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Synthesizing Conservation Motivations and Barriers: What Have We Learned from Qualitative Studies of Farmers' Behaviors in the United States?

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ABSTRACT
Since 2011, qualitative studies examining adoption of conservation practices and programs (CPPs) have burgeoned. This article presents a systematic review of all U.S.-based qualitative investigations into CPP adoption since 1996. We found three themes are discussed primarily as motivating adoption: farmer characteristics, environmental awareness, and trust in information sources. Four themes are discussed primarily as barriers to adoption: farm management, negative perceptions of a conservation practice, perceptions that adoption is a risk, and land tenure. Four themes were discussed as both motivations and barriers: economic factors, social norms, perceptions of government programs, and farm characteristics. Overall, we found farmers' economic and management needs and their perceived and actual limitations to conservation behavior influenced adoption. Implications of our findings for policymakers and practitioners include promoting systems-based conservation strategies and stressing the benefits of conservation practices.

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Introduction

In the United States (US), agricultural nonpoint source (NPS) pollution is a major contributor to water quality impairments (McDowell et al. 2016; Capel et al. 2018). Impairments have resulted in policies and programs to address NPS pollution in agricultural watersheds that are voluntary rather than regulatory. These approaches fund farmers to participate in conservation programs and adopt conservation practices (Reimer and Prokopy 2014). One example of a voluntary policy instrument is the Environmental Protection Agency Clean Water Act Section 319 Nonpoint Source (NPS) Program that provides federal grants to states, tribes, and territories to develop and implement NPS management programs, projects, and practices (McDowell et al. 2016). Section 319 guidance focuses on coordinating other federal programs, specifically those

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included in the United States Department of Agriculture (USDA) Farm Bill, to incentivize participation in conservation programs (USEPA 2013). Farm Bill programs (e.g., Environmental Quality Incentives Program and Conservation Reserve Program) do so through funding technical assistance and conservation practice implementation (e.g., cover crops, no-till, and nutrient management) (Reimer and Prokopy 2014).

Scholarly interest in understanding farmers' pro-environmental behaviors on agricultural landscapes, including adoption of conservation practices and programs (CPPs), began with an initial focus on the individual, i.e., farmers' decision to adopt (Forney, Rosin, and Campbell 2018). Focusing on individuals' adoption decisions then shifted to understanding the broader social context within which decisions were made. A more recent shift suggests using "governance" as a lens through which to analyze individual- and contextual-level understanding of farmer decision-making (Forney, Rosin, and Campbell 2018). Given the predominantly voluntary nature of CPPs in the US, conservation decision-making and subsequent water quality outcomes[1] in watersheds dominated by agricultural land use is largely a result of whether or not farmers adopt CPPs. We therefore sought to explore individuals' (i.e., farmer) decision-making, and the broader social context that feed into decision-making.

Scholars have synthesized the substantial quantitative CPP adoption literature to make sense of predictors of farmers' conservation behaviors (e.g., Prokopy et al. 2008; Baumgart-Getz, Prokopy, and Floress 2012), finding that there are very few consistent determinants of conservation adoption (Baumgart-Getz, Prokopy, and Floress 2012; Knowler and Bradshaw 2007; Prokopy et al. 2019; Prokopy et al. 2008). Moreover, quantitative studies tend to focus on what motivates CPP adoption, rather than on both motivations for and barriers to adoption (Prokopy et al. 2019), and others have noted issues with quantitatively assessing CPP adoption (Floress et al. 2018a). In contrast, due to qualitative studies' focus on understanding the context of conservation decision-making, they often focus on both motivations and barriers (Pape and Prokopy 2017; Woods et al. 2014). Qualitative studies help researchers and practitioners understand nuanced contextual factors related to decision making while generating testable hypotheses to inform future conservation behavior research. However, the qualitative research examining motivations for and barriers to adoption of CPPs in the US has not been synthesized. We therefore ask: what motivations and barriers to CPP adoption emerge from qualitative studies, and what do they suggest for the future of CPP adoption research and practice?

To answer this question, we reviewed qualitative peer-reviewed articles, PhD dissertations, M.S. theses, and technical reports about CPP adoption studies conducted in the United States between 1996 and 2017, though our literature search extended back to 1982. Our results can be used to inform future research and support the development of effective conservation practices, programs, and policies for improved soil and water resources.

Methods

Studies for inclusion were identified by conducting a reverse citation search of earlier synthesis papers and two separate keyword searches in Web of Science and SCOPUS.

All articles needed to (1) be published between 1982 and 2017; (2) use farmers as the unit of analysis; (3) report on research from the United States; (4) report on adoption of or willingness to adopt one or more soil and/or water CPPs; and (5) be original research (i.e., review articles and thought pieces were excluded). This search process resulted in 1,632 studies, the titles and abstracts of which yielded 171 studies investigating farmers' adoption of or willingness to adopt CPPs. Of these, 49 met additional criteria for inclusion in the qualitative synthesis: (1) a qualitative method of data collection was used (e.g., interviews, focus groups, and open-ended survey questions), and (2) findings were presented with actual quotes or thematic descriptions, not only descriptive statistics about the quantitative findings (see Appendix 1).

Studies were distributed equally between the two lead authors to develop the coding framework and code the studies. The initial coding framework included two broad categories – barriers and motivations – and subcategories that were developed deductively based on categories used in Prokopy et al. (2019). The coding framework was then refined inductively to develop subcategories through an examination and interpretation of each study's results as written by its authors. We coded both the themes and farmer quotes reported by study authors. Emergent themes were also developed within subcategories (hereafter, child-categories) and subcategories within child-categories (hereafter, grandchild-categories) (see Appendix 2 for the coding framework). More often than not, articles were inconsistent in making the distinction between whether it was about "adoption" or "willingness to adopt"[2] CPPs. Thus, this distinction was not part of the coding framework; we refer to CPP "adoption" throughout this article.

Once the final coding framework was established, an inter-coder reliability process was undertaken (Campbell, Koontz, and Bonnell 2013; Miles and Huberman 1984) by the two lead authors, who completed all article coding. This process entailed each researcher reviewing half ($n = 12$) of the other researcher's coded studies. This process ensured credibility and trustworthiness of the findings by coming to agreement on and clarifying code definition language. Following inter-coder reliability discussions, the researchers individually ensured studies were coded according to the refined code definitions. Data analysis was conducted using NVivo 12 (QSR International Pty Ltd, Doncaster, Australia).

We report qualitative findings with respect to the number of studies coded for a given theme. Throughout the results, we include representative quotations for each coding theme reported, and draw comparisons between them. In addition, we use the phrase CPP to present our findings in aggregate, i.e., for both CPPs, except when a theme is specific to either conservation practices or conservation programs.

Results

Trends in Qualitative Research

Publication Trends

We coded 49 relevant qualitative studies published between 1996 and 2017 (Figure 1). Only seven that met our search criteria were published before 2011. Over half of the studies were published between 2014 and 2017.

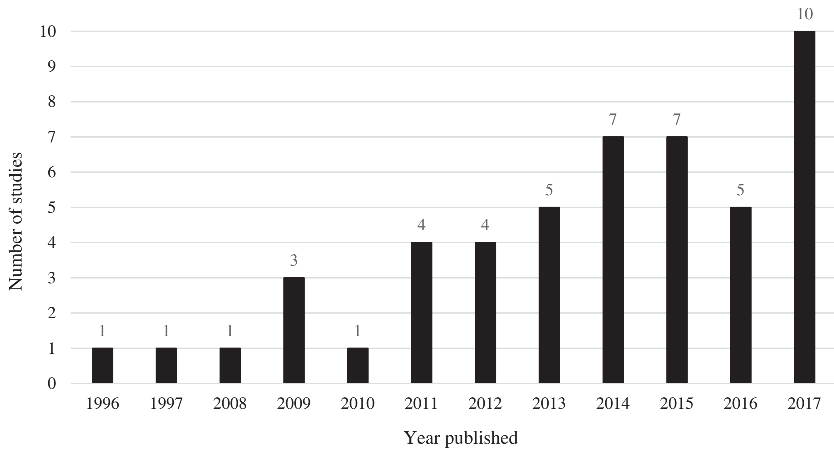

Figure 1. Qualitative articles by year published.

