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Social influence and forest habitat conservation: Experimental evidence from Vermont's maple producers

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Abstract

Working landscapes can provide biodiversity and ecosystem services. Many voluntary conservation programs ask those who manage working lands—farmers, ranchers, and forest landowners—to steward their resources in ways that maintain or increase these benefits. While research on landowners suggests the importance of social influence in management decisions, few studies have tested whether providing information about the behavior and opinions of others affects decisions related to private land and forest management, stewardship, or conservation. Using a randomized controlled trial design, we mailed three versions of a solicitation letter for a bird habitat conservation program to 967 individuals who manage forests to produce maple syrup. Maple producers who were messaged about recognition for participation were as likely to ask for more information about the program as those who received only a control message that described the program. Providing information about the participation of others had a negative effect on the number of producers requesting information compared to the control. These results highlight the importance of context in using social influence to change land manager behavior. Findings are relevant to conservation researchers and practitioners, offering applications of behavioral science to improve biodiversity and ecosystem service outcomes on private lands.

KEYWORDS

behavioral science, biodiversity conservation, field experiment, forest management, nudge, private lands, social influence, working landscapes

1 | INTRODUCTION

Working landscapes—croplands, pastures, and managed forests—cover nearly half of the planet's land surface (Foley et al., 2005). Although designated for production, they can deliver biodiversity conservation and ecosystem services when well managed (Kremen & Merenlender, 2018). The decisions of farmers, ranchers, and forest landowners are often key to conservation success (Hilty & Merenlender, 2003; Pasquini, Cowling, Twyman, & Wainwright, 2010).

Audience: This paper is written for conservation researchers and practitioners, offering applications of behavioral science to improve biodiversity and ecosystem service outcomes on private lands.

Since many of the environmental benefits and costs of private land management extend beyond the parcel, government agencies and non-governmental organizations offer voluntary programs encouraging private land owners and managers to account for social impacts, including conservation outcomes.

These programs are often designed to address the financial costs or information needs of changing management practices (Hanley, Banerjee, Lennox, & Armsworth, 2012). Research on private land managers, however, has found a range of non-monetary factors to be associated with management decisions (Baumgart-Getz, Prokopy, & Floress, 2012; Dayer, Lutter, Sesser, Hickey, & Gardali, 2017).

Surveys of farmer and forest owner management behavior indicate the importance of social and psychological variables, including social and cultural norms, empathy, autonomy, and habit, among others (e.g., Garbach & Morgan, 2017; Huff, Leahy, Hiebeler, Weiskittel, & Noblet, 2015; Mzoughi, 2011). While land managers who are environmentally conscious tend to be the most likely to engage with conservation programs, participation is also related to non-pecuniary external factors and program characteristics, including the participation of others and the complexity and clarity of information (Davis & Fly, 2010; Dayer, Stedman, Allred, Rosenberg, & Fuller, 2016; Reimer & Prokopy, 2014).

Behavioral science shows how leveraging social norms and other simple changes to program design can have policy-relevant effects on behavior (Kraft-Todd, Yoeli, Bhanot, & Rand, 2015; Madrian, 2014). Rather than restricting choice or changing financial incentives, researchers, and program managers have altered how or when options are presented, by whom, and in what context (Nelson, Partelow, & Schlüter, 2019). Often, these strategies employ social influence—leveraging people's sensitivity to the opinions and behavior of others (Abrahamse & Steg, 2013). These “behavioral interventions” have produced gains in a range of pro-social and pro-environmental individual behaviors, yet there have been few applications to decisions about land and natural resource management (Byerly et al., 2018). Behavioral strategies are often low-cost and preserve freedom of choice, making them well suited for stretched conservation budgets and property owners possibly resistant to mandates (Ferraro, Messer, & Wu, 2017). Applications of behavioral insights to land management decisions may offer new and essential policy options to achieve conservation goals (Reddy et al., 2017).

Understanding what influences private forest management decisions is critical for conservation outcomes. Here, we bring behavioral science into conservation practice to address the following question: does leveraging social influence through a simple change in messaging affect land managers' engagement with a conservation program?

We conducted a field experiment that tested whether information about (a) the participation of others or (b) public recognition influenced land managers' interest in conservation. In partnership with two practitioner organizations, we mailed different versions of a solicitation letter for a habitat conservation program to forest landowners who produce maple syrup. We measured differences in requests for more information about the program across the two treatment groups and a control.

