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Farmer identities and responses to the social–biophysical environment

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Abstract
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Keywords
agriculture, farmer identity, water quality, soil conservation

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Farmer identities and responses to the social–biophysical environment

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ABSTRACT

Row crop production in the United States (US) Midwest is responsible for a myriad of water pollution issues in the Mississippi River Basin and the Gulf of Mexico. US federal and state governments have spent billions of dollars since the 1930's to understand and develop biological and geophysical practices that will reduce the negative impacts of agriculture on these landscapes and water bodies. However, significantly fewer resources have been applied to understanding the human factor within this social–ecological system. Recently the social psychological framework known as farmer identity as been used to better understand how farmers view themselves as they perform their role as farmer. To empirically test this concept in the US state of Iowa, a farmer identity question was developed and data were collected as part of an annual survey of Iowa farmers. Four farmer identities (Productivist, Conservationist, Civic-minded, and Naturalist) are identified using principal components analysis and tested for their ability to predict support for farm policy scenarios related to soil and water resource protection. Results show that Productivist, Conservationist, and Naturalist identities were likely to be activated by soil and water policies; and the Civic-minded identity was not activated by soil and water policies in general but was significantly against more money for conservation because it might mean more regulation.

1. Introduction

The act of preparing soil to grow food has unintended consequences at field, farm, and watershed levels and beyond (Jackson et al., 2010; Tilman et al., 2002; Turner et al., 2012). Many types of intensified farming practices have led to loss of wetlands and wildlife habitat, erosion of the farmland soil base, and off-field sediment, pesticide, nitrogen and phosphorus losses that lead to downstream pollution and hypoxic conditions (EPA, 2013; Rabalais et al., 2002; Turner et al., 2012). These problems are not new. Seventy–five years ago Aldo Leopold wrote "The landscape of any farm is the owner's portrait of himself" (1939:299). He argued that a myopic focus on yield was reducing soil fertility, increasing soil erosion and decreasing the diversity of flora and fauna on cropland in the United States (US) Corn Belt.[1] Leopold urged farmers to recognize that healthy, stable soil provides a home to a variety of plants, animals, insects, and microorganisms that are an important part of the ecological system on their farms and the local social systems as a place to enjoy nature for recreation, socialization, and relaxation. He urged farmers to take as much interest in the dynamics of social and ecological systems on their farms and nearby landscapes as they did in understanding the mechanics of the tractors and implements they use to practice agriculture. In other words, he was asking them to see their farms as integrated social–ecological systems (SES). His assertion that farm landscapes

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[1] Corn is grown in most U.S. states, but production is concentrated in the Heartland region (including Illinois, Iowa, Indiana, eastern portions of South Dakota and Nebraska, western Kentucky and Ohio, and the northern two-thirds of Missouri). Iowa and Illinois, the top corn-producing States, typically account for slightly more than one-third of the U.S. crop (USDA 2013).

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are portraits of a farmer continues to be applicable and provides an argument that understanding farmers' identities and how those identities are expressed in the performance of agriculture is still important today.

Studies of farmer identity have been conducted in the US, European Union and Australia. These studies have focused on better understanding how farmer beliefs about how agriculture should be performed translates into the practices that are used on-farm. Understanding why farmers perform agriculture as they do may inform efforts to engage farmers in educational opportunities, incentives, and regulations that will motivate them to modify their practices to take action that improves and protects the social and ecological systems within and outside of their farm gates. In the US agriculture is being pushed to produce more food, fiber and feed, along with recent opportunities to produce renewable fuel, which has resulted in a number of negative impacts on the environment. The negative impact with the highest public profile is impaired water quality. As technology has helped farmers increase yields, it has also made it easier and less expensive to identify the sources of pollution in agricultural landscapes and water bodies. It is clear that row crop production agriculture is a primary cause of water pollution in the Mississippi River Basin and the Gulf of Mexico (EPA, 2013; Rabalais et al., 2002).

In the US there has not been a strong emphasis on farmers producing ecosystem services in the past and as a result ecosystem service production has remained a largely voluntary practice. However, as the need for food and clean water grow with the increasing population, so have society's expectations that farmers will adopt practices that will significantly reduce or eliminate the negative impacts of agriculture on water resources (Herrero and Thornton, 2013). This societal expectation creates a social situation that can be challenging for some farmers to verify their farmer identity as doing "good" the environment.

Two themes, individual farmer identities and the social–ecological context within which those identities are activated are the focus of this paper. A farmer's view of the land as part of (or not part of) the social–ecological system that ranges from the microscopic to the planet scale (Arbuckle, 2013a; Arbuckle, 2013b; Burton and Wilson, 2006; Egoz et al., 2001) seems to underlie the identity which dominates how a farmer practices agriculture.

Past research has explored two ideal types of farmers: the Productivist and the Conservationist. As with any business, farmers expect to recover their costs of operation and earn a profit. In many ways farms managed by both types of farmers may look quite similar to those not familiar with agriculture. The Productivist farmer relies heavily on one or two crop rotations, heavy applications of synthetic fertilizers, pesticides, genetically engineered seed and high-tech farm machinery (Tilman et al., 2002). High yields are produced, but often result in increased soil erosion, pollution of ground and surface water with nutrients and pesticides and a significant loss of biodiversity. In short, the Productivist's primary goals are short-term profits and maximizing the output of the land resource in order to achieve high yields. The Conservationist takes a slightly different view. While he/she likely uses many of the same practices and has many of the same yield and income goals as the Productivist, these farmers also consider the long-term value of the land resource and take action to reduce soil erosion and improve soil health. Concurrently those actions have the effect of reducing some of the negative impacts on the quality of water that flows through their farms. These management practices might include riparian buffers around streams and grassed waterways along the edges of fields that reduce the flow of nitrogen and other nutrients beyond their farms.

When farmers practice agriculture, they are influenced not only by their internal beliefs, values, knowledge and past experiences, but also by iterative interactions with their social and biophysical environments (Arbuckle, 2013a; Arbuckle, 2013b; Burton and Wilson, 2006; Egoz et al., 2001). Social and biophysical situations can range from field, farm, community and watershed conditions to local and global markets to social relations to public policies. While the Productivist and Conservationist identities are described in much of the literature on farmers, there is a gap in our knowledge about how these identities react to various social and biophysical situations. Further, all individuals, including farmers, have multiple identities and it is not well understood how the many roles and identities a farmer can assume might be activated to have concern for agro-ecosystem well-being while assuring their livelihoods.

