Journal of Environmental Psychology 53 (2017) 73–80

Contents lists available at ScienceDirect

Journal of Environmental Psychology

journal homepage: www.elsevier.com/locate/jep

Toward a theory of farmer conservation attitudes: Dual interests and willingness to take action to protect water quality

Kristin Floress [a, *], Silvestre García de Jalón [b], Sarah P. Church [c], Nicholas Babin [d], Jessica D. Ulrich-Schad [e], Linda S. Prokopy [c]

[a] Northern Research Station, United States Forest Service, 1033 University Place, Evanston, IL, United States
[b] Basque Center for Climate Change, Leioa, Spain
[c] Department of Forestry and Natural Resources, Purdue University, 195 Marstellar, West Lafayatte, Indiana, United States
[d] Sierra Nevada College, Incline Village, Nevada, United States
[e] Sociology & Rural Studies, South Dakota State University, Box 0504, Brookings, SD, United States

ARTICLE INFO

Article history:
Received 31 May 2016
Received in revised form
18 April 2017
Accepted 28 June 2017
Available online 29 June 2017

Keywords:
Attitudes
Dual interest theory
Water quality
Farmer
Indiana
Structural equation modeling

ABSTRACT

Water quality in the Midwestern United States is threatened as a result of agricultural runoff. Based on self-reported data from a survey of farmers in Indiana, we aim to provide a better understanding of how awareness of water quality problems, farm-as-business attitudes, and stewardship attitudes are related to each other and willingness to improve water quality. More specifically, we propose and test a structural equation model grounded in dual-interests theory to examine if and to what extent the relationships between awareness and farm-as-business attitudes are mediated by stewardship attitudes. We found evidence to support our model, particularly the importance of stewardship versus economic attitudes. Emphasizing economic incentives to increase adoption of conservation practices may need to be reconsidered given the growing evidence that pro-social variables influence conservation decisions. We draw attention to similarities and differences in applied environmental management and environmental psychology research, calling for greater integration across these approaches.

Published by Elsevier Ltd.

1. Introduction

Agriculture is the leading source of water quality impairments in numerous rivers and streams in the Midwestern United States. Sediment, excess nutrients, pesticides, and bacteria from crop and livestock production are the main nonpoint sources (NPS) of water pollution (EPA, n.d.). In recent decades, farmers have made considerable efforts to voluntarily reduce pollutant loadings and improve water quality by controlling runoff and more efficiently managing the use of agrochemical inputs (Osteen, Gottlieb, & Vasavada, 2012). Accordingly, many research endeavors have been undertaken to understand motivations for farmers' behaviors and willingness to engage in conservation (e.g., Ervin & Ervin, 1982; D'Souza, Cyphers, & Phipps, 1993; Prokopy, Floress, Klotthor-Weinkauf, & Baumgart-Getz, 2008; Blackstock, Ingram, Burton, Brown, & Slee, 2010; Baumgart-Getz, Prokopy, & Floress, 2012), though the focus has been on economic factors rather than psychosocial constructs (Chouinard et al., 2006; Gosling & Williams, 2010). This is particularly true in applied management contexts: as Chouinard et al. (2006) note, "… most studies about social factors … appear as studies of attitudes in the more sociological literature or as ad hoc variables in empirical adoption studies (p 9)".

Applied management research using economic self-interest, ad hoc attitudinal variables, and farmers' willingness to adopt a behavior or support a policy are often used to develop tools like watershed plans and farmer assistance programs intended to change behavior, while studies testing psychosocial theories of pro-environmental behavior are not as immediately incorporated into management practice. However, integrating pro-social and self-interest factors into models of environmental decision making is reflected across disciplinary boundaries. Bamberg and Möser (2007), for instance, integrated elements of both the norm activation model (NAM, Schwartz, 1977) that incorporates moral norms and the more rational-action driven theory of planned behavior

* Corresponding author.
E-mail addresses: kfloress@fs.fed.us (K. Floress), silvestre.garciadejalon@bc3research.org (S. García de Jalón), church9@purdue.edu (S.P. Church), nbabin@sierranevada.edu (N. Babin), Jessica.Schad@sdstate.edu (J.D. Ulrich-Schad), lprokopy@purdue.edu (L.S. Prokopy).

http://dx.doi.org/10.1016/j.jenvp.2017.06.009
0272-4944/Published by Elsevier Ltd.

(TPB, Ajzen, 1991) into a meta-analytic model of environmental behavior. They found support for their integrated model, including that intention was a key predictor of behavior and awareness of environmental problems impacted intent and behavior, though its impact was mediated by moral norms and feelings of guilt. De Groot and Steg (2009) also investigated the relationship between awareness and intent, finding support for a model where the relationship between awareness and intention is mediated by ascription of responsibility and personal norms.

While reflected for several decades in theories like the NAM, environmental management research has only more recently focused on developing and testing models that recognize "dual interests" and differentiate between self-interest and other (pro-social)-interests (e.g., Sheeder & Lynne, 2011; Reimer, Thompson, & Prokopy, 2012; Thompson et al., 2015) – what Chouinard et al. (2006) term "multi-motive/multi-utility" approaches (p5). Sheeder & Lynne (2011) found strong experimental support for including both self-interest and other-interest in models predicting conservation decisions, and these constructs have been further developed as attitudinal constructs by others outside of laboratory settings (e.g., Reimer et al., 2012; Thompson et al., 2015). Some research has shown that if self-interest (i.e., profitability) isn't negatively impacted, farmers may adopt conservation practices (Brodt, Klonsky, & Tourte, 2006; Chouinard et al., 2006).

