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Perspectives of Extension Agents and Farmers Toward Multifunctional Agriculture in the United States Corn Belt

Abstract

We surveyed the perspectives of farmers, crop professionals, and Extension agents and found that they have positive perspectives concerning multifunctional agriculture, including a positive effect of a nearby prairie to cropland productivity. The survey was conducted in central Iowa and included individuals predominantly from Iowa involved in commodity research and production. Our results are preliminary and provide a baseline for further research into the perspectives of change agents in the U.S. Corn Belt. They also provide insight into similarities among key links in the diffusion of innovation chain.

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Introduction

Agricultural systems in the US Midwest provide food, fiber, feed, and fuel at large scales. In addition, agriculture contributes to non-crop goods and ecosystem services, including carbon storage (Millennium Ecosystem Assessment, 2002; Jordan & Warner, 2010). However, production of row-crops is also associated with negative externalities (e.g., soil erosion and water quality impairment) (Nassauer, 2007). Fortunately, it is possible to manage farm systems for high-yielding, low-cost commodities as well as for enhanced ecosystem services, a practice commonly referred to as "multifunctional agriculture" (MFA) (Tomer, Porter, James, Boomer, Kostel, & McLellan, 2013). Specific practices of farm management can enhance or maintain on-farm productivity over time, while ameliorating negative impacts of farming, or even remove the cause of the negative impact (Boody, Vondracek, Andow, Krinke, Westra, Zimmerman, et al., 2005). Farmers in the Midwest have a positive attitude toward new conservation programs, and new conservation programs are being developed to maximize gains while minimizing disruption of current farming practices (Arbuckle 2013; Atwell, Schulte, & Westphal, 2010).

The perspectives of crop professionals and Extension personnel may influence the conversation they have with farmers about conservation programs. Making perspectives even more important is that farmers prefer to learn through personal methods such as field days, discussion, and one-on-one meetings that require effective communication (Franz, Piercy, Donaldson, Westbrook, & Richard, 2010). In order to better understand the perspectives of those involved in these conversations, we evaluated the perspectives of university Extension agents, agribusiness Extension agents (crop professionals), and farmers concerning MFA strategies. Specifically, our study was designed to ask questions that would provide a baseline understanding about how farmers, crop professionals, and Extension agents viewed the role of nature in agriculture, as well as their own role in managing natural services.

Methods

We targeted farmers, crop professionals, and Extension agents who attended outreach events around Iowa and at an annual integrated crop management (ICM) meeting. We collected perspectives from all three groups on ecosystem services in MFA. Extension agents were surveyed on the Iowa State University (ISU) campus and were ISU agronomic Extension specialists ($n = 19$, mean age = 55.7). Crop professionals and farmers who were surveyed at ICM attended a session that pertained to MFA (Session title: "Can conservation complement agriculture?"), which was led by the lead author. This session provided credit toward water quality training required for crop professionals. Crop professionals were industry representatives with credentials as certified crop advisors ($n = 96$, mean age = 42.1). Farmers were individuals who reported farm area (mean hectares = 367 ± 38 , mean ± 1 SE), or self-identified as farmers ($n = 106$, mean age = 54.1 ± 1.14), but did not report employment in seed or chemical sales. Farmers in our study were similar in age to the average age of an Iowan farmer in 2012 (55.6), but farmed larger parcels of land relative to the average corn-soybean farmer in Iowa (~207 ha, combined average area of corn and soybean farms in Iowa, 2012 Census of Agriculture). Farmers were also surveyed at soil and water management workshops in Iowa.

We surveyed all participants prior to any presentation regarding conservation, ecosystem service management, or MFA. Based on this methodology, we advise against generalization to a wider group. The data generated provides a baseline of understanding that should promote future studies of random population samples. It should be noted that all data was collected following Institutional Review Board approved protocols. Participants in each educational activity were informed of the intent of the study, asked to participate, and informed that participation was strictly voluntary and would in no way affect the credit they might receive for continued CCA credits. Participants were fully informed that all data was anonymous (no personally identifiable information was collected) and would only be reported as summary information.

The survey consisted of eight Likert scale questions with options to respond from strongly disagreeing to strongly agreeing (0 – 4), while percent lost revenue that could be recovered by government support, options were 25, 50, 75, or 100% (Table 1), and a series of demographic questions. Questions 1 and 2 were designed to evaluate the attitudes and values of farmers concerning the appropriateness of funding for agriculture. Questions 3-8 were designed to evaluate farmers' beliefs about the role of nature in agriculture and their own ability to manage for

ecosystem services. The Likert scale questions were determined to be internally reliable, with a Chronbach's alpha of 0.72 (Chronbach, 1951). This result indicates that responses on any one question tended to correlate with responses on other questions. In other words, an individual who recorded a high level of agreement on one question was likely to respond with a high level of agreement with another question. Thus, the survey asked a cohesive set of questions that generally addressed the same topic.