In our study context—the Northern Forest of the United States, a highly forested region dominated by 1.7 million family forest ownerships (Butler et al., 2016)—management decisions are essential to maintaining biodiversity benefits and ecosystem services. Every year, neo-tropical migratory bird species, including those of conservation priority, move from their wintering grounds in Central and South America to breed in the Northern Forest (Goetz, Sun, Zolkos, Hansen, & Dubayah, 2014). Habitat suitability for these species is influenced by forest composition and structure (Bakermans, Rodewald, & Vitz, 2012; Thompson & Capen, 1988). But habitat availability is declining, in part due to historic, intensive land use (agricultural clearing, clear-cut harvesting), and contemporary management practices that promote homogeneity in age structure across much of the privately owned forested land in the northeast (Ducey, Gunn, & Whitman, 2013). The region is also facing other large-scale environmental challenges, such as climate change and invasive pests, which threaten to reduce forest complexity (Foster et al., 2017). These changes will be compounded, as compositional and structural diversity are important for the delivery of ecosystem services, including tree biomass production and soil carbon storage (Gamfeldt et al., 2013). Despite these trends, family forest owners rank “wildlife” and “nature” in the top three reasons for owning their land, suggesting a pro-conservation norm (Butler et al., 2016). A range of governmental and non-governmental programs (e.g., Current Use, Forest Stewardship Program) seek to increase active forest management and stewardship actions that improve diversity in forest structure and species, yet drivers of and additional gains from participation are not well known (Ma, Butler, Kittredge, & Catanzaro, 2012).

Leveraging social influence could be an effective strategy for engaging forest owners in conservation programs. Forest owners report peers as important sources of information about management decisions (Kittredge, Rickenbach, Knoot, Snellings, & Erazo, 2013; Sagor & Becker, 2014). Information about other landowners' behavior is associated with reported and observed participation in programs for endangered and invasive species (Niemiec, Ardoin, Wharton, & Asner, 2016; Sorice, Haider, Conner, & Ditton, 2011), wildfire mitigation (Fischer & Charnley, 2012), and sustainable land management (Chen, Lupi, He, & Liu, 2009; Kuhfuss et al., 2016). However, we are not aware of any studies that have measured a causal effect of social information on observed forest landowner behavior.

By testing behavioral interventions in the context of land management we contribute (a) to the understanding of these strategies (i.e., can social influence affect land management decisions?) and (b) to the applicability of new policy tools to an important social dilemma (i.e., can behavioral insights influence behaviors related to biodiversity conservation?). We also add to the scant literature on the social dimensions of maple sugaring—a $141 million industry across 13 states and growing in extent (Snyder, Kilgore, Emery, & Schmitz, 2018; USDA, 2018).

2 | METHODS

2.1 | Context

We collaborated with Audubon Vermont and Vermont Maple Sugar Makers' Association (VMSMA) to conduct a field experiment on songbird habitat conservation in the Northern Forest of Vermont. Vermont is the leading producer of maple syrup in the United States, averaging nearly 7.5 million liters annually from an estimated 37,800 ha of privately owned forest[1] (USDA, 2018). These production forests (called "sugarbushes") are often managed within larger parcels of forested land (Farrell, 2013), which provide essential habitat for bird species that breed and nest in the region.

The conservation program we used was a joint program developed by Audubon Vermont, VMSMA, and Vermont Department of Forests, Parks, and Recreation. This program, called the Bird-Friendly Maple Project, invites producers to manage their sugarbush for multiple objectives in exchange for recognition that increases visibility and reputation. Participants agree to an inventory of bird habitat in their forest, minimize harvesting of trees from the forest during nesting season, and have a formal forest management plan that acknowledges bird habitat as a priority. Forest bird habitat for many target species of the program requires tree species diversity and complexity of forest structure. This management also has positive co-benefits on broader forest biodiversity and the delivery of ecosystem services (Doerfler, Gossner, Müller, Seibold, & Weisser, 2018; Gamfeldt et al., 2013). Unlike USDA Organic and Forest Stewardship Council, there are no fees to participate in the program.

At the start of our study, there were 27 producers in the Bird-Friendly Maple Project representing 2,412 ha of forest land. Early efforts to recruit producers into the program, which was established in 2014, included presentations at the Vermont Maple Conferences and outreach through VMSMA newsletters and email communications. Previous messaging about the program included benefits to birds, benefits to forest sustainability, and marketing benefits to producers.