The first applications of identity theory to farming focused on understanding farmer decision-making and behavior at the individual level of analysis. Burton first used identity theory to understand why farmers refused to participate in a plan to reforest their farmland (Burton and Wilson, 2006). Others have examined the adoption of agri-environmental practices (Arbuckle, 2013a; Arbuckle, 2013b; Burton et al., 2008; Burton and Paragahawewa, 2011; Burton and Schwarz, 2013; Emery and Franks, 2012; Sutherland, 2010); efforts to improve water quality (Blackstock et al., 2010; McGuire et al., 2013); the use of organics (Stock, 2007; Sutherland and Darnhofer, 2012; Sutherland et al., 2012); comparisons of farmer and consumer views of food (Selfa et al., 2008); and the role of social capital in farming communities (Sutherland and Burton, 2011). Most of the previous farmer identity research has been limited in scope. That is, much of the work was done using qualitative measures such as interviews and doing surveys with non-statistically valid samples. Others have advanced this concept through literature reviews and syntheses or case study analyses, and expanded theoretical work by incorporating other sociological theoretical frameworks (Arbuckle, 2013a; 2013b being the exception). These scientists have no doubt advanced this theoretical framework, but they have also challenged their peers to do empirical research in order to further test and develop this theory (Burton and Paragahawewa, 2011).

In this paper we take up the challenge of developing quantitative measures to further test this theory. Our intent is to examine farmers as individuals and the identities that are activated when making production decisions in varied environmental and social situations. Although the Productivist and Conservationist identities have been the primary focus of prior literatures, two additional identities which have little or no literatures are developed here. All four identities – Productivist, Conservationist, Civic-minded, and Naturalist – are subjected to different social and biophysical scenarios to understand how the social–ecological situation can activate one identity over another within the same individual.

Principal components analysis (PCA) is used to guide the development of indices that measure components of these four distinct identities based on data from a random sample state-wide survey of Iowa famers. Five farm-related public policy models representing social–ecological situations are used to evaluate the relationships between measures of identity and statements about agricultural policy. Results are then presented and followed by a discussion of the concept of "farmer identity" and its further development to increase understanding how identities influence farmers' perceptions and support for farm policies that attempt to address two of the unintended consequences of agricultural production: soil erosion and water pollution. Lastly we conclude by discussing the implications of findings and limitations of this research.

2. Identity theory and farmers

The identity construct has been defined as "a set of meanings

that define who one is when one is an occupant of a particular role in society, a member of a particular group, or claims particular characteristics that identify him or her as a unique person" (Burke and Stets, 2009, p. 3). In the course of life humans perform various roles, belong to different groups and have unique personalities. As such, they have multiple 'identities'. This concept of identity is based on the structural symbolic interactionist theory developed by Stryker (1980). Burke combined Stryker's structural identity theory with Powers' perceptual control theory (1973) to create the Identity Control Model. This framework demonstrates how particular identities are reinforced or changed (Burke, 1991). Burke and others (Cast, 2004, Cast and Burke, 2002; Freese and Burke, 1994; Smith-Lovin and Heise, 1988; Stets and Cast, 2007) have developed identity (control) theory to explore identities within social relationships such as families and couples. More recently, the identity control framework has begun to be used to examine how farmers' various identities influence their farmer role in agriculture.

2.1. Identity control theory

According to identity control theory (ICT), individuals are motivated to confirm or "verify" their identities. The identity verification process is based on a simple feedback loop that uses the social situation as the location where an identity is evaluated and feedback related to performance of a particular identity standard (i.e. identity meanings) is made. When the feedback matches the standard, the identity is verified. If the feedback does not match the standard, the identity is not verified and the individual must decide whether to either act in a different manner to support the identity or make changes to the identity standard (Burke and Stets, 2009; Cast, 2003; Tsushima and Burke, 1999). In the practice of agriculture the biophysical and social environments provide feedback to the farmer about his/her performance of their farmer identity and it is this concept that will be developed in this paper.

2.2. Farmer identity

The concept of farmer identity was developed in Great Britain by Burton (2004b) to better understand why grain farmers were not adopting a voluntary national government funded effort to reforest their cropland. He found that farmers' role identities are closely linked to their person identities. Burton and Wilson (2006) advanced the idea of the "farmer identity" by creating a typology of the farmers. They discovered that a majority of the farmers used intensive farm management practices and a strong focus on agricultural business practices to produce high yields in an efficient manner on large tracts of land. Most of the crops raised were sold as commodities on the open market. "Diversifiers" saw their farm as a place where they produced raw commodities that could be processed to create a value-added product (cheese made from the milk raised on the farm) and/or grow specialty crops that require more intensive growing and handling processes that require more work, but also earn a higher price. The final group identified was Conservationists. These producers saw their land as something more than a tool to create income. They used practices that balanced production with the need to conserve or improve the land and resources. This analysis and much of the subsequent research has relied on qualitative methods making it difficult to generalize to other locales.

2.3. Current research

The general hypothesis of the research presented here builds specifically on previous research which examined how US farmers can be motivated to modify their behavior in order to adopt practices that improve water and soil quality while maintaining or improving profitability (McGuire et al., 2013). That analysis showed that farmers have more than a single farmer identity and that a lack of verification of their identity led to changes in their identity (Fig. 1). This research found that feedback from local watershed group members served as a powerful mechanism for the farmer members in this particular situation to change their practices. Feedback from other group members facilitated changes in identity standards so that those farmers, who had been branded as polluters, modified their principle farmer identity to include using practices to reduce the flow of agricultural pollutants from their farms into ground and surface water (Morton and McGuire, 2011). Some farmers immediately acted on their own to adopt practices that reduced agricultural pollutants flowing off their farms. For these farmers it was a high priority to remove 'polluter' from their farmer identity. But many other farmers in the watershed group were not comfortable making changes immediately. However, being part of the watershed group gave them the opportunity to learn from the early adopters to try new practices. That group provided the learning space these producers needed to make changes in their farm practices to include managing for water quality that they would have not been willing to do on their own. The social situation, the group, precipitated a change in local farmer identities that resulted in sustainable changes to farm practices to reduce the pollutants flowing off their farmland.

