

**Human Dimensions of Young Forest Conservation Programs:
Effects of Outreach, Post-Program Management, and a Coupled-Systems Perspective**

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Abstract (Academic)

Achieving long-term conservation gains through the framework of conservation incentive programs requires an understanding of both the ecological and social components of these programs. Landowner program experiences and management decisions after program participation are important for long-term conservation, but these aspects of conservation programs are not well understood. To address this research gap related to conservation program participation, this thesis investigates Natural Resources Conservation Service programs that provide private landowners with financial and technical assistance to manage for young forest habitat in the eastern United States. We conducted a telephone survey to investigate private landowner experiences during and after participation in these NRCS conservation programs. Coordinating with biologists monitoring managed properties for birds, we assessed how in-person outreach and mailed monitoring results influenced landowners. Next, we evaluated how landowner motivations, resources, and cognitions were related to post-program young forest management intentions. Finally, we applied a coupled human and natural systems lens to investigate the linkage between wildlife outcomes, landowner perceptions, and continued young forest management. Our results demonstrate how in-person outreach can shape positive conservation experiences and increasing landowner trust in resource agencies. We also demonstrate the importance of both social and environmental factors for influencing landowner decision-making after conservation program participation. We detail the applications of this research for conservation agencies and professionals who work with private landowners.

Abstract (Public)

The decline of young forest habitat and associated wildlife species is a major conservation issue in the eastern United States. Since 2011, Natural Resources Conservation Service conservation programs have provided hundreds of private landowners with financial and technical assistance to create and maintain young forest habitat. Landowner program experiences and management decisions after program participation are important for long-term conservation, but information is limited on these aspects of NRCS young forest programs. In response, we conducted a telephone survey to investigate private landowner experiences during and after participation in these conservation programs. Coordinating with biologists monitoring managed properties for birds, we assessed how in-person outreach and mailed monitoring results influenced landowners. Next, we evaluated how landowner motivations, resources, and cognitions were related to post-program young forest management intentions. Finally, we examined how landowners observed and interpreted wildlife outcomes of young forest management and how these perceptions were related to habitat management after program participation. Our results highlight the importance of in-person outreach for shaping positive conservation experiences and increasing landowner trust in resource agencies. We also demonstrate the importance of both social and environmental factors for influencing landowner decision-making after conservation program participation. We detail the applications of this research for conservation agencies and professionals who work with private landowners.

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Attributions

Five co-authors contributed significantly to this thesis, which is a collection of three manuscripts. This section specifies the contributions of each co-author to this work.

Ashley Dayer is my academic advisor and primary project supervisor. In addition to writing the grant to fund this study, she and Jeff Larkin contributed to the study design of all three manuscripts and provided edits. Emily Heggenstaller contributed to the study design and editing of Chapter 1, which was published in PLOS One. D.J. McNeil and Amanda Rodewald provided ecological data and edits for Chapter 3. Given these contributions, this thesis is written in the first-person plural voice. Some information is redundant between chapters because each chapter was written as a stand-alone manuscript.

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Introduction

Publicly funded conservation programs are used to promote voluntary conservation efforts on private lands around the world. Designed to address environmental issues such as habitat loss or poor water quality, these programs vary in both specific function and purpose. Conservation programs may encourage landowners to set aside land through mechanisms such as conservation easements. Other programs incentivize the use of certain management practices by providing technical assistance and financial incentives to landowners through time-limited contracts (Reimer 2015). Global expenditures on private lands conservation are substantial. For instance, total conservation program spending by the United States Department of Agriculture's Natural Resources Conservation Service (NRCS) was nearly \$6 billion in 2017 (ERS 2018). Yet, in spite of these major investments over several decades, significant environmental issues related to wildlife conservation, water quality, and soil erosion remain problematic in the United States (e.g., Blanco-Canqui and Lal 2010; Reganold et al. 2011; Evans et al. 2016; EPA 2017). Given the scale of expenditures on private lands conservation, rigorous evaluations of these conservation programs are critically important. Quantifying the outcomes of conservation programs can help inform resource management agencies and policy makers on how to best refine and improve conservation program delivery. Environmental outcomes of conservation programs, such as acres of habitat created, are a key measure of program efficacy. In addition to environmental outcomes, program performance from a social perspective is arguably of comparable importance from a conservation standpoint (Reimer et al. 2014). Social outcomes of conservation programs may include effects on human behaviors, social norms, social networks, institutions, or scientific contributions (Bellamy et al. 2001; de Snoo et al. 2013). Despite the significance of these social metrics, social science research into these types of conservation

program effects has been limited (Reimer et al. 2014). In particular, there is a gap in research related to the long-term effects of conservation program participation on landowner management behavior (Dayer et al. 2017). Understanding both what social outcomes occur and how to improve these outcomes is crucial in order to achieve long-term conservation gains through the framework of these conservation incentive programs.

To address the lack of research on the human dimensions of conservation programs, this thesis investigates landowner experiences during and after participation in NRCS conservation programs targeting young forest habitat. The long-term decline of ephemeral young forest habitat (also known as early successional forest habitat) and associated wildlife species is one of the most pressing wildlife conservation issues in the eastern forests of the United States (King and Schlossberg, 2014; NABCI, 2016). Two NRCS conservation programs, Working Lands for Wildlife (WLFW) and the Regional Conservation Partners Program (RCPP), are prominent efforts to address this conservation issue through support for young forest management on private lands. These voluntary conservation programs provide cost share payments and technical assistance to private landowners who manage for young forest on their properties. Efforts to restore young forest through the WLFW program have been ongoing since 2012, when the young forest-reliant Golden-winged Warbler (*Vermivora chrysoptera*) was named a WLFW target species in its Appalachian Mountain breeding population range (i.e., GA, KY, MD, NC, NJ, PA, TN, VA, WV). In 2015, a 25-partner consortium led by the American Bird Conservancy received an RCPP award of \$5 million with the goal of creating young forest habitat for the Golden-winged Warbler and other wildlife species in Minnesota, Wisconsin, and Michigan. The ecological effects of these management initiatives in terms of vegetative and bird responses is being evaluated through an ongoing Conservation Effects Assessment Project (Bakermans et al. 2015; McNeil et al. 2017). However, landowner experiences in these young forest programs and

management outcomes after program participation are not well understood. Investigating these young forest programs from a social perspective provides an opportunity to address research questions that are applicable for young forest management and for conservation programs broadly.

Past research on the human dimensions of young forest management forms the basis for this thesis to investigate the experiences of landowners enrolled in NRCS young forest programs. In response to heightened awareness of young forest conservation need, significant research progress has been made in recent years toward understanding social aspects of young forest management. This research has primarily studied private forest landowners in the Northeast United States, with a broad goal of encouraging young forest conservation in a wider constituency. Gobster (2001) initially characterized the key determinants of landowner support for young forest management as interest in timber and non-timber forest products, aesthetic perceptions, and recreational use. Case, Seng, and Christoffel (2009) identified negative perceptions related to cutting trees and prohibitive management costs as key barriers for landowners to conduct young forest management. Subsequent research by Dayer et al. (2016) investigated predictors of private forest landowner intentions to conduct patch-cutting, a type of even-aged management that creates young forest. Dayer et al. (2016) found that landowners with positive beliefs about the effects of patch-cutting for their land and wildlife, who believed in positive outcomes of land and wildlife management, were members of a game wildlife organization, and who had conducted patch cutting in the past were more likely to patch-cut in the future. Based on these results, Dayer et al. (2016) suggested that messaging on young forest should focus on benefits to land and wildlife. Dayer et al. (2014) also emphasized the key role of educational efforts for encouraging young forest management, especially for landowners who had already managed for young forest. Taken together, this body of research establishes a

diversity of motivations related to young forest management, the importance of wildlife in shaping landowner management decisions, and the potential for education to support young forest management.

Beyond research specifically related to young forest management, the broader literature related to private landowner conservation is also relevant for this thesis. This literature asserts a range of programmatic factors that make private land conservation more effective, such as increased program flexibility or continued outreach/extension support (e.g., Race and Curtis 2009; Swann and Richards 2016). However, these claims are often not well supported by empirical evidence. For example, ongoing outreach support such as site visitations and follow-up to landowner participants in conservation programs may encourage continued conservation efforts. Landowner outreach is a tangible subject for management agencies and conservation NGOs, while it is also often a lower priority budget item. In Chapter 1, we evaluated how outreach to landowners in young forest programs affected their program experiences and post-program intentions. In our study, this outreach was from biological field technicians who were monitoring birds on managed properties. Outreach from these technicians involved in-person site visits and mailings that included property-specific monitoring results.

In general, management outcomes after conservation program participation are poorly understood (Dayer et al. 2017). Whether landowners re-enroll in conservation programs or persist with conservation in the absence of incentives has significant consequences for environmental outcomes in the long-term. In Chapter 2, we assessed the drivers of landowner intentions to manage for young forest habitat after program contracts ended. Specifically, we considered landowner intentions to re-enroll in similar programs or continue management without further cost-share within ten years after their contract ended. Continued management in this time-frame is important to maintain young forest habitat quality, which declines as forest

succession processes take place. Previous research has identified several pathways that could support continued conservation behaviors after incentive contracts end (Dayer et al. 2017). We evaluated three of these pathways- landowner motivations, resources for management, and cognitions about program participation- as predictors of post-program management intentions.

In addition to these social influences, environmental outcomes of previous management are thought to influence landowner decision-making (Moon and Cocklin 2011; Reimer et al. 2012). For conservation programs focused on specific wildlife species, increased abundance or visibility of wildlife could encourage a landowner to continue management actions. In Chapter 3, we considered young forest management from a coupled human and natural systems perspective, an approach that focuses on feedback loops between the environment and human behavior. By incorporating independently collected bird monitoring data, we explored how property level wildlife outcomes informed landowner perceptions and were related to actual young forest management actions after the program.

This thesis investigates the influence of outreach from biological field technicians, drivers of landowner behavior following participation in NRCS conservation programs targeting wildlife habitat, and the interplay between landowners and the responsive ecological context of their management activities. These topics have practical importance for the delivery of young forest programs, but are also highly relevant for private lands conservation broadly. Conservation programs provide a remarkable opportunity to achieve conservation goals on private lands, to the benefit of imperiled wildlife species and ecosystems. Understanding how both social and ecological factors contribute to outcomes of conservation programs is essential to attain environmental goals in the long term.

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Chapter 1. Effects of Biological Monitoring and Results Outreach on Private Landowner Conservation Management

Abstract

Sustained management efforts by private landowners are crucial for the long-term success of private land natural resource conservation and related environmental benefits. Landowner outreach is a primary means of recruiting private landowners into voluntary conservation incentive programs, and could also help sustain conservation behaviors through time. However, evaluation of outreach targeting landowners during or after participation in natural resource conservation incentive programs is lacking. We assessed two methods of landowner outreach associated with a Natural Resources Conservation Service incentive program targeting effective management of early successional forest habitat on private land in the Appalachians and Upper Great Lakes regions of the United States. While early successional forest habitat benefits many wildlife species, the program target species were the Golden-winged Warbler (*Vermivora chrysoptera*) and American Woodcock (*Scolopax minor*). After habitat management through the program occurred, biological technicians monitored wildlife and vegetation on enrolled properties and results were communicated to landowners in mailed packets. Our research focused on whether landowner interactions with technicians or receipt of result mailings could influence landowner post-program management intentions and management-related cognitions (e.g., agency trust, perceptions of outcomes). We conducted a telephone survey with landowners from January to May 2017, and analyzed survey data using quantitative group comparisons and qualitative coding methods. Landowners that accompanied biological technicians on monitoring site visits had higher agency trust and more positive perceptions of program outcomes. Result mailings did not improve landowner perceptions of program outcomes or agency trust, but did provide benefits such as increased landowner

knowledge about birds. Neither outreach method was associated with more positive landowner post-program management intentions. Our findings underline the importance and potential of direct interactions between conservation biologists and landowners. These two forms of non-traditional outreach administered by biologists could be a worthwhile component of future conservation program evaluations on private lands.

Introduction

Natural resource conservation on privately owned lands is critically important for the protection of biodiversity and ecosystem services in the United States and around the world (Kamal et al. 2015). With greater than 70 percent of the contiguous United States held under private ownership, private landowner cooperation is fundamental for achieving goals such as wildlife habitat conservation on a landscape scale (Bogart et al. 2008; Ciuzio et al. 2013). Private land conservation takes many forms, from the establishment of conservation easements to active management approaches such as buffer strip installation or sustainable timber harvests. In the United States, federal conservation programs funded by the Farm Bill (Agricultural Act of 2014) and administered by agencies such as the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) are the largest funding source for private land conservation (Ciuzio et al. 2013). These programs provide financial and technical assistance to enable landowners to conduct conservation practices that benefit individual landowners, society, and the environment (NABCI 2017).

Outreach is a central tool used to encourage private landowners to undertake conservation, through participation in federal programs or otherwise. Conservation related outreach includes many forms of communication and stakeholder engagement techniques, such as educational programs, personal contacts, and informational mailings (Stern 2008). The

purpose of most conservation related outreach is to influence the cognitions or behaviors of a target audience (Jacobson et al. 2006). Research has demonstrated the importance of outreach for influencing private land conservation behaviors. For example, landowners with access to quality information and familiarity with agency personnel are more likely to use best management practices (Baumgart-Getz et al. 2012). Relationships with agency staff and one-on-one agency visits can also encourage landowners to participate in conservation programs (Jackson-Smith and McEvoy 2011). For landowners who are already participants in voluntary conservation programs, communication and contact with agency staff contributes to landowner satisfaction (Selinske et al. 2015) and continued use of conservation practices (Race and Curtis 2013).

Interactive, personal methods of communication are recognized as the most effective means of conservation outreach (Ferranto et al. 2012) and conservation agencies such as the NRCS acknowledge the importance of personalized interactions with landowners (Newton 2001). However, limited funding for staff and technical assistance are barriers for federal agencies in the United States to communicate consistently and proactively with private landowners (Reimer and Prokopy 2014). Separate from these challenges, the NRCS-led Conservation Effects Assessment Project (CEAP) was initiated in 2004 to help quantify environmental benefits of federal conservation programs. The CEAP effort relies on diverse partnerships with non-governmental science and technology partners to implement outcome-based monitoring and assessment projects. In addition to quantifying environmental outcomes, monitoring initiatives such as those supported by CEAP may provide an avenue for outreach to landowners involved in conservation management. The process of biological monitoring on private land has some basic elements suitable for landowner outreach. Biological monitoring tends to require landowner interactions through site visits and related scheduling, and produces site-level information that could be of interest to landowners. However, it is unclear if

monitoring-associated outreach to these already committed landowners could improve program experiences or influence future management behaviors.

In the Eastern United States, NRCS incentive programs targeting effective management of early successional forest habitat provide an opportunity to examine how outreach to landowners can shape social outcomes of conservation program participation. The long-term decline of early successional forest habitat and associated wildlife species such as Golden-winged Warbler (*Vermivora chrysoptera*) and American Woodcock (*Scolopax minor*) is a major conservation issue (King and Schlossberg 2014; NABCI 2016). ‘Early successional forest habitat’, hereafter referred to as ‘young forest’, is ephemeral habitat with persistent shrubs or seedling to sapling-sized trees. This successional habitat is typically caused by disturbance events such as timber harvest, wind-throw, or fire (Litvaitis 2003). A key feature of young forest habitat is the inherent need for recurring management such as timber harvests to create new young forest or maintain shrublands, and retain habitat quality for associated wildlife species (Bakermans et al. 2011). In addition to this necessity for continued management, past human dimensions research has shown that landowners most likely to manage for young forest are those who have already done so in the past (Dayer et al. 2016). Thus, these landowners are an important group for creating new young forest and maintaining this habitat on the landscape. There is also high potential for outreach to influence this group of landowners. Research has found that policy tools such as financial incentives and educational outreach would be most influential among landowners who had already conducted young forest management in the past (Dayer et al. 2014). Elements of the NRCS Working Lands for Wildlife effort and the Regional Conservation Partnership Program provide incentives to create young forest on private lands in the Appalachians and Upper Great Lakes regions of the United States. Young forest habitat benefits many species of wildlife, but these two program applications are specifically

aimed at providing habitat for Golden-winged Warblers and American Woodcock. An ongoing CEAP assessment is studying the biological effectiveness of these NRCS efforts in terms of vegetation and bird response to management actions (Bakermans et al. 2015; McNeil et al. 2017). The CEAP monitoring process involves two methods of outreach: biological technician site visits and communication of site-specific monitoring results to landowners. This outreach could build landowner commitment for continued management. Although not a complete substitute for traditional visits from agency or extension staff, site visits from biological technicians are an opportunity to engage landowners in-person, build relationships, and provide scientific information about monitored properties (Hilty and Merenlender 2003). In this CEAP assessment, biological technicians were affiliated with the Indiana University of Pennsylvania or the American Bird Conservancy. Communication of monitoring results constituted an additional, complementary approach to site visits for the CEAP assessment. Giving individual landowners feedback on the environmental benefits of their management actions has been suggested as one way to encourage continued use of conservation practices (Hansson et al. 2012). This feedback strategy has some basis in existing interventions designed to alter conservation-related behaviors. For example, in the field of home energy conservation, mailed feedback on household performance has been shown to cause significant, lasting reductions in homeowner energy consumption (Frey and Rogers 2014).

Evaluating whether biological monitoring related outreach could influence landowner conservation management intentions was our primary interest. Landowner post-incentive program management, either through program re-enrollment or behavioral persistence without further incentives, is important for long-term conservation outcomes on the land (Dayer et al. 2017). To assess outreach efficacy, we also considered other cognitive elements that may serve as behavioral antecedents. Drawing from literature on landowner conservation behaviors we

identified several social variables that are likely to facilitate the effects of outreach on landowner behavior. These cognitive variables included landowner perceptions of management outcomes, agency trust, program satisfaction, outcome beliefs, and normative beliefs.

Perceptions have been broadly defined as “the way an individual observes, understands, interprets and evaluates a referent object... or outcome” (Bennett 2016). In the case of natural resource conservation programs, positive or negative perceptions of management effects could be influenced by outreach. For example, landowner perceptions of successful management are related to follow-up communication from habitat program biologists (Kammin et al. 2009), and landowner perceptions of conservation practice effectiveness are related to the use of those practices (Swann and Richards 2016; Farmer et al. 2017).

Trust is an important component of many natural resource management contexts (Stern and Coleman 2014). Several dimensions have been used to conceptualize trust including rational trust, affinitive trust, and procedural trust (Stern and Coleman 2014). Each of these dimensions of landowner trust in the NRCS and agency partners could be influenced by effective outreach efforts. Rational trust (rooted in evaluations of expertise and utility; Stern and Coleman 2014) and affinitive trust (based on emotional connections and feelings of shared values; Stern and Coleman 2014) in particular could be bolstered by agency interactions and feedback on management successes.

Landowner satisfaction can stem from fulfilled participation motivations (Selinske et al. 2015, Wright et al. 2015). Outreach that helped meet landowner motivations could generate satisfaction with the program and the sponsor agency. Satisfaction has been shown to relate to continued conservation efforts, especially through continued program participation (Selinske et al. 2015).

Outcome beliefs are assessments of the likely outcomes of future behaviors, and are thought to drive attitudes toward specific behaviors and behavioral intentions (Fishbein and Ajzen 2010). A landowner who believes a management action will result in positive and desired outcomes would be expected to be more likely to implement that action (e.g., Dayer et al. 2015). Outreach that highlights the positive effects of management could encourage a landowner to think future management is likely to result in positive outcomes as well.

Landowner normative beliefs about conservation management relate to social pressures to use a management practice. Important normative beliefs include whether other people perform a behavior (descriptive norms) and whether others approve or disapprove of the behavior (injunctive norms) (Fishbein and Ajzen 2010). Landowner beliefs about management norms have been shown to influence management intentions (Kuhfuss et al. 2015) and could be positively affected by outreach. Interaction with technicians who promote conservation or messages that emphasize collective achievements could change landowner normative beliefs related to management practices.

Drawing on these variables, our research investigated how two methods of outreach -- biological technician site visits and monitoring result mailings -- influenced landowners in two young forest habitat conservation programs. Specifically, we hypothesized that result mailings and technician site visits would increase landowners' post-program management intentions and improve management-related cognitions including perceptions of management outcomes, agency trust, program satisfaction, outcome beliefs, and normative beliefs.

Methods

Biological Monitoring and Results Communication

Our study population consisted of 189 landowners that signed conservation program contracts with NRCS between 2012 and 2016 to manage for young forest on properties in Maryland, Minnesota, New Jersey, Pennsylvania, and Wisconsin. After management began, these landowners voluntarily allowed biological technicians onto their properties to monitor for birds and vegetation regrowth as part of the CEAP assessment. At the time of biological monitoring site visits the managed properties were either under a current NRCS contract or had recently finished a contract with NRCS to create young forest. The monitoring process involved 4-5 site visits to a managed property between mid-April and mid-July each year in 2015 and/or 2016. In total each property was visited 1-4 times to survey American Woodcock, 2-4 times to survey songbirds including the Golden-winged Warbler, and 1-2 times to survey vegetation. Technicians notified landowners prior to each site visit. The extent of landowner-technician interactions varied among landowners. Some landowners never met with technicians, some greeted technicians at the property, and others accompanied technicians during the site visit(s).

