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Received: 18 August 2020 | Accepted: 29 July 2021

DOI: 10.1002/pan3.10257

PEOPLE AND NATURE | BRITISH ECOLOGICAL SOCIETY

RESEARCH ARTICLE

Farmer identities influence wildlife habitat management in the US Corn Belt

Adam P. Dixon[1] | J. Gordon Arbuckle[1,2] | Erle C. Ellis[1]

[1]Department of Geography & Environmental Systems, University of Maryland Baltimore County, Baltimore, MD, USA

[2]Department of Sociology, Iowa State University, Ames, IA, USA

Correspondence
Adam P. Dixon
Email: adampdixon@umbc.edu

Present address
Adam P. Dixon, 1000 Hilltop Circle, Baltimore, MD, USA

J. Gordon Arbuckle, 303c East Hall, 510 Farm House LaneAmes, IA 50011, USA

Handling Editor: Unai Pascual

Abstract

1. Farmer wildlife management practices are critical to conserve biodiversity and ecosystem functions across intensively used agricultural landscapes. Policies and initiatives aimed at encouraging these practices have generally focused on economic incentives, with limited effectiveness.
2. Farmer identity theory addresses the emergence of norms, values and perceptions in farm management and can contribute to the development of policies and initiatives that engage more effectively with farmers and farming communities.
3. Here we evaluate linkages between farmer identity and wildlife habitat management practices in the intensively farmed US state of Iowa.
4. We conducted an exploratory factor analysis using data from a survey of over 1,300 Iowa farmers that asked their opinions on what constitutes 'a good farmer'. We use logistic regression to model relationships between farmer identity factor scores and contextual variables against participation in a set of habitat management practices.
5. Four 'good farmer' identity types were identified and labelled as productivist, soil conservationist, wildlife conservationist and civic-minded. Logistic regression results indicated that these farmer identity types have highly divergent responses to wildlife habitat management practices among Iowa farmers. Recreational factors may supplement identity and are also influential towards habitat production on farms.
6. We conclude that farmer identity theory offers a critical link between social and ecological processes on Iowa farms. The research presented here quantitatively associates farmer identity theory with wildlife habitat management, increasing our understanding of how wildlife habitat practices and individual-level farmer identities interact.

KEYWORDS

biodiversity, rural sociology, social–ecological, wildlife conservation, working landscapes

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1 | INTRODUCTION

Over the past half century, farming practices in the US Corn Belt have shifted production from hay, small grains and pasture, to exclusively corn (*Zea mays*) and soybean (*Glycine max*) production using larger field sizes and reducing overall perennial vegetation cover (Corry, 2016). As a result, wildlife populations such as grassland birds have declined significantly (Evans & Potts, 2015; Shaffer & DeLong, 2019). Efforts to mitigate agricultural impacts towards farmland bird populations are limited by increasing agricultural intensification (Stanton et al., 2018). Solutions have been proposed through reconciling agricultural practices with habitat production through diversification, improved farm design and through formation of coalitions among farmers, citizens and government agencies to increase wildlife-friendly habitat practices (Kremen & Merenlender, 2018; Landis, 2017; Rosenzweig, 2003). Fundamental to this challenge are addressing knowledge gaps in understanding how social and ecological systems interact, and how diverse value systems negotiate landscape management (Ellis et al., 2019; Mastrángelo et al., 2019).

To increase their effectiveness for both stakeholders and wildlife, conservation strategies must innovate to reposition values, agency and well-being as central to farm policy and initiative development and execution (Hicks et al., 2016). One way to address this is to improve understanding of relationships between farmer identity and wildlife conservation to inform conservation strategy development in agricultural landscapes. Here we apply a farmer identity-based approach to understanding farmer decision-making in relation to on-farm wildlife habitat management practices.

Farmer identity represents the cycle of an individual's subjective understanding of good farming practices which are verified through social and ecological feedback (Burton, 2004; Lequin et al., 2019; McGuire et al., 2015; Sulemana & James, 2014). The farmer identity concept represents a relatively new pathway towards understanding how farmer attitudes and behaviours contribute to environmental conservation (Prokopy et al., 2019), and has not been directly assessed in relation to wildlife habitat management.

There is ample evidence that wildlife habitat can exist in the margins of agricultural landscapes and even complement row-crop farming (Quinn et al., 2014), thereby increasing local biodiversity (Fahrig et al., 2011). Agricultural field margins provide a space for fencing, create boundaries for fields and property, act as wind breaks reducing wind erosion of soil and provide habitat for wildlife through forage and cover resources (Marshall & Moonen, 2002; Schulte et al., 2017). Pollination and pest-control services are provided by vegetation situated in field edges and could be incorporated to a greater extent in farm design (Landis, 2017). Within-field farming practices may also serve wildlife habitat functions with crop stubble and residue containing forage material for migrating birds and deer, and provide a space for the establishment of nests for a variety of bird species (Rodgers, 1983). Reduced tillage during spring or fall and increased use of mulching provides forage resources and reduces destruction of nests by farming equipment (Anteau et al., 2011). The tillage of crop fields has been shown to significantly impact nesting birds by either destroying or altering active nest sites and thus hampering brood success (Rodgers, 1983).

Farmers may implement wildlife-friendly practices on their own if they have the resources and intention (van Dijk et al., 2016); however, agri-environmental schemes (AESs) enacted by governments are a catalyst for many efforts to increase and diversify wildlife habitat on farms and address soil and water conservation concerns. AESs tend to focus on economic reward structures through direct payments and/or technical assistance (Batary et al., 2011). Yearly AES investments total roughly US $2 billion in the United States, and roughly US $3 billion in the European Union (Claassen et al., 2008; Kleijn & Sutherland, 2003). Despite these large investments, agriculture continues to be a major contributor to biodiversity loss, climate change, soil degradation and water pollution (National Research Council, 2010). Furthermore, the benefits of AESs are often temporary as a slight majority of enrolled land in the United States typically transitions back into a row-crop production land when contracts expire and are not renewed, as well as when commodity crop prices exceed the value of these set-aside subsidies (Bigelow et al., 2020).