Theoretical Trends

Out of the 49 studies reviewed, 22 employed theory as part of research design and analysis. Twenty-one studies did not include any theory, four studies used theory in the literature review only, and two studies incorporated theory only in the discussion. Commonly used theories included Diffusion of Innovations (Rogers 2003), Theory of Planner Behavior (TPB) (Ajzen 1991), Reasoned Action Approach (previously TPB) (Fishbein and Ajzen 2011), and multifunctionality (Harden et al. 2013).

Methodological Trends

Out of 49 studies reviewed, 22 used only qualitative data collection methods (see Appendix 1) and 27 studies used mixed-methods (quantitative and qualitative). Between 1996 and 2011, only six studies used a mixed-methods design. The dominant qualitative method used across all studies was interviews ($n = 38$).

Barriers and Motivations – An Overview

Almost every study included motivation subcategories ($n = 46$) and the majority also included barrier subcategories ($n = 39$). Several subcategories were discussed as both motivations for, and barriers to, CPP adoption; Table 1 illustrates this trend for subcategories coded in 10 or more studies as either a motivation or a barrier.

Our findings reflect the nuanced way in which each theme is discussed as both motivations and barriers when studies are examined in aggregate. Within the qualitative studies analyzed, some themes operate along a motivation-barrier continuum. For example, *economic factors*, *social norms*, perceptions of *government programs,* and *farm characteristics* were discussed as both a motivation for and a barrier to CPP adoption (see Table 1). Whereas these themes were discussed as both motivating and hindering CPP adoption, several themes were discussed more often as either barriers or motivations. Three subcategories were coded more often as motivations: *farmer characteristics* ($n = 22$), *environmental awareness* ($n = 17$), and *trust in information sources* ($n = 17$)

Table 1. Barrier and motivation subcategories (number of studies).

Barriers and motivations	Number of studies		
Subcategories	Barrier	Motivation	Predominantly discussed as:
Economic factors ($n = 37$)	26	30	Both
Farm management ($n = 32$)	28	19	Barrier
Social norms ($n = 25$)	14	18	Both
Farmer characteristics ($n = 24$)	7	22	Motivation
Government programs ($n = 23$)	16	19	Both
Farm characteristics ($n = 23$)	14	16	Both
Practice ($n = 22$)	17	10	Barrier
Environmental awareness ($n = 21$)	4	17	Motivation
Distrust/trust in information sources ($n = 19$)	6	17	Motivation
Risk ($n = 17$)	12	5	Barrier
Land tenure ($n = 10$)	10	4	Barrier

(see Table 1). We also found four subcategories coded more often as barriers: *farm management* ($n = 28$), negative perceptions of a conservation *practice* ($n = 17$), perceptions that adopting a CPP is a *risk* ($n = 12$), and *land tenure* ($n = 10$) (see Table 1).

In the following pages, we describe child-category motivation and barrier themes that, when combining motivation and barrier study counts, emerged in four or more studies.

Barriers and Motivations – A Comparative Perspective

Economic Factors

Eight child-categories emerged as themes in four or more studies within the *economic factors* ($n = 37$) subcategory (Table 2).

Conservation practice implementation costs emerged as a dominant theme that were equally discussed as motivating ($n = 15$) or hindering ($n = 15$) adoption. Perennial vegetation such as cover crops, pasture, riparian buffers, and restored wetlands were perceived by farmers as expensive conservation practices, thus monetary incentives were necessary to make adoption feasible (Atwell, Schulte, and Westphal 2009). Costs associated with establishment and termination of cover crops were identified as barriers to adoption (Krajewski 2017; Reimer, Weinkauf, and Prokopy 2012; Roesch-McNally et al. 2017). In addition, high implementation costs emerged as a barrier to adoption of

Table 2. Economic factors ($n = 37$ studies): child-categories (number of studies).

Economic factors	Number of studies	
Child-categories	Barrier	Motivation
Cost ($n = 22$)	15	15
Yield ($n = 16$)	9	11
General economic loss/benefits ($n = 16$)	4	13
Commodity markets ($n = 15$)	9	7
Profitability ($n = 13$)	8	8
Labor ($n = 9$)	3	6
Market demand ($n = 5$)	3	3
Land value ($n = 4$)	3	1

grassed waterways (Reimer, Weinkauf, and Prokopy 2012), changing to no-till from conventional tillage farming, nutrient management (Xie 2014), and adoption of hedgerows and other biodiversity-enhancing vegetated features (Brodt et al. 2009). In contrast, reduced input cost was discussed as a motivation to adoption. A variety of reduced input costs were described, including fuel and labor savings related to no-till: "*This producer's comment illustrates all the input savings he associates with no-till: 'The ground pounders are just spending a tremendous amount of money on iron, horsepower, fuel, and labor, where I'm not'*" (Reimer, Weinkauf, and Prokopy 2012, 125). Nutrient management strategies that reduced fertilizer inputs emerged as a cost reduction: "*Others more generally commented that if they had the ability to reduce fertilizer application they would directly benefit through buying less fertilizer and would not need another incentive*" (Stuart, Schewe, and McDermott 2014, 215).

Whether conservation practice adoption resulted in a reduction or improvement in yield emerged as an important economic consideration that could motivate or hinder adoption. An almost equal number of studies discussed this theme as a barrier ($n = 9$) and motivation ($n = 11$). Farmers were concerned about reduced yield, which influenced adoption of cover crops (Roesch-McNally et al. 2017), conservation tillage (Reimer, Weinkauf, and Prokopy 2012), reduced nitrogen application (Stuart, Schewe, and McDermott 2014), and perennial vegetation (Atwell, Schulte, and Westphal 2009). A farmer said: "*I have not tried* [cover crops] *on soybeans going to corn and probably for obvious reasons ... .it could be a five bushel decline so that gives me a little bit of concern*" (Roesch-McNally et al. 2017, 7). However, several studies described yield improvements as motivating adoption. For example: "*Many of the farmer participants discussed how they had altered their management practices because they had seen the benefits of cover crops (e.g., erosion prevention, improvements to soil health and yield boosts) ... many producers who had been using cover crops noted that they had not experienced yield declines but instead saw improvements to their yield*" (Roesch-McNally et al. 2017). Other practices described as improving yields, and thereby increasing profitability, included spring fertilizer application and no-till (e.g., Christianson et al. 2014; Roesch-McNally, Arbuckle, and Tyndall 2018; Xie 2014).

There were several other dominant themes within the *economic factors* subcategory. For example, fluctuations in crop prices (*commodity markets*) and reduction or increase in *profitability* both discouraged and motivated adoption (see Table 2). *General economic benefits* ($n = 13$) and a decreased need for *labor* ($n = 6$) (i.e., if adoption resulted in a reduction in labor with respect to farm management), were discussed more often as motivations for CPP adoption.

Farm Management

Seven child-categories emerged as themes in four or more studies within the *farm management* ($n = 32$) subcategory (Table 3).

Compatibility of a conservation practice with farm management emerged as an important theme that either motivated or hindered adoption. Most studies discussed compatibility as a barrier ($n = 17$), and fewer studies discussed it as motivating adoption

Table 3. Farm management ($n = 32$ studies): child-categories (number of studies).

Farm management	Number of studies	
Child-categories	Barrier	Motivation
Compatibility ($n = 20$)	17	9
Management effort ($n = 19$)	17	5
Status quo ($n = 11$)	11	1
Timing ($n = 8$)	8	0
Change in farmable acreage ($n = 6$)	5	2
Livestock system integration ($n = 5$)	0	5
Systems thinking ($n = 4$)	0	4

($n = 9$). Compatibility was discussed primarily in terms of physical or business-related compatibilities. Physical compatibility concerned land availability (or lack thereof), field shape, and topography. Hedgerows and other biodiversity-enhancing vegetated features were considered physically incompatible due to space constraints. For example, farmers mentioned these practices as barriers when they wanted to plant crops to the field edge, as well as when discussing the need for enough space at the end of rows to turn their equipment around (Brodt et al. 2009). Physical incompatibility also entailed either a complete lack of or a mismatch between farm equipment/infrastructure required versus that available for adoption of conservation practices. For example, a farmer mentioned, "*Years ago my dad tried the no-till with the furrow irrigation and that's a no go. There's too much trash in the fields for furrow irrigation, but with a pivot then it's a no brainer*" (Foley 2013, 64). Several studies discussed business-related incompatibilities: "*Several reasons were repeated by multiple farmers for why they did not follow their nutrient management plan, including (i) they think they'll 'go out of business' …* " (Perez 2015, 410). However, other studies discussed conservation practice compatibility with farm management as a motivation to adoption. For example, grassed waterways were considered to be "*a necessary part of the farm operation,*" thus making them highly compatible with farmers' needs (Reimer, Weinkauf, and Prokopy 2012, 124). Similarly, perennial wheat was considered to be compatible with farm management: "*put this* [perennial] *wheat in the buffer I would have one planting for multiple years so I wouldn't have to clean my planting equipment …* " (Adebiyi, Schmitt, and Snapp 2016, 106).

