



Understanding the relationship between land tenure and conservation behavior: Recommendations for social science research

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ABSTRACT

The long-term viability of United States (US) agriculture and food systems is contingent upon sustainable soil and water conservation. Currently, the majority of conservation practices rely on voluntary adoption by farmers. However, a large and growing proportion of farmland is rented, thereby presenting a conservation decision-making context where tenant farmers have less control over conservation behavior than farmers who own the land they operate. For decades, social science scholarship has examined whether and how land tenure affects farmers' conservation behavior. The overall effect of tenure on conservation behavior has been found to be inconclusive in quantitative studies, whereas qualitative studies suggest that it hinders conservation behavior. This article draws upon reviews of quantitative and qualitative studies examining conservation adoption in the US between 1982 and 2017 to highlight gaps in and opportunities for understanding the relationship between land tenure and conservation behavior. Highlighting the multidimensional nature of land tenure, we propose that future research on conservation adoption in agriculture use the following eight dimensions: within-farm tenure heterogeneity, tenure stability, market dynamics, type of lease arrangements, lease negotiation timelines, relational aspects, non-operating landowner characteristics, and operator characteristics. We invite scholars to operationalize and measure these dimensions to evaluate their effects on conservation behavior on rented farmland.

1. Introduction

A large and growing proportion of United States (US) farmland is rented. The US Department of Agriculture's Tenure, Ownership, and Transition of Agricultural Land (TOTAL) survey estimated that 2.1 million landowners rented about 354 million acres of farmland to tenant farmers (operators) in 2014 (USDA-NASS, 2015). Cash crops such as rice, corn, soybeans, wheat, and cotton are commonly grown in areas where more than 50% of farmland acres are rented (Bigelow et al., 2016). Over 76 million acres of highly productive farmland are rented in

the US Midwest that generate \$14.3 billion of rent received (USDA-NASS, 2015). Rented farmland is not limited to the US Midwest; 82.6 million acres of farmland are rented in the Western states of California, Idaho, and Washington (USDA-NASS, 2015). Rented US farmland acres increased from 38.8% in 2012 (USDA-NASS, 2014) to 39.2% in 2017 (USDA-NASS, 2019), a trend that is expected to increase even further as investors seek alternative investment options due to the economic fallout from COVID-19 (Schafer, 2020).

As the share of land being rented has increased, interest in understanding the relationships between land tenure, often used as a proxy for

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control or lack thereof over land management decisions, and adoption of soil and water conservation practices (hereafter, conservation practices or CPs) has also grown in the US (Petrzelka et al., 2021; Weigel et al., 2021) and around the globe (Leonhardt et al., 2021; Robinson et al., 2018; Xu et al., 2021). Public and scholarly interest in this convergence of issues is especially urgent given the centrality of agricultural land management practices to the food-energy-water nexus in a rapidly changing global climate (FAO, 2014). Despite research efforts to quantify relationships between land tenure status and adoption of CPs, findings from decades of US-based quantitative adoption studies have been inconclusive (Prokopy et al., 2019). Qualitative studies, however, suggest that land tenure does hinder conservation behavior through barriers such as a fear of losing access to rented land and high rental rates, among others (Ranjan et al., 2019a). Rather than assuming that the lack of a consistent signal in the quantitative literature indicates land tenure is *unimportant* for CP adoption, we assess whether the disparity between quantitative and qualitative research findings may be due to how land tenure has been operationalized in past quantitative scholarship on farmers' conservation behavior.

We examine past scholarship on CP adoption, including selected studies focusing on non-operating landowners (NOLs) who own farmland and rent it to an operator, to summarize published results and identify potential shortcomings in conceptualization and measurement of land tenure. Subsequently, we make several recommendations for future scholarship examining the effects of land tenure on CP adoption. By identifying shortcomings and proposing ways that the study of relationships between land tenure and conservation behavior among farmers might be improved, we hope to inform the design of future CP adoption studies. To that end, we invite scholars to operationalize the dimensions we propose below (see Section 3.4) and test their effect on farmers' conservation behavior.