These initial assessments found that Vermont sugar makers who were interested in the Bird-Friendly Maple program were often managing their land in ways which do provide habitat for migratory and nesting birds but needed guidance on how to improve. Participating producers have reported incorporating this information to revise their forest management practices (e.g., leaving dead woody material or maintaining diverse forest composition in harvesting decisions). This anecdotal evidence is supported by the only study we are aware of that links maple production and biodiversity management (Clark & McLeman, 2012). Thus, for producers who already manage in bird-friendly ways, the program does not require costly, large-scale changes in forest structure but instead creates a pipeline for information and asks for a commitment to maintain and improve practices over time, both publicly and contractually (as reflected in their forest management plans).

2.2 | Sample

VMSMA provided a list of their membership, including mailing addresses and the size of the maple production operation (in membership categories based on number of taps). We included only members of VMSMA that were maple producers, had valid mailing addresses, and were not already part of the Bird-Friendly Maple Project. This resulted in a sample of 967 individuals, families, and businesses. This list was merged with maple producers from the United States Department of Agriculture (USDA) Organic INTEGRITY Database to determine which were certified organic (see Appendix S1 for more on the data and matching process).

Almost half of our sample (42%) had less than 1,000 taps, which approximates to 7 ha or less of forestland in syrup production (Farrell, 2013). Producers were located across the state, and 26 producers had a mailing address outside Vermont. Eleven percent of our sample was USDA certified organic, with the proportion of organic certification increasing with size of production.

2.3 | Experiment

Using a randomized controlled design, we tested messaging interventions using social influence to elicit interest in the Bird-Friendly Maple Project. We incorporated our tests into three versions of a mailing to VMSMA members about the program (Table 1).

The mailings asked recipients if they would like to receive more information about the Bird-Friendly Maple Project, with an option to check "YES" or "NO." Those who checked "YES" also provided an email address or phone number to indicate how they would like to be contacted. This request for information served as our behavioral outcome, a measure of engagement with the conservation program. Similar designs have been used to experimentally test farmer engagement in conservation practices (Kuhfuss et al., 2016; Wallander, Ferraro, & Higgins, 2017), including using

TABLE 1 Control and treatment groups

	Mailing wording	N	<1,000 taps	% organic
Control	"The Bird-Friendly Maple Project"	323	135	9.9
Peer participation	"Many of your fellow sugar makers are part of …" "Join dozens of Vermont sugar makers who are part of the program"	321	134	12.1
Recognition	"Recognizing the stewardship of sugar makers through …" "Earn recognition and visibility for forest stewardship"	323	135	12.1

Note: N, total number of producers who received that version of the mailing; <1,000 taps, number of producers within the total that were designated "small" in block random assignment; % organic, proportion of sample that was USDA certified organic.
Mailing wording for treatment groups is additive to the control.

a request for information as the dependent variable (Andrews, Clawson, Gramig, & Raymond, 2013).

The content of the mailings was designed in collaboration with Audubon Vermont and pre-tested on a small group prior to deployment. All mailings were sent first-class in envelopes with VMSMA logos to increase the likelihood of opening.

All producers in our sample received a 6 × 9" envelope containing a promotional card ("Promotion"), a response card ("Response"), and a postage-paid envelope (Figures S1 and S2). The Promotion card displayed photos of forest-dwelling songbirds under the name of the program. On the back, there was a message requesting the producer to complete the enclosed survey and a brief list of benefits of program participation, all related to forest health and forest birds. The second, smaller Response card listed the name of the program on one side and a five-question survey on the other (see *Survey*, below), including the option to request more information.

This baseline version acted as the control. Each treatment built on this version with short phrases in three locations in the mailing (Figure 1).

2.4 | Treatment 1: Peer participation messaging

This treatment highlighted the participation of other producers in the Bird-Friendly Maple Project. This provided a descriptive social norm by indicating how others are behaving. Such information signals which behaviors are common in a given situation and can lead people to follow suit (Cialdini, Kallgren, & Reno, 1991). For example, hotel guests who learned of others' water conservation behavior were more likely to reuse their towels than those who learned only of the environmental benefits of towel reuse (Goldstein, Cialdini, & Griskevicius, 2008). Similar applications of descriptive norms have shown to increase curbside recycling (Schultz, 1999), household energy conservation (Allcott, 2011), and voter turnout (Gerber, Green, & Larimer, 2008). Such information about the behavior of others has shown consistent effects on encouraging pro-environmental behavior (Farrow, Grolleau, & Ibanez, 2017), even among people who rate normative information as the least motivating behavior-change lever (Nolan, Schultz, Cialdini, Goldstein, & Griskevicius, 2008).

