

Exploring motives for participation in a perpetual easement program: Going beyond financial incentives

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ABSTRACT

Private land conservation has become an important element of the global conservation portfolio. Often, landowners are encouraged to participate in private land conservation with financial incentives. However, there is a concern that financial incentives may be limited given the ephemeral nature of funding. Financial incentives also have the potential to crowd-out participation from landowners motivated by altruistic factors rather than financial ones. These concerns underscore the importance of understanding drivers of participation in conservation programs. While there is a plethora of studies examining motivations for participation in term-limited conservation programs, there are far fewer that look at landowners' reasons for participating in perpetual programs. We examined landowners' non-financial motivations for participation in a United States Fish and Wildlife perpetual easement program using several analytical approaches. We first looked at correlations between the likelihood of participation in the easement program and survey respondent's beliefs, values, norms, and perceived behavioral control using a Bayesian regression analysis. Next, using a cluster analysis we segmented our landowner sample into two groups, tested for differences between the group theoretical constructs, and looked for patterns in geographic distributions of the clusters. Our results suggested that individuals who accepted responsibility for habitat protection and recognized habitat threats were more likely to have participated in the easement program. We did not find significant demographic patterns in our cluster analysis but did see differences across the tested theoretical constructs of theory of planned behavior and value-belief norm theory. Further exploration of variation revealed potential for conservation opportunities and allowed us to make recommendations for future policy actions.

1. Introduction

The relative importance of private land conservation is increasing for meeting protected area and biodiversity goals (e.g. Global Biodiversity Framework 2022, Chapman et al., 2023). The extent and effectiveness of private land conservation is highly dependent on positive relationships of government, NGOs, and trust organizations with landowners. In this context, considering social processes and their incorporation into program design is essential (Ban et al., 2013; Bennett et al., 2017; Mascia et al., 2003). Recent studies have identified both extrinsic and intrinsic motives for program participation as well as contextual factors (Landon et al., 2021; Liu et al., 2018; Prokopy et al., 2019; Selinske et al., 2015;

Selinske et al., 2017; Selinske et al., 2019). While there is a growing body of literature addressing participation motivations in term-limited programs (e.g. Baumgart-Getz et al., 2012; Capano et al., 2019; Liu et al., 2018; Prokopy et al., 2008, 2019; Wachenheim et al., 2018), there are far fewer studies focused specifically on perpetual private land conservation (but see Cortés-Capano et al., 2021; Kemink et al., 2021).

Given perpetual private land conservation can introduce the issue of property right losses for current and future generations, studying motivations specific to participation in these programs is critical as they are likely to vary compared to choices to participate in term-limited programs (Jackson-Smith et al., 2005; Sorice et al., 2011; Sorice et al., 2021; Stroman et al., 2017). In fact, a recent review that assessed 43 studies of

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landowner participation in perpetual conservation programs identified both the issue of property right losses and the desire to be compensated for the land value as two of the most common variables (Kemink et al., 2021). Internal factors like personal norms and social capital were also important to participation, but not as commonly included in studies (Kemink et al., 2021). Thus, further research to understand the relationships between external and internal factors in motivating participation in perpetual conservation programs is needed.

Financial incentives are often used to compensate landowners for the loss of land value and to drive participation in conservation programs (e. g. Farm Service Agency: USDA, 2022; Selinske et al., 2022; Stephens et al., 2002). Arguably, financially incentivizing perpetual private land conservation programs is the predominate norm (Kemink et al., 2021). For example, participation in perpetual conservation easements like those sold by the United States Fish and Wildlife Service [USFWS] or the United States Department of Agriculture [USDA] is usually incentivized through financial payments or tax breaks in the United States (USFWS, 2016; USDA, 2022). Other perpetual private land conservation programs in Denmark (Broch and Vedel, 2012), Germany (Brouwer et al., 2015), Queensland (Comerford, 2014), the Northern Territory in Australia (Adams et al., 2014), and Norway (Mitani and Lindhjem, 2015) have similarly used financial incentives to motivate participation.

While the use of financial incentives can be an effective approach for encouraging behavioral change (Reddy et al., 2017), certain challenges can arise if it is not balanced appropriately by other interventions. First, political and public financial support cannot be consistently guaranteed. The ephemeral nature of funding for private land conservation programs may risk their long-term success and ability to engage a growing participant base. Second, for some landowners, financial incentives are not sufficiently motivating to participate in private land conservation while for others, they are just one of many extrinsic and intrinsic motives (Farmer et al., 2011; Cooke and Corbo-Perkins, 2018; Groce and Cook, 2022; Selinske et al., 2019). Further, financial incentives do not always guarantee sustained management practices or participation in other conservation behaviors (Barnes et al., 2020). There are also concerns that external incentives will crowd out autonomous motivations like personal norms for conservation (Frey and Jegen, 2001; Kusmanoff et al., 2016; Rode et al., 2015; Stern, 2006; Triste et al., 2018). Finally, questions have been raised about the ability of financial incentives to provide conservation impact or additionality (Börner et al., 2017; Yasué and Kirkpatrick, 2020) because programs may be paying landowners for something they are already willing and able to do (Mills et al., 2017; Reddy et al., 2017).

Because of these concerns associated with financial incentives, there has been a renewed interest in understanding what actions policymakers can take to encourage individuals to engage in conservation behaviors on their own accord (Barnes et al., 2013; Mills et al., 2017). Autonomous motives are more likely to induce behavior change that becomes embedded in social norms over time (Ayer, 1997; Ahn and Ostrom, 2002; Nilsson et al., 2016). Our research sought to build upon the current knowledge base of non-financial landowner motivations for participation in perpetual conservation easements by using participation in the United States Fish and Wildlife Service Small Wetlands Acquisition Program (hereafter Small Wetlands Acquisition Program) easements as a case study. We chose this program as it is perhaps the most well-known conservation easement program administered by the United States Fish and Wildlife Service. This program is one of the primary perpetual protection programs for wetlands and grasslands on private land in eastern North and South Dakota and northeastern Montana – an area known as the Prairie Pothole Region. Results from previous studies of the grassland easements in the Small Wetlands Acquisition Program suggest that landowners may be volunteering land they already intended to conserve, thus offering relatively little additionality (Braza, 2017; Claassen et al., 2017). Understanding what motivates participants to join the Small Wetlands Acquisition Program may thus shed further light around program design to improve outcomes for

existing participants as well as to grow the number and type of participants into the future.

