

**Who will represent societal interests as the U.S. government steps  
back from agricultural advice? Evidence from Michigan's Public  
and Private Sectors**

By  
Maaz Gardezi

A thesis submitted in partial fulfillment of the requirements for the degree of  
Master of Science from the School of Natural Resources and Environment  
at the University of Michigan

August 2014

Prof. Maria Carmen Lemos, Thesis Advisor

Prof. Don Scavia, Member of Thesis Committee

## **ABSTRACT:**

Public agencies, such as agricultural extension have traditionally played a crucial role in transferring and diffusing information on Best Management Practices (BMPs) from research universities and experiment stations to farmers. They have also been instrumental in targeting incentives to facilitate farmers' adoption of BMPs, which is critical to mitigate and prevent environmental pollution driven by agriculture. However, a reduction in these public organizations' budgets and personnel has increasingly challenged their ability of to provide conservation advice. Meanwhile increasing commercialization of farming and farmers' requirements for individually-tailored advice have cleared way for private sector advisors to fill this gap in service delivery. In this context, it is not clear who would represent broader societal interests (e.g. environmental conservation and water quality) as the U.S. government steps back from agricultural advice. This is especially true regarding the provision of conservation advice. Using a mix of qualitative and quantitative methods, this study examines the drivers and constraints to the provision of conservation advice in the state of Michigan. It focuses on the role of different types of knowledge intermediaries across the public-private divide to understand how shifting resources and roles shapes the dissemination of BMPs. It finds that overall private advisors will likely be able to fill the vacuum in service delivery of BMPs caused by a retrenchment in public sector's activities. However, their ability to do so is critically dependent on three main factors: a) private advisors' personal motivations to supply advice on BMPs, b) sustained government support for voluntary compliance programs and c) the development of a market for BMPs.

## **ACKNOWLEDGEMENTS:**

I would like to express my gratitude to my supervisor, Prof. Maria Carmen Lemos, whose expertise, understanding, and patience, added considerably to my graduate experience. I appreciate her vast knowledge and skill in areas of environmental governance and social and human dimensions of environment. It was under her tutelage that I developed a focus and became interested in the field of environmental governance. She provided me with direction, technical support and became more of a mentor and friend, than a professor. I would also like to thank Prof. Don Scavia for taking time out from his busy schedule to serve as my external reader and member of my thesis committee. I sincerely acknowledge his suggestions for, and provision of the materials evaluated in this study.

Thanks also goes out to Dr. Yun-Jia Lo who provided me with statistical advice at times of critical need. I would also like to thank my friends in the Useful to Usable group, particularly Dr. Amber Saylor Mase, Jean McGuire & Dr. Nicolas Babin for our exchanges of knowledge, which helped enrich the experience.

I would also like to thank my family for the support they provided me through my entire life and in particular, I must acknowledge my wife and best friend, Hina, without whose love, encouragement and support, I would not have finished this thesis.

# Table of Contents

<b>Introduction</b> .....	<b>5</b>
<b>Literature Review</b> .....	<b>7</b>
<b>Research Methods &amp; Analytical Framework</b> .....	<b>10</b>
Analytical Framework.....	10
Research Methods .....	11
Quantitative Data & Descriptive Statistics.....	13
<b>Results &amp; Discussion</b> .....	<b>15</b>
Organizational responsibility to provide advice on BMPs amidst financial cutbacks .....	15
Beliefs & attitudes regarding conservation farming. Are they significant drivers of behavior? .....	16
Significant driver of behavior: market for BMPs.....	17
Negative interplay with other advice: a distraction for firms .....	19
Supply driven demand for advice on BMPs?.....	13
<b>Public Private Synergy</b> .....	<b>22</b>
<b>Conclusion</b> .....	<b>26</b>
<b>Annex</b> .....	<b>28</b>
<b>Bibliography</b> .....	<b>29</b>

## 1. INTRODUCTION:

Corn is Michigan's second largest crop commodity. Corn production is also a significant driver of nonpoint source pollution loads in Michigan and elsewhere in the U.S. Agricultural best-management practices (BMPs), also known as conservation practices, can potentially mitigate nonpoint source pollution from agricultural lands and valuably contribute to ecosystem services (Daloglu, 2013; Reimer et al., 2012). These BMPs have already achieved some success in reducing soil, water and wind erosion. For example, since 1982, soil erosion (both wind and water) on agricultural lands has decreased by an estimated 43% (USDA NRCS 2009). Despite this reduction in soil erosion, significant concerns persist regarding deteriorating soil and water-quality, with incidence of hypoxia and eutrophication surfacing as a persistent environmental challenge for policy makers and practitioners (Michalak et al., 2013). These challenges place extra responsibility on existing publicly funded knowledge systems for decision support in the agricultural sector. Public agencies, such as Extension, the Natural Resource Conservation Service (NRCS) and the Conservation District in Michigan have traditionally played a crucial role in transferring and diffusing information on BMPs from research universities and experiment stations to farmers and have targeted incentives to facilitate farmers' adoption of BMPs and related technologies (Prokopy et al., 2013; Rogers, 1968; Wolf, 1998). However, a reduction in these public organizations' budgets (McDowell, 2004; Serenari et al., 2013; West et al. 2009), coupled with commercialization of farming and farmers' requirements for individually-tailored advice have cleared way for private sector advisors to fill this gap in service delivery (Ginder, 1992; Haigh et al. 201x; Prokopy et al., 2013; Wolf, 1995; Wolf et al., 1995). Additionally, over time, extension has become less important for farmers' soil conservation decisions (Prokopy et al., in review; Pompelli et al., 1995; Tucker & Napier, 2002). While a handful of studies stress that as the government steps back from agricultural advice, the private sector will step in to provide agricultural advice for the larger interests of society (Boehlje, 1998), it is not clear how broader societal interests (e.g. environmental conservation and water quality) would be affected by this shift. This is especially true regarding the provision of conservation advice.

This paper explores how institutional change in the sector of agricultural advice is likely to shape the future of conservation advice, more especially that concerning BMPs. As mentioned above, traditionally, public agencies such as extension have played an important role in linking

science to decision making by transferring and diffusing information, practices and technologies from research to users. Funded through a federal, state and local government fiscal arrangement, these advisors have supported growers' on-farm management needs as well as provided advice on BMPs that allows farmers to protect ecosystems across a landscape more widespread than their farm. Such publicly funded advice is free to growers, with an overall aim of improving public welfare. Private advisors, in turn provide different types of advice (financial, agronomic, marketing, conservation) primarily to earn income and make profit (Changnon, 2004, also see Boehlje, 1998; Haigh et al., in review; Wolf et al., 2001). Profit is however only one of many drivers for the kind of advice they provide. For instance, growing public concerns about the acceleration of negative impacts of conventional agricultural practices and advisors' own perception of the potential economic, environmental and social benefits of implementing BMPs has meant that private advisors' could be motivated to provide this kind of advice even if they cannot directly profit from it.

Understanding how motivations and institutional/organizational factors affect specific behavior is particularly important to unpack advisors' willingness to provide advice on BMPs, amidst growing concern about the acceleration of negative impacts of existing agricultural practices and potential threats to the sustainability of current processes of public provision of agricultural knowledge. We argue that advisors' willingness and ability to produce and deliver conservation farming depends on three sets of variables: a) how organizational structure and moral obligations shape advisors' profile as providers of conservation farming advice; b).how their attitudes, beliefs and behavior influence their perception toward possible environmental benefits of conservation farming; and c) whether and how the existence of a market shapes their ability (or inability) to provide advice related to conservation farming. On the one hand, we hypothesize that a reduction in public advisors' organizations budget will jeopardize their ability to provide conservation farming advice. On the other hand, private advisors with an established clientele are more likely to provide advice on BMPs, as long as it does not negatively interplay with the other types of advice that they provide.