Most studies discussed farm management effort as a barrier to adoption ($n = 17$), and few studies discussed it as motivating adoption ($n = 5$). Farmers discussed conservation practices as a barrier when they increased demand on a farmer's time: "*Some producers noted the increased operational requirements associated with grassed waterways, including time and resources necessary to maintain the waterway and the increased time and effort required to manage crops around the waterway*" (Reimer, Weinkauf, and Prokopy 2012, 124). Cover crops were discussed similarly. For example, cover crop termination and residue incorporation, due to their demand on farmers' time and wet conditions during spring, were inconvenient and risky for farmers (Christianson et al. 2014). In contrast, several studies discussed reducing farm management effort as a motivating factor. For example, "*Farmers stated that conservation practice adoption depended on whether the practice could save time and money*" (Woods et al. 2014, 349). Farmers were also motivated to adopt conservation tillage because it saved time, and thus reduced farm management effort (Osmond et al. 2015).

Table 4. Social norms ($n = 25$ studies): child-categories (number of studies).

Social norms	Number of studies	
Child-categories	Barrier	Motivation
Subjective norms ($n = 14$)	8	8
Trust/distrust, community ($n = 7$)	2	6
Neighbors ($n = 7$)	3	5
Leadership present ($n = 6$)	0	6
Blame shifting ($n = 4$)	4	0

There were several other dominant themes within this subcategory. Integrating crop production with raising livestock ($n = 5$) and thinking about and managing the farm as a system ($n = 4$) were not often discussed, but when they were, they were always motivations for conservation practice adoption. In contrast, incompatibility of practice timing as part of the larger farm operation ($n = 8$) was always discussed as an impediment, particularly with regard to having enough time after harvest to establish cover crops. Status quo bias ($n = 11$) – or farmers' perceptions that there was no reason for them to change their operations – and loss of farmland ($n = 5$) were discussed more often as themes discouraging adoption.

Social Norms

Five child-categories emerged as themes in four or more studies within the *social norms* ($n = 25$) subcategory (Table 4).

Several aspects of social norms, such as subjective norms, blame shifting, neighbors' experiences with conservation practices (dis)trust in community, and presence of leadership in the community, emerged as themes motivating or hindering adoption. Presence of leadership (e.g., farmers as conservation leaders/champions, watershed coordinators encouraging CPP adoption) was always discussed as motivating adoption. An overall sense of trust in the community was discussed as motivations ($n = 6$) more often than barriers ($n = 2$), i.e., trust in community was discussed more often as motivating adoption than distrust in community presenting a barrier. A sense of trust in the community as motivating adoption is illustrated in the following quote from a study, "*The creation of group solidarity among farmers working for and by themselves was even more significant than the pollution problem itself. Team members were gradually seen getting together for coffee at half-time at football games, sponsoring closed field days for team members and their families to show the conservation measures on their farms …*" (Moore, Parker, and Weaver 2008, 10).

Blame shifting was always discussed as hindering adoption. For example, Motallebi et al. (2016, 5) quoted a farmer, "*I don't see how they can ask farmers, dairymen to control the waste when these big towns and big cities are dumping waste in the River. I think you're wasting your time*". Subjective norms both motivated and hindered adoption. Subjective norms as a motivation is illustrated by this quote from Reimer, Weinkauf, and Prokopy (2012, 124), "*Producers in this watershed discussed grassed waterways as if they were common sense and they needed them to control erosion, reflecting a commonly held belief as well as a perceived norm*". Perceptions of neighbors' success, challenges or inaction, were described as both a motivation and barrier to adoption. Illustrating how

Table 5. Farmer characteristics ($n = 24$ studies): child and grandchild-categories (number of studies).

Farmer characteristics	Number of studies	
Child and grandchild-categories	Barrier	Motivation
Farmer type ($n = 6$)	3	4
Farmer identity ($n = 22$)	4	21
Steward (low, high) ($n = 16$)	1	16
Innovator ($n = 6$)	0	6
Financially motivated ($n = 3$)	2	1
Amish ($n = 1$)	1	1
Agrarian ($n = 1$)	0	1

neighbors' experiences influence adoption decision, Xie (2014, 159) mentioned, "*… one farmer raised questions about the actual benefits of cover crops – based on observation of his neighbor's cover crops, he asserted that cover crops could invite insect problems, or make the soil too cold to be ready for planting*".

Farmer Characteristics

Two child-categories emerged as themes in four or more studies within the *farmer characteristics* ($n = 24$) subcategory (Table 5).

Farmer identity emerged as the primary theme in the *farmer characteristics* subcategory ($n = 22$), predominantly discussed as motivating adoption ($n = 21$), with respect to stewardship ($n = 16$) and innovator ($n = 6$) identities. Stewardship identity ranged from wanting to protect one's own land to a sense of responsibility toward the environment. For example: "*I wanna see the land preserved as much as possible …*" (Druschke 2013, 90) concerns ones' own farm, while "*… I feel charged with a certain environmental responsibility …*" (Kennedy et al. 2016, 109) concerns a sense of environmental responsibility.

The innovator identity pertained to learning; innovative farmers were willing to try and experiment with new practices, and learn from their experiences. For example, Bossange et al. (2016, 13) noted that changing to conservation tillage entailed a change in mindset, "*Examples that farmers gave about the mindset change that is required to be able to adopt CT (conservation tillage) included … (the) necessity to free up time and/or resources to understand whole system changes and be ready to sustain this additional learning time for a number of years during their transition to CT …*". Kennedy et al. (2016, 108) quoted a rancher who desired to learn, "*New ideas come up, whether from other ranches, the university, or even ourselves (what we might think and just to try new things) and that is how we learn and develop and become better land and grass managers*".

Government Programs

Six child-categories emerged as themes in four or more studies within *government programs* ($n = 23$) subcategory (Table 6).

Table 6. Government programs ($n=23$ studies): child-categories (number of studies).

Government programs	Number of studies	
Child-categories	Barrier	Motivation
Cost-share ($n=15$)	4	15
Application processes requirements ($n=11$)	10	1
Eligibility ($n=9$)	9	0
Flexibility ($n=9$)	7	3
Technical assistance ($n=4$)	0	4
Distrust/trust ($n=5$)	5	0

Availability of cost-share, and whether that availability was advertised, were themes that acted as motivations for conservation program adoption ($n=15$). For example: "*Well, they* [the federal government] *paid us. If they didn't pay us, we wouldn't have done it … I think these [conservation set aside] programs are a good thing, but they'll never happen unless there is a government program paying you to do it. You can't afford to pay $4000 per acre for land and then let it sit there and look pretty; you can't do it*" (Atwell, Schulte, and Westphal 2009). Further highlighting the importance of cost-share in motivating adoption, Campbell, Koontz, and Bonnell (2011, 1135) reported, "*Agency staff and farmers alike noted the importance of cost-share programs and the agency's ability to advertise as critical in farmer decisions to adopt BMPs* [Best Management Practices]". In contrast, lack of cost-share and perceptions that cost-share is not necessary and, when available, is not enough acted as barriers to adoption of conservation programs ($n=4$). For example, farmers in Reimer, Weinkauf, and Prokopy (2012, 125) mentioned, "*… the payments from the government programs were not enough to cover the loss of productive land*". Osmond et al. (2015, 387) described farmers as discontinuing conservation practices if cost-share ceased, whereas Kalcic et al. (2014, 808) found cost-share was unnecessary for adoption of grassed waterways.