In addition to these issues of effectiveness and sustained impact for biodiversity conservation on farms, direct payment incentive programs may also create conflict with the production-oriented farmer identity. First, direct payments can introduce counterproductive incentives for farmers to withhold wildlife habitat friendly management actions in the expectation of payment (Engel et al., 2008). Second, is that while direct payments may position subsidized habitat production embedded into farming landscapes as equal compensation for the opportunity cost of not farming, production-oriented farmers may see these installations not through an economic lens, but rather as a lost opportunity to demonstrate farming skill and know-how on land that has produced row-crops through several family generations (Burton, 2004). Thus, the implementation of wildlife-friendly practices will likely interfere with symbolic interpretations of row-crop farming by production-oriented farmers and will be viewed negatively in this regard. If this is indeed true, farming identity is likely a good predictor of reactions to practices introducing wildlife habitat onto farms and by extension to farm management behaviour.

1.1 | Farmer identity theory

Identity theory provides a useful framework for examining the development of attitudes that reflect behaviours and choices in farming, because it addresses the emergence of norms, values and perceptions towards wildlife habitat management on farms (Burke & Stets, 2009; de Snoo et al., 2013). Identity is a crucial source of meaning in individuals' lives, without which would be a life without purpose or structure, resulting in low self-worth and esteem (Burke & Stets, 2009). Thus, identity motivates behaviours that are reinforced by successive social and environmental feedback and reflected appraisals. Identity theory is rooted in symbolic interactionist social theory, which emphasizes how symbolism embedded in

language can reveal social structure and the roles individuals occupy in life (Stryker, 1980).

Several complementary lines of identity theory have been developed and integrated into social psychology research (Carter, 2013). An identity salience hierarchy has been proposed, where role choices by individuals are based on salience of identity expressed differently across places and social context (Stryker, 1983). 'Principle-level' identities are overall expressions of one's self-reflection, while 'program-level' identity is associated with a more specific set of characteristics expressed when required by place and social context. A simple example is the coexistence of both professional and family identities, where professional situation choices and behaviours are different from those when holding the role of family member. An identity control theory has also been proposed where once an identity is activated, one's identity meanings are matched with perception of the self by a psychological control system (Burke & Stets, 2009). Other uses of the identity concept exist, such as through the analysis of 'self-identity' as a component of the factors leading to the intentions that predict eventual behaviour (Ajzen, 1991; Fielding et al., 2008). For this study, we focus on the identity salience hierarchy as described by Burke and Stets (2009) because it provides an appropriate framework for examination of multiple identity types which may be expressed independently given different social and ecological feedbacks.

We propose farmer identity here as an extension of the identity salience hierarchy with all farmers expected to desire the principle-level identity of being 'a good farmer', and then expressing one or more program-level identities dependent upon social–ecological context (Figure 1). Farmer identity is an attractive concept to social–ecological research in agricultural systems, because it provides a theoretical framework to interpret symbol usage both in language and in visible farming practices. Farmers, in a sense, communicate through land use practices to signal group belonging and self-concept. This is expressed in concepts like 'road farming', which describes farmers focusing more energy on operations visible by peer farmers gazing from their vehicles than on parts of their farm not visible from the road, or using land use practices such as straight crop rows and cleanly tilled fields in order to signal farming success (Burton, 2004; Nassauer et al., 2011). Furthermore, identity is not static or homogenous, rather it is multiple and hierarchical with the potential to be expressed differently given different spatial, temporal and environmental situations (Burton & Wilson, 2006). From a behaviour change standpoint, this raises the possibility of an individual transitioning between program-level identities, such as from production-oriented behaviours which value agricultural yield above other concerns, to behaviours that integrate other priorities. To this end, McGuire et al. (2013) demonstrated the shift of priorities of