In Section 1, we present a review of the related literature and discuss the shortcomings from the literature for understanding the role of private and public advisors in provisioning advice regarding best management practices. We borrow from social psychology theories of behavior, particularly the theory of reasoned action and the theory of planned behavior, in the

hope of creating a foundation for understanding advisors' motivations. Next, we present our study rationale & methodological procedures (Section 3), along with description of our survey data on advisors in Michigan. Section 4 provides results of our qualitative analysis and the implications of our findings for the literature. In Section 5, we look at the changing roles of the state and the market and potential synergy between the two sectors. Finally, Section 6 concludes the study and presents its limitations along with suggestions for future research.

## **2. LITERATURE REVIEW**

A number of studies have shown several factors to influence crop advisors' willingness to supply advice on BMPs. For example, some scholars suggest that advisors' willingness to provide advice on BMPs is contingent on their ability to gain knowledge, skills and resources necessary for provisioning this advice (Klerkx, 2010) and being able to foster partnerships within their social networks (Engel, 1995). Research also suggests that advice on BMPs is generally more complex and knowledge-intensive to supply, as compared with conventional farming practices. Hence, crop advisors need to spend more time and resources learning and disseminating advice on BMPs to farmers (Ingram, 2008; Laurent et al., 2006; Roling et al., 1994). Previous research also differentiates between public and private sector advisors' role in disseminating advice on BMPs. Public agencies such as extension have traditionally been at the forefront of providing farmers' information on farm management skills, marketing strategies and natural resource management such as BMPs (USDA, 2014). Funded through a federal, state and local government fiscal arrangement, these agencies have traditionally supported both growers' on-farm management needs and advice on BMPs to protect ecosystems across a landscape more widespread than their farm.

BMPs are highly effective practices to enhance the use of agricultural resources, through integrated management of the resource base i.e. soil, water and biological resources (Knowler et al., 2007; Garcia-Torres et al., 2003; NRC, 2010). BMPs can mitigate nonpoint source pollution from agricultural lands and valuably contribute to ecosystem services (Reimer et al., 2012; Daloglu, 2013). Some commonly used BMPs are zero or minimum tillage, cover crops, integrated pest management, nutrient management and varied crop rotation. By promoting such practices, soil erosion and land and water pollution is reduced, the long term dependence on

external inputs is minimized, and environmental management is improved (FAO, 2001; NRC, 2010). There is strong empirical evidence that federal and state agricultural policies and programs have influenced farmers' choice of farm management practices, including adoption of BMPs (Daloglu, 2013; Lehrer, 2013); Prokopy et al., 2008). For instance, the 1985 Farm Bill introduced land retirement programs, such as the Conservation Reserve Program (CRP) and Wetland Reserve Program (WRP) that offered farmers 10 to 15-year payment contracts to plant erosion-prone lands to trees and grasses. As a result, farmers' were able to reduce their labor and time requirements by supplementing their income with state funded financial assistance (Lambert et al. 2007). Successive Farm Bills enacted in the last two decades have also introduced metrics for achieving best possible environmental management. For example, Michigan Agriculture Environmental Assurance Program (MAEAP) and the Environmental Quality Incentive Program (EQIP) are encouraging farmers to follow highest environmental standards in crop production by incentivizing management practices that otherwise risk-averse farmers would be hesitant to adopt (Bosch and Pease, 2000; Daloglu, 2013).

Research focusing on how beliefs and attitudes affect behavior can help us understand the role private advisors may play in disseminating BMPs. Two prevalent approaches in this literature to explain human behavior in decision making are the theory of reasoned action and the theory of planned behavior. Both these theories are based on the assumption that all decision makers are rational individuals, who weigh the pros and cons of their behavior prior to engaging (or not) in a behavior (Ajzen et al., 1980; Madden et al., 1992). In reasoned action, both individuals' attitude and norms regarding a specific behavior influence the likelihood of them performing that behavior or not. For example, Holmes (2003) found that pro-environmental attitudes and beliefs regarding benefits of protected areas strongly influenced afforestation behavior of western Tanzanians. In another study Naess (2013) found that Tanzanian farmers' personal observations about changing rainfall patterns and more frequent droughts were more effective in influencing their decision to switch from a traditional but water-thirsty crop (*lugugu*) than a government ban. How individuals perceive other important individuals and groups' consideration of their behavior is also important in shaping their subjective norms (Ajzen et al., 1980; John et al., 2011). These norms that distinguish between acceptable and unacceptable behaviors have evolved from socio-cultural codes and given rise to social practices that guide the interaction of individuals in societies. Ostrom (2008; 2010) highlights the importance of what



she labels ‘rules-in-use’, which are the general dos and don’ts one learns on the ground but might not exist in written form. These rules, norms and practices guide individuals’ behavior.

Going beyond reasoned action, the theory of planned behavior incorporates individuals’ “perceived behavioral control” (Ajzen, 2002), which is dependent on the existence and ownership of resources--such as skills, time, and money--required to engage in any given behavior. It also refers to individuals’ perception that these resources may (or may not) facilitate and support their behavior. Through the years, scholars have added and studied different variables affecting planned behavior including self-efficacy or the strength of one’s belief in one’s own ability (Armitage et al., 1999) and moral obligation (Gorsuch, et al., 1983; Manstead, 2000). Moral obligation, which demonstrates an individual’s “moral correctness” (John et al., 2011) has been extensively researched in understanding individuals’ pro-environmental behaviors (see for example, work by Tonglet et al. (2004) in understanding people’s behavior for participating in recycling activities, Lam’s (1999) work on behavior regarding water conservation and Zubair et al.’s (2006) research on farm level forest conservation behavior in Pakistan. See also John et al., 2011 extensive review of this literature).

On related research, scholarship focusing on agricultural advisors’ motivation to uptake climate information has shown that both individual/organizational and market factors influences crop advisors willingness to provide climate advice to their clients (Lemos et al., forthcoming, Haigh et al. in review). Hence, advisors are motivated to uptake and disseminate climate information because of both their personal beliefs regarding climate change (Lemos et al., forthcoming) as well as their ability to profit from supplying this information (Haigh et al., in review). Interestingly, crop advisors are willing to provide this information as long as it does not conflict with their business (Lemos et al, forthcoming; Haigh et al., in review). Yet, these findings highlight that advisors can still be motivated to provide climate information, even if there isn’t a market or demand for it.

### 3. Research Methods and Analytical Framework

#### *Analytical Framework*

The study has two main goals. First, we seek to understand whether private sector will be able to fill the vacuum in service delivery of BMPs caused by a retrenchment in public sector's activities. Second, we search for conditions that improve public-private sector synergy and thus potentially improve policy effectiveness and service delivery regarding advice on BMPs. To achieve these goals we explore the following hypotheses:

**Hypothesis 1:** Even if motivated by societal interests to provide conservation advice, public advisors' ability to do so is critically limited by the level of resources (organizational budget, human resources and institutional incentive) that is available to them.

**Hypothesis 2:** If private advisor's see their prosperity linked with improving societal outcomes, including viewing provision of advice on BMPs as an ethical responsibility, then they would be more inclined to provide this type of advice, regardless of a reduction in their profit.

**Hypothesis 3:** If there exists a market for conservation advice then private advisors will be motivated to provide this advice.

