Received: 11 January 2021 | Revised: 18 May 2021 | Accepted: 8 June 2021

DOI: 10.1111/csp2.489

CONTRIBUTED PAPER

Conservation Science and Practice
A journal of the Society for Conservation Biology
Open Access

WILEY

Exploring pathways to participation in an at-risk species conservation program

Michael G. Sorice[1] | **C. Josh Donlan**[2,3] | **Anna R. Santo**[1] | **Gloria M. Luque**[2] | **Christian A. Hagen**[4]

[1]Department of Forest Resources & Environmental Conservation, Virginia Tech, Blacksburg, Virginia, USA

[2]Advanced Conservation Strategies, Midway, Utah, USA

[3]Cornell Lab of Ornithology, Ithaca, New York, USA

[4]Department of Fisheries, Wildlife, and Conservation Sciences, Oregon State University, Corvallis, Oregon, USA

Correspondence
Michael G. Sorice, Department of Forest Resources & Environmental Conservation, Virginia Tech, Blacksburg, VA 24061, USA.
Email: m-sorice@vt.edu

Funding information
Pheasants Forever, Grant/Award Number: 68-3A-14-120; USDA National Institute of Food and Agriculture McIntire-Stennis Program, Grant/Award Number: 1007271

Abstract

The success of conservation efforts for imperiled and endangered wildlife species relies on private landowners, yet a definitive model of landowner cooperation remains elusive. We use a case study to explore the multiple pathways by which demographics, rootedness, resource dependence, environmental attitudes, social influence, and program structure intersect to jointly explain participation in a federally funded cost-share program to help prevent the Lesser Prairie-Chicken from being listed under the U.S. Endangered Species Act. We conducted structured interviews across three ecoregions with 64 participants and 22 nonparticipants. We analyzed the data using fuzzy-set qualitative comparative analysis, an approach that identifies the multiple combinations of conditions related to engagement in the program. We found that two concepts, landowner characteristics and social influence, were most commonly associated with participation while profiles representing typical landowner tropes performed poorly. Finally, the positive effect of encouragement by agency representatives suggests that agency staff play a central role in determining participation. It also suggests landowners' decision processes may not be as deliberative as the literature on private lands conservation suggests. The results of our case study suggest new avenues for research that explicitly consider the role of heuristics in decisions to participate.

KEYWORDS

decision making, endangered species, incentive program, lesser prairie-chicken, prelisting conservation, private landowners, private lands, qualitative comparative analysis, southern great plains, *Tympanuchus pallidicinctus*

1 | INTRODUCTION

An increased number of species are receiving protection under the U.S. Endangered Species Act of 1973 (ESA) due to increasing human demands on natural resources and their resulting negative impacts to wildlife populations. Nearly two-thirds of these federally listed species occupy private land, and approximately one-third occupy only private lands (Evans et al., 2016). Achieving private landowner cooperation with endangered species recovery efforts has historically been challenging due to concern over land regulation (Norris, 2004).

Consequently, research and practice over the past three decades has focused on providing assurances and incentives to landowners with listed species on their land (Byl, 2019). These efforts have evolved to also include the implementation of incentive-based voluntary conservation programs for species that are *at risk* of being listed (also known as "candidate" species) under ESA protections in the hope that the listing can be prevented (Donlan, 2015). However, there are major challenges in recruiting and maintaining private landowner cooperation with these *prelisting conservation* efforts due to the perceived threat of future land regulations should the species eventually be listed (e.g., Brook, Zint, & De Young, 2003; Lien et al., 2019).

The threat of land regulation under the ESA provides a particularly unique socio-political case study to understand drivers of participation in incentive-based, voluntary conservation efforts. The original intention of the ESA was to correct unwanted biodiversity loss, yet it ostensibly exacerbated the problem on private lands due to: challenges with enforcement (Bean, 1998); over-reliance on biologists manage social conflict (Kellert, 1994); a command-and-control approach to implementation; and a bureaucratic structure that precludes organizational learning, flexibility, and adaptability (Clark, 1997; Norris, 2004). These factors have created lasting concerns about land regulation and have led some private landowners to refuse government access to their property, or even to preemptively destroy habitat that could support both candidate and listed species (Brook et al., 2003; Lueck & Michael, 2003; Polasky & Doremus, 1998). Thus, the question of participation in a program to help wildlife generally is qualitatively different than asking private landowners to participate in a program to specifically help a listed species or one that is at risk of becoming a listed species. Structurally, for instance, programs involving at-risk and listed species may contain explicit assurances against future regulation as part of the agreement (e.g., Byl, 2019).

Previous research on participation in programs to protect at-risk and endangered species has considered how landowner characteristics (e.g., age, gender, land use objectives) and perceptions (e.g., beliefs, attitudes, and constraints) are related to willingness to participate. For example, Kline, Alig, and Johnson's (2000) examination of forest landowners' willingness to adopt harvest restrictions to protect or enhance riparian habitat for endangered salmon in return for a federal income tax deduction found that the more a private forest owner depended on the land for timber sales, the less willing she or he was to participate. Langpap (2004) found willingness to participate in incentive programs designed to provide habitat for endangered species to be positively related to the number of acres owned, membership in conservation organizations, and the importance landowners place on wildlife habitat. Participation was negatively related to age, and it was not related to perceptions of regulatory risk from the ESA. In an analysis of the same data focusing on conservation effort, assurances against future regulation were related to effort, while demographics and property size were not (Langpap, 2006). In red-cockaded woodpecker (*Dryobates borealis*) habitat, researchers documented a number of factors related to program participation including acres owned, perceptions of risk, attitudes toward endangered species, and how landowners are introduced to the conservation program (Mehmood & Zhang, 2005; Zhang & Mehmood, 2002). Past participation and income have also been positively related to interest in an endangered species conservation program in North Carolina, while age, acres owned, and beliefs about private property rights were negatively related (Rodriguez, Peterson, Cubbage, Sills, & Bondell, 2012). Participation in related incentive programs focusing on wildlife in general or similar habitat goals has also been related to participation in a program for at-risk species (Sorice & Conner, 2010). Finally, Ward, Green, and Izlar (2018) found past participation was positively related to intention to participate in incentive programs to protect endangered species habitat for members of forestry associations. However, no demographic characteristics were related to intention. In sum, landowner characteristics are sometimes related to program participation in conservation programs for at-risk species, but consistent patterns of participation have not emerged.