In addition to the text in the control version, this treatment included the statements, "Many of your fellow sugar makers are part of (the Bird-Friendly Maple Project)" and "Join dozens of Vermont sugar makers who are part of the program." These statements were meant to demonstrate that other producers have made the commitment to manage their sugarbush in ways that benefit birds. Informal interviews with producers prior to designing the experiment indicated that other producers are sources of information. This is supported by survey evidence of maple producers (Kuehn, Chase, & Sharkey, 2017; Murphy, Chretien, & Brown, 2012). Thus, it was expected that producers receiving this messaging would be more likely to request more information about the Bird-Friendly Maple Project than those who received only information about the program.

2.5 | Treatment 2: Recognition messaging

This treatment made salient the recognition benefits of participating in the Bird-Friendly Maple Project. Public recognition makes one's behavior known to or observable by others. This engages reputational concerns, as people are often motivated to maintain a positive image (Bénabou & Tirole, 2006). As a behavioral intervention, it has shown to increase charitable donations (Ariely, Bracha, & Meier, 2009), work performance (Bradler, Dur, Neckermann, & Non, 2016), and residential energy conservation (Yoeli, Hoffman, Rand, & Nowak, 2013). People are repeatedly more willing to incur personal costs in time, money, and effort for a socially desirable cause when others are informed of their behavior (Kraft-Todd et al., 2015).

FIGURE 1 Promotional card sent to maple producers and variations by treatment. The reverse side included text about the benefits of the program and treatment-specific text (Table 1)

This version of the mailing augmented the control with the statements, "Recognizing the stewardship of sugar makers through (the Bird-Friendly Maple Project)" and "Earn recognition and visibility for forest stewardship." It also included an image of the certification sticker offered to participants, which says "Produced in Bird-friendly Habitats." Audubon Vermont advertises these recognition benefits, which include signage for retail sales and a listing on Audubon's website, to attract producers to the Bird-Friendly Maple Project and other bird habitat conservation programs. We intended to test whether the explicit mention of those benefits would in fact increase interest in the program compared to information alone. Since this messaging highlighted how the program makes producers' behavior observable to others, it was expected to elicit concerns around image and reputation. We expected that this treatment would increase interest in the Bird-Friendly Maple Project.

2.6 | Assignment to treatment

Maple producers were assigned to treatment conditions through block randomization on size of operation. This technique can increase precision in estimating treatment effects if the grouping variable predicts the outcome (Imbens & Rubin, 2015). We suspected that producer size (number of taps) would be negatively correlated with our outcome measure for two reasons. First, larger producers are more likely to sell their syrup in bulk (Becot, Kolodinsky, & Conner, 2015). These producers would be less likely to value the brand reputation and eco-marketing to consumers offered by the Bird-Friendly Maple Project. Second, maple syrup sales are more likely to be the primary source of income for larger producers (Becot et al., 2015). For them, business decisions are likely to be more profit-motivated than for smaller producers who have other income streams and smaller forests to manage.

We stratified the sample into two blocks as in Snyder et al. (2018): less than 1,000 taps and 1,000 taps or more. The number of subjects in each treatment and the proportion that are certified organic is shown in Table 1.

Drawing on a laboratory experiment that provided information about others' land conservation behavior (Banerjee, Vries, Hanley, & Soest, 2014), which found a standardized effect size of 0.23 on socially efficient land use decisions (Janusch, Palm-Forster, Messer, & Ferraro, 2018), we expected to detect a small effect of our treatments. We hypothesized an effect size of 0.1 at $\alpha = 0.05$ and $n = 967$, giving us a power of 0.80. We used the Benjamini–Hochberg procedure to control the false discovery rate for multiple comparisons and report "BH adjusted" p values for treatment effects (Benjamini & Hochberg, 1995).

2.7 | Survey

While the primary objective of this study was to estimate treatment effects of social influence on a conservation behavior, we used this opportunity to collect information about Vermont maple producers. We included a brief survey to capture more specific information on size (number of taps and number of acres) and tenure (number of years the sugarbush has been in operation). We also asked subjects about the future of their sugarbush (number of years it is expected to stay in operation) and their primary reason for producing maple syrup.

Lastly, we provided an incentive of the chance to win $50 through a lottery to encourage responses to our mailing. A meta-analysis found that incentives increase response rates to mailed surveys (Edwards, Cooper, Roberts, & Frost, 2005). Producers were provided with a postage-paid business reply envelope addressed to the University of Vermont. The data collection process began July 16, 2018. A reminder email was sent from VMSMA 1 month after the initial mailing. The final responses were received by September 31, 2018.