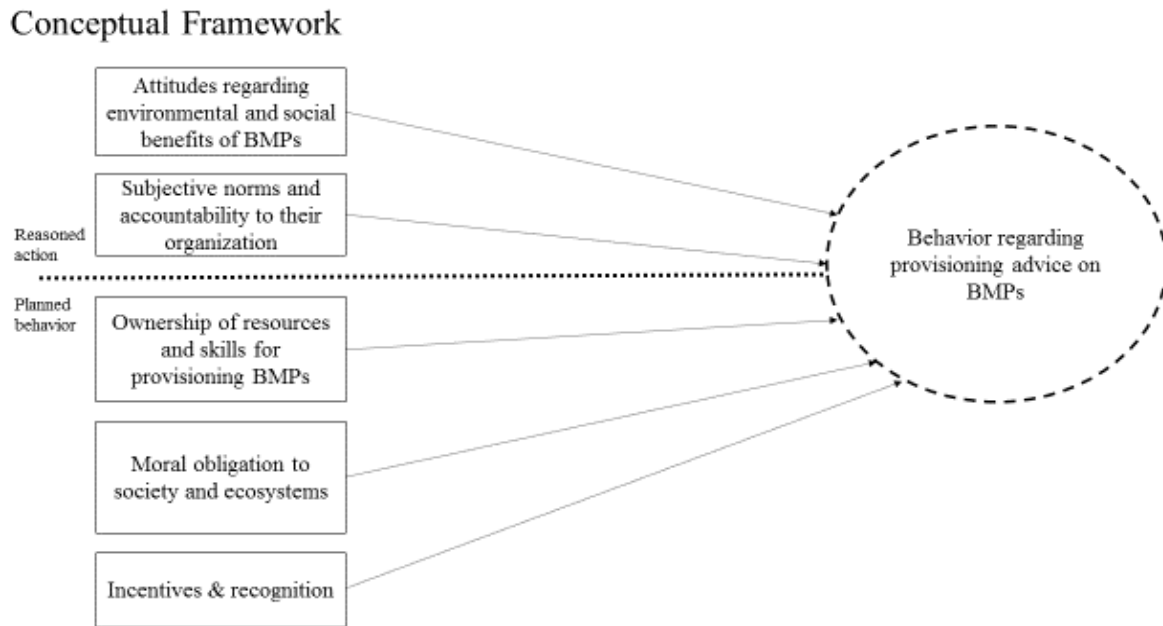
**Hypothesis 4:** If there is no market for conservation advice, but private advisors believe that this advice is useful for farmers, then they will be willing to provide this advice, as long as it doesn't negatively interplay with other types of advice (agronomic, financial).

**Hypothesis 5:** If there is no market for conservation advice, but private advisors believe that they have nurtured a strong relationship with their client, then they will be willing to provide this advice, as long as it doesn't risk spoiling their relationship.

The main questions and hypotheses of this study are fundamentally concerned with understanding advisors' beliefs and attitudes regarding BMPs and its role in driving their behavior to provide advice on BMPs. We draw a conceptual framework (Figure 1) to explain different factors that could drive advisors' behavior to disseminate advice on BMPs. Both advisors' attitude and norms regarding BMPs may influence the likelihood of them providing this type of advice. Pro-environmental attitudes and beliefs regarding benefits of BMPs could

influence their motivation to supply advice to farmers. Advisors may also perceive their organizations' mission and goals (subjective norms) to shape and guide their behavior to provision advice on BMPs. shaping their subjective norms (Ajzen et al., 1980; John et al., 2011). In addition, existence and ownership of resources--such as skills, time, and money--required to learn and disseminate information on BMPs is a driver for advisors' to provision advice on BMPs.

**Figure 1:** Conceptual Framework



*(b) Research methods*

This work combines quantitative and qualitative methods to study relationships between private and public advisor's personal characteristics, beliefs, motivations and other resources that influence their willingness and ability to supply BMPs. By employing mixed methods, we aim at combining philosophical arguments, viewpoints and data types to expand the scope of our analysis (Johnson et al 2006; Creswell et al., 2013). We use descriptive statistics to characterize private and public advisors' demographics, organizational resources and motivations for providing advice on BMPs. In addition, we use qualitative methods to shed light on information either not covered by the survey questionnaire or not solely explained by numbers. Therefore, we

use qualitative data to complement and further validate the quantitative survey results to analyze how and why advisors make the decision to provide advice on BMPs.

Data for the analysis come from two sources. Over 2000 technical specialists who advise corn producers in four states in the Midwestern United States responded to an electronic survey in the spring of 2013 (response rate ~ 22%). Of those, two hundred and fifty one advisors were from Michigan. From the MI sample, we selected 153 respondents who stated that they provided conservation related advice to corn farmers. These included both private and public sector advisors. For example, there were 54 private sector's certified crop advisors (CCA) and 67 public advisors from Extension, Natural Resource Conservation Service (NRCS) and Conservation District (CD). These organizations, in varying degrees and roles, are at the forefront of providing Michigan corn farmers' advice relating to conservation farming practices. The advisors answered a detailed questionnaire that highlighted their experience with seeking information and providing different types of advice, such as agronomic, conservation, financial and climate change related advice. Respondents reported their personal characteristics, perception of concerns regarding agronomic and environmental matters and organizational support for seeking new knowledge and pursuing collaborations. The survey questions and a few selected variables of interest to this study are included in Appendix 1 and Table 1, respectively.

We draw on qualitative data from key informant interviews. We conducted ten interviews in corn-producing counties in Michigan. Interview subjects were chosen from our survey data, based on their organizational role as a public or a private entity and according to whether they provided farmer's advice on conservation farming practices or not. In order to get a balanced account, we interviewed equal number of private and public sector respondents and varied them across different years of work experience, age, education and other personal income/wealth characteristics. For both private and public advisors we used a standardized interview questionnaire with only minor adjustments to our questionnaire across the two groups. We used NVivo 10 for Windows for coding qualitative data from our interviews. Advisors' personal attitudes, beliefs, behavior, organizational culture, and resources regarding knowledge acquisition and BMP advice dissemination to farmers formed basis for coding interviews. We

stopped the interview process when we reached a point of saturation in terms<sup>1</sup> of no new information.<sup>1</sup>

*(c) Quantitative Data and Descriptive Statistics:*

Our quantitative data sample includes 54 private advisors and 67 public advisors from Michigan. Table 1 shows all variables of interest, along with their Pearson Chi-square statistical significance value. Chi-square results show independence between the category of advisors (private and public) and the variable in question. All variables marked with an asterisk indicate that there is a statistically significant relationship between advisor types (public/private) and that variable. We use this data to provide an overview of private and public advisors' personal and organizational characteristics. According to our sample, private advisors are on average older and less educated than public advisors. They own fewer farms, but their farm sizes are generally larger than farms owned by public advisors. Private advisors are serving their clients across greater geographical distances. For example, 66.7% of the private advisors provide advice across multiple counties, compared with 49.3% public advisors. Compared to public advisors, private advisors are predominant providers of advice on agronomic farming practices. The opposite is true when observing provision of conservation advice across these two groups. While 46.3% of private advisors provide advice on BMPs, a much larger percentage of public advisors are providing this advice (80.9%). The data suggests that public advisors are primarily responsible for provisioning advice on BMPs.

Concerns regarding soil erosion and nutrient loss differ significantly between public and private advisors. Table 1 shows that while both advisor groups may be equally concerned regarding weeds, insects and disease, their regard concerning other environmental issues, such as soil and nutrient loss differ drastically with public advisors considerably more concerned than the private advisors. In addition, there are also significant differences between public and private advisors resolve to make recommendations regarding BMPs. Compared to private advisors, conservation farming practices such as reduced nitrogen application, cover crops and no till are highly recommended by public advisors. On the flip side, greater percentages of private advisors are still recommending conventional tillage practices.

---

<sup>1</sup> Following standard IRB guidelines, we do not disclose advisors or their organizations' names during our analysis and only provide an anonymous description of interesting texts and comments found in these interviews.