One challenge in bridging the divide between the applied environmental management and psychosocial literatures is the difference in how key concepts – such as attitudes – are operationalized, especially because they are not always distinguishable within any discipline. Gifford and Sussman (2012, p.65) state, "Attitudes can be confused with other constructs, such as values, beliefs (sometimes called the cognitive component of attitudes), opinions, personality dispositions, and personal norms." Fielding, Hornsey, and Swim (2014) observe that while social psychologists discriminate between beliefs and attitudes, they are not always distinguishable in the climate change literature. Thompson et al. (2015) included a number of statements in their environmental attitude scales that relate to the ascription of responsibility and personal norm constructs of the NAM. The survey instrument upon which the current research is based was informed by prominent theories of environmental behavior, but designed to give resource managers and communicators practical results upon which they could design programs. Thus, while differences in the definition of attitudes may exist among and within disciplines, we adopt that which is common in environmental management and succinctly summarized by Thompson et al. (2015): attitudes are evaluations of various environmental, financial, and moral dimensions related to choosing to participate (or not) in conservation.

We aim to empirically contribute to the recent developments related to farmers' conservation attitudes while beginning to answer the calls from prominent researchers in both environmental psychology and environmental management: that of Steg and Vlek (2009) to understand benefits of different approaches to impacting pro-environmental behavior, and that of Prokopy et al. (2008) to integrate theoretical work from appropriate fields into our understanding of farmers' decisions. We call attention to ways in which different theoretical approaches complement each other, and describe ways in which the disciplinary boundaries of both approaches could be bridged to have more impact on a significant source of water pollution.

Building on these foundations, in this research we examine awareness of water quality problems attributable to farming sources, attitudes reflecting other-interest and self-interest, and willingness to adopt behaviors. Specifically, we examine the relationships among: 1) awareness of consequences of agricultural activities, 2) self-interest (farm-as-business attitudes), 3) other-interest (stewardship attitudes), and 4) willingness to take actions to protect water quality.

2. Theoretical and applied foundations of the proposed model

Comprised of affective, cognitive, and conative components (Ajzen, 1988; Breckler, 1984), attitudes are important – though not always significant – constructs related to environmental behaviors (Gifford & Sussman, 2012). Pro-environmental attitudes have been said to arise from associated values (Stern, 2000) and can be behavior-specific (e.g., the TPB, Ajzen, 1991). Both behavior-specific and more general measures of environmental attitudes have been examined with regard to behavior, and it has been well-established that they are not, alone, sufficient for prediction (Gifford & Sussman, 2012).

A commonly used approach in environmental management-related social science studies to examining attitudes and behavior is the cognitive hierarchy (Fulton, Manfredo, & Lipscomb, 1996), whereby attitudes are defined simply as one's "… tendency to respond favorably or unfavorably toward the object in question," (Vaske & Donnelly, 1999, p. 527). In this approach, attitudes are preceded by an individual's value orientations (Homer & Kahle, 1988), and influence behavioral intent and behaviors (Fulton et al., 1996). Vaske and Donnelly (1999), for example, found that intentions to vote in a manner protective of wildlands were influenced by preservation attitudes, which were preceded by biocentric or anthropocentric value orientations. As values are relatively unchanging and not context-specific, they have been criticized by natural resources social scientists as being confused with attitudes (Vaske, 2008).

Despite these definitional differences, one conative component of attitudes – the willingness to engage in a behavior – has been studied in both literatures. Within agricultural producer populations, willingness is often assessed when developing new interventions, particularly measures related to an individual's willingness to pay for benefits and accept charges, programs, and policies. Willingness and intent to engage in a behavior are recognized to be antecedents of behavior. Some discussion of whether they are different constructs has taken place, but Ajzen (2011) conceptualizes them as components of the same construct. Bamberg and Möser's (2007) meta-analysis of environmental behavior studies found that intention explains about 27% of the variation in environmental behaviors across included studies. The type of behavior matters when considering the role of willingness in actual behavior decisions. For lower cost behaviors, such as supporting policies, willingness may be a stronger predictor. Behaviors that are higher cost and require significant changes are impacted more strongly by institutional, structural change than individual attitudes (Heberlein, 2012). We describe below factors found to be important in predicting willingness and behavior, while recognizing there is a distinction between the two.

2.1. Self- and other-interest

Theories intended to predict environmental behavior that incorporate pro-social, other-interest concepts include the NAM (Schwartz, 1977) and the value-belief-norm theory (VBN), which is partially based upon concepts from the NAM (Stern, 2000). In these two theories, personal norms related to a behavior, awareness of consequences of one's behaviors, and ascription of responsibility for acting in an other-interested manner lead to behaviors. Considered a more "rational action" approach, the TPB, on the other hand, proposes individual evaluations of behaviors based upon behavior-specific attitudes, perceived behavioral control, and

subjective norms to be the antecedents of behavioral intention and behavior (Ajzen, 1991). Neither the NAM/VBN nor the TPB, however, include the economically driven self-interest variables that often comprise the majority of data collected to inform agricultural program development.

Within the environmental management literature, both rational self-interest approaches based upon economic motivations and those incorporating dimensions of morality have been criticized for not having greater integration and thus power in understanding the complexity of factors that play a role in farmers' decisions (Chouinard et al., 2006). Even so, many financial policy tools that encourage voluntary adoption of conservation practices are based upon the premise that farmers want to maximize self-interest (Sheeder & Lynne, 2011), but are found to be incomplete. For example, Shortle, Ribaudo, Horan, and Blanford (2012) note that economic incentives have largely failed to improve water quality, and others have found that financial incentives alone don't account for changes in behavior (e.g., Czap, Czap, Khachaturyan, Lynne, & Burbach, 2012; Sheeder & Lynne, 2011).

