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Land use decisions after the Conservation Reserve Program: Re-enrollment, reversion, and persistence in the southern Great Plains

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Abstract

The temperate grasslands of North America remain one of the most modified and threatened ecosystems on the planet. In the United States, the conservation of grassland-dependent wildlife continues to be challenged by the widespread conversion of privately owned grasslands to cropland. Recent analyses indicate that land exiting the Conservation Reserve Program (CRP), the country's largest private lands conservation program, is a primary source of grassland conversion. In this mixed-methods study, we employed focus groups and mail surveys to understand the decisions made by landowners in the southern Great Plains as their CRP contracts near expiration and up to 7 years following expiration. We explored both the post-contract intentions of landowners with fields currently enrolled in CRP and the self-reported, post-contract decisions of landowners whose CRP contracts expired between 2011 and 2017. Interest in re-enrolling in CRP upon contract expiration was high among landowners with current fields; however, over half of landowners with former CRP fields reported being unable to re-enroll when they tried. We found higher rates of grassland persistence than have been previously reported, but also detected temporal patterns that suggest that cropland reversion is increasingly likely as the time since contract expiration increases. This study highlights the need for increased attention to the barriers that preclude transition into other conservation programs following CRP and more detailed understanding of what drives landowner decision-making about re-enrollment and post-CRP land use. These insights will be critical for increasing the effectiveness of programs for enduring grassland conservation on private lands.

KEYWORDS

Conservation Reserve Program, financial incentive programs, grasslands, Great Plains, habitat conservation, landowner, persistence, private lands, reversion

[†]The views expressed in this article are those of the authors and do not represent those of the U.S. Department of Agriculture.

1 | INTRODUCTION

Earth's temperate grasslands are among the most transformed and threatened ecosystems in most of the places where they are found (Henwood, 2010; Hoekstra, Boucher, Ricketts, & Roberts, 2005; White, Murray, & Rohweder, 2000). Their conversion for agriculture, forestry, bioenergy, and other forms of development has sustained human populations, but presents an ongoing challenge to the conservation of grassland-dependent wildlife species across the globe (e.g., Azpiroz et al., 2012; Fargione et al., 2009; Lark, Salmon, & Gibbs, 2015; NABCI, 2017). In the United States, 85% of grasslands are privately owned (NABCI, 2013), turning attention to voluntary financial incentive programs as a key approach to the conservation and restoration of grassland habitat (Doremus, 2003; Kamal, Grodzińska-Jurczak, & Brown, 2015). The Conservation Reserve Program (CRP) is the largest private lands conservation program by acreage in the country, covering over 22.3 million acres (approximately 90,390 km^2) as of August 2019 (USDA FSA, 2019). Since 1985, CRP has provided landowners with a yearly rental payment for retiring environmentally sensitive agricultural lands and establishing grasses or other vegetative cover that will improve environmental quality. The economic impacts of CRP are substantial; the program distributes almost $2 billion to landowners annually (USDA FSA, 2016). Biophysical assessments have shown that CRP also enhances wildlife habitat (Ciuzio et al., 2013; DiGaudio, Kreitinger, Hickey, Seavy, & Gardali, 2015; Higgins, Naugle, & Forman, 2002), improves water quality (Cullum, Locke, & Knight, 2010; Lowrance, Dabney, & Schultz, 2002), sequesters carbon (Li et al., 2017), and increases soil productivity (Gebhart, Johnson, Mayeux, & Polley, 1994). However, the durability of CRP's conservation benefits depends upon how the fields enrolled in the program are managed once their 10- to 15-year contracts expire. This study explores the post-contract decisions of CRP landowners in the southern portion of the U.S. Great Plains, a region with some of the greatest number of acres enrolled in the program, but also the greatest number of acres due to expire within the next few years.

As their CRP contracts near expiration, landowners generally choose to either revert the grassland established during the program back to crops or continue with grassland conservation, whether by re-enrolling in CRP or persisting with grass cover outside of CRP. The potential for reversion to crops following CRP has raised concerns about the ephemeral nature of voluntary financial incentive programs on private lands and the likely loss of conservation benefits when financial incentives for wildlife-friendly land management practices end (Caldas, Bergtold, Peterson, & Earnhart, 2016; Dayer, Lutter, Sesser, Hickey, & Gardali, 2018; Swann & Richards, 2016). Reversion to crop production reverses improvements to soil and water quality associated with CRP (Gewin, Kennedy, Veseth, & Miller, 1999; Gilley, Doran, Karlen, & Kaspar, 1997; Karlen et al., 1999). It also undermines the wildlife benefits derived from the program; in fact, grasslands created through CRP could become an ecological trap by recruiting wildlife to habitat that rapidly becomes poor-quality (Schlaepfer, Runge, & Sherman, 2002) if those fields are plowed or developed. On the other hand, conservation *persistence*, which refers to a landowner's choice to continue with conservation once an incentive program ends, generates environmental benefits that endure beyond the life of contracts and federal expenditures (Dayer et al., 2018; Roberts & Lubowski, 2007).

Attention to patterns of conservation persistence and reversion of grassland to cropland following CRP is particularly important given the scale of the program. Recent analyses indicate that acreage exiting CRP comprises the largest source of grassland conversion to cropland in the U.S. (Hendricks & Er, 2018; Lark et al., 2015; Morefield, LeDuc, Clark, & Iovanna, 2016). With contracts on almost 12.5 million acres (over 50,000 km^2) of land enrolled in CRP across the country due to expire between 2019 and 2022 (USDA FSA, 2017a), insight into landowners' post-CRP land use decisions is critical for understanding the conservation impact of the program, and, more generally, anticipating the long-term availability of grassland habitat in the central U.S.