In most applications of identity control theory the identity verification or change process starts in the social situation. In developing identity, standards and comparators for their farmer identity are based on the attitudes, beliefs and experiences that each farmer holds for their person identities and their farmer role identities. The sources for the attitudes, beliefs and experiences come from multiple sources such as other farmers, family, community standards, education, interaction with local geography and use of previous farm practices. Identities become activated when an individual encounters meanings that are relevant to that identity within the social situation. Since farmers, like all humans, have multiple identities it is possible for there to be conflict among an individual's various identities in response to a single situation. This is where a person's identity hierarchy comes into play. The hierarchy is simply a ranking of identities with the most important, or sometimes the most active, identities at the top and less important identities at lower positions. This hierarchy accounts for why a farmer who may want to use a practice such as cover crops in their farm management system, but does not because a parent owns the land and forbids use of such a practice. In this individual's case, the son identity is more salient than his farmer identity.

The social situation is not the only place where farmer identities are verified or changed. We theorize that the biophysical environment can also affect how a particular identity moves up or down in the hierarchy and influence farmer management decisions that contribute to soil erosion and water pollution. A farmer can perform agriculture in a manner that is verified in the social situation by family members, other farmers, advisors, community members and the agricultural markets and still not produce a crop because weather conditions or poor soil quality (biophysical environment) did not allow it. Since farmers are in the business of producing a crop, failure to do so results in their farmer identity not being verified. It is direct feedback that is tied to an action and does not carry values judgment that the farmer needs to think about. Thus the biophysical and social situations are both vitally important to expression of identity control theory in agriculture. In Fig. 2 we expand the social situation of model 1, to include biophysical contexts and propose that these situations can affect the identity of farmers.

As noted earlier McGuire et al. (2013) examined two primary

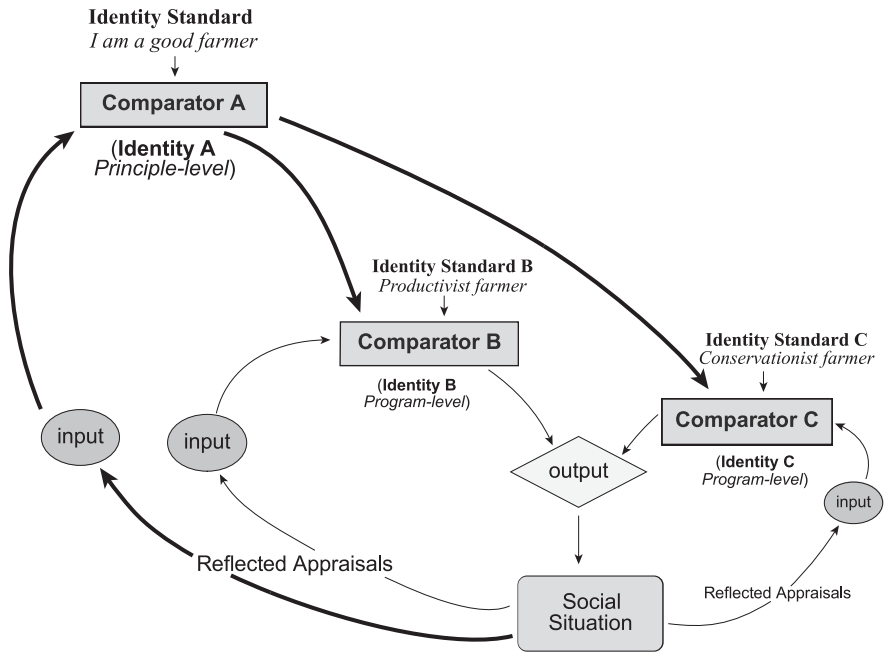

Fig. 1. Farmer identity control model (A) with productivist (B) and conservationist (C) identities (McGuire et al., 2013 p. 61).

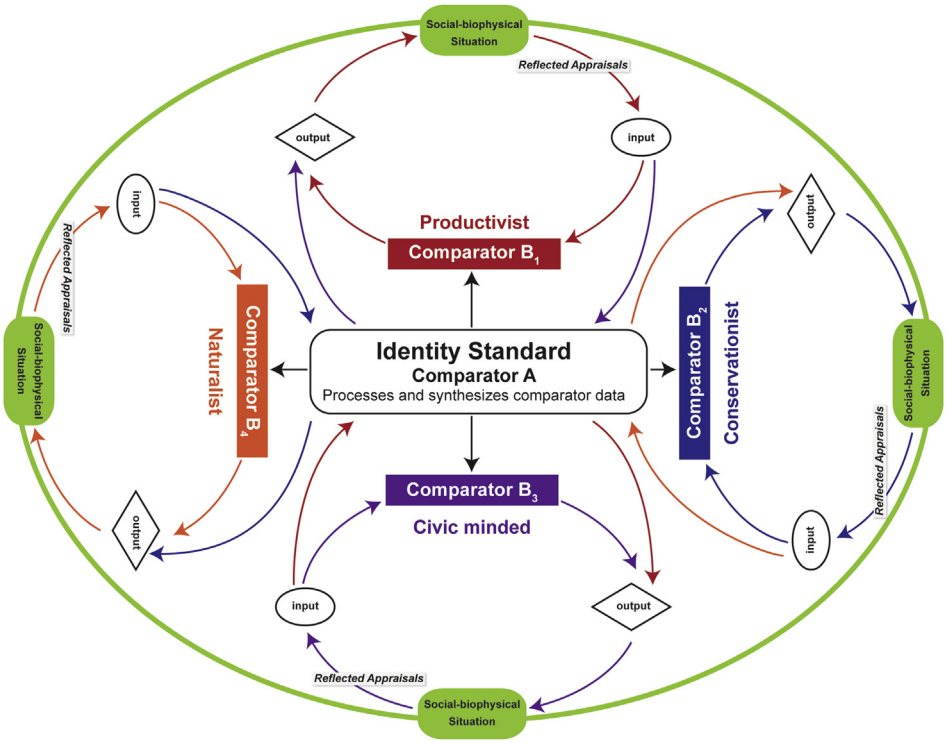

Fig. 2. Farmer identities: a four program-level model. Principle-level identity standard (A) of the farmer role and supporting identity standards (B_1, B_2, B_3, B_4).

