The Effect of Land Value and Local Community Characteristics on Best Management Practice Adoption

Hua Zhong
Ph.D. Candidate, University of Kentucky
hua.zhong@uky.edu

Wuyang Hu
Professor, University of Kentucky
wuyang.hu@uky.edu

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Abstract:

Land premium added by the increase of environmental quality could motivate farmers to adopt Best Management Practices (BMPs). Local community also demands nearby farms to abate agricultural pollution and implement BMPs. Our study attempts to examine whether land values and local community characteristics can influence BMP adoption in addition to the socioeconomic and demographic characteristics. We aggregate our survey data on BMP adoption conducted between 2011 and 2012 in Kentucky and the public data by using the geographic information, and then use Probit models to estimate choices of BMP adoption. In the model, we measure the land value effect by using percentage differences of farmland values between 2007 and 2012, and approximate the local community characteristic effect by including rural effect, urban effect, residential effect, and local farm business effect. Results show that increasing land values would motivate farmers to adopt additional riparian buffers; the local equine inventory have the positive impact on farmers' future adoption of animal fences and nutrient management; farms located at the rural communities are less likely to fence off animal from water resources.

Key words: best management practice, land value, local community

Introduction

Best Management Practices (BMPs) are practices to control agricultural nonpoint source pollution from surface water resources, and to intercept contaminated flows running into the underground water. Given growing concern about agricultural pollution issues, numerous studies have attempted to understand factors explaining farmers' BMP adoption. Three syntheses summarize previous empirical studies to explain the adoption of conservation practices in terms of farmer and farm household characteristics, farm biophysical characteristics, farm financial characteristics, and farmers' attitudes and their environmental awareness (Knowler and Bradshaw 2007; Prokopy et al. 2008; Baumgart-Getz, Prokopy, and Floress 2012). However, fewer studies have explicitly examined effects of land values and local community characteristics on BMP adoption.

Our research is inspired by two empirical findings. First, BMPs such as riparian buffers can contribute to property values as amenity in addition to the environmental benefit (Bastian et al. 2002; Qiu et al. 2006; Bin et al. 2009; Ma and Swinton 2011). As the most valuable asset, land determines a farm's financial health. Any BMPs that may add value to the land will directly motivate adoption. Second, households in the urban fringe area or near farms have the increasing demand for better water quality, farmland preservation, and biodiversity conservation (Leggett and Bockstael 2000; Ready and Abdalla 2005; Chen, Irwin, and Jayaprakash 2009), and the strong unwillingness for the agricultural pollution from farming practices and the livestock production (Palmquist, Roka and Vukina 1997; Herriges et al. 2005; Ready and Abdalla 2005). As a result, community demand for amenity and disutility from agricultural pollution also affect the adoption of certain BMPs, such as plant buffers alongside a river or a waste storage facility preventing agricultural run-off from entering waterways.

The objective of our research is to investigate whether land values and local community characteristics can influence BMP adoption. In doing so, our study aggregates our survey data on BMP adoption conducted between 2011 and 2012 in Kentucky and the public data from the U.S. census data, and the U.S. Department of Agriculture Economic Research Service (USDA ERS). Our survey asked farmers' willingness to adopt BMPs if compensated through a proposed incentive payment program. The BMPs examined include riparian buffers, animal fences, no till, waste storage facilities, and nutrient management. Farmland values are measured by the increase of land values between 2007 and 2012; local community characteristics include rural effect, urban effect, residential effect, and local farm business effect.

The article is organized as follows. The second section briefly reviews the previous literature. The third section introduces our study area. The fourth section demonstrates the empirical model and the variable specification. The last two sections discuss our empirical findings, and conclude the contribution of our research.

Literature review

When farmers implement BMPs, they would expect improvement of soil condition, the profitability of the technology, the extra benefit to their wealth, and the increase of environmental quality (Shively 1996; Fuglie 1999; Fuglie and Kascak 2001; Moreno and Sunding 2005; Amsalu and Graaff 2007; Berentsen et al. 2007; Davey and Furtan 2008; Abdulai and Huffman 2014). In the same time, since BMP adoption could improve the land quality and the landscape on the farm, BMP adoption eventually would benefit land values. Bastian et al. (2002) employ the hedonic model to estimate effects of agricultural amenity and production attributes on farmland prices, and conclude that scenic view and habitat near the farms can influence land values as environmental amenity. Qiu et al. (2006) use the contingent valuation method to investigate residents' perceptions, and their willingness-to-pay for riparian buffers, and find that riparian buffers have economic values for local residents. Bin et al. (2009) consider the imposition of the buffer rule as the quasi-experiment, and use a spatial autoregressive hedonic model to estimate how riparian buffers affect residential property values near the farmland before and after the imposition. Ma and Swinton (2011) also employ the hedonic model to value ecosystem services, and find that ecosystem services with the direct use value, such as providing natural amenities, are more likely to be perceived by land buyers, and be capitalized into land prices.

Although previous studies have concluded that environmental practices would improve environmental quality and could contribute to land premium, few studies have explicitly examined whether land value would influence farmers' future adoption. Moreno and Sunding (2005) as well as Davey and Furtan (2008) attempt to use assessed values of land and buildings to measure the wealth effect on BMP adoption, but cannot find evidences that the asset value has the significant impact on the adoption of conservation practices. One possible explanation is that conservation practices examined in both studies—the irrigation technology and the conservation tillage—do not observably change the landscape or improve attributes of agricultural production, so the asset value fails to explain the adoption.