An expansive literature has examined conservation behavior on private lands in the U.S. (Baumgart-Getz, Prokopy, & Floress, 2012; Prokopy et al., 2019; Prokopy, Floress, Klotthor-Weinkauf, & Baumgart-Getz, 2008), with much of this work focusing specifically on the factors that encourage or limit landowner participation in CRP (Chang & Boisvert, 2009; Isik & Yang, 2004; Konyar & Osborn, 1990; Parks & Schorr, 1997; Ranjan, Church, Floress, & Prokopy, 2019). Beginning with the first round of expiring CRP contracts, researchers have also sought to understand the land use intentions of CRP participants following the program (Atkinson, Romsdahl, & Hill, 2011; Beutler, Janssen, & Ghebremicael, 1994; Diebel, Cable, & Cook, 1993; Gustafson & Hill, 1993; Johnson, Misra, & Ervin, 1997; Skaggs, Kirksey, & Harper, 1994), and more recent analyses have investigated actual changes in land use on former CRP fields (Caldas et al., 2016; Hendricks & Er, 2018; Morefield et al., 2016; Roberts & Lubowski, 2007). Previous research has made it clear that agricultural producers make decisions about land use in response to current conditions within their operations, families, and communities; in relation to the expected productivity of their fields under alternative uses

(Lubowski, Plantinga, & Stavins, 2008); and within the confines of global commodity markets (Coppess, 2017; Hallerstein & Malcolm, 2011) and federal policies (Hendricks & Er, 2018). Land use, and specifically conservation-oriented land use, is also driven by the underlying motivations (Sorice, Kreuter, Wilcox, & Fox, 2014) and land ethics (Turner, Wuellner, Nichols, & Gates, 2014) of landowners. Importantly, each of these contexts is not static, but varies from year to year, and landowner decision-making and resulting land use are similarly dynamic across time (Reimer et al., 2014).

This study builds upon the aforementioned literature to explore the decisions made by landowners in the southern Great Plains at a time in which the enrollment cap, or the maximum number of acres that could be enrolled in CRP, set by the federal farm bill was at an all-time low and competition for enrollment was at an all-time high (USDA FSA, 2016; USDA FSA, 2010). We explored the re-enrollment and post-CRP decisions made by landowners in this context as their CRP contracts near expiration and up to 7 years following expiration. Here, we describe the re-enrollment and post-CRP land use intentions of landowners with fields currently enrolled in CRP and the reported re-enrollment and post-CRP land use decisions of landowners whose fields are no longer in the program. Specifically, we address: (a) the extent to which CRP landowners in this region are or were interested in re-enrolling in the program upon contract expiration; (b) what landowners do, or intend to do, with their CRP field if it is not re-enrolled in the program; (c) relationships between re-enrollment and post-CRP land use decisions; and (d) how patterns of conservation persistence and reversion of grassland to cropland vary over time.

This study contributes to the existing body of work on post-CRP land use in three key ways. First, we provide an update to analyses conducted in the southern Great Plains before CRP was embedded in the social and economic fabric of the region (e.g., Skaggs et al., 1994). Second, unlike previous studies (e.g., Caldas et al., 2016; Roberts & Lubowski, 2007), we differentiate between landowners who unsuccessfully tried to re-enroll in CRP upon contract expiration and those who chose not to re-enroll, voluntarily removing their land from the program. Separating CRP landowners who were not interested in re-enrolling their fields from those who wanted to re-enroll allowed us to consider the impact of the program's enrollment cap and explore the relationship between re-enrollment decisions and post-CRP land use decisions. And finally, while other studies have assessed post-CRP land use one (Caldas et al., 2016) or a few years after contract expiration (Morefield et al., 2016), our study included landowners whose CRP contracts expired over a seven-year period, between 2011 and 2017. This longer timeframe allowed us to identify some temporal patterns in grassland conversion, which has been noted as a key knowledge gap (Roberts & Lubowski, 2007).

2 | METHODS

This mixed-methods study employed both focus groups and mail surveys to understand the post-contract decisions of CRP landowners. In an exploratory, sequential research design, we initially conducted focus groups and then used insights from this qualitative phase to develop quantitative survey instruments (following Creswell & Plano Clark, 2017). This sequential approach allowed us to design surveys that would be salient for our target population and explore the resonance of perspectives from the focus groups among a broader sample of landowners in the study area. In addition to integration during survey design, qualitative data were integrated with quantitative data during the interpretation of study findings, in order to generate both generalizability and depth of understanding (Creswell & Plano Clark, 2017).

2.1 | Study area

This study focused on CRP re-enrollment and grassland persistence in the southern Great Plains, a region that includes portions of five states (Colorado, Kansas, New Mexico, Oklahoma, and Texas). The southern Great Plains is characterized by a spectrum of CRP participation, containing three of the top states in the country in terms of CRP acreage (Texas, Kansas, and Colorado) (USDA FSA, 2019) as well as areas in which CRP participation is very low (USDA FSA, 2017b). We selected 34 contiguous counties in the 5-state region that represent this spectrum of CRP enrollment (Figure 1). As of 2017, over 2 million acres (8,162 km^2) of former cropland across our study counties were enrolled in CRP (USDA FSA, 2017b), and the contracts on two-thirds of these acres (5,582 km^2) are due to expire between 2020 and 2022 (USDA FSA, 2017c).

CRP acreage in the southern Great Plains provides substantial grassland habitat for wildlife (Jones-Farrand, Burger, Johnson, & Ryan, 2007), including imperiled species such as the Lesser Prairie-Chicken (Harryman et al., 2019; Spencer, Haukos, Hagen, Daniels, & Goodin, 2017), and also fills important roles for human communities. The southern Great Plains has a regional history of drought and soil erosion, encompassing areas most heavily impacted by the Dust Bowl of the 1930s (Opie, 1998). Grasslands established through CRP,