The failure of financial policy tools to change behavior is increasingly recognized as resulting from what has long been recognized in psychosocial disciplines: farmers, like most people, are likely not driven exclusively by narrow self-interest but also by the welfare of others such as their local community or the natural environment (Czap et al., 2012; Van Vugt, 2009). Bishop, Shumway, and Wandschneider (2010) found both private and social costs impacted farmers' willingness to adopt manure digester technology. Similarly, Reimer et al. (2012) found that attitudes towards responsibility for water quality were influenced by stewardship attitudes and that farmers were also willing to accept reduced profits or increased costs because of "off-farm benefits". Thompson et al. (2015) found three groups in their cluster analysis of farmers according to stewardship and farm-as-business attitudes: almost all farmers in their study had positive stewardship attitudes, but varied in terms of whether they viewed their farm in terms of yield maximization. Some farmers may be "pure cases" of either being driven more by stewardship or by business, but many will engage in practices with an environmental outcome though it may be more costly to themselves (Chouinard et al., 2006).

2.2. Awareness of water quality consequences related to agriculture

Stewardship attitudes, as conceptualized in the current paper, are comprised of items closely related to the NAM/VBN constructs ascription of responsibility and personal norms, where awareness of consequences is causally prior to responsibility and norms (Stern, Dietz, Abel, Guagnano, & Kalof, 1999). Awareness alone, though, is a weak predictor of behavior due to mediating constructs (Kaiser et al., 1999a,b) and this weak relationship is highlighted in recent meta-analyses of farmer conservation behaviors (Baumgart-Getz et al., 2012; Prokopy et al., 2008), and pro-environmental behavior in general (Bamberg & Möser, 2007). While Guagnano (2001) notes there may be instances where awareness alone is enough to impact behavior, others have found factual knowledge to not be necessary to predict policy or practice support. For example, Gobster et al. (2016) found knowledge wasn't as important as whether an individual believed something was happening when predicting management action support. Awareness, though, of the environmental consequences of farming are generally considered a necessary step toward adopting practices that improve water quality (Blackstock, Ingram, Burton, Brown, & Slee et al., 2010; Ervin & Ervin, 1982; Prokopy et al., 2008).

Past research reveals different findings about farmers' awareness of consequences to water quality impairments from farming operations. Several studies have found that farmers do recognize water quality consequences from agricultural practices (e.g., Hu & Morton, 2011; Ward & Lowe, 1994). D'Souza et al. (1993) found that farmers who are aware of on-farm environmental issues are more likely to implement sustainable practices. However, other research has found that when farmers are asked about local water quality issues they may fail to acknowledge them (Popp & Rodriguez, 2007), do not feel issues are the consequences of agriculture (Blackstock et al., 2010) or that issues are not severe enough to warrant regulation (Barnes, Toma, Willock, & Hall, 2013). Floress, Mangun, Davenport, and Williard (2009) found people incorrectly identified water quality impairments attributable to nutrient runoff from farms as instead related to salt and other sources.

2.3. The proposed model and hypotheses

Using the varied work described above to inform our approach, we use structural equation modeling to examine the relationship of farmers' awareness of consequences to water quality from agriculture and willingness to take action to improve water quality. De Groot and Steg (2009) found, across five studies, strong empirical support for the role of responsibility and norms as mediating the relationship between awareness of consequences and prosocial intentions and behavior. Thus, we aim to determine whether stewardship (other-interest) attitudes, comprised of items highly related to personal norms and ascription of responsibility, mediates the relationships between awareness of consequences and willingness to take action, and farm-as-business (self-interest) attitudes and willingness to take action. We note that, while causality may not be supported by the research design, this doesn't preclude mediation analysis; it simply requires reporting the limitations of the data and research design and having theoretical support for the model (Hayes, 2013). Thus, defensible hypotheses must provide at least some evidence for the order of variables. While the work on dual interests in farmers has posited farm-as-business and stewardship attitudes as parallel to each other, these models have not included awareness variables or have not used statistical procedures requiring reflection on causal order. Awareness has been empirically supported as predictors of moral norms (Bamberg & Möser, 2007), ascription of responsibility, and personal norms (De Groot & Steg, 2009), aspects of which are captured in our stewardship construct. Farm-as-business attitudes, though, reflect self-interest that may be underpinned by structural constraints such as on- or off-farm income. Therefore, while we considered parallel multiple mediator and moderator models, we include farm-as-business attitudes as an exogenous variable.

Hypotheses

1. Greater awareness of sources of local water quality impairments will be (a) positively associated with stewardship attitudes and (b) willingness to take action to improve water quality.
2. Positive farm-as-business attitudes will be (a) negatively associated with stewardship attitudes and (b) willingness to take action to improve water quality.
3. Positive stewardship attitudes will be associated with greater willingness to take action to improve water quality.
4. Positive stewardship attitudes will mediate the relationships between both exogenous variables and willingness to take action to improve water quality.

3. Data and methods

3.1. Study area

This research took place in Indiana, U.S.A., a significant contributor of agricultural water pollution that causes hypoxic

areas ("dead zones") in downstream aquatic ecosystems (e.g., the Gulf of Mexico and western Lake Erie basin), and threatens the economic and ecological health of these bodies of water (Rabalais, Turner, & Wiseman, 2002). A survey was conducted of Indiana farmers to help agricultural organizations develop a statewide, non-regulatory strategy for improving water quality by increasing soil health and nutrient use efficiency. We wished to see if and how the data collected from this standard questionnaire used across the Midwestern U.S. (described below, the development of which was informed by many of the studies cited in our literature review) could contribute to developing a more nuanced understanding of farmers' attitudes underlying their behavior: specifically, developing a model that incorporates both self- and other-interest.