2. Methods

This paper draws upon our published reviews of quantitative and qualitative studies examining farmer adoption of CPs in the US between 1982 and 2017 (Prokopy et al., 2019; Ranjan et al., 2019a), and Floress et al. (2019) – a publicly available database of selected statistics and information from the studies included in our reviews. To be included in our published reviews, studies had to focus on farmers' adoption of one or more CPs. We reviewed peer-reviewed articles, Ph.D. dissertations, M.S. theses, and technical reports published during this 35-year time-span. The CP adoption studies were identified through a reverse citation search of earlier synthesis studies and multiple keyword searches in Web of Science and SCOPUS. The published database provides a detailed description of the study selection process.

For this paper, we evaluate studies in the database that examine relationships between land tenure and adoption of CPs² – 36 quantitative, 8 qualitative, and 3 mixed-methods studies (47 studies total).³ For quantitative studies included in this paper, we defined each instance of a given study examining relationships between land tenure as an independent variable and CP adoption as a dependent variable (DV), as an observation. A number of studies included multiple analyses (i.e., separate regressions for distinct practices), and/or multiple measures of tenure within analyses, resulting in a total of 284 observations of land tenure independent variable and CP adoption DV combinations. For

each observation, we examined the measurement scales used to operationalize land tenure in the original studies. Drawing upon previous literature, we hypothesized that owning versus renting land, or having a more secure lease, will have a positive effect on adoption. When necessary, variables were reverse-coded to fit the hypothesis. For quantitative studies, we used significance vote-count and sign test methodologies to examine the effects of land tenure on CP adoption. Simple vote-counts entailed counting the number of times an independent variable was reported to be not significant, positively significant, or negatively significant at a significance level of $p \leq 0.05$. The sign test analysis entailed accounting for the signs of estimated regression coefficients and test statistics, and testing whether the direction (positive or negative sign) of an estimated effect size coefficient for each independent variable was consistent with our hypothesis (Bushman and Wang, 2009). For a detailed description of quantitative data analysis please refer to Prokopy et al. (2019).

For qualitative studies included in this paper, two of the authors developed an initial coding framework which included 'barriers' and 'motivations' as broad categories that were developed deductively based on categories identified in Prokopy et al. (2019). These authors then inductively refined the coding framework to develop subcategories by coding the themes and farmer quotes as published in the original studies, and subsequently examining and interpreting each study's results focusing on land tenure. Once the final coding framework was established and agreed upon, the qualitative articles were coded following an inter-coder reliability process where each author reviewed half of the other author's coded studies to ensure credibility and trustworthiness of the findings (Campbell et al., 2013). Data analysis was conducted using NVivo 12 (QSR International Pty Ltd, Doncaster, Australia). For a detailed description of qualitative data analysis please refer to Ranjan et al. (2019a).

While we draw primarily upon the studies in the database to closely examine past scholarship on the relationships between land tenure and conservation adoption, we also review selected additional studies focusing on NOLs to inform and bolster our recommendation for the need to examine the dimensions we propose in this study (see Table 1).

3. Results and discussion

3.1. Land tenure and conservation behavior in quantitative research

The earliest quantitative study in the database examining the effect of tenure on CP adoption was published in 1988, and over three decades of scholarly interest in whether or not tenure motivates conservation behavior has followed. Since 1988, 38 studies in the database (36 solely quantitative and 2 mixed method) included tenure as an independent variable. Among the 284 land tenure observations, only 9% (26/284) were found to be consistent with the hypothesis that owning versus renting land, or having a more secure lease, will have a positive effect on adoption. Seven percent (20/284) were found to be inconsistent with our hypothesis. The vast majority of observations (238/284; 84%) were found to be not significant. Overall, the effect of tenure on CP adoption appears unclear when we look across all studies.