Research has also explicitly considered how the structure of programs to help candidate and listed species relates to participation. The most consistent factors for participation center around the core of the program structure: compensation and assurances against future regulation (Langpap, 2004, 2006; Mehmood & Zhang, 2005; Sorice et al., 2013; Sorice, Haider, Conner, & Ditton, 2011). Compensation and cost share tend to be positively related to participation as are programs that provide assurances against future regulation (Langpap, 2006; Sorice et al., 2011). Programs that allow landowners themselves to contribute to management decisions are also more desirable (Sorice et al., 2013; Kreye et al., 2018). In contrast, programs that require some form of protection in perpetuity to help at-risk species tend to be less desirable: landowners prefer programs for at-risk and listed species with shorter contract lengths and without conservation easements (Kreye, Pienaar, Soto, & Adams, 2017; Rodriguez et al., 2012; Sorice et al., 2011, 2013). Yet, these factors and their influence on participation vary regionally. For example, stories of

landowners actively helping at-risk species with no compensation or assurances exist in other landscapes (e.g., Wilcove et al., 2004; Kreye et al., 2018).

A clear understanding of the conditions that drive private landowner participation in at-risk species conservation programs remains elusive. We propose that there are multiple pathways to participation, all of which are context dependent. We explored this idea of multiple pathways through a case study of landowner participation in the U.S. Department of Agriculture Natural Resources Conservation Service's (NRCS) Working Lands for Wildlife program to conserve the lesser prairie-chicken (*Tympanuchus pallidicinctus*). The Lesser Prairie Chicken Initiative (LPCI) provides a unique context to examine participation in the shadow of the ESA, which may make participation a potentially risky proposition for private landowners to contribute to conservation efforts, especially if landowners perceive that a collective failure ultimately leaves them vulnerable to ESA regulation. Our objective was to explore reasons for participation as opposed to testing specific hypotheses or searching for an optimal model of participation.

We explored how participation in the LPCI is related to seven factors or constructs, all of which have been hypothesized or shown to be related to participation in conservation programs for at-risk species in other contexts (Table 1): (a) landowner demographics (e.g., Zhang & Mehmood, 2002); level of connection to the land, including (b) rootedness and (c) resource dependence, which have both been shown to have a negative association with intention to participate in an at-risk species conservation program (e.g., Sorice et al., 2012); underlying values, including (d) concern for environment and (e) dominance values toward wildlife (e.g., utilitarian or instrumental perspectives on the value of wildlife) which may have negative influence on intention to participate (e.g., Brook et al., 2003; Kreye et al., 2018); (f) social norms and (g) program structure, which both have been demonstrated to influence participation in programs for at-risk species (Langpap, 2004, 2006; Sorice et al., 2011; Sorice & Conner, 2010).

2 | BACKGROUND

The lesser prairie-chicken is an iconic species of the Southern Great Plains. Like most species of grouse, they

TABLE 1 Factors and constructs identified to be related to management decision making or participation in conservation incentive programs

Factor or construct	Description
Demographics	Landowners with certain characteristics may be more or less likely to participate (e.g., Zhang & Mehmood, 2002)
Rootedness	This concept reflects the degree to which a landowner is embedded in the social world that shapes their beliefs (Hay, 1998; Tuan, 1980). Applied here, it is a landowner's family heritage, the amount of time a landowner has lived in an area, as well as their degree of socialization with the farming or ranching lifestyle (Sorice, Conner, Kreuter, & Wilkins, 2012)
Resource dependence	The degree to which a landowner relies on their land to support their livelihood may influence their willingness to participate in a program. It reflects an economic dependence as well as a psychological commitment to the livelihood as part of their self-identity (Marshall, 2011; Sorice et al., 2012)
Concern for environment	Participation may vary based on concern about the consequences of natural resource degradation for themselves, other people, and nature. These items respectively represent egoistic, altruistic, and biocentric values (Schultz, 2001)
Dominance values toward wildlife	Rural landowners are more likely to express dominance values than the general public and less likely than the general public to express that wildlife deserve rights and care (Gigliotti and Sweikert, 2019). We focused on the role of dominance values because they are widespread and associated with stronger property rights beliefs (Vaske, Miller, Toombs, Schweizer, & Powlen, 2018), which is a vital aspect of at-risk and endangered species recovery (Hadlock & Beckwith, 2002). In our study area the prevalence of the dominance value ranges from about 68% of residents in Texas to 80% of residents in Oklahoma (Manfredo et al., 2017)
Social influence	Landowners may or may not consider feedback from other landowners, or consider the opinion of program staff when deciding to participate. Indicators of social influence include social proof, descriptive norms, and injunctive norms (Fishbein & Ajzen, 2010; Thøgersen, 2008)
Program structure	Landowners can be drawn toward or pushed away from programs based on how they are structured (e.g., Langpap, 2004)

require large, mostly unfragmented landscapes. Estimates suggest that more than 85% of the lesser prairie-chicken historical distribution has been converted to cropland (Hagen, Jamison, Giesen, & Riley, 2004). Thus, working lands have direct and significant implications on the health of lesser prairie-chicken populations.

The lesser prairie-chicken became a candidate species for listing under the ESA in 1998 and was proposed to be listed as a threatened species 14 years later in 2012. It was eventually listed in 2014 but removed 2 years later when a court determined that the federal government had not properly considered coordinated efforts to conserve the species through incentivized voluntary conservation on private lands. Re-evaluation of the species' status was scheduled for 2018; however, it had yet to occur at the time this paper was written.

Launched in 2010, the LPCI is a voluntary prelisting conservation program that focuses on increasing habitat quality for the lesser prairie chicken, which was a candidate species for listing under the ESA during the study period. The goal is unique for at-risk species programs in that it explicitly states an intent to promote the long-term sustainability of ranching operations while increasing the abundance and distribution of the lesser prairie-chicken (LPCI, 2019). The program offers participants financial and technical assistance for over two dozen practices deemed to be benign or beneficial to the lesser prairie-chicken. Participants are required to develop a grazing plan and implement select practices related to improving wildlife habitat in accordance with the goals of their ranching operations. Conservation practices differ for each individual but can include adjustments to grazing management, removal of invasive trees, or placing markers on their fences. To date, over 1.1 million acres have been enrolled in the program.

3 | METHODS

3.1 | Study area

The study area consisted of all privately owned lands within the lesser prairie-chicken's occupied range, covering four ecoregions: Shinnery Oak Prairie, Shortgrass/CRP Mosaic Prairie, Mixed Grass Prairie, and Sand Sagebrush Prairie (McDonald et al., 2014) (Figure 1). The study area spans five states and more than 80 counties. We targeted our sampling in areas identified as highest-priority (*focal area*, *connectivity zone*, or *modeled habitat*) by the Southern Great Plains Crucial Habitat Assessment Tool (Southern Great Plains Crucial Habitat Assessment Tool 2013). Most private land in the region is operated as farms or ranches and is owned by individual families, associations, or corporations. In general, the region is characterized by few large cities and low human population densities.