The process of applying for government conservation programs and their associated requirements was predominantly discussed as a barrier ($n=10$) to conservation program adoption. Concerns with excessive paperwork, lengthy application processes, and program complexity and requirements were discussed as hindering enrollment. For example, "*Program requirements, particularly lengthy application processes, burdensome application paperwork, and ongoing contract maintenance, were mentioned as a potential barrier (or at least a hassle) by both participants and nonparticipants*" (Reimer and Prokopy 2014, 326). Government program restrictions and their impact on grassed waterways adoption is illustrated in Enloe, Schulte, and Tyndall (2017, 581): "*And that's why we never have done* [a grassed waterway] *with a cost-share or with the NRCS* [Natural Resources Conservation Service], *because the restrictions on it are usually too big. You can't spray it or mow it when you want to; when you think it's right. You can't necessarily put down what you think is correct as far as crops and … sometimes they way over-engineer them for what they need to be*".

The only exception to this theme was one study where reporting requirements were described as motivating program enrollment. Bautista, Waller, and Roanhorse (2010, 36) state, "*The only operators who were motivated by the BMP reporting requirements were those who prepared their own report… With one exception, all of these respondents indicated that one day or less time was needed to prepare those reports*".

Table 7. Farm characteristics ($n = 23$ studies): child and grandchild-categories (number of studies).

Farm characteristics	Number of studies	
Child and grandchild-categories	Barrier	Motivation
Farm/land quality ($n = 18$)	10	13
Vulnerable ($n = 7$)	0	7
Marginal land ($n = 6$)	1	5
Open ditches, absent ($n = 3$)	2	1
No issues ($n = 4$)	4	0
Flat land ($n = 3$)	3	0

There were several other dominant themes within this subcategory. Ineligibility for government programs ($n = 9$) and distrust in such programs ($n = 5$) were always discussed as discouraging adoption, whereas availability of technical assistance was always discussed as a motivation ($n = 4$). Flexibility and inflexibility of government conservation programs motivated ($n = 3$) or discouraged ($n = 7$) adoption, respectively.

Farm Characteristics

One child-category emerged as a theme in four or more studies within the *farm characteristics* ($n = 23$) subcategory (Table 7).

Farm/land quality was discussed as both motivating ($n = 13$) and hindering adoption ($n = 10$). Farm characteristics discussed always as barriers to CPP adoption were: flat land and farmers' perception that they do not have soil or water issues on their farm.

Having flat land was perceived as a farm feature that alleviated the need for adoption of conservation practices. For example, Xie (2014, 161) quoted a farmer, "… *we farm on flat and leveled ground and there is no space for grassed waterways and filter strips*". Conservation tillage was also perceived by farmers to be "… *unnecessary on flat ground due to a lack of erosion*" (Reimer, Weinkauf, and Prokopy 2012, 126). Absence of waterways was discussed more often as a barrier ($n = 2$) than a motivation ($n = 1$): "*Several producers noted that they did not have creeks or ditches that needed to be buffered*" (Reimer, Weinkauf, and Prokopy 2012, 125). Land that was vulnerable to erosion and sedimentation problems ($n = 7$) and marginal land ($n = 5$) predominantly motivated adoption. For example, conservation tillage was perceived to be highly compatible with highly erodible land (Reimer, Weinkauf, and Prokopy 2012). Similarly, Druschke (2013, 89) reported that farmers were motivated to join the conservation effort in their watershed, "*because of the material erosion and sedimentation problems they witnessed on their farms*". Conservation practice adoption enabled farmers to better utilize the land by reducing idle or marginal land (Bautista, Waller, and Roanhorse 2010). Moreover, marginal land was discussed as motivating adoption of perennial conservation practices such as restored wetlands and riparian buffer strips (Atwell, Schulte, and Westphal 2009).

Practice – Perceptions of Conservation Practice(s)

Three child-categories emerged as themes in four or more studies within the *practice* ($n = 22$) subcategory (Table 8).

Table 8. Practice – perceptions of conservation practice(s) ($n = 22$ studies): child-categories (number of studies).

Practice	Number of studies	
Child-categories	Barrier	Motivation
Current/prior use of practice ($n = 8$)	3	7
Lack of time ($n = 5$)	5	0
Current/prior use of other practice ($n = 4$)	2	3

Barriers and motivations were often discussed in relation to farmers' current or prior experiences using a given conservation practice. Whether prior experiences were positive or negative influenced whether the farmer was motivated to adopt that practice or not. For example, a farmer's positive experience with grassed waterways influenced continuation of the practice, "*Grassed waterways are real easy—yes, we do them, we'll keep doing them, even if we pay for themGrassed waterways are real easy—yes, we do them, we'll keep doing them, even if we pay for them*" (Kalcic et al. 2014, 808). However, farmers' negative experiences also hindered adoption: "*In the all-weather paddock of one Kentucky respondent, the majority of limestone had washed away and left 'a horrible mess.' She said, 'In theory it is wonderful, but the practicality of it is not*'" (Rebecca and Linda 2015, 39). A related, but more nuanced consideration of practice adoption, were farmers' current or prior experiences using different conservation practices. For example, "*Cover crops' compatibility with a producer's current farming system was important for every producer who had adopted it. They were using annual ryegrass specifically because they were practicing no-till. Annual ryegrass was seen as beneficial for no-till because of its deep root system*" (Reimer, Weinkauf, and Prokopy 2012, 126). Finally, a lack of time to adopt a conservation practice was always discussed as a barrier to adoption ($n = 5$).

Environmental Awareness

Three child-categories emerged as themes in four or more studies within the *environmental awareness* ($n = 21$) subcategory (Table 9).

General environmental knowledge (e.g., awareness of water quality problem in the watershed) was discussed as both hindering ($n = 3$) and motivating ($n = 3$) adoption. Similarly, a number of studies discussed CPP knowledge as motivating ($n = 4$) and hindering ($n = 2$) adoption. The primary theme in the *environmental awareness* subcategory was environmental concern, and it was predominantly discussed as a motivation for adoption ($n = 9$). Environmental concern was often discussed as motivating adoption with respect to farm management choices, as well as farmers' awareness that these choices have environmental implications. For example, "*If there was a practice that showed a great economic return, but yet resulted in, losing nitrogen, or losing nutrients or, you know, something that was really bad for water quality, I would think twice about it*" (David et al. 2015, 379). Further illustrating this theme, Mattia, Lovell, and Davis (2016, 198) found that farmers expressed chemical use concerns as follows: "*… resistant weeds are the 800 pound gorilla in the room… land diversification will be necessary and critical*".

Table 9. Environmental awareness ($n = 21$ studies): child-categories (number of studies).

Environmental awareness	Number of studies	
Child-categories	Barrier	Motivation
Environmental concern ($n = 10$)	1	9
Knowledge, programs/practice ($n = 6$)	2	4
Knowledge, environmental ($n = 6$)	3	3

Distrust/Trust in Information Sources

Five child-categories emerged as themes in four or more studies within the *distrust/trust in information sources* ($n = 19$) subcategory (Table 10).

Trust, or lack thereof, in sources of information in general, or in specific sources of information such as farmers, watershed groups, conservation agencies, and university extension, emerged as an important theme that motivated or hindered adoption of conservation practices. Farmers ($n = 7$) and watershed groups ($n = 4$) were always identified as trusted information sources that motivated adoption. For example, a farmer expressed trust in other farmers, "*We're pretty open as far as, if something's working we're pretty open with other people and say, 'Here's something we're doing that we like' and vice versa. There's some of the neighbors we talk to, they're doing something that we're not doing and that works good, they're open with us, too …*" (Church and Prokopy 2017, 360). Similarly, trust in watershed groups was reported as motivating adoption, "… [a farmer] *mentioned repeatedly that the support of the other watershed group members had motivated him to implement changes that he would not have adopted otherwise*" (McGuire et al. 2013, 65). Unlike farmers and watershed groups, trust and distrust in conservation agencies and university extension as information sources was discussed as both motivating and hindering adoption. Specifically, whereas seven studies identified conservation agencies as trusted information sources as motivations, three studies identified them as distrusted information sources that hindered adoption. Illustrating trust in conservation agencies, Enloe, Schulte, and Tyndall (2017, 582) reported, "*Although all farmer respondents expressed mistrust of 'the government', many participants named an NRCS contact as a primary source of information and support*". University extension was discussed as both trusted/distrusted information source, motivating ($n = 5$) and hindering ($n = 4$) adoption, respectively. Illustrating the theme of distrust in university extension, Stuart, Schewe, and McDermott (2014, 214) reported, "*Interview participants*

Table 10. Distrust/trust in information sources ($n = 19$ studies): child-categories (number of studies).