To address this gap, we used two social-psychological theories – theory of planned behavior and value-belief norm theory – to test for differences between two landowner groups and better understand factors that contribute to participation in the Small Wetlands Acquisition Program. We explored the extent to which the social-psychological constructs from these frameworks could be used to better inform policymakers about the potential to leverage non-financial motives for encouraging participation in the Small Wetlands Acquisition Program and provide recommendations about next steps for potential future studies of behavioral interventions.

2. Materials and methods

2.1. Theoretical overview

To improve program designs that increase the total participation as well as diversity of types of participants, researchers have sought to combine multiple behavioral theory constructs (Ateş, 2020; Delaroché, 2020; Han, 2015; Price and Leviston, 2014). Two theories that have been used together in past studies to address questions around conservation behavior are the theory of planned behavior (Fishbein and Ajzen, 2010) and the value-belief norm theory (Stern et al., 1999; Fig. 1). Traditionally, the value-belief norm theory provides a more prescriptive view valuable to policy recommendation, based on the premise that behaviors are guided by moral norms and environmental values (Schwartz, 1992, 1977; Stern, 2000; Stern et al., 1999). In contrast, the theory of planned behavior suggests that individuals behave in certain ways to gain rewards and/or avoid punishments (Bamberg and Möser, 2007; Kaiser et al., 2005; Price and Leviston, 2014). The two are often combined because, while the theory of planned behavior is useful for assessing rational and situational influences on behavior (Delaroché, 2020), it is often criticized for failing to appropriately test the influence of normative factors (Kaiser et al., 2005). Including the value-belief norm theory addresses this gap. Mills et al., (2017) used concepts from both theories to suggest that more permanent behavioral changes might be elicited from private landowners if financial incentives were supplemented with behavioral nudges that activated social and personal norms such as participatory learning approaches or information campaigns that emphasized neighbors' positive environmental behavior. Other studies of conservation and environmental behavior that have examined concepts within one or both of these frameworks have suggested that programs focused on improving landowners' feelings of control, obligation to the community, self-efficacy, awareness of responsibility or consequences, and involvement would likely increase positive environmental behavior or conservation program participation (Armitage and Conner, 2001; Landon et al., 2017; Harland et al., 2007; Pradhananga and Davenport, 2022, 2019; Guagnano, 2001; Johansson et al., 2013; Nilsson et al., 2004; Wynveen and Sutton, 2017). Below, we provide a brief overview of each theory as relevant to this analysis.

2.2. Theory of planned behavior

The theory of planned behavior is focused on decision-making and goal-oriented behaviors (Ajzen, 1991, 1985; Fishbein and Ajzen, 2010). This theory states that changes in intention lead to modification in behavior. Intention is determined by *attitudes*, *subjective norms*, and *perceived behavioral control* (Fig. 1). *Attitudes* include both instrumental (level of desirability) and experiential (level of pleasantness) aspects. *Perceived behavioral control* is defined as how well someone perceives they can control the outcome of a behavior, implying that they are financially or technically equipped to carry it out (Ajzen, 1991). This construct has often been the strongest predictor of intentions in studies of conservation, pro-environmental behavior, and agriculture (Price and Leviston, 2014; Despotović et al., 2019; Maleksaeidi and Keshavarz,

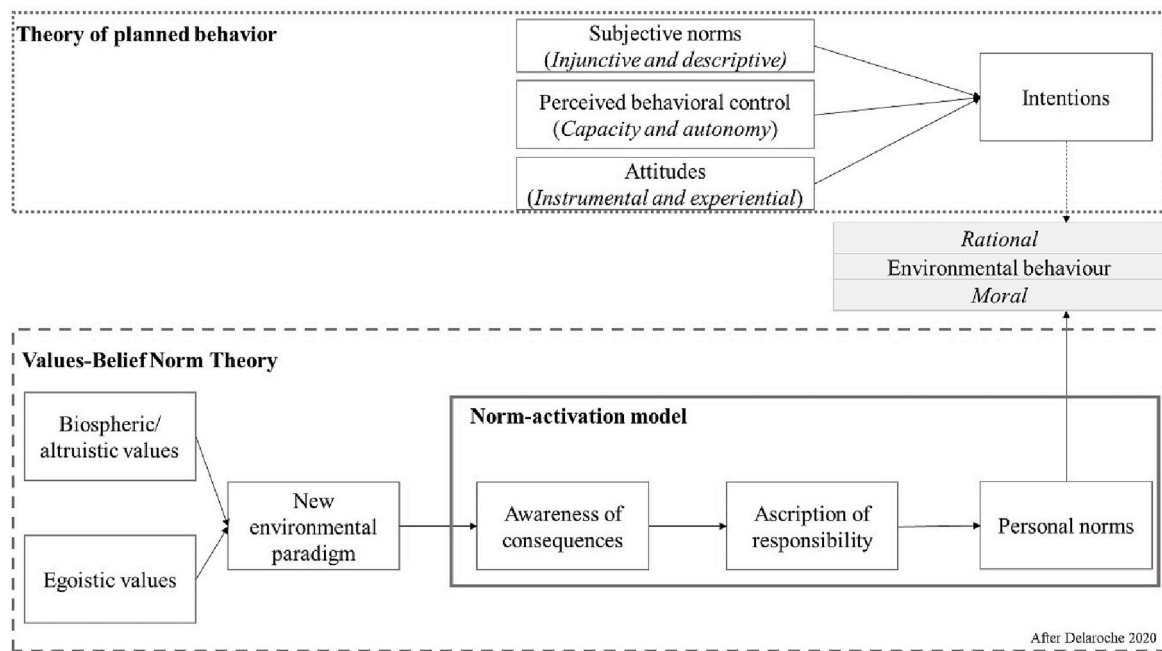


Fig. 1. Chart modeled after Fig. 1 in Delaroche, 2020 demonstrating how the theory of planned behavior and value-belief norm theory contribute to the rational and moral aspects, respectively, of environmental behavior. Words in italics under the theory of planned behavior represent sub-dimensions of constructs as introduced by Fishbein and Ajzen, 2010.