identities, Conservationist and Productivist (Fig. 1). As their titles imply, a farmer with a strong Conservationist identity attempts to balance productivity with caring for the biophysical environment. The Productivist identity exemplifies the view that producing the greatest amount of crop yield per acre is an appropriate farmer identity. This farm management style uses large amounts of inputs and technology to maximize the yield and profit per land unit. However identity theory posits that individuals hold multiple identities and that those identities are activated by the social situation. Since agriculture is so dependent on the land resource and accompanying climate, it is vital to better understand more precisely what is actually contained in the social situation and how feedback from the biophysical situation contributes to an individual farmer's identity. By including the biophysical feedback in this

identity control model it is possible to account for the social–ecological relationship that exists in any farming system. We offer several policy scenarios to serve as surrogates to test how farmers would respond if they are faced with having to adopt soil and water conservation practices that may not fit within their farmer identities.

Fig. 2, an expanded farmer identity model represents four program level identities. In both Figs. 1 and 2 the farmer identity sits at the top and is considered the principle level of the identity and varies according to individual (Burke and Stets, 2009). Said another way, it is an overview of the farmer identity. The principle level contains the general aspects of an individual farmer's identity. The next level is known as the program-level. Program-level identities are those where the farmer behaviorally supports the principle identity. Depending on the social and biophysical situation, the farmer's actions alter the environment which leads to feedback that either verifies the identity or not. The expanded model (Fig. 2) adds two more possible farmer identities and a modification of the social situation to include biophysical situations (e.g. soil erosion and water quality issues). Although, still a simplistic representation of identity, Fig. 2 more completely illustrates the conceptual representation of the iterative flow and processing of social and biophysical data that shape how farmers respond to feedback in the decision-making process, resulting in different agricultural practices.

2.4. Farmer identity and public policy scenarios

Four farmer identities — Productivist, Conservationist, Civic-minded, Naturalist — are expected to be activated in ways that support the overall farmer identity (principle-level identity) depending on the social and biophysical situation. The principle farmer role identity is specific to an individual and includes all of the meanings that a farmer attaches to performing that role. Each time a farmer encounters a situation that activates the farmer identity he/she automatically compares and reflects on the situation (Burke, 1991). If the situation presents new ideas, challenges current actions, or adds social pressure to think or act differently, the individual is forced to purposefully reflect, re-evaluate and decide whether to keep doing what they are doing or adjust and change their behaviors to conform to perceived standards in their farmer identity.

In order to measure farmer identity behaviors, attitudinal proxies were used. Asking respondents about particular agricultural practices or federal land-use policies associated with soil and water conservation management should activate their farmer identity and individuals should behave in ways consistent with those identity meanings. In the case here, it would mean expressing particular attitudes that support those identity meanings. For example, research on the moral identities found individuals hold moral measures within their self-identities and define and act upon them in order to verify their identities (Stets and Carter, 2011). Therefore it is appropriate to ask farmers how they think a "good farmer" would act in a particular situation, in order to measure their self-attitude (a comparator in their farmer role identity) and their subsequent attitudes toward agricultural practices or federal land-use policy scenarios. This understanding allows for the creation of an appropriate semantic differential scale (strongly agree to strongly disagree) that allows farmer respondents to rate how well each item in a list of practices matches their farmer identity (Stets and Serpe, 2013). Support for this use of self-attitudes as a measure of farmer identity can be found in research by Lokhorst et al. (2011). These scientists found that nearly 60 percent of farmers who reported having attitudes in support of voluntary conservation measures, did in fact act on those beliefs.

In this study, five agriculture policy scenarios representing social–ecological situations are used to activate one or more farmer identities. These policies were chosen because they provided social and biophysical situations that are relevant to a particular farmer identity. The expected response to the policies is provided in Table 1. It is posited that the identity most strongly connected to the individual's person identity will be highest in the identity hierarchy and therefore salient and likely to be activated. So, for instance if a farmer holds a strong Productivist identity we posit it would be unlikely that they would support the idea that they should be required to provide habitat for wildlife on their farm. However, other program identities may also be activated by the social–ecological situation but not become the principle identity. Thus, since the policies are soil and water conservation focused, we expect that the conservation identity will be activated by these situations but not always be the dominant or highest ranked identity. Of interest is 1) whether different policies representing specific social/biophysical situations activate different identities and 2) whether there is evidence that more than one identity can be activated by a single situation.

3. Methods

3.1. Data collection

The data for this analysis were collected as part of the 2010 Iowa Farm and Rural Life Poll (IFRLP). The IFRLP has been distributed to a panel of Iowa farmers since 1982 by the Iowa Agricultural Statistics Service under the guidance of Iowa State University Department of Sociology Extension and in partnership with the Iowa Department of Agriculture and Land Stewardship. Surveys were sent to 2224 farm operators in January and February 2010 and 1360 usable surveys were returned for a 61 percent response rate. Even though this is a panel survey, farmers retire or leave farming for a variety of reasons requiring replacements to maintain sample size. When this occurs other farmers are selected from a random sample of the United States Department of Agriculture (USDA) Census of Agriculture master list. The USDA definition of a farm operation includes enterprises that generate as little as $1000 in annual sales. Farmers with low annual farm income often opt-out of participating in the survey as many of the questions do not seem relevant to them. As a result the sample skews toward larger farm operations. The policy scenarios focused on conservation compliance policies that include water quality and wildlife; federal farm program control of soil erosion; local drainage-wetland projects; state funding for soil and water that encompasses fish, wildlife and natural areas; and money for conservation tied to regulation.