3.2 | Sampling

The population of interest consisted of all individuals currently serving as a farm or ranch's primary decision-maker (typically the landowner) who were aware of and eligible to enroll in the LPCI. We defined *participants* as individuals with active LPCI contracts, as well as those who had completed one or more contracts and were no longer enrolled. *Nonparticipants* were landowners who had chosen not to enroll after becoming aware of and knowledgeable about the program.

Because a centralized list of LPCI participants was unavailable, we obtained lists of active and past LPCI participants for each county from the local NRCS District Conservationists, or from state NRCS offices where possible. Similarly, it was not possible to identify the full population nonparticipants. Although it was possible to identify a landowner's eligibility to enroll, there was no way to identify landowners with a priori knowledge of the program. Consequently, we employed a purposive sampling strategy focusing on recruiting landowners with a diversity of opinions on participation in the program, which provides greater depth to the case study (Ragin, 2000).

To recruit current and past participants we asked the NRCS State Conservationist in each state to identify the counties with the greatest participation in the LPCI program. We then asked each county NRCS office to assist in identifying landowners with a diversity of positive and negative opinions or experiences with the program. To recruit knowledgeable nonparticipants, we asked (a) each local NRCS office to identify individuals who had learned about the program from them and chosen to not enroll; (b) active or past program participants to identify friends, neighbors, or family members who know about the program but did not want to participate; and (c) nonparticipants we engaged to identify other individuals who had chosen to not participate. We explicitly requested help in identifying nonparticipants with a diversity of positive and negative opinions related to the LPCI and endangered species.

We used a quota sampling approach with a goal of interviewing 90 landowners, including eight current, eight past, and eight nonparticipants from each ecoregion and state. When ecoregions spanned several states, we sampled from each state in a ratio roughly proportional to the number of landowners in each state. In some ecoregions or states, there were fewer current, past, or nonparticipants than our sampling goals, so we invited all individuals to

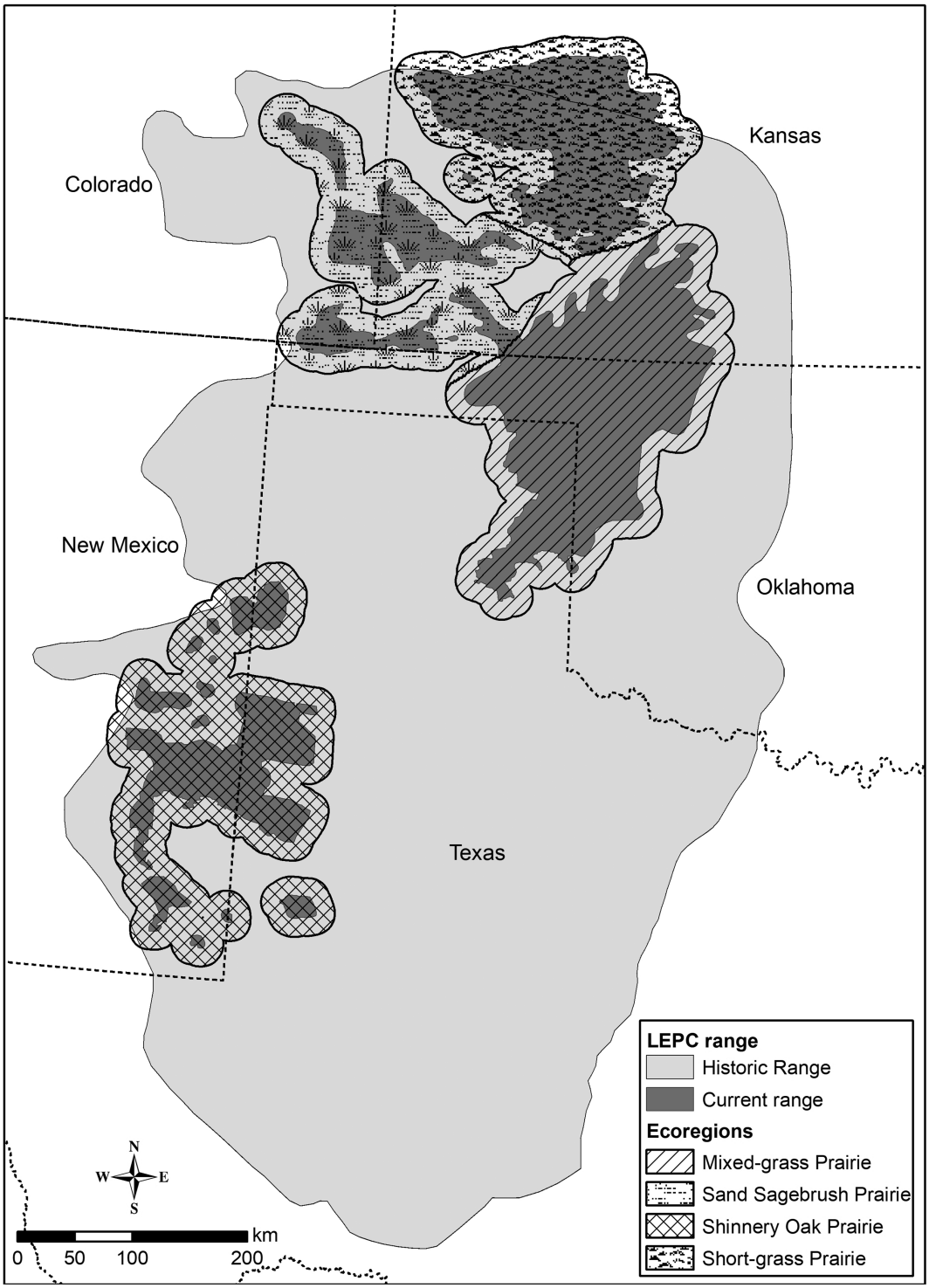

FIGURE 1 Extent of lesser prairie-chicken habitat circa 2014.
Source: Boal and Haukos (2016)

participate and increased our sample size in other areas. When an individual was the decision-maker for land in multiple states or ecoregions, we categorized this person by the county from which we obtained their contact information from the NRCS. We conducted all interviews between October 2017 and January 2018.

3.3 | Data collection

We conducted face-to-face interviews with landowners using a structured questionnaire format. We included the following factors and constructs in the interviews (Table S1, Supporting Information).