Using biological data collected from monitored properties, we summarized bird response to habitat management efforts in site-specific result mailing packets (Appendix A) for each landowner. Property visitation dates and detection numbers for the two target species (Golden-winged Warbler and American Woodcock) were detailed explicitly. A list of all bird species that were detected on the landowner's property was also included. Species of Greatest Conservation Need (as defined by associated State Wildlife Action Plans, e.g., PGC 2015) were marked with an asterisk in these lists. Results were carefully worded to emphasize the positive effects of management while accurately conveying the monitoring data from the landowner's property. The mailing concluded with encouragement to continue to create and maintain young forest. Past research on effective landowner communications in this context was incorporated into the mailings, such as the term 'young forest' rather than the term 'early successional habitat' (Case,

Seng, & Christoffel 2009) and a focus on young forest management benefits for wildlife (Dayer et al. 2016). The mailings also referenced the collective accomplishment of landowners in the program and concluded with encouragement to continue to create and maintain young forest habitat.

Survey Design

We developed a telephone survey questionnaire to explore post-program management intentions, perceptions of program outcomes, program satisfaction, agency trust, outcome beliefs, and normative beliefs. Social scientists at Virginia Tech, cooperating NRCS staff, and private lands biologists reviewed the survey. The survey was pre-tested with 8 private landowners who participated in similar NRCS habitat conservation programs. The survey consisted of primarily closed-ended questions. Only survey items used in analyses reported in this manuscript are discussed here (see Appendix B for full survey). We restricted analysis to those measures that were hypothesized to be affected by outreach efforts.

The independent variables in this study related to the two outreach methods being investigated. Both were operationalized as binary variables. Biological technician site visits were operationalized as whether or not a landowner had accompanied a technician during at least one site visit-- a level of interaction expected to have the greatest impact for a landowner. The other independent variable-- result mailing reception-- was whether or not a landowner had received a result mailing with monitoring results.

The dependent variables related to post-program young forest management intentions and management-related cognitions. Landowner intentions to manage for young forest within 10 years after their NRCS contract by re-enrolling in an NRCS program (Appendix B, #13) or if further cost share was not available (#17) were measured on 5-point Likert-type scales from 'not

at all likely' to 'extremely likely'. A list of landowner motivations for owning woodland from the National Woodland Owner Survey (Butler et al. 2016) was adapted into a set of potential motivations of participating in the habitat program. For each motivation a follow-up item (#9A, 9C-9I) asked what effect program participation had for that related program outcome, on a 5-point Likert-type scale from 'very negative effect' to 'very positive effect'. Satisfaction with the habitat program overall, cost share payments, wildlife outcomes, and interactions with NRCS (#11A-D) were measured on a 1 to 10 scale, from 'not at all satisfied' to 'completely satisfied'. Agency trust was operationalized using three items (#12A-C) corresponding with three dimensions of trust (affective, rational, and procedural trust).

Outcome beliefs about the effects of future management were measured with 7 items (#19A-G), which corresponded to the 8 perception items (access to expert advice was not considered a relevant outcome of future management and was therefore excluded). Landowner normative beliefs about nearby landowners were measured with two items (#20A, C) relating to descriptive norms (whether nearby landowners manage for young forest), and injunctive norms (whether nearby landowners think the respondent should manage for young forest). Another item (#20B) looked at normative influence – the importance of nearby landowners' opinions to the respondent. Injunctive norms of people important to the respondent were measured with two items (#21A-B)

We also developed a shortened follow-up survey questionnaire as a post-test for a sub-set of landowners after they received result mailings. The follow-up survey included repeated measures of all of the items outlined above and concluded with one additional open-ended question that assessed landowner thoughts on the effect of the result mailings: "What effect, if any, did the result mailing have on you?" Responses were recorded in the data file verbatim, and then read back to landowners to ensure accuracy.

Survey Methods

Between January 2017 and May 2017, we conducted the primary survey with all landowners in the study population. To maximize the response rate, we varied the day of week and time of day that we attempted to reach landowners via phone. If two phone numbers were available in the database for a landowner we tried both. We left no more than two messages on a landowners' voicemail or with another person who answered the line. Survey responses were entered into Qualtrics software.

At the time of the primary survey, 63.4% (n=120) of the population had been sent result mailings in October 2015 and again in December 2016. The other group of landowners had received no result mailings at the time of the primary survey, and served as a pseudo-control group. The pseudo-control landowner group was sent result mailings in April 2017 after completing the primary survey. The follow-up survey was then conducted in May 2017 with landowners in the pseudo-control group who had completed the primary survey and indicated interest in the follow-up.

This research was conducted with approval from, and in accordance with, the Virginia Tech Institutional Review Board (Protocol #16-597). Before completing the telephone survey, respondents were read a consent statement informing them of the study's purpose and confidentiality of their responses. Respondents were then asked to provide oral consent stating their agreement to participate in the survey. Verification that the respondent had expressed verbal consent was recorded in the data file. Written consent was not obtained due to the telephone survey methodology, and the Virginia Tech Institutional Review Board approved the oral consent procedure. Members of the research team also signed compliance agreements that ensure NRCS cooperators will not disclose protected agricultural or personally identifiable information,

as required by Section 1619 of the Food, Conservation, and Energy Act of 2008.

Of the 189 landowners contacted for the primary survey, 102 completed the survey for a response rate of 57.9%. The primary survey took 30 minutes on average to complete. For the follow-up survey, 32 of the 42 eligible landowners completed the survey for a response rate of 76.2%.

To check for non-response bias in terms of contract characteristics, group comparisons (Mann-Whitney U and chi-square tests) between primary survey respondents and non-respondents were made using contract data in the CEAP assessment database. The variables used for non-response tests included 'years since contract start', 'acres planned', 'property region', and 'practices contracted'. Practices used by 10 or fewer landowners total were dropped from comparisons to ensure adequate sample sizes for statistical tests. The only significant difference detected ($\chi^2 = 5.095$, $p = 0.024$) was for the practice 'Tree/Shrub planting' (one of nine contracted practices), which a greater proportion of respondents conducted (10.8%) than non-respondents (2.4%). The sample was not weighted to adjust for this minor difference.

Analysis

We analyzed our data using SPSS (version 24.0). Incomplete questions from completed surveys were dropped on an analysis-by-analysis basis. One scale was constructed using the mean of two items that measured injunctive norms of important others (#21A-B). The Cronbach's alpha for this scale was 0.78, indicating a high degree of reliability.

Shapiro-Wilk tests were used to assess response normality, and two sets of Mann-Whitney U tests were used to analyze the primary survey data. The first set of Mann-Whitney U tests compared the variables of interest for landowners who received result mailings and landowners who had not received result mailings. The second set of tests compared landowners

who accompanied biological technicians on at least one site visit and landowners who had not. In order to correct for running multiple independent comparisons, Benjamini-Hochberg values (Benjamini and Hochberg 1995) were utilized to assess p-value significance with a false discovery rate of 5%. The two sets of Mann-Whitney U tests were treated separately for these corrections.

We paired primary survey responses to each respondent's follow-up survey responses to further examine the effect of the results mailing on these individuals. Wilcoxon signed-rank tests were used to compare primary survey and follow-up survey responses, using the same set of survey items as the dependent variables in the Mann-Whitney U tests. Benjamini-Hochberg values were also used to assess significance for these paired comparisons.

Our qualitative data analysis included responses from the 32 respondents who completed the follow-up survey in May 2017 and answered the open-ended question "What effect, if any, did the result mailing have on you?" We created a comprehensive and mutually exclusive code list based upon major recurring response themes and coded responses accordingly. Some respondents discussed more than one theme, so individual responses were often coded for multiple themes.

Results

Primary Survey

Survey respondents were primarily male (88%) and averaged 61 years old (median = 63 years, SD = 11 years). The majority (66%) had a four-year college degree or higher. Respondents owned their land for an average of 37 years (median = 20 years, SD = 35 years), and owned a mean of 780 acres (median = 235 acres, SD = 2133 acres). Respondents' enrolled properties

were located in Pennsylvania (59%), Minnesota (30%), New Jersey (7%), Maryland (2%), and Wisconsin (2%).

About a third (36%) of respondents lived within one mile of the property enrolled in the habitat program. The remaining 64% of respondents lived greater than one mile from the enrolled property, and were considered absentee landowners (Butler et al. 2016). Chi-square tests detected no significant associations between absentee status and result mailing reception ($\chi^2=1.516, p = 0.218$) or absentee status and whether a landowner had accompanied a technician ($\chi^2= 3.146, p = 0.076$).

Of 102 surveyed landowners, 33 reported accompanying biological technicians on at least one site visit of their property and 69 did not accompany technicians. Several Mann-Whitney U tests (Table 1) detected significant differences between landowners who accompanied biological technicians on at least one site visit and landowners who did not accompany technicians.

Table 1. Comparison of phone survey responses of landowners in NRCS young forest habitat programs based on whether they accompanied technicians monitoring enrolled properties for birds and vegetation post-management, eastern United States, February- June 2017.

Variable	Mean		Z (U)*	p -value
	Did Not Accompany Technician (n=69)	Accompanied Technician (n=33)		
<i>Young forest management intentions</i>				
Program re-enrollment	3.74	3.91	0.78 (1243.5)	0.434
Management if further cost share not available	3.12	3.48	1.51 (1324)	0.130
<i>Perceptions: Effect of participation on...</i>				
Access to expert advice	4.25	4.70	3.20 (1538)	0.001
Hunting opportunities	3.83	3.97	0.89 (1255)	0.372
Bird-watching opportunities	3.88	4.48	3.51 (1571)	<0.001
American Woodcock	3.76	4.04	1.70 (717)	0.088
Golden-winged Warbler	3.87	3.86	0.00 (493.5)	1.000
Other birds that use young forest	4.33	4.63	1.90 (990.5)	0.058
Scenery	3.48	3.73	0.83 (1251.5)	0.404
Forest health	4.30	4.59	2.03 (1182)	0.042
<i>Satisfaction</i>				
Overall program satisfaction	8.59	9.00	1.41 (1324)	0.159
Cost share satisfaction	8.51	9.00	1.18 (1292.5)	0.240
Wildlife outcome satisfaction	8.00	8.36	0.61 (1168.5)	0.543
NRCS satisfaction	8.90	9.52	2.26 (1415.5)	0.024
<i>Trust</i>				
Rational trust	4.45	4.52	0.62 (1213.5)	0.536
Affinitive trust	4.42	4.72	2.59 (1413.5)	0.010
Procedural trust	4.31	4.61	1.84 (1349)	0.066
<i>Outcome Beliefs: Managing for young forest within ten years after the contract would...</i>				
Benefit hunting opportunities	4.48	4.91	2.63 (780)	0.009
Benefit bird-watching opportunities	4.39	4.88	3.52 (907.5)	<0.001
Benefit American Woodcock	4.18	4.35	1.32 (758)	0.189
Benefit Golden-winged Warbler	4.20	4.60	2.77 (825)	0.006
Benefit other birds that use young forest	4.45	4.81	2.82 (952.5)	0.005
Improve the scenery	3.96	4.32	1.73 (751)	0.084
Benefit forest health	4.43	4.70	2.10 (911.5)	0.035
<i>Normative Beliefs</i>				
Descriptive norm: nearby landowners	1.98	1.78	1.48 (869)	0.140
Injunctive norm: nearby landowners	1.93	2.30	-0.74 (536)	0.457
Normative influence: nearby landowners	2.85	2.31	-2.39 (423.5)	0.017
Injunctive norm: important people	3.59	3.39	-0.60 (646)	0.547

Landowners who accompanied technicians had more positive perceptions of program participation effects on their access to expert advice and bird-watching opportunities. Those landowners who accompanied technicians also believed in the benefits of future young forest management for hunting, bird-watching, Golden-winged Warblers, and other birds more strongly than those who had not accompanied technicians. Landowners who had accompanied technicians also had higher affinitive agency trust. We found no significant differences between the two groups in terms of future management intentions or satisfaction with program components.

Of 102 surveyed landowners, 58 landowners had received the result mailings and 44 had received no result mailings (pseudo-control group). A chi-square test detected no significant association between landowners who had accompanied biological technicians and landowners who had received result mailings ($\chi^2 = 1.91, p = 0.167$). Mann-Whitney U tests detected no significant differences between landowners who had received the result mailings and landowners who had received no result mailings (pseudo-control group) in terms of management intentions, perceptions of program outcomes, or outcome beliefs (Table 2). We detected no significant differences in other key measures including satisfaction, trust, and normative beliefs.

Table 2. Comparison of phone survey responses of landowners in NRCS young forest habitat programs based on reception of mailing with bird monitoring results, eastern United States, February- June 2017.

Variable	Mean		Z (U)*	p -value
	Received No Mailing (n=44)	Received Mailing (n=58)		
<i>Young forest management intentions</i>				
Program re-enrollment	3.91	3.71	-1.00 (1134.5)	0.319
Management if further cost share not available	3.23	3.25	0.71 (1264)	0.944
<i>Perceptions: Effect of participation on...</i>				
Access to expert advice	4.41	4.38	-0.82 (1167.5)	0.412
Hunting opportunities	3.84	3.90	-0.76 (1265.5)	0.939
Bird-watching opportunities	3.93	4.19	1.15 (1402)	0.250
American Woodcock	3.88	3.84	-0.20 (597)	0.843
Golden-winged Warbler	3.93	3.83	-0.61 (508.5)	0.543
Other birds that use young forest	4.35	4.50	0.59 (907)	0.558
Scenery	3.64	3.50	-0.91 (1145)	0.361
Forest health	4.51	4.33	-1.28 (855)	0.201
<i>Satisfaction</i>				
Overall program satisfaction	8.77	8.69	-0.84 (1159.5)	0.403
Cost share satisfaction	8.80	8.57	-0.85 (1158.5)	0.397
Wildlife outcome satisfaction	8.17	8.09	-1.25 (1026)	0.212
NRCS satisfaction	9.02	9.16	-0.24 (1244.5)	0.808
<i>Trust</i>				
Rational trust	4.55	4.41	-1.33 (1105)	0.183
Affinitive trust	4.57	4.47	-0.95 (1133.5)	0.345
Procedural trust	4.44	4.38	-0.73 (1152)	0.465
<i>Outcome Beliefs: Managing for young forest within ten years after the contract would...</i>				
Benefit hunting opportunities	4.56	4.66	0.07 (702)	0.947
Benefit bird-watching opportunities	4.59	4.53	-0.56 (643.5)	0.577
Benefit American Woodcock	4.47	4.07	-2.44 (495.5)	0.015
Benefit Golden-winged Warbler	4.42	4.28	-1.16 (574)	0.248
Benefit other birds that use young forest	4.65	4.52	-0.87 (706)	0.387
Improve the scenery	4.17	4.02	-0.70 (595.5)	0.491
Benefit forest health	4.68	4.40	-1.83 (633)	0.068
<i>Normative Beliefs</i>				
Descriptive norm: nearby landowners	1.89	1.92	0.52 (564)	0.603
Injunctive norm: nearby landowners	2.29	1.87	-1.66 (634.5)	0.097
Normative influence: nearby landowners	2.72	2.60	-0.65 (575)	0.516
Injunctive norm: important people	3.67	3.41	-0.87 (674.5)	0.382

Bolded p-values are significant with Benjamini-Hochberg correction procedure for multiple independent comparisons.

*Mann-Whitney U Test Statistic.

Follow-Up Survey

No significant differences were detected by Wilcoxon signed-rank tests comparing landowners' responses before and after receiving a result mailing (the same set of survey items were used as for the previous Mann-Whitney U tests). Seven themes emerged through qualitative analysis of landowner responses to the open-ended question in the follow-up survey (Table 3).

Table 3. Qualitative analysis of follow-up phone survey responses to “What effect, if any, did the result mailing have on you?” by landowners in NRCS young forest habitat programs, eastern United States, May-June 2017.

Thematic Code	Frequency (%)	Definition	Example Response
Bird knowledge	23 (71.9%)	Landowner learned about birds on their property from the mailing	“We learned stuff we didn't know about the land and what's on it. They listed a bunch of birds they recorded on the property that a lot of us didn't know were there.”
Satisfied	18 (56.3%)	Landowner was generally happy with the mailing or felt good about the results	“The membership liked receiving the info and were happy to know what was in it.”
Social interactions	10 (31.3%)	Landowner mentioned sharing the mailing with others or interactions with biologists and technicians	“Since I got grandkids to share it with them and my son and daughter to let them know since it will be their land someday.”
Management effects	9 (28.1%)	Landowner indicated an improvement on their property related to young forest management	“It was really a positive letter, made me feel a lot better about the mess out there, that the birds are arriving and will continue to arrive, especially the warbler.”
Motivated	6 (18.8%)	The mailing motivated landowner to take actions such as looking for birds or continued management	“Encouraged me to continue to manage for young forest.”
Reinforced observations	6 (18.8%)	The mailing matched or reinforced landowner's personal observations on their property	“We've seen an increase in birds, turkeys, different animals we've never seen before. There were a lot of trees before so it is easier to see now.”
Negative	2 (6.3%)	Landowner felt negatively about the mailing or the results from their property	“I was disappointed, I should have known once the trees were gone other species would go too.”

The most commonly occurring theme in the open-ended responses was ‘bird knowledge’, which related to landowners learning about bird diversity and bird presence on their property.

The second most common theme, ‘satisfied’, included responses indicating that the landowner

was generally satisfied with the mailing or felt positively about the results. Responses coded as the ‘social interactions’ theme mostly expressed that the result mailing had been shared with family, friends, or neighbors. Some responses with this theme also indicated that the landowner had positive interactions with technicians during the monitoring process. The ‘management effects’ theme included responses that connected young forest management with changes on the respondent’s property, such as an increase in wildlife numbers or diversity. Responses with the ‘motivated’ theme mentioned how the mailing motivated the respondent to take action, either to look for birds on their property or to continue management for young forest. The ‘reinforced observations’ theme was associated with responses indicating that the mailing matched with the landowner’s personal observations of wildlife or forest health on their property. The least common theme was ‘negative’, corresponding to responses that were negative about the mailing and/or the property results.

Discussion

Our results suggest an important difference in efficacy between the two forms of landowner outreach evaluated in this study. Biological monitoring technician interactions with landowners (in the form of landowners accompanying technicians on site visits) were related to a range of positive social outcomes for landowners. In contrast, result mailing communications had limited effects on landowners. Our results are comparable to other research that has demonstrated personal, interpretive outreach is more influential than passive forms of outreach (Sharp et al. 2013). Additionally, neither outreach method in our study was associated with higher landowner intentions to manage for young forest after the conservation program. The potential complexity and costs of young forest management are factors that could easily dampen the influence of a positive program experience, which may explain why outreach was not as

effective in this respect. These findings align with research in the environmental education field, which has shown that information alone is not sufficient to change behaviors (Ardoin et al. 2013). Pairing informative mailings with other interventions such as personal interactions and signs can be effective at achieving behavioral changes (McKenzie-Mohr 2000). However, we were unable to examine interactive effects between the result mailing and technician interactions because of sample size. A separate variable that might have an influence on outreach effects is ownership status as either a resident or absentee landowner. Sample size limited us from investigating interaction effects between outreach and landowner absentee status.

Landowners that accompanied technicians had higher affinitive trust for NRCS and partners, a dimension of trust based on feelings of shared values and connectedness that can result from positive shared experiences (Stern and Coleman 2014). Better perceptions of program outcomes and more positive outcome beliefs about future management were also associated with accompanying technicians. While these significant differences match our hypotheses based upon prior research findings, we are unable to assume the causal effect of technician interactions. For example, landowners more interested in bird-watching may have been more likely than non-birders to take an opportunity to look for birds on their property. It is possible that landowners accompanied technicians to supervise a visit to their property, rather than due to a high interest in birds. Exposure to the tangible benefits of management and interactions with a scientific expert during a site visit could be a powerful interactive experience for landowners. Our findings suggest that site visits and direct interactions had an important, positive influence on landowners. These contracted technicians helped landowners see their managed properties in a more positive light and provided a relatable face for the NRCS even though they are not NRCS staff. For these NRCS programs and others, partner positions and contractors make up a significant portion of landowner contacts, and may play a key role in

shaping landowner experiences with conservation programs and perceptions of the sponsor agency.