**Table 1: Descriptive Statistics**

<b>Descriptive Statistics of Advisor Related Variables</b>	<b>Private Advisors N = 54</b>	<b>Public Advisors N = 67</b>	<b>chi-square (p-value)</b>	
<i>Advisor Demographic</i>				
<i>Age</i>				
25 - 45 years (%)	25.0	48.4	0.035	**
46 years and above (%)	75.0	51.6	0.035	**
<i>Education</i>				
2 year college/technical degree of lower (%)	37.0	5.9	0.000	***
4 year college degree or higher (%)	63.0	94.1		
<i>Own Farmland (%)</i>				
29.6		43.3	0.122	
<i>Acres Owned</i>				
0-500 Acres (%)	68.8	79.3	0.430	
501-3000 Acres (%)	31.3	20.7		
<i>Area of Service</i>				
County (%)	3.7	31.3		
Multi-County (%)	66.7	49.3		
State (%)	13.0	11.9		
Multi-State (%)	16.7	7.5		
<i>Advisors' Concentration</i>				
Provides Agronomic Advice to Corn Producers (%)	98.1	47.1	0.000	***
Provides Conservation Advice to Corn Producers (%)	46.3	80.9	0.000	***
Provides Advice on Government Programs to Corn Producers (%)	3.7	58.8	0.000	***
<i>Advisors' farm-level concerns</i>				
Concerned about weeds (%)	67.9	57.4	0.235	
Concerned about insects (%)	54.7	54.4	0.973	
Concerned about disease (%)	43.4	48.5	0.574	
Concerned about nutrient loss (%)	34.0	61.8	0.002	***
Concerned about soil erosion (%)	35.8	77.6	0.000	***
<i>Advisors' Recommendations to Farmers</i>				
Recommended Reduce Nitrogen Application (%)	9.3	19.1	0.127	
Recommended Cover Crops (%)	55.6	80.9	0.003	***
Recommended No Till (%)	35.2	63.2	0.002	***
Recommended Tillage (%)	31.5	14.7	0.027	***
<i>Intersectoral Relationships</i>				
Trust Extension (%)	50.0	86.6	0.000	***
Trust Agribusiness (%)	49.1	32.4	0.062	*
<i>Organizational Support</i>				
for seeking new information	90.6	85.3	0.383	
for collaborating when seeking new information	87.0	92.6	0.301	
* significant at the 90% level				
** significant at the 95% level				
*** significant at the 99% level				

#### 4. RESULTS & DISCUSSION

##### *(a) Organizational responsibility to provide advice on BMPs amidst financial cutbacks.*

From our key informant interviews, we find that public advisors overarching responsibility toward supporting their organizational mission regarding soil & water conservation and environmental stewardship strongly drives their motivations to supply this advice. These findings are generally consistent with literature documenting public advisors foremost responsibility to invest in information to support advice on matters concerning public well-being (Boehlje, 1998; Womack, 2002). For example, one public advisor remarked regarding their public service mission to furnish advice on BMPs:

*We do these programs (supporting BMPs) to help protect natural resources within state. We're here to help the producer, you know (Interview 7).*

Similarly, another public advisor commented:

*It's what I live for. It's been my passion for 30 years and I find it very important (Interview 5).*

And another public advisor remarked:

*It's going to help them (farmers), help their kids, their grandchildren. Nobody wants bad water; nobody wants their fields to blow away important soil. I think if you don't tell them that they're doing things wrong, sit down and educate them, and then you are not doing your job properly (Interview 7).*

However, a public advisor, whose organization is currently undergoing a sustained budgetary cut back, remarked:

*In terms of financial support, what has changed is that we don't not have much cost share available for them (farmers) to implement the practice. (Interview 7).*

And another interviewee suggested that:

*Yes, the overall support (organizational) has gone down. As a result, we are still expected to provide the same meetings, field days, tours etc. as before. We just have less personnel available to do the job (Interview 5).*

These quotes suggest that a reduction in public sectors' budget is impacting not only state funded cost share programs but also hampering their ability to reach a wider clientele. In this context, public advisors' organizational responsibility and mission to serve public might not be strong enough to overcome a drastic decrease in resources. Even if advisors believe in their mission, lack of basic resources such as personnel and financial support for program implementation may represent a hard limit in their ability to continue to provide conservation advice.

***(b) Beliefs & attitudes regarding conservation farming. Are they significant drivers of behavior?***

From our qualitative data, all of the advisors interviewed believed in the environmental benefits of BMPs (See Table 2). For example, one private advisor stated:

*My own farm is probably about 4 miles as crow flies from great lakes, so conservation farming practices are really important to me, because any soil or inputs that leaves my farm leads to the Great lakes (Interview 10).*

Similarly, another private advisor remarked:

*Conservation has always been important for me. To give you a real life example, I have a small farm myself as well. I am going through a Michigan Agriculture Environmental Assurance Program (MAEAP) verification process on my farm right now. I've already taken the farm assist program and am in the process of installing different conservation practices on my own farm. I hope within the next year that my farm will be certified (Interview 1).*

However, the same advisor commented:

*I rarely recommend BMPs. I only try and provide growers with parameters to allow them to make part of their own farm management decisions. So I don't make conservation related decisions for them - I only give them information that helps them make decisions.*



The data above illustrates that while private advisors’ personally believe in the benefits of BMPs, these beliefs do not strongly influence their behavior to supply advice on BMPs. Therefore, to understand advisors’ behavior, it may be useful to look beyond private advisors’ pro-environmental beliefs and uncover other drivers of behavior.

**Table 2:** Metrics for evaluating advisors’ motivation for supplying advice on BMPs

<b>Why do you provide conservation farming advice?</b>		
	<b>Public Advisors (% Respondents)</b>	<b>Private Advisors (% Respondents)</b>
Complying with government regulation	95%	75%
Environmental benefits	85%	60%
Fulfilling your organizational goal	95%	35%
Fee	0%	80%
Selling own product	0%	90%
Free information/public good	100%	20%
Financial viability of your organization	85%	95%

***(c) Significant driver of behavior: market for BMPs***

Previous research has shown that private advisors are less likely to spend their resources to obtain information to support public welfare, unless they can sell their products, charge a fee for advice and/or earn a profit for their organization (Boehlje, 1998; Tonya et al., 201X; Womack, 2002). Interestingly, the data suggests that private advisors will source information and provision advice regarding BMPs, if they see a market for this advice. Our results also show that private advisors see an expanding demand (market) for BMPs as an opportunity to couple their

organizational goal of achieving profitability with their personal beliefs regarding reducing environmental degradation through BMPs. For example, one private advisor commented:

*I like to push cover crops (BMP), just because they are great benefit to soil and its another avenue, another part of the market that we can be involved in, which has been fastest growing in the last three years, in terms of new things, they are not necessarily new, but people are just using them more often now (Interview 10).*

Several possible mechanisms could account for the creation or expansion of a market for BMPs. The data highlights that private advisors are strong supporters of voluntary compliance programs, such as the Michigan Agriculture Environmental Assurance Program (MAEAP) and the Environmental Quality Incentive Program (EQIP), as it allows their clients (farmers) to reduce their production risks from adopting new BMPs. For example, a private advisor, who is a strong proponent of state run voluntary compliance programs, remarked:

*The government, I know has a few programs that have helped a lot (in creating a demand for BMPs). Because anything that cost the farmer money, he's going to be apprehensive to do that, until he sees the benefits. And the success of state voluntary programs that have cost-shared cover crops (BMPs) and grassed waterways (BMPs) shows that you have to help farmers, you have to give him first before he sees a real benefit (Interview 10).*

In addition to government funded voluntary programs, both environmentally aware farmers and consumers are driving farmers to seek advice on BMPs. For example, a private advisor commented:

*I think farmers have definitely seen the benefits of cover crops more and more now than they have ever had before. Because they can now use fewer inputs, it's a way to cut down on these inputs (Interview 10).*

Another private advisor remarked:

*I think here in Michigan at least, there is a strong trend for growers especially in the area of cover crops, just trying to improve soil health by implementing the use of cover crops and so yeah to me it is an exciting trend because when I started 3 years ago and we*

*had fairly high adaption of cover crops and we went away from it and now we're coming back into it (Interview 4).*

Based on advisors' responses, our results provide evidence for three factors that are motivating private advisors' to provision advice on BMPs: (1) state funded voluntary compliance programs, (2) increasing consumer awareness regarding environmental degradation caused by intensive food production practices, and (3) more environmentally aware and environmentally supportive farmers.