2019; Delaroche, 2020). *Perceived behavioral control* contains two sub-dimensions: *capacity* and *autonomy*. Respectively, these refer to an individual's perception that she/he is capable of performing a behavior and the degree to which she/he believes that performing the behavior is up to them (Fishbein and Ajzen, 2010).

The *subjective norms*, described in the theory of planned behavior, are a type of *social norm*, that influence the *personal norms* in the value-beliefs norm theory through an individual's internalization of external expectations (Hynes and Wilson, 2016; Klöckner, 2013; Olsson et al., 2018). *Subjective norms* are defined as how an individual believes that people important to them will perceive their adoption of a certain behavior (Ajzen, 1991) and are often recorded as one of the weaker constructs of this theory (Armitage and Conner, 2001 but see La Barbera and Ajzen, 2020). Similar to *perceived behavioral control*, *subjective norms* contain two sub-dimensions: *injunctive* and *descriptive norms*. The former refers to what people think others would like them to do and the latter what important others do (Fishbein and Ajzen, 2010). While no formal framework integrating the theory of planned behavior and value-beliefs norm exists, meta-analyses have supported that the relationship between social norms and environmental behaviors are mediated by constructs including awareness of consequences and ascription of responsibility (Bamberg and Möser, 2007). Further, studies of participation in best management practices have also demonstrated similar connections with moral obligations (Pradhananga et al., 2015; Vaske et al., 2020), emphasizing the potential for alternative routes for policy to take outside of financial incentives.

2.3. Value-belief norm theory

The value-belief norm theory encompasses concepts from previous theories such as the norm activation theory, (Schwartz, 1977), value-basis theory (Stern and Dietz, 1994), and the New Ecological Paradigm (NEP: Stern et al., 1999; Dunlap et al., 2000; Fig. 1). Based on the value-belief norm theory, values preface beliefs and act as guiding principles or goals that can vary by importance (de Groot and Steg, 2008; Steg et al., 2005; Stern et al., 1999). Traditionally, the value-belief norm theory describes three value orientations - *altruistic*, *biospheric*, and

egoistic- all of which someone can possess at once (de Groot and Steg, 2009a, 2008; Ruepert et al., 2017). People with strong *altruistic* and *biospheric* orientations will decide to behave pro-environmentally if the action has net benefits for other people or the environment respectively. Those with strong *egoistic* orientations will behave pro-environmentally if the action has net benefits for themselves (de Groot and Steg, 2009b).

Within the value-belief norm framework, values influence the environmental worldview, which has a cascade effect (Fig. 1, Delaroche, 2020), impacting awareness of consequences, ascription of responsibility, and personal norms (Klöckner, 2013). *Personal norms* can be defined as moral self-expectations (Harland et al., 1999). The literature provides strong support for this chain of relationships (de Groot and Steg, 2010, 2009a; Stern et al., 1999) in a variety of scenarios from water conservation (Landon et al., 2017), energy use (Abrahamse and Steg, 2011), to participation in management practices (Vaske et al., 2020). Specifically, with regards to private landowner conservation programs, previous work has demonstrated support for the value-belief norm framework, including studies where *personal norms* directly predicted practice adoption (Pradhananga and Davenport, 2019) and studies where the portion of value-belief norm specific to the norm-activation theory was examined (Pradhananga et al., 2017). Some studies have also shown that landowners with biospheric value orientations are more likely to maintain upkeep and management of privately protected property (Farmer et al., 2017; Stroman and Kreuter, 2015).

2.4. Study area and program

Our study focused on the Prairie Pothole Region of North Dakota, South Dakota, and Montana. This study area encompasses 298,259 km² populated by 1.2 million individuals. The population is predominantly concentrated in urban areas with the average density being 4.45 individuals/km² (United States Census 2010). The United States Fish and Wildlife Service Small Wetlands Acquisition Program is one of the main conservation programs that conservation partners use in the region to perpetually protect wetlands and grasslands. The easement program has enough interested landowners to be considered over-subscribed and has a relatively long waiting list in most states, particularly in North Dakota

and South Dakota. This fact is not necessarily a result of many conservation-minded landowners though. The program provides immediate financial benefits to make it appealing to individuals who are ‘land rich and cash poor’ as well as tax breaks in most states if all or part of the value of the easement is donated.

Under the Small Wetlands Acquisition Program, through the purchase or donation of a wetland easement, the United States Fish and Wildlife Service acquires the rights to draining, burning, leveling, pumping, or filling a protected basin. The easement is considered to include the original delineated area along with any enlargement caused by normal or abnormal increases of water. Management of wetland vegetation is not required and in dry years landowners maintain the right to till through the wetland. Similarly, grassland easements under the program are geared towards acquiring rights focused on protecting and not managing grasslands covered by the easement. Grassland easements acquire the rights to any alteration of permanent vegetative cover, agricultural crop production, and haying or mowing before July 15 without special dispensation. While management remains in the hands of the landowners, both easements provide the United States Fish and Wildlife Service access to inspect and determine compliance with the terms of agreement (USFWS 2016).

2.5. Survey content

We developed an online survey instrument using Qualtrics. The survey questions were tested by six current delivery specialists in conservation programs employed by the non-profit agency Ducks Unlimited (DU). We also piloted the survey via email across a random sample of 500 landowners whose addresses we acquired from a marketing company (goleads.com, 2021). The final survey contained survey items or questions about respondents’ values, beliefs, norms, perceived behavioral control, and actual conservation practices in the past year that we used to estimate the latent variables within both the theory of planned behavior and value-belief norm theory framework (Supplementary Material: JCU IRB Ethics Approval H7299). Below we detail these survey items and indicate the associated latent variable and framework (Fig. 1; Supplementary Material).

2.5.1. Measures of value-belief norm theory constructs

We used previously developed scales to measure constructs from the value-belief norm theory. These constructs included biospheric-altruistic and egoistic values, the New Ecological Paradigm, awareness of consequences, ascription of responsibility, and personal norms (Fig. 1, Supplemental Materials). First, we measured values using the question “how important are the following as guiding principles in your life”, which included nine principles that were used to develop the biospheric-altruistic and egoistic constructs (Nordlund and Garvill, 2002; Schultz et al., 2005; Stern and Dietz, 1994). Responses to the related question ranged from not at all important (0) to supremely important (10, Table 1). Next, we measured individuals’ awareness of consequences and ascription of responsibility specific to wetland and grassland habitat using an 11-point Likert scale. We also measured the New Ecological Paradigm (NEP) in short form (six items: Table 1), which assesses broad beliefs about awareness of consequences (Stern et al., 1999; Dunlap et al., 2000). Finally, we measured personal norms related to grassland and wetland loss using three measures specific to each on an 11-point Likert scale (Table 1). Here, we describe personal norms as self-defined standards of behavior that are derived from one’s values and enforced by feelings of guilt or pleasure. Personal norms often act as a mediating influence between social norms and behaviors (de Groot and Steg, 2009a; Tanner, 1999).