- Demographics: We collected a number of variables related to landowner characteristics including gender, age, education, and occupation. Operation characteristics included land management objectives, their decision-making authority, involvement in land management, and the number of acres managed.
- Rootedness: We characterized rootedness by both the individual and familial tenure on their land, as well as current familial connections. We measured social connection as the proportion of their childhood growing up in the area and living on a farm or ranch (1 = *none* to 5 = *almost all*). Landowners also indicated the percent of their family and friends that currently live in the area and that currently farm or ranch in the area. Finally, respondents indicated the number of generations the land has been in their family for both the respondent and, if applicable, the respondent's spouse. For our analysis, we used the response from the respondent or the spouse that indicated the highest number of generations.
- Resource dependence: We asked respondents the degree to which being a farmer or rancher describes their beliefs about themselves and the degree of importance it plays in their life (1 = *does not describe me at all* to 5 = *perfectly describes me*). These items included an array of topics, including land use objectives related to livestock production and crop production, as well as experiencing a rural lifestyle and outdoor recreation. It also included the salience (e.g., *I am a rancher*) and prominence of their self-identities as a rancher or farmer (e.g., *farming/ranching is an important part of who I am*). We measured economic dependence on the land by asking respondents to what degree they managed their land as *a business*, as *an important source of income*, to *provide financially for themselves/their family*, and to what degree they *rely on their place for income*. We also asked about the percent of income that comes from activities on their land.
- Values: Respondents were asked how well eight statements related to *dominance over wildlife* described their beliefs (1 = *does not describe my beliefs* to 5 = *completely describes my beliefs*) (Manfredo et al., 2017). We averaged those scores together to create a single index (Cronbach's $\alpha = .77$).

  Respondents were also asked about their concern over the consequences of natural resource degradation for themselves, other people, and nature that respectively represent egoistic, altruistic, and biocentric values (Schultz, 2001). They responded to multiple items including concern for *me*, *people in my community*, *animals*, and *wildlife* on a scale from 1 = *not important at all* to 5 = *extremely important*. Multiple indicators of each value were averaged into an index representing each value.
- Social influence: The influence of others comes from what individuals see others doing, what they think others want them to do, and the degree to which they believe the behavior of others leads to desired outcomes (Cialdini & Goldstein, 2004). We asked landowners to consider whether or not what they had heard from others or what they had seen others do influenced their decision to participate (Sorice et al., 2011; Sorice & Conner, 2010). We incorporated social proof by assessing the degree to which landowners were familiar with other participants who leveraged the program (a) to improve their land, (b) to help the lesser prairie-chicken, and (c) for whom the program resulted in "no harm" to the landowner. We considered the role of the NRCS agent recommending the program to each individual. We also considered reputational effects, namely that landowners may derive value from others regarding them as good wildlife stewards. All items were measured on a 5-point scale where 1 = *not true at all* and 5 = *completely true* except for open-ended items asking how landowners first heard about the program, and what they had heard about the program from other landowners prior to making their decision to enroll or not enroll. Responses for open-ended items were coded into binary variables (e.g., heard positive feedback, heard negative feedback, heard no feedback). The third author led the coding process, with the first author assisting and verifying the interpretation of codes.
- Programmatic factors: Landowners ranked the importance of seven program attributes: the application process, compatibility with the needs of their operation, protection from regulation under the ESA, payments and cost-share, timing, and monitoring. These items were selected based on previous research (e.g., Langpap, 2004; Sorice et al., 2013) and in consultation with state and county NRCS agents in the region.

3.4 | Analytical approach

Our approach to data analysis recognizes that participation in a conservation incentive program is the result of myriad intersecting factors related to the individual, the program, and the social setting. We also recognize that multiple paths to participation exist, with the possibility that no single path necessarily dominates. We explicitly recognize that for some, a certain condition (e.g., having large landholdings) may be relevant to participation while for others the same condition may not be related. In addition, the absence of that same condition (e.g., not owning enough land to be considered a large landholder) may be

substantively related to participation when combined with a different set of conditions (Ragin, 1987).

Analytical methods that explore whether conditions (i.e., specific indicators of a factor including characteristics of landowners, their land, or perceptions they hold) or combinations of conditions are present in all cases where landowners participated are not commonly used in the conservation field (but see, e.g., Basurto, 2013; Pahl-Wostl & Knieper, 2014; Qin et al., 2017). Conditions that are consistently present are considered *necessary* conditions (Ragin, 2000). In some cases, a particular condition or combination of conditions may give rise to participation without needing to be combined with other conditions. In these instances, the condition or conditions are considered *sufficient* conditions.

We adopted qualitative comparative analysis (QCA) as our analytical approach because of its utility for identifying combinations of conditions associated with an outcome (i.e., participation) (Ragin, 2000). QCA differs fundamentally from a correlation-based statistical approach (e.g., general linear modeling) in that QCA does not view variables as competing to explain variation in outcomes (net effects). Instead, it considers how variables intersect to create combinations of conditions capable of leading to the same outcome (Ragin, 2006). QCA was appropriate for our case study because it offers a systematic way to address our main research question of whether multiple pathways to participation exist. It provides insight into identifying the pathways and understanding how common each is in the context of the LPCI.

While a strength of QCA lies in its focus on joint effects and the ability to identify multiple pathways to a common outcome, it suffers from computational limitations: because of the exponential relationship between the number of conditions, only a small number of variables can be assessed at one time. The analysis of joint effects requires that all logically possible combinations of conditions be considered, which limits the scope of analysis. For instance, exploring participation with three conditions requires consideration of 2^3 or eight possible outcomes, while a six-condition solution requires consideration of 2^6 or 64 outcomes. Due to computational intensity and limitations, we limited the size of our QCA analyses to eight conditions or less within each factor or construct (Ragin, 2008). We began by exploring possible pathways for a particular factor or construct by evaluating the performance of each condition individually. We then explored combinations of conditions across factors or constructs that demonstrated relatively high consistency and coverage scores when considered individually. While this allowed us to identify the presence of multiple pathways it constrains us from being able to identify so-called best fit models.

3.5 | Data analysis

Qualitative comparative analysis is a configurational method using Boolean algebra and set theory that allows the researcher to contrast all empirically observed configurations of conditions (e.g., landowner and land characteristics, perceptions, and beliefs) with the outcome of interest (Ragin, 2000). We employed a fuzzy logic approach which treats conditions as having varying degrees of membership. Because data preparation for fuzzy set QCA involves deliberate choices made by the research team (Ragin, 2000), we describe in detail our process of preparing the dataset.