***(d) Negative interplay with other advice: a distraction for firms***

In addition to private advisors personal beliefs and existence of a market for BMPs, we asked respondents whether there were times when they had to retract from supplying advice on BMPs because it conflicted with their organizational goal of selling inputs. While exploratory, our results suggest that for private advisors, an explicit conflict exist between supplying advice on BMPs and selling their organization's products. For example, one private advisor stated:

*Business sells product, and conservation - another definition is using less. So there is always a conflict there. For example, if you're talking about things like buffer strips (BMP). If you want to put buffer strips on two acres of your land. So now you have 8 acres instead of 10 acres. For us that is two acres less that we're selling a product for (Interview 3).*

Interestingly, this same advisor in our survey showed "concern" regarding soil erosion and nutrient loss. This data point highlights that awareness regarding environmental concerns may not always influence private advisors' behavior to provision advice on sustainable farming practice. .

***(e) Supply driven demand for advice on BMPs?***

Public and private advisors prescribe BMPs as experts of agricultural knowledge (Klerkx, 2008). Our data reveals that advisors will be more willing to prescribe and "push" for BMPs when they either do not risk losing their clientele or have established trust with their clients. For example, one private advisor commented:

*Its touchy thing and place to tread lightly (advice on BMPs) because it depends: you have to know the guy first before you say something. You may see their fields, creeping a*

*little close to a water way, you got to tread lightly and try to set a tone that they're doing something wrong. It's a lot of subtle suggestions as we want to maintain a good relationship. And you can't do that if you're accusing them (Interview 3).*

Similarly, a public advisor commented:

*Sometimes that's very difficult one (bringing BMPs into conversations with farmers). We're pretty public friendly organization. My success is being able to establish rapport with most of the farmers. Sometimes you're more successful with one than another. Once you've established some trust and you can reach out and have more one-on-one types of communication - you have a tendency to go further. (Interview 5).*

Our analysis suggests that if there isn't a market or demand for BMPs, both public and private advisors' willingness to supply advice on BMPs, will be conditional on, inter alia, whether they have already nurtured a strong relationships with their client.

**Table 3.** Results: Private and Public Advisors' Motivation & Impact on BMPs Advice

Public Sector Advisors		Private Sector Advisors			
<b>Situation</b>	Budget reduced for public advisory sector.	There is a market for BMPs related advice.	Negative interplay of advice on BMPs with other advice provided.	Absence of a market/demand for BMPs	
<b>Impact on Advisors</b>	i. Reduced state funding for cost-sharing conservation programs makes it difficult for advisors to convince farmers to adopt BMPs. ii. Less service personnel leads to reduced ability of advisors to reach a wider clientele.	i. State funded voluntary conservation programs drive farmers' willingness to demand advice on BMPs (creates demand for BMPs)	i. Supplying advice on BMPs conflicts with advisors' ability to sell their firm's agricultural inputs and make profit.	i. No demand for BMPs from either farmers or consumers.	
		ii. More consumer are becoming aware of the negative environmental impacts of intensive farming practices (creates demand for BMPs)			
		iii. Farmers are becoming more environmentally aware (creates demand for BMPs).			
<b>Motivation to supply advice on BMPs</b>  (Lighter shaded cells = Weaker Motivation, Darker cells = stronger motivation)	i. Organizational responsibility to support BMPs.	i. Coupling organizational goal of profitability & personal beliefs about the benefit of BMPs.	i. Profit	i. Lower level of trust established between farmers and advisors.	i. Higher level of trust established between farmers and advisors.
			ii. Awareness regarding environmental benefits.		ii. Personal beliefs regarding environmental benefits of BMPs.
					iii. Advice on BMPs does not negatively impact ability to sell firms' products and make profits.
<b>Impact – Provision of Advice on BMPs</b>	↓	↑	↓	↓	↑

The purpose of this study was to explore whether advisors' beliefs and attitudes regarding conservation farming and environmental benefits of BMPs also influenced their behavior to provide farmers with advice on BMPs, or if other factors influenced their behavior, such as an existence of a market for advice on BMPs. We can draw three preliminary conclusions. Table 3 illustrates a synopsis of these results. First, it shows that reduced budget for public advisors will hamper their ability to effectively provision advice on BMPs. According to our analysis, a constrained budget for cost-sharing state-funded conservation programs and overall reduced size of workforce are demotivating public advisors. As a result, in the backdrop of dwindling financial support, their perception of being a member of a public organization and thus their responsibility to deliver advice on BMPs is not significantly driving them to supply this advice (light grey shaded cell). Second, the results highlight that policy makers should not assume that private advisors' personal views regarding environmental benefits of BMPs or awareness about negative impacts of intensive farming will strongly influence their behavior regarding BMPs.

Instead, an existence of demand for BMPs will highly motivate (dark grey shaded cell) private advisors as it enables them to earn profit. Third, state funded voluntary programs have helped in creating a demand for farmers to adopt BMPs. These programs significantly drive private advisors' motivation to supply advice on BMPs. Overall, our analysis suggests that profit is the strongest driver of private advisors' to supply advice on BMPs. Factors that hamper their ability to earn profit, will create a disincentive for them to provide advice on BMPs. Our results illustrate that as government steps back from directly provisioning advice on BMPs, they may focus on policies that create an enabling environment for farmers to demand BMPs on their land. This market would ensure the continuity of provision of BMPs by the private sector.

## **5. PUBLIC-PRIVATE SECTOR SYNERGY**

A major defining attribute of modern environmental governance is the increased role of market-based actors and instruments and a reduced role of the state and its agencies (Evans, 1995; Ostrom 1996, 2010; Lemos and Agrawal, 2006). Traditionally, agricultural information – provided freely by the state - has been critical for transferring new technology and innovation (Rogers, 1968), increasing productivity and farm income as well as resolving complex environmental problems, such as the development and application of advice on conservation farming practices to reverse detrimental human impacts on ecosystems (Daloglu, 2013). Recently, dynamic changes in agricultural advice are fostering hybrid forms of collaborations and dependencies across the public-private divide (Wolf et al., 2001; Haigh et al., in review; Lemos et al., in review). According to Wolf et al. (1998), “the state versus the market” or the “private versus public” are obsolete divisions as these compartmentalize advisors into categories that are neither comprehensive nor mutually exclusive (Wolf et al., 1998). Instead, both the public and the private sector advisors, with diverse values and motivations, are asymmetrically relying on each other's' resources and networks, to provision different types of advice to farmers (See for example Wolf et al., 2001; Haigh et al., in review; Lemos et al., in review for climate change related advice). While this hybridity can lead to beneficial outcomes, it is dependent on conditions that feed collaborations across the public-private divide (Lemos and Agrawal 2006; Evans, 1996). In the hybrid governance framework (Lemos and Agrawal, 2006), the division of work between the public and private sectors is predicated on many of the tasks that each sectors

is likely to perform better (e.g. meeting societal interests (public) vs. efficiency (private)) as well as on the potential complementarity between their roles (e.g. enacting regulation (public) vs. setting a market place to implement these regulations in a cost-effective manner (private)). We argue that synergistic relationships across public-private divide can lead to improved service delivery and policy effectiveness of BMPs, provided that trust, interdependence and complementarity exists between public and private sector advisors (Lemos and Agrawal 2006; Evans, 1996).