3 | RESULTS

A total of 177 producers responded to the mailing, an 18% response rate. This is within the range of similar studies of maple producers and farmers (10–27%) (Andrews et al., 2013; Becot et al., 2015; Kuehn et al., 2017). The median number of taps was 1,300 across sugarbushes of 20 ha (Table 2), matching that of the total sample (median number of taps = 1,500) and previous studies of maple producers (Becot et al., 2015; Snyder et al., 2018). Respondents had been producing maple syrup for an average of 30 years. Analysis of variance (ANOVA) confirmed balance across treatments for number of hectares ($F = 0.59$, $p = .55$) and tenure ($F = 0.03$, $p = .97$) among respondents. The difference between number of taps was marginally significant ($F = 2.51$, $p = .08$), with those who responded to the peer information treatment having more taps on average than producers in the other two conditions (995 and 2,201 taps difference of means, 95% CI, 245 to 4,156 taps). This discrepancy is driven by two producers in that treatment with 38,000 and 35,000 taps, which are 50% larger than the next largest producer who responded to the survey, at 24,000 taps. Excluding these outliers, we see balance across treatments in number of taps ($F = 1.52$, $p = .22$) among respondents to the survey.

Enjoyment and income were the most frequently cited reasons for producing maple syrup (Figure 2). Regarding producers' intentions for their operations, we found that respondents expect their forests to stay in production for an average of 38 more years ($SD = 37$ years). Of survey respondents, 17% indicated they expect or hope their forest to stay in production indefinitely, 10% did not know, and 18% replied that their sugarbush would no longer be in production in the next 10 years. Since the survey was completed after producers had been treated by the social messaging, responses to these subjective questions could have been influenced by the treatments. There was a marginally significant difference between treatments among producers who rated stewardship as their primary reason for sugaring ($\chi^2(2, 177) = 4.92$, $p = .09$) (Figure 2). We found no difference between the future outlooks of respondents in different treatments ($F = .11$, $p = .9$).

3.1 | Treatment effects

Across all groups, the majority of those who replied to the mailing also requested more information about the Bird-Friendly Maple Project (86% of all returned Response cards). Twenty-four producers (2.5% of the full sample) completed the survey but opted not to receive more information. Half of these had received the peer participation message, which had more "NO" responses than the other two groups (Table 2). There is a marginally significant difference between responses to the mailing (requested information, responded but did not request information, and did not return response card) between the treatment groups ($\chi^2(4, 967) = 7.97$, $p = .09$).

Our primary outcome of interest was whether the request for information varied across treatment groups. The request rate among those in the control group was the highest, at 18.6%, while requests came from only 12.8% of those messaged about others' participation and 16.1% of those messaged about recognition (Figure 3; Table 3). This difference is not jointly significant ($\chi^2(2, 967) = 4.10$, $p = .13$). Pairwise comparisons between the control and each treatment suggest a negative effect of the peer participation message ($\chi^2(1, 644) = 4.10$, BH adjusted $p = .09$).

To increase the precision of the estimated treatment effects on the decision to request more information, we fit a linear probability model and included as predictors organic certification and size. The outcome variable was equal to one if the producer requested more information about the program or zero, otherwise. We estimated the intent-to-treat effects since we do not know whether all participants received the treatments.

These estimates are shown in Table 3. The values are similar to the differences observed without the regression. Producers who were informed about the participation of others were 6.1 percentage points less likely to request information about the Bird-Friendly Maple Project than those who received only the control message (95% CI, −11.8 to −0.5 percentage points, BH adjusted $p = .07$). We do not detect an effect of the recognition treatment on interest in the

TABLE 2 Descriptive statistics of respondents to mailing (by treatment and overall)

		Control	Peer participation	Recognition	All respondents
Size	Taps	1,100	1800	1,500	1300[a]
	Hectares	20	21	22	20
Tenure	Years[b]	30	30	30	30
Requested information	Yes	60	41	52	153
	No	8	12	4	24
Total responses		68	53	56	177

Note: Values for taps, hectares, and years are medians, as the distributions for these variables are right-skewed with outliers.
[a]The median number of taps of the full sample is 1,500 (using midpoints of tap categories).
[b]Some respondents answered this question in number of "generations," which we multiplied by 28 years (Fenner, 2005).