3.2. Data collection and limitations

Data were collected in 2014 through a survey of farmland owners and operators in Indiana. The questionnaire included many tested questions from a suite of social indicators developed for studies focused on nonpoint source pollution awareness, attitudes and behaviors (Genskow & Prokopy, 2010; Prokopy et al., 2009). The survey sample was generated through a Freedom of Information Act (FOIA) request to the United States Farm Service Agency (FSA) in late 2013. A list of all owners and renters of farmland in Indiana who had received FSA payments in 2012 was provided. All out-of-state addresses were eliminated and the resulting name and address list was cleaned by removing duplicates, trusts, non-farm businesses, clubs, churches, estates, organization, partnerships, and university-related contacts. A random number generator was then used to sample 2587 of the 71,274 landowners and producers in Indiana. The logos of nine of Indiana's agricultural organizations and Purdue University Extension who worked in coordination to conduct the survey were included on the cover letter to help encourage questionnaire completion.

A five-wave (advance letter, 1st mailing of paper questionnaire, reminder postcard, 2nd mailing of paper questionnaire, 3rd mailing of a paper questionnaire, reminder postcard) protocol was used to contact those on the final address list. Recipients were given the option to complete the questionnaire online but were also sent a self-addressed stamped envelope to return the hardcopy. Once contacts completed the survey they were no longer sent subsequent mailings. This process achieved a response rate of 51.8% (n = 1341) including both agricultural producers and non-producing owners of agricultural land. Survey instructions directed recipients to have the person in the household who made the most land management decisions and was over 18 years old to complete the survey. The sample for this paper included only full- or part-time agricultural producers ($n = 647$).

While we have an adequate sample size, conclusions drawn should be interpreted with the understanding that our research design was non-experimental, despite the underlying theoretical support for our mediation model.

3.3. Measures

All latent variables were formed by indicators rated on 4- or 5-point scales (Table 1). Indicators for awareness of agricultural water pollution sources were four items aimed at understanding the degree to which farmers understood the consequences to water quality from agricultural production. Respondents were asked how much of a problem each source was in the area where they farmed, and response choices ranged from 1 (not a problem/don't know) to 4 (severe problem). Indicators for farm-as-business were three items related to economic considerations when making farming decisions. Respondents were asked how important each was when making decisions about nutrient management on their farm, and response choices ranged from 1 (not at all important) to 5 (very important). Four indicators of stewardship attitudes relating to ascription of responsibility, personal norms, and community benefits of clean water were measured on an agreement scale ranging from 1 (strongly disagree) to 5 (strongly agree). Indicators of willingness to take action included willingness to change practices and willingness to pay more taxes or fees to improve water quality, also measured on a 1 to 5 agreement scale.

3.4. Data analysis

Structural equation modeling (Bollen, 1989) in Stata 14 (StataCorp, 2015a) was conducted to evaluate our model and hypotheses. The assumption of multivariate normality was not met, thus a nonparametric bootstrap (250 replications as recommended by Nevitt & Hancock, 2001) was used to obtain the variance-covariance matrix for maximum likelihood estimation of model parameters (StataCorp, 2015b). Structural and measurement models were calculated simultaneously, and estimated relationships among four latent, unobserved variables that manifested in measured indicators (see Table 1). We followed recommendations of Hayes (2013) to conduct the mediation analysis.

4. Results

4.1. Respondent characteristics

Demographic and farm characteristics of respondents who fully answered the survey are shown in Table 2. On average, respondents were approximately 58 years old. About 30% had received a bachelor's degree or higher. About 10% of respondents were women, which is reflective of the state's composition of farmers by gender. The average farm size managed by respondents was 446 acres (~180 ha), about 44% of the sample owned livestock, and almost 98% were growing crops, pasture, and/or hay.

4.2. Descriptive statistics of model indicators

Descriptive statistics about the indicators for latent variables are found in Table 1, and show that there is a range of awareness among respondents about consequences to water quality from production practices. The majority of respondents felt soil erosion was at least a slight problem: only 22% felt it wasn't a problem at all. In contrast, most felt manure was not a problem or only a slight problem, and about half of respondents felt pesticides were not a problematic source of pollution. Of particular interest given the topic of this paper is that close to half (~47%) of respondents believed fertilizer application to farm fields was not a significant source of water quality impairments in the area where they farm. Taking into consideration that numerous streams and rivers in Indiana are heavily polluted from synthetic and natural fertilizer (i.e., manure), our results suggest that some farmers are not aware of the consequences to water quality from nutrient application. Soil erosion may be a more salient issue with more immediate, on-farm consequences, and thus have higher levels of awareness associated with it.

The items related to farm-as-business attitudes tended to be important to respondents. For all three statements (personal out-of-pocket expense, evidence of economic benefits, and saving money), more than 80% of respondents indicated it was an important or very important factor when making decisions about their farm operation.

Farmers tended to have favorable stewardship attitudes, ranging from about 74% agreeing or strongly agreeing that it is important to

Table 1
Frequency (%), mean, and standard deviation (SD) of model variables.