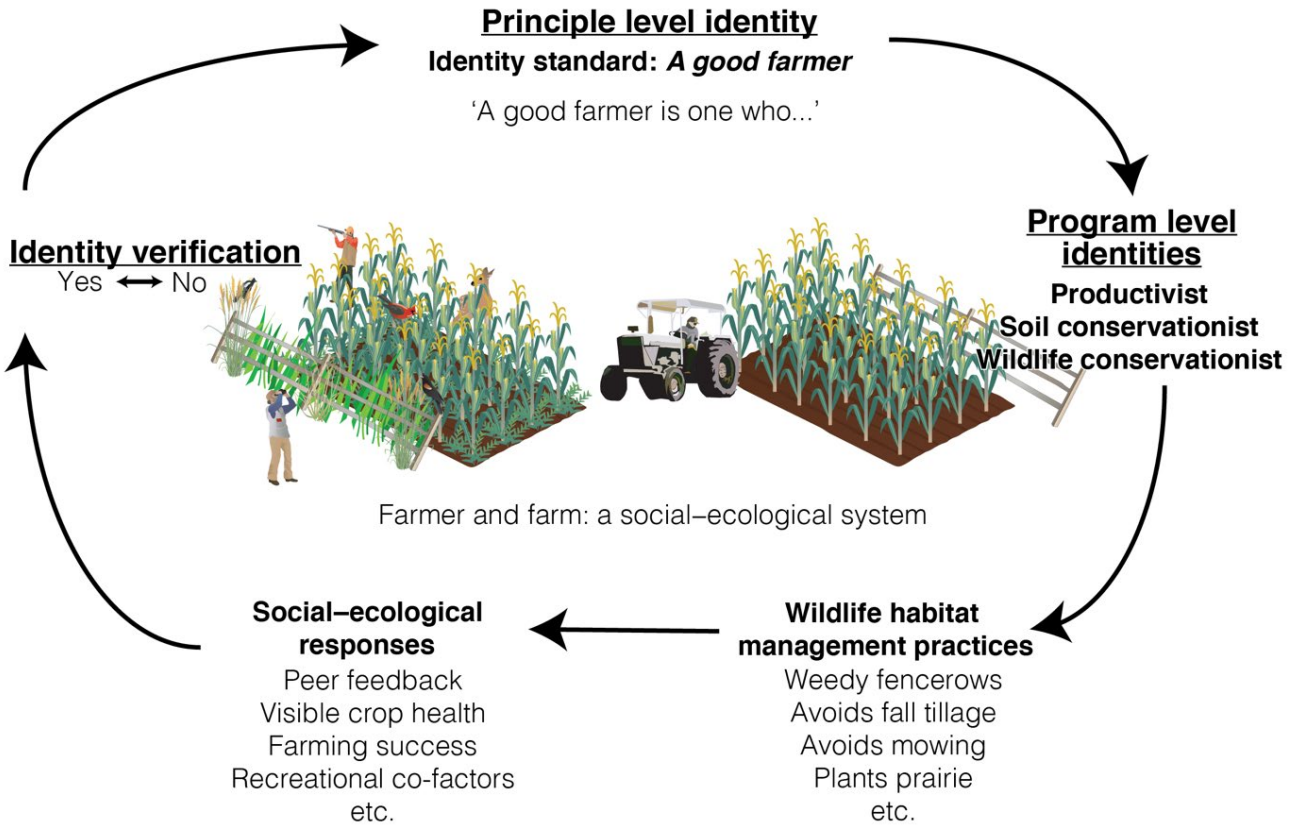

FIGURE 1 Conceptual diagram of the farmer identity model. Farmer identity represents the cycle of an individual's subjective understanding of good farming practices which are verified through social and ecological feedback. The figure is adapted from the studies by Burke (1991) and McGuire et al. (2013). All colour graphical elements came from the Integration and Application Network (ian.umces.edu/media-library) licensed under Attribution-ShareAlike 4.0 International (CC BY-SA 4.0)

production-oriented farmers upon regular meetings with peer farmers organized in watershed groups.

1.2 | Research framework and objectives - Farmer identity and wildlife habitat

We build on previous research that examines how farmers express identity through farming practices for soil and water quality concerns in Iowa (McGuire et al., 2013, 2015), by adding wildlife habitat as another key component of farm management. Wildlife habitat management practices are defined here as deliberate land management techniques for the benefit of undomesticated animal life. All farmers are expected to hold the principle-level identity as 'a good farmer'. Beneath the good farmer identity, program-level identities are based on which practices the farmer emphasize in management decisions (Burke, 1991; McGuire et al., 2013). Identity verification occurs after farmers receive social and ecological feedback from their farm management decision. For instance, a farmer with clean fencerows and well-fertilized row-crops, both observes the ecological response and receives positive feedback from peer farmers verifying a productivist identity.

Several farmer identity constructs applied in previous research have been proposed and utilized as composites of attitudes and behaviours impacting farmer environmental management (Burton, 2004; Cullen et al., 2020; McGuire et al., 2013; Sulemana & James, 2014). The already mentioned production-oriented identity refers to farmers' wish to be evaluated by success in yield and profit. Hence, a focus on fertilizer and pesticide application to produce the greenest crop fields and clean fence margins visibly signal these personal characteristics and provide identity verification to the farmer. A 'productivist' identity was defined as 'the overwhelmingly utilitarian approach to land use based on intensive forms of agricultural production and accompanying attitudes, goals, roles and behaviours that result in a uniform landscape' (Burton, 2004). Several non-production-oriented farming identities have also been proposed. Agricultural producer, agribusiness person and soil conservationist were proposed as an identity hierarchy within British farmers based on the analysis of qualitative interviews and survey analysis (Burton, 1998; Burton & Wilson, 2006). Cullen et al. (2020) suggested forward-looking, and optimistic caretaker identities to join productivist and conservation-oriented identities, which emerged in their factor analysis of a survey of Irish farmers. In previous work in Iowa, four identities were identified through a component analysis of survey responses asking farmers about a range of scenarios of what it means to be a 'good farmer' (McGuire et al., 2015). The previous four types identified were productivist, soil conservationist, civic-minded and naturalist (McGuire et al., 2015). The productivist and soil conservationist constructs were literature based (Burton, 2004), while civic-minded and naturalist were newly introduced and based on the survey analysis.