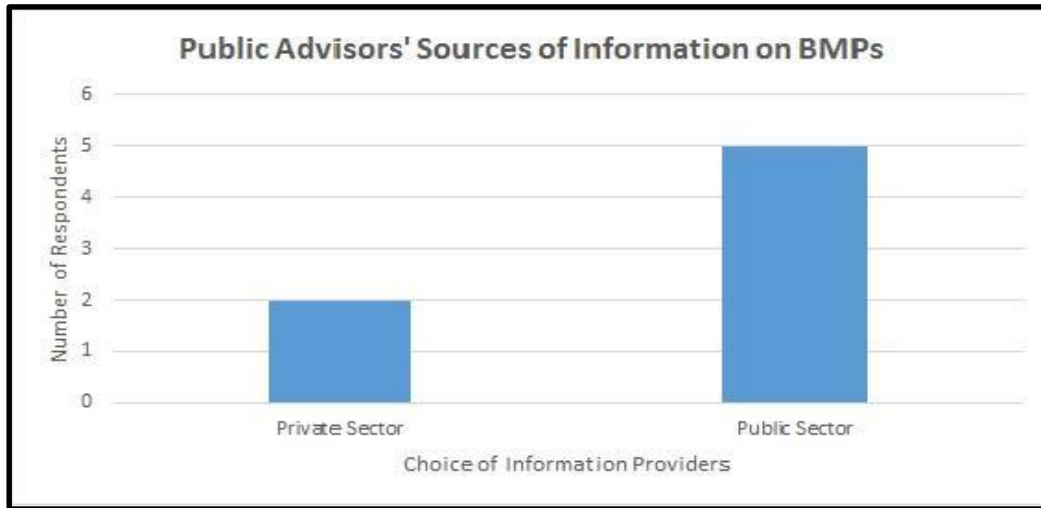
Like others (Tonya et al., in review, Wolf et al., 1998), the data here supports the view that while the private advisors overwhelmingly rely on public sector for their information, the latter are less likely to obtain their information from the private sector than they are from the public sector. For example, Figure 2.1. Illustrates the number of public advisor respondents who obtained their information on BMPs from both private and public sector. The graph depicts that public advisors' predominantly sourced this information from the public sector. On the other hand, Figure 2.2 illustrates that private advisors in our sample principally relied on public advisors for their information on BMPs. The following quote also show a private advisor's remarks regarding usefulness of collaborations between his firms and a major land grant university:

*We're working with a University (name undisclosed) and we're putting together some training modules with them right now. We had a conference call with them last week, and 4-5 individuals from our firm along with a team from the University were putting together soil conservation modules, such as soil health, cover crops and trying to help our sales staff being better educated in that area. I am excited about our collaborative project with the University (Interview 4).*

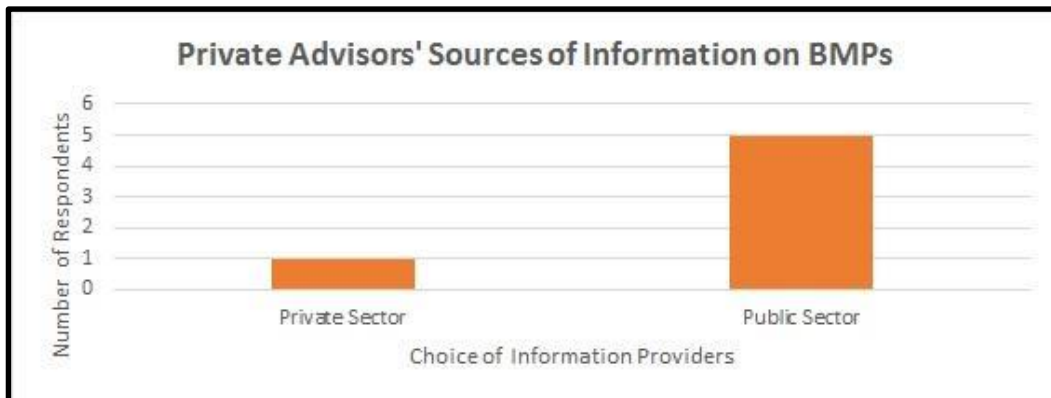
Clearly, private advisors derive significant value from bridging cross sector partnerships. These findings are generally consistent with a relative large body of literature documenting the significance of social networks in improving decision makers' ability to incorporate new knowledge in ways that add value to their own role within the network (Mintrom et al.; Valente et al., 1995; Kalafatis et al. in preparation). For example, one private advisor commented on the benefits accrued from such collaborations:

*These partnerships are important because they enable us to tap into their (public sectors) resources and develop our expertise in educating farmers. Farmers' education is traditionally their strength and so we're tapping into their resources. To me, this is a complemented energy. We're looking at them to assist us, prepare us and be able to better answer farmers' concerns regarding soil conservation (Interview 10).*

**Figure 2.1** Public Advisors' Source of Information on BMPs



**Figure 2.2** Private Advisors' Source of Information on BMPs



On the other hand, we speculate that public advisors are less likely to engage private advisors' knowledge base for knowledge on BMPs, because they do not perceive private advisors' responsible for provisioning this type of advice. Table 3 presents a description of views



of both private and public advisors' regarding whether future responsibility of provisioning advice on BMPs, a public good, will rest with private advisors or not.

**Table 3:** Private sector's role in provisioning advice on BMPs

<i>Future Role of Private Sector in Provisioning Advice on BMPs?</i>	
Private	Still need government support for cost-share programs, advice may be private sector.
Private	Need government support for cost-share programs, advice by may private sector.
Private	Need government support.
Private	Need government support for soil conservation. Public private collaborations already taking shape.
Private	Will be determined by farmers' demand for BMPs.
Public	Limited Role. Private sector only profit driven
Public	Limited Role. Private sector only profit driven
Public	Not at all. They are not doing right now.
Public	Depends on type of product. In Irrigation yes, but not in nutrient management.
Public	Will be determined by farmers' and consumers' demand for BMPs.

Table 3 above shows private advisors' views in the first five rows, whereas public advisors responses are in the last five rows. We can draw two preliminary conclusions from this table. First, public advisors' perceive private sector to have a limited role in provisioning advice on BMPs, although this may change depending on whether private sector can accrue profit from supplying this advice. Second, the private sector relies considerably on support provided by the government and foresees more collaboration with public agencies and actors in the future. For example, one private sector advisor commented on how both public and private sector had different roles in moving farmers toward sustainable farming practices:

*I try to provide conservation advice, but as far as who I am employed by, that's not really our job. We are in the business of selling seed, fertilizer and chemicals...The government gets them (farmers) into voluntary programs and kind of gives them guidelines on what they need to do. They (farmers) are then coming to us (private sector) to figure out how that needs to be done (Interview 10).*

These findings are consistent with other research (Boehlje 1998) that finds that while land-grant universities, with large public spending on research and extension has comparative advantage in knowledge generation, the private sector advisors are more efficient at using that knowledge to disseminate information according to farmers' specific and customized needs (Boehlje, 1998). Therefore, the future of advice on BMPs will be dependent on whether the public and private sector can find their own specific niche role in the market for advice and then spend resources to specialize in it.

Overall, our results suggest that future relationships between private and public advisors will be strongly dependent on government's continued financial support for voluntary compliance programs, such as the Michigan Agriculture Environmental Assurance Program (MAEAP) and the Environmental Quality Incentive Program (EQIP). These programs incentivize farmers' adoption of BMPs by reducing their production risks and assisting in creating markets for BMPs. If public funding free public advice continues to dwindle, an increase in demand from farmers for conservation advice may drive private advisors to provide advice on BMPs. In that case, we can expect to see more private sector involvement in service delivery of BMPs if the government continues its support for voluntary compliance programs. However, failure to support these programs can lead to significant hurdles for the private sector to deliver adequate level of advice on BMPs to growers.