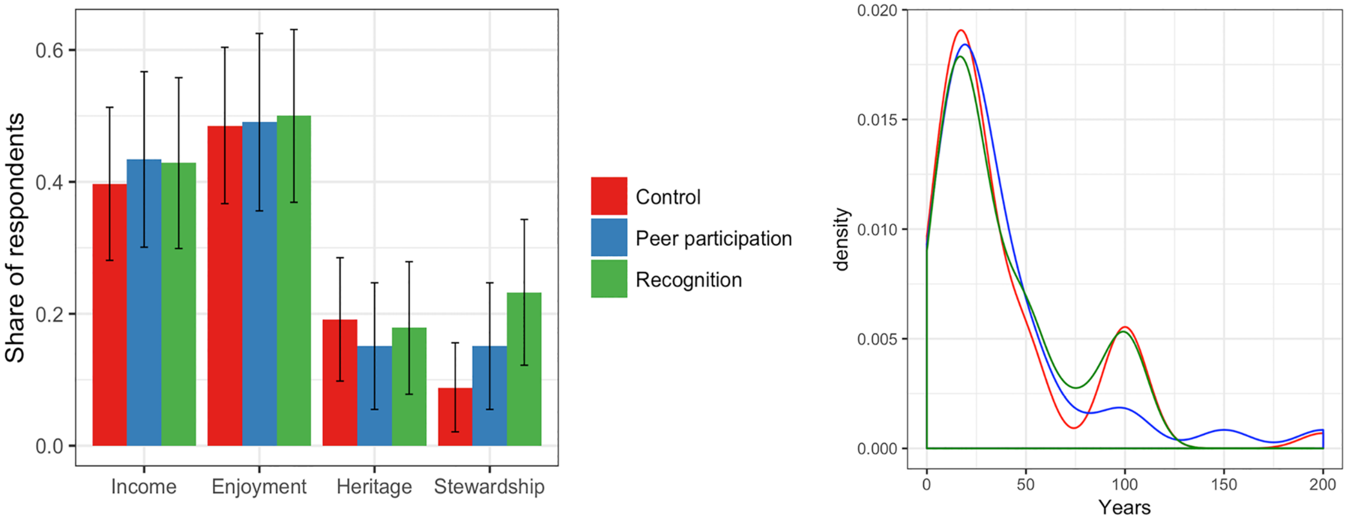

FIGURE 2 Survey responses of maple producers by treatment. Left: Primary reasons for producing maple syrup among survey respondents. The total share exceeds one because some producers selected more than one reason. Error bars represent 95% confidence intervals. Right: Length of time producers expect their sugarbushes to remain in maple production

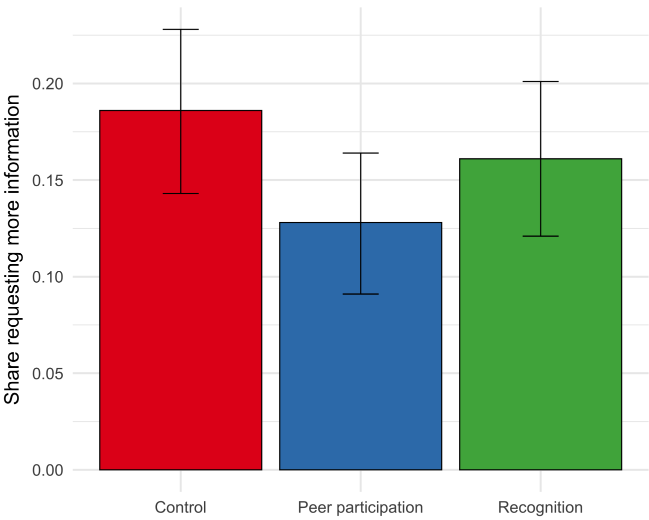

FIGURE 3 Proportions of each group that requested more information about the conservation program. Error bars are 95% confidence intervals

TABLE 3 Effects of social influence on requests for information about the conservation program

	Control	Peer participation	Recognition
Request rate	18.6	12.8	16.1
95% confidence interval (CI)	[14.3, 22.8]	[9.1, 16.4]	[12.1, 20.1]
Difference from control	—	−5.8[a]	−2.5
95% CI	—	[−11.4, −0.2]	[−8.3, 3.4]
Regression-adjusted difference	—	−6.1[a]	−2.7
95% CI	—	[−11.8, −0.5]	[−8.6, 3.2]

[a]Difference between treatment and control is significant at $p < .1$ adjusting for multiple comparisons. Regression-adjusted difference represents the coefficient from the linear probability model, which includes organic certification and size as predictors, and CIs are calculated using standard errors robust to heteroskedasticity (see Supplementary Information for full model results and alternative specifications).

program compared to the Control (95% CI, −8.6 to 3.2 percentage points, BH adjusted $p = .37$). Full model results and alternative specifications, including logistic regression, are available in Table S1.