The result mailings were beneficial in several respects; they increased landowner knowledge about birds on their property, increased landowner satisfaction to some extent, provided an interesting item to share with family and friends, and inspired a few landowners to observe birds or manage for young forest. However, our results suggest that few landowners made causative connections between management actions and effects for birds on their land. Surprisingly, two landowners also responded negatively to the mailings. While all mailings contained similar positive messages and lists of detected bird species, many landowners learned that there were no detections for one or both target species on their land, which could explain these few negative results. The uncertainty of detecting positive results in the form of species presence from conservation projects in the short-term is a possible risk of giving monitoring results feedback. Further, neither the primary or follow-up survey found significant differences in future management intentions based on result mailing receipt. Overall the mailings were not effective at encouraging future management or changing landowner cognitions. Yet, it may still be worthwhile to incorporate this element into biological monitoring strategies when easily communicated data are collected. Providing feedback on management efforts can be an incentive for landowners to allow technicians onto their properties for monitoring projects and help build relationships for ongoing monitoring purposes (Hilty and Merenlender 2003).

Conclusions

Relationship-building between landowners and agency staff is an important and often overlooked component of conservation programs. In cases of limited or absent agency staff capacity, biologists on monitoring contracts with a resource agency may fill an agency surrogate

role for productive landowner interactions. If landowners are interested and contexts are favorable, instructing biological technicians to take landowners on monitoring site visits could help build favorable perceptions of both management practices and the sponsor agency, and possibly commitment to continued management. In lieu of direct interactions with other conservation professionals, biological technicians can provide positive personal interactions that may keep landowners engaged. Our results emphasize the importance of having biological technicians with the ability and passion to effectively communicate with and educate landowners. As the final contacts many landowners have with conservation programs, monitoring technicians have an opportunity to leave a favorable last impression that promotes future management behaviors. Providing technicians with training on how to interact with landowners could increase the likelihood of these positive impressions. Although technician interactions may be a beneficial supplement, this is not a panacea outreach solution. Technicians may not have the same expertise or capacity for long-term relationship-building as professionals at natural resource agencies, university extension offices, and conservation NGOs that make contact with landowners as part of existing positions.

Alterations to our result mailing design could potentially increase the effectiveness of results communication. Changes could involve a greater emphasis on the efficacy of the collective landowner effort and accomplishment, comparisons to other landowners in the program, the inclusion of pre- and post-management data, and additional reminders (e.g. signs, bumper stickers) of the management behavior. Including measures related to other management outcomes, such as game species abundance or habitat diversity, could also broaden the appeal of results to landowners. We recommend that future research examine interaction effects between different outreach methods such as in-person interactions and informational mailings. It would also be informative to track landowners throughout the life of conservation program contracts to

understand how landowners are affected by program participation and interactions with agency and partner staff, contractors, and biological technicians. A longitudinal approach could better evaluate the causal role of outreach on landowner outcomes and explore the mechanisms for how different forms of outreach bring about positive effects. More generally, we also recommend that agencies contracting out efforts such as post-management monitoring consider the importance of contractor interactions with landowners, and more explicitly encourage partners to purposefully implement landowner outreach well. With limited resources available for landowner outreach, it is essential that those interactions with landowners that do take place are effective at encouraging conservation efforts.

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Chapter 2. Young Forest Conservation Incentive Programs: Predictors of Re-enrollment and Post-Program Persistence

Abstract

Environmental conservation actions conducted by private landowners are critically important for conservation efforts worldwide. Incentive programs are used to engage landowners in voluntary conservation, but outcomes after landowners exit these programs are poorly understood. Previous research identified several pathways, including landowner motivations, cognitions, and resources, which could sustain or undermine continued conservation management behavior after incentive program participation. We tested the utility of these pathways for predicting management intentions of participants in U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) young forest habitat conservation programs in the eastern United States. We conducted a telephone survey of enrolled landowners in the programs from January to May 2017 (n=102). We compared candidate multiple regression models to determine predictors of landowner intentions to re-enroll in young forest programs or to persist with management without further cost-share. We found intentions to re-enroll in NRCS young forest programs were highest among landowners with high agency trust, and for whom cost-share, environmental concerns, and hunting were important motivations. Management persistence intentions were highest for group landowners (e.g., hunting clubs, non-profits), landowners motivated by environmental concerns, and those less motivated by cost-share. Our results suggest that fostering trust through positive program experiences and recruiting landowners with supportive motivations and resources may encourage sustained young forest management. Differences in the predictors of program re-enrollment and management

persistence in this study highlight the importance of considering these outcomes separately for conservation programs widely.

Introduction

Voluntary incentive programs encourage private landowners to take actions that benefit conservation around the world. These programs include a range of efforts such as agri-environment schemes in the European Union and conservation programs administered by federal and state agencies in the United States. Functioning through various incentives such as cash payments, technical assistance, and/or cost-share agreements, the social and ecological benefits of these incentive programs are substantial. For example, U.S. Department of Agriculture (USDA) conservation programs in the United States provide ecosystem services such as erosion control and water quality improvement valued in billions of dollars (USD) (Gascoigne et al. 2011). Conservation programs are also critical for wildlife conservation, with millions of hectares of habitat on private land enhanced through voluntary USDA Farm Bill programs in the U.S. (NABCI 2017). Whereas previous research has focused on landowner recruitment into conservation programs (e.g., Sorice et al. 2011; Frondel et al. 2012; Reimer and Prokopy 2014), the decisions that landowners make after program participation are also crucial for sustaining conservation outcomes and are poorly understood. In particular, there is uncertainty over whether management behaviors fostered by financial payments endure beyond the program enrollment period, either through program re-enrollment or the ‘persistence’ of management without further payments (Dayer et al. 2017). Based upon prior research on behavioral persistence in the fields of public health and home energy use, Dayer et al. (2017) identified five pathways that potentially drive continued landowner conservation behaviors beyond conservation program participation. These pathways include sustaining motivations, landowner cognitions, habit

formation, social influences, and key resources. Landowner motivations are reasons for program participation, such as environmental stewardship or financial benefit motivations. The cognitions pathway is related to what landowners think about outcomes of management actions or program participation, which include satisfaction with the program or trust for the management agency. Habit formation concerns how the frequent performance of management actions may become habitual to some landowners. The social influences pathway identifies the importance of social networks and norms in influencing how landowners choose to manage their land. Finally, landowner resources, such as financial capital or labor capacity, likely influence continued management outcomes.

There are varying levels of empirical support for these pathways in private landowner research, but evidence in the context of post-program management is particularly limited due to overall limited research in this area (Dayer et al. 2017). Considering these pathways could help explain underlying drivers of landowner decision-making across a range of conservation programs, and help inform improvements in program delivery and design. We used Natural Resources Conservation Service (NRCS) administered incentive programs promoting young forest habitat in the eastern United States as a case study to examine landowner post-program management intentions and three of the proposed persistence pathways. We opted to focus on landowner motivations, cognitions, and resources, which we hypothesized to be the main influences on post-program management in this research context. Previous research has found that social norms are not highly influential in the context of young forest management (Dayer et al. 2016). Likewise, habituation is not likely to play a large role for young forest management actions that are performed infrequently (yearly or less often).

Drivers of Young Forest Management

Since 2012, components of NRCS Working Lands for Wildlife and the Regional Conservation Partnership Program have provided private landowners in the Eastern U.S. with financial and technical assistance to create young forest. These program applications target the Appalachians and Upper Great Lakes regions respectively; areas that are predominantly mature forest landscapes. Young forest, also referred to as ‘early successional forest habitat’, is ephemeral habitat comprised of shrubs and seedling- to sapling-sized trees (Litvaitis 2003). Young forest habitat is typically created by disturbance events such as fire or timber harvest (Litvaitis 2003). Currently, these two NRCS program applications are specifically directed to benefit Golden-winged Warblers (*Vermivora chrysoptera*) and American Woodcock (*Scolopax minor*), although young forest habitat is beneficial for many other wildlife species (King and Schlossberg 2014). Hundreds of landowners have been successfully contracted to create young forest through these programs, but it is not clear how participants will choose to manage their land once cost-share contracts end. Recurring management for young forest is important because the habitat is short-lived and requires renewal on a timescale of around 10-20 years (Bakermans et al. 2011). Landowners may be able to continue managing for young forest by re-enrolling in NRCS programs, but continued funding at the federal level for young forest management programs is not guaranteed. Therefore, landowner intentions related to re-enrollment and management persistence without further cost-share are both relevant management outcomes to sustain the conservation benefits of these programs. Previous research on private landowners, and young forest habitat management specifically, provide a basis for hypothesizing specific potential drivers of these management outcomes after young forest program participation.

Landowner motivations for conservation management can range widely, from environmental or financial concerns to secondary benefits such as improved hunting opportunities for a variety of game species (Dayer et al. 2017). Benefits to wildlife hunting are

particularly important concerns to many landowners that manage for young forest habitat (Dayer et al. 2015). Financial motivations are also highly relevant in the context of young forest management, which can be expensive. For example, a basic 5-acre forest overstory removal in Pennsylvania is estimated to cost around \$600/acre (NRCS 2018), although these costs may be offset by timber sale proceeds. Young forest management may provide benefits such as increased wildlife abundance or financial income. These benefits could fulfill motivations and encourage landowners to continue habitat management actions beyond program participation.

Cognitions that are relevant for understanding continued conservation include a landowner's attitudes, perceptions, satisfaction, and trust related to conservation management (Dayer et al. 2017). These cognitions are informed by an individual's past experiences with management outcomes or interactions with an agency. One specific attitude (a positive or negative evaluation of an object [Fishbein and Ajzen 2010]) that is important in the conservation program context is landowner satisfaction. For example, Selinske et al. (2015) measured enrolled landowner satisfaction with a voluntary conservation program in South Africa and found that satisfaction was correlated with landowner commitment to the program. Landowner satisfaction could be similarly relevant for young forest programs as well. Another important cognition is trust, a multifaceted concept that encompasses an individual's rational, emotional, and procedural trust (Stern and Coleman 2014). Rational trust is based on evaluations of expertise and utility of trusting another entity, while affective trust is tied to emotional connections and perceptions of shared values (Stern and Coleman 2014). Procedural trust is related to trust in procedures and systems that lower risk for an individual (Stern and Coleman 2014). Strong relationships and trust between landowners and natural resource agencies may increase the likelihood that landowners continue with conservation management (Race and Curtis 2013; Swann and Richards 2016). For these two young forest programs, a considerable focus was

placed on building collaborative relationships with private landowner participants. NRCS partner biologists or seasonal technicians were particularly involved with follow-up monitoring of managed properties and provided landowners with personalized feedback on management outcomes for wildlife (see Lutter et al. 2018). High satisfaction and trust could both provide a basis for landowners to re-enroll in similar programs and contribute to continued young forest management outside of programs as well.

Many resources related to management capacity are relevant for forest management, including landowner income, education, and access to technical assistance (Silver et al. 2015). Socioeconomic factors, such as landowner income and education, are likely important for young forest management because financial capital and information are both necessary for landowners to manage forests. More specifically related to technical assistance, contact with a forester and possession of a management plan are both positively associated with timber harvesting behavior among private landowners (Silver et al. 2015). Landowners with written forest management plans are also more likely to have conducted past management for wildlife habitat (Kilgore et al. 2015). Although all the landowners in these NRCS programs had contact with professional land managers and had conservation plans specific to the NRCS contract, they did not all have property-wide forest management plans. Developing these long-term plans usually requires expert consultation (Sagor and Becker 2014), and absence of a forest management plan could be a barrier to post-program management for some landowners. Finally, landowners who participated in these programs represent a range of ownership types, including individuals, joint owners, hunting clubs, and non-profits. Land ownership type can result in differences in forest management outcomes (Arano and Munn 2006). For these programs, the distinction between family forest owners and larger group owners could represent a key differential in management expertise or labor capacity. Landowners with greater available resources likely have the means to

continue with management, particularly if further cost-share funding is unavailable (Dayer et al. 2017).

The goal of this study was to examine the drivers of private landowner habitat management post-program – either through program re-enrollment or management persistence without further cost-share. We tested concepts associated with three theoretical pathways proposed by Dayer et al. (2017) to examine how well these pathways explained landowner post-program intentions. Specifically, we evaluated the relative and combined utility of landowner management related motivations, cognitions, and resources in predicting post-program intentions.

Methods

Survey Methods

Our study population consisted of 189 landowners that signed conservation program contracts with NRCS between 2012 and 2016 to manage for young forest on properties in Maryland, Minnesota, New Jersey, Pennsylvania, and Wisconsin. These landowners also voluntarily allowed biological technicians onto their properties to conduct post-management monitoring of birds and vegetation regrowth. Enrolled properties came from a wide range of ownership types; therefore, in cases of group property ownership the contracted individual was asked to respond on behalf of the group.

We conducted telephone surveys with landowners from January 20 – June 1, 2017. The survey and methods were approved by the Virginia Tech Institutional Review Board (Protocol #16-597). Members of the research team signed compliance agreements that ensure NRCS cooperators will not disclose protected agricultural or personally identifiable information, as required by Section 1619 of the Food, Conservation, and Energy Act of 2008. Of the 189

landowners called, 102 completed surveys for a response rate of 57.9%. Individual surveys took an average of 30 minutes to complete.

Survey Design

The telephone survey questionnaire evaluated landowner motivations for participation in the program, satisfaction with the program, agency trust, resources, and intentions to manage for young forest within ten years after their program contract. Scientists at Virginia Tech, cooperating NRCS staff, and private lands biologists reviewed the survey, which consisted of primarily close-ended questions. The survey was pre-tested with eight private landowners who participated in similar NRCS habitat conservation programs. Only survey items (Table 1) used in analyses reported in this manuscript are discussed here.

The two dependent variables in the study were landowner intentions to manage for young forest within 10 years after their NRCS contract through 1) re-enrollment in an NRCS program or 2) continued independent management even if further cost-share was not available. Each intention was measured on a 5-point Likert-type scale from ‘not at all likely’ to ‘extremely likely’.

The study’s independent variables related to landowner motivations, cognitions, or resources relevant for young forest management. A list of motivations for owning woodland used in the National Woodland Owner Survey (Butler et al. 2016) was adapted into a list of potential motivations for participating in the habitat program. Landowner trust for NRCS and partners was operationalized using three items relating to separate components of trust (Stern and Coleman 2014). Overall landowner satisfaction with the habitat program was measured on a 1 to 10 scale, from ‘not at all satisfied’ to ‘completely satisfied’. Respondent ownership was classified using forest ownership classes utilized by the National Woodland Owner Survey (Butler et al. 2016).

Landowners were also asked for their highest level of educational attainment (as a measure of socioeconomic status; e.g., Kauneckis and York [2009]) and if they had a current, written forest management plan at the time of the survey.

Table 1. Telephone survey items, related concepts, and measurement scales.

Survey Items	Concept	Measurement
How likely are you to manage for young forest on your land within ten years after your contract end date by re-enrolling in a NRCS program?	Young Forest Management Intentions	5-point scale; 1= 'not at all likely', 2= 'slightly likely', 3= 'moderately likely', 4= 'very likely', 5= 'extremely likely'
If further cost share payments were not available, how likely are you to manage for young forest on your land within ten years after your contract end date?		
How important to you is...	Motivations	5-point scale; 1= 'not at all important', 2= 'slightly important', 3= 'moderately important', 4= 'very important', 5= 'extremely important'
Access to expert advice on forest management		
Improving bird-watching opportunities		
Benefiting American Woodcock		
Benefiting Golden-winged Warblers		
Benefiting other birds that use young forest		
Improving the forest health		
Harvesting timber for income		
Increasing the property value		
Receiving cost-share payments to create or maintain habitat		
Improving hunting opportunities		
Improving the scenery		
You trust the expertise of NRCS employees, partner biologists, and partner foresters to help you achieve your land management goals	Rational Trust	5-point scale: 1= 'strongly disagree', 2= 'disagree', 3= 'neither', 4= 'agree', 5= 'strongly agree'.
You feel that you have similar values to NRCS employees, partner biologists, and partner foresters	Affinitive Trust	
The rules and procedures of the NRCS habitat program ensure that you are treated fairly	Procedural Trust	
How satisfied are you with the conservation program overall?	Program Satisfaction	0= not completely satisfied, 1= completely satisfied. Collapsed from 10-point scale.
What is the highest level of formal education you	Education	6-point scale: 1= 'Less than high

have completed?		school', 2= 'High school diploma/G.E.D.', 3= 'Some college or technical school', 4= 'Associates degree', 5= 'College undergraduate degree', 6= 'Graduate or professional degree'.
Do you currently have a written property wide forest management or stewardship plan for the enrolled property?	Management Plan	0= 'no', 1= 'yes'.
Which category best describes your ownership of the property enrolled in the NRCS habitat program?	Ownership Type	0= Group Owner ('Club or Association', 'Corporation or Business Partnership', or 'Other'), 1= Family Forest Owner ('Individual', 'Joint', 'Family Partnership', or 'Trust or Estate').

Analysis

We conducted an exploratory factor analysis for landowner motivations using SPSS Statistics (version 24.0). We used principal components extraction with varimax rotation to extract factors and compute factor loadings. Inter-item indices were computed for each factor as the mean of the items included in the index. Index reliability was calculated using Cronbach's alpha. An additional index was also constructed for agency trust using the mean of the three trust survey items. The Cronbach's alpha for this trust index was 0.75, indicating high reliability.

We performed regression analyses using the 'AICcmodavg' package in R software version 3.42 (R Development Core Team <http://www.r-project.org>). A separate multiple linear regression analysis was conducted for each of the two dependent variables of interest. Each combination of the three pathways was considered, resulting in a candidate set of seven models for each dependent variable. Cases with missing data were dropped from the regression analyses. We evaluated models using AICc, Akaike's second-order Information Criterion corrected for

small sample sizes (Burnham and Anderson 2004). Models within two $\Delta AICc$ of the top ranked model were considered possible competitors (Arnold 2010).

Results

Respondent Characteristics

The majority (79%) of respondents were family forest owners: classified as either individual, joint, family partnerships, trusts, or estate ownership. The remaining respondents were classified as group ownerships: including clubs or associations (11%), corporations or business partnerships (7%), and non-profit organizations (3%). Survey respondents were primarily male (88%) and averaged 61 years old (median = 63 years, SD = 11 years). The majority (66%) had a four-year college degree or higher. Respondents owned their land for an average of 37 years (median = 20 years, SD = 35 years), and owned an average of 780 acres (median = 235 acres, SD = 2133 acres). Respondents' properties enrolled in the incentive programs were located in Pennsylvania (59%), Minnesota (30%), New Jersey (7%), Maryland (2%), and Wisconsin (2%). Roughly a third of respondents (29.7%) had a current, written forest management plan for the enrolled property.

Factor Analysis

Exploratory factor analysis identified two latent constructs underlying landowner motivations for program participation (Table 2). We labeled the first factor, which focuses on benefits to birds, forest health, and access to expert advice for forest management, "environmental" (Cronbach's $\alpha = 0.77$). The second factor, labeled "profit", concentrates on motivations of timber harvest income and property value. The "profit" factor also included cost-

share motivation, but the index reliability with this item was low (item inclusion decreased Cronbach’s alpha from 0.63 to 0.53) so cost-share motivation was treated as a distinct variable for subsequent analyses. Motivations that did not load on one of the two identified factors (hunting and scenery) were also treated as distinct motivations for subsequent analyses. Access to expert advice cross-loaded between factors, but after assessment of index reliability (item inclusion increased reliability of “environmental” factor and decreased reliability of “profit” factor) it was assigned to the “environmental” factor.

Table 2 Exploratory factor analysis of landowner motivations for enrolling in NRCS young forest habitat programs, eastern United States, February- June 2017.

Motivations for program participation	Factor 1 Environmental	Factor 2 Profit
Access to expert advice on forest management	0.539	0.408
Improving bird-watching opportunities	0.693	-0.095
Benefiting American Woodcock	0.690	-0.022
Benefiting Golden-winged Warblers	0.721	0.053
Benefiting other birds that use young forest	0.773	-0.037
Improving the forest health	0.632	0.296
Harvesting timber for income	-0.057	0.808
Increasing the property value	-0.126	0.713
Receiving cost-share payments to create or maintain habitat	0.206	0.535
Improving hunting opportunities	-0.013	0.073
Improving the scenery	0.326	0.348

Bolded factor loadings indicate items included in final factor structure that were averaged to create factor indices.

Across respondents, environmental and hunting motivations had the highest average importance (Table 3). Profit motivation had the lowest average importance, with a mean response value between ‘slightly important’ and ‘moderately important’. Landowners had generally high agency trust and satisfaction with the conservation program.

Table 3 Predictor variables of landowner intentions to manage for young forest after NRCS young forest habitat programs, eastern United States, February- June 2017.

