virginia, West Virginia and the District of Columbia - outlines specific actions to make these reductions by 2025. The Chesapeake Bay Program is a key partnership that facilitates coordination and goal setting among federal and state agencies, local governments, non-profit and academic organizations to implement the Watershed Implementation Plan. Leveraging riparian forest buffers as a cost-effective tool for water quality improvement, the Chesapeake Bay Program set a goal to restore

900 miles of riparian forest buffers in the Bay watershed each year in an agreement signed by all Bay jurisdictions. The Chesapeake Bay Program goal of 900 miles of riparian forest buffer installed per year has not been met since it was declared by the Chesapeake Bay Program in 2007, and recent years have been far below, with adoption rates around 200 miles per year, indicating a need for improved outreach (*Riparian Forest Buffer Outcome Management Strategy*, 2015).

The actors involved in riparian forest buffer implementation are private landowners with a riparian zone. In the Maryland Upper Potomac watershed, this includes agricultural as well as residential rural, suburban, and urban landowners. We recognize complicated land ownership agreements in the U.S. agricultural landscape ("USDA ERS - Farmland Ownership and Tenure,") and, for the purposes of discussing general outreach activities, we include tenants who make land management decisions even if they do not technically own the property. While urban landowner actors are not excluded from this study, due to small parcel size and urban infrastructure inhibiting space for riparian zone reforestation, there is a significantly less opportunity for riparian forest buffer implementation in urban landscapes. There is therefore also less outreach in urban landscapes compared to rural and suburban landscapes.

Riparian forest buffer outreach and implementation are complex. Organizations involved include federal government, state agencies, nongovernmental private and non-profit organizations, and community groups, described detail below. The roles vary from policy and regulation, goal setting and management, forest implementation, landowner engagement, and general education/advocacy.

The focus of this study is on voluntary participation in several riparian forest buffer programs that target private landowners. The most prominent program is the USDA Conservation Reserve Enhancement (CREP) program, which targets agricultural riparian forest buffers and requires landowners enter a 10-15 year contract in exchange for annual incentive/rental payments as well as maintenance support ("CRP and CREP Program | NRCS Maryland"). There are strict terms for eligibility, implementation, and maintenance. Maryland Forest Service, county Farm Service Agency (FSA), and county Natural Resources Conservation Service (NRCS) are involved in the landowner engagement process. Several nongovernmental organizations offer alternatives to CREP that have looser terms for participation. For example, Chesapeake Bay Foundation provides trees, maintenance cost-share, and technical support for farmers with fewer eligibility and maintenance requirements than CREP.

Several other initiatives target non-agricultural residential landowners. Maryland Forest Service's Backyard Buffer program targets residential riparian forest buffers in rural, suburban, and urban settings ("Backyard Buffers Program"). Landowners are provided free trees and information on how to plant and maintain them; there is no contract involved. Several nongovernmental organizations offer similar programs that provide resource for residential riparian forest buffers. For example, Cacapon Institute provides free trees and recruits community members for tree-planting events in urban and suburban settings. Local watershed advocacy groups such as Beaver Watershed Alliance seek to increase general community awareness about riparian forest buffers and water quality.

Prior research on riparian forest buffer adoption has been primarily in an agricultural context, and primarily in the context of behavior change theory. Landowner knowledge and attitudes are the most well-documented variable associated with adoption of riparian forest buffers. Knowledge related to the riparian forest buffers is a prerequisite for adoption in many studies (Prokopy et al; 2008, Baumgart-Getz et al. 2012, Tjaden, 2002; Skelton et al. 2005; Valdivia & Poulos 2009). Attitudes about conservation, government, the aesthetics of trees, and the moral responsibility to take care of their land are positively associated with adoption (Prokopy et al., 2019; Kenwick, et al. 2009; Ryan et al. 2003; Pradhananga, 2017; Shandas 2007, Valdivia & Poulos 2009; Wagner 2008). Mistrust of government or outsider intervention is the most commonly cited barrier (Shandas 2007; Rhodes et al. 2016; Armstrong et al. 2011) but trust of organizations or individuals affiliated with conservation organizations can also be a facilitator of adoption (Ranjan et al., 2019). Interpersonal relationships have been shown to have an important role in adoption (Atwell et al., 2009; Baumgart-Getz et al., 2012; Armstrong & Stedman 2011; Trozzo et al. 2014) as well as social norms (Valdivia & Poulos 2009). All studies have been on landowner perspectives and drivers of adoption; none have studied outreach activities that incorporate the landowner and practitioner perspectives. Additionally, no studies this far have bridged behavior change and social-ecological complexities in their approach. Contextualizing riparian forest buffers in a social-ecological system adds the role of cooperation among peers and collective action, and how willingness to engage in collective action is influenced by social-ecological feedbacks.

Given both the importance and complexity of riparian forest buffer outreach in the Maryland Upper Potomac Watershed, the objectives of this case study are to use the combined framework analysis to summarize current and past riparian forest buffer outreach efforts in the Maryland Potomac watershed, identify common themes and gaps in approaches among various actor groups; and prioritize strategies for future outreach that crosses landscape context.

2.0 Methods

We used qualitative ethnographic methods to characterize the knowledge of key actors involved in riparian forest buffer outreach in the Maryland Upper Potomac watershed. We will refer to these informants as "outreach practitioners." We gathered the perspectives of outreach practitioners through participant observation, semi-structured interviews, and a survey, progressing from an unstructured, exploratory to structured format (Bernard & Gravlee, 2015). We used landowner interviews and outreach testing to complement and validate the practitioner perspectives from interviews and survey (Figure 1).

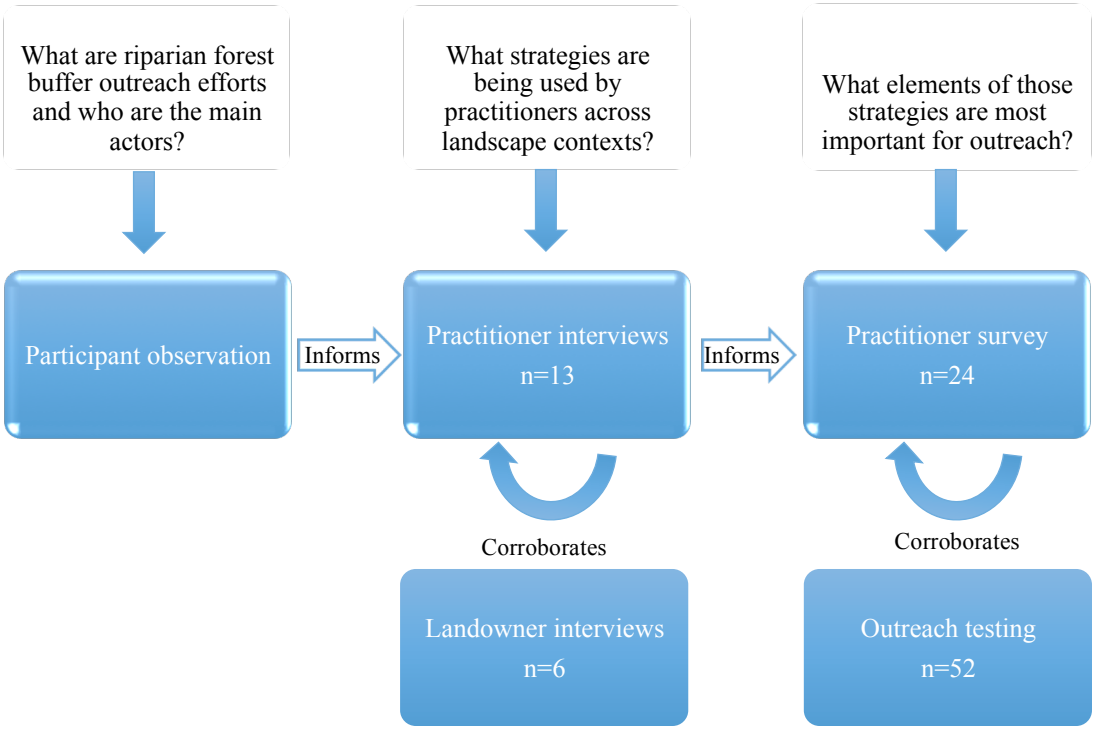


Figure 1: An overview of research methods that integrates behavior change and socio-ecological systems theory to understand riparian forest buffer outreach.

2.1 Participant observation

We observed several meetings and workshops in 2018 to understand the general tenor of riparian forest buffer outreach and the actors involved to inform the development of later stages of the study. To inform the development of interview questions, and following the systematic process outlined by Weller (1998), we conducted two unstructured pilot interviews and asked meeting attendees for feedback on interview questions. In the spring of 2019, we observed a workshop-style discussion on outreach strategies in conjunction with a Maryland riparian forest buffer planning meeting. Fourteen riparian forest buffer outreach practitioners participated in the workshop representing six different organizations: Maryland Forest Service, Chesapeake Bay Foundation, Alliance for the Chesapeake Bay,

Chesapeake Bay Program, University of Maryland Extension, and Calvert County Environmental Department. We audio recorded of the workshop and used the dialogue to help inform the development of codes and interview questions.

2.2 Practitioner interviews

From fall 2018 through summer 2019, we interviewed 16 outreach practitioners using an ethnographic approach. We used purposive sampling of key informants, a form of critical case study sampling (Bernard & Gravlee, 2015), to garner perspectives of the most relevant and knowledgeable actors across organization types, scales of outreach, and landscape contexts. We selected key informants based on three criteria, that the individual (1) conducts outreach or is involved in regional coordination and planning regarding outreach in the Maryland Potomac watershed, (2), works specifically in the context of streamside trees in the Maryland Potomac watershed, and (3) has been working in that capacity on a professional or volunteer basis for at least two years to be able to provide multi-year context and represent their organization's past work.