Our research objective is to assess relationships between farmer identity and behaviours that promote wildlife habitat practices on farms in Iowa. To our knowledge, there is no research on farmer identity and wildlife habitat management practices. We expect the identity verification process to be quantitatively substantiated by assessing farmer responses to wildlife habitat management practices, and thus demonstrate the salience of program-level identities. We follow the program-level identities proposed by McGuire et al. (2015) which found evidence for productivist, conservationist, naturalist and civic-minded, although we propose conservationist and naturalist to be better expressed as soil conservationist and wildlife conservationist. This distinction is made because the term naturalist refers to appreciation and observation of wildlife species while wildlife conservationist refers to active management behaviours to improve habitat for wildlife species. An active management approach is therefore a better representation of the intent of the survey questions. Beyond these program-level identities, several additional factors may supplement identity response in regard to wildlife habitat management. For instance, farmers may also utilize their land for recreational opportunities like hunting and birdwatching, which could impact their self-reflection as farmers and wildlife habitat management decisions (Macaulay, 2015). Hunting is specifically recognized as a rationale for wildlife habitat management on farms and on private lands (Macaulay, 2016). Birdwatching has also been shown to be positively related to conservation behaviours (although not specifically on agricultural land; Cooper et al., 2015; McFarlane & Boxall, 1996). Farmer age and farm size may also influence identity expression, as each of these factors have been shown to predict overall adoption of conservation practices (Prokopy et al., 2019). Taken together, we are interested in determining if identity constructs along with recreational and demographic features of farms are influencing wildlife habitat management in Iowa. Results will provide improved understanding of farmers' perspectives on use of wildlife-friendly practices on the farmland they manage, and address a research gap in our understanding of how farmer identity leads to adoption of wildlife habitat management by farmers (Prokopy et al., 2019). Improved understanding of farmers' perspectives may ultimately enable the next generation of wildlife conservation initiatives in the working landscapes of the US Midwest by illuminating how different outreach efforts may lead to improved outcomes.

1.3 | Research methods

We used survey data from the 2010 Iowa Farm and Rural Life Poll (IFRLP) for this analysis. The IFRLP is an annual survey administered by Iowa State University Extension Sociology in partnership with the United States Department of Agriculture (USDA) National Agricultural Statistics Service (NASS) and the Iowa Department of Agriculture and Land Stewardship following federal guidelines for research into human subjects. The USDA NASS, which conducted the survey, is required by law (Title 7, US Code and the Confidential Information Protection and Statistical Efficiency Act or CIPSEA, Public Law 107-347) to maintain confidentiality and to use data that it collects for statistical purposes only. Respondents were provided

with an informed consent statement that explained the objectives of the research and that the data would be kept confidential. Respondents indicated their consent to participate in the research by returning their completed survey. The survey was sent in early winter 2010 to over 2,200 farm operators, posing a range of questions focusing on farming and land management, including the 31-item good farmer question set and on-farm wildlife habitat practices. While the results are a decade old at the time of this research, the overall trajectory of Iowa agriculture has not appeared to change. The planted acres to corn and soybeans have changed little over the 2010 to 2020 period (USDA NASS, 2021). Changes in macroeconomics, policy and climate have likely impacted Iowa farmers over the past decade; however, we expect the survey to remain an accurate and useful instrument to measure farmer perspectives concerning wildlife habitat management. The survey presented a unique opportunity because it included both a series of questions related to wildlife habitat management in addition to the good farmer questions. The survey response rate was 61%, providing about 1,300 responses. All survey responses with missing data were removed leaving 1,048 responses used within the analysis. The average age of participants was 63 years old, with 48% of participants reporting more than half of their income as farm related, while 19% reported earning between 26 and 50% from farm operations (Arbuckle & Lasley, 2010).

We measured the multi-dimensional 'good farmer' identity through a 31-item question set. Each item was preceded by the statement, 'A good farmer is one who…' and respondents were asked to rate the importance of each statement on a 5-point scale, ranging from (1) 'Not Important at All' to (5) 'Very Important'. The good farmer questions address self-concept in relation to a wide range of farming practices. The IFRLP survey also asked farmers whether they currently used several habitat management practices recommended for Iowa farmland. These included annual management practices, such as timing of tillage, mowing or leaving rows of crops to benefit wildlife and one-time events, such as planting prairie or trees and shrubs. Response choices were 'Yes', 'No' and 'Not Applicable'. Responses recorded as 'No' and 'Not Applicable' were recoded to the same value (1 = yes, 0 = no or NA). These survey items were used as dependent variables to test activation of identity factors through wildlife habitat management practices.

Control variables of farm demographics were included because they may supplement activation of farmer identity constructs. Farmer age and total cultivated area are included because differences in these characteristics may also have an effect on the response variable (Prokopy et al., 2008, 2019). Two additional survey items that asked if the farmer had birdwatched or hunted in the previous year were included in the model. These recreational variables may also influence the dependent variable, as they suggest that the farmer actively uses wildlife habitat on their property.

All statistical analyses were completed in R using base functions and the psych package (R Core Team, 2019; Revelle, 2019). Exploratory factor analysis (EFA) with oblimin rotation reduced responses of the 31 good farmer queries into a set of latent constructs. The EFA is the most suitable dimension reduction technique (as opposed to Principal Components Analysis) because we hypothesize a set of four underlying constructs which will describe program-level identities (Osborne et al., 2014). A scree and parallel plot analysis guided the number of factor solutions in addition to previous research classifying farmer identity into four program-level identities using the same survey (McGuire et al., 2015). Factor scores were estimated using the Thurstone method (regression-based weights) for use as independent variables in a series of logistic regression models. Cronbach alpha reliability coefficients were calculated for each identity construct to evaluate reliability. Logistic regression model diagnostics indicated that no model assumptions had been violated. Diagnostics included examining for linearity among the predictor and dependent variables, multicollinearity by evaluating the variance inflation factors and influential values within the standardized residuals.

2 | RESULTS

Farmer use of the five wildlife habitat management practices ranged from 18% to 74% (Table 1). The most common practice was avoidance of mowing until late summer to protect bird nests, with nearly three fourths of farmers surveyed reporting that they performed this practice in the past year. The least common practice was planting trees on Conservation Reserve Program (CRP) land, at 18%. The mean area of soybean- and corn-cultivated land among participating farmers was 372 acres with a standard deviation of 526 acres. Forty-four per cent of farmers reported birdwatching in the past year, while 32% reported hunting.