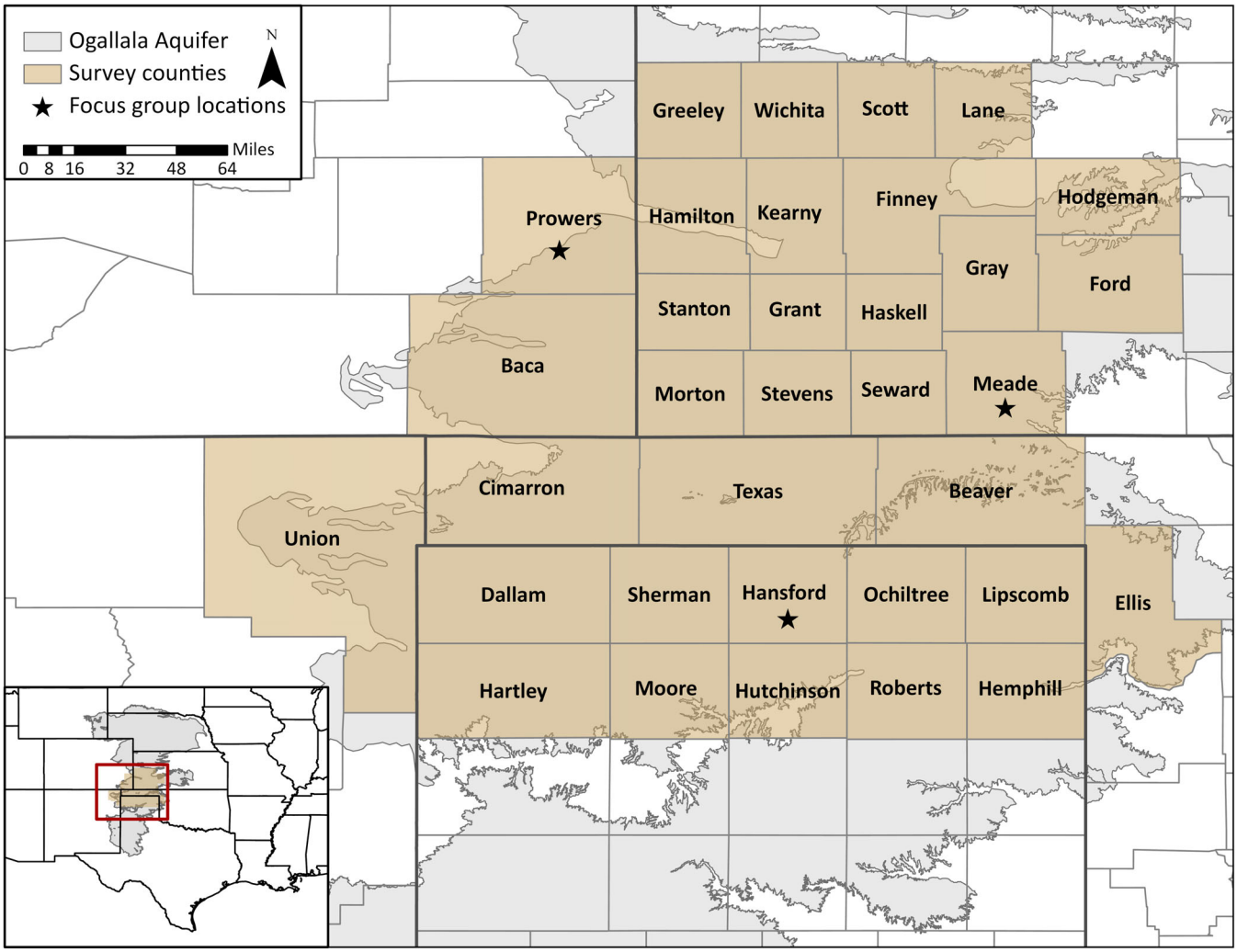

FIGURE 1 Map of the study area within the southern Great Plains of the United States, indicating the counties in which data collection was conducted

especially those comprised of native species, stabilize soils and contribute to the health of playas, shallow basins unique to the region that temporarily fill with water after rain (Daniel, Smith, Haukos, Johnson, & McMurry, 2014; Smith, Haukos, McMurry, LaGrange, & Willis, 2011). Playas provide critical wetland habitat for a diversity of species (Haukos & Smith, 1994) and recharge the Ogallala Aquifer, a massive underground reservoir threatened by unsustainable withdrawal (Gurdak & Roe, 2010). At least 40% of the land area of each county in our study is situated over the Ogallala Aquifer.

2.2 | Focus groups

In August 2017, we conducted three focus groups with landowners with fields currently enrolled in CRP in Prowers County, Colorado; Meade County, Kansas; and Hansford and Ochiltree Counties, Texas (Figure 1). These locations were distributed across the study area in an effort to include landowners operating within the diversity of biophysical and social conditions that characterize the region. Focus group participants were recruited via telephone using a randomized list of CRP landowners in the selected focus group counties provided by the Farm Service Agency (FSA). There were 11 participants in the Colorado focus group, 7 in the Kansas focus group, and 9 in the Texas focus group, for a total of 27 landowners. Semistructured focus group conversations (see Supporting Information for questions) covered landowners' motivations for enrolling in CRP; perceived benefits, drawbacks, and outcomes of the program; intentions and motivations to re-enroll; and intended post-CRP land use. Sessions were audio recorded and later transcribed. A summary of broad themes that emerged under each focus group question was used to

guide development of survey instruments. Landowner quotations illustrating each theme were identified and catalogued so they could be compared to and used in combination with quantitative data from the mail surveys.

2.3 | Mail surveys

We developed two survey instruments: one for the owners or operators of fields currently enrolled in CRP and another for the owners or operators of fields that were previously enrolled in CRP, but whose contracts expired without renewal between 2011 and 2017. Surveys consisted primarily of closed-ended questions that asked respondents about a specific CRP field. Questions included landowner plans for or experience with CRP re-enrollment, actual or intended post-CRP land use, and field and landowner characteristics, in addition to a range of other questions not reported on in this paper (see Supporting Information for survey instruments). Draft survey questions were pre-tested by 13 current and former CRP landowners in the southern Great Plains, in order to determine if landowners could generally recall details about the specified CRP field based on the information about the contract number, county, and field acreage provided in their survey packet. Follow-up phone calls with pre-testers also elicited feedback on any questions that were difficult to answer and the survey's length.

Sampling for our mail survey was conducted at the field level. Using data provided by FSA, we identified all fields in our study area that were currently or had previously been enrolled in CRP practices focused on grassland conservation (CP1, CP2, CP4, CP10, CP23, CP25, CP33, CP38, and CP42). Fields were then randomly selected, stratified by state based on the number of CRP fields located in the counties in our study area. For selected fields, we sent a survey to the individual who received the largest payment from the CRP contract and asked that the survey be completed by "a decision-maker related to the contract." Landowners who received a survey about an expired CRP field may have also owned a field currently enrolled in the program (and vice versa), but individuals included in the sample for expired fields were excluded from the sample for current fields so that each landowner received only one survey. For brevity, we refer to landowners in our study based on the field that was referenced in their survey, either as "landowners with current fields" or "landowners with expired fields."