We found that land tenure was conceptualized and measured in diverse ways.⁴ Among the 284 observations of land tenure as an independent variable, in decreasing order of the type of measurement scale, tenure was operationalized as a continuous ($n = 210$), binary ($n = 59$), and ordinal ($n = 15$) variable. Predominantly, continuous scales were used to measure the number of acres rented or percentage of acres owned relative to acres rented (or vice-versa). Binary scales were used to measure different dimensions of tenure such as type of lease (cash versus shared rent, and written versus verbal), whether or not a field was

² Please note that land tenure was one among many other variables or themes examined in these studies.

³ Please note that 1 mixed-methods study examined land tenure quantitatively, and 1 mixed-methods study examined land tenure qualitatively, assessed on the basis of our study coding criteria. One study examined tenure both quantitatively and qualitatively. Data from this study is reported under the section on quantitative research (Section 3.1) as well as qualitative research (Section 3.2).

⁴ As a result of this, a nuanced analysis on land tenure was not feasible in Prokopy et al. (2019).

Table 1
Land tenure dimensions, expected effects on conservation behavior, and select literature.

Dimensions	Hypothesis and expected effect on CP adoption	Select literature
i). Within-farm tenure heterogeneity	Operators are less likely to adopt CPs on rented parcels of land as opposed to parcels that are owned.	(Deaton et al., 2018) (Leonhardt et al., 2019)
ii). Stability of tenure	Operators feeling secure about their land tenure will be more likely to adopt CPs.	(Soule et al., 2000) (Xie, 2014) (Enloe et al., 2014) (Deaton et al., 2018)
iii). Market dynamics	Greater levels of both actual and expected congruence between commodity prices and rental rates will positively affect CP adoption.	(Ranjan et al., 2019b)
iv). Type of lease arrangements	Having a flexible lease, as opposed to a traditional (and more common) fixed cash rent lease will positively affect CP adoption.	(Soule et al., 2000) (Xie, 2014)
v). Lease negotiation timelines	Greater level of congruence between the timeline of negotiating lease terms and that of conservation decision-making will positively affect CP adoption.	(Ranjan et al., 2019b)
vi). Relational aspects	Quality of relationship between a NOL and an operator will positively affect CP adoption.	(Barnett et al., 2020) (Leonhardt et al., 2019)
vii). Non-operating landowner characteristics	NOLs characteristics such as being absentee, jointly owning rented land, and high financial dependency on income from rented land will negatively affect CP adoption.	(Ulrich-Schad et al., 2016) (Petrzelka et al., 2013) (Arbuckle et al., 2009)
viii). Operator characteristics	Farmers who only operate rented land, and those who are risk averse, will be less likely to adopt CPs. Number of NOLs, the total rented acres, and the overall scale of operation, could affect CP adoption both positively and negatively.	(Leonhardt et al., 2019) (Enloe et al., 2014)

rented, if a landowner was involved in decision-making, or whether the tenant was a relative or friend of the landowner or not. Ordinal scales were used in a single study to measure the number of years for which the land was rented, the duration of lease (e.g., yearly, 2–3 years, over 3 years) and the likelihood of lease termination (Xie, 2014). Taken together, quantitative studies predominantly operationalized land tenure as land ownership with little to almost no emphasis on relational aspects (e.g., friendship, landowner-operator relationship) and tenure or lease security. Another related issue pertained to CP adoption, i.e., the DV. Although these studies examined CP adoption, only Xie (2014) differentiated between whether the practice was adopted on rented or owned land.

3.2. Land tenure and conservation behavior in qualitative research

The earliest qualitative study in the database that explored the effect of tenure on CP adoption was published in 2009. Since 2009, ten studies (8 solely qualitative and 2 mixed method) explored the effect of tenure on CP adoption, predominantly reporting it as a barrier to adoption. Specifically, nine of the 10 studies explored whether the land where CPs were adopted was rented, and eight of the 10 studies explored whether or not landowners supported their operators' adoption of CPs. Overall, qualitative studies revealed themes that, from the perspective of an operator, acted as a barrier to CP adoption, such as the fear of losing access to rented land, and high cash rents (Enloe et al., 2017; Foley, 2013). These thematic barriers are directly related to land tenure, i.e., operators' real or perceived lack of control over the land they farm. Overall, whereas both quantitative and qualitative studies assessed tenure characteristics, such as lease type, rates, etc., qualitative studies explored contextual aspects such as an operator's perception of tenure security and landowner support of CP adoption.