We found evidence for four program-level identities through the EFA (Table 2). Parallel analysis suggested three to six possible factors. We retained a four factor solution based on the statistical strength of this solution and alignment with previous research using the same set of good farmer survey questions (McGuire et al., 2015). The four factor EFA solution resulted in a *p*-value for Bartlett's test of sphericity of 0.000, and a Kaiser-Meyer-Olkin overall mean sampling adequacy of 0.91. One survey item—'passes farm down within family'—did not load onto any of the factors with sufficient strength to warrant inclusion. The 30 remaining items demonstrated internal consistency with Cronbach's alpha 0.79 or above for grouped items within all four constructs. The productivist identity construct was associated with good farmer items indicating prioritization of up-to-date biotechnology (seeds and chemical use), high yields and profits, clean fencerows and fields, capitalizing on government payouts and a willingness to innovate (Table 2). The soil conservationist identity construct had high factor loadings for soil and water quality concerns including nutrient run-off, soil erosion, management of soil organic matter and the health of streams. Managing for both profit and environment also loaded onto the soil conservationist identity. The wildlife conservationist identity construct loaded onto items that would be expected to benefit wildlife, including cover cropping,

TABLE 1 Definitions for farmer identity constructs, control variables and wildlife habitat practices

Independent variables - Farmer identity, demographics and opinions			
Definitions based on exploratory factor analysis results		*References*	
Productivist	A farmer who has the most up-to-date equipment and technology, strives for high profits and yields, clean fields, clear fencerows and tries to get his/her crops planted first	Burton (1998); Burton and Wilson (2004); McGuire et al. (2015)	
Soil conservationist	A farmer who minimizes nutrient run-off and soil erosion, thinks long term, scouts for weeds and considers streams on the farm	Burton (1998); McGuire et al. (2015)	
Wildlife conservationist	A farmer who uses cover crops, maintains wildlife habitat and minimizes pesticides and tillage		
Civic-minded	A farmer who is active in their community and farm organizations, shares equipment with friends and neighbours and shares knowledge with other farmers	McGuire et al. (2015)	
Demographics, farm size and recreation		**Mean**	***SD***
Farmer age	The age of the survey taker	62.6	11.2
Cultivated acres	The total number of soybean and corn acres in production	372	526
Hunted	The survey taker went hunting in the past year	0.44	0.49
Birdwatched	The survey taker birdwatched in the past year	0.32	0.47
Wildlife habitat practices	**Please indicate which of the following practices are used on your farm**	**Mean**	***SD***
Model 1 - Weedy fencerows	Leave brushy and weedy fencerows at least 3 feet wide	0.42	0.49
Model 2 - Planted CRP	Have planted CRP acres to trees for wildlife	0.18	0.38
Model 3 - Avoid mowing	Avoid mowing areas such as grass waterways and ditches until late summer to allow birds to nest	0.74	0.44
Model 4 - Planted prairie	Have planted prairie grasses and flowers	0.34	0.47
Model 5 - Avoid fall tillage	Avoid fall tillage to leave food and cover for wildlife	0.48	0.5

maintaining wildlife habitat, minimizing pesticides and fungicides and avoiding and minimizing tillage events. The civic-minded identity construct had item loadings that suggested they were active in their community and in farm organizations, were community leaders, helped friends and neighbours with farm tasks and shared knowledge with other farmers.

Results of the binary logistic regression analyses confirmed a divergence in farmer identity types activated in response to the wildlife habitat practices presented (Table 3). The Pseudo R-squared statistics indicate that the models explained between 11 and 16% of the variance in the dependent variables. In the first model, the dependent variable 'Leave brushy and weedy fencerows at least 3 feet wide', was negatively associated with the productivist identity and positively associated with the wildlife conservationist identity, both results were significant ($p < 0.01$). In terms of magnitude, the odds ratios indicated that a 1 standard deviation (*SD*) increase wildlife conservationist identity score corresponded to a 79% greater likelihood that the farmer would have reported leaving brushy and weedy fencerows at least 3 feet wide. On the other hand, for the productivist identity construct, a factor score increase of 1 *SD* was associated with a 23% decrease in likelihood of wildlife-friendly fencerows. Neither the soil conservationist nor the civic-minded identities were significant in the model.

In model 2, 'Have planted CRP acres to trees for wildlife', the productivist farmer construct was significant and negatively associated with the dependent variable ($p < 0.01$), while the wildlife conservationist identity was significant and positive ($p < 0.001$; Table 3). Similar to model 1, a 1 *SD* increase in productivist identity factor score was related to a 24% lower likelihood of avoidance of planting CRP land to trees, and a 1 *SD* increase in wildlife conservationist identity score was related to an 83% greater likelihood of planting CRP land to trees. Again, neither the soil conservationist nor the civic-minded identities were significant in the model.

For model 3, 'Avoid mowing areas such as grass waterways and ditches until late summer to allow birds to nest', the soil conservationist and wildlife conservationist identity constructs were statistically significant predictors ($p < 0.01$). The odds ratios indicate that a 1 *SD* increase in soil conservationist identity and wildlife conservationist identity corresponded to a 35% and 42% greater likelihood, respectively, of avoiding mowing. In this model, neither the productivist nor the civic-minded identities were significant.