4 | DISCUSSION

We tested whether simple changes to messaging that leverage social information could increase engagement in habitat conservation among forest landowners. By running a field experiment in partnership with a conservation organization, we offer evidence about working lands managers' behavior in a real-world context. Results from this study suggest that providing information about the participation of others in a habitat conservation program can reduce interest among forest owners. This effect demonstrates the sensitivity of behavioral interventions to the context in which they are implemented.

Although this study does not have the precision to conclude that the peer participation message changed behavior, the estimate and confidence interval suggest that the treatment had a negative effect on interest in the conservation program (Cumming, 2014). We offer several potential explanations for the direction of this effect. First, it is possible that the norm was not sufficiently common to motivate conformity. Although positive verbal quantifiers, such as "many," have shown to be effective in encouraging pro-environmental behaviors that are not done by a majority (Demarque, Charalambides, Hilton, & Waroquier, 2015), people often do not follow a minority norm (Mortensen et al., 2019; Sieverding, Decker, & Zimmermann, 2010). In fact, if maple producers did not personally know any others who were part of the program, the messaging in this treatment may have cued them to follow the more common non-participation norm of their network. This result would be consistent with the positive effects of descriptive social norms on behavior (Farrow et al., 2017; Kraft-Todd et al., 2015). Alternatively, personal identity may have conflicted with the norm. Personal characteristics, such as political affiliations, can moderate the effects of social norms and other behavioral interventions (Costa & Kahn, 2013; Trujillo-Barrera, Pennings, & Hofenk, 2016). Many private land managers value their self-sufficiency and autonomy in management decisions (Howley, 2015; Lequin, Grolleau, & Mzoughi, 2019). Maple producers' sense of autonomy may have been threatened by the social pressure message, thus, producing a defiant "no" (a response known as " psychological reactance") (Steindl, Jonas, Sittenthaler, Traut-Mattausch, & Greenberg, 2015). This could also explain the larger number of "No" responses in this treatment than in the others. Third, perhaps the information that others were participating in the program and providing habitat caused some producers to free-ride. Although information about the contributions of others often increases contributions to public goods (called "conditional cooperation") (Frey & Meier, 2004), the provision of habitat on working lands often comes at the opportunity cost of production. If producers felt that enough others were already supporting biodiversity, they may have decided to avoid the costs associated with doing so themselves. Finally, the external peer pressure could have crowded out intrinsic motives (Bowles, 2008). Producers may have been interested in the program but, when feeling extrinsic pressure to participate, they decided against getting involved.

This result is supported by other studies that employed descriptive norms and failed to increase desirable social outcomes. Wallander et al. (2017) included information about other farmers' program participation in mailings to farmers about the Conservation Reserve Program. While the letter itself increased enrollment, the effect was unchanged by the addition of social information. Efforts to increase tax payment compliance and 401(k) contributions also found providing information about the behavior of others to have a negative effect on behavior (Beshears, Choi, Laibson, Madrian, & Milkman, 2015; John & Blume, 2018). A growing body of research on similar "nudge" interventions suggests other concerns, including unintended welfare costs, rebound effects, and limitations to the depth and length of behavior-change (Sunstein, 2017). Together, these findings highlight the importance of understanding how norms and nudges operate across contexts, populations and behaviors when employing them to change behavior.

We failed to detect an effect of recognition messaging on engagement with the program. Although there are studies showing that offering recognition or reputational benefits can increase participation in conservation (Atari, Yiridoe, Smale, & Duinker, 2009; Banerjee & Shogren, 2012), other land managers do not report recognition as a compelling reason to engage in conservation (Nebel, Brick, Lantz, & Trenholm, 2017). Our study was only able to test the effect of messaging about the possibility of recognition rather than the act of recognition itself. It is possible that the perceived recognition benefits were not obvious or strong enough to influence behavior, or contrarily, that such benefits were implicitly offered to the Control group. If the small observed difference between the recognition messaging and the control was a true effect, our study was underpowered to detect that difference ($\beta = .13$).

By using the VMSMA member list, we estimate the sample average treatment effect. This estimate is internally valid, but we expect VMSMA members to be more informed and engaged than the remaining 500–2000 non-member maple producers in the state (Becot et al., 2015) and therefore potentially not externally valid. All of the studies of U.S. maple producers that we are aware of used maple industry membership organizations as their samples (Becot et al., 2015; Kuehn et al., 2017; Snyder et al., 2018). As a result, there is little known about the number and demographics of non-member producers.