Based on the observational stage, we started with a list of the primary organizations involved with riparian forest buffer outreach and reached out to individuals within each organization that were involved with regional planning activities. We also asked interview participants to name individuals who are particularly knowledgeable on riparian forest buffer outreach; we interviewed those that were mentioned by at least three people. Recognizing the cross boundary nature of this work, we included some individuals from outside the Maryland Upper Potomac watershed because they were either involved in strategic planning in the

Maryland Upper Potomac efforts or they were mentioned by three other interviewees as being key informants for riparian forest buffer outreach. To ensure representation of small-scale efforts, we also interviewed two individuals who represent small-scale groups that are not involved in strategic planning meetings. Interviewees represented county (n=1) state (n= 4) and federal (n=1) government agencies; nonprofit and community organizations operating at the county (n=2), state (n=3), and multi-state regional (n=2) level; and a private consultant (n=1) operating at the county level. We stopped conducting interviews when all major organization types and scales were represented and there was saturation in themes (Guest, Bunce, & Johnson, 2006).

We conducted semi-structured and open-ended interviews to elicit detailed responses from the participants. A set of 16 questions asked participants about their experience working with landowners, outreach strategies, and perceptions about riparian forest buffer adoption (Appendix 1). We conducted most interviews in person at the interviewee's place of work or in a public space. We conducted some interviews over video conferencing or over the phone when it was not logistically feasible to meet in person or participants did not want to meet in person. We audio recorded, transcribed, and analyzed the interviews in MAXQDA (VERBI Software, 2017) using themes from behavior change theory and social-ecological system framework (below in 'Analysis').

2.3 Landowner interviews

We conducted semi-structured interviews with landowners to complement and corroborate statements made by outreach practitioners regarding riparian forest buffer adoption. The observational portion of the study revealed three main landowner types

relevant for this study: traditional farmers, who are multi-generational farmers with agriculture as their primary source of income; hobby farmers, who have another source of income other than agriculture but engage in farming activities; and non-operating landowners, who do not farm, although they may rent out a portion or all of their property to a farmer. We were referred landowners by outreach practitioners who had worked with them in the past to implement riparian forest buffers, and we interviewed two of each landowner type for six interviews total. We developed interview questions through participant observation and conversations with outreach practitioners. We asked landowners open-ended questions about their perspective on riparian forest buffers and their motivation for implementing them on their property (Appendix 1). We recorded, transcribed, and analyzed the interviews in MAXQDA (VERBI Software, 2017) using the same themes we used to analyze the practitioner interviews.

2.4 Practitioner survey

Following observations and semi-structured interviews, we conducted an electronic survey as a quantitative tool to complement the qualitative interviews and summarize main findings. We generated and distributed the survey using the online platform, Qualtrics (Qualtrics, 2019). Participants in the survey were those involved in the practitioner interviews and workshop observation, as well additional key informants who were not involved in that stage of the study. We sent the survey to 30 individuals and 24 of them completed it. The respondents can be broken into two dichotomous groups based on the context of their outreach: majority agriculture

context (n=15) vs. majority residential context (n=9); and government (n=12) vs. nongovernment (n=12).

We developed the survey questions based off of themes from the semi-structured interviews, which we discuss further in the 'Analysis' section. We asked survey participants to rate a list of statements about riparian forest buffer outreach strategies and approaches on a Likert scale of 'not important' to 'very important.' The statements summarized strategies used by outreach practitioners to initiate contact and establish relationships with landowners and deliver messages to landowners, as well as content that they used in those messages (Appendix 2).

2.5 Outreach testing

To understand and assess outreach in practice, we conducted post-intervention landowner questionnaires at various outreach events from 2017-2019. The outreach events were formatted to test the efficacy of incorporating norms of peer trust and reciprocity (McGinnis & Ostrom, 2014), trust between outreach practitioners and landowners (Ranjan et al., 2019a), and norms regarding riparian forest buffers (Ajzen, 1991) in various outreach events. All outreach events sought to increase knowledge of riparian forest buffers. While knowledge is necessary for behavior change, it is not an effective tool without additional tools to promote the desired behavior (Huis et al., 2012). Thus, as our first outreach format, we used informational workshop format as the baseline outreach format as it sought to increase knowledge of riparian forest buffers but incorporated no other elements of outreach beyond information. There were two workshops hosted by Maryland Forest Service. The workshops were 1.5

hours long and had approximately 30 participants each. A total of 28 workshop participants completed the questionnaire.

The second outreach format was a buffer tour, with a primary outreach emphasis of reinforcing cultural norms (Ajzen, 1991) of riparian forest buffers through showcasing successful buffers on the landscape. There was one buffer tour hosted by Maryland Forest Service with four participants; three completed the questionnaire.

The third outreach format was a peer learning circle, an event where information regarding land management is exchanged through dialoged between landowners and outreach practitioners as well as among landowners. The primary outreach emphasis was building norms of peer trust and reciprocity (McGinnis & Ostrom, 2014) through the incorporation of peer-to-peer learning, and a secondary emphasis of trust between outreach practitioners and landowners, with an investment in extensive interpersonal communication between landowners and outreach practitioners. Three learning circles were organized by American Farmland Trust and targeted women operating and non-operating landowners. Learning circles lasted a minimum of 8 hours over the course of one to three days, and circle size ranged from 5-15 participants. A total of 21 landowners completed the questionnaire.

At each event, to be able to draw comparisons among different formats of events, we asked landowners general questions regarding their confidence in managing their land before and after the event. We asked landowners to self-report their confidence in making decisions about the sustainability of their land before and

after the event, and their reported confidence in seeking help from a professional before and after the event, to measure outreach outcomes (Appendix 3).

3.0 Analysis

3.1 Interviews

We used behavior change theory and social ecological systems framework as a basis for analysis. Using a nested code format, we initially started with top-level codes of behavior change theory and social ecological systems framework, and sub-codes of major elements from each body of literature. After initial analysis of interviews, we combined codes and identified six major categories that spanned behavior change theory and social ecological systems framework: initial contact, message delivery, message content, trust, norms, and norms of trust/reciprocity.

Top level code	Definition of sub-codes
Initial contact	(1)Through peer referrals (social diffusion), (2) targeted marketing (social marketing)
Message delivery	(1)Interpersonal communication (2) impersonal communication
Message content	(1) Social benefits (2) ecological benefits
Trust	(1) trust in outreach practitioner (2) ambient landowner trust in riparian forest buffer programs
Norms regarding riparian forest buffers	(1) Social acceptance of riparian forest buffers
Norms of trust/reciprocity	(1) Dynamics among peers that contribute to collective action

Table 1: Codes and sub-codes from behavior change and social ecological systems used in text analysis.

3.2 Survey

Following text analysis of interview transcripts, we developed questions for the practitioner survey. We used the main categories of initial contact, message delivery, message content, trust, norms regarding riparian forest buffers, and norms of trust/reciprocity to group strategies mentioned by outreach practitioners in the interviews. We included in the survey any strategy mentioned at least twice by practitioners in the interviews. We used a frequency table to determine which strategies had high proportions of 'very important' responses to identify priority strategies.

3.3 Outreach testing

We used outreach testing to reinforce the findings from the interviews and survey. To do this, we compared the average self-reported change in confidence across different outreach emphasis among the three outreach event formats to indicate which format of event had the greatest change among participants.

4.0 Results and Discussion

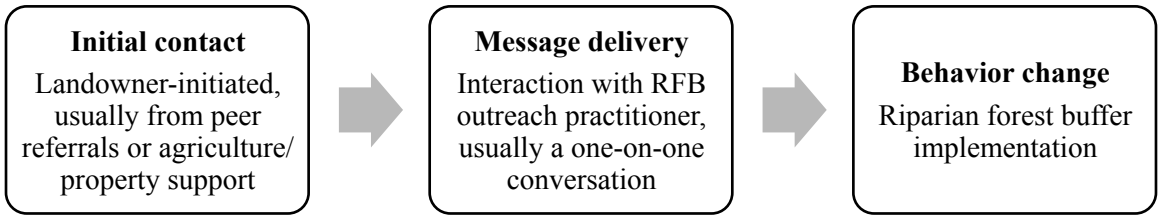
4.1 Overview of outreach models in Maryland Upper Potomac Watershed

There are two primary models that outreach practitioners in the Maryland Upper Potomac watershed use to influence landowners to implement riparian forest buffers, which can be defined by their primary strategy for initiating landowner contact (Figure 2). The social diffusion model leverages word-of-mouth diffusion (Rogers, 2003) to initiate landowner interest in riparian forest buffers and is most relevant in agriculture landscapes, where there are formal and informal networks for

information sharing (Manson, Jordan, Nelson, & Brummel, 2016). In this model the landowner initiates contact, usually seeking out guidance from a county-level agent (NRCS, FSA, Soil Conservation), agriculture consultant, extension agent, or other trusted source in the community regarding their agriculture practices or property management. The landowner is then referred to an organization that implements riparian forest buffers, and interpersonal communication between a landowner and outreach practitioner ensues.

Riparian forest buffer implementation is done through Maryland Forest Service within CREP, or other third party organizations such as Chesapeake Bay Foundation or Alliance for the Chesapeake Bay who can help implement buffers outside of CREP. This was the most frequently cited model for outreach among interview and survey participants. As an NRCS agent said, "we're not actually doing anything, other than what people hear you know, 'my neighbor did it,' that local word of mouth… we're just waiting for what comes into the door and we just sort of stumble upon it." A forestry practitioner said "usually it's word of mouth. So at some point, the landowner heard about a program or they heard about one of our foresters or a partner either having funding or information and then say there's a phone call or email and there's a site visit."

Social Diffusion Model:



Social Marketing Model:

Figure 2: The two prominent models of outreach used by outreach practitioners in the Maryland Upper Potomac watershed

The social marketing model leverages principles from marketing (Andreasen, 2002; Mckenzie-Mohr, 2000) to reach and influence landowners beyond passive social diffusion. The social marketing model is most common in residential landscapes but is used in agricultural landscapes as well. Initial contact is established through the dissemination of emails or postcards through partner organizations or other known networks, presence at community events, and general mass advertisement such as ads, flyers, and local media coverage. Often times an event such as a workshop or a tree planting event is used as a leverage tool to get people to the point of message delivery. Message delivery may be in a group setting such as a

workshop, or may be a one-on-one conversation. Riparian forest buffer implementation varies; in a small-scale residential context, free seedlings and instructions may be provided through the Maryland Forest Service's Backyard Buffer program or other similar programs that provide trees but rely on landowner to implement the buffer. On a large scale, the implementation may be done through Maryland Forest Service within CREP, or other third party organizations such as Chesapeake Bay Foundation or Alliance for the Chesapeake Bay outside of CREP.