Pathway	Variable	Mean	SD
Motivations	Environmental Motivation	3.91	0.60
	Profit Motivation	2.81	1.17
	Cost-share Motivation	3.67	1.05
	Hunting Motivation	3.79	1.21
	Scenery Motivation	3.30	1.20
Cognitions	Agency Trust	4.47	0.58
	Program Satisfaction (%)	46.4	
Resources	Education	4.65	1.40
	Management Plan (%)	30.9	
	Group Owner (%)	19.6	

Re-enrollment

Generally, landowners expressed strong intentions to manage for young forest through re-enrollment in NRCS programs. The majority (64.7%) of landowners stated they were either ‘very likely’ or ‘extremely likely’ to re-enroll in an NRCS young forest program within ten years after their contract end date. The top ranked model for predicting re-enrollment intentions included landowner motivations and cognitions (Table 4). This model explained about 27% of the variation in landowner re-enrollment intentions.

Table 4 Candidate multiple regression model set for predicting landowner intentions to re-enroll in NRCS young forest habitat programs, eastern United States, February- June 2017.

Model	K	Adj. R ²	AICc	ΔAICc	w _i
Motivations + Cognitions	9	0.27	278.13	0	0.64
Motivations + Resources + Cognitions	12	0.30	279.58	1.45	0.31
Resources + Cognitions	7	0.20	284.44	6.31	0.03
Motivations	7	0.19	285.70	7.57	0.01
Motivations + Resources	10	0.21	287.73	9.60	0.01
Cognitions	4	0.14	287.93	9.80	0.00
Resources	5	0.07	296.99	18.86	0.00

See Table 3 for predictor variables within each of the pathway categories labeled here (e.g., motivations). *K* the number of estimated parameters, *AICc* Akaike’s information criterion, $\Delta AICc = AICc - \min AICc$, *w_i* Akaike weight or the probability of being the best model given observed data and set of considered models.

The global model (motivations, resources, and cognitions) was within two $\Delta AICc$ of the top ranked model for landowner re-enrollment intentions. This model included three additional parameters, but these parameters provided no net reduction in $AICc$ and we therefore chose to accept the top ranked model (Arnold 2010).

We ran additional diagnostic procedures for the top-ranked model (Table 5) due to the small sample size. The histogram of residuals mirrored a normal distribution and Kolmogorov-Smirnov test results ($p= 0.18$) indicated that the standardized residuals were approximately normal distributed. There were no highly influential cases (Cook's Distance > 1). Variance inflation factor (VIF) values were all below 1.34 and tolerance statistics above 0.75.

Four variables were significant predictors within the top ranked model: environmental motivation, cost-share motivation, hunting motivation, and agency trust. Landowners with stronger 'environmental' motivations to benefit birds, improve forest health, and receive expert advice on forest management had higher intentions to re-enroll in NRCS programs to manage for young forest. Landowners who were more motivated to improve hunting and receive cost-share also had greater intentions to re-enroll. Re-enrollment intentions were greater for landowners who had higher trust in NRCS and partners. While program satisfaction was not a significant predictor in the top ranked model, there was a positive correlation ($r_{pb}= 0.266$; Appendix D) between program satisfaction and re-enrollment intention. This relationship may have been masked by agency trust in the regression model.

Table 5 Summary of multiple linear regression model “motivations + cognitions” for predicting landowner intentions to re-enroll in NRCS young forest habitat programs, eastern United States, February- June 2017 (n= 97).

Independent Variables	β coeff.	p value
Environmental Motivation	0.20	0.042 *
Profit Motivation	0.00	0.981
Cost-share Motivation	0.28	0.006 **
Hunting Motivation	0.22	0.014 *
Scenery Motivation	0.02	0.797
Agency Trust	0.30	0.004 **
Program Satisfaction	0.04	0.671
Adjusted R^2	0.27	
F	6.17***	

* $p < .05$; ** $p < 0.01$; *** $p < 0.001$.

The top ranked model did not include measured variables categorized as key landowner resources. While possession of a forest management plan was not included in the top-ranked model, we note that this variable was a significant predictor of re-enrollment intention in the second ranked (global) model. There was also a positive correlation between possession of a forest management plan and re-enrollment intention ($r_{pb} = 0.289$; Appendix D).

Management Persistence

Landowners also expressed high intentions to persist with young forest management if further cost-share assistance was not available. There was a weak positive correlation between landowner re-enrollment intentions and persistence intentions ($r_s = 0.216$; Appendix D). Just under half (45.6%) of landowners stated they were either ‘very likely’ or ‘extremely likely’ to manage for young forest within ten years after their contract end date if further cost-share was not available. The top ranked model for persistence intentions included landowner resources and motivations, and explained about 18% of the variation in landowner persistence intentions (Table 6).

Table 6 Candidate multiple regression model set for predicting landowner intentions to persist with young forest management if further cost-share unavailable, eastern United States, February- June 2017.

Model	K	Adj. R ²	AICc	Δ AICc	w _i
Motivations + Resources	10	0.18	285.83	0	0.51
Motivations	7	0.13	286.90	1.07	0.30
Motivations + Resources + Cognitions	12	0.17	289.02	3.20	0.10
Motivations + Cognitions	9	0.13	290.16	4.33	0.06
Resources	5	0.04	293.90	8.08	0.01
Cognitions	4	0.02	294.64	8.81	0.01
Resources + Cognitions	7	0.05	295.31	9.49	0.00

See Table 3 for predictor variables within each of the pathway categories labeled here (e.g., motivations). *K* the number of estimated parameters, *AICc* Akaike’s information criterion, $\Delta AICc = AICc - \min AICc$, *w_i* Akaike weight or the probability of being the best model given observed data and set of considered models.

Similar to the re-enrollment model ranking, one model was within two ΔAICc of the top ranked model for persistence intentions. While the motivations and resources model had more parameters, the lower AICc value indicates that these additional parameters were informative. Further, the significant predictors in the motivations model were also significant in the top ranked model.

In the top-ranked model, the histogram of residuals mirrored a normal distribution, and Kolmogorov-Smirnov test results (p= 0.20) indicated that the standardized residuals were approximately normal distributed. There were no highly influential cases (Cook’s Distance > 1). Variance inflation factor (VIF) values were all below 1.35 and tolerance statistics above 0.74.

Three variables were significant predictors within the resources and motivations model: environmental motivation, cost-share motivation, and family forest owner status (Table 7). Stronger ‘environmental’ motivations were related to higher intentions to persist with management without further cost-share assistance. Landowners with weaker motivations to receive cost-share also had higher persistence intentions. Finally, landowner persistence intentions were greater for landowners classified as clubs, associations, and other group owners, compared to family forest owners.

Table 7 Summary of multiple linear regression model “motivations + resources” for predicting landowner intentions to persist with young forest management if further cost-share unavailable, eastern United States, February- June 2017 (n= 96).

Independent Variables	β coeff.	p value
Environmental Motivation	0.34	0.001 **
Profit Motivation	-0.02	0.832
Cost-share Motivation	-0.35	0.002 **
Hunting Motivation	0.11	0.260
Scenery Motivation	0.04	0.660
Education	0.08	0.435
Management Plan	0.11	0.300
Group Owner	0.23	0.030 *
Adjusted R^2	0.18	
F	3.52**	

* $p < .05$; ** $p < 0.01$; *** $p < 0.001$.

Discussion

The landowners in our study were generally committed to continued young forest management, either through re-enrollment in NRCS programs or persistence without further cost-share. The mean landowner intention to re-enroll was higher than mean intention to persist, indicating greater interest in re-enrollment if the option is available. Previous research has found landowner intentions to persist with conservation management post-program ranging from 31% (Johnson et al. 1997) to 85% of landowners (Jackson-Smith et al. 2010; Hayes 2012). Our findings are near the center of this range, with about 46% of landowners stating they were very likely or extremely likely to persist with management post-program. Previous studies have also shown that structural conservation practices involving infrastructure installations or land-use change have higher rates of continued usage, whereas practices that require continuous application are discontinued sooner (Jackson-Smith et al. 2010; Hayes 2012). The involvement

of both structural (e.g., tree planting or cutting) and continuous practices (e.g., herbicide treatments) in young forest management may help explain our results in this respect.

Influential drivers of landowner intentions to re-enroll in similar NRCS young forest programs involved landowner motivations and cognitions about the program. Re-enrollment intentions were higher for landowners with greater trust in NRCS and the agency's partners. Trust is based partially upon past experiences (Stern and Coleman 2015), so positive experiences with NRCS likely contribute to re-enrollment intentions in this population. Landowner satisfaction with the young forest program was also associated with higher re-enrollment intentions. These results suggest that a successful experience with a conservation program can influence long-term management outcomes. In addition to these variables tied to program experiences, landowner motivations to improve hunting opportunities was also linked to higher intentions to re-enroll in NRCS young forest programs. This corresponds with previous research by Dayer et al. (2015) that found landowners who were members in game wildlife organizations were more likely to conduct patch cutting of forest. Young forest habitat benefits a wide range of game species (e.g., white-tailed deer [*Odocoileus virginianus*], wild turkey [*Meleagris gallopavo*], and ruffed grouse [*Bonasa umbellus*]), so the significance of hunting as a motivation for landowners to continue management is not surprising. Finally, possession of a current, written management plan was linked to higher re-enrollment intentions. Beyond providing landowners with a technical guide to achieve future management goals, the process of creating these plans may help provide landowners with social networks that support continued management. For example, Minnesota landowners with a forest management plan were more likely to be able to name a professional forester and had more extensive social networks related to forest management (Sagor and Becker 2014).

Available resources were even more relevant for landowners when they were asked to consider management persistence without NRCS cost-share assistance. One resource measure, ownership classification, was a significant predictor of persistence intentions. Specifically, groups such as clubs and associations had higher persistence intentions than family forest owners. The resources available to these larger groups could differ from family forest owners in a range of ways, such as having dedicated land management employees and an ability to mobilize volunteer labor capacity for management purposes. Group ownership also reduces the financial burden on any one individual, and these groups may be slower to change management strategies than individual landowners. Group obligations and norms may also work to encourage continued management. In addition to group ownership, landowner environmental motivations were also a significant predictor of management persistence without further cost-share. Landowners who were more motivated out of concern for wildlife and forest health had higher intentions to keep doing some habitat management on their own. Past research has similarly found that farmers motivated to stop soil erosion were less likely to convert retired fields back to crops after a conservation program (Skaggs et al. 1994).

The importance of cost-share to a landowner was a significant predictor of both re-enrollment and management persistence intentions, indicating that cost-share is an essential factor in post-program decision-making for many landowners. Even for those landowners amenable to further management without cost-share, the extent that landowners are able to manage for young forest would likely be reduced without this financial support. Buffum et al. (2014) found that financial incentives increase the forest acreage that landowners are able or willing to manage, a function that is likely at play in this study as well. For conservation related incentives in general, there are concerns about the potential of financial incentives to undermine or crowd out non-financial motivations of incentivized individuals (e.g., Rode et al. 2014). While

financial motivations were clearly important in this study, we were unable to examine how participation in the young forest habitat program may have changed landowner motivations.

Our findings suggest several key policy and program administration implications. First, re-enrollment and persistence were only weakly correlated. This disconnect could be detrimental to conservation efforts if funding for program re-enrollments were cut without considering factors that support persistence – if landowners had no supporting motivations or resources, for example. Our results suggest that providing landowners the ability to re-enroll in conservation programs would be the best approach to maintaining conservation gains. Given the importance of cost-share funding in this context, if NGO or state funding could be used to further reduce financial burden on landowners this could encourage re-enrollment and contribute to long-term conservation outcomes. Second, while specific wildlife species were important to some landowners, most participated for more general conservation benefits associated with the NRCS programs. For these young forest programs, a range of landowner motivations — including forest health, wildlife, and hunting — were drivers of continued post-program management. Appealing to a broader set of motivations through conservation program advertisement and design could help prospects of long-term management. Third, landowner experiences with conservation programs and professionals were important for shaping future management outcomes. In this study, agency trust was a key driver of landowner intentions to re-enroll in NRCS programs. Some elements of a landowners' experience in a conservation program can be enhanced to potentially foster long-term management. For example, previous analyses from this survey (Lutter et al. 2018) have shown that higher agency trust was related to increased interactions with monitoring technicians. Fostering trust through greater attention to these personal interactions could bolster program re-enrollment. Our results also suggest that expanding the forest management plans created through these programs into more extensive

property wide forest management plans could help promote future re-enrollment. Finally, while group owners appeared better able to continue management without cost-share, this does not mean cost-share assistance is wasted on these groups. Besides likely increasing the acreage and quality of habitat these groups manage, enrolling group owners in conservation programs can build long-term relationships with entities that may endure beyond individual landowners. The role of group owners such as hunting clubs and non-profits in other conservation programs deserves greater attention, as these groups appear to react to programs differently than individual landowners.

Despite our consideration of a range of variables expected to predict continued young forest management, there was still a large amount of unexplained variance in persistence intentions. Persistence outcomes have been rarely studied (Dayer et al. 2017), and there is a strong need to better understand these outcomes separately from program re-enrollment. Further refining the pathways used to predict behavior is one direction that could potentially increase explanatory power of this modeling approach. For example, collecting greater detail on landowner access to specific resources like management equipment and labor capacity may be beneficial.

Young forest programs represent one of many conservation incentive programs and related management practices. The pathways that drive post-program behaviors, including social influence and habits, likely vary between different management contexts. For example, the Conservation Reserve Program (CRP) is another program managed by the U.S. Department of Agriculture that contrasts with the NRCS young forest programs considered in this study. The CRP is a term land-retirement program popular in regions that face high demand for commodity crop production, and enrolled landowners may be more influenced by available resources and habitual inertia than landowners in young forest programs. Future research should examine a

range of conservation programs and practices using a similar set of variables, such as the pathways suggested by Dayer et al. (2017), to deepen our understanding of how management contexts drive long-term decision-making – both re-enrollment and persistence.

Conclusion

Beyond providing insights into the participants of these specific NRCS young forest programs, this research has implications for understanding conservation incentive programs generally. Recognizing the distinction between program re-enrollment and management persistence is important, as these outcomes may differ greatly. As public policies continue to limit landowner participation through explicit re-enrollment restrictions or indirectly through funding limitations, understanding how and why landowners manage lands after conservation programs conclude is a necessity. With billions of dollars spent annually on conservation incentive programs around the world, it is critical to avoid operating on untested assumptions about program outcomes.

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Chapter 3: Young Forest Management on Private Lands as a Localized Coupled Human and Natural System

Abstract

Encouraging conservation on private lands is a crucial element of policies that seek to mitigate habitat loss and fragmentation around the world. Although previous research has investigated social influences on private landowner habitat management, the extent to which environmental outcomes of management affect landowner decision-making is not as well understood. Past research suggests that landowner observations of positive results for wildlife and habitat on their land could reinforce further habitat management actions. We used the lens of coupled human and natural systems to investigate private lands management for young forest, an important and limited habitat type in the eastern United States. By integrating field-based monitoring of wildlife with surveys of landowner perceptions, we examined how private landowners observed and interpreted wildlife outcomes of young forest management at the property scale, and how these perceptions related to continued habitat management. We recorded presence of Golden-winged Warbler and American Woodcock and estimated bird diversity in spring 2015 and/or 2016 on 102 properties enrolled in Natural Resources Conservation Service young forest habitat programs. Bird surveys were paired with landowner responses to a telephone survey conducted from January to May 2017 (n=102). We found that most (71.6 - 81.6%) landowners accurately assessed bird presence on their properties, with this knowledge informed by their personal observations of birds and outreach from the agency and monitoring technicians. Landowners who completed their conservation program contracts (n= 85) had implemented a range of different management practices after the program to maintain and create young forest habitat. Landowner perceptions of positive management outcomes for birds, forest

health, and scenery on their property were associated with more intensive post-program management. This unique application of a coupled systems approach gives insight into how private landowners experience and respond to environmental effects of habitat management.

Introduction

Land management actions conducted by private landowners have substantial environmental consequences around the world. Private landowners may create habitat for wildlife and restore ecosystem function, or contribute to environmental degradation through poor stewardship. Landowner actions are partly informed by the environmental outcomes of past management, but these outcomes may or may not be readily apparent to landowners (Moon and Cocklin 2011, Reimer et al. 2012). Ecological responses to management, and how landowners observe and interpret these changes on their land, likely have a considerable effect on future management and environmental conservation in the long-term. Environmental management can therefore be considered as a system with complex interactions involving both social and ecological components. A comprehensive view of environmental management may draw on the coupled human and natural systems (CHANS) framework, an interdisciplinary lens used to understand linkages and feedbacks between humans and their environment (Carter et al. 2014, Hull et al. 2015). The CHANS approach has been applied to understand land use changes (e.g., Meyfroidt 2013a), and has also been introduced as a theoretical foundation for researching human-wildlife interactions (Morzillo et al. 2014). A key feature of the coupled systems perspective is a focus on mechanisms by which human actions that influence the environment (e.g., wildlife and wildlife habitat) produce feedbacks that in turn effect human behavior (Liu et al. 2007, Carter et al. 2014). For example, Morzillo et al. (2014) applied the CHANS framework to examine how human observation of rodents and rodent evidence affected use of traps and

poison to control rodents. Morzillo et al. (2014) hypothesized the existence of feedback effects whereby management decisions that attract wildlife (e.g. habitat creation) could become recurrent if wildlife-related events reinforced continued management. Previous research has also examined how management outcomes for specific wildlife species could affect private landowner decision-making. Sorice (2012) found that private landowner attitudes toward enrollment in a conservation program directed at an at-risk songbird were influenced by landowner beliefs related to outcomes for the songbird and their property. Understanding how landowners perceive and respond to ecological outcomes of environmental management is important for understanding how private lands conservation functions over time. We applied the CHANS approach to the context of young forest management by private landowners in the eastern United States.

Young forest

In the eastern United States, maturing forests and reductions in anthropogenic and natural disturbances have caused young forest habitat to decline for decades (Brooks 2003). Young forest habitat, also referred to as early successional habitat, is ephemeral habitat that may result from disturbance of mature forest stands by natural events such as tree disease, insect damage, wildfire, beaver flooding, and blowdowns, and human disturbances including logging and prescribed fire (King and Schlossberg 2014). Young forest habitat is important for wildlife from a range of taxa including reptiles (Kjoss and Litvaitis 2001), mammals (Litvaitis 2001), and birds (King and Schlossberg 2014). Two young forest-associated wildlife species of particular conservation concern in the eastern United States are the Golden-winged Warbler (*Vermivora chrysoptera*) and the American Woodcock (*Scolopax minor*). Classified as a near-threatened species (Birdlife International 2016), the Golden-winged Warbler is a neotropical migratory

songbird that has experienced one of the steepest population declines of any North American songbird species over the past 50 years (Rosenberg et al. 2016). Loss of young forest habitat has likely contributed the most to this decline (Buehler et al. 2007), although the species faces other challenges such as competition and hybridization with the closely related Blue-winged Warbler (*Vermivora cyanoptera*) and loss of wintering habitat (King et al. 2016). Another bird species dependent on young forest is the American Woodcock, a premier game species that has experienced significant population declines in eastern North America (Cooper and Rau 2012). Forest management prescriptions developed for Golden-winged Warbler are also suitable for American Woodcock, so habitat management for these species can occur simultaneously (Bakermans et al. 2015a). In addition to benefiting these species of conservation concern, young forest habitat is also beneficial for more common game species of wildlife including white-tailed deer (*Odocoileus virginianus*), wild turkey (*Meleagris gallopavo*), and ruffed grouse (*Bonasa umbellus*) (Fuller and DeStefano 2003; Greenberg et al. 2011; Gilbert 2012).

Significant concerns for young forest reliant species have led conservation groups to develop ambitious goals related to young forest restoration. For example, the Golden-winged Warbler Conservation Plan published by the Golden-winged Warbler Working Group set a goal of increasing range-wide breeding habitat acreage by over 1 million acres (404,685 hectares) between 2010 and 2050 (Roth et al. 2012). While young forest habitat management on public lands by state and federal agencies are significant contributions (Oehler 2003), a large proportion of forest in the eastern United States is privately owned. For example, private landowners own an estimated 70.4% of the woodland area in Pennsylvania and 72.5% in Minnesota, two important states for young forest conservation (Butler et al. 2016). Given these ownership statistics, private landowner management for young forest is a key component of large-scale habitat restoration efforts intended to recover declining wildlife populations.

Since 2012, federal conservation incentive programs administered by the United States Department of Agriculture's Natural Resources Conservation Service (NRCS) have provided cost-share and technical assistance to encourage private landowners to manage for young forest. Components of the Working Lands for Wildlife program and the Regional Conservation Partnership Program have been applied to young forest conservation in the Appalachians and Great Lakes regions, respectively. These federal program applications have been targeted toward focal regions and property locations likely to benefit the Golden-winged Warbler and American Woodcock (NRCS 2017). These conservation programs have successfully contracted hundreds of landowners to restore more than 6,450 hectares of young forest habitat on private lands (NRCS 2017). Although research has demonstrated that these management efforts are beneficial for wildlife (Bakermans et al. 2015a, Aldinger et al. 2015, McNeil et al. 2017), the longevity of these benefits relies in part on human social factors. For conservation programs such as these, landowner persistence with habitat management after program participation is a key component for shaping long-term conservation outcomes. Yet, few studies have examined how and why landowners choose to manage their land after conservation program participation ends (Dayer et al. 2017). In the case of young forest, recurring management by private landowners is critically important because the habitat requires renewal on a timescale of around 10-20 years (Bakermans et al. 2011).