We collected 198 surveys from all groups. All respondents were residents of Iowa or of bordering states. (16 respondents reported working in a state other than Iowa.) Response rate varied by group, but was always greater than 75%, as we distributed approximately 250 surveys to farmers and crop professionals at meetings, and all Extension agents submitted a complete survey. We coded responses of "I don't know" or unanswered questions as missing.

All analyses were performed in R vers. 3.1 (R production team, 2014). Chi-square analyses were conducted for each question to determine if there was a significantly different pattern of responses among the three groups. Demographics were examined using ordinary least squares regression to determine if age or farm size were significantly associated with responses that showed trends.

Results

We collected responses from 106 farmers, 96 crop professionals, and 19 Extension agents employed by Iowa State University. Responses to each question are summarized in Table 1. Below we summarize the response of each question organized by three general themes; support for federal funding to agriculture and conservation, confidence with environmental concepts related to ecosystem services, and response of cropland to the inclusion of prairie.

Questions #1, #2, and #6 were related to federal funding for agriculture and conservation, and the ability of the respondents to receive these funds. Extension agents and farmers were moderately to highly supportive of federal funds to support agriculture (Table 1). Extension agents were the most supportive of federal funds to support productivity, and farmers and crop professional were the least supportive. On the question of support for federal funds to support conservation (#2), Extension agents were more supportive than crop professionals, but Extension agents tended to be more supportive than farmers. When asked if they felt confident that they could get funding to support enhancement of services and productivity (#6), farmers were more confident than Extension agents, and crop professionals were in between. When asked what percent of lost revenues for planting crop land to prairie would be recovered by government funds, respondents felt they could get about 50% of their money back.

Table 1.
Summary of Responses

		1 0%	2 25%	3 50%	4 75%	5 100%	MEAN (SD)	X ²	df	p
1. Do you support federal funds to support	Extension Agent	1	0	5	4	8	3.0(1.14)	9.70	8	0.29
	Crop	4	8	36	33	15	2.5(0.99)			

<i>agricultural productivity?</i>	Professional)			
	Farmer	7	6	37	31	24	2.6(1.1)			
2. <i>Do you support federal funds to support conservation?</i>	Extension Agent	0	0	1	5	12	3.6(0.6)	11.5	8	0.1
	Crop Professional	2	7	20	37	30	2.9(0.99)			
	Farmer	2	3	23	34	44	3.1(0.95)			
3. <i>How confident are you that you could manage habitat to provide an environmental benefit?</i>	Extension Agent	4	2	7	4	1	2.9(0.94)	10.3	8	0.2
	Crop Professional	12	26	28	14	7	2.8(1.00)			
	Farmer	9	18	37	16	16	3.0(0.89)			
4. <i>How confident are you that you could manage habitat to provide an environmental benefit AND increase agricultural productivity?</i>	Extension Agent	0	1	6	6	6	2.6(0.90)	3.83	8	0.8
	Crop Professional	2	6	28	31	28	2.5(1.08)			
	Farmer	0	5	27	37	37	2.7(0.95)			
5. <i>How comfortable with the term "ecosystem service" are you?</i>	Extension Agent	0	2	7	7	3	1.8(1.22)	8.67	8	0.3
	Crop Professional	4	14	22	35	15	1.8(1.13)			
	Farmer	0	12	30	39	25	2.1(1.18)			
6. <i>How confident are you that you could obtain funding [for]</i>	Extension Agent	5	5	4	5	0	1.5(1.17)	12.4	8	0.1
	Crop	10	26	21	21	9	1.9(1.19)	5		3

<i>habitat that provides an environmental benefit?</i>	Professional)			
	Farmer	5	28	25	24	17	2.2(1.18)			
7. <i>Imagine you've chosen to convert one acre of cropland to diverse prairie. What percent of lost productivity do you believe you could recoup with government funds?</i>	Extension Agent	1	2	4	3	0	48(25)	2.56	8	0.96
	Crop Professional	9	21	23	11	4	43(27)			
	Farmer	8	22	28	17	5	47(27)			
8. <i>What do you expect the effect of one acre of prairie on the productivity of the adjacent cropland to be?</i>	Extension Agent	0	0	6	7	5	2.9(0.80)	6.75	8	0.56
	Crop Professional	1	9	38	29	13	2.5(0.90)			
	Farmer	3	12	38	26	20	2.5(1.04)			

Questions #3, #4, and #5 were related to confidence with environmental concepts related to ecosystem services (Table 1). When asked about their ability to manage for an environmental benefit, all groups were relatively positive that they could manage a parcel of land in a way that would provide an environmental benefit. Farmers were the most confident, followed by Extension agents and crop professionals. We found similar but lower average responses when we asked about managing a parcel of land that would provide an environmental benefit and maintain high productivity. When asked about their comfort with the term "ecosystem service", respondents were less positive than in previous questions. Farmers were the most comfortable with the term, with crop professionals and Extension agents less sure. All groups showed awareness of the term "ecosystem service" by defining and giving examples of ecosystem services (Table 2).