4.2 Interpersonal communication is key

Outreach communication channels are an important consideration for behavior change, for initial contact and message delivery in both the social diffusion and social marketing models. Allowing for dialogue, face-to-face, interpersonal communication is the most effective form of outreach (Abrahamse & Steg, 2013) and has been documented as being important for riparian forest buffer outreach (Atwell et al., 2009). Through the interviews and survey, we found interpersonal communication was the most important communication channel for establishing initial contact and for message delivery, across both models of social diffusion and social marketing (Figures 3, 4, 5)

Interpersonal communication is important for initiating contact with landowners across both outreach models of this case study. Practitioners cited referrals as by far the most important strategy for initiating contact, underlying the importance of interpersonal communication element of the social diffusion model (Figure 3). While social marketing as an outreach model does not rely on referrals, results from the survey still underlie the importance of interpersonal communication

for making initial contact. Communicating through networks of partner organizations facilitates the personal element of this impersonal communication channel by leveraging trusted networks (Kueper et al., 2013). Of the social marketing methods, communicating through networks was the most important with 75% of respondents indicating it is 'important' or 'very important' for outreach.

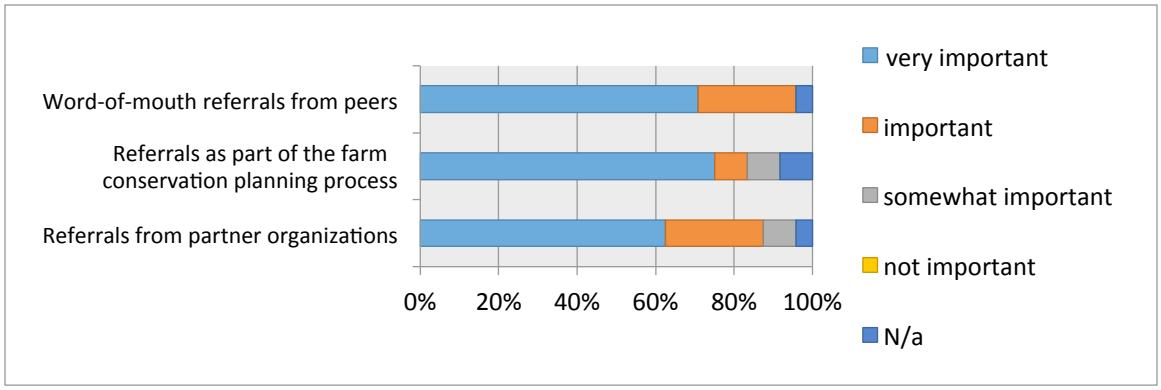


Figure 3: Communication channels for identifying landowners mentioned by practitioners in interviews and rated among survey respondents. These types of referrals form the basis of the social diffusion model for outreach.

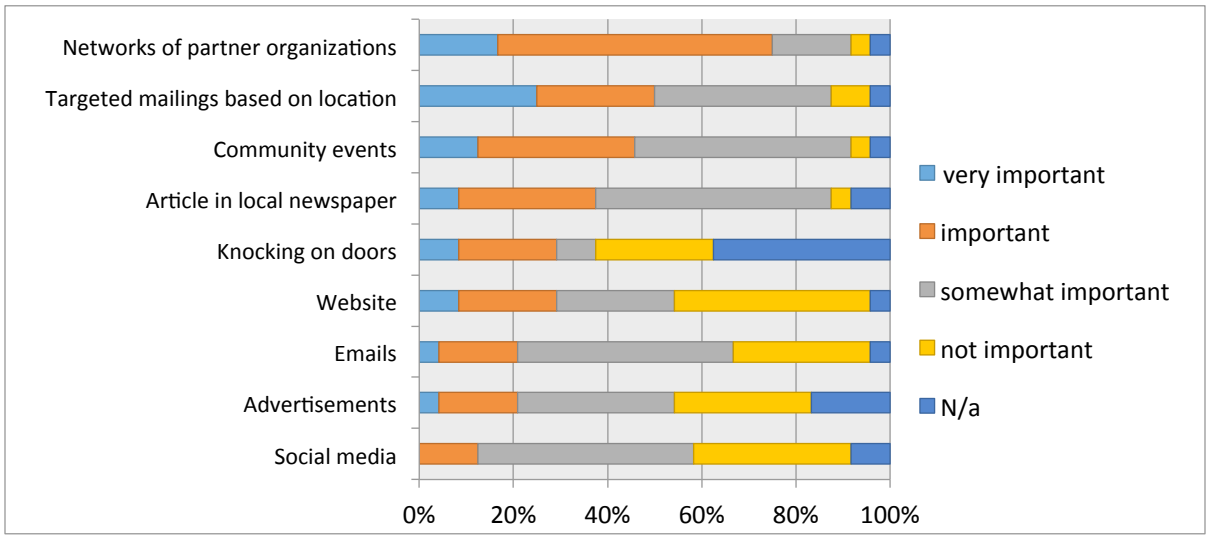


Figure 4: Communication channels for identifying landowners mentioned by practitioners in interviews and rated among survey respondents. These types of advertisements form the basis of the social marketing model for outreach.

Interpersonal communication, particularly through one-on-one conversations, was by far the most important communication channel for message delivery (Figure 5). All respondents said having a one-on- one conversation is an important communication channel. No other forms of communication were ubiquitously important; however, the only impersonal communication channel, written content, was distinctly of little importance for most respondents compared with channels that do have an interpersonal component. Practitioners spoke about the tradeoffs between outreach scale and impact, where outreach on a small scale, namely one-on-one interactions, has a limited reach but a significant impact and outreach on a large scale, such as written materials, can have a wide reach but a minimal impact. However, even at large scales, the low return on mass outreach does not compare to the return on interpersonal, one-on-one communication. As one outreach practitioner said, "there's no way around, it gets it slow. It's really hard to do effective outreach at a massive scale and large scale. I think you need to do those things, you need to do the wide spread information to say get people to your workshops, or to just contribute to the overall general awareness of the issues. But you can't rely on electronic and digital outreach and mailed outreach on its own."

This importance of interpersonal communication for initiating contact and message delivery is in line with previous studies, in both residential and agricultural contexts. In a residential study it was found that a two-way conversation between a landowner and outreach practitioner that allowed for assessment, dialogue, and feedback was effective in changing land management behavior (van Heezik et al.,

2012). In an agricultural context, interpersonal communication has been long documented in its importance at the decision-stage of the adoption of a new practice, and particularly for late adopters (Rogers & Beal, 1958; Warriner & Moul, 1992).

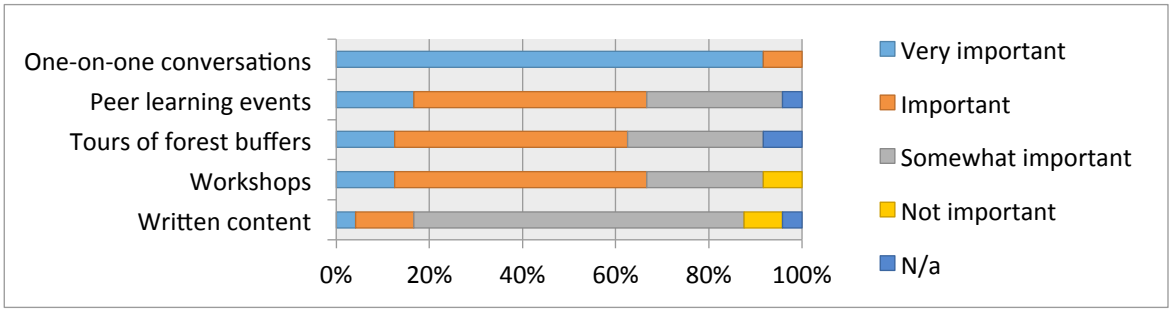


Figure 5: Communication channels for message delivery mentioned by practitioners in interviews and rated among survey respondents.

4.3 Interpersonal communication facilitates trust

This case study demonstrated the importance of trust in outreach, and how interpersonal communication between outreach practitioners and landowners is needed to build trust. In accordance with qualitative adoption literature (Ranjan et al., 2019), trust was a key element of outreach in the interviews and survey as it was cited explicitly by all but one practitioner in the interviews of this study and rated 'important' or 'very important' among all survey respondents. In this case study, mistrust of outsiders and the riparian forest buffer program is a significant barrier to the adoption of riparian forest buffers. As we will discuss below, interpersonal communication is a key outreach strategy to overcome that mistrust (Mayer et al., 1995).

In an agricultural context, landowner trust is a known significant barrier for riparian forest buffer outreach to overcome. Mistrust of outside, particularly

government, intervention is a trait that is common in agricultural communities (e.g. Enloe et al., 2017) and hinders riparian forest buffer adoption (Armstrong et al., 2011). As in the agricultural context, trust can be a barrier in residential context. Landowners in a residential context are likely to respond to initial contact from a trusted source (Brook et al, 2003), and previous studies on residential riparian forest buffer adoption have indicated low levels of trust in county, state, and federal government as information sources (Shandas, 2007a). One traditional farmer described his initial mistrust of outside interventions, and further development of mistrust based on inconsistencies and inefficiencies in the program governance:

"When [the riparian forest buffer program] first came out it just seemed like another way to control what farmers were doing because back when they- when all of that stuff first started to come out, I'm not just speaking for myself, I'm speaking for all of the farmers too, that we were all a little scared and nervous about what restrictions they're gonna put on us and stuff like that so we're all a little hesitant at first but then we all started to come around just because it's a sign of the times, we have to get involved and we don't have much choice. But I mean if we have to stay off that area of land anyway, we might as well improve it for the future by putting in buffers. If we're not gonna- and I see some waste to it on like some levels, you know what I mean? I always think if they're protecting the streams, you're putting some trees in, you're putting up a buffer, I mean that's great. But then I also see where some of the money might get wasted, like they're doing something- I hate to say it- for like a hobby farmer that has just like a handful of animals and they're going in there and they're spending- putting in like a manure thing and different things for a guy that works away from home and makes a lot of money at his job and then comes home and plays with his couple cows. I think that maybe the money should be spent on larger farms."