We contracted with the Survey Research Institute at Cornell University to layout, mail, and perform data entry for our surveys. Surveys were administered between April and June 2018 using a modified Dillman approach, consisting of two survey mailings and a reminder postcard (Dillman, Smyth, & Christian, 2014). We mailed a total of 3,129 surveys: 1,250 to landowners with current CRP contracts and 1,879 to landowners with expired contracts. We used Statistical Package for the Social Sciences (SPSS Version 25.0) to analyze survey data. Based on three field characteristics included in the data provided to us by FSA (field acreage, previous re-enrollments, and contract expiration year), we conducted a nonresponse analysis using *t* tests and Pearson's chi-square tests to check for significant differences between landowners who completed the survey and those who received a survey but did not complete it. To assess how well survey respondents represented the population of agricultural producers in our study region, we qualitatively compared three demographic characteristics (age, gender, and farm acreage) to publicly available data on all producers in our study counties from the 2017 U.S. Census of Agriculture (USDA NASS, 2020).

In order to describe (a) landowner interest in or experience with CRP re-enrollment and (b) intended or actual post-CRP land use among survey respondents, we evaluated basic frequencies for responses to closed-ended survey questions. Below, we report only valid percentages for these analyses, excluding missing values generated in the dataset for questions that were not answered by respondents. Based on qualitative insights from our focus groups and ethnographic research conducted with landowners in the same region in an earlier phase of this study (Steinmetz, 2018), we hypothesized that there would be a significant relationship between landowner interest in re-enrolling in CRP upon contract expiration and conservation persistence if re-enrolling is not possible. For landowners with current fields and landowners with expired fields, we tested this hypothesis by cross-tabulating a dichotomous re-enrollment variable with post-CRP land use and used Pearson's chi-square tests to identify significant differences in conservation persistence between those who tried to or are likely to re-enroll and those who did not try or are not likely to re-enroll in the program (see Supporting Information). Based on evidence that landowner maintenance of conservation-oriented agricultural practices varies across years (e.g., Jackson-Smith, Halling, de la Hoz, McEvoy, & Horsburgh, 2010) and that the amount of acreage converted to crop production follows fluctuating commodity prices (Hallerstein & Malcolm, 2011), we also expected rates of conservation persistence on expired CRP fields to differ significantly depending on the year the CRP contract ended. To test this hypothesis, we cross-tabulated contract expiration year with a dichotomous variable for persistence (defined as either leaving

the majority of the field in grass or enrolling it in another conservation program) and, due to the small number of responses for some years (McHugh, 2013), used a likelihood ratio chi-square test to evaluate the significance of observed differences across years.

3 | RESULTS

3.1 | Survey response

We received 700 completed surveys: 337 from landowners with a former CRP field and 363 from landowners with a current CRP field. After excluding nondeliverable and ineligible surveys (reducing the total sample to 2,941), our overall adjusted response rate was 23.8% (19.6% for landowners with an expired CRP field; 29.7% for landowners with a current CRP field). Respondents tended to be either fully retired (36.8%) or full-time agricultural producers (28.2%), and they reported being involved in farming or ranching for an average of 38 years. Respondents were predominantly male (72.3%), with an average age of 71 years, and operated an average of just under 2,000 total acres (approximately 8 km^2). Over 91% of respondents owned the field referenced in their survey, and almost 57% owned or operated another CRP field as well. For this reason, we refer to all respondents as "landowners." Demographic characteristics of our survey sample generally reflect broad trends in farmer age, gender, and average farm acreage across the counties in our study region (see Supporting Information).

Our nonresponse analysis compared 337 respondents with fields formerly enrolled in CRP to 1,380 nonrespondents and 363 respondents with fields currently enrolled in CRP to 861 nonrespondents. For both groups, there were no significant differences between respondents and nonrespondents in terms of field acreage (Table S1) or whether the field had been previously re-enrolled in CRP (Table S2). There were no significant differences in contract expiration year between respondents and nonrespondents with current CRP fields (Table S3), but these differences were significant between respondents and nonrespondents with former CRP fields (Pearson $\chi^2 = 21.854$, $p = .001$; Table S4). More respondents than nonrespondents had CRP fields that expired in 2016 (12.8% vs. 7.9%) or 2017 (11.3% vs. 7.8%) and fewer respondents than nonrespondents had fields that expired in 2012 (28.2% vs. 35.5%).

3.2 | CRP re-enrollment

Of landowners with a former CRP field, 54.5% ($n = 165$) stated that they tried to re-enroll their expired field in the program (Figure 2a). Interest in re-enrolling was even higher among landowners with a current CRP field; over 83% ($n = 298$) of respondents indicated that, given the same rental payment, they would "likely" or "very likely" re-enroll, if possible (Figure 2b). Landowners with current CRP fields in all three focus groups also indicated that they would be likely to re-enroll once their current contracts expire, partially due to observable changes on their fields while in the program. A landowner in Colorado said, "If there's going to be a re-enrollment, I'll sign ours up, because almost everything we signed up benefited." However, focus group participants further explained that re-enrollment decisions are contingent upon both the status of commodity markets and their