Finally, in questions #7 and #8 we evaluated perspectives of farmers concerning the response of cropland to the inclusion of prairie (Table 1). All groups perceived a positive effect. Extension agents perceived the highest positive effect, and crop professionals and farmers each perceived a slightly less positive effect. When asked about compensation for the planting of a small prairie parcel, all three groups perceived that they could recoup slightly less than half of their productivity loss from

government funds.

We also summed responses to questions directly related to MFA management and on the same scale (Questions 2,3,4,5,6,8). When we did this, farmers had the highest score (18.28 ± 0.47 , mean $\pm 1 SE$), Extension agents were slightly lower (18.13 ± 1.08), and crop professionals had the lowest score (17.11 ± 0.50), with a neutral response on all questions resulting in a 12.00. Thus, all respondents on average reported positive attitudes toward concepts of MFA.

Table 2.

Responses about Services from Prairies (above the line) and the Definition of Ecosystem Service (below the line)

Farmers	Crop Professionals	Extension Agents
Wildlife	Wildlife	Wildlife
Soil	Soil	Soil
Water	Water	Water
Recreation and Scenic	"??"	Beneficial insects
Natural services that enhance ecosystems	Soil and Water	Improves the land/environment
Soil and Water	Natural Services	Systemic approach
Action beneficial to environment	Action beneficial to environment	Use of federal funds
Habitat	Habitat	Using non-productive land
Goods and services	Systemic approach	Service provided by an ecosystem
"??" (2% of responses)	"??" (9% of responses)	"??" (20% of responses)
Responses are listed in the order of frequency the response was given within the group "??" represent a response of either the sort of "I don't know" or question marks written as the response.		

Demographics were important determinants for some perspectives. Age was positively associated with support for government funds for conservation, while farm size ($\log(\text{acres})$) was not ($b = 0.017$, $t = 2.77$, $p = 0.006$ and $b = 0.07$, $t = 1.09$, $p = 0.279$, respectively). Familiarity with terminology was also significantly influenced by age but not farm size ($b = 0.021$, $t = 2.54$, $p = 0.012$ and $b = -0.139$, $t = 1.66$, $p = 0.099$, respectively). The area farmed had a significantly negative effect on the perceived effect of one acre of prairie on adjacent row crop agriculture, while age did not ($b = -0.168$, $t = 2.34$, $p = 0.021$ and $b = 0.008$, $t = 1.18$, $p = 0.240$). However, the

average response at the largest farm scales was still a neutral effect. None of the other questions revealed strong trends associated with demographics. Although there were significant relationships between demographic factors and several response variables, the amount of variation explained by any one was low.

Conclusion and Implications

We observed that the three groups typically involved in the communication of novel agricultural conservation strategies have multiple topics with high levels of similarity. In fact, we could find no significantly different distributions of responses. Important, our results suggest that Extension agents in Iowa who promote multifunctional agriculture to farmers will be talking to groups that on average agree with the value and feasibility of such conservation strategies. What is unclear in our study is what effect these extremely similar perspectives among groups have on the adoption of novel strategies that support MFA. For example, can Extension agents and crop professionals increase the adoption of MFA, when all three groups have similar perspectives about its effectiveness? In contrast, could more positive perspectives promote increased adoption, as long as there were sufficient similarities? Future research should evaluate the perspectives of new, potential change agents.

Farmers in our study are generally aware that farms provide ecosystem services and that multiple services can be managed within a single agricultural landscape, or that MFA is a feasible concept. They also seem to be aware of what is meant by ecosystem services (Table 2). The implication is that Extension agents and crop professionals can communicate with farmers from a point of common understanding. This knowledge will contribute to understanding how Iowa farmer perspectives may influence the acceptance of new conservation practices that support MFA. Since farmers are somewhat accepting of the idea that multiple services can be provided by agriculture and that non-crop habitat may contribute to services, conservation practices that capitalize on these beliefs may be successful. Other research supports the confidence of Extension agents in multifunctional strategies. For example, (Bentrup, Emery, D'Adamo-Damery, & Flora, 2014) found that a majority of respondents were confident that they could find opportunities and design multifunctional buffers after using a guide to such strategies.

In conclusion, the perspectives detailed in our study are an important baseline for promoting sustainable agricultural practices to farmers. We found that on average, conversations between farmers and crop professionals or Extension agents will consist of people with similar perspectives of conservation and ecosystem service management.

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