In the context of these conservation programs and the overarching need for young forest conservation and creation, understanding what determines long-term private landowner management for young forest is critically important. Previous research has identified private landowner negative perceptions related to cutting trees and high management costs as barriers to young forest management through timber harvesting (Case, Seng, and Christoffel 2009). Prior results from this research project have also identified a range of private landowner motivations

for young forest management, including benefits to wildlife (Lutter et al. 2018). Furthermore, landowner attitudes and beliefs about the positive effects of management for land and wildlife, environmental motivations, and hunting motivations (Dayer et al. 2016, Lutter et al. 2018) have all been shown to be important drivers of management for young forest. These studies have focused on social influences for young forest management, but have not thoroughly investigated how the responsive ecological context of management could inform landowner decision-making.

After management is conducted to create young forest, vegetation structure and wildlife composition change rapidly due to ecological succession (Schlossberg and King 2009). Landowners who have managed for young forest will form their own perceptions of program outcomes informed by their lived experiences including, but not limited to, direct interactions with wildlife on their property (Morzillo et al. 2014, Bennett 2016). In this research context, we previously found that outreach from technicians monitoring for birds on managed properties also plays an important role in building landowner knowledge of birds and influencing landowner perceptions of program outcomes (Lutter et al. 2018). These perceptions could affect future management decisions. Some authors have speculated that landowners managing for specific wildlife such as Golden-winged Warbler might discontinue management if those species do not appear (Quinn and Wood 2017). Similarly, if landowners perceived their previous management was effective and had positive outcomes, this could promote future management for young forest (e.g., Reimer et al. 2012). Prior research has shown past behavior to be a good predictor of landowner intentions to conduct patch-cutting, a management practice that generates young forest habitat (Dayer et al. 2016). This could be evidence of positive environmental outcomes informing continued management. However, Dayer et al. (2016) also found that self-reported land characteristics including habitat composition and acreage were poorly predictive of management intentions. The authors highlighted this disconnect as a need for independently

measured land characteristics and suggested that a deeper examination of wildlife outcomes was merited (Dayer et al. 2016).

Coupled system model

Coupled systems frameworks have been previously applied to examine forest management in the United States. Approaches such as historical landscape analyses (Steen-Adams et al. 2015) and agent-based modeling simulations (Wimberly et al. 2014, Rammer and Seidl 2015) have been used to evaluate how social and ecological systems may interact to influence forest outcomes. Recognizing that CHANS function at multiple temporal and spatial scales, we opted to focus on young forest management at the individual property scale. While efforts to conserve young forest habitat are made regionally, the actions to manage habitat are often implemented at the level of individual properties. Understanding social-ecological feedbacks at the property scale is important because individual landowner decisions have a cumulative effect.

To examine the relationship between environmental outcomes, landowner cognitions, and continued young forest management, we drew from CHANS models developed by Morzillo et al. (2014) and Meyfroidt (2013b). Our hypothesized connections between target species presence/absence, landowner knowledge of bird detections, perceptions of management outcomes, and future management actions is represented in Figure 1.

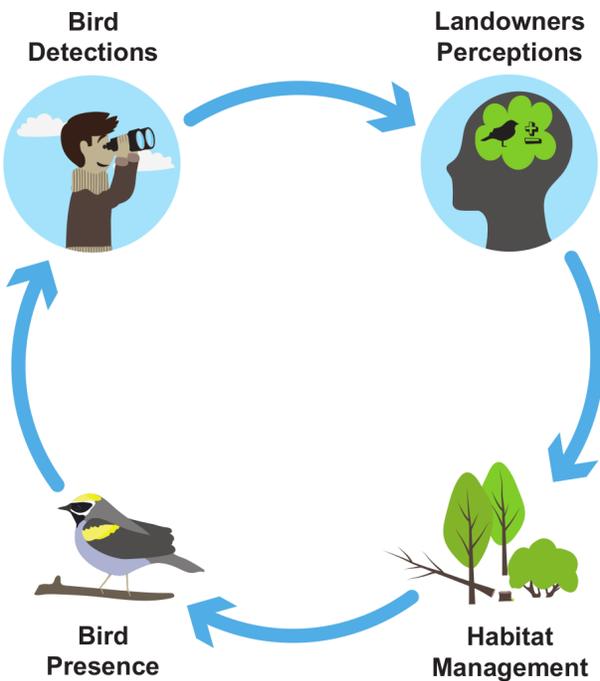


Figure 1. Hypothesized young forest coupled human and natural system at the property scale.

In our model, habitat management by landowners through participation in an NRCS program influences bird species presence on a property. A landowner may see or hear birds on their land, or be informed by other people that birds were detected on their property. These bird detections (or lack of detections) may or may not accurately reflect bird presence on a property. Next, landowner knowledge of bird detections likely affects their perceptions about whether habitat management was effective or not. Positive perceptions about management outcomes could then lead to continued habitat management. Overall, we expected reinforcing feedback between bird responses and continued management, with positive bird responses leading landowners to continue habitat management. However, it is possible that positive ecological outcomes could lead landowners to discontinue management if they felt the habitat required no additional management. Testing this type of local-scale CHANS model in the context of habitat management for two wildlife species of conservation concern is a novel contribution to the study of human-wildlife interactions. Furthermore, this research incorporates independently collected

species presence/absence data to examine the connection between ecological outcomes and continued habitat management behaviors. While the CHANS model primarily focuses on birds, other environmental outcomes such as forest health, scenery, and hunting are important in this system. We investigated landowner perceptions of these program outcomes, but did not collect field data associated with these environmental measures.

The main objectives of this study were to:

- Determine the relationship between bird presence at the property scale and landowner knowledge of bird detections;
- Quantify the relative importance of bird presence, landowner detection of birds, and knowledge of bird detections by others for influencing landowner perceptions of program outcomes; and
- Assess how bird presence, landowner detection of birds, and landowner perceptions of program outcomes are related to post-program continuance of young forest management by landowners.

Methods

Bird monitoring

We monitored bird presence after young forest habitat creation or enhancement across 189 privately owned properties in Maryland, Minnesota, New Jersey, Pennsylvania, and Wisconsin, USA. These properties were enrolled in NRCS conservation programs for young forest management, and had been managed for young forest habitat between 2012 and 2016. Landowners voluntarily allowed biological technicians to conduct post-management monitoring of birds and vegetation regrowth. At the time of monitoring site visits, the managed properties

were either under a current NRCS contract or had recently finished an NRCS contract to create young forest. The avian monitoring process involved 3 site visits to each managed property between mid-April and mid-July each year in 2015 and/or 2016.

To quantify American Woodcock use of young forest sites, we conducted singing ground surveys in 2015 and 2016 within the dates and time period permitted under the U.S Fish and Wildlife Service American Woodcock Singing Ground Survey protocol (BSC 2014; Seamans and Rau 2017). American Woodcock survey timing varied by region with Appalachian surveys conducted from 15 April – 5 May and Great Lakes surveys conducted from 1 – 20 May. The challenge with monitoring the singing activity of American Woodcock is that the allowable dates for any given region are restricted to only this 20-day window. Moreover, the survey period each evening is only 38 minutes in duration. As such, we only surveyed each site once annually for American Woodcock in order to maximize the number of sites surveyed each year. Survey locations were randomly located with each young forest management footprint. Each survey lasted 6 minutes during which time we recorded the number of singing (“peenting”) males.

To quantify Golden-winged Warbler (and associated songbird) use of young forest sites, we conducted avian point counts from mid-May through June 2015-16. Survey timing varied by region with Appalachian surveys occurring 10 days earlier (15 May-15 June) than within the Great Lakes (25 May – 25 June). These survey periods corresponded to the time at which most songbird species, including the Golden-winged Warbler, are most detectable. Point count locations were randomly located with each management footprint. Points were surveyed twice annually between 0.5 hours before sunrise to 4 hours after sunrise. Each point count survey consisted of a 10-minute passive period, followed by a 2-minute Golden-winged Warbler playback, and a final 1-minute passive period. This survey protocol is intended to maximize the detection probability for Golden-winged Warblers to nearly 1.0.

Monitored properties were visited 1-2 times to monitor for American Woodcock and 2-4 times to monitor for songbirds including the Golden-winged Warbler. Landowners interacted with monitoring technicians in two primary ways. During monitoring, some landowners met with technicians on their property or accompanied them during the site visit. Lists of detected bird species were also shared with some landowners in outreach mailings. The majority of landowners in the study (67.6%) either accompanied technicians on a site visit, received an outreach mailing, or received both forms of outreach (Lutter et al. 2018). The area of land managed for young forest through the program and NRCS contract end years were recorded for each property.

For analysis, bird presence was operationalized in terms of presence of the two target species, Golden-winged Warbler and American Woodcock, as well as total bird species richness on a property. Each target species was classified as present on a property if it was detected by monitoring technicians in 2015 and/or 2016. Bird species richness was defined as the count of bird species detected across all monitoring site visits in 2016. American Woodcock and Golden-winged Warbler were excluded from this richness measure to ensure consistency with the telephone survey item wording.

Telephone survey

We conducted telephone surveys with landowners of monitored properties from January 20 – June 1, 2017. The telephone survey methods were approved by the Virginia Tech Institutional Review Board (Protocol #16-597). As part of the consent process, respondents agreed to allow their survey responses to be paired with monitoring data collected from their property. Members of the research team signed compliance agreements that ensure NRCS cooperators will not disclose protected agricultural or personally identifiable information, as required by Section 1619 of the Food, Conservation, and Energy Act of 2008.

Of the 189 landowners called, 102 completed telephone surveys for a response rate of 57.9%. Individual surveys took an average of 30 minutes to complete. Survey responses were paired with ecological monitoring data using property addresses. To check for non-response bias in monitoring data, group comparisons (Mann-Whitney U and chi-square tests) between survey respondents and non-respondents were conducted. Respondents and non-respondents did not differ significantly in terms of American Woodcock presence, Golden-winged Warbler presence, or total bird species richness.

The telephone survey consisted primarily of closed-ended questions that evaluated landowner knowledge of bird detections on their property, perceptions of management outcomes, and management for young forest after the program contract. Eight private landowners who had participated in similar NRCS conservation programs pre-tested the survey. Only survey items used in analyses reported in this manuscript are discussed here.

A set of items assessed landowner knowledge of bird detections by three groups of people: the landowner him/herself, NRCS or partners (including monitoring technicians), or anyone else. The landowner was asked which of these groups had seen or heard Golden-winged Warbler, American Woodcock, or other birds that use young forest on their property since the landowner's enrollment in the NRCS program began. Seven items measured landowner perceptions of program participation effects for Golden-winged Warbler, American Woodcock, other birds that use young forest, scenery, hunting, bird-watching, and forest health on their property. Each perception was measured on a 5-point Likert-type scale from 'very negative' effect to 'very positive' effect. Some respondents chose to respond 'not sure', which was recorded rather than entered as missing data. For landowners who had finished their NRCS contract, we asked what management practices they had used to manage for young forest habitat since their contract ended. We used a list of nine forest management practices derived from the

Golden-winged Warbler best management practices guide (GWWG 2013) and NRCS practices commonly used for young forest habitat management. The survey also included demographic questions, including total property area owned.

Analysis

We analyzed our data using SPSS (version 24.0). For our first research objective, we used the cross-tab function in SPSS to compare bird presence, as determined by biological monitoring, with landowner knowledge of Golden-winged Warbler and American Woodcock detections. Chi-squared tests and phi coefficients were used to assess the independence of these dichotomous variables.

Our next research objective involved understanding how bird presence and detections influenced landowner perceptions of program outcomes for Golden-winged Warbler, American Woodcock, and other birds. First, we collapsed the responses into dichotomous variables due to a number of not sure responses- landowner perceptions were categorized as either positive (responses of positive or very positive) or not positive (responses of negative, neutral, or not sure). We then performed three binary logistic regression analyses using these landowner perceptions of program outcomes as dependent variables. Bird presence, landowner personal detection of birds, and knowledge of bird detections by others were used as independent variables for these regressions.

To investigate continued management, we constructed an index of post-program management intensity. First we classified management practices as ‘passive maintenance’, ‘active maintenance’, or ‘timber management’ (GWWG 2013). Passive maintenance practices required minimal additional effort from a landowner (i.e., native planting or deer fencing maintenance), active maintenance practices were more involved actions used to maintain young

forest habitat (i.e., brush clearing, cutting shrubs, herbicide application, invasive removal, and prescribed burning), and timber management practices were those that involved cutting additional trees (i.e., cutting new patches 4 hectares or more in size, cutting to expand existing patches). To calculate the index, passive maintenance practices were assigned a weight of 1, active maintenance a weight of 2, and timber management practices a weight of 3. The weighted practice scores were then summed for each landowner. Available remaining land area was calculated by subtracting habitat area managed through the program from total property area owned. Spearman's ranked order correlations and point biserial correlations were used to assess the relationship between post-program management index scores and bird presence, landowner bird detections, perceptions of ecological outcomes, time since contract, and remaining property area. To correct for multiple comparisons, Benjamini-Hochberg correction with a false discovery rate of 5% was used to evaluate correlation significance (Benjamini and Hochberg 1995).

Results

Survey respondents were primarily male (88%) and averaged 61 years old (median = 63 years, SD = 11 years). The majority (66%) had a four-year college degree or higher. Respondents owned their land for an average of 37 years (median = 20 years, SD = 35 years), and owned a mean of 316 hectares (median = 95 hectares, SD = 863 hectares).

Respondents' enrolled properties were located in Pennsylvania (59%), Minnesota (30%), New Jersey (7%), Maryland (2%), and Wisconsin (2%).

Biological monitoring surveys detected American Woodcock on 68.6% of respondent properties, and Golden-winged Warbler on 36.3% of properties. An average of 28.5 bird species (median = 27 species, SD = 11 species) were detected on respondent properties in 2016.

Bird Detections

Landowner knowledge of American Woodcock detections matched bird presence results for 71.7% of respondents (Table 1). About 10.1% of respondents thought that American Woodcock were detected on their property when biological monitoring surveys did not detect the bird. A slightly greater proportion of respondents (18.2%) did not think that American Woodcock had been seen or heard on their property when biological monitoring had actually detected the bird. There was a significant association between landowner perceptions of American Woodcock detection and presence as determined by biological monitoring surveys ($\chi^2 = 13.88, p = <0.001$). This relationship was moderately strong ($\phi = 0.37, p = <0.001$).

Table 1. Cross-tabulation of landowner knowledge of American Woodcock detection on their property and American Woodcock presence determined by biological monitoring, eastern United States, February- May 2017 (n= 99).

	Landowner knowledge of American Woodcock detection	
	Not Detected	Detected
American Woodcock Absent	19 (19.2%)	10 (10.1%)
American Woodcock Present	18 (18.2%)	52 (52.5%)

Landowner knowledge of Golden-winged Warbler detections matched bird presence results for 81.3% of respondents (Table 2). About 10.8% of respondents thought that Golden-winged Warblers were detected on their property when biological monitoring surveys did not detect the bird. A smaller proportion of respondents, 7.9%, did not think that Golden-winged Warbler had been seen or heard on their property when biological monitoring had actually detected the bird. Landowner perceptions of Golden-winged Warbler detection and presence as determined by biological monitoring surveys were significantly associated ($\chi^2 = 37.36 p = <0.001$). This association was strong ($\phi = 0.61, p = <0.001$).

Table 2. Cross-tabulation of landowner knowledge of Golden-winged Warbler detection on their property and Golden-winged Warbler presence determined by biological monitoring, eastern United States, February - May 2017 (n= 102).

	Landowner knowledge of Golden-winged Warbler detection	
	Not Detected	Detected
Golden-winged Warbler Absent	54 (52.9%)	11 (10.8%)
Golden-winged Warbler Present	8 (7.9%)	29 (28.4%)

Perceptions of Management Effects

Just over half of respondents (53%) thought that participating in the NRCS program had a positive or very positive effect for American Woodcock on their property. The logistic regression model predicting perception of positive program effects on American Woodcock was statistically significant, $\chi^2(4) = 39.43$, $p < 0.001$ (Table 3). The model correctly classified 79.8% of cases (Nagelkerke $R^2 = 0.438$). Of the four predictor variables, two were statistically significant: personal detection of the bird and knowledge that NRCS or NRCS partners had detected the bird on the property. Landowners who had personally detected the bird had 4.16 times higher odds to perceive a positive effect on American Woodcock from program participation. Similarly, landowners who thought NRCS or partners had detected the bird on their property had 5.48 times higher odds to perceive positive effects on American Woodcock.

Table 3. Summary of logistic regression models for predicting landowner perceived positive effect on American Woodcock, Golden-winged Warbler, and other birds from NRCS young forest habitat program participation, eastern United States, February- May 2017 (n= 102).

Independent Variables	American Woodcock		Golden-winged Warbler		Other birds	
	Exp(B)	p-value	Exp(B)	p-value	Exp(B)	p-value
Landowner detected bird	4.16	0.016	1.63	0.529	5.94	0.007
NRCS or partners detected bird	5.48	0.002	3.25	0.083	4.50	0.017
Someone else detected bird	2.47	0.151	9.10	0.051	3.10	0.090
Bird presence ^a	0.98	0.975	2.06	0.245	1.03	0.331
Nagelkerke R^2	0.438		0.372		0.421	

^aBird species richness was substituted for bird presence in the ‘other birds’ model.

Less than half of respondents (44.1%) thought that participating in the NRCS program had a positive or very positive effect for Golden-winged Warbler on their property. The logistic regression model predicting perception of positive program effect on Golden-winged Warbler was statistically significant, $\chi^2(4) = 33.20$, $p < 0.001$. The model correctly classified 77.5% of cases (Nagelkerke $R^2 = 0.372$). Of the four predictor variables, none were statistically significant, although detection of Golden-winged Warbler by someone else was marginally significant.

A majority of respondents (77.5%) thought their program participation had a positive or very positive effect for other birds on their property. The logistic regression model predicting perception of positive program effects on other birds was statistically significant, $\chi^2(4) = 32.88$, $p < 0.001$. The model correctly classified 88.2% of cases (Nagelkerke $R^2 = 0.421$). Of the four predictor variables, two were statistically significant: personal detection of the bird and knowledge that NRCS or partners had detected the bird on the property. Landowners who had personally detected other birds had 5.84 times higher odds to perceive a positive effect on other birds from program participation. Landowners who thought NRCS or partners had detected other birds on their property also had 4.49 times higher odds to perceive positive effects on other birds.

Post-Program Management

Of 102 survey respondents, 85 had completed their NRCS contracts at the time of the telephone survey. Among these 85 landowners, the average time since their contract ended was 2.09 years (min= 0 years, max= 4 years). The minimum remaining property area was 8.2 hectares. The majority of landowners (71.8%) who had completed their contracts had implemented some form of management actions for young forest management since their contract ended (Figure 2). The practice used by the most landowners (51.8%) post-contract was establishment or maintenance of native plantings. In contrast, fewer landowners had used active

maintenance practices such as brush clearing (44.7%) or habitat creation practices such as patch-cutting (11.8%). The least commonly used practice was prescribed burning, performed by only 4.7% of landowners post-contract.