2.5.2. Measures of theory of planned behavior constructs

We measured two constructs within the theory of planned behavior: subjective norms and perceived behavioral control (Fig. 1, Supplemental Materials). We measured subjective norms specific to participation in

Table 1

Items used to measure theoretical constructs with mean values, standard deviations (SD), and results of reliability analysis (Cronbach’s alpha: α and total omega ω). $N = 89$ except for Egoistic, Biospheric, and New ecological paradigm where $N = 88$.

Latent variable	Survey item	Mean	SD	α	ω
Value-belief norm theory					
Egoistic	Using natural resources for personal income	6.93	2.95	0.66	0.66
	Protecting private property rights	9.39	2.22		
Biospheric	Conserving natural resources for my own recreational use	6.84	2.84	0.86	0.89
	Preserving nature for its own sake	8.95	2.20		
	Conserving natural resources for human use	7.86	2.65		
	Protecting nature for human health and well-being	8.78	2.30		
	Maintaining unity with nature	8.19	2.92		
	Respecting the earth - its beauty and natural processes	8.77	2.59		
	Distributing natural resources fairly	6.10	3.25		
New ecological paradigm	We are approaching the limit of the number of people the earth can support	5.07	2.82	0.82	0.85
	When humans interfere with nature it often produces disastrous consequences	7.07	2.65		
	Plants and animals have as much right as humans to exist	6.30	3.02		
	The earth is like a spaceship with very limited room and resources	5.82	3.13		
	The balance of nature is very delicate and easy to upset	6.82	2.61		
	Humans were meant to rule over the rest of nature (reverse coded)	5.95	3.28		
Personal norm	I feel obligated to be a community leader in wetland protection	6.98	2.49	0.83	0.92
	I feel obligated to be a community leader in grassland protection	7.91	2.42		
	I feel a personal obligation to learn more about wetlands in my county	7.42	2.29		
	I feel a personal obligation to learn more about grasslands in my county	8.73	2.16		
Awareness of consequences	Wetland loss is a significant challenge for wildlife in my state	7.45	2.93	0.91	0.95
	Grassland loss is a significant challenge for wildlife in my state	8.81	2.75		
	Wetland loss is a significant challenge for wildlife in other states	7.9	2.45		
	Grassland loss is a significant challenge for wildlife in other states	8.73	2.19		
Ascription of responsibility (1)	It is my personal responsibility to help protect wetland resources	9.03	2.29	0.91	0.96

(continued on next page)

Table 1 (continued)

Latent variable	Survey item	Mean	SD	α	ω
Ascription of responsibility (2)	It is my personal responsibility to help protect grassland resources	9.83	1.51		
	It is my personal responsibility to ensure that what I do on the land does not negatively affect wetlands	9.46	1.87		
	It is my personal responsibility to ensure that what I do on the land does not negatively affect grasslands	9.84	1.53		
	Local government (e.g, county) should be responsible for protecting wetland resources	5.45	3.43	0.96 ^{a*}	
	Local government (e.g, county) should be responsible for protecting grassland resources	5.52	3.33		
Theory of planned behavior					
	Subjective norm				
	Community members whose opinion I value would support my participation in a wet easement	5.97	2.12	0.69 ^{a*}	
	Community members whose opinion I value would support my participation in a grass easement	6.16	2.36		
Perceived behavioral control	I have the financial resources I need to use conservation practices on the land.	6.99	2.66	0.44 ^a	
	I have the knowledge and skills I need to implement conservation practices on the land	8.25	2.01		

^a Calculated with Pearson's two-tailed correlation statistic.

* P-value is significant at the 0.01 level and correlation value is >0.60.

the Small Wetlands Acquisition conservation easements. If respondents indicated that they had participated in an easement, they were asked whether they thought people whose opinion they valued supported their participation. If they indicated no participation, they were asked whether they thought people whose opinion they valued would support their participation (Table 1). Answers were measured on a scale of 0 to 10 and where 0 means completely disagree and 10 means completely agree. Perceived ability or behavioral control (Ajzen, 1991) can help activate personal norms (Harland et al., 2007; Klöckner, 2013; Pradhananga et al., 2017, 2015; Schwartz, 1977) and has also been shown to encourage positive environmental behavior (Chan and Bishop, 2013). We asked two questions to measure respondents' perceived level of control surrounding conservation programs and practices— relative to their financial and knowledge capacity (Table 1).

2.6. Survey distribution

Results from a pilot survey distributed via email indicated response rates (<1 %), far below the norm for this region (Midwest: >18 %: Avemegah, 2020; Wang et al., 2020), despite us having followed protocol suggested by Dillman et al. (2014). As such we employed the strategy of convenience sampling, which is the method of administering surveys to any individuals that are nearest, qualified, and available. Qualified individuals were defined as those ≥18 years old who owned, rented, or worked >32.37 ha of land within the Prairie Pothole Region

of North Dakota, South Dakota, or Montana (Fig. 2). Easement transactions are typically not conducted on parcels smaller than 32.37 ha in size in this region. Grassroots groups helped to disseminate the survey via monthly newsletter emails, fliers, and advertisements in local publications. These groups included North Dakota Grazing Lands Coalition, Pulse Agriculture, South Dakota Soil Health Coalition, South Dakota Grazing Lands Coalition, North Dakota Stockman's Association, Montana Ranch Stewards, the Prairie Pothole Venture, and Ducks Unlimited. We further incentivized participation by placing those who completed the survey in a drawing for a Yeti cooler. Because we depended on these groups for dissemination of the survey, participation dates varied depending on when the various organizations' newsletters were released. The earliest date was Sept 24, 2021, and the survey was cut off on Dec. 10th. We note that, because these methods resulted in a convenience sample, we were limited in our ability to generalize to larger populations, and unable to calculate response rates. However, we examined respondents for potential bias by comparing demographics to the average landowners within the study region as described by the most recent agricultural census from 2017.