Distrust/trust in information	Number of studies	
Child-categories	Barrier	Motivation
Farmer ($n = 7$)	0	7
University extension ($n = 8$)	4	5
Conservation agency ($n = 8$)	3	7
Watershed group ($n = 4$)	0	4
General ($n = 4$)	1	4

Table 11. Risk ($n = 17$ studies): child-categories (number of studies).

Risk	Number of studies	
Child-categories	Barrier	Motivation
Uncertainty ($n = 11$)	11	0
Reduced risk ($n = 4$)	0	4

stated that they lacked confidence in university recommendations and/or felt they were outdated".

Risk

Two child-categories emerged as themes in four or more studies within the *risk* subcategory ($n = 17$) (Table 11).

The primary theme in the *Risk* subcategory was uncertainty associated with CPP adoption, and it was always discussed as a barrier to adoption ($n = 11$). For example, a farmer expressed uncertainty in the usefulness of conservation tillage on their farm, "*There was a lot of uncertainty, does it really work? There, you see other people using it and you know it can work, but does it work for our operation? There's some uncertainty there*" (Reimer, Weinkauf, and Prokopy 2012, 126). The secondary theme in the *risk* subcategory was reducing risk through CPP adoption and it was always discussed as a motivation for adoption ($n = 4$). Illustrating reduction in risk as a motivation for farmers to enroll in a water conservation program, Bautista, Waller, and Roanhorse (2010, 39) reported, "*Most interviewed operators enrolled primarily with the goal of reducing the risk that future water demands will exceed their allotment and/or deplete their supply of flexibility credits*". Reducing weather-related risks on their farms motivated farmers to adopt cover crops. For example, a farmer mentioned, "*You're trying to think ahead and say, how can I make that soil more resilient or able to handle the stresses …, whether it's a dry stress or too much rain or something like that, you know? By having that structure and those roots there* [from using cover crops] *and holding on to that soil and maybe, hold on to more nutrients through* [the winter]" (Roesch-McNally, Arbuckle, and Tyndall 2018, 12).

Land Tenure

Two child-categories emerged as themes in four or more studies within the *land tenure* – whether the farmer owned or rented their farmland – subcategory ($n = 10$) (Table 12).

These themes included whether or not landlords supported farmers' adoption of conservation practices ($n = 8$), and the fact that the land was rented or leased ($n = 9$). For

Table 12. Land tenure ($n = 10$ studies): child-categories (number of studies).

Land tenure	Number of studies	
Child-categories	Barrier	Motivation
Leased land ($n = 9$)	9	2
Landlord ($n = 8$)	6	3

Table 13. Benefits ($n = 32$ studies): child-categories.

Benefits	Number of studies
Child-categories	Motivation
Erosion reduction	19
On-farm, general	12
Soil health	12
Off-farm, general	11
Habitat	9
Water quality improvement	9
Future generations	6
Aesthetics	4
Livestock health	4

example, "*Focus group participants also mentioned the role of rented land as a barrier to adoption. They suggested that as many producers rented ground on short term contracts and have less incentive to conserve or invest in conservation efforts*" (Foley 2013, 69). Highlighting aspects of rented farmland that create barriers for conservation practice adoption, Enloe, Schulte, and Tyndall (2017, 581) reported, "*Within a context of strong competition for land, high cash rents, and annual rental contracts, farmer respondents were nervous about losing access to rented ground*". Lack of support from non-operating landowners (NOLs[3]) for farmers' conservation decision-making acted as a barrier ($n = 6$). For example, "*In four cases, the farmer saw the landowner's lack of interest in conservation as an impediment to using conservation practices that he would like to use on rented land*" (Kalcic et al. 2014, 805). In contrast, supportive NOLs were discussed as motivating adoption ($n = 3$). For example, "*… one farmer specifically noted that he had successfully worked with his landlords to establish hedgerows on rented land, with the landlord paying material costs and the farmer providing the labor*" (Brodt et al. 2009, 203).

Benefits of Conservation Practices as a Motivation

Benefits associated with conservation practice adoption were often discussed as motivating factors ($n = 32$). Unlike subcategories discussed in the previous section, benefits of conservation practices did not emerge as a comparative theme. Instead, scholars explicitly reported benefits of conservation practices as factors motivating adoption. Table 13 lists *benefits* child-categories coded in four or more studies.

The most prevalent *benefit* theme was erosion reduction, discussed as motivating adoption for a variety of conservation practices ($n = 19$) such as cover crops, filter strips, grassed waterways, hedgerows, rotational grazing, and no-till (Brodt et al. 2009; Brummel and Nelson 2014; Reimer, Thompson, and Prokopy 2012; Reimer, Weinkauf, and Prokopy 2012; Reimer and Prokopy 2014; Roesch-McNally et al. 2017; Xie 2014). Most studies described farmers' and ranchers' soil erosion concerns in terms of reducing soil loss: "*Farmers also linked the RG* [rotational grazing] *practice with improvements in soil conservation on their property, noting in particular that their permanent pastures lead to improved soil retention and reduced erosion: '… on a rainy day. You drive past the neighbors and you will see brown water running out of the fields, it runs clear as can be all [on our farm] except where we till and we don't do that very often …'*" (Brummel and Nelson 2014, 458). On-farm benefits ($n = 12$) and soil health ($n = 12$) were the second most coded *benefit* theme. On-farm benefits were discussed in more general terms: "*I actually talked a landlord into putting nine acres in CRP [Conservation Reserve Program] last year … Some of that stuff you just do … I offered to do it 'cause, in the long run, I thought it was going to benefit the ground and benefit everybody involved*" (Atwell, Schulte, and Westphal 2009). Both erosion reduction and on-farm benefits are related to farm characteristics (Table 7). The soil health theme was discussed in relation to practices like perennials, organic practice in general, cover crops, no-till, and rotational grazing (Adebiyi, Schmitt, and Snapp 2016; Bossange et al. 2016; Brummel and Nelson 2014; Reimer and Prokopy 2014; Ulrich-Schad, Brock, and Prokopy 2017). The third most frequently coded *benefit* theme was off-farm benefits ($n = 11$). In large part, practices that took land out of production seemed to have more perceived off-farm benefits than on-farm: "*The more engineering-oriented approaches (controlled drainage, bioreactors, and wetlands) in addition to cover crops were perceived to have either equal or slightly greater benefits to the region than to the individual farm …* " (Christianson et al. 2014, 417).

Other *benefits* included habitat provisioning ($n = 9$), water quality improvement ($n = 9$), benefits for future generations ($n = 6$), and benefits related to Aesthetics ($n = 4$) and livestock health ($n = 4$).

Discussion

Agriculture-driven environmental externalities and the predominantly voluntary nature of conservation policies and programs in the United States has resulted in substantive research examining farmers' motivations for CPP adoption. Much of this scholarship is quantitative, and subsequent meta-analyses demonstrate that there are very few consistent determinants of conservation adoption (Baumgart-Getz, Prokopy, and Floress 2012; Knowler and Bradshaw 2007; Prokopy et al. 2019; Prokopy et al. 2008). During the past decade, more qualitative research has emerged than in the past perhaps because journals and reviewers have become more open to publishing qualitative research in the agricultural field (see Prokopy 2011 for discussion of biases against publishing qualitative data). These data, in farmers' own words, enrich our understanding of conservation behaviors, while documenting both motivations and barriers to adoption (Roesch-McNally et al. 2017; King, Baker, and Tomlinson 2017; Mattia, Lovell, and Davis 2016; Grover and Gruver 2017). Although the number of qualitative studies has grown over the years, current scholarship lacks a qualitative synthesis. We thus reviewed 49 qualitative US-specific studies to identify and synthesize farmers' motivations for and barriers to CPP adoption (see Table 1). We recognize that a synthesis of qualitative literature cannot predict farmers' conservation behaviors. However, we suggest these findings are broadly indicative of an overall trend that show multiple factors that influence CPP adoption.