We also acknowledge the large number of non-respondents who may not have received the treatments. The relative proportion of responses that did not want more information compared to those that did suggests that producers who were not interested may not have responded at all. While we do not know how many of the non-responses did not receive or open the mailing, random assignment should have produced similar proportions across treatments.

Lastly, although we offer evidence on an observed behavior, rather than an attitude or intention, the behavioral outcome we measured is cheap. Checking a box on a postcard is much less costly than changing forest management practices. However, 31 producers in our sample have scheduled appointments to enroll in the Bird-Friendly Maple Project since receiving this mailing. Unfortunately, we are unable to attribute this action to any one treatment due to inconsistent follow-up.

Although the particular interventions in this study did not have a positive effect on stewardship, other behavioral interventions or different iterations of social messaging warrant future research. Highlighting stewardship in the recognition treatment may have primed producers to list stewardship as a reason for sugaring, suggesting further evidence that simple changes in messaging may influence responses. Moreover, nearly 50% of all respondents indicated they produce syrup for enjoyment, with another 15–20% selecting stewardship or heritage. These are consistent with previous studies of maple producers (Murphy et al., 2012; Snyder et al., 2018). The high proportion of respondents who selected the non-monetary reasons supports the notion that managers of working lands value more than profits, even recognizing that our respondents are not representative of all maple producers.

Additionally, nearly a fifth of respondents indicated that their sugarbush would not be in production after 10 years. Since the average age of producers in this region is 61 years old (Kuehn et al., 2017), there is a risk that land transfers will remove forested land from maple production in favor of higher value uses. Engaging this population in conservation programs could have an important and lasting legacy on the forested landscape.

In 2011, the U. S. maple industry had tapped only 0.4% of maple trees that are suitable for production, most of which are on private lands (Farrell and Chabot, 2012). As the industry grows, expanding the extent of maple production could be good for environmental outcomes because it keeps the forest as forest, as opposed to other land uses such as development. Despite a paucity of research linking maple production to biodiversity outcomes, there is evidence that less intensive production systems can be consistent with conservation goals (Clark & McLeman, 2012). For producers who would or already are managing in ways that support biodiversity, behavioral interventions may "nudge" them to do more. In other cases, better evidence on the costs and benefits of managing working forests for conservation would inform appropriate interventions to align private and public interests.

The working landscape is a critical component of bird and biodiversity conservation in the Northern Forest. With 80% of the landscape in private ownership (Thompson, Plisinski, Olofsson, Holden, & Duveneck, 2017), sole reliance on protected areas and reserve lands is not a viable solution. Conservation programs that promote and support forest products industries and successfully engage forest owners are essential to maintaining vibrant ecological and human communities.

5 | CONCLUSION

We conducted a field experiment that offers evidence that land managers' engagement in conservation programs can be influenced by simple changes in messaging. Providing information that others are participating, however, had a negative effect on conservation behavior in this study. This result highlights the importance of tailoring behavioral interventions to specific contexts and conducting future studies to build evidence on effective interventions and reasons for failure.

Although we were unable to detect an effect of offering recognition on conservation behavior, future research should try again with larger samples or more meaningful treatments. Providing recognition for land stewardship is already a strategy used by farm and wildlife conservation initiatives, including state-funded agricultural programs and bird-, pollinator-, and wildlife-friendly habitat programs. It is not clear what the causal effect of providing public recognition is on engaging land managers in conservation. We encourage efforts to test this and other larger interventions, including longer-term studies of communications campaigns, outreach strategies, and changes to incentives. In cases where conservation is costly to landowners, such efforts are likely necessary to induce behavior change. While our study provides insights into the potential impact of a minor, costless change in messaging, such research is only a small part of designing more effective evidence-based conservation policies.

Applying behavioral science to biodiversity conservation requires creative ways to test strategies and observe impacts. Unlike electricity use or spending habits, land management decisions are difficult to observe, infrequent, and require financial and time commitments. While this makes testing behavioral insights challenging, shifting these behaviors can have long term benefits on the provision of biodiversity and ecosystem services from working landscapes.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

AUTHOR CONTRIBUTIONS

All authors contributed to the design of the study and writing the manuscript; H.B. collected and analyzed the data.

ETHICS STATEMENT

This study was approved by the University of Vermont Research Protections Office (CHRBS 18–0618).

DATA ACCESSIBILITY

The data from this study are available on Open Science Framework: https://osf.io/grcn4/?view_only=b2b1520354d54f69ad136d0e438a5a4d.

ENDNOTES

[1] Calculated from the USDA-reported 5,670,000 taps in Vermont in 2018 and 150 taps per hectare following the density measurements of Farrell (2013).

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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