The farmer identity is measured by asking farmers the importance of different qualities in a "good farmer": *People have different opinions about what makes a "good farmer."* Please rate the following items in terms of their importance to what characteristics make a good farmer (See Appendix). Drawing on previous literature, we developed 31 items as possible dimensions of a "good farmer" identity. In addition to understanding the social aspects of agricultural production, an effort was made to measure attitudes toward wildlife and beliefs about farmer interaction with others in the community. Respondents were asked to evaluate the importance of a particular dimension on a five point scale from "Not at All Important" (1) to "Very Important" (5). Additional topics covered in the 2010 survey included; wildlife and outdoor recreation, drainage renovation and nutrient removal wetlands, the Iowa Natural Resources and Outdoor Recreation Trust Fund, conservation and conservation compliance, and specific personal and farm characteristics (Arbuckle et al., 2010).

Table 1
Social–ecological scenarios and proposed farmer principle identity activation.

	Social–ecological scenarios	Productivist	Conservationist	Civic-minded	Naturalist
Model 1	"Conservation compliance policy should be extended beyond soil erosion to cover other areas such as water quality and wildlife habitat."	−			
Model 2	"Farmers should be required to control soil erosion on highly erodible land to stay eligible for federal farm program benefits."		+		
Model 3	"I would support the establishment of a coupled drainage-wetland system pilot project in my district."			+	
Model 4	"Iowa farmers would benefit from increased funding for soil and water conservation, fish, wildlife, and natural areas, and parks and trails."				+
Model 5	"More money for conservation would mean more regulations for Iowa farmers."	+	−	−	−

− = negative significance, + = positive significance.

3.2. Data analysis

The data were analyzed in two stages. First, a principal component analysis (PCA) with varimax rotation was performed using the 31 items to determine the underlying dimensions of the farmer identity. Four components had eigenvalues over 1.0, were theoretically cohesive, and statistically tested above .70 using Cronbach alpha test for reliability (Nunnally, 1967) (Table 2a). The PCA loadings of the four components were then used as independent variables representing four distinct farmer identities. The PCA scores were estimated from a covariance matrix and are in standardized units where the mean = 0 and variance = 1. The five dependent policy scenario variables were chosen because they were thought to activate a particular identity in a positive or negative direction.

All questions had five categories of answers: "strongly disagree", "disagree", "uncertain", "agree" and "strongly agree". The uncertain response was omitted on the theoretical premise that "uncertain" meant the individual did not yet have a strong enough perception of this situation to activate a particular identity under the identity control model. Each of the five dependent scenario variables were recoded so that "strongly disagree" and "disagree" were equal to zero (0) and "strongly agree" and "agree" were equal to one (1).

A second analysis was performed through logistic regression models with the five public policy scenarios as dependent variables and the four farmer identities' PCA loadings as the independent variables, controlling for farmer age and their 2009 corn-soybean acreage. The descriptive statistics for these variables are shown in Tables 2a, 2b and 3.

Model 1 focuses on water quality with the dependent variable: "Conservation compliance policy should be extended beyond soil erosion to cover other areas such as water quality and wildlife habitat." Model 2 is formed around the belief that farmers should be required to control erosion on highly erodible land to stay eligible for federal farm program benefits. The third model addressed drainage renovation and nutrient removal wetlands. This is of prime importance due to the role that nutrients from Midwest croplands play in the formation of the annual hypoxic zone in the Gulf of Mexico. The state's eastern lands drain directly into the Mississippi River and its western territory drains into the Missouri River and subsequently into the Mississippi River, thus the entire state of Iowa sits within the Mississippi River Basin. Recent assessments have shown that in order to make significant reductions in the volume of nutrients flowing into the Mississippi River Basin Midwest farmers must significantly reduce the flow of fertilizers from cropland to ground and surface water in the state (IDALS et al., 2013; US EPA, 2013).

The fourth policy scenario (Model 4) focused on a vote by Iowans to amend the state's constitution to establish a natural resources and outdoor recreation trust fund. The *Iowa's Water and Land Legacy* legislation was designed to establish a permanent and protected source of funds to improve and protect natural areas and water quality in the state (State of Iowa Legislature, 2010). The IFRLP was deployed early in 2010, several months prior to the November election when it was to put to a vote of the citizens. The act specifically addressed: "soil and water conservation; fish, wildlife and natural areas; parks and trails; and the restoration of wetlands to help protect against future flooding" (IFRLP, 2010 p.11). Passage of the constitutional amendment meant that residents had agreed that 3/8 of one percent (.00375) of any future tax increases in Iowa would be deposited in the Iowa Natural Resources and Outdoor Recreation Trust Fund. This is of significant importance to farmers since 86 percent of Iowa's landscape is currently used for agriculture (USDA-NASS, 2011; US Census, 2010). Some anticipated that farmers would not support this effort because these funds could eventually be used to require farmers to adopt soil and water conservation practices that could be costly to their farm operations. The statement about this effort serves as the dependent variable in Model 4: "Iowa farmers would benefit from increased funding for soil and water conservation, fish, wildlife, and natural areas, and parks and trails". This legislation subsequently passed in the 2010 General Iowa election as a state amendment to the Iowa Code with substantial (63%) public support.

The fifth model also uses a variation on the proposed *Iowa Water and Land Legacy legislation*. The statement suggests that if more funds were spent on conservation, the result would be an increase in regulations for Iowa farmers, "More money for conservation would mean more regulations for Iowa farmers."

4. Results

4.1. Farmer identities

The principal components analysis revealed four identities: Productivist, Conservationist, Civic-minded and Naturalist identities (Table 2a). The four identities as sets had a Cronbach's alpha reliability coefficient of .893 (Productivist alpha = .82; Conservationist alpha = .90; Civic-minded alpha = .83; and Naturalist alpha = .70), a KMO of .909 and a Bartlett's test of sphericity of .000. Taken together these measures reveal strong internal consistency within the components.

The items composing the Productivist and Conservationist identities were consistent with previous research (Burton, 2004a; Burton and Wilson, 2006; Arbuckle, 2013a; Arbuckle, 2013b;

Table 2a
Principal component analysis of Iowa farmer perceptions of farmer identities[a] (n = 1222).