Results for model 4, 'Have planted prairie grasses and flowers', showed the productivist identity construct to be negatively associated with planting prairie ($p < 0.05$), while both the soil and wildlife conservationist constructs were positive predictors ($p < 0.05$). A 1 *SD* increase in productivist orientation was related to an 18% lower

TABLE 2 Exploratory factor analysis results (n = 1,048). The average Cronbach's alpha is reported under grouped items which loaded onto the same factor

Good farmer items – *'A good farmer is one who…'*	Productivist	Soil conservationist	Wildlife conservationist	Civic-minded
Uses latest biotechnology	0.74	0.05	−0.01	0.03
Has most up-to-date equipment	0.71	−0.11	0.09	0.04
Has highest profit per acre	0.69	0.04	−0.05	−0.01
Has the highest yields per acre	0.68	0.03	−0.09	−0.04
Get their crops planted first	0.60	−0.09	0.03	−0.03
Maximizes government payments	0.57	−0.16	0.20	−0.08
Keeps fields clean	0.49	0.23	−0.12	0.10
Makes sure farm looks nice from road	0.39	0.10	−0.10	0.33
Keeps fencerows clear of brush	0.39	0.08	−0.20	0.13
Is willing to try new practices and approaches	0.34	0.25	0.16	0.04
Cronbach's $\alpha = 0.83$				
Minimizes nutrient run-off	−0.02	0.94	−0.03	−0.02
Minimizes soil erosion	0.02	0.93	−0.03	−0.04
Maintains or increases soil organic matter	0.04	0.71	0.09	0.00
Considers health of streams on their land	−0.07	0.69	0.09	0.05
Manages for both profit and environment	0.22	0.41	0.17	0.04
Long-term conservation of farm resources before short-term profits.	−0.09	0.40	0.36	0.13
Thinks beyond their own farm to the social and ecological health of their watershed	−0.04	0.38	0.32	0.26
Scouts before spraying for pests/weeds/disease	0.11	0.32	0.31	0.14
Cronbach's $\alpha = 0.89$				
Uses cover crops between harvest and planting	−0.04	−0.04	0.65	−0.03
Maintains habitat for wildlife	−0.01	0.06	0.58	−0.01
Minimizes the use of pesticides/fungicides	0.02	0.12	0.56	−0.08
Avoids fall tillage	0.06	0.13	0.50	−0.02
Minimizes tillage	0.12	0.16	0.48	0.11
Cronbach's $\alpha = 0.79$				
Is active in their community	−0.02	0.02	−0.07	0.87
Is a leader in their community	0.02	−0.03	−0.03	0.83
Is active in farm organizations	0.07	−0.08	0.13	0.69
Shares equipment with friends and neighbours	−0.04	−0.07	0.37	0.37
Plans with other farmers to establish practices that will protect their watersheds	−0.03	0.16	0.41	0.36
Helps friends and neighbours with farm tasks	−0.08	0.08	0.26	0.33
Shares knowledge with other farmers	0.10	0.11	0.26	0.30
Cronbach's $\alpha = 0.82$				

likelihood of planting prairie, while a 1 *SD* increase in the soil and wildlife conservationist constructs translated into a 34% and 29% greater likelihood of that behaviour respectively. Again, the civic-minded identity was not activated.

In the final model, 'Avoid fall tillage to leave food and cover for wildlife', the productivist identity construct was associated negatively ($p < 0.05$) and the wildlife conservationist identity was positive ($p < 0.01$). The odds ratio indicated an 18% decline in likelihood of avoiding fall tillage for each 1 *SD* increase in productivism factor score and a 79% increase in likelihood for similar increases in the wildlife conservationist factor scores. For the fifth time, the civic-minded identity was shown to be inconsequential.

Among the control variables, the birdwatching and hunting variables were significant and strong positive predictors across all models. For birdwatching, the odds ratios indicated that a 1 *SD* increase translated into increases of likelihood of wildlife-friendly practices

TABLE 3 Results from the logistic regression models

	Model 1					Model 2					Model 3	
	Weedy fencerow					Planted CRP					Avoid mowing	
			95% CI for odds ratio					95% CI for odds ratio				
	Coeff.	*SE*	Lower	Odds ratio	Upper	Coeff.	*SE*	Lower	Odds ratio	Upper	Coeff.	*SE*
(Intercept)	−0.41	0.42	0.29	0.67	1.52	−2.84***	0.56	0.02	0.06	0.17	0.51	0.46
Productivist	−0.26**	0.08	0.66	0.77	0.90	−0.27**	0.10	0.63	0.76	0.92	−0.11	0.09
Soil conservationist	−0.08	0.09	0.78	0.93	1.10	0.05	0.12	0.84	1.05	1.32	0.30**	0.09
Wildlife conservationist	0.58***	0.11	1.45	1.79	2.21	0.60***	0.13	1.41	1.83	2.38	0.35**	0.12
Civic-minded	−0.10	0.09	0.76	0.90	1.07	−0.06	0.11	0.76	0.94	1.17	−0.18	0.10
Farmer age	0.00	0.01	0.98	1.00	1.01	0.01	0.01	0.99	1.01	1.03	0.00	0.01
Cultivated acres	0.00	0.00	0.999	1.000	1.000	0.00	0.00	1.000	1.000	1.000	0.00*	0.00
Birdwatched	0.69***	0.14	1.52	1.99	2.60	0.40*	0.18	1.06	1.50	2.12	0.45**	0.16
Hunted	0.31*	0.15	1.03	1.37	1.82	0.78***	0.18	1.54	2.18	3.09	0.67***	0.18
Cox and Snell R^2	0.11					0.08					0.07	
Nagelkerke R^2	0.15					0.14					0.11	
AIC	1,324					906					1,137	

$p < 0.001$***; $p < 0.01$**; $p < 0.05$*.

between 50% and 99%. For hunting, the magnitude of effect size ranged between 37% and 2.18 times more likely to use the practices. The size of cultivated area was significant in the 'avoid fall mowing model', but the magnitude of effect was negligible. Finally, farmer age was not a significant predictor in any of the models.