Awareness of consequences to water quality (α = 0.80)	NP	SliP	MP	SP		*m*	*SD*
Soil erosion from farm fields* (A1)	22.15	46.80	27.15	3.90		2.13	0.80
Fertilizers or manure used for crop production* (A2)	47.19	38.91	12.66	1.25		1.68	0.74
Manure from farm animals* (A3)	61.03	29.58	6.73	2.66		1.51	0.74
Pesticides or herbicides used for crop production (a4)	50.08	37.99	10.52	1.41		1.63	0.73
Stewardship attitudes indicators** (α = 0.80)	SD	D	N	A	SA	*m*	*SD*
It is my personal responsibility to help protect water quality (S1)	0.62	0.46	6.03	57.19	33.69	4.25	0.65
It is important to protect water quality even if it slows economic development (S2)	0.77	2.16	19.63	52.86	21.02	3.95	0.76
My actions have an impact on water quality (S3)	1.08	1.55	11.13	57.65	25.97	4.08	0.73
The quality of life in my community depends on good water quality in local rivers, streams, and lakes (S4)	1.24	2.63	17.00	55.95	20.71	3.95	0.76
Farm-as-business attitudes indicators (α = 0.73)	NI	SI	U	I	VI	*m*	*SD*
Personal out-of-pocket expense*** (F1)	1.85	9.43	3.40	41.58	39.41	4.12	1.00
Evidence of the economic benefits*** (F2)	1.70	3.86	6.34	49.61	33.38	4.15	0.85
Saving money*** (F3)	1.39	8.04	4.79	42.97	37.09	4.13	0.95
Willingness to take action indicators**	SD	D	N	A	SA	*m*	*SD*
I would be willing to pay more taxes or fees to improve water quality (W1)	16.07	29.21	35.24	14.22	2.94	2.58	1.02
I would be willing to change the way I manage my property to improve water quality (W2)	1.70	8.35	37.40	41.89	8.35	3.48	0.83

*Answer choices: NP = not a problem/don't know, SliP = slight problem, MP = moderate problem, SP = severe problem **Answer choices: SD = strongly disagree, D = disagree, N = neither agree nor disagree, A = agree, SA = strongly agree***Answer choices: NI = not at all important, SI = somewhat important, U = undecided, I = important, VI = very important.

Table 2
Respondent characteristics (n = 647).[a]

Variable	Number of respondents	Percentage of respondents
Gender		
Male	572	89.94
Female	64	10.06
Education		
Some formal schooling	13	2.07
High school diploma/GED	228	36.36
Some college	132	21.05
2 year degree	63	10.05
4 year degree	136	21.69
Post-graduate degree	55	8.77
Owns Livestock		
Yes	284	43.89
No	363	56.11
Days worked off-farm		
None	309	49.13
1–49	77	12.24
50–99	19	3.02
100–199	34	5.41
200 or more	190	30.21
Rents Farmland		
Yes	235	37.66
No	389	62.34

[a] Number of respondents does not total to 647 for every category due to item non-response.

protect water quality even if economic development is slowed to about 91% agreeing it is their personal responsibility to protect water quality.

The strength of respondents' attitudes for the two statements related to willingness to take action ranged depending on the action. Fewer respondents agreed or strongly agreed they would be willing to pay more taxes or fees to improve water quality compared to change the way they manage their property (~17% *v.* ~50%, respectively), and more respondents had neutral attitudes with regard to these statements than any others included in our model. Fees and payments are one type of policy tool, and typically considered an easier, lower cost solution than changing farm management practices.

4.3. Structural equation model results

According to Hu and Bentler's (1999) guidelines for assessing model fit and ensuring the least combined Type I and Type II errors - SRMR less than 0.09 in combination with either RMSEA less than 0.06 or CFI greater than 0.95 - our model fits the data well. (Fig. 1). The root mean squared error of approximation (RMSEA) was 0.06, comparative fit index (CFI) 0.96, and standardized root mean square residual (SRMR) was 0.05.

Our first hypothesis, that greater awareness of agricultural pollution sources would be Hypothesis 1a, that increased awareness of consequences of production practices would be associated with positive stewardship attitudes, was supported by our results ($z = 3.33$, $p < 0.01$), as was hypothesis 1b, that increased awareness

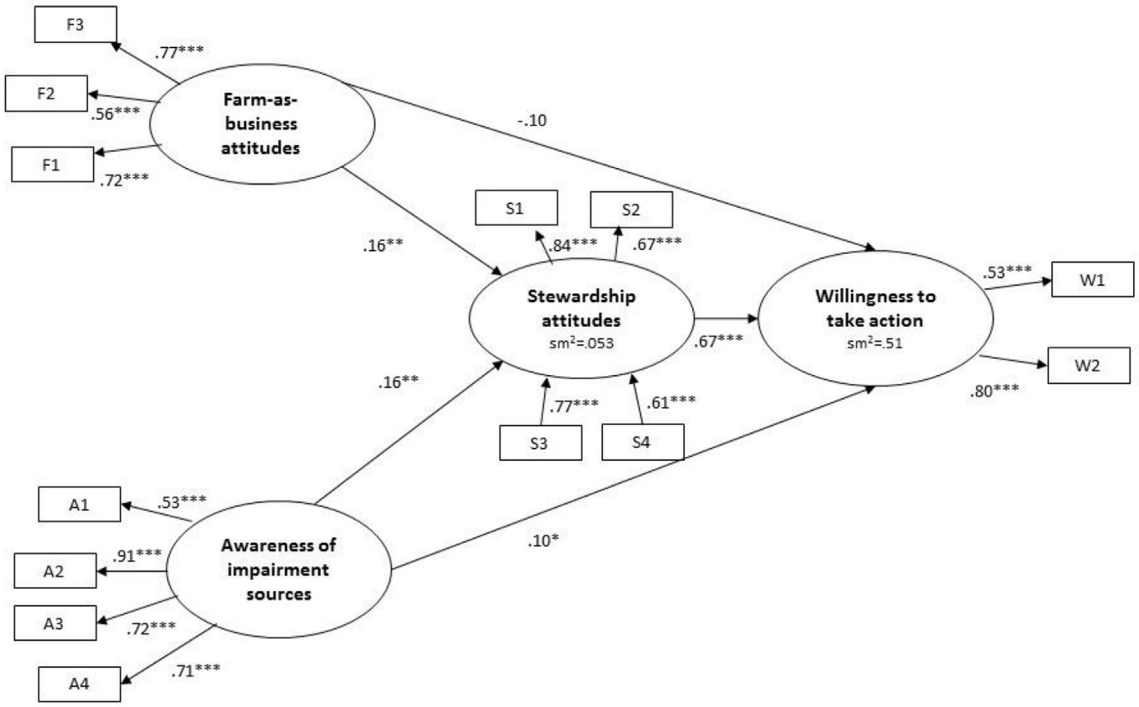

Fig. 1. Standardized model results.
*p < 0.05, **p < 0.01, ***p < 0.001.