Our synthesis corroborates what is widely acknowledged in both research and practice: farmer decision-making is complex. Indeed, the complex interplay of farmers' motivations and barriers is reflected in our synthesis revealing themes as both motivations for, and barriers to, CPP adoption (see Table 1). In fact, conservation behavior, or lack thereof, is often an outcome of contrasting tensions, for example, between economic motivations (Table 2) conflicting with several other barriers such as risk perceptions (Table 11) or land tenure (Table 12). Complexity in farmers' conservation decision-making therefore begs for theoretically grounded approaches to understanding their behavior. Indeed, existing behavior change theories incorporate many complexities including aspects such as efficacy, motivation, social norms, attitudes toward the behavior, etc., providing a useful way to examine and potentially predict conservation behaviors. Our results show a dominant scholarly focus on understanding farmers' decision-making *via* theories and frameworks that help explain individual-level behavior, such as TPB (Ajzen 1991), Reasoned Action Approach (Fishbein and Ajzen 2011), and Diffusion of Innovations (Rogers 2003). However, theoretically grounded understanding of farmers' conservation behavior, especially using theories and frameworks that incorporate both individual- and contextual-level factors, presents a fruitful avenue for the development of future scholarship on CPP adoption. To that end, using the analytical lens of "governance" is a potential starting point (Forney, Rosin, and Campbell 2018) because farmers' decision-making is not made in isolation to the larger institutional, market, and governance context in which they are embedded. In addition, scholars can build off existing theories, yet use an inductive approach to analysis to help disentangle the complexity of farmer decision-making. Moreover, the themes we identify in this study can act as building blocks for adding to existing or developing new conservation behavior theories and frameworks.

The rich contextual description we provide in our synthesis reveals interconnections between themes, especially the complex interplay between factors motivating and hindering CPP adoption. Consequently, quantitative approaches to understanding conservation behavior might struggle to approach predictive certainty. In this regard, we believe that a domain of research needing greater exploration is employing a mixed-methods approach to generate and test hypotheses. Our synthesis indicates a limited, but growing trend in studies employing a mixed-methods data collection approach, especially since 2011. Whereas this is a promising trend, predictive research designs could benefit from exploratory and explanatory research designs working in tandem. Qualitative research designs could also benefit from making a distinction between actual adoption *versus* willingness to adopt (Floress et al. 2018a). Moreover, instead of reporting findings in general terms (e.g., general economic loss/benefits, general on-farm/off-farm benefits) authors should be explicit in reporting themes.

Our findings show that farmers' economic and farm management needs are important considerations for CPP adoption, which is in turn a function of their farms' characteristics. As others (e.g., Czap et al. 2015; Floress et al. 2017) note, however, fulfilling economic and farm management needs is not sufficient for CPP adoption, because farmers' conservation behaviors can be mediated by social-psychological factors like risk perceptions, social norms, identity, environmental awareness, and trustworthiness of information. CPP adoption is also influenced by farmers' current or prior CPP experiences (positive or negative). Moreover, actual limitations to behavioral intention are influential, for example, when farmland is rented. These two latter findings fit within the *Reasoned Action Approach* Framework (previously Theory of Planned Behavior), which emphasizes perceived and actual behavioral limitations as influencing behavior

(Fishbein and Ajzen 2011). Our overall findings are suggestive of potential pathways for influencing CPP adoption.

Farmers' current or prior conservation experiences (see Table 8) influenced their motivations to adopt; this emphasizes the importance of research on adoption persistence (Reimer et al. 2014; Dayer et al. 2018). For example, once a practice has been adopted, farmers may be motivated to continue the practice (i.e., persist with adoption) or try a new practice, especially if they have a positive experience using that practice (e.g., if adoption results in a reduction in labor, or in other forms of savings; see Table 2). Therefore, scholars should consider testing the effect of positive behavioral reinforcements on farmers' motivation to persist with adoption, using experimental approaches. To that end, qualitative research designs can help identify themes that act as building blocks to generate testable hypothesis about farmers' conservation behavior reinforcements. Using semi-structured interviews, qualitative studies could explore farmers' motivations for, and barriers to, persisting with adoption.

Implications for Policymakers and Practitioners

A comparative assessment of barriers and motivations revealed several nuanced findings with practical implications. Farmers' stewardship and innovation identities emerged as CPP motivations. Farmers' environmental concern, trust in other farmers, watershed groups, and agency personnel as information sources, and social norms, including trust in and presence of leadership in their community, also emerged as themes that motivated adoption (Pape and Prokopy 2017; Floress, Prokopy, and Allred 2011). Together, these themes present an opportunity for practitioners to design farmer education and outreach programs. For example, when working with farmers on conservation, practitioners could highlight existing conservation social norms (or foster new ones), such as a sense of trust in the community and a strong community leadership presence. In addition, practitioners could leverage farmers' trusted information seeking networks, including conservation leaders and innovative farmers in the watershed, and also help improve farmers' awareness of environmental issues in the watershed. Moreover, practitioners could stress benefits of conservation adoption to help negate a farmer's perception that implementing conservation is risky (Slovic 1993). Alternatively, instead of forging trust to bend the farmer to their will, practitioners could facilitate participatory co-learning and decision-making among farmers to generate CPP recommendations (Getz and Warner 2006).

Consistent with previous research (e.g., Reimer, Weinkauf, and Prokopy 2012), our findings show that conservation practices should be compatible (or perceived to be compatible) with farmers' farm management needs; especially in-field practices (e.g., cover crops) that would change farmers' current management strategies. Farm management considerations are also important for structural, edge-of-field practices that may result in permanent loss of farmland (e.g., grassed waterways). Our findings suggest that thinking of the farm as a system and identifying ways to integrate conservation practices with farmers' management needs and requirements, including raising livestock, are opportunities for overcoming conservation barriers (e.g., O'Connell et al. 2014; Singer, Nusser, and Alf 2007). Indeed, systems-based conservation strategies center upon holistic farm planning and planning over the long-term, which can result in greater on-farm benefits when practices are implemented together (Lengnick 2014).

Overall, economic themes highlight the obvious; farmers' micro- and macro-economic considerations affect conservation behavior. Practitioners can incorporate these considerations into how they promote conservation. For example, our analysis highlights the importance of how farmers' positive or negative perceptions of current or prior CPP use influence future CPP adoption. Subsequently, practitioners should consider taking steps to reinforce farmers' positive CPP experiences while negating negative experiences. These actions could also help farmers overcome status quo bias (see Table 3).

Like other research, our findings suggest rented farmland is a barrier to CPP adoption (Petrzelka, Ma, and Malin 2013; Ulrich-Schad et al. 2016). More specifically, communication between tenant farmers, NOLs, and farm managers, as well as NOLs' support for tenant farmers' conservation decision-making, emerged as aspects of land tenure that both motivated and hindered adoption. To that effect, practitioners should consider designing outreach programs directed toward NOLs and take steps to improve communication between NOLs and tenant farmers, as well as "intermediaries" such as farm managers, and NOLs and tenant farmers (Ranjan et al. 2019). Practitioners could also use these outreach programs to promote the importance of secure land tenure, including multi-year leases, to encourage conservation behavior on rented farmland.

Given the predominantly voluntary nature of agricultural conservation policies and programs in the United States, perhaps the most salient policy implications relate to conservation programs. Indeed, the process of applying for government programs and associated program requirements emerged as conservation barriers. Policymakers could be mindful of these barriers when designing agricultural conservation policies and programs. For example, as our findings suggest, the timing of conservation adoption is an important consideration for farmers, especially with respect to how it fits within farm management processes. Subsequently, addressing what farmers perceive to be complex and burdensome application and reporting requirements, especially rules famers perceive to be constraining to decision-making, could improve future iterations of policies and programs. Additionally, our findings suggest the need to make cost-share available to farmers. Lack of sufficient funding, especially in light of shrinking and uncertain federal budget, presents an opportunity for policymakers to explore alternative funding avenues. We also suggest directing limited financial and technical resources toward the most vulnerable lands.

Vulnerability of farmland emerged as a motivation (see Tables 7 and 13), further bolstering the argument for channeling conservation funding toward the farmers whose lands have the greatest impact on soil and water resources, or conservation targeting (Arbuckle 2013; Kalcic et al. 2014). This can be coupled with strategies that increase conservation action such as forming multi-stakeholder collaborative partnerships that can maximize funding, technical, and social resources from private, local, state, and federal sources (e.g., Floress et al. 2018b). Such partnerships can help create programs that support conservation practice adoption without relying solely on two sources of funding: the farmer and the government.