2.7. Survey response

We received 138 responses to the survey of which 80 % (110) were completed in November. Only 109 of the 138 responses were qualified (>32.37 ha) and, of those 109 individuals, only 89 completed >75 % of the survey. Most respondents were males (81 %) and born between 1933 and 2000. The remaining 19 % respondents were females born between 1952 and 1996. The average age of all respondents was 49, which is slightly younger than the average age of respondents in the latest agricultural census for the three states (the average age was 57 in 2017). However, the 2017 agricultural census did suggest that the male to female ratio of our respondents was representative of the larger population of primary producers in the three states surveyed (Table 2, USDA National Agricultural Statistics Service, 2017).

2.8. Factor analysis

We constructed the latent variables from the theories described above using factor analyses. Ideally, we would have liked to conduct the factor analysis separately for those participating in easements and those not participating in easements, however our sample size of participants was not large enough to do so. As such, we examined the two groups together and attempted to describe differences between the two qualitatively and through the other two sections of our analysis (regression and cluster analysis).

Scores were assessed for each latent variable and the items used to measure it using principal component analysis (PCA) with a varimax rotation and we extracted components until eigenvalues were ≤1 using the psych package (Revelle, 2022) in Program R (R Core Team, 2020). For latent variables that we measured with more than two items, we used Cronbach's alpha and McDonald's omega (total omega) to assess internal consistency (McDonald, 1999), with a cutoff threshold of 0.70 (Campo-Arias and Oviedo, 2008; Cronbach, 1951; Netemeyer et al., 2003). We used Pearson's correlation for latent variables measured with two items and considered variables with values of $p \leq 0.05$ and $\rho > 0.60$ to contain sufficient correlation to be combined. We then computed the factor scores as means and used them in a Bayesian analysis to estimate their effect on landowners' sales of e Small Wetland Acquisition easements. Finally, following methods recently implemented by Lang and Rabotyagov (2022), to look at adoption of best management practices we conducted a cluster analysis and examined differences between those who sold and did not sell conservation easements. We also conducted visual comparisons of differences between the clusters' spatial distributions. Latent variables that did not meet the standards for Cronbach's alpha or Pearson's correlation were not combined and not included in the regression or cluster analysis.

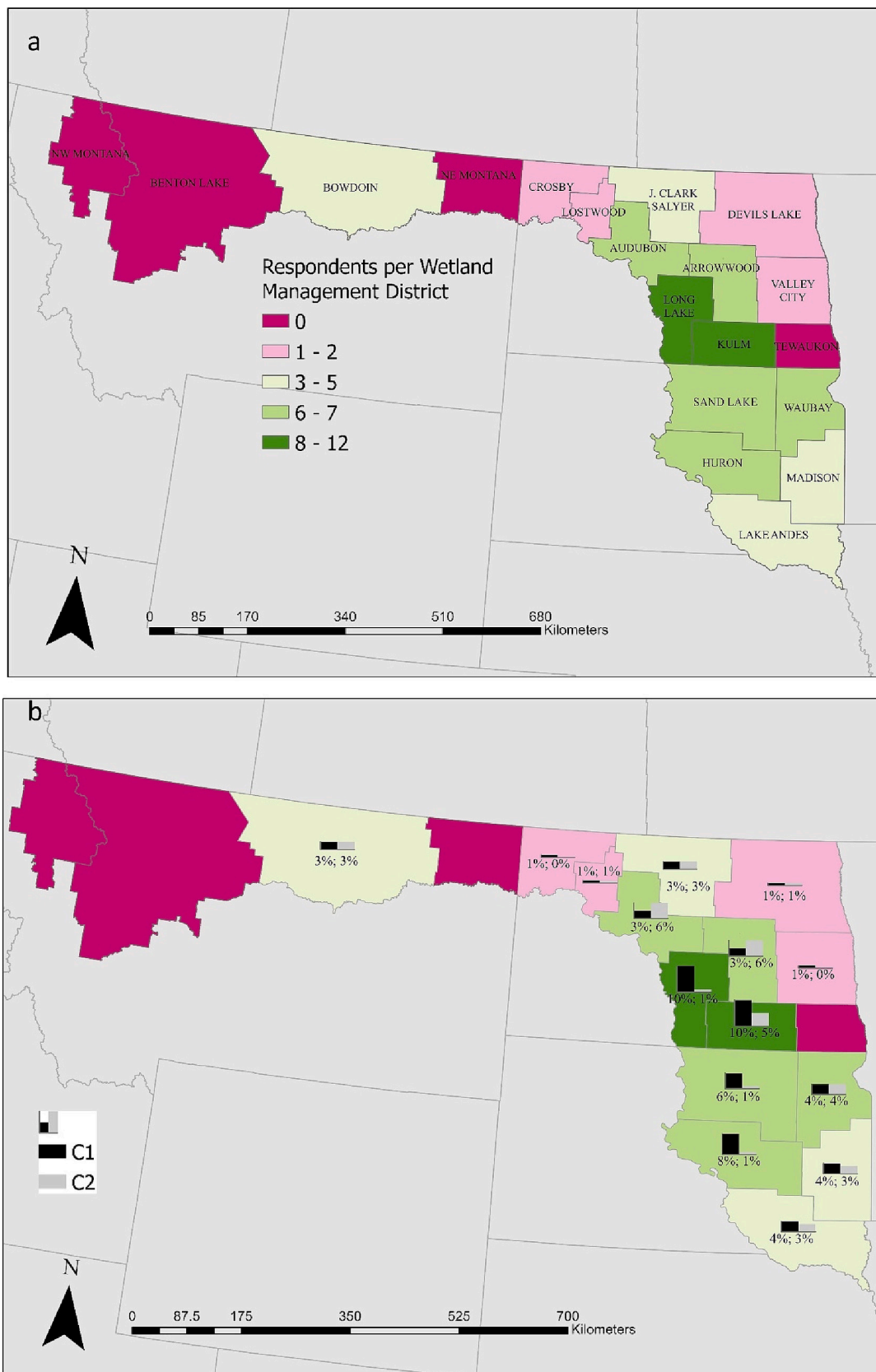


Fig. 2. Map A: the distribution of survey respondents by Wetland Management District across the Prairie Pothole Region of North Dakota, South Dakota, and Montana, and Map B: after Lang and Rabotyagov, 2022, the percentage of individuals in clusters C1 and C2. Ten respondents not included in map totals and percentage calculations because towns of residence were not shared or outside of the Prairie Pothole Region.