3 | DISCUSSION

Results provide evidence that farmer identity constructs can be robust predictors of Iowa farmers use of key wildlife habitat management practices. The most consistent predictors were the productivist and wildlife conservationist identity constructs. In four out of five models, the productivist farmer identity was associated with substantially lower likelihood than farmers engaged in wildlife habitat management practices, while the wildlife conservationist identity was strongly related to higher likelihood of wildlife habitat management practice use. These results, which were in line with our research expectations, indicate that farmer identity constructs provide an entry point towards understanding how different symbolic interpretations of row-crop farming can be incompatible (productivism) or compatible (conservationism) with wildlife habitat management behaviours. A similar conclusion has been touched on in previous research finding that subsidized environmental management may be only partially effective because of interactions between farmers' attitudes, behaviours and situational context (Ahnström et al., 2009; de Snoo et al., 2013). Moreover, competing attitude frames towards conservation practices may impact willingness to adopt conservation practices (Thompson et al., 2015). Productivist farmers may be more subject to situational factors such as stressed finances or agronomic concerns than farmers with other program-level identities, which would preclude attention to wildlife habitat management practices (Reimer et al., 2012). Thus, while a farmer may value the importance of wildlife habitat on their farm, their ability to express an identity beyond a production orientation can be constrained by the overall context of their situation which includes a preponderance of factors, including the economy, their social and cultural affiliations, government policies, etc. (Ahnström et al., 2009).

The recreational control variables were statistically significant in each wildlife habitat management scenario indicating influence on management decisions. These results point to recreation-related outreach as a key avenue for targeting efforts to improve wildlife habitat management on farms. Birdwatching-related outreach appears to be particularly promising. Forty-four per cent of respondent farmers reported that they participated in this activity, and 75% reported adapting the timing of their mowing practices to allow birds to nest, suggesting an affinity for birds. Recreational opportunities likely interact and aid in the formation of farmer identity creating opportunities for social interaction and evoking discussions of wildlife habitat management themes in conversation. A study linking pro-environmental behaviour to hunting and birdwatching demonstrated a similar effect for private land owners (not just farmers; Cooper et al., 2015). That our study of only farmer respondents reached a similar conclusion is important.

To examine statistically if recreational variables are independent of identity constructs, we conducted a follow-up analysis using a chi-squared test to assess differences in overall effect on prediction of weedy fencerows (model 1) by the coefficients within the logistic regression model. Results demonstrated that identity and recreational effects were significantly different (<0.05 level, $x^2 = 6.3$),

			Model 4					Model 5				
			Planted prairie					Avoid fall tillage				
95% CI for odds ratio					95% CI for odds ratio					95% CI for odds ratio		
Lower	Odds ratio	Upper	Coeff.	*SE*	Lower	Odds ratio	Upper	Coeff.	*SE*	Lower	Odds ratio	Upper
0.68	1.66	4.10	−2.10***	0.45	0.05	0.12	0.29	−0.89*	0.42	0.18	0.41	0.93
0.75	0.90	1.06	−0.20*	0.08	0.70	0.82	0.96	−0.20*	0.08	0.71	0.82	0.96
1.13	1.35	1.61	0.29**	0.09	1.12	1.34	1.61	0.14	0.09	0.97	1.15	1.36
1.13	1.42	1.79	0.25*	0.11	1.05	1.29	1.59	0.58***	0.11	1.46	1.79	2.21
0.69	0.84	1.02	0.03	0.09	0.87	1.03	1.23	−0.02	0.09	0.83	0.98	1.17
0.99	1.00	1.02	0.01	0.01	1.00	1.01	1.03	0.01	0.01	0.99	1.01	1.02
1.000	1.000	1.001	0.00	0.00	1.000	1.000	1.001	0.00	0.00	1.000	1.000	1.000
1.16	1.58	2.15	0.68***	0.14	1.49	1.97	2.60	0.53***	0.14	1.30	1.70	2.22
1.39	1.95	2.76	0.71***	0.15	1.53	2.04	2.73	0.53***	0.15	1.28	1.70	2.27
			0.11					0.12				
			0.15					0.16				
			1,238					1,334				

suggesting that contributions towards predicting the wildlife habitat management practice was supplementary rather than overlapping. This process of recreation and farmer identity supplementation may align with the observation Mullendore et al. (2015) made when asking if conservation behaviours increase an individual's sense of place on his or her farm. Intentional wildlife habitat creation increases recreational opportunities such as birdwatching or hunting and may end up becoming part of a person's identity, for example, 'the non-farming activities I pursue on my land say a lot about who I am' (Mullendore et al., 2015). This points to an opportunity to engage with farmers by appealing to the wildlife conservationist identity (which may not be the most salient program-level identity) by proposing improvements in recreational opportunities through habitat improvement.

The diverging results between productivist and wildlife conservationist identities have direct policy and advocacy implications. The negative relationship between productivism and wildlife-friendly behaviours suggests that programs that promote wildlife habitat management practices as something that a productivist-oriented 'good farmer' *should* conduct within their farming operation would likely be met with scepticism. Conversely, there is likely a direct and willing audience among farmers with stronger wildlife conservationist identities. Future farmland conservation initiatives could be designed to take these lessons into account. First, local government or non-profit initiatives might evaluate the goals and values of farmers through short questionnaires that seek to understand their wildlife values orientation; results would guide customized recommendations and interactions with different farmers (Gigliotti & Sweikert, 2019). Second, programs like the CRP in the United States, which have demonstrated success but often only over the short term (Claassen et al., 2008), might achieve longer term benefits by taking identity heterogeneity into account as part of any future strategy.