3.3. Land tenure and conservation behavior in studies focused on non-operating landowners (NOLs)

A limited but growing body of US-focused social science research has examined the relationship between land tenure and conservation behavior from the perspective of NOLs (Arbuckle et al., 2009; Petrzelka

et al., 2021, 2013; Ulrich-Schad et al., 2016). Non-operating landowners face several barriers to implementing conservation practices, including information deficit and information asymmetry barriers (Ranjan et al., 2019b), the need for more information in order to encourage their operators to adopt conservation practices (Ulrich-Schad et al., 2016), and the communication gap between NOLs and operators (Petrzelka et al., 2021). The USDA TOTAL survey found that only 18% of NOLs were involved in conservation decisions on their land, although their participation varied by decision-type (Bigelow et al., 2016). These studies have called for understanding the role of operators in facilitating CP adoption on rented farmland (Petrzelka et al., 2013), the need for qualitative research to examine differences and similarities in perceptions, attitudes, values, etc. between NOLs and operators (Ulrich-Schad et al., 2016), and the value of experimental approaches to test the efficacy of conservation interventions on rented farmland (Ranjan et al., 2019b; Reddy et al., 2020).

3.4. Recommendations for conceptualizing land tenure

Whereas comprehensive review of quantitative studies suggests unclear effects of tenure on CP adoption, qualitative studies predominantly report renting farmland as hindering adoption. These qualitative studies, combined with studies focusing on NOLs, facilitate identification of specific themes that could be operationalized in quantitative studies to more effectively and systematically understand the relationship between land tenure and conservation behavior. We conclude that inconsistent and inconclusive results in quantitative studies may be due to use of measures that do not capture the complexity of tenure. Therefore, we see a need for scholars to develop more nuanced conceptualizations of the multidimensional nature of land tenure and accordingly revise their methodological approaches to measure the relationships between land tenure and conservation behavior.

Taking cues from the current quantitative and qualitative scholarship on land tenure, and our combined experiential knowledge of conducting research with NOLs and farm operators, we identify and describe several key dimensions of land tenure, especially in relation to their effect on conservation behavior. We also propose several hypotheses and provide a non-exhaustive list of studies that have attempted to

operationalize the land tenure dimensions (Table 1). Before we provide a description of the key land tenure dimensions, we want to acknowledge that operationalization and development of robust measures entails paying attention to the theoretical underpinnings of a construct. To that end, there is a vast theory base in the social sciences, and more specifically in earlier studies on land tenure and conservation, that can inform how land tenure could be conceptualized, e.g., the principal-agent problem (Masuda et al., 2021), collective action and social exchange theory (Fischer et al., 2019), and power and gender dynamics (Barnett et al., 2020; Petrzalka et al., 2018).

i) Within-farm tenure heterogeneity:

Many farm operations, especially the larger ones, farm both owned and rented land (USDA-NASS, 2015). Understanding the effect of land tenure on CP adoption in any given farm operation should account for which parcels of land are rented and which are owned, whether there are multiple landowners and types of lease arrangements (e.g., cash rent vs. crop share), and whether and to what extent these are related to differences (even within the same farm) in CP adoption. Research methods that ask about overall CP adoption without discerning how that adoption varies spatially in relation to land tenure will not be able to draw valid conclusions about the relationships between the two phenomena.

ii) Stability of tenure:

It is important to account for operators' perceptions of how secure they feel about their tenure in relation to a specific NOL-operator arrangement. In this regard, how long the operator has rented a specific farm, and their expectations to rent the farm irrespective of any changes in land ownership, could act as proxies for stability of tenure. Relatedly, operators' perception of how competitive the rental market is, and the formality of tenure arrangement (e.g., handshake versus written lease), could also influence their perceived risk of losing rented land. These nuances are not captured by traditional survey questions that measure the length of an operator's lease (i.e. even operators who have rented the same land for 20 years may only have an annual lease) as a way of imputing tenure stability.

iii) Market dynamics:

High rental rates combined with declining commodity prices could reduce profit margins for operators, thereby reducing their capacity to adopt and motivations for adopting CPs. In this regard, it is important to account for: (1) operators' expected profit margins on rented land, and (2) operators' perceptions of how cash rent on their farm compares with commodity prices, as well as the average cash rents in their region/county. Understanding these dynamics is especially crucial in regions with high rates of rental increases due in part to the increasing financialization of agricultural land markets. For example, rental market dynamics might be different in the U.S. Midwest due to higher rents, as opposed to the western U.S. states.

iv) Type of lease arrangements:

Different lease arrangements vary with respect to how, and to what extent, they can distribute risks and rewards between NOLs and operators. For example, a fixed cash rent lease does not allow for sharing risk/rewards. In contrast, a flexible cash rent lease, or a crop share lease, is amenable to sharing risks/rewards. Therefore, it is important to account for the type of lease arrangement to understand how that affects CP adoption.

v) Lease negotiation timeline:

Given that CP adoption entails an annually recurring decision-making process, especially for farm management practices (e.g., cover crops, conservation tillage), it is important to align this process with when the terms of the lease, including those pertaining to conservation, are negotiated. In this regard, operators' perception that these negotiations are timely in relation to farm management decisions, could affect CP adoption.

vi) Relational aspects:

Foundational to a land tenure arrangement are the different forms of social exchanges between a NOL and an operator. In this regard, operators' perceptions of their relationship, including a congruence between operators' and NOLs' conservation expectations, could affect CP adoption. These dynamics include having a trusting and friendly relationship, frequency and ease of communication, and perceptions of locus of power in conservation decision-making. These relational aspects could affect operators' willingness to talk to their NOL about CPs, and their perceptions of how receptive the NOL would be towards this conversation, and subsequent adoption of CPs.

vii) Non-operating landowner characteristics:

NOLs are heterogeneous in their characteristics. For example, some NOLs live on or near the land they rent, whereas other NOLs live in a different county, state, or country, and this geographic proximity or distance may impact capacity to be involved in land management decisions. Type of rented land ownership (e.g., individually, family, corporation, etc.) is another characteristic. These characteristics, among others such as gender, age, etc., could shape NOLs' financial motivations as well as dependency on income from rented land. Characteristics of NOLs themselves, therefore, could influence operators' decision to adopt CPs on rented land, for example, by influencing their perceptions of relational aspects.

viii) Operator characteristics:

Just like NOLs, operators are heterogeneous in their characteristics. For example, some farmers operate only the land they rent, as opposed to those that are owner-operator on some of their land and an operator on others. An operator's risk aversion towards, and risk tolerance for, experimenting with CPs on rented land is yet another characteristic. Arguably, risk aversion and risk tolerance could affect operators' perceptions regarding the stability of tenure, which is related to their perception of control over their decisions, thereby affecting their decision of whether and to what extent they adopt CPs on owned versus rented land (*within-farm tenure heterogeneity*). The number of NOLs an operator rents from, the total rented acres, and the overall scale of operation, are additional operator characteristics that could affect CP adoption on rented land.

Overall, the eight dimensions highlight different aspects of land tenure, and challenges pertaining to operationalizing it. For example, within-farm tenure heterogeneity poses a measurement problem, especially when an operator farms both owned and rented land, and it is difficult to ascertain whether and to what extent CP adoption occurred on owned versus rented acres. Other dimensions such as stability of tenure, lease arrangement type, negotiation timeline, and relational aspects are structural and dyadic in nature because both the NOL and the operator jointly contribute to these dimensions and how they influence conservation behavior. Market dynamics also represent a structural dimension; however, rental rates and commodity prices are beyond the control of NOLs and operators. Lastly, characteristics of the NOL and the operator are individual-level, as opposed to structural, dimensions of land tenure.