This landowner's continued mistrust of the program highlights the limitations of the social diffusion model of riparian forest buffer outreach. While this particular landowner was satisfied with his forest buffer, he said he would not refer it to a peer: "I mean I wouldn't want to refer somebody. But if someone was considering it, I would be glad if they wanted to see mine or if they wanted to call me. If they had

questions for me, I would be glad to talk with them about that. But as far as a referral, I wouldn't wanna say, hey look I think that guy oughta have a tree buffer down there, why don't you go talk to him, 'cause you still have some older generation farmers out there that want the least amount to do with the government as possible." This lack of referral underlies the importance of trust in the riparian forest buffer programs. Outreach strategies must increase trust in the riparian forest buffer program to facilitate referrals that are essential to the social diffusion model.

Building trust in the riparian forest buffer programs is facilitated through the nuances of interpersonal communication. First and foremost, practitioners build trust in riparian forest buffer programs by establishing individual trust with the landowner (Figure 6). This is relationship-building is a process of listening to the landowner about their goals and, through dialogue, conveying how riparian forest buffers can contribute to those goals. One practitioner compared this type of trust to customer service, and explained its importance for effective outreach:

"Customer service is huge if you do a great job, the calls start coming in and that's what happened with [our landowner assistance coordinator] and that's been my previous experience as well, and it's about being flexible, being able to meet with them at their property on their time…walking through, answering all their questions, looking at their property, talking through the options. It's time and it's relationship building and some of that is having people with the right personalities, a lot of patience. I guess for me it's a very personal thing, it's really developing trust is a big part of that and just what you're doing and you know this, and anyone that does this type of work knows this, is listening and really trying to understand what their goals are and how you can help them."

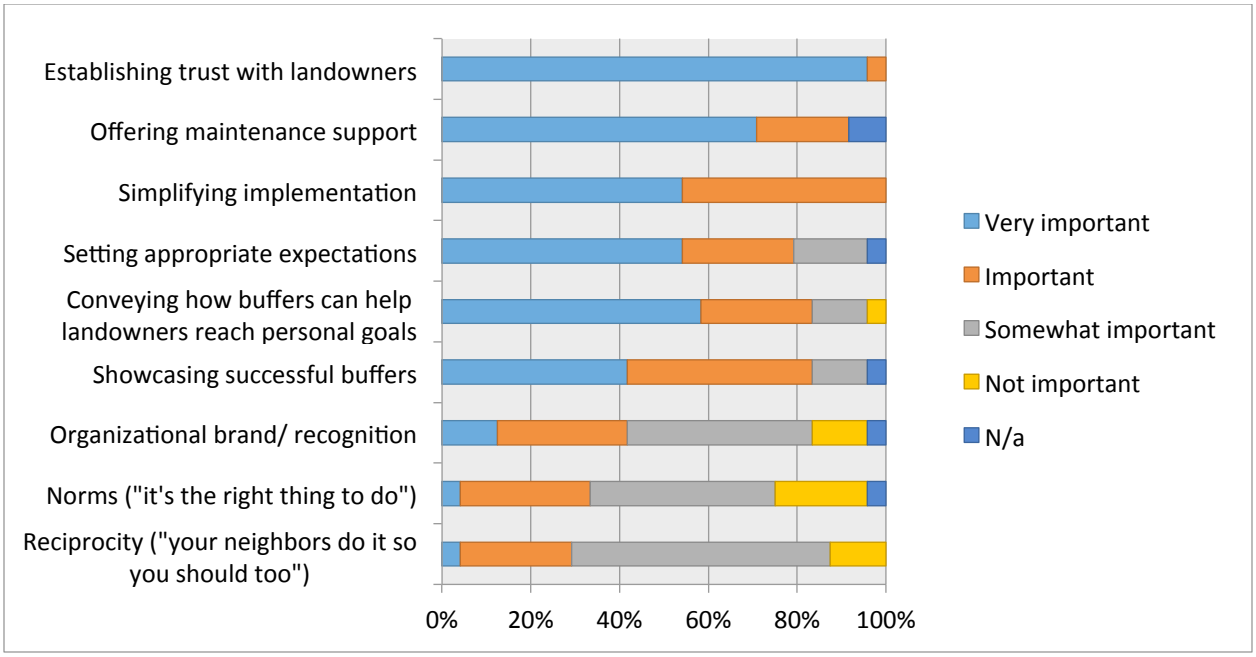


Figure 6: Elements of outreach strategy mentioned by practitioners in interviews and rated by practitioners in the survey.

Beyond this relationship building between the landowner and the outreach practitioner, it is crucial for outreach to build trust in the riparian forest buffer program. As one practitioner explained, the reputation of and trust in CREP in particular has played a significant role in the adoption of riparian forest buffers over the years:

"Initially there was, I don't want to say a bad reputation, but 'you better think about this before you consider joining CREP among the landowners, they were talking to each other. And then I think as those lessons learned got rolled into the next round of folks that we were working with. Those hurdles and barriers and some of the things the initial participants, we were able to address those and so then that narrative shifted to maybe this is something you really should consider because you're getting money and the trees are being established and there's a lot more discussion and transparency about what was gonna be required. At the beginning there was not as much- it wasn't anything by- it wasn't intentional but was just a thing. 20-some years ago this whole reliance of 'plant it, walk away and we're good to go' was changing and it forced us to have a better messaging and I think we're able to set expectations for landowners in terms of if 'you're signing up for this, expect this level of commitment.' And I think that has helped."

As the practitioner explained improving the reputation of CREP has been a concerted effort and evolution over many years to improve trust in the riparian forest buffer programs. Showcasing successful outcomes, setting appropriate maintenance expectations, and offering maintenance support is a key part of building trust (Figure 5), both in what the landowner is offered up front and in the outcomes of riparian forest buffer projects that, in turn, affect how riparian forest buffer programs are viewed. One practitioner explains how the cycle of maintenance and successful outcomes influences both an individual's decision and perceptions in the broader community: "Keeping up the interaction, the maintenance, is as important as a part of the engagement is the initial showing up… don't plant it and walk away, that's the worst, because then word gets out quickly in the farm community." Establishing a positive reputation in the community is an interpersonal process that relies on setting expectations and ensuring positive outcomes with landowners who implement riparian forest buffers through maintenance assistance.

Landowner perspectives corroborated the practitioner emphasis on one-on-one, interpersonal communication to establish interpersonal trust. A positive, personal relationship with the practitioner(s) that landowners worked with was key in them deciding to go through with a riparian forest buffer program and in their satisfaction with the program. Many landowners talked about how much they liked working with the practitioners and that made it a pleasant experience for them. One traditional farmer said: "The people involved generally speaking, are what make it [a good program]. The program on its own is nice, but that you get to work with people like that… That's what made it a smooth experience. Yeah, the experience was all a great

pleasure." Another landowner mentioned a specific practitioner 29 times in the interview, and said he was an "outstanding person" and a "helpful resource." From the landowner perspective, a trusted relationship with the outreach practitioner played a critical role in their satisfaction with establishing the riparian forest buffers. The investment in building a personal relationship through interpersonal communication is important for ensuring landowner satisfaction with the riparian forest buffers once implemented, which, as we will discuss, in turns leads to further social reinforcement.

4.4 Interpersonal communication leverages social-ecological feedbacks between landowner and their riparian zone

The benefits of riparian forest buffers, or how landowners interact with their riparian zone, are an important consideration of social-ecological feedbacks in a riparian system. In addition to building trust, interpersonal communication is important to be able to account for context-specific social-ecological feedbacks between the landowner and their riparian zone. These feedbacks can be characterized as the benefits that the landowners receive from the riparian zone. Particularly across contexts of a heterogeneous landscape and heterogeneous actors, no single benefit is a generalizable benefit for all landowners (Figure 7). One residential landowner cited flooding issues as the primary motivation for implementing riparian forest buffers, and says of them now "the buffer is helping because the trees, the trees that [outreach practitioner] recommended were aimed at wet areas so they're pulling more than normal share of water out of the ground and they survived the flooding." Whereas a traditional farmer cited hunting, in addition to the financial incentives from CREP, as reinforcement of their decision to implement riparian forest buffers: "we enjoy deer

hunting, so we want to maintain a little bit of habitat for them… so there's no downside of it, you're going to get this for your payments on the ground."

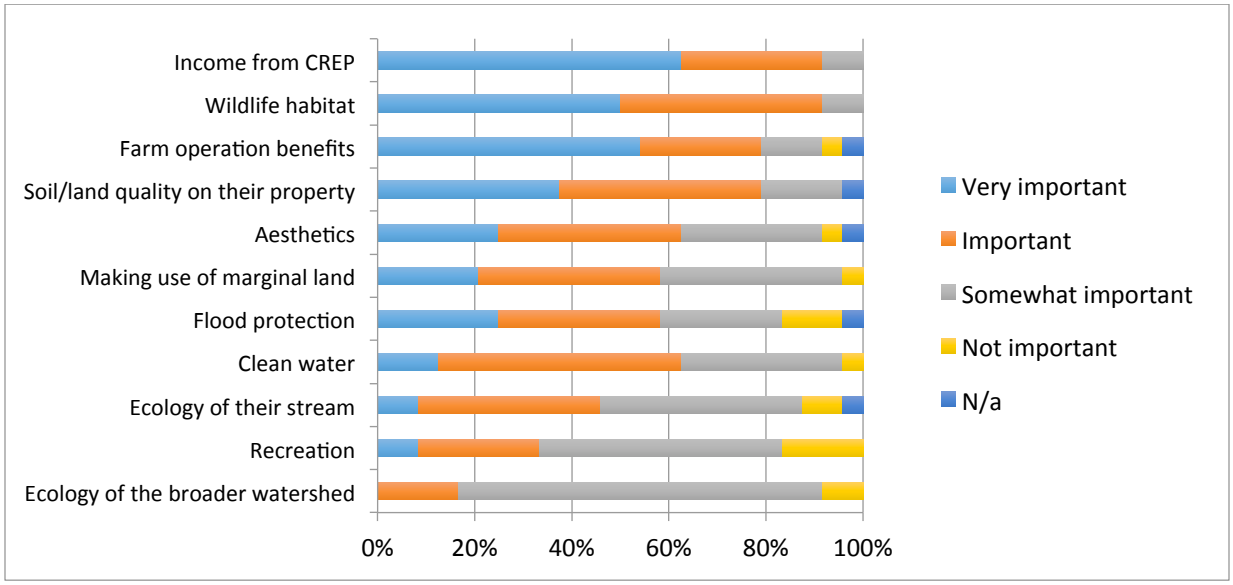


Figure 7: Survey responses to "how important are the following benefits in influencing landowner decision-making regarding buffers?"