would be associated with willingness to take action ($z = 2.04$, $p < 0.05$). However, the magnitude of the relationships between awareness and the other two downstream latent variables is rather small. Hypothesis 2a was that positive farm-as-business attitudes would be negatively associated with stewardship attitudes, but that relationship was not evident in these data ($z = 2.69$, $p < 0.05$). Instead, we see the same small, positive relationship between this construct and stewardship as we did with awareness and stewardship. The relationship between farm-as-business attitudes and willingness was not significant, and while the direction of the standardized coefficient is negative as hypothesized, hypothesis 1b was not supported ($z = -1.75$, $p = 0.081$). Note, however, that using the less stringent significance level of 0.10 would change this conclusion though the magnitude of the relationship is small. Stewardship attitudes has a strong, positive association ($\beta = 0.70$) with willingness to take action ($z = 6.65$, $p < 0.001$), supporting hypothesis 3.

The standardized indirect effects of both awareness and farm-as-business variables on willingness were 0.11 (z = 2.97, $p = 0.003$) and 0.09 ($z = -2.59$, $p = 0.010$), respectively, supporting hypothesis 4. Thus, at least some of the association between awareness and willingness and between farm-as-business and willingness is transmitted through stewardship in this model. However, the magnitudes of these relationships are quite small. Given the negligible amount of variation explained in stewardship attitudes by the exogenous variables, their effects should be interpreted quite cautiously. About 50% of the variance in willingness to take action is explained by the model, however, and thus the model provides some information for the evolving theory on farmer conservation behaviors, particularly with regard to non-economic motivations.

5. Discussion and conclusions

This study provides insight into dual interests in the study of farmer behaviors, extending recent work related to these constructs (Czap et al., 2012; Reimer et al., 2012; Thompson et al., 2015). Our results indicate farmers may be willing to take water quality-relevant action if they have positive stewardship attitudes, as the magnitude of the association of stewardship attitudes and willingness was rather large. This is consistent with other theories that hypothesize ascription of responsibility (e.g., Stern et al., 1999; Pradhananga and Davenport, 2015) and stewardship attitudes or other-interest (Czap et al., 2012; Reimer et al., 2012; Thompson et al., 2015) precede behavior. Like theories in environmental psychology showing responsibility is influenced by awareness (e.g., Stern et al., 1999) and applied management research showing that knowledge factors into farmers' decision to participation in conservation programs (e.g., Church & Prokopy, 2015), we see that awareness remains a relevant, but not solitary, consideration for developing behavior change tools. Interestingly, the indicator variable assessing awareness of consequences of fertilizer application was a gap in respondents' knowledge, suggesting that the concept of "awareness of consequences" needs to be further developed for this population and issue.

Farm-as-business attitudes had a positive, rather than negative, association with stewardship attitudes, and its association with willingness was insignificant at the 0.05 level (but negative as expected). More investigation of how farm-as-business attitudes are related to stewardship attitudes and behavior is needed, as economic self-interest is currently dominant in how agricultural conservation policies and programs are designed. Our research is also among the first attempts to develop this theory in an applied context using inferential modeling rather than typologies or

experimental research.

Indiana's Nutrient Reduction Strategy includes two objectives relevant to our research: encouraging voluntary behavior changes supported by incentive programs and using resources to have the greatest nutrient reduction impacts (ISDA, 2013). In our study, farm-as-business attitudes did not impact willingness to take action. Monetary incentive programs may not be the most effective use of resources, and alternative incentives – such as promoting off-farm, community benefits that speak to stewardship attitudes instead of profits and yields – are equally important. This is consistent with the work on dual interests and other recent research on farmer attitudes (e.g., Sheeder & Lynne, 2011; Czap et al., 2012; Reimer et al., 2012; Thompson et al., 2015) and the findings of Dunn et al. (2016) who found that users are expanding their use of cover crops without cost share funding.

It is important to note that we studied willingness, not actual behavior, and other factors can impact whether a willingness to act translates into actual action. We have already noted the importance of institutional or structural factors for higher cost behaviors (Heberlein, 2012), but one key area for exploration with farmers is the importance of visual cues. As Nassauer (1995) said, "What *is* good may not *look* good, and what looks good may not be good." This distinction is an important one, particularly with regard to farmer identity and what being a "good farmer" looks like on the landscape (e.g., McGuire, Morton, & Cast, 2013). More recently, farmer occupational identity has been more thoroughly explored and offers additional avenues for research (Groth & Curtis, 2017). It is possible that occupational identity would be a useful variable to include in research investigating farmer attitudes and behaviors. An interesting result of this study is the low variation explained by the model for stewardship attitudes. This raises the question of what variables would have more explanatory power for stewardship attitudes in our model. In addition to potentially including identity and visual cues, other recent work has found connectedness to nature (Gosling & Williams, 2010) and on-farm environmental benefits (Reimer et al., 2012) to also be related to farmers' conservation behaviors.

Through this work, we also begin to investigate the usefulness of widely implemented surveys in the Midwestern United States beyond applied management, and move toward developing mutual awareness between applied management and psychosocial disciplines. It would be beneficial for both broad approaches to draw more extensively upon the other's expertise to more rapidly and effectively impact behaviors degrading environmental quality. It would be worthwhile to test the impact of stewardship messaging on behaviors in applied management settings: currently, economic interventions are the only ones tested on a broad scale. Because research has found inconsistent factors leading to eventual adoption of conservation practices, new ways of conceptualizing farmers' attitudes is a promising stream of research that can help build understanding of what impacts willingness to act, and to design programs that consider stewardship along with important constructs from environmental psychology. Expanding and evaluating the types of programs and policies offered to encourage voluntary behavior adoption would contribute to Steg and Vlek's (2009) call to test interventions and determine which are most effective in different contexts.