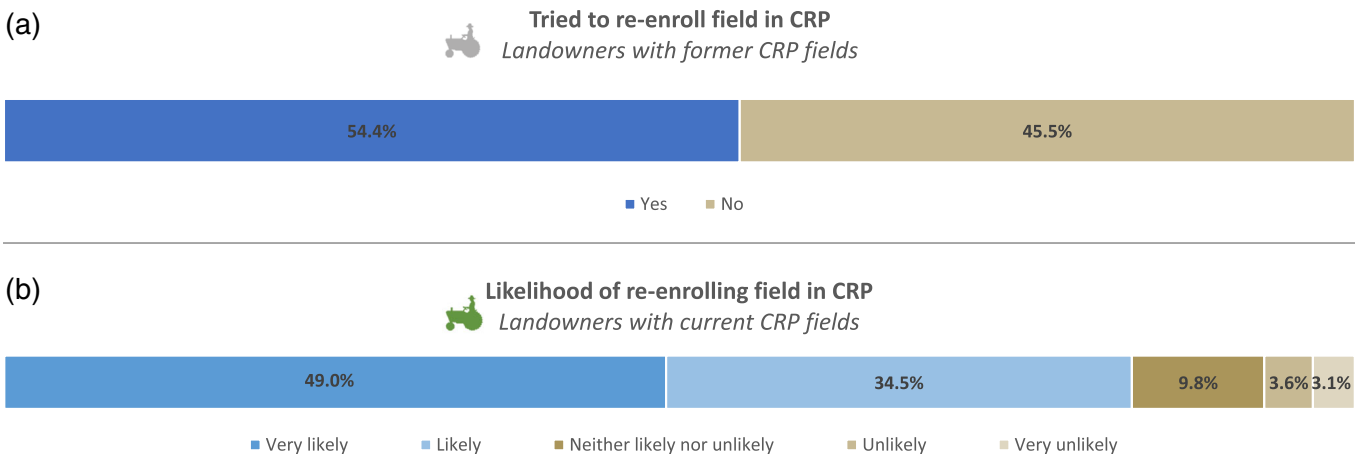

FIGURE 2 (a) The reported re-enrollment decisions of landowners with former CRP fields, indicating whether they unsuccessfully tried to re-enroll their field in CRP. (b) The reported likelihood that landowners with current CRP fields will re-enroll their field in CRP, given the same rental payment

long-term plans for the land. A Colorado landowner provided one explanation of how decisions about re-enrollment are mediated by economic factors: "The price of CRP has been going down...so, you know, we will have to look at that, too. It might come up where you just say it isn't worth it." Landowners in that focus group also considered re-enrollment in light of its long-term consequences for the next generation of farmers in their family and community. One landowner said: "If I were doing it myself there'd be no question, but I have a 30-year-old son that I am trying to set up and a grandson coming on...if he wants to stay in [farming] he has to have so many acres."

3.3 | Post-CRP land use

We asked landowners with former CRP fields to select which, among five land uses, had been applied to the majority of their field since the field exited CRP. Landowners most often reported persisting with grassland, either by leaving the majority of their CRP field in grass (61.9%, $n = 197$) or, less frequently, enrolling it in another conservation program (4.7%, $n = 15$) when their field was not re-enrolled in CRP (Figure 3a). While 66.6% of these landowners persisted with grass cover, 28.6% ($n = 90$) of landowners with a former CRP field reverted the majority of that field to crops, almost exclusively dryland crops. Another 4.7% ($n = 15$) of respondents sold the former CRP field referenced in their survey.

Our survey for landowners with a current CRP field asked how likely they would be to employ the same five land uses on their field if they do not or cannot re-enroll it in CRP. Over half of these landowners (54.7%, $n = 186$) indicated that the majority of their CRP land would "likely" or "very likely" stay in grass (Figure 3b). In our focus groups, landowners who said they would persist with grass after CRP frequently explained that they would transition to grazing or haying as a way to continue to generate income from land that was not suitable for farming, while still controlling erosion. Landowners with current CRP fields also reported being likely to persist with grass by enrolling the majority of their field in another conservation program; 39.3% ($n = 132$) reported