As many practitioners described in their interviews, having a one-on-one conversation with a landowner is key because it provides a full understanding of the benefits specific to a given landowner. As one practitioner said, understanding a landowner's interests and concerns is the key first step in message delivery:

"relationship building is a big part of it. Connecting with people on their interests, just so that we understand right from the get-go, either what are their concerns, what are their challenges or for example, do they like to hunt and fish and so if you understand, maybe they have an interest then you could talk about fishing and improved water quality. If they have animals, you can talk about heard health and the impact of keeping their animals out of the stream and have them get clean water."

This one-on-one, interpersonal conversation allows the outreach practitioner to listen to a landowner's specific needs, and provide information on how riparian forest buffers address or fit in with that need, in turn facilitating a positive social-ecological feedback. This form of exchange is critical in the message delivery phase

of social diffusion and social marketing models of outreach, and is important across residential (van Heezik et al., 2012) and agricultural (Warriner & Moul, 1992) contexts.

4.5 Cultural norms of riparian forest buffers

Community norms, or internalized social rules, affect preferences and therefore adoption of private land conservation practices (Nassauer et al., 2009). Community norms regarding perceptions of riparian forest buffers can be both a benefit and barrier to riparian forest buffer adoption (Ranjan et al., 2019a). In the agricultural context, the cultural convention of a "tidy" landscape is a barrier for riparian forest buffer implementation (Nassauer, 1997). Moreover, the conflict between trees in the riparian zone and farmer cultural models of productivity are at odds with one another. As one practitioner says, "there's just that historical view of trees is, 'my great granddaddy cleared all these trees and I'm not going to be putting any back' I mean that's not how you make productive ag land, you have to get the trees off and the shade out if you're going to make money off it."

This cultural model was also observed among farmers on the Eastern Shore of Maryland (Paolisso et al, 2013), where farmers believe that land should be used according to its productivity, and that soil conservation practices are most effective when they help make the agricultural practice profitable. Outreach practitioners leverage this in current outreach through using 'farm operation benefits' and 'making use of marginalized land' in messaging when conducting outreach (Figure 5). This further reinforces the importance of one-on-one conversations, where these context-

specific operational benefits, and how they fit within farmers' cultural model of productivity, can be conveyed to overcome the barrier of norms.

An outreach practitioner explains his outreach approach in addressing this cultural model:

"'I grew up hating trees and father told me I have to hate trees and my grandfather told me I have to hate trees. All of my peers hated trees. How can I reconcile this with myself that I can plant trees?' Which is why I try to bring in those arguments that help give them cover. Like look let's just do the finances. And you're thinking that it just dollars and cents. You take away the whole- the subjective viewpoint on trees and let's just take dollars and cents and what makes sense for you at your bottom dollar to do some of these activities. And that's where that currency conversation cuts across every time. Because if they can justify it in their minds and tell their neighbors yeah I put trees in there because I'm not getting anything out of my soybeans or my corn. I'm tired of wasting my time and energy on maintenance, all of it's expensive. Put some trees in there, mow it for a few years, and I'm good to go."

As this excerpt highlights, the key is not only conveying the financial incentives but also demonstrating how riparian forest buffers maximize operations for farmers. Financial incentives through CREP and other programs provide a key impetus to overcome both the barriers of not only the financial feasibility but also norms about the acceptability of riparian forest buffers. This framing of riparian forest buffers is key for the agricultural context to overcome cultural conventions that go against riparian forest buffers, and reinforce the perspective that is in line with this convention. As one traditional farmer said, "Buffers has nothing to do other than that's the best use of that land. The Chesapeake Bay water quality, we know that that's probably a benefit is coming out of it. But that's not me. That's not the main reason we're doing it; flat out it's just because it's the best use of that ground to make it productive forest."

Similar to agricultural landscapes, cultural norms in residential landscapes provide an important context for riparian forest buffer outreach. While cultural norms of tidiness in residential landscapes seem at odds with riparian forest buffers, outreach can be framed in way that reinforces cultural norms of care. Outreach messaging that communicates human intention, particularly intention to care for the landscape or "cues to care", can reinforce adoption of conservation practices (Nassauer, 1995). We found this as important messaging with residential landscapes, where those who did not farm as their primary source of income were interested in riparian forest buffers for the opportunity to provide care for their property. As one residential landowner said,

"It's not just planting trees, it can really be fun when you start researching trees, which ones are best for wildlife… . So it was really fun picking the trees and then laying it out. So for me, I didn't just say, 'good plan,' I picked my trees and I take care of it. So I don't know if everybody follows up. But you know, if you ride by most of these, you'll see a lot of down plastic. Well, I'm the type that I'm going to put a new stake in there. I'm going to try to save every tree and I know, you know, you're supposed to have so much of a loss. But I literally tried to save everyone and replant if they die."

Beyond cultural norms of landscape care, using norms by reinforcing the idea that riparian forest buffers are the "right thing to do" can be effective in communities where this is already the dominant belief. This may be particularly effective in residential landscapes where acceptability of riparian forest buffers is driven primarily by aesthetics, not productivity (Kenwick et al., 2009; Shandas, 2007b). One residential landowner who is a hobby farmer and a self-proclaimed environmentalist said, when discussing why he decided to implement riparian forest buffers, "I decided

the responsible thing to do was plant trees," demonstrating the normative appeal of riparian forest buffers to certain landowners.

For example, using a normative appeal in messaging to convey that buffers are the "right" thing to do has demonstrated improved outcomes for riparian forest buffer outreach (Metcalf et al., 2019). However, this method of intentionally and explicitly normalizing riparian forest buffers has been used sparingly among outreach practitioners in this study, as the use of 'norms' was only 'somewhat' or 'not important' for 63% of survey respondents (Figure 5). One past riparian forest buffer outreach effort attempted to normalize forested buffers through a campaign called "Is your buffer Naked?" but, as a practitioner shared, "it got people's attention but I don't think it got their attention in a way that really motivated them to approach it in a positive matter," indicating that norms have not been effectively, intentionally leveraged in past outreach efforts, and presents an opportunity for future outreach.

There is opportunity to further and intentionally leverage this normative belief in residential contexts. Norms regarding landscape practices are most important at the neighborhood scale where neighbor mimicry can reinforce social diffusion (Goddard et al., 2013). Since norms are not widely used among practitioners of this study, there is opportunity to explicitly incorporate them into outreach. In particular, outreach can use norms to elevate the social diffusion model of outreach in residential landscapes by showcasing successful buffers on the landscape, reinforcing buffers as a 'cute to care' (Nassauer, 1995), and facilitating interactions among landowners that reinforce social diffusion.

4.6 Norms of trust and reciprocity

Norms of trust and reciprocity among peers is a key element in facilitating landowners collective action (McGinnis & Ostrom, 2014). Although few practitioners alluded to the role of peer reciprocity in interviews, it is an outreach strategy that is getting more attention among some practitioners interviewed. The use of reciprocity was not an outreach priority for most survey respondents (Figure 6). Some practitioners alluded to norms of trust and reciprocity in interviews, citing the importance of peer-to-peer information exchange that also facilitates mutual pressure:

"With forest owners, we have a long history of peer-to-peer education meaning landowner to landowner and we don't have as much experience with famers but we think the same principles are going to apply. So the best spokesperson is probably a neighbor or someone else in that community and so if someone sees their neighbor doing some practice, they're going to be way more likely to think about it themselves compared to hearing it from somebody from the government or a nonprofit."

As this practitioner explained, leveraging norms of trust and reciprocity is effective but strategies to implement this are not well understood. One known strategy for leveraging norms of reciprocity among landowners is peer-to-peer learning, where collective learning (Kueper et al., 2013) and group identity (Postmes et al., 2005) increase adoption. One nongovernmental practitioner uses norms of reciprocity as a core tenant in their outreach approach through peer learning circles, and was the only one to cite this as a prominent method in interviews. This program targets women landowners and hosts peer learning events where open dialogue and information sharing among peers is encouraged and network-building is an underlying goal. As the practitioner explains, "The reason we offer [peer learning circles] on the county-level is to have the participants leave our program with a network of friends but also of people that can help support them or even help make decisions, help them make

decisions for the lands that they own." By facilitating networks of riparian forest buffer adoption, this model leverages norms of reciprocity.

Norms of reciprocity and trust can also be leveraged by outreach practitioners as a benefit of riparian forest buffers as can facilitate positive relationships among peers. For example, riparian forest buffers can improve relationships among community members as it did with one traditional farmer:

"I'm a farmer and you hear of this stuff and think ah this isn't a good thing because they're trying to control us a little more and do this and do that and you don't know if this is a good thing or not. But you know now my mind is changed- I think it is a good thing and it's not just because of the money. I mean my mind has changed just because some of my landowners that I rent ground from- wanna see mother nature taken care of, so if I'm implementing some of this stuff on my own farms, and they ask me about it, what do you think about my farm and that kind of stuff, it makes a good relationship between me and the landowners. If I'm taking good care of their land."

This peer relationship-building element of riparian forest buffers, although not mentioned as a benefit by practitioners, can be considered further in message delivery for residential and agricultural landowners alike.

4.7 Further evidence of norms and interpersonal communication from outreach events

Outreach testing reinforces the importance of interpersonal communication and provides further evidence that leveraging norms can bolster interpersonal outreach. While all outreach event formats sought to increase general knowledge and awareness of riparian forest buffers, the three formats of outreach represented three approaches for message delivery in the social marketing outreach model: peer learning circle, which leveraged interpersonal communication and norms of trust and reciprocity, buffer tours which leveraged cultural norms of riparian forest buffers, and

an informational workshop which we considered the baseline format as it only sought to increase general knowledge and awareness.