We created our fuzzy outcome variable, *participation in the LPCI program*, to reflect the degree to which an individual was engaged with the program. A full participant was considered to be anyone who had completed one or more LPCI contract(s) or who was actively enrolled in an LPCI contract at the time of the interview (Table S2). A full nonparticipant was anyone who knew about the LPCI program, had never applied, and did not intend to apply in the future. We selected a crossover point as an individual who had enrolled in the program and subsequently terminated their contract, a sign that he or she was interested enough to initially engage.

Conditions were also individually calibrated into fuzzy scales based on the scales used to measure each construct. For a 5-point scale spanning *does not describe me at all* to *completely describes me*, the former was scored as completely out (membership = 0) and the latter was scored as completely in (membership = 1). For interval-level data, such as acres owned, we used data sources such as U.S. Agricultural Census data to purposefully select calibration scores (see Table S1 for calibration of independent condition variable).

The fit of a solution is indicated by the degree to which cases that display the outcome (participation level > 0.50) share a particular condition or configuration of conditions (referred to as *consistency*) and the amount of the outcome that is related to a given configuration of conditions (referred to as *coverage*) (Ragin, 2008). QCA best practices recommend setting the threshold for consistency no lower than 0.80 to assure that the combinations of conditions reported are reliably related to the outcome of interest. Coverage indicates how much of the outcome (e.g., participation) is related to a given combination of conditions and is scaled from 0 to 1 to indicate the importance of the configuration. Coverage reflects empirical relevance and can also be applied to the entire solution to indicate how well multiple configurations of a construct relate to the outcome. *Unique coverage* expresses the degree to which membership scores are captured by a given configuration without overlap from any other

configuration. By viewing configurations as *profiles of individuals* related to participation, unique coverage is conceptually related to the cases or membership scores that uniquely traveled that path toward the program participation.

We explored which conditions (or configurations of conditions) were necessary and/or sufficient to describe participation in the LPCI program. Conceptually, *necessary conditions* are required to produce the outcome and are thus present in all instances of an outcome. The definition when using a fuzzy logic is slightly modified and more technical: necessary conditions are identified when the membership score in the fuzzy outcome of participation is less than or equal to the membership score in the condition. In other words, instances of the outcome are a subset of instances of the causal conditions (Ragin, 2000; Schneider & Wagemann, 2010). Conceptually, a *sufficient condition* will always be associated with the outcome, but it may not be the only condition that leads to the outcome. When using fuzzy logic, sufficiency is technically identified when membership scores in the causal condition(s) are less than or equal to membership scores in the outcome. In other words, instances of the cause are a subset of instances of the outcome.

Using *fsQCA* software (v.3.0), we identified conditions that met an 0.80 necessary condition threshold for both participation *and* nonparticipation and excluded these *trivial* conditions from subsequent analyses (Ragin & Davey, 2016). Their presence was considered relatively uninformative because they were consistently present for nearly all individuals in our population (Ragin, 2008). We next assessed consistency to explore the configurations of conditions that were sufficient for participation in the LPCI. To reduce complexity, we grouped variables into seven factors or constructs and explored sufficiency of conditions within each (Table 1). To conduct these analyses, we used the truth table algorithm in *fsQCA* that examines all of the logically possible and empirically-occurring combinations of conditions and outcomes. Following suggested practices, we removed configurations for which we did not have any empirical examples from our data and retained configurations with a raw consistency threshold of 0.80 (Ragin, 2008).

Finally, we examined models representing combinations of conditions that we hypothesized a priori would exhibit high consistency and coverage scores in their sufficiency tests using theoretical knowledge and researcher experience following interviews. For all models, we followed the guideline that models are informative when solution consistency is above 0.74 and solution coverage is between 0.25 and 0.65 (Skarmeas, Leonidou, & Saridakis, 2014). Because the configurations resulting from the analysis reflect individual characteristics and perceptions, we refer to them as *profiles*.

4 | RESULTS

We interacted with 138 of the 159 individuals invited to participate, and 95 participated in in-person interviews (response rate = 60%; cooperation rate of 69%) (AAPOR, 2016). Our results are based on 86 useable interviews (22 nonparticipants and 64 active or past participants). Most respondents were from Kansas (45), followed by Colorado (13), Texas (13), New Mexico (9), and Oklahoma (6). With respect to ecoregion, 31 were from mixed grass prairie, 22 from shortgrass/CRP mosaic, 19 from sand sagebrush prairie, and 14 from the shinnery oak prairie. Overall, we are confident in our representation of participants because it was greater than the number of annual contracts over the past 5 years and similar to the total number of 2018 participants ($n = 69$). We found it difficult to find nonparticipant landowners who were familiar enough with the program to have considered the possibility of enrollment, and interviewed 55% of the knowledgeable nonparticipants we identified. Consequently, the lack of random sampling does not permit generalization to all landowners in the study area, nor can generalizations be made about all prelisting conservation programs.

4.1 | Necessary Conditions

Almost half of the conditions examined were considered trivial (21 of the 47), meaning that the conditions met the *necessary condition* threshold (0.80) for both the participation and nonparticipation outcomes. While these conditions may be related to participation, they were nearly universally true for both groups. Trivially necessary conditions related to being male, farming or ranching as a primary occupation, managing land for livestock, spending a high proportion of one's life in the area, a strong family heritage in the area, economic dependence on the land, high salience of the ranching identity, wildlife dominance value orientations, and values toward the environment.

Seven conditions were determined to be nontrivial necessary conditions, meaning they met the consistency threshold for necessity (0.80) for participants or nonparticipants, but not both (Table S3). For participants, these included being the sole primary decision-maker for their land, not having a high percentage of family living in the area, not hearing positive feedback about the LPCI, not hearing negative feedback about the LPCI, not hearing any feedback at all from other landowners about the LPCI, ranking compatibility of the program with their operation as highly important, and having low levels of monitoring by the NRCS on their property as a low importance. Seven conditions were nontrivial to understand nonparticipation: working on the land >40 hr/

week, not being a small land manager (i.e., managing at least 10,000 acres), growing up in the area for most of one's childhood, growing up on a farm for most of one's childhood, centrality of farming or ranching to one's lifestyle, having a profit orientation toward the land, and having a large percentage of income derived from the land. Of all these conditions, social influence variables focusing on program feedback had the highest consistency scores: having *not* heard any positive or negative feedback was highly consistent with participation (consistency scores ≥0.90).

4.2 | Sufficient Conditions

We used two complementary approaches to explore pathways to participation. First, we examined the conditions (or sets of conditions) that were alone sufficient to produce the outcome, focusing on the individual constructs (i.e., construct-focused profiles). Second, we examine cross-construct profiles informed by a priori knowledge of landowner types. Figure 2 shows the overall consistency and coverage scores for each profile examined, while Table 2 provides an abridged list of profiles resulting from the analysis (Table S4 contains full outcomes).