## **Conclusion**

Our findings confirm some early assumptions and raise new concerns regarding the future of advice on BMPs. By deploying a mix of qualitative and quantitative methods, our study suggests that conditional on certain factors, private advisors will be able to fill the vacuum in service delivery of BMPs caused by a retrenchment in public sector's activities. We find profit to be the strongest driver of private advisors' to supply advice on BMPs. In contrast, factors that hamper advisors' ability to earn profit, will create a disincentive for them to provide advice on BMPs. Our results also illustrate that as government steps back from directly provisioning advice on BMPs, they may focus on policies that create an enabling environment for farmers to demand BMPs on their land. For example, voluntary compliance programs incentivize farmers' adoption of BMPs by reducing their production risks and assisting in creating markets for BMPs. This market would ensure the continuity of provision of BMPs by the private sector. Therefore, we

can expect to see more private sector involvement in service delivery of BMPs if the government continues its support for voluntary compliance programs. However, failure to support these programs can lead to significant hurdles for the private sector to deliver adequate level of advice on BMPs to growers.

**ANNEX:**

- Q1. In how broad of an area do you advise corn producers?
- Q2. What is the average farm size of your clientele in acres?
- Q3. What types of advice do you provide to corn producers? (Financial, Marketing, Agronomic, Conservation etc).
- Q4. Do you or your employer charge a direct fee for the advice you provide to corn producers?
- Q5. In addition to your work with corn producers, do you operate your own farm? If yes, please indicate approximate number of acres farmed
- Q6. The following are problems that some Corn Belt farmers have experienced over the past few years. How concerned are you about the following potential problems for corn production in your area? (Increased weed pressure, increased insect pressure, higher incidence of crop disease, increased loss of nutrients into waterways, increase soil erosion).
- Q7. Thinking about the following agencies, organizations, and groups, how much do you trust or distrust them as sources of information about climate change and its potential impacts? (University Extension, Agribusiness Companies)
- Q8. My organization supports my effort to seek new information
- Q9. I collaborate with others when I seek new information

**REFERENCES:**

1. Ajzen, I. (2002). Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. *Journal of Applied Social Psychology* 32, 665–683.
2. Ajzen, I., and Fishbein, M. (1980). ‘Understanding Attitudes and Predicting Social Behaviour.’ (Prentice-Hall: Englewood Cliffs, NJ.)
3. Arbuckle Jr, J. G. (2013). Farmer attitudes toward proactive targeting of agricultural conservation programs. *Society & Natural Resources*, 26(6), 625-641.
4. Armitage, C. J., Armitage, C. J., Conner, M., Loach, J., & Willetts, D. (1999). Different perceptions of control: Applying an extended theory of planned behavior to legal and illegal drug use. *Basic and Applied Social Psychology*, 21(4), 301-316.
5. Belknap, J., & Saupe, W. E. (1988). Farm family resources and the adoption of no-plow tillage in Southwestern Wisconsin. *North Central Journal of Agricultural Economics*, 10(1), 13-23.
6. Boehlje, M. 1998. Information and technology transfer in agriculture: the role of the public and
7. Boyer, E. W., Goodale, C. L., Jaworski, N. A., & Howarth, R. W. (2002). Anthropogenic nitrogen sources and relationships to riverine nitrogen export in the northeastern USA. In *The Nitrogen Cycle at Regional to Global Scales* (pp. 137-169). Springer Netherlands.
8. Camboni, S. M., and T. L. Napier. 1993. Factors affecting use of conservation farming practices in East Central Ohio. *Agriculture Ecosystems & Environment* 45 (1-2):79-94.
9. Changnon, S. A. 2004. Changing uses of climate predictions in agriculture: implications for prediction research, providers, and users. *Weather and forecasting*
10. Coleman, J. S., Katz, E. L. I. H. U., & Menzel, H. E. R. B. E. R. T. (1966). *Medical Innovation: A diffusion Study..* New York:: Bobbs-Merrill Company.
11. Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches.* Sage.
12. Daloglu, I. (2013). *An Integrated Social and Ecological Model: Impacts of Agricultural Conservation Practices on Water Quality*, Dissertation, University of Michigan.
13. Engel, P. G., & van den Bor, W. (1995). Agricultural education from a knowledge systems perspective: From teaching to facilitating joint inquiry and learning. *European Journal of Agricultural Education and Extension*, 1(4), 1-23.

14. Evans, P. (1996). Government action, social capital and development: reviewing the evidence on synergy. *World development*, 24(6), 1119-1132.
15. Evans, P. (1997). State-society synergy: government and social capital in development. *Research Series*.
16. FAO, 2001. The economics of soil productivity in Africa. *Soils Bulletin*. Rome
17. Galloway, J. N., Dentener, F. J., Capone, D. G., Boyer, E. W., Howarth, R. W., Seitzinger, S. P., ... & Vöösmary, C. J. (2004). Nitrogen cycles: past, present, and future. *Biogeochemistry*, 70(2), 153-226.
18. Ginder, R. (1992). The future role of farm input suppliers in the sustainable agriculture movement. *Iowa State University Staff Papers Series, Department of Economics*, 241.
19. Gorsuch, R. L., & Ortberg, J. (1983). Moral obligation and attitudes: Their relation to behavioral intentions. *Journal of Personality and Social Psychology*, 44(5), 1025.
20. Hermans, F., Stuiver, M., Beers, P. J., & Kok, K. (2013). The distribution of roles and functions for upscaling and outscaling innovations in agricultural innovation systems. *Agricultural Systems*, 115, 117-128.
21. Holmes, C. M. (2003). The influence of protected area outreach on conservation attitudes and resource use patterns: a case study from western Tanzania. *Oryx* 37, 305–315.
22. Holt, D. (1998). Integrating public and private R&D. *Privatization of information and agricultural industrialization*, 51-71.
23. Ingram, J. (2008). Agronomist–farmer knowledge encounters: an analysis of knowledge exchange in the context of best management practices in England. *Agriculture and Human Values*, 25(3), 405-418.
24. Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a definition of mixed methods research. *Journal of mixed methods research*, 1(2), 112-133.
25. Just, David R., Steven A. Wolf, Steve Wu, and David Zilberman. 2002. "Consumption of Economic Information in Agriculture." *American Journal of Agricultural Economics* 84 (1): 39-52.
26. Klerkx, L., & Jansen, J. (2010). Building knowledge systems for sustainable agriculture: supporting private advisors to adequately address sustainable farm management in regular service contacts. *International Journal of Agricultural Sustainability*, 8(3), 148-163.