	Productivist	Conservationist	Civic-minded	Naturalist
Uses chemical technology	.765	.125	.085	−.014
Up to date equipment	.757	−.061	.146	.131
Highest yield per acre	.751	.018	−.011	−.018
Highest profit per acre	.751	.108	.043	−.034
Crops planted first	.697	−.099	.024	.108
Keeps fields clean	.509	.309	.241	−.331
Farm looks nice	.444	.194	.432	−.219
Keeps fencerows clear	.394	.114	.245	−.438
Cronbach α = 0.82				
Minimizes nutrient runoff	.005	.869	.068	.089
Minimizes soil erosion	.027	.866	.062	.071
Maintains organic matter	.054	.777	.113	.100
Considers stream health	−.047	.775	.132	.078
Conservation over profit	−.063	.665	.270	.236
Watershed health	.025	.628	.364	.260
Scouts before spraying	.135	.627	.262	.138
Profit & environment impact	.250	.597	.089	.132
Minimizes tillage	.141	.477	.284	.413
Cronbach α = 0.90				
Active in community	.147	.134	.787	−.003
Community leader	.165	.094	.779	.018
Farm organizations	.185	.084	.743	.166
Shares equipment	−.024	.105	.621	.264
Helps friends and neighbors	−.070	.221	.561	.132
Protects watersheds	.034	.413	.505	.388
Shares knowledge	.125	.337	.491	.110
Cronbach α = 0.83				
Uses cover crops	−.008	.177	.223	.658
Maintain wildlife habitat	.000	.292	.209	.624
Avoids fall tillage	.089	.369	.113	.541
Minimizes pesticide use	.015	.394	.167	.428
Cronbach α = 0.70				

[a] The question was: People have different opinions about what makes a "good farmer." Please rate the following items in terms of their importance to what characteristics make a good farmer. Answer options were on a five point scale from *Not at All Important*, *Not Really Important*, *Somewhat Important*, *Important* and *Very Important*.

McGuire et al., 2013). Productivist items included the following: uses chemical technology, up-to-date equipment, highest yield per acre, highest profit per acre, has a goal to be first in planting crops, and values keeping fields clean and fencerows clear. In contrast, the Conservationist identity loaded on items associated with protecting soil and water resources: works to minimize soil erosion and nutrient runoff, maintains organic matter, considers stream health, places a high value on conservation over profit, scouts before spraying, and minimizes tillage.

The Civic-minded and Naturalist identities do not have prior literatures and are an untested set of farmer identities. A review of the variables that were labeled the Civic-minded identity suggested that these were individuals who view their farmer role as one that includes community leadership and responsibilities to be an active, civic-minded, and engaged member of the local community. Items within this component were: active in the community, a community leader, active in farm organizations, helps friends and neighbors, and shares knowledge and equipment. The Naturalist identity was somewhat more difficult to label. Items within this component included: uses cover crops, maintains habitat for wildlife, minimizes pesticide use, and avoids fall tillage. Research on prairie

Table 2b
Farmer characteristics.

	N	Range	Mean(SD)
Total corn and soybean acres farmed in 2009	1330	0–5810	347.26(513.37)
Age	1360	26–95 years	63.73(11.58)

Table 3
Descriptive statistics for social ecological variables.

	Dependent variables	N	Mean(SD)[a]
Model 1 Water quality	Conservation compliance policy should be extended beyond soil erosion to cover other areas such as water quality and wildlife habitat	1135	.95(.23)
Model 2 Highly erodible land	Farmers should be required to control soil erosion on highly erodible land regardless of participation in federal farm programs	816	.57(.50)
Model 3 Coupled drainage-wetlands	I would support the establishment of a coupled drainage-wetland system pilot project in my district	533	.69(.46)
Model 4 Wildlife, parks & trails	Iowa farmers would benefit from increased funding for soil and water conservation, fish, wildlife, and natural areas, and parks and trails	836	.68(.47)
Model 5 Conservation regulation	More money for conservation would mean more regulations for Iowa farmers	959	.92(.27)

[a] The responses for the models were recoded from five categories (Strongly Disagree, Disagree, Uncertain Agree, Strongly Agree) to three: 0 = Strongly Disagree, Disagree; 1 = Agree, Strongly Agree; with Uncertain omitted.

management and the landowners and farmers who are involved in managing grasslands (Miller et al., 2012) offered guidance on naming. The variables within the Naturalist identity closely match the attributes that have been observed in those who manage prairie and grassland areas. This led to a definition of this farmer identity as one that balances farm production with a strong interest in wildlife (flora and fauna) either to consume it as hunters, mushroom foragers or fishers, or to appreciate it as a bird watcher or hiker (Table 2a).

4.2. Farmer identities and models

In the second portion of the analysis, binary logistic regression was used to determine whether specific policy scenarios that focused on the social and biophysical landscape would activate one or more of the four identities. Acres farmed and age were included in all models as control variables. This sample of farmers reported an average of 347 acres farmed and were on average about 64 years old (Table 2b). The majority of all respondents agreed or strongly agreed with the five dependent variable scenarios ranging from a low of 57% for Model 2 proposing farmers should be required to control soil erosion on highly erodible land regardless of participation in federal farm programs to a high of 95% in Model 1 agreeing conservation compliance should be extended beyond soil erosion to cover other areas such as water quality and wildlife habitat (Table 3). Models 2, 3, and 4 have modest R^2 with Models 1 and 5 having much poorer model fit (Table 4). The results for each of the models are presented next.

Model 1 represents a proposal to extend soil erosion conservation policy to include water quality and wildlife habitat (Table 4). Both the Productivist and Conservationist were positive and significant, interpreted as the odds of having an increased level of support for this policy is associated with an increase in activation of the Productivist and Conservationist identities. It was expected that the Conservationist identity would be positive and significant, however, it was posited that the Productivitist would respond in a negative way and be the highest ranking/principle identity. Neither the Civic-minded nor Naturalist in Model 1 were significant as was expected. Age was positive and significant. The magnitude of the odds ratio and coefficient for the Conservationist (2.508) was much larger than the Productivist (1.59) indicating that the odds of the Conservationist increasing support for this scenario generated a two fold increase in the outcome with the other identities held constant. The Conservationist is likely the principle identity in this particular social–ecological situation as it shows the strongest unit increase in support for extending soil erosion conservation to include water quality.