Conclusion

The goal of this study was to provide a synthesis of qualitative studies on US farmers' motivations for and barriers to CPP adoption. We found several factors that are predominantly discussed in the qualitative literature as barriers, several of which are discussed as motivations, and others that are discussed as both motivating and hindering adoption. Through this analysis, we identified specific themes that motivate and hinder adoption. These findings were then discussed in light of their implications for both policy and practice.

Qualitative data allowed for a deeper understanding of farmers' reasoning for adoption than a quantitative approach, and our child-categories provided additional explanation and understanding of the influences on CPP adoption. Our analysis highlights the need for methodologically rigorous and conceptually sound qualitative research, that not just complements quantitative research, but is conducted independently, and even instead of quantitative research. To that end, and especially given the growing interest in qualitative research (see Figure 1), themes discussed in this study provide a salient starting point for qualitative researchers interested in understanding farmers' conservation decision-making. Like all studies, this one has limits. Given that our study was a qualitative endeavor, we do not make any claims about predicting farmers' conservation behaviors. Instead, by focusing on farmers' motivations and barriers, we provide contextual richness to current knowledge and understanding of sustainable farming practice promotion in the United States. By doing so, we hope to inform how quantitative studies conceptualize variables that are predictive of farmers' conservation behavior. For example, instead of including enrollment in conservation programs as a dichotomous variable in their models, scholars should consider conceptualizing conservation program enrollment more broadly by including specific elements such as farmers' perceptions of flexibility and inflexibility of, and trust and distrust in, conservation programs. In addition, we do not present our findings with respect to specific dependent variables, i.e., CPPs (e.g., cover crops, no-till, grassed waterways). We do this in order to speak broadly to what our findings mean for promoting agricultural conservation practices, as well as to keep our findings relevant to scholars, both in the United States and abroad. Future meta-analytic endeavors should consider testing the relative importance of qualitative themes in predicting CPP adoption.

Overall, we present the following 12 suggestions – 6 specific to research and 6 specific to practice. We suggest 6 aspects of research design, collection, and analysis to move the needle forward on our understanding of farmer conservation decision-making:

1. Develop theories that move beyond an individual-level understanding of farmers' conservation behavior.
2. Use qualitative methods and inductive analysis to understand nuances of farmer decision-making.
3. Consider mixed-methods to generate and test hypotheses.
4. Clearly distinguish between adoption and willingness to adopt.
5. Be explicit rather than broad when describing themes.
6. Design research that is theoretically grounded utilizing both individual- and contextual-level elements.

We pose 6 suggestions relevant to conservation outreach and messaging:

1. Collaborate with community farmer leaders to affirm or develop conservation social norms and leverage trusted information seeking networks.
2. Stress the benefits of conservation adoption in terms of risk reduction.
3. Engage in co-learning between farmers and practitioners to generate CPP recommendations.
4. Reinforce positive CPP experiences to engender CPP adoption and permanence.
5. Connect with NOLs to facilitate endeavors to integrate conservation into rented land and promote secure land tenure.
6. Channel conservation funding toward land with the greatest negative impact on soil and water resources.

Farm management, including CPP adoption, involves a complex decision-making process. Thus, it is not surprising that meta-analysis endeavors have found very few consistent determinants of conservation adoption. To account for the contextual reality of conservation behavior, it seems imperative that we turn to qualitative methods to enrich our understanding of motivations and barriers to those behaviors. To that end, we believe our study provides a timely synthesis.

Disclaimer statement

The findings and conclusions in this publication are those of the authors and should not be construed to represent any official USDA or U.S. Government determination or policy.

Notes

1. We acknowledge that water quality outcomes are a shared responsibility, with the onus not only on farmers to adopt CPPs, but watershed stakeholders working together to improve watershed health, which is a public good.
2. Whereas "adoption" is the actual behavior, "willingness to adopt" can be conceptualized as "behavioral intention" under the Reasoned Action Approach Framework (Fishbein and Ajzen 2011). As this framework suggests, behavioral predictors vary depending upon whether the dependent variable is the actual behavior or the intention to behave. The constructs of "willingness to adopt" and "adoption" can also be conceptualized as revealed and stated preference, respectively.
3. NOLs are people who own farmland and rent it to a tenant farmer, rather than farming it themselves.

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Appendix 1. Overview of relevant qualitative studies analyzed.

Author(s) & year	Data collection approach	Qualitative method(s) used	Number of farmers in the study (qual. only)	Type of CPP(s)
Adebiyi, Schmitt, and Snapp (2016)	Qualitative	Interviews	11	Perennial wheat
Arbuckle and Roesch-McNally (2015)	Mixed	Interviews	20	Cover crops
Armstrong and Stedman (2012)	Qualitative	Interviews	17	Riparian buffer strips
Atwell, Schulte, and Westphal (2009)	Qualitative	Interviews	23	Perennial vegetation
Bautista, Waller, and Roanhorse (2010)	Mixed	Open-ended survey questions	21	Government program
Bossange et al. (2016)	Mixed	Interviews	7	Conservation tillage
Brodt et al. (2009)	Mixed	Open-ended survey questions	22	Hedgerows and other biodiversity enhancing features
Brummel and Nelson (2014)	Qualitative	Interviews	48	Rotational grazing
Campbell, Koontz, and Bonnell (2011)	Mixed	Interviews	5	Many
Christianson et al. (2014)	Mixed	Focus group (FG)	1 FG with 11 farmers	Many
Church and Prokopy (2017)	Qualitative	Interviews	12	Many
David et al. (2015)	Mixed	Interviews	Not specified	Many
Druschke (2013)	Qualitative	Ethnographic interviews	Not specified	Conservation practices
Enloe, Schulte, and Tyndall (2017)	Qualitative	Interviews	14	Conservation practices
Foley (2013)	Qualitative	Interviews	29	Conservation practices
Grover and Gruver (2017)	Qualitative	Interviews	33	Sustainable agriculture
Gutwein and Goldstein (2013)	Qualitative	Interviews	16	Payment for ecosystem services
Harden et al. (2013)	Qualitative	Focus group & interviews	Not specified	Phosphorus reducing conservation practices
Kalcic et al. (2014)	Qualitative	Interviews	10	Many
Kalcic et al. (2015)	Qualitative	Interviews	12	Many
Kennedy, Burbach, and Sliwinski (2016)	Qualitative	Interviews	13	Grassland management
King, Baker, and Tomlinson (2017)	Qualitative	Interviews	42	Many
Krajewski (2017)	Mixed	Open-ended survey questions	97	Many
Logsdon et al. (2015)	Mixed	Interviews	14	Conservation practices
Lubell, Hillis, and Hoffman (2011)	Mixed	Interviews	16	Many
Mattia, Lovell, and Davis (2016)	Mixed	2 focus groups	Not specified	Multifunctional perennial cropping systems
McCann et al. (1997)	Mixed	Open-ended survey questions	25	Conservation practices
McGuire, Morton, and Cast (2013)	Mixed	Interviews and participant observation	9; observations not specified	Many
Miller, Chin, and Zook (2012)	Mixed	Interviews	1	Cover crops
Moore, Parker, and Weaver (2008)	Mixed	Interviews and participant observation	Not specified	Conservation practices

(*continued*)

Appendix 1. Continued.