4.2.1 | Factor or construct-focused profiles

Demographics

We analyzed the following nontrivial demographic conditions: age, education level, how many hours an individual spends managing their land in a typical week, and whether an individual was the primary decision-maker for his land. Five landowner profiles were related to participation (solution consistency = 0.86; solution coverage = 0.61). Being the sole primary decision-maker was present in 80% of the profiles, suggesting it was a reliably important condition. Longevity (operationalized as age and the proportion of one's life an individual owned their land) was also a recurring characteristic in the profiles. Longevity was evident in the two profiles with the greatest unique coverage (Table 2).

Operational characteristics

Five operational profiles were associated with participation (solution consistency = 0.86) and the overall solution applied moderately to our sample of landowners (solution coverage = 0.53). Three of these profiles shared a number of conditions, including having a farm or ranch size that is considered *not large* for the region (<10,000 acres), lower involvement with land management, and using the land for activities that are not necessarily tied to economic revenue. Another common condition was the absence of land management for crops. However, the profile that included landowners with a large farm or ranch (>10,000 acres) and who work on their farm or ranch full-time had 3.5 times the unique coverage compared to all other profiles. These results align well with how LPCI participants score land management objectives compared to nonparticipants: crops were less important compared to livestock, rural lifestyle, and personal recreation (Figure S2).

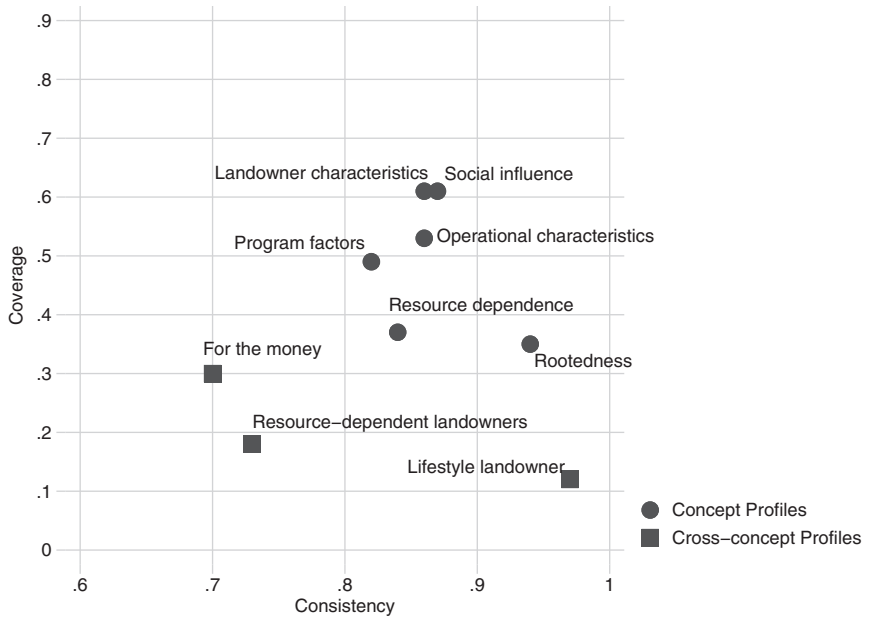

FIGURE 2 Plot of the overall consistency and coverage scores for each construct and cross-construct profile. Consistency reflects the degree to which individuals who participate share a particular condition or configuration of conditions, while coverage is the amount of participation explained by a given profile. Both scales range from 0 to 1

TABLE 2 An abridged selection of landowner profiles sufficient for participation in the LPCI

	Coverage		
	Raw	**Unique**	**Consistency**
Demographics			
Primary decision-maker, typically manages the land ≥40 hr/week, and ≥60 years of age	0.33	0.10	0.83
Primary decision-maker with a college degree and has owned the land ≥90% of his adult life	0.31	0.14	0.85
Operational characteristics			
Manage <1,000 acres, rural lifestyle and recreation moderately (or more) characterizes land use and having crops does not	0.14	0.03	0.87
Manage ≥25,000 acres and the following moderately (or more) characterizes land use: lifestyle, recreation, wildlife conservation, and investment	0.11	0.02	0.87
Rootedness			
Spent less than half of life growing up on a farm and at least half of life growing up in the area	0.17	0.08	0.94
Spent less than half of life growing up on a farm and <20% of family currently farm or ranch in the area	0.13	0.02	0.93
Resource dependency			
Self-identifies as a rancher and not as a farmer, is profit-oriented, and earns ≥50% of household income from the land	0.15	0.11	0.80
Self-identifies as a rancher and not as a farmer; earns <50% of household income from the land	0.21	0.08	0.82
Social influence			
Did not hear anything negative about the program from other landowners nor have they heard anything at all about the program from others. And, they heard about the program from their NRCS representative	0.61	0.61	0.87
Program structure			
High payments, high cost share, and high compatibility	0.24	0.09	0.86
High cost share, high compatibility, and sensible timing	0.19	0.04	0.84

Note: For factors or constructs with multiple profiles, unique coverage expresses the degree to which membership scores are captured by a given configuration of conditions without overlap from any other configuration. Consistency is the degree to which individuals who participate share a particular condition or configuration of conditions. See Table S4 for full output.

Rootedness

Rootedness conditions appear to be strongly related to participation (solution consistency = 0.94), but there was considerable unaccounted for variation with respect to other factors that may influence participation (solution coverage = 0.34). Four profiles with conditions of rootedness were considered sufficient for participation. Growing up on a local farm or ranch was not included in a profile. In fact, every pathway to participation in the solution terms included either *not* growing up on a farm or growing up *outside* the local area (Table 2).

Resource dependence

Resource dependence conditions were sufficient by themselves for participation; however, consistency was lower than operational characteristics and rootedness (solution

consistency = 0.84; solution coverage = 0.37). Three profiles shared some similarities, particularly a lack of profit motivation and lower land-generated earnings. On average, program participants scored nonrevenue generating land management objectives higher than nonparticipants (e.g., personal recreation and wildlife management; see Figure S2). One profile represented individuals who are profit oriented and dependent on their land, but self-identify as ranchers rather than farmers. The unique coverage of this group is nearly twice that of the other profiles.

Social influence

One solution was found to be sufficient for participation: individuals were unfamiliar with the program until their NRCS agent introduced them to it. Thus, a key condition for participation was the NRCS acting an influencer, as opposed to other individuals or family influencing the decision to participate. Along with landowner characteristics, social influence had the strongest relationship with participation (solution coverage = 0.61).