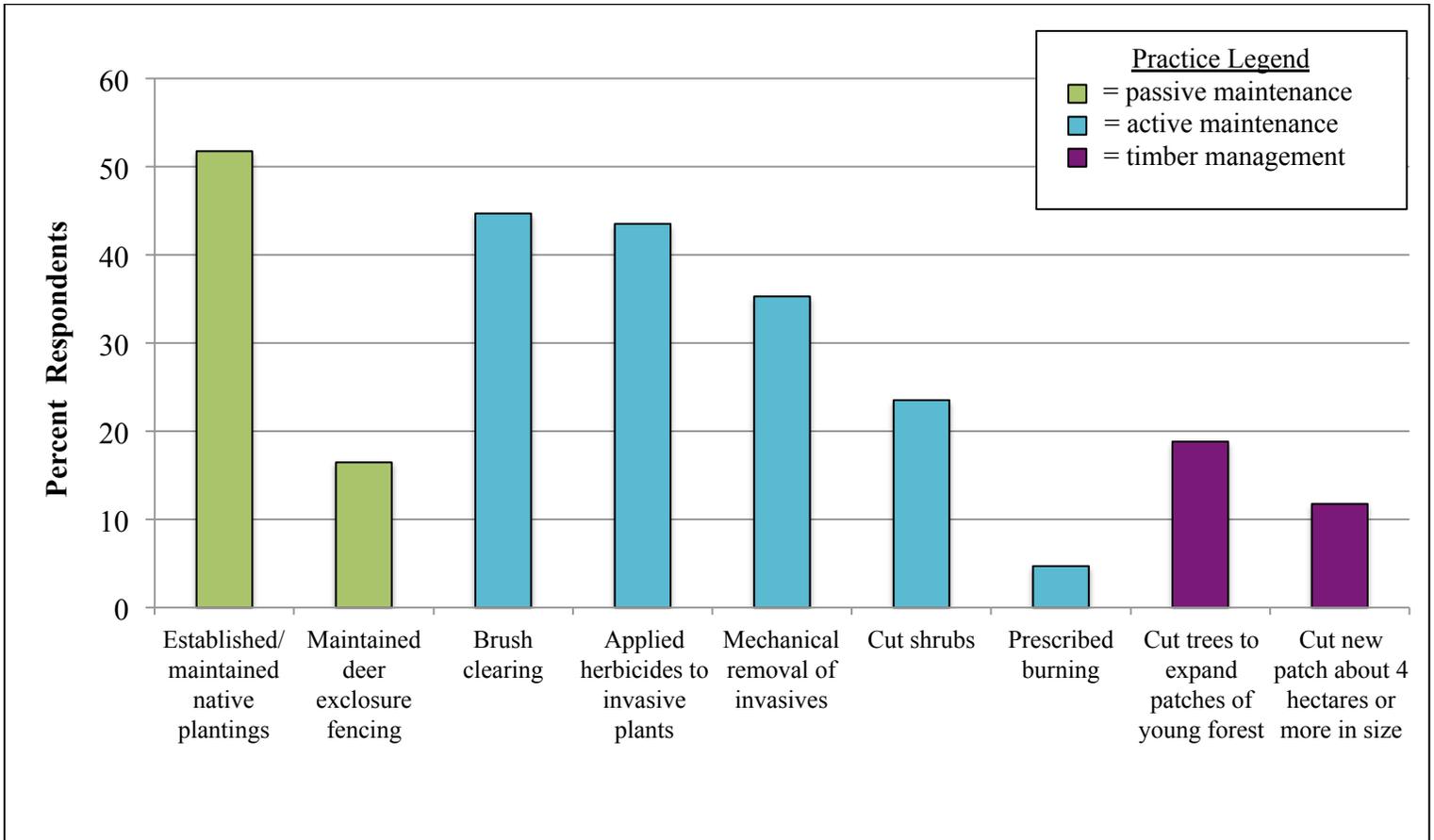


Figure 2. Landowner young forest management actions after NRCS young forest program participation, eastern United States, February- May 2017 (n=85).

Several variables were significantly correlated with landowner post-program management intensity (Table 4). Specifically, positive perceptions of management effects for other birds, forest health, and bird-watching were significantly positively related with higher levels of post-program management. In terms of biological monitoring data, Golden-winged Warbler presence on a property had a significant negative relationship with post-program management. There was no relationship between post-program management and either

landowner personal detection of birds on their property or the number of years since a landowner's contract end date.

Table 4. Bivariate correlations between bird presence, landowner bird detections, landowner perceptions, and landowner young forest management after NRCS program participation, eastern United States, February- May 2017 (n= 85).

	Independent variables	Post-contract management index	p-value
Bird presence	American Woodcock presence ^a	-0.17	0.115
	Golden-winged Warbler presence ^a	-0.26	0.016*
	Bird species richness ^b	0.09	0.395
Landowner detection of birds	Saw/heard American Woodcock ^a	0.17	0.112
	Saw/heard Golden-winged Warbler ^a	0.23	0.035
	Saw/heard other birds ^a	0.33	0.002*
Landowner perceptions of program outcomes	Positive effect on American Woodcock ^a	0.16	0.138
	Positive effect on Golden-winged Warbler ^a	-0.01	0.915
	Positive effect on other birds ^a	0.31	0.003*
	Effect on forest health ^b	0.29	0.012*
	Effect on hunting ^b	0.14	0.206
	Effect on bird-watching ^b	0.44	0.000*
	Effect on scenery ^b	0.27	0.011*
	Years since contract ended ^b	0.19	0.084
	Remaining property area ^b	0.03	0.824

*Significant with Benjamini-Hochberg correction procedure for multiple independent comparisons

^aPoint bi-serial correlation, ^bSpearman's correlation.

Discussion

By integrating field-based monitoring with landowner survey responses, we investigated property level linkages between environmental outcomes and continued young forest management. Overall, our results show the importance of landowner perceptions about the effects of past management for informing habitat management actions.

Most landowners in this study had an accurate understanding of target species presence or absence on their own property. However, bird presence or abundance was not a main driver of landowner perceptions of program outcomes. Instead, perceptions of outcomes for American Woodcock and other birds were influenced by personal detection of birds, and whether the landowner knew NRCS or an NRCS partner had seen birds on their property. The significant role of the agency and its partners in informing landowner perceptions of program outcomes were heightened in this context by outreach from monitoring technicians. Specifically, previous findings from this survey showed that landowners who accompanied monitoring technicians during site visits had better perceptions of program outcomes for bird-watching on their property (Lutter et al. 2018). The mailings that some landowners received with bird monitoring results from their property likely influenced knowledge about which birds were present (Lutter et al. 2018). If this avian monitoring and related outreach had not been conducted as a follow-up to NRCS program participation, it is possible that the agency would have played a smaller role in shaping landowner perceptions.

We found that landowners had conducted a range of management practices since their program contracts had ended. Continued management intensity was not associated with remaining property area or years since contract end, indicating that these factors were not major management constraints in this case. The most used practices post-program were related to habitat maintenance, while a smaller number of landowners had created additional young forest habitat through further timber management. In general, these results correspond with research indicating that landowners are more likely to persist with management practices that are less intensive or expensive to implement (Jackson-Smith et al. 2015, Dayer et al. 2017). The intensity of continued young forest management after the program was related to positive perceptions of program outcomes for forest health, other birds, bird-watching, and scenery. These results align

with previous research by Farmer et al. (2016), which found that landowners who experienced general environmental improvements on their land reported more conservation actions than those who perceived unchanged environmental conditions. Landowners in our study were highly motivated to benefit forest health and birds in general on their properties (Lutter et al. 2018), so it is reasonable that these program outcomes would be influential for landowner decision-making. In contrast, perceived outcomes for target species and hunting were not significantly associated with continued management. This could reflect the greater amount of landowner uncertainty regarding program outcomes for target species, indicated by the proportion of 'not sure' responses. The time scale of management considered in this study may also have been insufficient to fully capture the relationship between target species outcomes and landowner management decision-making. If landowners felt that there was still time for Golden-winged Warbler, American Woodcock, or game species to appear on their properties, they may not have interpreted their management effort as unsuccessful in this respect. In the case of Golden-winged Warbler, optimal habitat conditions are roughly 4-12 years post-harvest (Bakermans et al. 2015b). The landowners in this study had all exited the habitat program in the previous 4 years, leaving considerable time for Golden-winged Warbler to appear in managed areas.

Generally, bird presence on a property and landowner personal detections of birds were not strongly associated with continued management. Surprisingly, one wildlife measure- Golden-winged Warbler presence- had a negative relationship with continued management. However, landowner perceptions of Golden-winged Warbler outcomes or detection of the bird did not exhibit this same negative relationship. Rather than Golden-winged Warbler discouraging further management, it is possible that the habitat most closely associated with Golden-winged Warbler was seen by landowners as requiring less intensive maintenance. Alternatively, properties where

heavy maintenance was conducted could have had less cover and foliage that is important for Golden-winged Warbler foraging (Bakermans et al. 2015b).

We did not find indications of coupled systems feedback between target species presence and continued young forest habitat management. Landowner perceptions of target species outcomes were not related to continued management, even though landowners in this study population were generally motivated to benefit American Woodcock and Golden-winged Warbler (Lutter et al. 2018). Previous research has suggested that program efficacy for a target wildlife species can be outweighed by other landowner priorities for conservation program participation (Sorice et al. 2013). While target species were not related to continued management, our results suggest that other environmental outcomes for birds in general, forest health, and scenery may feedback to influence landowner decision-making in this system. In this study no field data was collected on forest health or scenery, although measuring these outcomes objectively could be difficult regardless. In terms of general bird outcomes, landowner perceptions and personal experiences were more closely tied to continued management than bird diversity on a property. It is possible that landowners responded to changes in bird composition on their properties that we were unable to detect. A linkage between general bird outcomes on a property and continued habitat maintenance or creation could help reinforce conservation gains of young forest management over time.

The use of a CHANS model relating private landowners and wildlife species of conservation concern has potential applicability in other systems involving habitat management. NRCS young forest programs are just one of many conservation efforts currently targeting specific wildlife species on private lands around the United States. For example, the Working Lands for Wildlife program recently expanded from seven to eighteen regional projects, which include target wildlife such as the Eastern Hellbender (*Cryptobranchus alleganiensis*), American

Black Duck (*Anas rubripes*), and Cutthroat Trout (*Oncorhynchus clarkii*). Each of these species and related habitats present unique challenges in terms of engaging private landowners in conservation and sustaining management through time. The characteristics of each species are likely highly influential, with research suggesting that management for wildlife can be influenced by whether the targeted wildlife is perceived by a landowner as beneficial or detrimental (Kross et al. 2018). In addition to desirability, wildlife also vary in visibility to a landowner. In our study, American Woodcock and Golden-winged Warbler, to a lesser extent, are relatively visible to landowners. Despite this visibility, results for these birds were still not highly influential in terms of landowner decision-making. In other management settings, more cryptic or aquatic target wildlife could make it even more difficult for landowners to recognize when management actions are effective. On the other hand, this disconnect could potentially be offset if the habitat management actions produced other observable outcomes, such as an increase in other wildlife or aesthetic benefits (Reimer et al. 2012). Future research could comparatively investigate different private lands management contexts to explore when coupled systems feedback occurs or does not occur. Considering feedback effects over longer time scales could lessen the role of landowner uncertainty about past management outcomes and allow more time for continued management to be implemented. Finally, bird monitoring in our study was only conducted after habitat management actions had taken place. Since landowner perceptions of outcomes are likely informed by how management changed their property, measuring baseline ecological conditions as well as post-management outcomes in future research could be beneficial.

Conclusion

Beyond providing insights into the participants of these specific NRCS young forest programs,

Private landowners face many challenges to create habitat on their lands, even with the assistance of cost-share programs. When habitat management is implemented, the results may reward landowners for their efforts or disappoint them. Understanding when and why management outcomes encourage or discourage landowners to continue habitat management is an important question for private land conservation in general. Our study suggests that positive perceptions of management outcomes for birds, forest health, and scenery could contribute to sustained young forest conservation. This insight into how landowners experience and understand management outcomes can help guide conservation professionals in how to communicate on these topics to better promote positive landowner experiences and continued conservation. We found that some landowners received positive reinforcement from outcomes on their properties. However, this feedback was not universal, which opens a potential role for agency staff and conservation professionals to help facilitate landowner experiences with habitat management outcomes during property visits. This could help landowners interpret management outcomes positively, regardless of whether their property results were what they initially expected. Finding ways to evaluate the success of many management outcomes, and raising landowner awareness of the positive results of their actions could help encourage continued conservation.

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Conclusion

Federal conservation programs that provide cost share to private landowners are an important component of current young forest conservation efforts in the United States. This thesis provided insight into landowner experiences in these programs, and suggestions to better engage landowners in long-term conservation.

Summary of Findings

In Chapter 1, we examined how outreach to private landowners affected their experiences in NRCS young forest programs and their future management intentions after program participation. Follow-up to landowners after conservation program involvement is thought to encourage continued conservation (Race and Curtis 2013; Swann and Richards 2016) but this outreach is rarely implemented. A post-program avian monitoring effort provided an opportunity for us to assess two different forms of outreach to landowners- site visits by biological monitoring technicians and mailings with monitoring results. We found that landowners who accompanied biological technicians monitoring managed properties for birds had higher agency trust and more positive perceptions of program outcomes. The result mailings did not increase agency trust or improve perceptions, but did increase landowner knowledge about birds. Neither form of outreach was associated with higher intentions to manage for young forest after the program.

These results showed the importance of in-person outreach to landowners, and the positive influence that technicians on monitoring contracts might have when interacting with landowners. Management agencies and conservation professionals should make the most of

opportunities for in-person interactions to improve trust and encourage conservation efforts on private lands.

Chapter 2 focused on landowner intentions to manage for young forest within ten years after the end of their contracts. Few studies have examined management intentions or behaviors after private landowners exit incentive program contracts (Dayer et al. 2017), making this a research priority. Continued conservation actions after program participation are often important for maintaining program environmental benefits, such as increased young forest habitat quality. To predict landowner management intentions after the young forest conservation program, we identified motivations, resources, and cognitions likely to influence landowner decision-making. Landowner intentions to re-enroll in NRCS programs for young forest were highest for landowners with high agency trust and who were strongly motivated by cost-share, environmental concerns, and hunting. Intentions to persist with young forest management if further cost-share was unavailable were highest for group landowners (e.g., hunting clubs, non-profits), landowners motivated by environmental concerns, and those less motivated by cost-share. Overall our results revealed high interest in continued management for young forest, albeit with greater interest in doing so with cost-share assistance. Fostering trust, such as through follow-up outreach to landowners, and recruiting landowners with supportive motivations and resources could help improve young forest conservation outcomes in the long-term.

In Chapter 3, we applied a coupled human and natural system framework to investigate young forest management at the property level. Moving beyond management intentions, in this chapter we considered actual management outcomes for a subset of respondents who had already left the program. We hypothesized that positive wildlife outcomes would promote continued young forest management. By pairing field-based monitoring of wildlife with surveys of landowners, we examined how landowners observed wildlife outcomes on their property and

how these observations informed landowner perceptions. We found that landowners had accurate knowledge of bird presence on their property. Landowner perceptions of positive program outcomes for forest health and birds were related to more intensive management after the program. However, there was not a strong association between bird presence and continued management for young forest. Overall, positive perceptions of management outcomes could contribute to sustained young forest conservation. Promoting positive landowner interpretations of management outcomes could help encourage continued conservation.

Chapters 2 and 3 provided alternate perspectives on young forest management after program participation ended. Behavioral intentions, such as those discussed in Chapter 2, do not always translate into behaviors (Webb and Sheeran 2006) meaning that information on actual management behaviors (Chapter 3) is usually preferable. In this thesis, post-program behaviors were not measurable for some landowners who were still involved in the program. In addition, measuring intentions provided valuable insight into both re-enrollment and persistence likelihood for a longer time frame after program participation. Taken together, Chapters 2 and 3 indicate that both social and environmental factors influence young forest management post-program.

Program Reflections

In general, survey respondents were satisfied with their experience with the NRCS program, had high trust in the agency, and thought their habitat management through the program resulted in positive outcomes for their land. Further, there was high interest overall in continuing to manage for young forest. Young forest management facilitated by these NRCS programs has beneficial effects for wildlife (Bakermans et al. 2015; McNeil et al. 2017), and the programs appear to meet the needs of landowners who participate. These are all encouraging findings for proponents of young forest conservation. However, the young forest habitat restored

through these programs is only a fraction of the acreage thought to be necessary to recover wildlife species like the Golden-winged Warbler. Meeting those figures will require a combination of efforts on both private and public lands. Yet the future of funding for young forest conservation through these two NRCS programs is not clear. Whether or not these specific initiatives continue, incentive programs for private landowners will likely remain an important piece of young forest conservation efforts in the future.

This thesis offered specific recommendations to improve young forest conservation programs in terms of design, messaging, and recruitment. The relevance of our findings also extends beyond the context of young forest management. In demonstrating the benefits of in-person site visits from biological monitoring technicians, we underline the importance of personal interactions with landowners for other biologists conducting monitoring efforts on private lands. Our results also hint at the value of site visits from other conservation professionals and agency staff who provide technical assistance to landowners. Outreach from these sources could be expected to be even more influential than from monitoring technicians for whom outreach is a secondary concern. Increased consideration and funding for in-person meetings with landowners could improve long-term conservation outcomes in a range of private lands conservation contexts.

In terms of understanding the effectiveness of these NRCS programs at encouraging young forest conservation, our results raise some questions. Landowners appeared willing to continue managing for young forest even if cost-share was not available, which could suggest that cost-share programs for young forest are unnecessary. Previous research on forest landowners indicates that cost-share plays an important role in helping landowners expand management efforts (Andrejczyk et al. 2016). While this thesis did not include information on management acreage, anecdotal evidence suggests that cost-share functions similarly for these

landowners. While landowners might continue to manage for young forest without cost-share, the extent and intensity of management would likely decrease. Another important topic not addressed in this thesis was what baseline management landowners were doing prior to enrolling land into the NRCS program. Some landowners may have already been conducting similar habitat management actions on their land, or previously participated in similar conservation programs. Knowledge of prior management would give a more complete picture of how participating in these specific programs altered a landowner's management.

Given that there are complications and uncertainties related to working with private landowners, implementing young forest management on public lands may appear an easier option. Alternatively, providing cost-share to a smaller group of landowners with larger tracts of forest could be a more streamlined method to meet the acreage goals for conservation programs. While these hypothetical options may be effective from a habitat standpoint, a major goal of these conservation programs is to engage people in conservation. Conservation is a long-term, inter-generational process that involves people's connections to the land, wildlife, and the environment. The environmental outcomes of public conservation programs are essential, but the means by which these results are obtained are important to consider. To be successful, these programs must promote conservation interest in landowners who participate, and in their family, friends, and neighbors. The future state of forests in the eastern United States will be influenced by whether landowners value a diversity of wildlife and habitats, understand how their actions can bring about change, and have the tools and knowledge to manage their land appropriately.

Scholarly Contributions

This research offers major contributions to the literature on landowner behavior after conservation program participation. We presented the first study to examine both landowner

intentions to re-enroll in similar programs and persist with management in the absence of cost-share. This thesis also provides the second study to measure actual, albeit self-reported, landowner habitat management behaviors after a conservation program (Dayer et al. 2017). Beyond simply quantifying post-program behaviors, this thesis applied a theoretical framework for understanding post-program that was proposed by Dayer et al. (2017). Considering these persistence pathways and building upon their operationalization here will be useful for future research into conservation program outcomes.

This thesis also presents an innovative investigation of conservation related outreach to private landowners. No study has previously evaluated how the biological monitoring process may influence private landowner conservation. We demonstrated that monitoring for biological purposes on private lands can have positive social benefits, particularly through personal interactions between monitoring technicians and landowners. Delivering feedback to landowners on property specific biological monitoring results was also a novel component of this research. This thesis was the first application of this outreach method, pioneered in the energy conservation literature (i.e., Frey and Rogers 2014) to the context of wildlife conservation. Our methods and findings provide a starting point for future research to examine how specific types of conservation outreach can affect individual landowners.

To the field of coupled human and natural systems research, we contribute a unique approach of pairing wildlife presence information with social science survey data at the property level. Tying together two different coupled systems frameworks, we were able to evaluate the relationships between wildlife presence, wildlife detections, landowner cognitions, and habitat management actions. In this context, outcomes for birds, forest health, and scenery were more closely associated with continued management than outcomes for targeted wildlife species. We

recommend that our theoretical model be expanded beyond target wildlife species to incorporate a wider range of environmental outcomes.

Closing

Publicly funded programs that incentivize private landowners to undertake conservation actions are an important conservation policy tool. Social science-based research is essential for understanding conservation program efficacy and for informing future program delivery. Applying this research is important to effectively sustain long-term conservation gains through conservation programs. In this thesis, we provided insight into how outreach from biologists can shape landowner experiences in conservation programs. Further, we demonstrated how both social and ecological factors influence continued conservation after program participation. This type of research is critical to guide future conservation efforts on private lands.

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YOUR RESULTS ARE IN!



Golden-winged Warbler



American Woodcock



Young forest habitat 3 years after timber harvest

A Conservation Effects Assessment Project (CEAP)

Assessing Wildlife Response to the Natural Resources
Conservation Service's (NRCS) Conservation Programs
Supporting Young Forest Habitat

Dear [REDACTED]

We are excited to share with you the results of our second year of Golden-winged Warbler, American Woodcock, and songbird surveys.

As you may know, Golden-winged Warbler and American Woodcock populations have been declining for decades, primarily due to habitat loss in the United States. These two bird species (see cover photos) and many other species of birds, mammals, and reptiles rely on young forest habitat during some or all of their life.

Since 2012, you and 190 other private landowners in 5 different states have created 7,934 acres of young forest habitat through NRCS conservation projects. The critically important young forest habitat you and other participants are creating/have created provides an essential home for an abundant diversity of native wildlife. Together, you are making a positive difference for wildlife in your region!

Your property was visited on 1 occasion (May 19, 2016) to survey for American Woodcock, and visited on 4 occasions (June 3, 2016, June 17, 2016, June 19, 2016 and June 24, 2016) to survey for Golden-winged Warblers and other songbirds. We conducted surveys at 1 point location in the areas where you have created young forest habitat and 4 point locations where you plan to create young forest habitat. Along with this letter we have enclosed a map showing where on your property we surveyed for birds.