Acknowledgements

The authors wish to thank two anonymous reviewers, Amit Pradhananga, Adam Reimer, Sonya Sachdeva, and Lynne Westphal for their thoughtful reviews on earlier drafts of this manuscript. This research was funded by the Indiana Soybean Alliance/Indiana Corn Marketing Council. Representatives from funders reviewed the questionnaire for face validity and assisted in obtaining logos used on the questionnaire cover letter to increase response rate.

References

Ajzen, I. (1988). *Attitudes, personality and behavior*. Chicago: Dorsey Press.
Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*, 179–211.
Ajzen, I. (2011). The theory of planned behavior: Reactions and reflections. *Psychology & Health, 26*, 1113–1127.
Bamberg, S., & Möser, G. (2007). Twenty years after hines, hungerford, and tomera: A new meta-analysis of psycho-social determinants of pro-environmental behavior. *Journal of Environmental Psychology, 27*, 14–25.
Barnes, A. P., Toma, L., Willock, J., & Hall, C. (2013). Comparing a 'budge' to a 'nudge': Farmer responses to voluntary and compulsory compliance in a water quality management regime. *Journal of Rural Studies, 32*, 448–459.
Baumgart-Getz, A., Prokopy, L. S., & Floress, K. (2012). Why farmers adopt best management practice in the United States: A meta-analysis of the adoption literature. *Journal of Environmental Management, 96*, 17–25.
Bishop, C. P., Shumway, C. R., & Wandschneider, P. R. (2010). Agent heterogeneity in adoption of anaerobic digestion technology: Integrating economic, diffusion, and behavioral innovation theories. *Land Economics, 86*, 585–608.
Blackstock, K. L., Ingram, J., Burton, R., Brown, K. M., & Slee, B. (2010). Understanding and influencing behaviour change by farmers to improve water quality. *Science of the Total Environment, 408*, 5631–5638.
Bollen, K. A. (1989). *Structural equations with latent variables*. New York: John Wiley & Sons Inc.
Breckler, S. J. (1984). Empirical validation of affect, behavior, and cognition as distinct components of attitude. *Journal of Personality and Social Psychology, 47*, 1191.
Brodt, S., Klonsky, K., & Tourte, L. (2006). Farmer goals and management styles: Implications for advancing biologically based agriculture. *Agricultural Systems, 89*, 90–105.
Chouinard, H. H., Paterson, T., Wandschneider, P. R., & Ohler, A. M. (2006). Will farmers trade profits for stewardship? *Land Economics, 84*, 66–82.
Church, S. P., & Prokopy, L. S. (2015). Indian Creek watershed project: Key takeaways for watershed success. *Purdue Extension: FNR-511-W*, 6.
Czap, N. V., Czap, H. J., Khachaturyan, M., Lynne, G. D., & Burbach, M. (2012). Walking in the shoes of others: Experimental testing of dual-interest and empathy in environmental choice. *The Journal of Socio-Economics, 41*, 642–653.
De Groot, J. I. M., & Steg, L. (2009). Morality and prosocial behavior: The role of awareness, responsibility, and norms in the norm activation model. *The Journal of Social Psychology, 149*, 425–449.
Dunn, M., Ulrich-Schad, J., Prokopy, L. S., Myers, R. L., Watts, C. R., & Scanlon, K. (2016). Perceptions and use of cover crops among early adopters: Findings from a national survey. *Journal of Soil and Water Conservation, 71*, 29–40.
D'Souza, G., Cyphers, D., & Phipps, T. (1993). Factors affecting the adoption of sustainable agricultural practices. *Agricultural and Resource Economics Review, 22*, 159–165.
Environmental Protection Agency (EPA). (n.d.). What is nonpoint source pollution? Retrieved August 9, 2015 from http://water.epa.gov/polwaste/nps/whatis.cfm.
Ervin, C. A., & Ervin, D. E. (1982). Factors affecting the use of soil conservation practices: Hypotheses, evidence, and policy implications. *Land Economics, 58*, 277–292.
Fielding, K. S., Hornsey, M. J., & Swim, J. K. (2014). Developing a social psychology of climate change. *European Journal of Social Psychology, 44*, 413–420.
Floress, K., Mangun, J. C., Davenport, M. A., & Williard, K. W. J. (2009). Constraints to watershed planning: Group structure and process. *Journal of the American Water Resources Association, 45*, 1352–1360.
Fulton, D. C., Manfredo, M. J., & Lipscomb, J. (1996). Wildlife value orientations: A conceptual and measurement approach. *Human Dimensions of Wildlife, 1*, 115–134.
Genskow, K., & Prokopy, L. S. (2010). Lessons learned in developing social indicators for regional water quality management. *Society and Natural Resources, 23*, 83–91.
Gifford, R., & Sussman, R. (2012). Environmental attitudes. In S. D. Clayton (Ed.), *The Oxford handbook of environmental and conservation psychology* (pp. 65–80). New York: Oxford University Press.
Gobster, P. H., Floress, K., Westphal, L. M., Watkins, C. A., Vining, J., & Wali, A. (2016). Resident and user support for urban natural areas restoration practices. *Biological Conservation, 203*, 216–225.
Gosling, E., & Williams, K. J. H. (2010). Connectedness to nature, place attachment, and conservation behavior: Testing connectedness theory among farmers. *Journal of Environmental Psychology, 30*, 298–304.
Groth, T. M., & Curtis, A. (2017). Mapping farmer identity: why, how, and what does it tell us? *Australian Geographer*, 1–19. http://dx.doi.org/10.1080/00049182.2016.1265881.
Guagnano, G. A. (2001). Altruism and market-like behavior: An analysis of willingness to pay for recycled products. *Population and Environment, 22*, 425–438.
Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York: The Guilford Press.
Heberlein, T. A. (2012). *Navigating environmental attitudes*. Chicago: The University of Chicago Press.