Program attributes

Each profile included respondents' preferences for seven program attributes as conditions. Consistency was lower than other concepts we investigated (solution consistency = 0.82); however, profiles related to preferences for program attributes applied moderately to our sample (solution coverage = 0.49). The profiles were differentiated by whether a landowner had a positive or negative view of each attribute. The profiles with the highest coverage included those with high prescribed grazing incentives and cost-share assistance, high compatibility with existing land activities, and sensible time requirements for required practices. Unique coverage was low for all profiles. These results aligned well with how both participants and nonparticipants rated the importance of program attributes, as well participant responses to why they initially enrolled in the LPCI (Figure S3a). The two most common responses to the question *why landowners initially expressed interest in the program* included a desire for cost-share and payments for implementing prescribed grazing (Figure S3b). Assurances for protection against the ESA were relatively rare in the solution pathways and those that included it had the lowest coverage. This indicates that other program attributes were relatively more important overall for our sample.

4.2.2 | Combining conditions across constructs

We constructed cross-construct landowner profiles to portray landowner phenotypes commonly understood to practitioners as being likely to participate in a prelisting conservation program. We also explored a researcher-informed profile and two empirical profiles.

- Lifestyle landowner: The lifestyle-oriented individual owns smaller parcels of land, focuses on managing land for recreation and is less involved in land management. The following profile was strongly associated with participation (consistency = 0.97) but had low coverage (0.12): primary land use is recreation, works <20 hr per week doing land management, and manages <5,000 acres.
- The resource-dependent rancher: This profile emphasizes dependence on the land for income with a specific focus on ranching. Conditions included: (a) >50% of household income comes from their farm or ranch, (b) a profit-orientation toward the land, (c) the self-image of a rancher as important; and the following program preferences (d) financial assistance (payments and cost share to implement prescribed grazing), and (e) compatibility of the program with land activities. Participation was not strongly associated with this profile (consistency = 0.73) and coverage was low (0.18).
- The resource-dependent rancher rooted in the area: An extension of the *resource-dependent rancher*, this profile considers an individual's connection to the area via growing up on a farm for >50% of their life, living in the area for >50% of their life, and having land that has been owned for at least three generations. Participation was not strongly associated with these characteristics (consistency = 0.66) and coverage was very low (coverage = 0.09).

5 | DISCUSSION

5.1 | Multiple pathways to participation

While the premise that there are multiple pathways to participation in voluntary conservation programs is intuitive, identifying those pathways can be challenging. Identifying multiple pathways to participation has received much less attention compared to correlation-based analyses, which tend to seek an optimal solution by focusing on the unique contribution of each variable while holding all others constant. The QCA approach permits the examination of multiple configurations of landowner characteristics and beliefs, operational characteristics, social influence, and program structure, and how those configurations relate to participation. It does this by emphasizing the importance of joint effects: how variables combine rather than compete to explain an outcome (Fiss, 2011). By doing so, it contributes to a

nuanced understanding of the multiple forces associated with participation in a particular context.

A number of conditions we explored were considered trivial and not sufficient for participation. This triviality was a result of homogeneity in the respondents: most were experienced male ranchers over 60 for whom ranching (and farming) represents a way of life. Both participants and nonparticipants in our sample shared similar values toward natural resources and a similar level of dominance values toward wildlife. While this finding could be related to our sampling approach, self-selection bias, or other related issues in social science sampling, the assessment of triviality is useful because it explicitly recognizes that some conditions can be prevalent in a particular socio-cultural context leaving them with little ability to explain participation. For instance, our sample was characterized as having a strong family heritage in the area, high economic dependence on the land, and a strong sense of identity as a rancher. Expected pathways to participation differ for this context than might be expected in other contexts, such as situations where amenity-focused landowners are primarily uninvolved with land management (e.g., Selinske et al., 2019), or where a mix of amenity- and production-focused landowners occur.

Some concepts were more useful in discriminating between participation and nonparticipation within our sample. For example, being a sole decision-maker was an important condition. Profiles focused on either age and involvement, or education and high land tenure were also important. Previous research investigating the importance of age on participation in at-risk species conservation program has resulted in mixed results: it may be related (Kline et al., 2000; Langpap, 2004; Rodriguez et al., 2012) or not (Sorice et al., 2012; Ward et al., 2018). The difference in our approach is the emphasis on the joint explanation offered by age *and* involvement *and* decision-making authority. Similarly, while education and land ownership have been investigated as drivers of participation (e.g., Langpap, 2004, 2006; Ward et al., 2018), hypotheses of joint association with participation have not been tested.

While demographics represent the characteristics of the landowner, program conditions represent structural factors that may draw landowners into the program. The top profiles in our sample contained some form of financial incentive (Table 2). Although evidence suggests that financial incentives are not always an important motivator to help at-risk or endangered species (Wilcove et al., 2004), this supports previous research highlighting the need for financial incentives (e.g., Langpap, 2006; Sorice et al., 2013). The perceived threat of land regulation is unique to programs focusing on at-risk and endangered species; yet, we found that assurances against future regulation were not part of a sufficient solution in our study. Instead, the joint effect of financial incentives and compatibility with a landowner's land use objectives was a key combination of conditions associated participation within our sample. Lack of compatibility has previously been identified as a potentially important indirect cost to landowners, but it has not received a lot of attention in the at-risk species conservation literature (Epanchin-Niell & Boyd, 2020). This identifies a potential intersectional relationship for program design: program administrators jointly considering financial incentive *and* compatibility with land management goals may be more important than considering each separately. This finding also supports the hypothesis that programs designed with empathy for landowner needs can result in higher participation than programs designed with a strong focus on an at-risk species' needs (e.g., Sorice et al., 2013).

The value of the QCA approach as a complement to correlation-based approaches lies in the acknowledgement that it is not compulsory to identify singular optimal model because "the average landowner" does not exist. In addition, rather than identifying the unique effects of conditions as being important or unimportant per se, QCA identifies conditions that contribute to an understanding of an outcome. Our case study offers the insight that many of the concepts used to study private lands participation are useful, but that significant heterogeneity in the configuration that results in participation likely exists. For instance, within our single research effort, five landowner characteristic profiles were strongly associated with participation. This means that each profile by itself is capable of consistently producing the outcome on its own (Ragin, 2000). Similarly, three land characteristic profiles and five rootedness profiles were consistently related to participation. Variations in findings across studies may also reflect contextual variables that render some conditions *trivial* in particular research settings. Acknowledgement in future research of the cultural landscape and the conditions to which findings are applicable is important because private landowners may exhibit high levels of homogeneity in some regards and heterogeneity in others.