Of the outreach events tested, the peer learning circle format was the longest investment in interpersonal communication and trust-building, as it lasted at minimum 8 hours over the course of 1-3 days, whereas the workshops and buffer tour lasted 1-3 hours. Additionally, the peer learning circle format was the only format to facilitate information sharing among peers. The learning circle format had the greatest outcomes on participant confidence, with an average 53.3% increase in 'confidence in making decisions that improve the sustainability of my land' and 62.2% increase in 'confidence in seeking assistance from a natural resource professional' (Table 2). Interaction and communication among individuals in a group is a key determinant in the development of norms and therefore in decision making (Postmes et al., 2005). The peer learning circle not only invests in interpersonal communication and trust between the landowner and outreach practitioner, but reinforces norms regarding adoption of riparian forest buffers and norms of reciprocity.

The buffer tour sought to understand the role of reinforcing cultural norms through showcasing successful riparian forest buffers in the community. This outreach event showed similar increase in confidence seeking assistance from a natural resource professional as the workshop, and no change in confidence in making decisions that improve the sustainability. From these findings, it is unclear if the tour format has an advantage over standard informational workshop format. However, only three participants filled out the questionnaire, so more research into the outreach outcomes of buffer tours is needed.

	Confidence in making decisions that improve the sustainability of land			Confidence in seeking assistance from a natural resource professional		
Outreach Event	**Average before**	**Average after**	**% change**	**Average before**	**Average after**	**% change**
Peer learning circle	2.1	3.3	53.3%	2.1	3.5	62.2%
Workshop	2.9	3.8	33.3%	2.8	3.8	38.9%
Buffer tour	3.3	3.3	0.0%	2.7	3.7	37.5%

Table 2: Landowner self reported confidence before and after outreach events.

5.0 Implications for riparian forest buffer outreach in the Maryland Upper Potomac watershed

Future outreach strategies should consider elements of both social diffusion and social marketing models of outreach in the Maryland Upper Potomac watershed. In the social diffusion model, initial contact relies on word of mouth referrals. Riparian forest outreach should focus on building trust in riparian forest buffer programs to leverage peer referrals. However, active, social marketing outreach is needed to influence landowners who are not reached by word of mouth referrals, particularly in residential context. While impersonal strategies are less effective than referrals, methods that utilize trusted sources such as partner organization networks can be helpful, along with efforts to increase connectivity to further peer connections and referrals, in making initial contact. Message delivery that is interpersonal, ideally in-person conversations on the landowner's property, and recognizes cultural norms should be prioritized for message delivery. Further, small group formats such as learning circles can be used in addition to interpersonal communication to reinforce cultural norms and reciprocity.

6.0 Conclusions

In this study we sought to understand outreach through a combination of behavior change theory and social-ecological systems frameworks. Informed by behavior change theory, we found interpersonal communication, trust, and cultural norms were key for outreach. We found that a social-ecological systems framework reinforced the importance of trust, and introduced concepts of social-ecological feedbacks and norms of trust and reciprocity that add to our understanding of behavior change. We found that riparian forest buffer outreach needs interpersonal connections between landowners and outreach practitioners to build trust and account for context-specific social-ecological feedbacks. This suggests that, in complex actor-resource systems like riparian forest buffers, generalized "one size fits all" outreach strategies may be set up for failure. Conservation programs such as riparian forest buffers may be reinforced through outreach activities that draw upon social-ecological feedbacks that demonstrate and leverage trust and norms in order to positively impact program adoption.

Appendices

Appendix 1: Interview questions

Practitioner interview questions:

1. Briefly, describe your organization
    a. Is it non-profit, local government, state government, federal government, academic, extension, other
2. Approximately how many hours a week do you spend on outreach-related activities?
    a. What portion of that is specifically for engaging landowners in riparian forest buffer programs (both Agricultural/CREP and residential/non-CREP)?
3. What state(s) or counties are the landowners that you are reaching out to located?
4. Would you describe your organization's buffer outreach activities as ongoing, discrete programs, or both?
    a. If discrete, please describe any major programs from the past 5 years (are there any other noteworthy programs that you have not implemented in the past 5 years?)
    b. If ongoing, please provide a general overview of your ongoing efforts
5. Walk me through a typical interaction you have a landowner – from your initial contact to them confirming/finalizing their participation in the program.
    a. Follow up: Did you make initial contact with them or did they contact if you? If you made initial contact, how did you identify the landowner and make contact? If they made contact, how do you think they learned about you?
6. How do you identify and make initial contact with prospective landowners?
    a. (Examples if needed: written letters, emails, pamphlets, phone calls, website, social media, other media, interactions meetings, community events, workshops)
7. Once you make initial contact with landowners, what messaging do you use to try to get them to implement riparian forest buffer?
8. Consider all of your organization's buffer-related outreach efforts. What elements of those efforts do you see as being crucial or most successful in recruiting landowners for riparian forest buffer programs?
9. Are there any outreach tactics you or your organization has tried that were found to be unsuccessful, or less successful than others?
10. Do you have any formal or informal evaluation for measuring outreach success?
11. Based on your experience and interactions with landowners, what do you think are the main reasons a landowner implements riparian forest buffers?
12. What do you think are the main reasons people don't implement buffers? (i.e. what are the main barriers for riparian forest buffer implementation?)

13. What general messaging do you usually use to persuade an average landowner to participate in your buffer programs?
14. Are there any specific types of landowners that you have tried to target with your outreach?
    a. How do you go about reaching that target audience?
    b. Do you adjust your messaging or tactics based on their attributes?
15. What are the main obstacles or difficulties you face in conducting outreach?
16. Is there anything else related to your buffer outreach efforts that we didn't cover and you would like to share?

Landowner interview questions:

1. Tell me about your property
2. Tell me about the riparian forest buffers on your property
3. Do you remember how you first heard about riparian forest buffers?
4. Can you recall what led you to want to put them on your property?
5. What are the positives you see in having riparian forest buffers?
6. What about the negatives?
7. Are you involved in any formal (farmer/landowner) networks?
    a. Do you ever talk about riparian forest buffers in any of those networks?
8. Do you ever talk about forest buffers with neighbors or any other informal networks?
9. If you were to tell a peer about riparian forest buffers, what would you say? Would you recommend them?
10. If you were to try to help get the word out about riparian forest buffers, what would you do?
11. Is there anything else you'd like to add?

Appendix 2: Practitioner survey questions

1. Geographic reach of your work (e.g. county or counties, state(s), watershed)

2. What type of landowners do you usually engage with? Approximate the percentage for each (total should be 100) - Agricultural

- Agricultural
- Residential - Rural
- Residential - Suburban
- Residential – Urban

3. How important are the following channels for reaching prospective landowners for riparian forest buffers? Please drag to rank.

Very important – Important – Somewhat important – Not important – N/a

a) How important are the following channels for reaching prospective landowners for riparian forest buffers? Extremely important, important, somewhat important, not important
b) Referrals as part of the farm conservation planning process
c) Referrals from partner organizations
d) Networks of partner organizations (email/newsletter lists, events, etc.)
e) Targeted mailings based on geographic location
f) Knocking on doors
g) Advertisements
h) Social media
i) Website
j) Emails
k) Community events
l) Article in local newspaper
m) (optional) Comments or others not mentioned:

4. How important are the following elements of outreach in influencing landowners to implement riparian forest buffers?

Very important – Important – Somewhat important – Not important – N/a

a) Showcasing successful buffers
b) Conveying general benefits of buffers
c) Conveying how buffers can help landowners reach their personal goals
d) Setting appropriate maintenance expectations
e) Simplifying the implementation process
f) Norms ("it's the right thing to do")
g) Reciprocity ("your neighbors do it so you should too")
h) Your organizational brand/recognition
i) Establishing trust with individual landowners
j) Establishing trust within the community
k) Story telling/using a narrative approach
l) Offering maintenance support
m) (optional) Comments or others not mentioned:

5. How important are the following benefits in motivating landowners to implement riparian forest buffers?
Very important – Important – Somewhat important – Not important – N/a

a) Farm operation benefits
b) Making use of marginal land
c) Income from CREP
d) Ecology of their stream
e) Ecology of the broader watershed
f) Soil/land quality on their property
g) Wildlife habitat
h) Recreation
i) Flood protection
j) Opportunity to take care of/nurture their land
k) Aesthetics
l) Clean water
m) (optional) Comments or others not mentioned:

6. How effective are the following content delivery approaches in influencing landowners to implement riparian forest buffers?
Very effective – Effective – Somewhat effective – Not effective – N/a

a) Workshops
b) One-on-one conversations with landowners
c) Tours of forest buffers
d) Peer learning events (learning circles, workshops with opportunities for discussions)
e) Written content (pamphlets, emails, articles)
f) Visual content (imagery, video)
g) (optional) Comments or others not mentioned:

Appendix 3: Landowner post-outreach questionnaire

1. Please rank your confidence in the following before the workshop:
Making decisions that improve the sustainability of my property
Seeking assistance from a natural resource professional to improve sustainability of my property

2. Please rank your confidence in the following after the workshop:
Making decisions that improve the sustainability of my property
Seeking assistance from a natural resource professional to improve sustainability of my property