Table 2
Sociodemographic characteristics of survey participants.

Characteristic		N	%
Gender	M	71	79.78 %
	F	17	19.10 %
Age	21–88	86	–
Farming operation	Row crop agriculture	4	4.49 %
	Cattle ranching	31	34.83 %
	Mixed operation	44	49.44 %
	Hobby farming	1	1.12 %
	Other	9	10.11 %
Primary occupation	Farming	10	11.24 %
	Ranching	41	46.07 %
	Farming and ranching	28	31.46 %
	Other	10	11.24 %
Participation in environmental group	Yes	51	57.30 %
Land ownership	Rent	5	5.62 %
	Own	23	25.84 %
	Rent and own	58	65.17 %
Conservation program participation	No participation	11	12.36 %
	At least one	78	87.64 %
Easement on property	Wet	32	35.96 %
	Grass	25	28.09 %
Sold easement personally	Wet	4	4.49 %
	Grass	5	5.62 %
	Both	11	12.36 %
Education	< High School	3	3.37 %
	High school	5	5.62 %
	Some college	10	11.24 %
	Junior college	10	11.24 %
	Vo-tech	9	10.11 %
	Bachelor's degree	36	40.45 %
Graduate degree	16	17.98 %	

2.9. Bayesian logistic regression

We examined the factor scores within the context of the value-belief norm theory and theory of planned behavior and their relationships with landowners' participation in United States Fish and Wildlife easements. We used actual reported behaviors rather than intention variables as these have been shown to be better predictors of future behaviors (Beetstra et al., 2022; Sheeran and Webb, 2016). The reported behavior we used was defined by how individuals responded to the question about sale of easements. If they indicated that they owned/rented property with a grass and/or wet easement on it that they sold themselves, we considered this evidence of participation. We obtained all parameter estimates within a Bayesian environment in the R package rstanarm (Goodrich et al., 2022) because this approach has been suggested to be more appropriate for studies with small sample sizes than a frequentist approach (Gelman, 2006). We then ran three Markov chains fit with weakly informative priors structured around a student's T distribution as recommended by the package documentation and recent research surrounding small sample sizes (7 df, mean = 0, s.d. = 2.5: Gabry and Goodrich, 2020; Gelman, 2006).

2.10. K-means cluster analysis

Using the factor scores from the factor analysis we conducted a K-means cluster analysis with the cluster (Maechler et al., 2022) package in program R (R Core Team, 2020). This classification used the sum of dissimilarities as the measure of cluster dispersion around medoids (Kaufman and Rousseeuw, 1990). While we tried 2, 3, 4, and 5 classes, we ultimately selected the number of classes that best maximized inter-cluster distances and minimized intra-cluster distances. We compared factor scores using Kolmogorov–Smirnov tests and demographic statistics between clusters using Fisher exact tests in the stats package in program R (R Core Team, 2020). We visually examined differences and similarities in the spatial distribution of clusters as well using ArcGIS 10.8 (ESRI).

3. Results

3.1. Factor analysis

Our principal component analysis confirmed the suitability of our indicator variables for assessing the value-belief norm theory and theory of planned behavior frameworks (Table 1, Supplementary Materials). The principal component analysis supported two constructs for *ascription of responsibility*: one to represent ascription of responsibility to oneself, the other to the local government. We labeled these AR1 and AR2 respectively in the following analyses. The indicators for latent variables including *awareness of consequences*, *ascription of responsibility (1)*, *personal norms*, *NEP*, and *biospheric values* all demonstrated strong internal consistency or homogeneity (Cronbach's alpha >0.70) except for *egoistic* (Cronbach's alpha = 0.66; total omega = 0.66). For other indicator variables where we had to use Pearson's chi-squared as a measure of correlation because they had <3 survey items, correlation values all measured $\rho > 0.60$ with *P*-values <0.05 except for the *perceived behavioral control* variable ($\rho = 0.44$) (Table 1). We assumed that the results for all survey items besides those ascribed to *egoistic* and *perceived behavioral control* provided sufficient evidence of internal consistency and correlation and combined relevant items to create factors for further analysis of the theoretical frameworks. We removed one individual from the regression and cluster analysis because of missing data (N remaining = 88).

3.2. Bayesian logistic regression

On average, most landowners were unlikely to sell an easement (intercept median: -1.72, 90 % CI: -2.18 - -1.30). Posterior distributions from the Bayesian regression indicated that landowners had a higher probability of having sold an easement on their property if they were aware of dangers to wetland and grassland habitat (median: 0.67, 90 % CI: 0.09–1.28) and recognized that someone (themselves; median: 0.44, 90 % CI: -0.27–1.17 or the government; median: 0.62, 90 % CI: 0.13–1.15) needed to accept responsibility for protecting it (Fig. 3). Similarly, those individuals who felt ethically required to participate in protecting wetlands and grasslands (median: 0.15, 90 % CI: -0.33–0.69) or felt pressure from peers to participate (median: 0.03, 90 % CI: -0.38–0.45) had a higher probability of having sold an easement (Fig. 3). In contrast, those who exhibited on average a positive

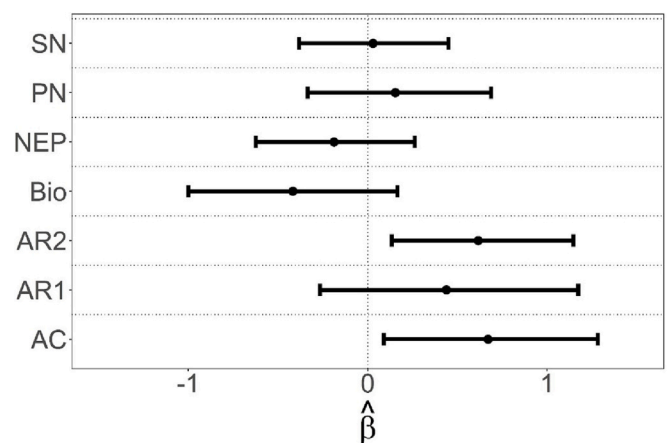


Fig. 3. Logistic scale parameter estimates from Bayesian analysis of the relationship of 88 survey respondents' participation in the US Fish and Wildlife Survey Small Wetlands Acquisition easement program. Components of the theory of planned behavior (SN: subjective norm) and value-belief norm theory (Bio: biospheric value orientation, NEP: new ecological paradigm, AC: awareness of consequences; AR1, AR2: ascription of responsibility, PN: personal norms. Dots are median parameter estimates and horizontal lines indicate 90 % credible intervals.

relationship with environmental values (median: -0.42, 90 % CI: -1.00–0.16) and a higher likelihood to act on behalf of the environment (median: -0.19, 90 % CI: -0.62–0.26) had a lower probability of having sold an easement (Fig. 3).