On your property, we surveyed American Woodcock in the 1 area that has been managed for young forest. We detected a total of 1 American Woodcock at 1 of 1 points surveyed.

We detected a total of 2 Golden-winged Warblers at 1 of 1 points surveyed in the area that has been managed for young forest. Additionally, we detected a total of 20 species during our surveys in the managed areas (please see below). Moreover, of the 20 species we detected, 3 are currently considered species of greatest conservation need (denoted in the list with an asterisk) so your project is already having meaningful benefits to birds! Along with the list of species, we have included photos of 10 bird species that benefit from young forest on private lands, 9 of which were detected on your property!

- | | |
|----------------------------|----------------------------|
| 1. American Crow | 11. Hermit Thrush |
| 2. American Goldfinch | 12. Nashville Warbler |
| 3. American Redstart | 13. Ovenbird |
| 4. American Woodcock* | 14. Red-eyed Vireo |
| 5. Black-and-white Warbler | 15. Rose-breasted Grosbeak |
| 6. Black-capped Chickadee | 16. Turkey Vulture |
| 7. Chestnut-sided Warbler | 17. Veery* |
| 8. Common Loon* | 18. Wilson's Snipe |
| 9. Eastern Wood-Pewee | 19. Wood Duck |
| 10. Golden-winged Warbler* | 20. Yellow-throated Vireo |

Thank you for allowing us to conduct these surveys on your property! We look forward to continue working with you to manage and maintain young forest habitat to benefit wildlife like Golden-winged Warblers and American Woodcock on your property and across the region. We are also always looking for more participants, so if anyone you know is interested in forest management opportunities please contact Callie Bertsch (below).

YOUNG FOREST IS ESSENTIAL FOR THESE BIRDS



Ovenbird



Golden-winged Warbler



Black-and-White Warbler



Chestnut-sided Warbler



Song Sparrow



Veery



Rose-breasted Grosbeak



Red-eyed Vireo



White-throated Sparrow



Common Yellowthroat

Appendix B: Main Telephone Survey

Survey Questions	Default Survey	Group Owner Survey
<p>INTRODUCTION:</p> <p>Hi, my name is (insert). I am a (affiliation) at [institution]. May I please speak with _____?</p> <p style="padding-left: 40px;">⇒ If he/she is not available: When may I call back to reach him/her? Date and time: _____</p> <p>I am conducting a research study to learn more about landowners who enrolled in Natural Resource Conservation Service habitat programs to help improve how well these programs meet conservation goals and landowner objectives for their land. I believe that the NRCS partner biologists let you know I would be calling about your enrolled land. The phone survey will take about 20 to 30 minutes to complete, your participation is voluntary, and your identity and responses will be kept confidential.</p> <p>Information collected by NRCS partners about your habitat project including land acreage enrolled, contract dates, practices implemented, and biological results of management will be included in this research with your survey responses. The results of this research study will be published and used in a Masters thesis. There are no known risks associated with this survey. Although we would greatly appreciate your help, you are free to decline this survey.</p> <p>Do you consent to participate in this research study? Yes <input type="checkbox"/> No <input type="checkbox"/> [if no, thank them and end call].</p> <p>[If yes] Thanks for your willingness to participate. As we move through the survey, please feel free to ask for clarification if I have phrased something unclearly.</p> <p>In this survey, I will ask you about your involvement in an NRCS habitat program. Some people participate in more than one NRCS program, so to make it clear which I am talking about, the enrolled property address is (_____) and the contract involved (_____) practices.</p> <p>Which category best describes your ownership of the property enrolled in the NRCS habitat program?</p> <p>Individual <input type="checkbox"/> Joint, such as a husband and wife <input type="checkbox"/> Family partnership <input type="checkbox"/> Trust or Estate <input type="checkbox"/> Club or Association <input type="checkbox"/> Corporation or Business partnership <input type="checkbox"/> Not an owner <input type="checkbox"/> Other (please specify) <input type="checkbox"/> _____</p> <p>***Responses that classifies respondent as a family forest owner (Individual, Joint, Family Partnership, Trust or Estate) use survey version 1. Responses indicating Club or Association, Corporation or Business, and Other use version 2 of the survey- answer on behalf of the group.***</p>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<p>Who makes the management decisions, such as whether or not to harvest trees, for the property enrolled in an NRCS habitat program under your name? CHECK ALL THAT APPLY</p> <p>You <input type="checkbox"/> Your spouse <input type="checkbox"/> Your children <input type="checkbox"/> Another family member <input type="checkbox"/> Your land manager or forester <input type="checkbox"/></p>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Other (please specify) <input type="checkbox"/> _____		
Next, it would be helpful to know some characteristics of the property you enrolled in the NRCS habitat program. 3. How many years have you or a family member owned the enrolled property for? If you have multiple parcels that were enrolled, think of the one owned longest. _____	☑	☑
4. About how far do you live from your enrolled property in miles? If you have multiple parcels that were enrolled, think of the nearest. _____	☑	☑
5. Do you currently have a written property wide forest management or stewardship plan for the enrolled property? Yes <input type="checkbox"/> No <input type="checkbox"/> NOT SURE <input type="checkbox"/>	☑	☑
6. How many acres of land do you own in total? _____	☑	☑
7. On average, what percentage of your household's annual income is derived from the wooded land that you own? _____	☑	☑
Enrolling land in an NRCS habitat program might result in many different outcomes. We are interested in how important several potential outcomes are for you. 8A. How important to you is having access to expert advice on forest management on your land? Not at all important <input type="checkbox"/> Slightly important <input type="checkbox"/> Moderately important <input type="checkbox"/> Very important <input type="checkbox"/> Extremely important <input type="checkbox"/> NO RESPONSE <input type="checkbox"/> 9A. What effect did participating in the NRCS habitat program have on your access to expert advice on forest management on your land? Very Positive effect <input type="checkbox"/> Positive effect <input type="checkbox"/> No effect <input type="checkbox"/> Negative effect <input type="checkbox"/> Very negative effect <input type="checkbox"/> 8B. How important to you is receiving cost share payments to create or maintain habitat on your land? 9B. What effect did participating in the NRCS habitat program have on your ability to afford costs related to habitat creation or maintenance on your land? 8C. How important to you is improving hunting opportunities on your land? 9C. What effect did participating in the NRCS habitat program have for hunting opportunities on your land? 8D. How important to you is improving bird-watching opportunities on your land? 9D. What effect did participating in the NRCS habitat program have for bird-watching opportunities on your land?	☑	☑

<p>8E. How important to you is benefiting American Woodcock on your land?</p> <p>9E. What effect did participating in the NRCS habitat program have on American Woodcock on your land?</p> <p>10A. How certain are you about the answer you just gave?</p> <p>Very Certain <input type="checkbox"/></p> <p>Certain <input type="checkbox"/></p> <p>Neither Certain or Uncertain <input type="checkbox"/></p> <p>Uncertain <input type="checkbox"/></p> <p>Very Uncertain <input type="checkbox"/></p> <p>8F. How important to you is benefiting Golden winged Warblers on your land?</p> <p>9F. What effect did participating in the NRCS habitat program have on Golden winged Warblers on your land?</p> <p>10B. How certain are you about the answer you just gave?</p> <p>8G. How important to you is benefiting other birds that use young forest habitat on your land?</p> <p>9G. What effect did participating in the NRCS habitat program have on other birds that use young forest habitat your land?</p> <p>10C. How certain are you about the answer you just gave?</p> <p>8H. How important to you is improving the scenery on your land?</p> <p>9H. What effect did participating in the NRCS habitat program have on the scenery on your land?</p> <p>8I. How important to you is improving the forest health on your land?</p> <p>9I. What effect did participating in the NRCS habitat program have on the forest health on your land?</p> <p>8J. How important to you is harvesting timber for income on your land?</p> <p>9J. What effect did participating in the NRCS habitat program have on timber harvesting for income on your land?</p> <p>8K. How important to you is increasing property value of your land?</p> <p>9K. What effect did participating in the NRCS habitat program have on the property value of your land?</p>		
<p>Okay, now I have a few questions about your level of satisfaction with different parts of the NRCS habitat program. For each you can respond on a 1 to 10 scale, where 1 is not at all satisfied, 5 is moderately satisfied, and 10 is completely satisfied.</p> <p>11A. How satisfied are you with the conservation program overall?</p> <p>11B. How satisfied are you with the program cost-share payments?</p> <p>11C. How satisfied are you with the wildlife outcomes on your land?</p> <p>11D. How satisfied are you with your interactions with Natural Resources Conservation Service employees, partner biologists, and partner foresters?</p>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<p>Thanks! To what extent do you agree or disagree with the following statements:</p> <p>12A. You trust the expertise of NRCS employees, partner biologists, and partner foresters to help you achieve your land management goals.</p> <p>Strongly Agree <input type="checkbox"/></p> <p>Agree <input type="checkbox"/></p>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

<p>Neither <input type="checkbox"/></p> <p>Disagree <input type="checkbox"/></p> <p>Strongly Disagree <input type="checkbox"/></p> <p>NOT SURE <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p> <p>12B. You feel that you have similar values to the NRCS employees, partner biologists, and partner foresters.</p> <p>12C. The rules and procedures of the NRCS habitat program ensure that you are treated fairly.</p>		
<p>In the next sections I am going to ask you about managing for young forest on your property. The term young forest refers to areas with well-developed ground cover, shrubs, and young trees, and the absence of a closed tree canopy. It may help to picture the area that you have managed through this NRCS habitat program- how it looks now and over the next few years as the vegetation grows in.</p> <p>When I say management or managing, I mean taking actions on your property to influence trees or other plant cover. In this survey, when I say managing for young forest I am referring to both actively creating new young forest and taking action to maintain existing young forest.</p> <p>Your contract with the NRCS habitat program ends in [YEAR] OR ended in [YEAR].</p> <p>13. How likely are you to manage for (again, as a reminder I mean create or maintain) young forest on your land within ten years after your contract end date by re-enrolling in a Natural Resources Conservation Service program?</p> <p>Not At All Likely <input type="checkbox"/></p> <p>Slightly Likely <input type="checkbox"/></p> <p>Moderately Likely <input type="checkbox"/></p> <p>Very Likely <input type="checkbox"/></p> <p>Extremely Likely <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p> <p>14. How likely are you to sell or give away any of the forested land you own within ten years after your contract end date?</p> <p>Not At All Likely <input type="checkbox"/></p> <p>Slightly Likely <input type="checkbox"/></p> <p>Moderately Likely <input type="checkbox"/></p> <p>Very Likely <input type="checkbox"/></p> <p>Extremely Likely <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<p>IF CONTRACT HAS ENDED:</p> <p>15A. Since your contract ended, have you consulted an expert forester or biologist on habitat management decisions independent of <u>cost share payments</u>?</p> <p>Yes <input type="checkbox"/></p> <p>No <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p> <p>FOR EVERYONE:</p> <p>15B. <u>If further cost share payments were not available</u> how likely are you to consult an expert forester or biologist on <u>future habitat management decisions</u> within ten years after your contract end date?</p> <p>Not At All Likely <input type="checkbox"/></p> <p>Slightly Likely <input type="checkbox"/></p> <p>Moderately Likely <input type="checkbox"/></p> <p>Very Likely <input type="checkbox"/></p> <p>Extremely Likely <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

<p>IF CONTRACT HAS ENDED:</p> <p>16A. <u>Since your contract ended</u>, have you used any of the following management practices to manage- either create or maintain- for young forest on your land <u>without cost share payments</u>: For each practice you can say yes or no:</p> <p>Cutting a <u>new patch</u> of trees about 10 acres or more in size while leaving behind some mature trees standing in the area <input type="checkbox"/></p> <p>Cutting to <u>expand an existing patch</u> of young forest while leaving behind some mature trees standing in the area <input type="checkbox"/></p> <p>Applying herbicides to invasive plants <input type="checkbox"/></p> <p>Mechanical removal of invasive plants <input type="checkbox"/></p> <p>Establishing or maintaining native tree or shrub plantings <input type="checkbox"/></p> <p>Maintaining deer fencing <input type="checkbox"/></p> <p>Mechanical brush clearing (also called brush hogging) <input type="checkbox"/></p> <p>Cutting shrubs such as alder <input type="checkbox"/></p> <p>Prescribed burning <input type="checkbox"/></p> <p>NOT SURE <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p> <p>FOR EVERYONE:</p> <p>16B. <u>If further cost share payments were not available</u>, which of the following management practices would you use in the future to manage- either create or maintain- for young forest on your land within ten years after your contract end date: For each practice you can say yes or no:</p> <p>Cutting a <u>new patch</u> of trees about 10 acres or more in size while leaving behind some mature trees standing in the area <input type="checkbox"/></p> <p>Cutting to <u>expand an existing patch</u> of young forest while leaving behind some mature trees standing in the area <input type="checkbox"/></p> <p>Applying herbicides to invasive plants <input type="checkbox"/></p> <p>Mechanical removal of invasive plants <input type="checkbox"/></p> <p>Establishing or maintaining native tree or shrub plantings <input type="checkbox"/></p> <p>Maintaining deer fencing <input type="checkbox"/></p> <p>Mechanical brush clearing (also called brush hogging) <input type="checkbox"/></p> <p>Cutting shrubs such as alder <input type="checkbox"/></p> <p>Prescribed burning <input type="checkbox"/></p> <p>NOT SURE <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<p>17. <u>If further cost share payments were not available</u>, how likely are you to manage for young forest on your land (using any of the practices described in the previous question) in the future within ten years after your contract end date?</p> <p>Not At All Likely <input type="checkbox"/></p> <p>Slightly Likely <input type="checkbox"/></p> <p>Moderately Likely <input type="checkbox"/></p> <p>Very Likely <input type="checkbox"/></p> <p>Extremely Likely <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p> <p>18. <u>Now thinking further into the future, if further cost share payments were not available</u>, how likely are you to manage for young forest on your land between ten to twenty years after your contract end date?</p> <p>Not At All Likely <input type="checkbox"/></p> <p>Slightly Likely <input type="checkbox"/></p> <p>Moderately Likely <input type="checkbox"/></p> <p>Very Likely <input type="checkbox"/></p> <p>Extremely Likely <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

<p>Regardless of whether or not you intend to keep managing for young forest on your land after your contract ends, we are interested in what you think the effects would be if you did choose to manage for young forest <u>without further cost share payments</u>.</p> <p>To what extent do you agree or disagree with the following statements: (ONLY ASK ABOUT IMPORTANT OUTCOMES IN QUESTION 8).</p> <p>19A. Managing for young forest on your land within ten years after your contract end date would benefit hunting opportunities on your land: Strongly Agree <input type="checkbox"/> Agree <input type="checkbox"/> Neither Agree or Disagree <input type="checkbox"/> Disagree <input type="checkbox"/> Strongly Disagree <input type="checkbox"/> NOT SURE <input type="checkbox"/> NO RESPONSE <input type="checkbox"/></p> <p>19B. Managing for young forest on your land within ten years after your contract end date would benefit bird-watching opportunities on your land:</p> <p>19C. Managing for young forest on your land within ten years after your contract end date would benefit American Woodcock on your land:</p> <p>19D. Managing for young forest on your land within ten years after your contract end date would benefit Golden-winged Warblers on your land:</p> <p>19E. Managing for young forest on your land within ten years after your contract end date would benefit other birds that use young forest habitat on your land:</p> <p>19F. Managing for young forest on your land within ten years after your contract end date would improve the scenery on your land:</p> <p>19G. Managing for young forest on your land within ten years after your contract end date would benefit forest health on your land:</p> <p>19H. Managing for young forest on your land within ten years after your contract end date would improve timber harvesting for income on your land:</p> <p>19I. Managing for young forest on your land within ten years after your contract end date would benefit the property value of your land:</p>	<input checked="" type="checkbox"/>	
<p>20A. How common is it that other landowners in the region purposely manage for young forest on their land without cost share payments? Not At All Common <input type="checkbox"/> Slightly Common <input type="checkbox"/> Moderately Common <input type="checkbox"/> Very Common <input type="checkbox"/> Extremely Common <input type="checkbox"/> NOT SURE <input type="checkbox"/> NO RESPONSE <input type="checkbox"/></p> <p>20B. When it comes to management activities you do on your land, how important are the opinions of other landowners in the region to you? Not at all Important <input type="checkbox"/> Slightly Important <input type="checkbox"/> Moderately Important <input type="checkbox"/> Very Important <input type="checkbox"/></p>	<input checked="" type="checkbox"/>	

<p>Extremely Important <input type="checkbox"/></p> <p>NOT SURE <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p> <p>To what extent do you agree or disagree with the following statements:</p> <p>20C. Other landowners in the region think that you should manage your land for young forest within ten years after your contract end date if <u>further cost share payments were not available</u></p> <p>Strongly Agree <input type="checkbox"/></p> <p>Agree <input type="checkbox"/></p> <p>Neither Agree or Disagree <input type="checkbox"/></p> <p>Disagree <input type="checkbox"/></p> <p>Strongly Disagree <input type="checkbox"/></p> <p>NOT SURE <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p>		
<p>21A. People who are important to you think that you should manage for young forest on your land within ten years after your contract end date <u>if further cost share payments were not available</u>:</p> <p>Strongly Agree <input type="checkbox"/></p> <p>Agree <input type="checkbox"/></p> <p>Neither Agree or Disagree <input type="checkbox"/></p> <p>Disagree <input type="checkbox"/></p> <p>Strongly Disagree <input type="checkbox"/></p> <p>NOT SURE <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p> <p>21B. People you respect and admire think you should manage for young forest on your land within ten years after your contract end date <u>if further cost share payments were not available</u>:</p> <p>Strongly Agree <input type="checkbox"/></p> <p>Agree <input type="checkbox"/></p> <p>Neither Agree or Disagree <input type="checkbox"/></p> <p>Disagree <input type="checkbox"/></p> <p>Strongly Disagree <input type="checkbox"/></p> <p>NOT SURE <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p>	<input checked="" type="checkbox"/>	
<p>22A. If you really wanted to, you could manage for young forest without further cost share payments within ten years after your contract end date:</p> <p>Strongly Agree <input type="checkbox"/></p> <p>Agree <input type="checkbox"/></p> <p>Neither Agree or Disagree <input type="checkbox"/></p> <p>Disagree <input type="checkbox"/></p> <p>Strongly Disagree <input type="checkbox"/></p> <p>NOT SURE <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p> <p>22B. For you to continue managing for young forest without further cost-share payments within ten years after your contract end date is under your control:</p> <p>Strongly Agree <input type="checkbox"/></p> <p>Agree <input type="checkbox"/></p> <p>Neither Agree or Disagree <input type="checkbox"/></p> <p>Disagree <input type="checkbox"/></p> <p>Strongly Disagree <input type="checkbox"/></p> <p>NOT SURE <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p>	<input checked="" type="checkbox"/>	
<p>23A. <u>If further cost share payments were not available</u>, is managing for young forest on your land within ten years after your contract end date:</p> <p>Very Desirable <input type="checkbox"/></p>	<input checked="" type="checkbox"/>	

<p>Desirable <input type="checkbox"/></p> <p>Neither Desirable or Undesirable <input type="checkbox"/></p> <p>Undesirable <input type="checkbox"/></p> <p>Very Undesirable <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p> <p>23B. <u>If further cost share payments were not available</u>, is managing for young forest on your land within ten years after your contract end date:</p> <p>Very Good <input type="checkbox"/></p> <p>Good <input type="checkbox"/></p> <p>Neither Good or Bad <input type="checkbox"/></p> <p>Bad <input type="checkbox"/></p> <p>Very Bad <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p>		
<p>24. <u>If further cost share payments were not available</u>, is your management for young forest on your land within ten years after your contract end date limited by the following factors? For each, you can say yes or no.</p> <p>You don't have enough time <input type="checkbox"/></p> <p>You don't have enough money <input type="checkbox"/></p> <p>You don't know how to manage for young forest <input type="checkbox"/></p> <p>You don't have enough acreage <input type="checkbox"/></p> <p>You don't like how it looks <input type="checkbox"/></p> <p>You think that further management within ten years is unnecessary <input type="checkbox"/></p> <p>None of those <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<p>Okay, that was the final question about how you might manage your land in the future. Now I have a few questions about outdoor recreational behaviors that you may take part in.</p> <p>25. Do you or a member of your family hunt?</p> <p>Yes <input type="checkbox"/></p> <p>No <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p> <p>(IF 25 = YES)</p> <p>26A. Over the past year, about how many days have you personally hunted on the land you enrolled in the NRCS habitat program? Days _____</p> <p>26B. Over the past year, about how many days have you personally gone hiking or walking on the land you enrolled in the NRCS habitat program? Days _____</p> <p>26C. Over the past year, about how many days have you personally gone bird-watching on the land you enrolled in the NRCS habitat program? Days _____</p> <p>26D. Over the past year, about how many days have you personally done other recreational activities on the land you enrolled in the NRCS habitat program? Days _____</p>	<input checked="" type="checkbox"/>	
<p>27. Since you enrolled in the NRCS habitat program, which of the following people have seen or heard American Woodcock on or near the land you managed for young forest?</p> <p>You <input type="checkbox"/></p> <p>NRCS employees, partner foresters, or partner biologists <input type="checkbox"/></p> <p>Someone else <input type="checkbox"/></p>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