27. Klerkx, L., & Leeuwis, C. (2008). Matching demand and supply in the agricultural knowledge infrastructure: Experiences with innovation intermediaries. *Food Policy*, 33(3), 260-276.
28. Klerkx, L., Hall, A., & Leeuwis, C. (2009). Strengthening agricultural innovation capacity: are innovation brokers the answer?. *International Journal of Agricultural Resources, Governance and Ecology*, 8(5), 409-438.
29. Knowler, D., and B. Bradshaw (2007). Farmers' adoption of conservation agriculture: A review and synthesis of recent research. *Food Policy* 32 (1):25-48.
30. Lam, S. P. (1999). Predicting Intentions to Conserve Water From the Theory of Planned Behavior, Perceived Moral Obligation, and Perceived Water Right. *Journal of Applied Social Psychology*, 29(5), 1058-1071.
31. Laurent, C., Cerf, M., & Labarthe, P. (2006). Agricultural extension services and market regulation: learning from a comparison of six EU countries. *Journal of agricultural education and extension*, 12(1), 5-16.
32. Lynne, G. D., J. S. Shonkwiler, and L. R. Rola. 1988. Attitudes and farmer conservation behavior. *American Journal of Agricultural Economics* 70 (1):12-19.
33. Madden, T. J., Ellen, P. S., & Ajzen, I. (1992). A comparison of the theory of planned behavior and the theory of reasoned action. *Personality and social psychology Bulletin*, 18(1), 3-9.
34. Manstead, A. S. R. (2000). The role of moral norm in the attitude–behavior relationship. In ‘Attitudes, Behavior, and Social Context: the Role of Norms and Group Membership’. (Eds D. J. Terry and M. A. Hogg.) pp. 11–30. (Lawrence Erlbaum Associates: Mahwah, NJ.)
35. McDowell, G. (2004). Is Extension an idea whose time has come--and gone. *Journal of Extension*, 42(6), 1-6.
36. Michalak, A. M., Anderson, E. J., Beletsky, D., Boland, S., Bosch, N. S., Bridgeman, T. B., ... & Zagorski, M. A. (2013). Record-setting algal bloom in Lake Erie caused by agricultural and meteorological trends consistent with expected future conditions. *Proceedings of the National Academy of Sciences*, 110(16), 6448-6452.
37. Mintrom, M., & Vergari, S. (1998). Policy networks and innovation diffusion: The case of state education reforms. *The Journal of Politics*, 60(01), 126-148.

38. Naess, L. O. (2013). The role of local knowledge in adaptation to climate change. *Wiley Interdisciplinary Reviews: Climate Change*, 4(2), 99-106.
39. Napier, T. L., M. Tucker, and S. McCarter. 2000. Adoption of conservation production systems in three Midwest watersheds. *Journal of Soil and Water Conservation* 55 (2):123-134.
40. Nowak, P. J. 1983. Obstacles to adoption of conservation tillage. *Journal of Soil and Water Conservation* 38 (3):162-165.
41. National Research Council (NRC). 2010. *Toward sustainable agricultural systems in the 21st century*. Washington, D.C: National Academies Press.
42. Ostrom, E. (2008). Institutions and the environment. *Economic Affairs*, 28(3), 24. doi:10.1111/j.1468-0270.2008.00840.x
43. Ostrom, E. (2010). *Understanding Institutional Diversity*. Princeton University Press.
44. Pierre, L., & Rivellie, T. (2013). The role of advisory services in the dynamic of Agricultural Knowledge and Innovation Systems: locking in or locking out?. Final program, 251.
45. Pompelli, G., C. Morfaw, and B. English. 1995. Tennessee farm operators' attitudes about extension service soil conservation information. *Journal of Extension*, 33(6).
46. Prell, C., Hubacek, K., & Reed, M. (2009). Stakeholder analysis and social network analysis in natural resource management. *Society and Natural Resources*, 22(6), 501-518.
47. private sectors. *Privatization of Information and Agricultural Industrialization*, 4-23.
48. Prokopy, L. S., Haigh, T., Mase, A. S., Angel, J., Hart, C., Knutson, C., ... & Widhalm, M. (2013). Agricultural Advisors: A Receptive Audience for Weather and Climate Information?. *Weather, Climate, and Society*, 5(2), 162-167.
49. Rahm, M. R., and W. E. Huffman. 1984. The adoption of reduced tillage - the role of human-capital and other variables. *American Journal of Agricultural Economics* 66 (4):405-413.
50. Reimer, A. P., Weinkauff, D. K., & Prokopy, L. S. (2012). The influence of perceptions of practice characteristics: An examination of agricultural best management practice adoption in two Indiana watersheds. *Journal of Rural Studies*, 28(1), 118-128.
51. Rodela, R. (2011). Social learning and natural resource management: the emergence of three research perspectives. *Ecology and Society*, 16(4), 30.
52. Rogers, E.M., 1962. *Diffusion of Innovations*. The Free Press, New York.



53. Roling, N. G., & Wagemakers, M. A. E. (1994). A new practice: facilitating sustainable agriculture. *Facilitating Sustainable Agriculture: Participatory learning and adaptive management in times of environmental uncertainty*, 3-32.
54. Ryan, R.; Erickson, D.; De Young, R. 2003. Farmers' Motivations for Adopting Conservation Practices along Riparian Zones in a Mid-western Agricultural Watershed. *Journal of Environmental Planning and Management* 46 (1):19-37.
55. Serenari, C., Peterson, M. N., Bardon, R. E., & Brown, R. D. (2013). The Impacts of the Great Recession on State Natural Resource Extension Programs. *Journal of Extension*, 51(4), 4FEA11.
56. St John, F. A., Edwards-Jones, G., & Jones, J. P. (2011). Conservation and human behaviour: lessons from social psychology. *Wildlife Research*, 37(8), 658-667.
57. Swanson, B. E. (2006). The changing role of agricultural extension in a global economy. *Journal of International Agricultural and Extension Education*, 13(3), 5-17.
58. Tonglet, M., Phillips, P. S., & Read, A. D. (2004). Using the Theory of Planned Behaviour to investigate the determinants of recycling behaviour: a case study from Brixworth, UK. *Resources, Conservation and Recycling*, 41(3), 191-214.
59. Tosakana, N. S. P., L. W. Van Tassel, J. D. Wulfhorst, J. Boll, R. Mahler, E. S. Brooks, and S. Kane. 2010. Determinants of the adoption of conservation practices by farmers in the northwest wheat and range region. *Journal of Soil and Water Conservation* 65 (6):404-412.
60. Tucker, M. and T.L. Napier. 2002. Preferred sources and channels of soil and water conservation information among farmers in three Midwestern US watersheds. *Agriculture, Ecosystems and Environment*, 92:297-313.
61. U. S. Department of Agriculture Natural Resources Conservation Service. 2009. Summary report: 2007 National resources inventory.
62. United States Department of Agriculture (USDA). 2014. "About us: Extension" Downloaded July 19, 2014 from <http://www.csrees.usda.gov/qlinks.extension.html>.
63. Valente, T. W., & Rogers, E. M. (1995). The origins and development of the diffusion of innovations paradigm as an example of scientific growth. *Science communication*, 16(3), 242-273.

64. West, B., Drake, D., & Longo, A. (2009). Extension: A modern-day Pony Express. *Journal of Extension* [On-line], 47(2) Article 2COM1. Available at: <http://www.joe.org/joe/2009april/comm1.php>
65. Wolf, S. (1995). Cropping systems and conservation policy: The roles of agrichemical dealers and independent crop consultants. *Journal of Soil and Water Conservation*, 50(3), 263-270.
66. Wolf, S. A. 1998. Privatization of crop production information service markets. *Privatization of information and agricultural industrialization*. CRC Press, New York, 151-182.
67. Wolf, S., Just, D., & Zilberman, D. (2001). Between data and decisions: the organization of agricultural economic information systems. *Research policy*,30(1), 121-141.
68. Wolf, S., Nowak, P., Robert, P. C., Rust, R. H., & Larson, W. E. (1995). The status of information-based agrochemical management services in Wisconsin's agrochemical supply industry. In *Site-specific management for agricultural systems: proceedings of Second International Conference*, Minneapolis, MN, USA, March 27-30, 1994. (pp. 909-920). American Society of Agronomy.
69. Womack, Ryan. 2002. "Information Intermediaries and Optimal Information Distribution." *Library & Information Science Research* 24 (2): 129-155.
70. Zubair, M., and Garforth, C. (2006). Farm level tree planting in Pakistan: the role of farmers' perceptions and attitudes. *Agroforestry Systems* 66, 217–229.