Homer, P. M., & Kahle, L. R. (1988). A structural equation test of the value-attitude-behavior hierarchy. *Personality Differences and Individual Processes, 54*, 638–646.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*, 1–55.

Hu, Z., & Morton, L. W. (2011). US Midwestern residents' perceptions of water quality. *Water, 3*, 217–234.

Indiana State Department of Agriculture (ISDA) and the Indiana Department of Environmental Management (IDEM). (2013). *Indiana nutrient reduction strategy: A framework to reduce nutrients entering Indiana's waters*. Retrieved August 21, 2015 from http://www.in.gov/isda/files/Indiana_Nutrient_Reduction_Strategy_(2).pdf.

Kaiser, F. G., Ranney, M., Hartig, T., & Bowler, P. A. (1999). Ecological behavior, environmental attitude, and feelings of responsibility for the environment. *European Psychologist, 4*, 59.

Kaiser, G., Wolfing, S., & Fuhrer, U. (1999). Environmental attitude and ecological behavior. *Journal of Environmental Psychology, 19*, 1–19.

McGuire, J., Morton, L. W., & Cast, A. D. (2013). Reconstructing the good farmer identity: Shifts in farmer identities and farm management practices to improve water quality. *Agriculture and Human Values, 30*, 57–69.

Nassauer, J. I. (1995). Messy ecosystems, orderly frames. *Landscape Journal, 14*, 161–169.

Nevitt, J., & Hancock, G. R. (2001). Performance of bootstrapping approaches to model test statistics and parameter standard error estimation in structural equation modeling. *Structural Equation Modeling, 8*, 353–377.

Osteen, C., Gottlieb, J., & Vasavada, U. (2012). *Agricultural resources and environmental indicators. Economic Research Service*. United States Department of Agriculture (USDA), 2012 Edition, EIB-98. Retrieved June 5, 2015 from http://www.ers.usda.gov/media/874175/eib98.pdf.

Popp, J., & Rodriguez, G. (2007). The role of stakeholders' perceptions in addressing water quality disputes in an embattled watershed. In *Southern agricultural economics association meeting*. Mobile, Alabama. Retrieved August 15, 2015 from http://ageconsearch.umn.edu/bitstream/34808/1/sp07po06.pdf.

Pradhananga, A. K., & Davenport, M. (2015). Landowner motivations for civic engagement in water resource protection. *Journal of the American Water Resources Association, 51*, 1600–1612.

Prokopy, L., Floress, K., Klotthor-Weinkauf, D., & Baumgart-Getz, A. (2008). Determinants of agricultural BMP adoption: Evidence from the literature. *Journal of Soil and Water Conservation, 63*, 300–311.

Prokopy, L. S., Genskow, K., Asher, J., Baumgart-Getz, A., Bonnell, J., Broussard, S., et al. (2009). Designing a regional system of social indicators to evaluate nonpoint source water projects. *Journal of Extension, 47*, 1–9.

Rabalais, N. N., Turner, R. E., & Wiseman, W. J., Jr. (2002). Gulf of Mexico hypoxia, AKA" the dead zone". *Annual Review of Ecology and Systematics, 33*, 235–263.

Reimer, A. P., Thompson, A. W., & Prokopy, L. S. (2012). The multi-dimensional nature of environmental attitudes among farmers in Indiana: Implications for conservation adoption. *Agriculture and Human Values, 29*, 29–40.

Schwartz, S. (1977). Normative influences on altruism. *Advances in Experimental Social Psychology, 10*, 221–279.

Sheeder, R. J., & Lynne, G. D. (2011). Empathy-conditioned conservation: "Walking in the shoes of others" as a conservation farmer. *Land Economics, 87*, 433–452.

Shortle, J. C., Ribaudo, M., Horan, R. D., & Blanford, D. (2012). Reforming agricultural nonpoint pollution policy in an increasingly budget-constrained environment. *Environmental Science & Technology, 46*, 1316–1325.

StataCorp. (2015a). *Stata Statistical Software: Release 14*. College Station, Texas: StataCorp LP.

StataCorp. (2015b). *Stata 14 base reference manual*. College Station, Texas: Stata Press.

Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behavior: An integrative review and research agenda. *Journal of Environmental Psychology, 29*, 309–317.

Stern, P. (2000). Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues, 56*, 407–424.

Stern, P. C., Dietz, T., Abel, T. D., Guagnano, G. A., & Kalof, L. (1999). A value-belief-norm theory of support for social movements: The case of environmentalism. *Human Ecology Review, 6*, 81.

Thompson, A. W., Reimer, A., & Prokopy, L. S. (2015). Farmers' views of the environment: The influence of competing attitude frames on landscape conservation efforts. *Agriculture and Human Values, 32*, 385–399.

Van Vugt, M. (2009). Averting the tragedy of the commons: Using social psychological science to protect the environment. *Current Directions in Psychological Science, 18*, 169–173.

Vaske, J. J. (2008). *Survey research and analysis: Applications in parks, recreation, and human dimensions*. State College: Venture Publishing, Inc.

Vaske, J. J., & Donnelly, M. P. (1999). A value-attitude-behavior model predicting wildland preservation voting intentions. *Society and Natural Resources, 12*, 523–537.

Ward, N., & Lowe, P. (1994). Shifting values in agriculture: The farm family and pollution regulation. *Journal of Rural Studies, 10*, 173–184.