4. Conclusion

A key missing piece in ensuring the long-term viability of US agriculture and food systems is a better understanding of the relationship between the growing phenomenon of rented farmland and implementation of CPs. For several decades, quantitative social science research has focused on understanding farmers' (owner-operator) conservation behavior, a subset of which specifically examines conservation decision making of tenant farmers (operators). Fundamentally, insecure land tenure may be an indicator of diminishing control operators have

over land management decisions. With diminishing control over their decisions, motivation to adopt CPs on rented farmland is expected to be lower, with predictable deleterious effects on key soil and water quality and climate resilience outcomes. We identified and described eight dimensions for which better measures could be developed and operationalized to improve our understanding of the relationships between tenure and CP adoption. We also proposed several hypotheses, which if tested could strengthen our understanding of how land tenure may affect conservation behavior. Overall, the literature shows that land tenure is multidimensional and how it affects conservation behavior is complex. In this paper, we have used a generalized description of land tenure dimensions in order to encourage broader application and testing.

Our paper contributes to calls for examining structural factors affecting conservation behavior (Prokopy et al., 2019), and the need to develop theories that move beyond an individual-level understanding of conservation behavior (Ranjan et al., 2019a). Given that conservation decision-making regarding rented land is diffuse, i.e., involves at least two individuals – NOL and the operator, land tenure falls under the aforementioned domains. Specifically, structural dimensions such as market dynamics and stability of tenure, combined with the measurement problem posed by within-farm tenure heterogeneity, emphasize the challenges associated with operationalizing land tenure using social science data collection methods. Whereas our findings bring to fore the complex nature of land tenure and measurement challenges, additional related factors that could influence measurement of the relationship between land tenure and conservation behavior include, but are not limited to, balancing the underlying tradeoffs between study generalizability and contextual applicability, confirmation and social desirability bias (Leonhardt et al., 2021), intention-behavior gap (Weigel et al., 2021), and a clear definition of land tenure (Robinson et al., 2018).

Our overarching message to scholars working in this domain is to recognize this complexity, and to accordingly design data collection instruments that, when relevant and possible, take into account the dimensions we propose. To better understand the effect land tenure has on adoption of CPs, more systematic, rigorous conceptualization and measurement of multiple dimensions of land tenure is needed to generate better data, more valid analytical results, and facilitate comparisons between studies. Understandably, operationalization of specific dimensions will vary depending upon the study context and design. Therefore, the goal should not be to account for every dimension, nor to seek universal predictors of conservation behavior. Instead, it should be to ensure that dimensions expected to affect conservation behavior in a given context are operationalized and that the scholarship moves towards a contextual understanding of conservation behavior. Indeed, accounting for, and investigating the contextual factors, and differentiating between whether and to what extent adoption varies between owned and rented land, can result in a better understanding of the relationship between land tenure and conservation behavior (Leonhardt et al., 2021). Once operationalized and tested for their effect on conservation behavior, these dimensions could then be used to develop and refine theories related to NOL-operator decision-making (see Section 3.4 for a few examples). By doing so, our hope is that future studies are better positioned to reveal pathways via which land tenure influences conservation behavior. Given the growing phenomenon of rented farmland, there is an urgent need to unravel the theoretical and conceptual underpinnings of how land tenure affects conservation behavior.

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Author agreement/declaration

We, the authors, certify that all authors have seen and approved the final version of the manuscript being submitted. The article is the authors' original work, hasn't received prior publication and isn't under consideration for publication elsewhere.

Conflict of interest statement

We, the authors of the manuscript titled, "Understanding the relationship between land tenure and conservation behavior: Recommendations for social science research", would like to state that there is no conflict of interest.

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