The second model proposes a scenario where farmers are required to control soil erosion on highly erodible land to stay eligible for federal farm program benefits. The Conservationist, as expected, was positive and significantly associated with this scenario with an odds ratio of 1.845, interpreted as the odds of support for this policy increased by 84.5% with the activation of this identity. Two other identities, the Productivist and the Naturalist were also significant and positively activated with odds ratios 1.436 and 2.965 respectively. The Civic-minded identity was not significant; nor were the control variables corn and soybean acres, and age. The Naturalist has the largest coefficient and odds ratio showing an almost three fold increase in support for the policy compared to the other identities, suggesting that this identity is likely higher in the identity hierarchy than the Productivist or Conservationist.

The third model, support for the establishment of a coupled drainage-wetland system pilot project in my district, has elements of a collective community level impact that would likely affect more than one landowner since it would follow the hydrological landscape rather than boundaries of ownership. All identities were significant. The Productivist, Conservationist and Naturalist were positive and significant at the .01 level; the Civic-minded was negative with a lower significance ($p < .10$). It was expected that the Civic-minded would be positive, significant, and the strongest or principle identity. However, it was the weakest of the four identities. Again, the Naturalist had the largest coefficient and odds ratio (2.963) showing the odds of increasing support were almost threefold when other identities were held constant, providing evidence of a much stronger impact than the other three program level identities. Age was negative and significant in this model.

The fourth scenario (Model 4) stated that Iowa famers would benefit from increased funding for soil and water conservation, fish, wildlife, and natural areas, and parks and trails. The Naturalist was expected to be the principle identity activated in this scenario, and the odds ratio (2.170) and coefficient (.775) support this posit with the odds of support for this scenario increasing more than two-fold compared to other the identities. Two other identities, the Productivist and Naturalist, were also positive and significant with smaller odds ratios (1.450 and 1.630 respectively) but still substantially showing an odds increase of 45% and 63% when other

Table 4
Results of logistic regression activation of farmer identities on social–ecological scenarios.

Independent variables	Social–ecological scenarios									
	Model 1[a] Water quality		**Model 2**[b] Highly erodible land		**Model 3**[c] Coupled drainage-wetland		**Model 4**[d] Wildlife, parks & trails		**Model 5**[e] Conservation regulation	
Farmer identities	Logit coeff (SE)	Exp (B)	Logit coeff (SE)	EExp (B)	Logit coeff (SE)	Exp (B)	Logit coeff (SE)	Exp (B)	Logit coeff (SE)	Exp (B)
Productivist	.469(.155)***	1.598	.362(.087)***	11.436	.356(.113)***	1.428	.372(.087)***	1.450	−.200(.126)	.819
Conservationist	.919(.154)***	2.508	.612(.093)***	11.845	.542(.124)***	1.719	.489(.093)***	1.630	−.434(.150)***	.648
Civic-minded	.145(.159)	1.156	−.145(.091)	00.865	−.203(.119)*	.816	.071(.093)	1.074	.430(.127)***	1.536
Naturalist	.217(.166)	1.243	1.087(.110)***	22.965	1.086(.135)***	2.963	.775(.099)***	2.170	−.615(.136)***	.541
Corn & Soy Acres	.001(.000)	1.001	.000 (.000)	11.000	.000 (.000)	1.000	−.001(.000)***	.999	.000(.000)	1.000
Age	.025(.013)*	1.025	.004 (.008)	11.004	−.024 (.011)**	.976	.000(.008)	1.000	.017(.012)	1.017
Constant	1.554(.847)*	4.730	.104 (.532)	11.109	2.447(.733)***	11.554	1.119 (.540)**	3.063	1.686(.785)**	5.398
Model coefficient	56.167***		223.337***		129.928***		153.230***		57.284***	
Log likelihood	355.091		805.070		470.777		789.283		413.031	
Cox and Snell R^2	.053		.258		.235		.183		.065	
Nagelkerke R^2	.161		.345		.331		.257		.153	

*p < .1; **p < .05; ***p < .01.
[a] Conservation compliance policy should be extended beyond soil erosion to cover other areas such as water quality and wildlife habitat (n = 1024).
[b] Farmers should be required to control soil erosion on highly erodible land regardless of participation in federal farm programs (n = 750).
[c] I would support the establishment of a coupled drainage-wetland system pilot project in my district (n = 486).
[d] Iowa farmers would benefit from increased funding for soil and water conservation, fish, wildlife, and natural areas, and parks and trails (n = 759).
[e] More money for conservation would mean more regulations for Iowa farmers (n = 858).

identities were held constant. Corn and soybean acres was significant and negative. Civic-minded was not significant.

Model 5 outcome variable focused the expectation that increased spending on conservation would mean more regulation for Iowa farmers. Three identities were significant with the Conservationist and Naturalist having significant and negative coefficients showing disagreement with this statement. The Civic-minded was significant and positive, indicating agreement with an odds increase in the outcome by 53.6% with each additional unit of support. The Productivist identity was not significant. Examination of the magnitude of odds ratio and coefficients of the three significant identities reveals similarity in activation despite differences in direction of support, with odds decrease in support by 64.8% and 54.1% with activation of the Conservationist and Naturalist respectively for each unit of agreement; and odds increase by 53.6% for the Civic-minded compared to other identities.

5. Discussion

This research was a beginning attempt to use quantitative data to better understand the relationship between the social–biophysical situation and the activation of farmer identities. Of interest was whether some program level identities would be significantly associated with a particular social–biophysical situation (e.g. scenarios in this paper) and not other situations (scenarios) suggesting that situations differentially activate different identities. A second question of interest was whether more than one identity would significantly be associated with a single situation and if the principle identity could be quantitatively made visible. Although our expectations (Table 1) for which identity would be the principle identity significantly associated with a specific scenario were not entirely on the mark, the overall findings offer evidence of answering both of these general questions.