Our results showed that productivist farmers were less likely to both plant trees to CRP or plant prairie. Resistance to actively increase wildlife habitat on farms may come from a desire to maximize yield, which require maximizing total crop area. It may also stem from a lack of autonomy in the process of deciding where to install wildlife habitat. Bottom-up solutions that put farmers in control of the process might be a pathway to reduce negative reactions to initiatives to increase wildlife habitat. Design processes led by farmers may create potential for innovative solutions responsive to productivist sensibilities that value results rather than prescribed process (Cullen et al., 2018). Abandoning prescriptive-based solutions could be explored using a result-oriented framework to encourage conservation behaviours which might altogether avoid negative responses from production-oriented farmers by engaging with their sense of autonomy (Stock & Forney, 2014).

Relative to prior research on farmer identity, we believe that our approach of using a large set of 'good farmer' questions is more comprehensive than approaches measuring identity through a single or limited number of proxy statements (Sulemana & James, 2014; van Dijk et al., 2016). The concept of a good farmer appears to allow respondents to describe their internal sense-making process with more clarity, especially when provided a large number of well-constructed survey items. The good farmer items used here after demonstrating EFA simple structure were 30 items which addressed a more comprehensive view of identity including attitudes, goals, behaviours and roles. We suggest that future farmer identity research maintain a large number of items for statistical reliability and improve on our

questions in order to examine nuances in the identity constructs we proposed here (Osborne et al., 2014).

It is possible that future research could identify a principle identity concept more encompassing, touching on more holistic rationales for farm management. The good farmer concept was developed through in-depth qualitative interviews (Burton, 1998). New principle identity concepts would likely originate using these same research methods. Qualitative research seeking to elicit the discourse of farmers in their descriptions of what a good farmer means to them in relation to wildlife habitat, in addition to the full range of wildlife habitat management practices farmers engage in and why would advance farmer identity research. Such an approach might seek to link deeply held values, the farming experience and social learning that influence landscape processes (Gosnell et al., 2019). Understanding more completely how farmers with various productivist identities, yet who also maintain soil conservationist or wildlife conservationist identities of less salience that emerge under a specific social and environmental context would be of high research and outreach value. Furthermore, the farmer identity concept could be directly linked to observable ecological processes. Ecological observations such as wildlife population dynamics, or changes within the structure of non-cropped habitats, could be linked to reported conservation or production-oriented identities. For example, qualitative surveys combined with high-resolution mapping of wildlife habitat would allow a direct comparison between what farmers express and visible wildlife habitat management practices on their land. These efforts could also be combined to understand farmer identity expression changes with different social and spatial context. For instance, spatially mediated peer effects were found to influence conservation practice adoption and therefore could be leveraged to increase the chance of initiative success (Kolady et al., 2020).

4 | CONCLUSIONS

The research presented here extends farmer identity theory into the realm of wildlife management and increases our understanding of how wildlife habitat practices and individual-level farmer identities interact. Farmer identities were tested for activation using five wildlife habitat management practices and with recreational and demographic covariates. Productivist, soil conservationist and wildlife conservationist identity types were readily divided based on their factor scores and statistically significant when regressed against wildlife habitat management practices. Productivist and wildlife conservationist farmers demonstrated significant divergence in four out of five wildlife habitat management practices tested. Results indicate that Iowa farmers have heterogeneous perspectives on what constitutes being a good farmer, and that wildlife conservation behaviour varies by identity type. Furthermore, it was demonstrated that certain behaviours like the recreational covariates birdwatching and hunting serve supplementary roles alongside identity responses to wildlife habitat management practices. Understanding these variations in response is important, because it provides a pathway towards linking invisible social processes with observable ecological processes such as vegetation structure and amount. The divergent responses also suggest that the influence of policies and investments in wildlife habitat management in agricultural landscapes are governed by the attitudes, behaviours and roles that the farmer identity constructs represent. This may explain why agri-environmental schemes sometimes fail to produce long-term benefits, as farmers with a production-oriented identity have a negative response to wildlife habitat management practices in relation to 'good farming'. The implications of this research include adapting the design of initiatives to incorporate the social and ecological context individual farmers are operating within. Tailoring initiatives to improving wildlife habitat on farms to different identity characteristics would likely increase their effectiveness over the long term.

ACKNOWLEDGEMENTS

The Iowa Farm and Rural Life Poll survey was supported in part by the Iowa Agriculture and Home Economics Experiment Station, Ames, Iowa, which is supported by USDA-NIFA and State of Iowa funds.

CONFLICT OF INTEREST

The authors declare no conflict of interest either personal or financial that has influenced preparation of this manuscript.

AUTHORS' CONTRIBUTIONS

A.P.D. and J.G.A. conceived the ideas and designed the methodology; the US Department of Agriculture National Agricultural Statistics Service collected the data; A.P.D. and J.G.A. analysed the data; A.P.D. led the writing of the manuscript. All authors contributed critically to the drafts and gave final approval for publication.

DATA AVAILABILITY STATEMENT

Use of the Iowa Farm and Rural Life Poll was conditioned upon agreement form with the US Department of Agriculture National Agricultural Statistics Service not to disseminate or share the data in original or aggregated form. Therefore, the authors are unable to archive data in a public repository.

ORCID

Adam P. Dixon https://orcid.org/0000-0002-1358-6317
J. Gordon Arbuckle https://orcid.org/0000-0001-9419-4624
Erle C. Ellis https://orcid.org/0000-0002-2006-3362

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How to cite this article: Dixon, A. P., Arbuckle, J. G., & Ellis, E. C. (2022). Farmer identities influence wildlife habitat management in the US Corn Belt. *People and Nature*, 4, 103–114. https://doi.org/10.1002/pan3.10257