3.3. K-means cluster analysis

We segmented the respondents to our survey into two groups using the cluster package in program R (Maechler et al., 2022). For ease of discussion, we labeled the first group *C1* ($N = 56$) and the second, *C2* ($N = 32$). We tested and found significant differences in all variables of the value-belief norm theory and theory of planned behavior frameworks between *C1* and *C2* except *subjective norms* (Table 3; Fig. 4). Individuals in *C1* in our cluster analysis were more likely to have a positive outlook on the environment and to feel ethically responsible for protecting it. *C1* individuals exhibited higher awareness of potential challenges with wetland and grassland ecosystem health in their landscape and had higher levels of agreement that either the government or themselves should take responsibility for addressing these challenges (Table 3). Despite these dissimilarities in sociopsychological factors, we saw no comparable patterns of dissimilarity in socioeconomic factors. There was no significant difference between *C1* individuals and *C2* individuals in age ($P = 0.61$), education ($P = 0.17$), sex ($P = 0.07$), operation type ($P = 0.34$), or participation in an environmental group ($P = 0.37$).

Individuals in our *C1* cluster contained all but three of those who had sold an easement ($N = 16/19$), suggesting that the remaining respondents in that group might have similar values and beliefs that could be leveraged to encourage easement participation. The bulk of this group was concentrated in four Wetland Management Districts (Fig. 2): Long Lake, Kulm, Sand Lake, and Huron. While the distribution of the *C2* group was concentrated more northward (Audubon, Arrowwood, Kulm; Fig. 2), the difference did not appear to be significant when tested with a Fisher's exact test ($P = 0.05$).

4. Discussion

We investigated how social-psychological constructs correlated with landowner participation in a perpetual private land conservation program. We used a Bayesian logistic regression and a cluster analysis to look at how different values, beliefs, and norms correlated with the likelihood of selling an easement across the entire sample and within specific sub-groups. Our results provide information about different behavioral motivations that can be used to improve targeting practices for the Small Wetlands Acquisition Program.

Individuals who sold an easement on their property were more likely to be aware of the environmental consequences of their actions for wetlands and grasslands and acknowledged that they and/or the local government had some responsibility for protecting these habitats. These results align with the value-belief norm theory that proposes awareness and ascription of responsibility as predictors of norm-activation (Stern

Table 3

Descriptive statistics and results of Kolmogorov–Smirnov (K–S) tests of constructs between landowner clusters with P-values and D statistics.

Construct	Mean score		K-S test P-value (D)
	<i>C1</i>	<i>C2</i>	
Value-belief norm theory			
Personal norm	0.46	-0.82	<0.001 (0.65)
Ascription of responsibility (1)	0.49	-0.88	<0.001 (0.66)
Ascription of responsibility (2)	0.24	-0.44	<0.001 (0.44)
Awareness of consequences	0.47	-0.83	<0.001 (0.62)
New ecological paradigm	0.32	-0.58	<0.001 (0.46)
Biospheric value orientation	0.53	-0.96	<0.001 (0.74)
Theory of planned behavior			
Subjective norm	0.16	-0.32	0.23 (0.24)

et al., 1999). Our cluster analysis further confirmed these findings as 16/19 of the individuals in our sample who sold an easement were grouped together into *C1*. Individuals in group *C1* had significantly higher factor scores for the ascription and awareness constructs than those in group *C2*. Other studies have demonstrated similar results where individuals have exhibited higher self-expectations to take conservation action due to certain beliefs about their own responsibility (Harland et al., 2007; Pradhananga and Davenport, 2019, 2022; Stern et al., 1999) and awareness (Johansson et al., 2013; Vaske et al., 2020).

While having an awareness or knowledge of the problem at hand is important (Bamberg and Moser, 2007; Blackstock et al., 2010) studies suggest that this information does not directly change behavior unless certain internal or external contextual factors are in place (Epanchin-Niell et al., 2022; Kollmuss and Agyeman, 2002). A lack of appropriate or needed contextual factors could explain the low correlation of personal norms with the probability of participation in easements, despite the presence of a moral obligation to protect wetlands and grasslands. In previous studies of private land conservation, others have shown that certain contextual factors (Bolderdijk et al., 2013; Mills et al., 2017) can act as an obstruction for norm activation and engagement in the desired behavior. Stern (2000) recognized that the influence of personal norms on behavior would depend on how influential economic, personal, and social contextual factors were to the issue at hand and suggested that a stronger influence of contextual factors would result in a weaker influence of personal norms on behavior. This has implications for those developing behavioral interventions because it emphasizes the importance of a balanced approach that addresses both internal and external motivations.

The main contextual factors we assessed in this survey addressed individuals' perceived behavioral control to participate in conservation through access to financial and information resources, their perceptions of peers' opinions, and basic sociodemographic information. Within the framework of the theory of planned behavior, the perceived behavioral control construct has usually played an influential role in predicting intentions (Armitage and Conner, 2001). In contrast, subjective norms typically have a weak or nonsignificant regression coefficient in predicting behavioral intentions within this framework (Armitage and Conner, 2001; Ma et al., 2021; Mahon et al., 2006 but see la Barbara and Ajzen 2020). Our results confirmed those of previous studies in that subjective norms had a nonsignificant regression coefficient. Unfortunately, one of the limitations of our study was that we were unable to include perceived behavioral control in the formal analysis due to a lack of internal consistency.