1=no confidence 2=somewhat confident 3=confident 4=very confident

Appendix 4: Practitioner survey responses

How important are the following communication channels for initiating contact with landowners?	Very important		Important		Somewhat important		Not important		N/a	
Word-of-mouth referrals from peers	17	70.8%	6	25.0%	0		0	0.0%	1	4.2%
Referrals as part of the farm conservation planning process	18	75.0%	2	8.3%	2	8.3 %	0	0.0%	2	8.3%
Referrals from partner organizations	15	62.5%	6	25.0%	2	8.3 %	0	0.0%	1	4.2%
Networks of partner organizations (email/newsletter lists, events, etc.)	4	16.7%	14	58.3%	4	16.7 %	1	4.2%	1	4.2%
Targeted mailings based on geographic location	6	25.0%	6	25.0%	9	37.5 %	2	8.3%	1	4.2%
Community events	3	12.5%	8	33.3%	11	45.8 %	1	4.2%	1	4.2%
Article in local newspaper	2	8.3%	7	29.2%	12	50.0 %	1	4.2%	2	8.3%
Knocking on doors	2	8.3%	5	20.8%	2	8.3 %	6	25.0 %	9	37.5 %
Website	2	8.3%	5	20.8%	6	25.0 %	10	41.7 %	1	4.2%
Emails	1	4.2%	4	16.7%	11	45.8 %	7	29.2 %	1	4.2%
Advertisements	1	4.2%	4	16.7%	8	33.3 %	7	29.2 %	4	16.7 %
Social media	0	0.0%	3	12.5%	11	45.8 %	8	33.3 %	2	8.3%
How important are the follow strategies in promoting riparian forest buffers?	Very important		Important		Somewhat important		Not important		N/a	
Establishing trust with individual landowners	23	95.8%	1	4.2%	0	0.0 %	0	0.0%	0	0.0%
Offering maintenance support	17	70.8%	5	20.8%	0	0.0 %	0	0.0%	2	8.3%
Establishing trust within the community	17	70.8%	7	29.2%	0	0.0 %	0	0.0%	0	0.0%
Simplifying the implementation process	13	54.2%	11	45.8%	0	0.0 %	0	0.0%	0	0.0%
Setting appropriate maintenance expectations	13	54.2%	6	25.0%	4	16.7 %	0	0.0%	1	4.2%
Conveying how buffers can help landowners reach their personal goals	14	58.3%	6	25.0%	3	12.5 %	1	4.2%	0	0.0%
Showcasing successful	10	41.7%	10	41.7%	3	12.5	0	0.0%	1	4.2%

buffers						%				
Conveying general benefits of buffers	7	29.2%	10	41.7%	6	25.0 %	1	4.2%	0	0.0%
Story telling/using a narrative approach	3	12.5%	6	25.0%	11	45.8 %	2	8.3%	2	8.3%
Your organizational brand/recognition	3	12.5%	7	29.2%	10	41.7 %	3	12.5 %	1	4.2%
Reciprocity ("your neighbors do it so you should too")	1	4.2%	6	25.0%	14	58.3 %	3	12.5 %	0	0.0%
Norms ("it's the right thing to do")	1	4.2%	7	29.2%	10	41.7 %	5	20.8 %	1	4.2%
How important are the following benefits in influencing landowners to adopt riparian forest buffers?	Very important		Important		Somewhat important		Not important		N/a	
Income from CREP	15	62.5%	7	29.2%	2	8.3 %	0	0.0%	0	0.0%
Wildlife habitat	12	50.0%	10	41.7%	2	8.3 %	0	0.0%	0	0.0%
Farm operation benefits	13	54.2%	6	25.0%	3	12.5 %	1	4.2%	1	4.2%
Soil/land quality on their property	9	37.5%	10	41.7%	4	16.7 %	0	0.0%	1	4.2%
Opportunity to take care of/nurture their land	8	33.3%	12	50.0%	4	16.7 %	0	0.0%	0	0.0%
Aesthetics	6	25.0%	9	37.5%	7	29.2 %	1	4.2%	1	4.2%
Making use of marginal land	5	20.8%	9	37.5%	9	37.5 %	1	4.2%	0	0.0%
Flood protection	6	25.0%	8	33.3%	6	25.0 %	3	12.5 %	1	4.2%
Clean water	3	12.5%	12	50.0%	8	33.3 %	1	4.2%	0	0.0%
Ecology of their stream	2	8.3%	9	37.5%	10	41.7 %	2	8.3%	1	4.2%
Recreation	2	8.3%	6	25.0%	12	50.0 %	4	16.7 %	0	0.0%
Ecology of the broader watershed	0	0.0%	4	16.7%	18	75.0 %	2	8.3%	0	0.0%
How important are the following communication channels for message delivery?	Very effective		Effective		Somewhat effective		Not effective		N/a	
One-on-one conversations with landowners	22	91.7%	2	8.3%	0	0.0 %	0	0.0%	0	0.0%
Peer learning events	4	16.7%	12	50.0%	7	29.2 %	0	0.0%	1	4.2%
Tours of forest buffers	3	12.5%	12	50.0%	7	29.2 %	0	0.0%	2	8.3%
Workshops	3	12.5%	13	54.2%	6	25.0 %	2	8.3%	0	0.0%

Visual content (imagery, video)	2	8.3%	10	41.7%	7	29.2 %	2	8.3%	3	12.5 %
Written content (pamphlets, emails, articles)	1	4.2%	3	12.5%	17	70.8 %	2	8.3%	1	4.2%

Bibliography

Abrahamse, W., & Steg, L. (2013). Social influence approaches to encourage resource conservation: A meta-analysis. *Global Environmental Change*, *23*(6), 1773–1785. https://doi.org/10.1016/j.gloenvcha.2013.07.029

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Ajzen, I. (1992). Persuasive communication theory in social psychology: a historical perspective. In M. Manfredo (Ed.), *Influencing Human Behavior* (pp. 2–28). Champaign, Illinois: Sagamore Publishing.

Andreasen, A. R. (2002). *Marketing Social Marketing in the Social Change Marketplace* (Vol. 21). Retrieved from www.social-marketing.org.

Armstrong, A., Ling, E. J., Stedman, R., & Kleinman, P. (2011). Adoption of the Conservation Reserve Enhancement Program in the New York City watershed: The role of farmer attitudes. *Journal of Soil and Water Conservation*, *66*(5), 337–344. https://doi.org/10.2489/jswc.66.5.337

Armstrong, A., & Stedman, R. C. (2011). Landowner willingness to implement riparian buffers in a transitioning watershed. *Landscape and Urban Planning*, *105*, 211–220. https://doi.org/10.1016/j.landurbplan.2011.12.011

Atwell, R. C., Schulte, L. A., & Westphal, L. M. (2009). Linking resilience theory and diffusion of innovations theory to understand the potential for perennials in the U.S. Corn Belt. *Ecology and Society*, *14*(1). https://doi.org/Artn 30

Backyard Buffers Program. (n.d.). Retrieved November 24, 2019, from

https://dnr.maryland.gov/forests/Pages/programs/Backyard-Buffer-Program.aspx

Barnaud, C., Corbera, E., Muradian, R., Salliou, N., Sirami, C., Vialatte, A., … Antona, M. (2018). Ecosystem services, social interdependencies, and collective action: a conceptual framework. *Ecology and Society*, *23*(1), art15. https://doi.org/10.5751/ES-09848-230115

Baumgart-Getz, A., Prokopy, L. S., & Floress, K. (2012). Why farmers adopt best management practice in the United States: A meta-analysis of the adoption literature. *Journal of Environmental Management*, *96*, 17–25. https://doi.org/10.1016/j.jenvman.2011.10.006

Bernard, H. R. (Harvey R., & Gravlee, C. C. (2015). *Handbook of methods in cultural anthropology*.

Brook, A., Zint, M., & De Young, R. (2003). Landowners' Responses to an Endangered Species Act Listing and Implications for Encouraging Conservation. *Conservation Biology*, *17*(6), 1638–1649. https://doi.org/10.1111/j.1523-1739.2003.00258.x

Buffering the Bay: A Report on the Progress and Challenges of Restoring Riparian Forest Buffers in the Chesapeake Bay Watershed. (2014). Retrieved from https://www.chesapeakebay.net/channel_files/21750/forest_buffer_status_paper_final_(1).pdf

CRP and CREP Program | NRCS Maryland. (n.d.). Retrieved November 24, 2019, from https://www.nrcs.usda.gov/wps/portal/nrcs/detail/md/programs/?cid=nrcs144p2_025631

Enloe, S. K., Schulte, L. A., & Tyndall, J. C. (2017). Public–Private Partnerships Working Beyond Scale Challenges toward Water Quality Improvements from Private Lands. *Environmental Management*, *60*(4), 574–587. https://doi.org/10.1007/s00267-017-0905-5

Fielding, K. S., Terry, D. J., Masser, B. M., Bordia, P., & Hogg, M. A. (2005). Explaining landholders' decisions about riparian zone management: The role of behavioural, normative, and control beliefs. https://doi.org/10.1016/j.jenvman.2005.03.002

Goddard, M. A., Dougill, A. J., & Benton, T. G. (2013). Why garden for wildlife? Social and ecological drivers, Motivations and barriers for biodiversity management in residential landscapes. *Ecological Economics*, *86*, 258–273. https://doi.org/10.1016/j.ecolecon.2012.07.016

Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? An experiment with data saturation and variability. *Field Methods*, *18*(1), 59–82.

Hanson, G. C., Groffman, P. M., & Gold, A. J. (1994). Denitrification in Riparian Wetlands Receiving High and Low Groundwater Nitrate Inputs. *Journal of Environment Quality*, *23*(5), 917. https://doi.org/10.2134/jeq1994.00472425002300050011x

Huis, A., van Achterberg, T., de Bruin, M., Grol, R., Schoonhoven, L., & Hulscher, M. (2012). A systematic review of hand hygiene improvement strategies: a behavioural approach. *Implementation Science*, *7*(1), 92. https://doi.org/10.1186/1748-5908-7-92

Iverson Nassauer, J. (1995). Messy Ecosystems, Orderly Frames. *Landscape Journal*,

14(2), 161–169.

Kenwick, R. A., Shammin, M. R., & Sullivan, W. C. (2009). Preferences for riparian buffers. *Landscape and Urban Planning*, *91*. https://doi.org/10.1016/j.landurbplan.2008.12.005

Kotler, P., & Armstrong, G. (2015). *Principles of Marketing* (16th ed.). Pearson. https://doi.org/10.2307/2548367

Kueper, A. M., Sagor, E. S., & Becker, D. R. (2013). Learning from Landowners: Examining the Role of Peer Exchange in Private Landowner Outreach through Landowner Networks. *Society and Natural Resources*, *26*(8), 912–930. https://doi.org/10.1080/08941920.2012.722748

Lee, K. H., Isenhart, T. M., & Schultz, R. (2003). Sediment and nutrient removal in an established multi-species riparian buffer. *Journal of Soil and Water Conservation*, *58*(1). Retrieved from https://search-proquest-com.proxy-um.researchport.umd.edu/docview/220968513/fulltextPDF/799C39E4F104E9FPQ/1?accountid=14696

Lowrance, R., Todd, R., Fail, J., Hendrickson, O., Leonard, R., & Asmussen, L. (1984). Riparian Forests as Nutrient Filters in Agricultural Watersheds. *BioScience*, *34*(6), 374–377.