The notion that participation in conservation programs is not the purview of any particular type of landowner (e.g., lifestyle landowner vs. agricultural producer) or due explicitly to social norms or program structure is supported by our findings of multiple pathways and by the poor performance of the cross-construct models. This supports the idea is that program administrators of the LPCI and perhaps other at-risk conservation programs may benefit from casting a wide net rather than relying on a characteristic-based marketing segmentation strategy.

5.2 | Social influence and gatekeepers to participation

Incentive programs are voluntary and typically indirectly related to landowners' land use goals. Thus, a landowner's decision to participate in any at-risk species conservation program may be the result of careful deliberation. Our results suggest, however, that heuristics may play a substantive role in decision making in LPCI participation. Not hearing positive or negative feedback about the LPCI from other landowners or family was commonly associated with participation, along with interactions with an NRCS agent. A recurrent theme from interviews was that landowners had an initial interest in finding financial assistance to accomplish some goal on their land (A. Santo, personal communication). Landowners then visited their NRCS office to explore financial assistance programs and the NRCS officer introduced them to the LPCI. Under this scenario, a landowner may decide in the moment whether or not to participate (Reddy et al., 2017).

This observed interaction suggests the NRCS agents could be acting as a key influencer and/or *gatekeeper* in LPCI participation. These agents do not have the power to enroll participants, limiting their role as gatekeeper to enhancing or suppressing participation through the information they provide to landowners. If NRCS agents are important information brokers in the enrollment process as our results suggest, increased marketing efforts of the LPCI could lead to greater participation. However, landowner knowledge about the program prior to visiting the NRCS agent was not a necessary nor sufficient condition for participation. Thus, agents' key role in our case study is likely at the point of contact, offering information that helps landowners meet a specific need (Rogers, 2002). Landowners in this area may be identifying a need a priori (e.g., a cost-share program) and looking to a NRCS agent for insights to fulfill that need. Thus, an agent's ability to evaluate and communicate the potential program fit for landowners may be playing critical role in overall LPCI participation. These observations highlight the important role of training program providers to identify willing and interested landowners, and encourage their participation.

5.3 | New avenues for research on participation

Previous research examining beliefs and participation has largely focused on decision-making as an activity in which landowners deliberate over the various consequences of their decision and then make a choice (Fishbein & Ajzen, 2010; Sorice, 2012). Our case study suggests how a bounded rationality perspective can complement current models that assume decisions to participate or not are the outcome of thoughtful and calculated deliberation (e.g., Ward et al., 2018). A landowner may seek a solution that is considered *good enough*, rather than vigilantly calculating the expected value of all alternatives. Landowners may use heuristics in these situations in an attempt to identify appropriate behavior invoked based on their identity, rules, and recognition rather than systematic processing of information (Weber, Kopelman, & Messick, 2004). Identity reflects an individual's socially defined role in society and personal characteristics that define their sense of self (e.g., "I am the kind of person who helps wildlife"). Rules typically are the norms that help one assess socially appropriate behavior and recognition reflects patterns that allow individuals to categorize. For instance, a landowner enrolling in the LPCI may already be visiting their NRCS agent to talk about government programs. The LPCI program exists in the context of an already-familiar situation (i.e., an NRCS program). Identity-related beliefs that landowners like me both *enroll in cost-share programs* and *help wildlife* may be invoked. Program assurances provide an important safety net, but may not be considered core to the decision in all contexts. For practitioners, this could relate to finding innovative ways to design and implement conservation programs that are built on concepts familiar to landowners, recognize the cultural context of the area, are compatible with landowner's land-use goals, support landowners' aspirations for being responsible land stewards, and are supported by their local NRCS agent. Collaborative design processes may also help design programs that fit landowners' objectives (e.g., Cooke, Langford, Gordon, & Bekessy, 2012). Future research that explicitly considers how participation decisions match what a landowner considers to be appropriate behavior for themselves in a particular situation can provide greater insight into cooperation in at-risk program (March & Heath, 1994).

Our case study supports a rich mosaic of case studies trying understand the question of participation in various conservation programs in different contexts and employing a variety of methods. Our research is exploratory and not exhaustive. We focused on concepts found to be useful in the at-risk species and endangered species conservation literature, but a number of additional factors that influence participation in conservation programs in general warrant investigation (e.g., Epanchin-Niell & Boyd, 2020; Lubell et al., 2013; Selinske et al., 2019). Lessons from this case study suggest that (a) participation is jointly influenced by a number of factors (but not necessarily by land regulation concerns), and (b) because a landowner's decision to enroll may not be fully deliberative, agency personnel can play

a key role at the point of contact once a landowner expresses a need for their land. As important, it confirms an obvious, but often underappreciated, issue related to conservation programs and their design: multiple pathways to participation are likely the norm as opposed to the exception.

ACKNOWLEDGMENTS

This research was supported by Pheasants Forever, the Virginia Agricultural Experiment Station, and the USDA National Institute of Food and Agriculture McIntire-Stennis Program project 1007271. This study was conducted under Virginia Tech's Human Research Protection Program Approval #17-919.

CONFLICT OF INTEREST

This study focuses on the Lesser Prairie Chicken Initiative, a private lands conservation program administered by Natural Resources Conservation Service (NRCS). This research was funded by NRCS through Pheasants Forever, and the coauthors include an individual whose position is partially funded by the NRCS.

AUTHOR CONTRIBUTIONS

M.G.S. and C.J.D. designed the research with input from A.R.S. and C.A.H. A.R.S. collected the data; A.R.S. and M.G.S. led data analysis with support from G.M.L.; M.S. led writing the manuscript. C.J.D., A.R.S., G.M.H., and C.A.H. provided critical contributions to the manuscript and have given final approval for publication.

DATA AVAILABILITY STATEMENT

Due to the possible sensitivity of human subjects' data, and in compliance with Protocol #17-919 approved by the Virginia Tech Institutional Review Board, data are only accessible to project investigators.

ETHICS STATEMENT

Ethical approval to conduct this research was approved by the Virginia Tech Institutional Review Board (IRB # 17-919).

ORCID

Michael G. Sorice https://orcid.org/0000-0001-9865-0965

Anna R. Santo https://orcid.org/0000-0003-2056-0892

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SUPPORTING INFORMATION

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

How to cite this article: Sorice, M. G., Donlan, C. J., Santo, A. R., Luque, G. M., & Hagen, C. A. (2021). Exploring pathways to participation in an at-risk species conservation program. *Conservation Science and Practice*, *3*(9), e489. https://doi.org/10.1111/csp2.489