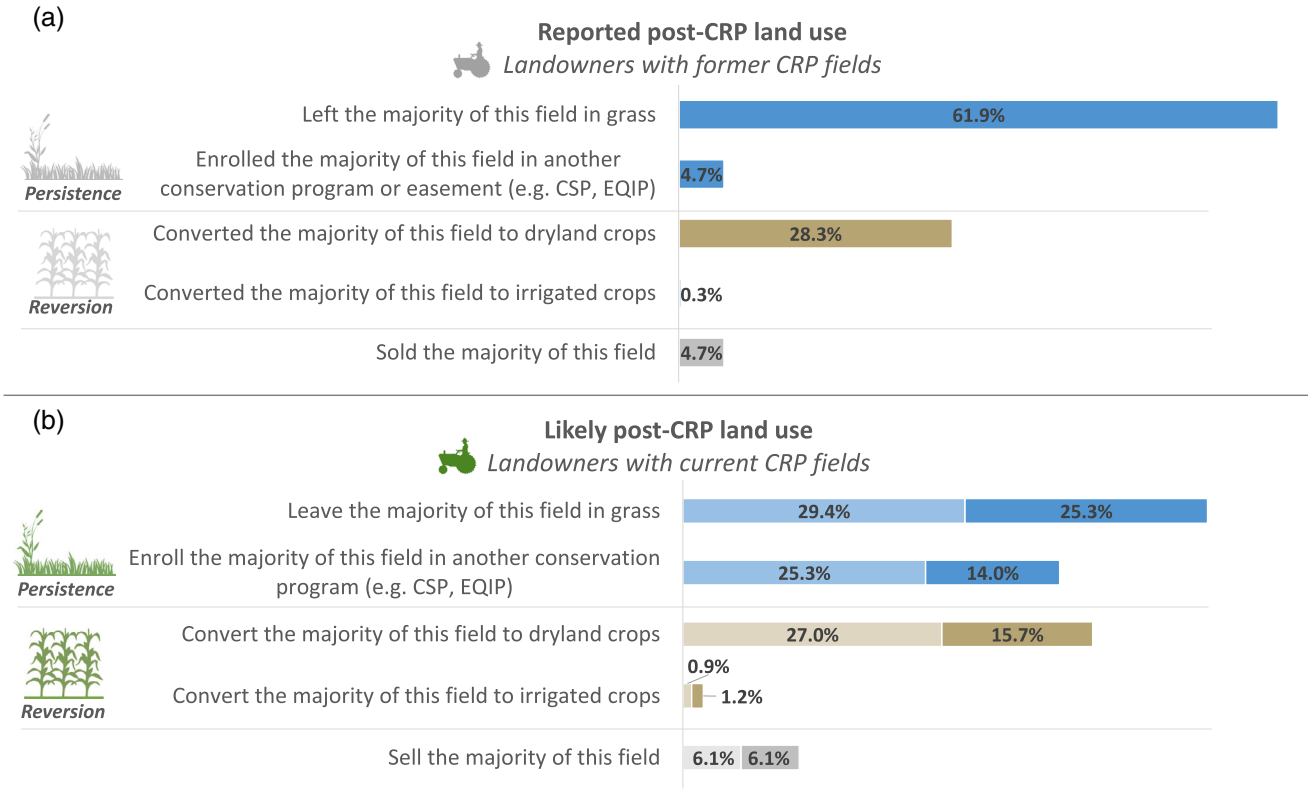

FIGURE 3 (a) Reported post-CRP land use on former CRP fields. Note: Participants with expired CRP contracts were asked to select only one land use that had been applied to the majority of their former CRP field, so totals sum to 100%. (b) Likely post-CRP land use on current CRP fields. Lighter shades of each color reflect respondents who reported being "likely" to apply the given land use if they cannot re-enroll their field in CRP; darker shades of each color reflect respondents who reported being "very likely" to apply that land use. Note: Participants with current CRP contracts were asked to evaluate the likelihood of each post-CRP land use, so totals sum to greater than 100%

that they would be "likely" or "very likely" to participate in a program such as the Environmental Quality Incentives Program (EQIP) or Conservation Stewardship Program (CSP) after CRP. These programs were rarely mentioned in our focus groups.

While over half of landowners with current CRP fields intended to persist with grass cover, 42.7% ($n = 144$) indicated they would "likely" or "very likely" convert the majority of their field to dryland crops. A landowner in Colorado explained: "The fact of the matter is that money talks. We would prefer to leave it in grass, but if you are asking us to take, let's say, $50,000 a year hit or something, we will probably shred it and plow it up." Just over 12% ($n = 38$) of landowners with current CRP fields reported being likely to sell the field in question if it could not be re-enrolled. A farmer in our Kansas focus group said: "If it's not productive, that owner is going to sell it, and the next owner is going to make it productive or they're going to sell it. It's not going to sit there and not...have some sort of a return."

3.4 | Linking re-enrollment and post-CRP land use

Initial focus group conversations indicated that re-enrollment and post-CRP land use decisions for a given field are both tightly linked to the field's agricultural potential. A farmer in Colorado explained that, based on field quality, his decisions about re-enrollment and post-CRP land use were partially made at the outset of CRP enrollment:

> I identified three different kinds of ground that we were putting in the CRP. We had some that, as long as I had anything to do with it, it would never be plowed back out again because I was tired of seeing the dirt blow every year and never being able to plant anything. Then, we had some that was marginal and could go either way. And then, we had some that was [definitely] coming back out ...[W]hen I chose the grass mixes for those, the stuff that I knew was going to stay in, we spent a lot more money on good grass seed..., and then the medium mix we spent less, and the one I knew would be plowed out, it was as cheap as I could go. And so I kind of already made part of those decisions right up front.

Other landowners reinforced that highly erodible lands are likely to be re-enrolled in CRP since they are not suitable for farming. One landowner in our Texas focus group said of his property: "The land here never should've been broke out from grass to begin with, so I plan on it staying in CRP as long as the program lives." Productive ground, on the other hand, is unlikely to be re-enrolled so that it can be broken out to crops again. Discussing post-CRP plans for his operation, one Colorado landowner said, "I'll have to break some of mine out. Now, that sand part I won't, but the stuff that's farmable." Focus group participants explained that the fate of marginal lands—those with limited, but some productive potential—depends on a range of other factors including commodity prices, family dynamics, access to equipment, and the age of the farmer. For example, when asked about their plans for re-enrollment, a focus group participant in Colorado said, "If I've got some marginal land that's pretty good... if I want [my son] to farm, I may have to take it out."

This relationship between re-enrollment decisions and post-CRP land use was supported by our survey data. Among landowners in our survey sample with former CRP fields, patterns of post-CRP land use differed significantly between those who did not try to re-enroll their former CRP field, leaving the program voluntarily, and those who tried to re-enroll the field but were not granted new contracts (Pearson $\chi^2 = 8.66$, $p = .03$) (Table 1). Compared to landowners who decided not to re-apply for CRP, those who tried to re-enroll their former CRP field in the program more frequently reported leaving the majority of their field in grass and less frequently reported converting the field to dryland crops once their CRP contracts expired.

The likelihood of certain post-CRP land uses also differed significantly between landowners with current CRP fields who were likely to re-apply for the program and those who were not likely to try to re-enroll (Table 2). Those interested in re-enrolling once their current contracts expire more often reported that they were likely to persist with grassland conservation, even if they could not re-enroll in CRP. Specifically, landowners who were likely to offer their CRP field for re-enrollment in the program more often reported that they would be likely to leave the majority of their field in grass (Pearson $\chi^2 = 8.69$, $p < .01$) or enroll in another conservation program (Pearson $\chi^2 = 8.86$, $p < .01$) if they could not re-enroll in CRP. Landowners who were not likely to re-enroll more often stated that they would be likely to convert the majority of their field to dryland crops if it was not re-enrolled (Pearson $\chi^2 = 7.66$, $p < .01$).

3.5 | Post-CRP land use over time

Although reported persistence with grassland conservation was relatively high among landowners with former

TABLE 1 Reported post-CRP land use among landowners with former CRP fields

	Reported post-CRP land use	All landowners with former CRP fields (%)	Landowners who tried to re-enroll (%)	Landowners who did not try to re-enroll (%)	Significance
Persistence	Left the majority of this field in grass	61.9	69.9	54.1	$\chi^2 = 8.66$, $p = .03$
	Enrolled the majority of this field in another program	4.7	4.9	5.2	
Reversion	Converted the majority of this field to dryland crops	28.3	20.9	34.8	
	Converted the majority of this field to irrigated crops	0.3	0.0	0.0	
	Sold the majority of this field	4.7	4.3	5.9	

Note: Columns reflect land use by all landowners with former fields as well as post-CRP land use among landowners who tried to re-enroll and those who did not. Significance reported is for a Pearson's chi-square test crossing reported post-CRP land use and re-enrollment decisions.