<p>NO RESPONSE <input type="checkbox"/></p> <p>28. Since you enrolled in the NRCS habitat program, which of the following people have seen or heard a Golden-winged Warbler on or near the land you managed for young forest? You <input type="checkbox"/> NRCS employees, partner foresters, or partner biologists <input type="checkbox"/> Someone else <input type="checkbox"/> NO RESPONSE <input type="checkbox"/></p> <p>29. Since you enrolled in the NRCS habitat program, which of the following people have seen or heard other birds that use young forest habitat on or near the land you managed for young forest? You <input type="checkbox"/> NRCS employees, partner foresters, or partner biologists <input type="checkbox"/> Someone else <input type="checkbox"/> NO RESPONSE <input type="checkbox"/></p> <p>FOR TREATMENT GROUP ONLY:</p> <p>30A. In the past two years you were sent two letters that included bird monitoring results from the enrolled property. Did you receive a mailing last year, which was delivered in October 2015 to you by mail or email? Yes <input type="checkbox"/> No <input type="checkbox"/> NO RESPONSE <input type="checkbox"/></p> <p>30B. (IF 30A=YES): Do you recall what this letter said about the presence of birds on your property? Yes <input type="checkbox"/> No <input type="checkbox"/> NO RESPONSE <input type="checkbox"/></p> <p>31A. Did you receive a letter in December 2016 by mail which included results from bird monitoring from the enrolled property? Yes <input type="checkbox"/> No <input type="checkbox"/> NO RESPONSE <input type="checkbox"/></p> <p>31B. (IF 31A=YES): Do you recall what this letter said about the presence of birds on your property? Yes <input type="checkbox"/> No <input type="checkbox"/> NO RESPONSE <input type="checkbox"/></p>		
<p>32A. When biologists visited the enrolled property to monitor for birds did you meet with them? Yes <input type="checkbox"/> No <input type="checkbox"/> NO RESPONSE <input type="checkbox"/></p> <p>32B. (IF 32A=YES): Did you accompany these biologists during one or more monitoring site visits? Yes <input type="checkbox"/> No <input type="checkbox"/> NO RESPONSE <input type="checkbox"/></p>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<p>33. Finally, I would like to ask you some background information about yourself: Are you a member of any land or wildlife related organizations? Examples might include game species organizations such as the National Wild Turkey Federation, forest owner associations, and conservation organizations such as the Audubon Society. Yes (specify): _____ None <input type="checkbox"/> NO RESPONSE: <input type="checkbox"/></p>	<input checked="" type="checkbox"/>	
<p>34. In what year were you born? Year: _____ NO RESPONSE: <input type="checkbox"/></p>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

<p>35. What is the highest level of formal education you have completed?</p> <p>Less than high school <input type="checkbox"/></p> <p>High school diploma/G.E.D <input type="checkbox"/></p> <p>Some college or technical school <input type="checkbox"/></p> <p>Associate's degree <input type="checkbox"/></p> <p>College undergraduate degree <input type="checkbox"/></p> <p>(for example, B.A., B.S.)</p> <p>Graduate or professional degree <input type="checkbox"/></p> <p>(for example, M.S., Ph.D., M.D.)</p> <p>NO RESPONSE <input type="checkbox"/></p> <p>36. What is your gender?</p> <p>Male <input type="checkbox"/></p> <p>Female <input type="checkbox"/></p> <p>Other <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p> <p>FOR CONTROL GROUP ONLY:</p> <p>37. Thanks so much! A letter with the monitoring results from your property will be arriving in the next month. Would you be willing to take a shorter follow up phone survey if I called you back sometime in May?</p> <p>Yes <input type="checkbox"/></p> <p>No <input type="checkbox"/></p> <p>That is all the questions that I have for you. Thank you for your time and have a great day.</p>		
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Appendix C. Follow Up Survey

Survey Questions	Default Survey	Group Owner Survey
<p>INTRODUCTION:</p> <p>Hi, my name is (insert). I am a (affiliation) at Virginia Tech. May I please speak with _____?</p> <p>⇒ If he/she is not available: When may I call back to reach him/her? Date and time: _____</p> <p>Thank you again for completing the telephone survey with me when I called several months ago. I am calling you back today because you indicated you would be interested in taking a follow-up survey with me after you had received a mailing with bird monitoring results from your property.</p> <p>As you know, I am conducting a research study to learn more about landowners who enrolled in Natural Resource Conservation Service habitat programs to help improve how well these programs meet conservation goals and landowner objectives for their land. The follow-up phone survey will take about 10-20 minutes to complete. Your participation is voluntary, and your identity and responses will be kept confidential.</p> <p>Information collected by NRCS partners about your habitat project including land acreage enrolled, contract dates, practices implemented, and biological results of management will be included in this research with your survey responses. The results of this research study will be published and used in a Masters thesis. There are no known</p>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

<p>risks associated with this survey. Although we would greatly appreciate your help, you are free to decline this survey.</p> <p>Do you consent to participate in this research study? Yes <input type="checkbox"/> No <input type="checkbox"/> [if no, thank them and end call].</p> <p>[If yes] Thanks for your willingness to participate. As we move through the survey, please feel free to ask for clarification if I have phrased something unclearly. The follow-up survey consists of a sub-set of questions that I asked in the first survey, so some questions may sound familiar. Thank you in advance for your patience.</p> <p>In this survey, I will ask you about your involvement in an NRCS habitat program. Some people participate in more than one NRCS program, so to make it clear which I am talking about, the enrolled property address is (_____) and the contract involved (_____) practices.</p>		
<p>1A. Did you receive a letter in March 2017 by mail which included results from bird monitoring from the enrolled property? Yes <input type="checkbox"/> No <input type="checkbox"/> [if no, thank them and end call]</p> <p>1B. (IF 1A=YES): Do you recall what this letter said about the presence of birds on your property? Yes <input type="checkbox"/> No <input type="checkbox"/></p> <p>***If respondent is a family forest owner (Individual, Joint, Family Partnership, Trust or Estate) use survey version 1. Club or Association, Corporation or Business, and Other use version 2 of the survey.</p>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<p>Enrolling land in an NRCS habitat program might result in many different outcomes. We are interested in what outcomes the program had for you and your property.</p> <p>2A. What effect did participating in the NRCS habitat program have on your access to expert advice on forest management on your land? Very Positive effect <input type="checkbox"/> Positive Effect <input type="checkbox"/> No Effect <input type="checkbox"/> Negative Effect <input type="checkbox"/> Very Negative Effect <input type="checkbox"/></p> <p>2B. What effect did participating in the NRCS habitat program have on your ability to afford costs related to habitat creation or maintenance on your land?</p> <p>2C. What effect did participating in the NRCS habitat program have for hunting opportunities on your land?</p> <p>2D. What effect did participating in the NRCS habitat program have for bird-watching opportunities on your land?</p> <p>2E. What effect did participating in the NRCS habitat program have on American Woodcock on your land?</p> <p>How certain are you about the answer you just gave? Very Certain <input type="checkbox"/> Certain <input type="checkbox"/> Neither Certain or Uncertain <input type="checkbox"/> Uncertain <input type="checkbox"/> Very Uncertain <input type="checkbox"/></p> <p>2F. What effect did participating in the NRCS habitat program have on Golden winged Warblers on your land?</p> <p>How certain are you about the answer you just gave?</p>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

<p>2G. What effect did participating in the NRCS habitat program have on other birds that use young forest habitat your land?</p> <p>How certain are you about the answer you just gave?</p> <p>2I. What effect did participating in the NRCS habitat program have on the scenery on your land?</p> <p>2J. What effect did participating in the NRCS habitat program have on the forest health on your land?</p> <p>2K. What effect did participating in the NRCS habitat program have on timber harvesting for income on your land?</p> <p>2L. What effect did participating in the NRCS habitat program have on the property value of your land?</p>		
<p>Okay, now I have a few questions about your level of satisfaction with different parts of the NRCS habitat program. For each you can respond on a 1 to 10 scale, where 1 is not at all satisfied, 5 is moderately satisfied, and 10 is completely satisfied.</p> <p>3A. How satisfied are you with the conservation program overall?</p> <p>3B. How satisfied are you with the program cost-share payments?</p> <p>3C. How satisfied are you with the wildlife outcomes on your land?</p> <p>3D. How satisfied are you with your interactions with Natural Resources Conservation Service employees, partner biologists, and partner foresters?</p>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<p>Thanks! To what extent do you agree or disagree with the following statements:</p> <p>4A. You trust the expertise of NRCS employees, partner biologists, and partner foresters to help you achieve your land management goals.</p> <p>Strongly Agree <input type="checkbox"/></p> <p>Agree <input type="checkbox"/></p> <p>Neither <input type="checkbox"/></p> <p>Disagree <input type="checkbox"/></p> <p>Strongly Disagree <input type="checkbox"/></p> <p>NOT SURE <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p> <p>4B. You feel that you have similar values to the NRCS employees, partner biologists, and partner foresters.</p> <p>4C. The rules and procedures of the NRCS habitat program ensure that you are treated fairly.</p>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<p>In the next sections I am going to ask you about managing for young forest on your property. The term young forest refers to areas with well-developed ground cover, shrubs, and young trees, and the absence of a closed tree canopy. It may help to picture the area that you have managed through this NRCS habitat program- how it looks now and over the next few years as the vegetation grows in.</p> <p>When I say management or managing, I mean taking actions on your property to influence trees or other plant cover. In this survey, when I say managing for young forest I am referring to both actively creating new young forest and taking action to maintain existing young forest.</p> <p>Your contract with the NRCS habitat program ends in [YEAR] OR ended in [YEAR].</p> <p>5. How likely are you to manage for (again, as a reminder I mean create or maintain) young forest on your land within ten years after your contract end date by re-enrolling in a Natural Resources Conservation Service program?</p> <p>Not At All Likely <input type="checkbox"/></p> <p>Slightly Likely <input type="checkbox"/></p> <p>Moderately Likely <input type="checkbox"/></p> <p>Very Likely <input type="checkbox"/></p>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Extremely Likely <input type="checkbox"/> NO RESPONSE <input type="checkbox"/>		
<p>IF CONTRACT HAS ENDED:</p> <p>6A. Since we spoke on (_____), have you used any management practices to manage- either create or maintain- for young forest on your land <u>without cost share payments</u>?</p> Yes <input type="checkbox"/> No <input type="checkbox"/> <p>6B. Which of the following management practices have you used since (_____) to manage for young forest on your land without cost share payments? For each practice you can say yes or no:</p> Cutting a <u>new patch</u> of trees about 10 acres or more in size while leaving behind some mature trees standing in the area <input type="checkbox"/> Cutting to <u>expand an existing patch</u> of young forest while leaving behind some mature trees standing in the area <input type="checkbox"/> Applying herbicides to invasive plants <input type="checkbox"/> Mechanical removal of invasive plants <input type="checkbox"/> Establishing or maintaining native tree or shrub plantings <input type="checkbox"/> Maintaining deer fencing <input type="checkbox"/> Mechanical brush clearing (also called brush hogging) <input type="checkbox"/> Cutting shrubs such as alder <input type="checkbox"/> Prescribed burning <input type="checkbox"/> NOT SURE <input type="checkbox"/> NO RESPONSE <input type="checkbox"/> <p>FOR EVERYONE:</p> <p>6C. If <u>further cost share payments were not available</u>, which of the following management practices would you use in the future to manage- either create or maintain- for young forest on your land within ten years after your contract end date: For each practice you can say yes or no:</p> Cutting a <u>new patch</u> of trees about 10 acres or more in size while leaving behind some mature trees standing in the area <input type="checkbox"/> Cutting to <u>expand an existing patch</u> of young forest while leaving behind some mature trees standing in the area <input type="checkbox"/> Applying herbicides to invasive plants <input type="checkbox"/> Mechanical removal of invasive plants <input type="checkbox"/> Establishing or maintaining native tree or shrub plantings <input type="checkbox"/> Maintaining deer fencing <input type="checkbox"/> Mechanical brush clearing (also called brush hogging) <input type="checkbox"/> Cutting shrubs such as alder <input type="checkbox"/> Prescribed burning <input type="checkbox"/> NOT SURE <input type="checkbox"/> NO RESPONSE <input type="checkbox"/> <p>7. If <u>further cost share payments were not available</u>, how likely are you to manage for young forest on your land (using any of the practices described in the previous question) in the future within ten years after your contract end date?</p> Not At All Likely <input type="checkbox"/> Slightly Likely <input type="checkbox"/> Moderately Likely <input type="checkbox"/> Very Likely <input type="checkbox"/> Extremely Likely <input type="checkbox"/> NO RESPONSE <input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Regardless of whether or not you intend to keep managing for young forest on your land after your contract ends, we are interested in what you think the effects would be if you did choose to manage for young forest <u>without further cost share payments</u> .	<input checked="" type="checkbox"/>	

<p>To what extent do you agree or disagree with the following statements:</p> <p>9A. Managing for young forest on your land within ten years after your contract end date would benefit hunting opportunities on your land:</p> <p>Strongly Agree <input type="checkbox"/></p> <p>Agree <input type="checkbox"/></p> <p>Neither Agree or Disagree <input type="checkbox"/></p> <p>Disagree <input type="checkbox"/></p> <p>Strongly Disagree <input type="checkbox"/></p> <p>NOT SURE <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p> <p>9B. Managing for young forest on your land within ten years after your contract end date would benefit bird-watching opportunities on your land:</p> <p>9C. Managing for young forest on your land within ten years after your contract end date would benefit American Woodcock on your land:</p> <p>9D. Managing for young forest on your land within ten years after your contract end date would benefit Golden-winged Warblers on your land:</p> <p>9E. Managing for young forest on your land within ten years after your contract end date would benefit other birds that use young forest habitat on your land:</p> <p>9F. Managing for young forest on your land within ten years after your contract end date would improve the scenery on your land:</p> <p>9G. Managing for young forest on your land within ten years after your contract end date would benefit forest health on your land:</p> <p>9H. Managing for young forest on your land within ten years after your contract end date would improve timber harvesting for income on your land:</p> <p>9I. Managing for young forest on your land within ten years after your contract end date would benefit the property value of your land:</p>		
<p>10A. How common is it that other landowners in the region purposely manage for young forest on their land without cost share payments?</p> <p>Not At All Common <input type="checkbox"/></p> <p>Slightly Common <input type="checkbox"/></p> <p>Moderately Common <input type="checkbox"/></p> <p>Very Common <input type="checkbox"/></p> <p>Extremely Common <input type="checkbox"/></p> <p>NOT SURE <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p> <p>10B. When it comes to management activities you do on your land, how important are the opinions of other landowners in the region to you?</p> <p>Not at all Important <input type="checkbox"/></p> <p>Slightly Important <input type="checkbox"/></p> <p>Moderately Important <input type="checkbox"/></p> <p>Very Important <input type="checkbox"/></p> <p>Extremely Important <input type="checkbox"/></p> <p>NOT SURE <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p>	<p><input checked="" type="checkbox"/></p>	

<p>To what extent do you agree or disagree with the following statements: 10C. Other landowners in the region think that you should manage your land for young forest within ten years after your contract end date if <u>further cost share payments were not available</u></p> <p>Strongly Agree <input type="checkbox"/></p> <p>Agree <input type="checkbox"/></p> <p>Neither Agree or Disagree <input type="checkbox"/></p> <p>Disagree <input type="checkbox"/></p> <p>Strongly Disagree <input type="checkbox"/></p> <p>NOT SURE <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p>		
<p>11A. People who are important to you think that you should manage for young forest on your land within ten years after your contract end date <u>if further cost share payments were not available</u>:</p> <p>Strongly Agree <input type="checkbox"/></p> <p>Agree <input type="checkbox"/></p> <p>Neither Agree or Disagree <input type="checkbox"/></p> <p>Disagree <input type="checkbox"/></p> <p>Strongly Disagree <input type="checkbox"/></p> <p>NOT SURE <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p> <p>11B. People you respect and admire think you should manage for young forest on your land within ten years after your contract end date <u>if further cost share payments were not available</u>:</p> <p>Strongly Agree <input type="checkbox"/></p> <p>Agree <input type="checkbox"/></p> <p>Neither Agree or Disagree <input type="checkbox"/></p> <p>Disagree <input type="checkbox"/></p> <p>Strongly Disagree <input type="checkbox"/></p> <p>NOT SURE <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p> <p>12A. If you really wanted to, you could manage for young forest without further cost share payments within ten years after your contract end date:</p> <p>Strongly Agree <input type="checkbox"/></p> <p>Agree <input type="checkbox"/></p> <p>Neither Agree or Disagree <input type="checkbox"/></p> <p>Disagree <input type="checkbox"/></p> <p>Strongly Disagree <input type="checkbox"/></p> <p>NOT SURE <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p> <p>13A. <u>If further cost share payments were not available</u>, is managing for young forest on your land within ten years after your contract end date:</p> <p>Very Desirable <input type="checkbox"/></p> <p>Desirable <input type="checkbox"/></p> <p>Neither Desirable or Undesirable <input type="checkbox"/></p> <p>Undesirable <input type="checkbox"/></p> <p>Very Undesirable <input type="checkbox"/></p> <p>NO RESPONSE <input type="checkbox"/></p>	<input checked="" type="checkbox"/>	
<p>14. Since you enrolled in the NRCS habitat program, which of the following people have seen or heard American Woodcock on or near the land you managed for young forest?</p> <p>You <input type="checkbox"/></p> <p>NRCS employees, partner foresters, or partner biologists <input type="checkbox"/></p>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Someone else
NO RESPONSE

15. Since you enrolled in the NRCS habitat program, which of the following people have seen or heard a Golden-winged Warbler on or near the land you managed for young forest?

You
NRCS employees, partner foresters, or partner biologists
Someone else
NO RESPONSE

16. Since you enrolled in the NRCS habitat program, which of the following people have seen or heard other birds that use young forest habitat on or near the land you managed for young forest?

You
NRCS employees, partner foresters, or partner biologists
Someone else
NO RESPONSE

17A. When biologists visited the enrolled property to monitor for birds did you meet with them?

Yes
No
NO RESPONSE

17B. (IF 17A=YES): Did you accompany these biologists during one or more monitoring site visits?

Yes
No
NO RESPONSE

18. Finally, you indicated that you received a letter in March that included results from bird monitoring from the enrolled property. In a few sentences could you describe what effect, if any, the result letter had on you?

That is all the questions that I have for you. Thank you for your time and have a great day!

Appendix D. Chapter 2 Correlation Matrix

	Re-enrollment Intention	Persistence Intention	Environmental Motivation	Profit Motivation	Cost Share Motivation	Hunting Motivation	Scenery Motivation	Agency Trust	Program Satisfaction	Education	Management Plan
Re-enrollment Intention	-	-	-	-	-	-	-	-	-	-	-
Persistence Intention	0.216 ^a	-	-	-	-	-	-	-	-	-	-
Environmental Motivation	0.296 ^a	0.253 ^a	-	-	-	-	-	-	-	-	-
Profit Motivation	0.075 ^a	-0.113 ^a	0.001 ^a	-	-	-	-	-	-	-	-
Cost Share Motivation	0.368 ^a	-0.175 ^a	0.196 ^a	0.158 ^a	-	-	-	-	-	-	-
Hunting Motivation	0.208 ^a	0.092 ^a	-0.084 ^a	0.081 ^a	0.030 ^a	-	-	-	-	-	-
Scenery Motivation	0.125 ^a	0.021 ^a	0.247 ^a	0.265 ^a	0.211 ^a	-0.001 ^a	-	-	-	-	-
Agency Trust	0.370 ^a	0.284 ^a	0.292 ^a	-0.044 ^a	0.102 ^a	0.074 ^a	-0.035 ^a	-	-	-	-
Program Satisfaction	0.266 ^b	0.123 ^b	0.261 ^b	0.140 ^b	0.126 ^b	0.038 ^b	0.037 ^b	0.438 ^b	-	-	-
Education	-0.002 ^a	0.123 ^a	0.289 ^a	-0.168 ^a	0.161 ^a	-0.026 ^a	-0.064 ^a	0.107 ^a	-0.109 ^b	-	-
Management Plan	0.289 ^b	0.106 ^b	0.151 ^b	-0.028 ^b	0.384 ^b	-0.052 ^b	0.139 ^b	0.130 ^b	-0.020 ^b	0.166 ^a	-
Group Owner	0.199 ^b	0.236 ^b	0.035 ^b	-0.275	0.213	0.135	-0.153 ^b	0.218 ^b	0.121 ^b	0.120 ^a	0.274 ^b

^aSpearman's correlation, ^bPearson's correlation.