Manson, S. M., Jordan, N. R., Nelson, K. C., & Brummel, R. F. (2016). Modeling the effect of social networks on adoption of multifunctional agriculture. *Environmental Modelling & Software*, *75*, 388–401. https://doi.org/10.1016/J.ENVSOFT.2014.09.015

Mayer, P. M., Reynolds, S. K., McCutchen, M. D., & Canfield, T. J. (2007). Meta-

Analysis of Nitrogen Removal in Riparian Buffers. *Journal of Environment Quality*, *36*(4), 1172. https://doi.org/10.2134/jeq2006.0462

Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995). *An Integrative Model of Organizational Trust*. *Source: The Academy of Management Review* (Vol. 20).

McGinnis, M. D., & Ostrom, E. (2014). Social-ecological system framework: Initial changes and continuing challenges. *Ecology and Society*, *19*(2). https://doi.org/10.5751/ES-06387-190230

Mckenzie-Mohr, D. (2000). Promoting Sustainable Behavior: An Introduction to Community-Based Social Marketing. *Journal of Social Issues*, *56*(3), 543–554. Retrieved from https://web.stanford.edu/~kcarmel/CC_BehavChange_Course/readings/Mckenzie_socialmarket_2000.pdf

Metcalf, A. L., Angle, J. W., Phelan, C. N., Muth, B. A., & Finley, J. C. (2019). More Bank for the Buck: Microtargeting and Normative Appeals to Increase Social Marketing Efficiency. *Social Marketing Quarterly*, *25*(1), 26–39. https://doi.org/10.1177/1524500418818063

Naiman, R. J. (2013). Socio-ecological complexity and the restoration of river ecosystems. *Inland Waters*, *3*(4), 391–410. https://doi.org/10.5268/IW-3.4.667

Nassauer, J. I. (1997). Cultural sustainability: aligning aesthetics and ecology. In J. Nassauer (Ed.), *Placing Nature: Culture and Landscape Ecology* (pp. 67–83). Washington, DC: Island Press. https://doi.org/10.3368/lj.18.1.96

Nassauer, J. I., Wang, Z., & Dayrell, E. (2009). What will the neighbors think? Cultural norms and ecological design. *Landscape and Urban Planning*, *92*(3–4),

282–292. https://doi.org/10.1016/j.landurbplan.2009.05.010

Newbold, J. D., Herbert, S., Sweeney, B. W., Kiry, P., & Alberts, S. J. (2010). Water Quality Functions of a 15-Year-Old Riparian Forest Buffer System. *JAWRA Journal of the American Water Resources Association*, *46*(2), 299–310. https://doi.org/10.1111/j.1752-1688.2010.00421.x

Onel, N. (2017). Pro-environmental Purchasing Behavior of Consumers. *Social Marketing Quarterly*, *23*(2), 103–121. https://doi.org/10.1177/1524500416672440

Ostrom, E. (2000). Collective Action and the Evolution of Social Norms. *Source: The Journal of Economic Perspectives*, *14*(3), 137–158. Retrieved from http://www.jstor.org/stable/2646923

Ostrom, E. (2009). A general framework for analyzing sustainability of social-ecological systems. *Science (New York, N.Y.)*, *325*(5939), 419–22. https://doi.org/10.1126/science.1172133

Paolisso, M., Weeks, P., & Packard, J. (2013). *A Cultural Model of Farmer Land Conservation*. *Source: Human Organization* (Vol. 72). Retrieved from https://www.jstor.org/stable/pdf/44148678.pdf?refreqid=excelsior%3A270b25870974d66c4b4be6bbb951a23b

Postmes, T., Haslam, S. A., & Swaab, R. I. (2005). Social influence in small groups: An interactive model of social identity formation. *European Review of Social Psychology*, *16*(1), 1–42. https://doi.org/10.1080/10463280440000062

Pradhananga, A. K., Davenport, M. A., Fulton, D. C., Maruyama, G. M., & Current, D. (2017). An Integrated Moral Obligation Model for Landowner Conservation

Norms. *Society and Natural Resources*, *30*(2), 212–227. https://doi.org/10.1080/08941920.2016.1239289

Prokopy, L. S., Floress, K., Arbuckle, J. G., Church, S. P., Eanes, F. R., Gao, Y., … Singh, A. S. (2019). Adoption of agricultural conservation practices in the United States: Evidence from 35 years of quantitative literature. *JOURNAL OF SOIL AND WATER CONSERVATION SEPT*, *74*(5). https://doi.org/10.2489/jswc.74.5.520

Prokopy, L. S., Floress, K., Klotthor-Weinkauf, D., & Baumgart-Getz, A. (2008). Determinants of agricultural best management practice adoption: Evidence from the literature. *Journal of Soil and Water Conservation*, *63*(5), 300–311. https://doi.org/10.2489/jswc.63.5.300

Qualtrics. (2019). Provo, UT.

Ranjan, P., Church, S. P., Floress, K., & Prokopy, L. S. (2019a). Synthesizing Conservation Motivations and Barriers: What Have We Learned from Qualitative Studies of Farmers' Behaviors in the United States? *Society & Natural Resources*, 1–29. https://doi.org/10.1080/08941920.2019.1648710

Ranjan, P., Church, S. P., Floress, K., & Prokopy, L. S. (2019b). Synthesizing Conservation Motivations and Barriers: What Have We Learned from Qualitative Studies of Farmers' Behaviors in the United States? *Society & Natural Resources*, *1920*, 1–29. https://doi.org/10.1080/08941920.2019.1648710

Rhodes Francisco X Aguilar Shibu Jose Michael Gold, T. K. (2016). Factors influencing the adoption of riparian forest buffers in the Tuttle Creek Reservoir watershed of Kansas, USA. *Agroforestry Systems*.

https://doi.org/10.1007/s10457-016-0045-6

Riparian Forest Buffer Outcome Management Strategy. (2015). Retrieved from https://www.chesapeakebay.net/documents/22043/3a_forest_buffer_final.pdf

Rogers, E. M. (2003). *Diffusion of innovations*. New York : Free Press.

Rogers, E. M., & Beal, G. M. (1958). The Importance of Personal Influence in the Adoption of Technological Changes. *Social Forces*, *36*(4), 329–335. https://doi.org/10.2307/2573971

Ryan, R., Erickson, D., & De Young, R. (2003). Farmers' motivations for adopting conservation practices along riparian zones in a Mid-western agricultural watershed. *Journal of Environmental Planning and Management*, *46*(1), 19–37. https://doi.org/10.1080/713676702

Shandas, V. (2007a). An empirical study of streamside landowners' interest in riparian conservation. *Journal of the American Planning Association*, *73*(2), 173–184. https://doi.org/10.1080/01944360708976151

Shandas, V. (2007b). An Empirical Study of Streamside Landowners' Interest in Riparian Conservation. *Journal of the American Planning Association*, *73*(2), 173–184. https://doi.org/10.1080/01944360708976151

Skelton, P., Josiah, S. J., King, J. W., Brandle, J. R., Helmers, G. A., Agronomy, C. A. F., & Kiesselbach, 102b. (2005). Adoption of Riparian Forest Buffers on Private Lands in Nebraska, USA. *Small-Scale Forestry Economics, Management and Policy*, *4*(2), 185–204. Retrieved from https://link.springer.com/content/pdf/10.1007%2Fs11842-005-0012-y.pdf

Tjaden, R. (2002). *Adoption of riparian buffer technology in a voluntary climate: an*

analysis of Maryland farmers' socioeconomic characteristics. University of Maryland.

Trozzo, K. E., Munsell, J. F., Chamberlain, J. L., & Aust, W. M. (2014). Potential adoption of agroforestry riparian buffers based on landowner and streamside characteristics. *Journal of Soil and Water Conservation*, *69*(2). https://doi.org/10.2489/jswc.69.2.140

US EPA. (2010). *Chesapeake Bay TMDL Document*. Retrieved from https://www.epa.gov/chesapeake-bay-tmdl/chesapeake-bay-tmdl-document

USDA ERS - Farmland Ownership and Tenure. (n.d.). Retrieved November 26, 2019, from https://www.ers.usda.gov/topics/farm-economy/land-use-land-value-tenure/farmland-ownership-and-tenure/

Valdivia, C., & Poulos, C. (2009). Factors affecting farm operators' interest in incorporating riparian buffers and forest farming practices in northeast and southeast Missouri. *Agroforestry Systems*, *75*(1), 61–71. https://doi.org/10.1007/s10457-008-9129-2

van Heezik, Y. M., Dickinson, K. J. M., & Freeman, C. (2012). Closing the gap: Communicating to change gardening practices in support of native biodiversity in urban private gardens. *Ecology and Society*, *17*(1). https://doi.org/10.5751/ES-04712-170134

VERBI Software. (2017). MAXQDA Standard. Berlin, Germany: VERBI. Retrieved from https://www.maxqda.com

Wagner, M. M. (2008). Acceptance by Knowing? The Social Context of Urban Riparian Buffers as a Stormwater Best Management Practice. *Society & Natural*

Resources, *21*(10), 908–920. https://doi.org/10.1080/08941920802183339

Warriner, G. K., & Moul, T. M. (1992). Kinship and personal communication network influences on the adoption of agriculture conservation technology. *Journal of Rural Studies*, *8*(3), 279–291. https://doi.org/10.1016/0743-0167(92)90005-Q

Weller, S. C. (1998). Structured Interviewing and Questionnaire Construction. In *Handbook of Methods in Cultural Anthropology* (pp. 363–407). https://doi.org/10.1525/aa.2000.102.1.183

Wright, A. J., Veríssimo, D., Pilfold, K., Parsons, E. C. M., Ventre, K., Cousins, J., … McKinley, E. (2015). Competitive outreach in the 21st century: Why we need conservation marketing. *Ocean and Coastal Management*, *115*, 41–48. https://doi.org/10.1016/j.ocecoaman.2015.06.029