TABLE 2 Likely post-CRP land use among landowners with a current CRP field

	Likely post-CRP land use	All landowners with current CRP fields (%)	Landowners who are likely to re-enroll (%)	Landowners who are not likely to re-enroll (%)	Significance
Persistence	Leave the majority of this field in grass	54.5	58.0	36.4	$\chi^2 = 8.69$, $p < .01$
	Enroll the majority of this field in another program	39.0	42.5	20.8	$\chi^2 = 8.86$, $p < .01$
Reversion	Convert the majority of this field to dryland crops	43.1	39.7	59.6	$\chi^2 = 7.66$, $p < .01$
	Convert the majority of this field to irrigated crops	2.1	1.8	3.8	$\chi^2 = 0.81$, $p = .37$
	Sell the majority of this field	11.6	11.3	13.2	$\chi^2 = 0.16$, $p = .69$

Note: Each row includes landowners with a current CRP field who reported being "likely" or "very likely" to employ the given land use on the majority of their CRP field if it cannot be re-enrolled in CRP. Columns reflect likely land use by all landowners with current fields as well as likely post-CRP land use for landowners who are "likely" or "very likely" to try to re-enroll and those who are not ("very unlikely," "unlikely," or "neither likely nor unlikely"). Significance values reported are for 2×2 Pearson's chi-square tests crossing likely post-CRP land use and likely re-enrollment decisions.

CRP fields, the likelihood of reversion to crops appears to increase over time following contract expiration. The number of landowners who have persisted with grassland conservation on their CRP fields differs significantly depending on the number of years that the field has been out of CRP (Likelihood Ratio $\chi^2 = 37.81$; $p < .01$) (Table 3). Grassland persistence was reported more often by landowners whose CRP contracts expired more recently than by landowners whose contracts expired longer ago. For example, while 97.1% of fields whose contracts expired in 2017 were reportedly still in grass when our survey was conducted, only 66.7% of fields whose

TABLE 3 Crosstabulation of the percent of landowners with former CRP fields who reported persisting with grassland conservation (leaving the majority of their former CRP field in grass or enrolling it in another conservation program) by the year that their CRP contract expired

Persistence x contract expiration year	All landowners with former CRP fields (%)	Landowners who tried to re-enroll (%)	Landowners who did not try to re-enroll (%)
2011	66.7	58.3	76.9
2012	51.9	66.7	47.9
2013	61.8	70.0	60.7
2014	74.4	80.0	64.3
2015	85.2	80.0	84.6
2016	82.1	80.6	87.5
2017	97.1	96.8	100.0
Significance	**Likelihood ratio $\chi^2 = 37.81$, $p < .01$**	**Likelihood ratio $\chi^2 = 14.15$, $p = .03$**	**Likelihood ratio $\chi^2 = 13.92$, $p = .03$**

Note: Significance reported is for a likelihood ratio chi-square test comparing the distribution of conservation persistence and grassland reversion to cropland between years for all landowners with former CRP fields and among landowners with each re-enrollment decision.

contracts expired in 2011 were still in grass at that time. Our focus groups provided additional insight into the timeline of grassland persistence following CRP. One Kansas farmer said of their expired CRP field: "We are holding it and not doing anything with it in hopes that we can try again [to re-enroll]."

4 | DISCUSSION

4.1 | Explaining re-enrollment decisions

In this study, we found that while interest in re-enrolling in CRP was quite high among current CRP landowners, over half of landowners with former CRP fields had been unable to re-enroll after their contracts expired. We did not evaluate why these former fields were not accepted for re-enrollment, but due to reductions over the past decade in the acreage allowed into CRP, the allocation of additional acres to targeted CRP initiatives, and cycles in contract expiration across the country, competition for enrollment in the CRP general sign-up was particularly high in some of the years included in our study (Coppess, 2017; Politsch, 2016). To illustrate, in 2016, only 22% of the 1.8 million acres (7,517 km^2) of cropland offered for enrollment were accepted into the program (USDA FSA, 2016), while in 2010, 90% of the 4.8 million acres (19,598 km^2) offered were accepted (USDA FSA, 2010). The most recent farm bill, passed in December 2018, raised CRP's enrollment cap, potentially generating more opportunities for landowners to re-enroll in the program. However, the farm bill also lowered maximum soil rental rates for enrolled fields. Our survey asked respondents about their interest in re-enrolling *given the same rental payment* and did not evaluate how a reduced rate might impact landowner decision-making related to re-enrollment.

Over 45% of landowners surveyed about a former CRP field did not try to re-enroll when their contracts expired. Our focus group conversations suggest that re-enrollment intentions are, at times, already determined when a field is initially enrolled in CRP and that those intentions depend largely on field quality. Consistent with ethnographic findings from an earlier phase of this study (Steinmetz, 2018), we found that some landowners use CRP to achieve continuing or nearly permanent retirement of fields that are unsuitable for farming. Other enrolled parcels, however, have productive potential and are unlikely to stay in CRP long-term. Jacobson (2014) found that, compared to similar fields that had never been enrolled in CRP, former CRP fields that were voluntarily removed from the program were 20–25% more likely to be farmed. The authors thus hypothesized that some landowners may use CRP "as a long, subsidized fallow period" (Jacobson, 2014, p.378). Greater insight is needed into the social and biophysical conditions that prompt landowners to offer agriculturally productive fields for CRP enrollment and the programmatic conditions that lead FSA to grant these fields CRP contracts.

4.2 | Understanding conservation persistence and reversion to cropland after CRP

Given the inability of many CRP landowners to re-enroll in the program after their initial contracts expire, we

sought to understand what landowners in this situation have done or are likely to do with their CRP fields. In general, we found that landowners' post-contract intentions and behaviors are promising for the establishment of enduring conservation benefits associated with CRP. Over half of landowners with a current CRP field reported being likely to keep their fields in grass if they cannot re-enroll in CRP, and the rate of reported conservation persistence among landowners with former CRP fields is even higher, around 66%. These rates of reported grassland persistence following CRP are higher than those described in previous studies of post-CRP land use across a variety of geographies (Caldas et al., 2016; Hendricks & Er, 2018; Morefield et al., 2016; Roberts & Lubowski, 2007), particularly studies that have reported only land use intentions (Atkinson et al., 2011; Beutler et al., 1994; Gustafson & Hill, 1993; Janssen, Klein, Taylor, Opoku, & Holbeck, 2008; Johnson et al., 1997).