Author(s) & year	Data collection approach	Qualitative method(s) used	Number of farmers in the study (qual. only)	Type of CPP(s)
Motallebi et al. (2016)	Mixed	Open-ended survey questions	90	Willingness to adopt riparian buffers in order to generate and sell credits under water quality trading programs
Mountjoy (1996)	Mixed	Ethnographic field observations	Not specified	Conservation practices
Ohde (2011)	Qualitative	Interviews	4	Conservation practices
Olson and Davenport (2017)	Qualitative	Interviews	30	Many
Osmond et al. (2015)	Mixed	Interviews	33	Many
Pape and Prokopy (2017)	Mixed	Interviews	20	Many
Perez (2015)	Mixed	Interviews	60	Nutrient management
Rebecca and Linda (2015)	Mixed	Interviews	15	Many
Reimer, Thompson, and Prokopy (2012)	Qualitative	Interviews	32	Conservation practices
Reimer, Weinkauf, and Prokopy (2012)	Qualitative	Interviews	45	Many
Reimer and Prokopy (2014)	Mixed	Interviews	20	Government programs
Roesch-McNally et al. 2017	Qualitative	4 focus groups	29	Cover crops
Roesch-McNally, Arbuckle, and Tyndall (2018)*	Qualitative	Interviews	159	Conservation practices
Stuart (2009)	Mixed	Interviews	43	Conservation practices
Stuart, Schewe, and McDermott (2014)	Mixed	Interviews and 4 focus groups	40; FG participation range 5-8 farmers	Nutrient management
Ulrich-Schad, Brock, and Prokopy (2017)	Mixed	Interviews	35	Many
Vollmer-Sanders, Wolf, and Batie (2011)	Mixed	Open-ended survey questions	29	Government program
Woods et al. (2014)	Qualitative	Interviews	Not specified	Conservation practices
Xie (2014)	Mixed	Open-ended survey questions	79	Many

Qualitative only denotes that the number reported here are for study participants from whom qualitative data was collected.
CPP: conservation practices and programs
The phrase conservation practices are used when the author(s) did not specify a conservation practice.
The phrase "many" is used when the study includes more than one conservation practice.
*Denotes study was published online in 2017.

Appendix 2. Coding framework

Code	Definition
Benefit	*Motivated to adopt due to on or off farm benefits*
Aesthetics	Includes discussions surrounding how a practice looks; described in positive terms
Erosion reduction	Practice is discussed as reducing on-farm erosion issues. Includes soil stabilization
Future generations	Practice discussed as helping to preserve farmland for future generations (usually referred to as family members)
Habitat	Practice increases wildlife habitat. Includes beneficial organisms like predatory insects
Livestock health	Code for improved livestock health benefit that motivates adoption
Off-farm, general	Includes environmental benefits. Do not code for water quality improvement. Includes public good. Use this code if the benefits are on-farm but cannot be captured in a more specific code
On-farm, general	Use this code if the benefits are on-farm but cannot be captured in a more specific code
Water quality improvement	Practice is specifically discussed as improving water
Economic factors	*Barriers or motivations related to economics (e.g., costs, profit reduced, etc.)*
Commodity markets	Pricing of crops and availability of markets for particular crops. Describes long-term thinking beyond short-term high commodity markets (e.g., sustainability of income over time)

(*continued*)

Appendix 2. Continued.

Code	Definition
Cost	Includes input costs (e.g., fertilizer, seeds, etc.). Includes reduction/increase in overall cropping costs. Includes high cost of the alternative practice (e.g., increasing cost of fertilizer)
General economic benefits	General discussions about broad economic benefits and issues. Code if the discussion is not specific enough to have a more detailed code
Labor	Issues or opportunities regarding farm labor (e.g., need more labor, labor reduced)
Land value	Issues or opportunities surrounding high/low cost of land. Includes intent to sell land for development
Market demand	Includes buyer requirements and/or consumer demand
Profitability	Issues or opportunities for profitability of land and farm operations (e.g., increased/decreased overall farm operation profitability)
Yield	Discussions surrounding yield due to practice adoption. Includes yield losses, increases, and can include yield staying constant (rather than declining)
Environmental awareness	*Barriers or motivations related to concern or awareness of environmental issues*
Environmental concern	Motivated to adopt because of environmental concerns
Knowledge, environmental	Knowledge of the environment/environmental issues acts as a motivation or barrier to adoption
Knowledge, program/practice	Practice or program would increase public/farmer/rancher awareness of conservation/ecosystem services
Farm characteristics	*Barriers or motivations related to farm characteristics (e.g., topography, soil quality, etc.)*
Farm quality/land characteristics	Issues and opportunities due to farm characteristics and farm quality
Flat land	Flat land typically discussed as a barrier to adoption of certain practices
Marginal land	Issues and opportunities for practice adoption due to less productive land
No issues	Land has no issues, thus practice adoption is not necessary
Open ditches absent	Land has no open ditches, thus practice adoption is not necessary
Vulnerable	Land is discussed in a variety of ways as being vulnerable (e.g., droughty and ponding)
Farm management	*Barriers or motivations related to farm management (e.g., compatible with goals/operations, time savings, etc.)*
Change in farmable acreage	Typically discussed as a barrier due to the perception that practice adoption will remove acreage from production
Compatibility	Includes compatibility and incompatibility with farm operations, goals, priorities, physical features, and business attributes. Includes issues or opportunities surrounding equipment
Livestock system integration	Issues and opportunities of practice adoption when livestock is part of the farm operation
Management effort	Includes discussions surrounding management effort increasing or decreasing. Includes time management. Indicates intensity of farm management acting as a barrier for a given DV
Status quo	Includes current level of conservation used, as well as conventional (no conservation) used
Systems thinking	Discussions surrounding farm operations and various practices as an integrated system
Timing	Issues and opportunities surrounding changes in timing due to practice adoption. Includes seeding and harvesting. Includes delay in receiving test results
Farmer characteristics	*Barriers or motivations related to farmer characteristics (e.g., education, identity, etc.)*
Farmer identity	Discussions surrounding a farmer's identity – written in terms that are about a farmer's farm philosophy or way of being in the world
Agrarian	Enjoys farming and the challenges associated with it; also passionate about farming and the farm itself
Amish	Farmer is Amish and practices they use are influenced by their beliefs
Financially motivated	Discusses farm operations through financial lens. Includes farm as business
Innovator	Farmer is continually seeking to learn new things and/or experiment with new ideas as part of farm operations
Steward (low, high)	Includes discussions about careful and responsible management of land, especially to allow productivity of the land over time

(*continued*)

Appendix 2. Continued.

Code	Definition
Government programs	*Barriers or motivations related to government programs (e.g., eligibility, paperwork, etc.)*
Application process/ requirements	Includes excessive regulation and burdensome requirements and program-specific paperwork. Code for long timeline associated with government programs acting as a barrier. Code for lack of equipment that can help meet the high standards set under government programs
Cost-share	Not only is the cost-share available, the availability is advertised so the word gets out. Code for themes other than when lack of cost-share is a barrier. For example, Cost-share, payment was not enough to cover the loss of productive land, or cost-share stops. Cost-share available and a lack of cost-share
Distrust/trust	Trust and distrust in the government in general and government programs
Eligibility	Discussions surrounding eligibility of a farmer's land for government programs
Flexibility	Discussions surrounding flexibility or lack of flexibility in government programs
Technical assistance	Issues and opportunities surrounding technical assistance for conservation practices
Land tenure	*Barriers or motivations related to whether land is owned or leased*
Landlord	Includes lack of understanding of the benefits of the practice. Includes terms of lease acting as a barrier
Leased land	Includes lack of control over leased land. Includes a lack of leased land
Practice – perceptions of conservation practice(s)	*Barriers or motivations that are related to the DV or other conservation practice*
Current/prior use of practice	Code for an existing conservation practice/program acting as a barrier to adopt the practice (DV) – specific to the practice in question
Current/prior use of other practice	Code for an existing conservation practice/program acting as a barrier to adopt the practice (DV) – use of a different practice than the one in question
Lack of time	Perceptions that farmer does not have enough time to implement/manage the practice.
Risk	*Barriers or motivations related to perceptions of risk related to the practice*
Reduced	Risk is or would be reduced if practice were adopted
Uncertainty	Uncertainty surrounding risks associated with practice adoption. Includes risk aversion acting as a barrier to adoption
Social norms	*Barriers or motivations related to individual and community norms*
Blame shifting	Farmers discuss other stakeholder groups as responsible for soil and water issues, thus they do not have a responsibility/need to adopt the practice
Leadership present	Leaders in the community acting as motivations/barriers to adoption (e.g., leading by example)
Neighbors	Neighbors have had success or failure from practice adoption
Subjective norms	Accepted practices and farming operations in the community acts as a motivation or barrier to practice adoption
Trust/distrust, community	Trust/distrust within the community acts as a motivation or barrier to practice adoption
Trust/distrust of information sources	*Barriers or motivations related to trust/distrust of various sources of information. Code for specific entities below*
Conservation agency	Code for trust/distrust in information received from conservation agency staff
University extension	Code for trust/distrust in information received from university extension personnel
Farmer	Code for trust/distrust in information received from farmers
General	Code for trust/distrust in information received, when the information source is not specified
Watershed group	Code for trust/distrust in information received from watershed group