While other limitations like our sample size and sampling methodology precludes broad generalizations, the results from our regression analysis and the differences between individuals in groups *C1* (containing 16/19 easement holders) and *C2* (largely non-easement holders) provide insights that would be useful to policymakers. The final sample size ($N = 89$) from our survey did not allow for rigorous and perhaps more traditional methods of analysis like structured equation modeling. However, the analyses we did complete were still internally consistent and the comparisons between the *C1* and *C2* groups we made were statistically significant based upon the statistical measures used. Further, while we had originally hoped to survey a broad cross-section of landowners in the Prairie Pothole Region, the convenience sample still provided us with a valid comparison of landowners who had and had not sold easements; ultimately allowing us to provide insights useful to policymakers.

The importance of beliefs, especially for those in group *C1*, suggests that policymakers could focus on efforts that seek to activate internalized responsibilities and known consequences for that group. In this case, peer-to-peer learning might represent a viable avenue to explore. Individuals participating in peer learning have demonstrated high retention of information and an increased awareness of conservation and management issues (Kueper et al., 2013). A study in Iowa demonstrated a marked increase in conservation behavior by farmers after they

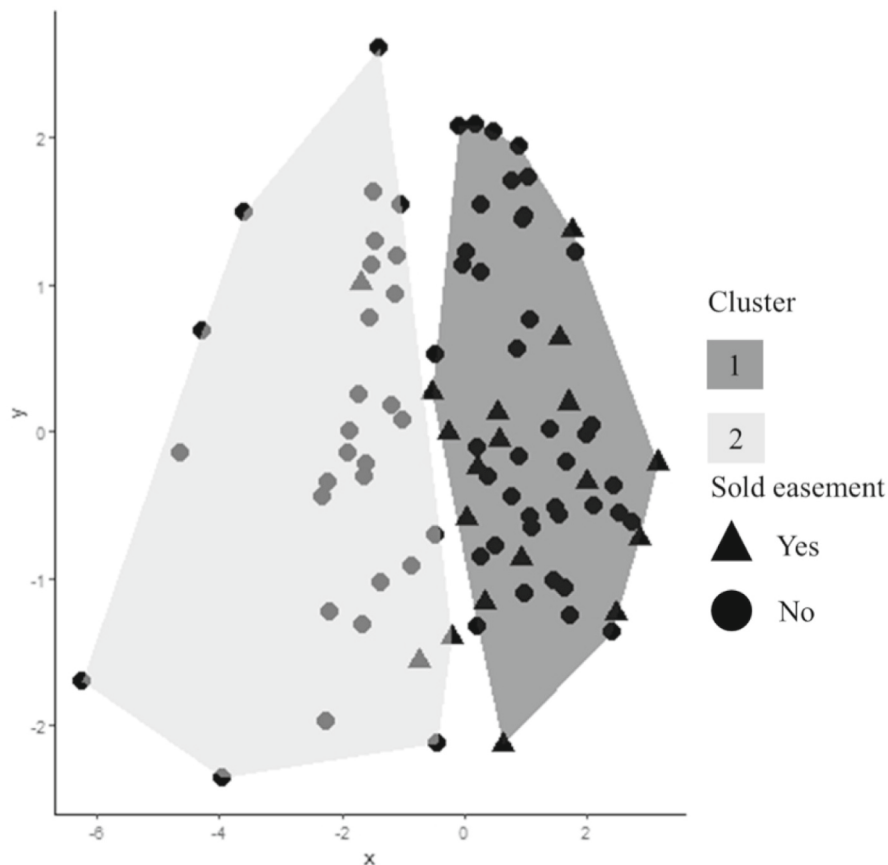


Fig. 4. Results from landowner cluster analysis. Cluster 1 represents group C1, cluster 2 represents group C2. Triangles represent individuals who sold an easement, circles those who did not.

learned about the environmental consequences of modifying their management (McGuire et al., 2013). A more recent investigation in the same region also found that farmers who partook in a formal farmer network that involved peer learning were more likely to try new conservation practices (Asprooth et al., 2023).

Peer learning programs could also prove useful to individuals in group C2. These individuals had lower factor scores for environmental values, beliefs, and norms than group C1. Previous research has shown that when groups share information and best practices, perceptions of what is considered appropriate behavior can change and thus, individuals' self-expectations and individual values and norms can change as well (van Dijk et al., 2015; Mills et al., 2011). Alternatively, if these individuals are not engaged in farmer networks or peer learning groups (Mills et al., 2017), technical advice delivered by a trusted advisor over time can be effective at shifting beliefs and norms (Sutherland et al., 2013; Lutter et al., 2018).

Suggestions for policymakers would be improved by a follow-up study that addressed some of the limitations we encountered in our study. First, the small sample size that resulted from our survey restricted the depth and explanatory power of our analysis. Second, the items we used to measure the perceived behavioral control variable did not appear to adequately describe the construct in which we were interested. An instrument that included more than two items such as one described by Tonglet et al. (2004) for recycling behaviors might provide better internal consistency. Finally, the sampling design we developed also meant that we were unable to generalize our results to other areas or populations. Although our sample provided a representative age distribution of the ND, SD, and MT Prairie Pothole Region, it is possible that excluding the option of a mail-in survey eliminated responses from individuals who use email or the internet less frequently. Convenience

sampling through landowner groups and flyers might have also created a response bias of landowners more likely to sell an easement (Acharya et al., 2013). However, we feel that the distribution of easement participants in our analysis demonstrated that there was some variability in our participants.

4.1. Conclusions

Recommendations for policymakers about behavioral interventions are often context-specific, emphasizing the importance of studies like ours. Despite the described limitations, we provide one of few studies that examine motives for participation exclusively in a private perpetual conservation program. Our results suggest future policymakers might benefit from identifying landowners by specific sociopsychological traits and targeting interventions accordingly. While financial incentives will likely continue to be used to motivate participation in the Small Wetlands Acquisition Program, we recommend, as others have (Selinske et al., 2017), that outreach and technical assistance programs should be consistently emphasized parallel to this approach. We would urge that future studies focus on gathering a larger sample that could be used to investigate direct causal mechanisms and generalize to the entire Prairie Pothole Region.

CRediT authorship contribution statement

KK, AD, RLP, and VMA conceived the project and study design. KK conducted data collection and organization. KK conducted the analysis and wrote the manuscript with editing assistance from AD, RLP, and VMA.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.biocon.2023.110193>.

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