Three patterns across the five social ecological scenarios offer insights about the four identities and their association with agreement or disagreement with particular soil and water conservation policies. First, the Productivist and Conservationist identities evidenced very similar support for the social–ecological scenarios in Models 1–4. These scenarios revolved around support for stronger measures protecting soil and water resources. Prior literatures find these identities to be distinguished by differences in the priority ranking given to production efficiencies and profit (Productivist) and the priority ranking given to managing the soil and water resources to accomplish both productivity and assure some level of healthy ecological functioning (Conservationist). None of these scenarios make any claims on production efficiency goals that might generate an internal conflict between these two identities. Thus, although the Conservationist identity is more strongly evidenced than the Productivist, they are in general congruent with each other in these four situations. It is only the fifth model, positing that more money for conservation would mean more regulations for Iowa farmers, where the two identities differ with the Productivist identity not activated although having the same directionally, of not agreeing with the statement. Future scenarios associated with economic conditions, markets, and production goals are likely to activate the Productivist and may evidence internal differences with the Conservationist identity. One of societal goals is to move more Productivist behaviors into Conservationist in order to reduce soil erosion and reduce off-field, off-farm nutrient losses. Future research should explore other situations that are likely to shift the principle identity from Productivist to Conservationist so as to increase behaviors that improve water quality.

Secondly the activation of the Naturalist dominated the other three identities in Models 2, 3, and 4, so clearly the items in this component are strongly associated with a broad range of soil and water management scenarios. The Naturalist label for the four items (maintain wildlife habitat, use of cover crop, avoids fall tillage, and minimizes pesticide use) collectively may not well reflect the essence of this identity. There are hints of valuing and protecting biodiversity although not explicit. This identity seems very important to understand but needs much more specification and development.

Lastly, the Civic-minded identity was significant only in Models 3 and 5; and in the opposite direction than expected. It also differed in directionality from the other identities. This suggests an identity quite different than the other three. A reassessment of the label "Civic-minded" with the component items extracted from the PCA reaffirms that this identity represents community leadership and active engagement in farm organizations and their community. The Civic-minded identity did not support the establishment of a coupled drainage-wetland system pilot project in my district (Model 3), in contrast to the support other the three significant identities in this scenario. The Civic-minded agreed that the likely outcome of more money for conservation would mean more regulations for Iowa farmers (Model 5). This agreement conflicts sharply with the negative response (disagreement) of the Conservationist and Naturalist identities. Why would the Civic-minded respond in the opposite direction of the Productivist and Conservationist on soil and water policies? EPA assessments of Iowa water quality and downstream impacts document excess agricultural nutrients and sedimentation of streams, lakes and rivers and continually pose the threat of regulation on farm enterprises. In Iowa there has been considerable opposition to regulation and community level concern led by farm organizations that regulation not replace voluntary compliance. Was the Civic-minded identity activated by group values and norms that are invested in the current voluntary system and against any threat of regulation? Like the Naturalist, the Civic-minded identity is not well developed and needs additional exploration to discover the social–biophysical situations that might activate and shift its location in the identity hierarchy.

The five social ecological scenarios used in this research represent a narrow set of social–biophysical situations with each having nuanced elements related to soil, water, and wildlife conservation. Theoretically it would be expected that social–biophysical scenarios that are different, such as climate change, fracking for oil, or local and global economic conditions might elicit very different identity patterns.

6. Conclusion

Farmers manage nearly 40 percent of the Earth's land mass to not only support themselves and their families but also to produce most of the food, much of the fiber and a growing proportion of the fuel that supports the Earth's current population of 7.2 billion people (United Nations, 2013). This equation puts farmers in a position of great responsibility to use the planet's natural resources in a manner that maximize crop production while minimizing the negative impact on the natural resources that are necessary for the comfort and survival of current and future generations. By better understanding how farmers see themselves and the practice of agriculture it is possible for policy makers and others to better understand what laws, tools, markets and incentives will allow for the maximization of production while minimizing erosion, water pollution and loss of biodiversity.

This research extends our understanding of the farmer identity. First, it is evident that a broader range of identities exist beyond the Productivist and Conservationist that have been established in previous literature. The PCA performed to answer this particular

question provided clear evidence that more than two identities exist within the population studied. The addition of the two new identities – Civic-minded and Naturalist – offer new considerations on how farmers view the practice of agriculture thereby potentially broadening the types of policy options that can developed and deployed in an effort to motivate farmers to adopt practices that reduce the negative unintended consequences of agriculture production.

A second contribution of this research is the patterns of association between particular policy scenarios and different farmer identities. While not all of the predictions were met, there is sufficient evidence that farmer identity can be used to predict at a very general level how a farmer may react to a specific landscape level policy. These results also suggest that further quantitative and qualitative studies should be conducted to better understand the farmer identity and how it can help policy makers change existing policy frameworks to allow farmers to make changes to their farming practices such that all benefit. This work is Iowa specific and uses data based on systems of agriculture that rely on large amounts of machine power and the concentrated use of off-farm inputs. Much more work is needed to fully explore and understand the concept of farmer identity and the manner in which it affects how individuals use different farm management systems and how farmers view their role in society and as caretakers of the landscape.

Appendix. Question

People have different opinions about what makes a “good farmer.” Please rate the following items in terms of their importance to what characteristics make a good farmer. Answer options were on a five point scale from “Not at All Important” to “Very Important.”

A good farmer is one who …
1. Scouts before spraying for pests/weeds/disease
2. Puts long-term conservation of farm resources before short-term profits
3. Considers the health of streams that run through or along their land to be their responsibility
4. Minimizes soil erosion
5. Minimizes nutrient runoff into waterways
6. Maintains or increases soil organic matter
7. Thinks beyond their own farm to the social and ecological health of their watershed
8. Minimizes the use of pesticides/fungicides
9. Reduces income volatility
10. Manages for both profitability and minimization of environmental impact
11.Has the highest yields per acre
12. Is willing to try new practices and approaches
13. Gets their crops planted first
14. Maximizes government payments
15. Has the highest profit per acre
16. Uses the latest seed and chemical technology
17. Has the most up-to-date equipment
18. Shares knowledge with other farmers
19. Keeps their fields clean
20. Avoids fall tillage
21. Is a leader in their community
22. Plans with other farmers to establish practices that will protect their watersheds
23. Shares equipment with friends and neighbors
24. Keeps fencerows clear of brush
25. Minimizes tillage
26. Is active in farm organizations
27. Makes sure their farm looks nice from the road
28. Uses cover crops between harvest and planting
29. Helps friends and neighbors with farm tasks
30. Maintains habitat for wildlife
31. Is active in their community

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