As Roberts and Lubowski (2007) have suggested, we found that this positive temporal spill-over (Jacobson, 2014) from CRP may be temporary. Our results indicate that while the majority of CRP fields that expired between 2011 and 2017 in our study region have remained in grass thus far, they are more likely to be reverted to crops as the time since their contract expiration increases. Only among fields that exited CRP more than five years prior to our survey did rates of reversion reach the 42% reversion rate that has been estimated by others when re-enrollment is not an option (Hendricks & Er, 2018; Roberts & Lubowski, 2007). Importantly, although the time range (2011–2017) of expirations for former CRP fields allowed us to explore cropland reversion by contract expiration year, we do not know in which year reverted fields were planted to crops. For example, we cannot determine from our data whether fields whose contracts expired in 2011 were immediately or only recently converted to cropland. It is possible that observed trends in conservation persistence and grassland reversion to cropland over time are due to mediating factors such as annual crop prices and re-enrollment incentives implemented in certain years. In the past, as the demand and price for agricultural commodities has increased, landowners have been drawn away from CRP by the opportunity to generate greater income by returning retired lands to active production (Hallerstein & Malcolm, 2011). The prices for corn and soybeans were at a record high in 2012, followed by 3 years of consistent declines (Newton & Kuethe, 2015). A similar pattern characterized sorghum prices over this time period (KSU, 2020). Future research should follow CRP landowners over time after their contracts expire to explore the intersecting influences of commodity prices and time on landowner decision-making and the fate of grasslands established through CRP.

4.3 | Promoting the persistence of grassland conservation

In spite of landowner interest, most of the acreage that comes out of CRP in the southern Great Plains is not entering another land conservation program. Almost 40% of landowners with a current CRP field reported that they would likely participate in another conservation program if they could not re-enroll in CRP. However, only 5% of the expired fields included in our survey sample had actually been enrolled in other programs 1–7 years after their CRP contracts ended. In a study across 12 midwestern U.S. states, Morefield et al. (2016) similarly found that former CRP fields rarely entered other land retirement programs or conservation easements. This may be due, in part, to limited opportunities for enrollment in other programs, which, like CRP, are capped, in terms of either acreage or expenditures.

Given that other conservation programs were rarely mentioned in our focus groups, it is also possible that CRP landowners in the region are less familiar with other incentive programs that balance agricultural production and conservation, a pattern that has been described among farmers in other states (Arbuckle, Lasley, & Ferrell, 2011; Reimer & Prokopy, 2014). CRP is administered by FSA, while other farm bill conservation programs are administered by the Natural Resources Conservation Service (NRCS). Although FSA and NRCS are both USDA agencies, differences in program eligibility, practices, applications, and communications may challenge transition between programs. Additionally, it is possible that landowners do not see NRCS programs as replacements for participation in CRP. For example, unlike CRP, EQIP and CSP do not offer yearly rental payments for land retirement; instead, these programs provide cost-share or incentive payments for landowners to implement specific conservation practices, including buffers, windbreaks, and pollinator strips, on active working lands (USDA NRCS, 2019). Given that many landowners in the southern Great Plains enroll fields in CRP that are marginal or altogether unsuitable for farming, these programs may not meet their economic needs in the same way that CRP does. Research comparing landowner understanding of and attitudes towards various private lands incentive programs is needed and may help explain cultural, economic, and institutional barriers to the transition between programs.

Some of the institutional barriers to the transition of CRP fields into other USDA conservation programs may have been eased by the 2018 farm bill, which clarifies that landowners can enroll in EQIP or CSP in the final year of their CRP contract. This policy change, in addition to increased allowances for grazing on CRP acres as

a component of mid-contract management, may help landowners get a jump-start on practices for grassland conservation or sustainable grazing that can be continued after their CRP contracts end. We suggest that private lands biologists and other technical experts might play a key role in connecting landowners to other programs that meet their financial needs while keeping grasslands on the landscape. Given that CRP grasslands appear to be more likely to be converted back to cropland over time, this post-CRP planning should be done before or soon after CRP contracts expire. Options for supporting the persistence of grassland established through CRP include NRCS programs, such as CSP, EQIP, and the Agricultural Conservation Easement Program (ACEP), as well as non-governmental programs, such as Audubon's Conservation Ranching Initiative, which grants a certification label that draws a premium for sustainably raised beef. Better understanding of (a) the factors that may be preventing the transition of expired CRP fields into other conservation programs and (b) the intersecting biophysical and social factors that promote grassland persistence after CRP is critical for maximizing the benefits of private lands conservation for wildlife populations, environments, and human communities.

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CONFLICT OF INTEREST

This study focuses on the Conservation Reserve Program, a private lands conservation program administered by USDA Farm Service Agency. This research was funded by USDA Farm Service Agency through a USGS Cooperative Research Unit Research Work Order, and the co-authors include a USDA employee.

AUTHOR CONTRIBUTIONS

Ashley A. Dayer, Michael G. Sorice, and Rich Iovanna conceptualized the study, research objectives, and study design. Ashley R. Gramza, Mary Sketch, Ashley A. Dayer, and Michael G. Sorice designed data collection instruments. Ashley R. Gramza and Mary Sketch performed data collection. Mary Sketch and Jessica C. Barnes conducted data analysis and wrote the manuscript. All authors reviewed and contributed to the final draft of the paper.

ETHICS STATEMENT

Focus group and survey questions and methods were approved by the Virginia Tech Institutional Review Board (Protocol #17-642). Members of the research team signed compliance agreements that ensure NRCS and FSA cooperators will not disclose protected agricultural or personally identifiable information, as required by Section 1619 of the Food, Conservation, and Energy Act of 2008.

DATA AVAILABILITY STATEMENT

Due to the possible sensitivity of human subjects' data, and in compliance with Protocol #17-642 approved by the Virginia Tech Institutional Review Board, focus group transcriptions and raw survey data are only accessible to project investigators.

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SUPPORTING INFORMATION

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

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