In addition to the land value effect, researchers also find that local community characteristics would affect farmers' behaviors of environmental services. Water pollutions from farming activities have negative impacts on nearby residential property values or farmland values (Palmquist, Roka and Vukina 1997; Leggett and Bockstael 2000; Herriges et al. 2005; Ready and Abdalla 2005). In response to the water pollution, households migrant out of local regions or appeal to local farm communities to control agricultural run-off. The environmental amenity-driven migration and the residential demand would therefore affect local farms' decisions and activities (Chen et al. 2009).

Our study aims to expand previous research to investigate whether and how land values and local community characteristics influence the adoption of BMPs. To our knowledge, few studies have explicitly examined effects of land value and the demand of environmental quality on BMP adoption.

Study Area

We conducted survey randomly chosen farmers across 35 counties in the Kentucky River watershed from 2011 to 2012 with response rate 23%. We selected 356 valid observations. The valid observation indicates responses contained at least some completed responses regarding to BMP-related questions and were used in the final analysis. Our survey questions included farmer participation in current government-funded environmental or conservation programs, their potential adoption of additional BMPs through a proposed Water Quality Trading (WQT) program, farm characteristics, and demographic characteristics. The WQT program enables facilities to achieve needed pollution controls through purchasing emission permits from permits sellers. In the same time, permit sellers such as farms can produce water quality permits by implementing BMPs at a lower cost than treatment facilities. The overall goal is to achieve water quality improvements cost-effectively by establishing a trading market with willing buyers and sellers (the U.S. Department of Agriculture Natural Resources Conservation Service 2012).

The key BMP adoption questions asked farmers: "Regardless of whether you are currently participating in any government cost share programs, if you knew that by using water quality management practices on your land, a nearby waste/sewage water treatment plant or factory will cover X% of your cost of implementing these practices, would you be interested in using additional water quality management practices (BMPs) in the form of the following activities?" A table was given to each respondent listing five BMPs: riparian buffers, fencing off animals, no till, waste storage facility and nutrient management." In the actual survey, X% is replaced by one of the following possible values with equal probability: 75%, 80%, 85%, 90%, 95%, 100%, 105%, 110%, 115% and 120%. Each respondent saw only one questionnaire and only one level of compensation. A respondent could answer "yes," "no," or "not possible for me" with respect to each practice. Response "Not possible for me" allows respondents to indicate if a specific BMP as not applicable on their land.

The survey design also included four different explanations and descriptions of WQT programs. Each participant was randomly assigned to one of the information scenarios. This design examines whether the different types of information may influence an individual's response. The first information treatment gives a basic explanation of WQT programs with minimal interpretation of WQT programs. The second information treatment includes the information in the first, plus an additional description of WQT programs implied cost savings for farmers. The third type contains the baseline information and information emphasizes the environmental benefits from WQT programs. The fourth treatment provides both cost savings and environmental benefits information.

Table 1 presents all variables and summary statistics for the entire sample. Table 2 explains discrete levels in explanatory variables.

Empirical Model

Our study employs the latent variable method to explain the decision of BMPs. y^* denotes an unobserved utility that determines observable decisions (y) of adopting BMPs. The y^* consists of a set of observable variables (x) explaining the adoption, and an unobserved random term (ε)

which follows the normal distribution. To be specific, the latent value (y^*) is represented as follows:

$$y^* = x'\beta + \varepsilon \tag{11}$$

$$y = 1\ (adoption) \qquad if \quad y^* > 0$$

$$y = 0\ (no\ adoption) \qquad if \ \ y^* \leq 0$$

where β is a vector of coefficients associate with observable variables (x). Then, we can derive the probability of adopting a BMP ($y = 1$) conditioning on socioeconomic variables and local community characteristics (θ):

$$Prob[y = 1|\theta] = Prob[y^* > 0|\theta] = Prob[x'\beta + \varepsilon > 0|\theta]$$

$$= 1 - F(-x'\beta|\theta) = F(x'\beta|\theta) \tag{12}$$

where $F(.)$ is the cumulative distribution function. We assume that $F(.)$ follows the normal distribution function $\Phi(.)$, and use a Probit model to estimate the probability of using a BMP.

$$Prob[y = 1|\theta] = \Phi(x'\beta|\theta) \tag{13}$$

Model specification

Our study uses the Probit model to estimate decisions of five BMPs in our survey. In the model of each BMP, the dependent variable is a binary choice of whether farmers would like to accept our offer to adopt the corresponding BMP (1 if yes, 0 if no). In addition, we also use a dependent variable indicating whether farmers would accept our offer to adopt any of the five BMPs (1 if yes, 0 if no) to investigate common factors explaining BMP adoption in our study area.

The independent variables include compensations for BMP adoption, land values, local community characteristics, farming plans, socioeconomic characteristics, and information treatments. Except variables of farming plans, all models use the same set of independent variables to explain the adoption of five BMPs. In the estimation, observations who answered "not possible for me" to a specific BMP are not included in the model of the corresponding BMP.

In our models, we examine the land value effect by using differences of land value between 2007 and 2012. We assume that if farmers have experienced land value increased in the last five years, they would expect land benefits from the investment on BMP, and thus the expectation would motivate their future adoption. We incorporate land value data from the U.S. census of agriculture into our survey data through the geographic information−the zip code. Due to the limited access to the census data, we can only collect land value data in the county level. The difference of land value is measured by the percentage difference of estimated market values of land and buildings ($\Delta L_{\%}$) between 2007 and 2012, and is displayed as follows:

$$\Delta L_{\%} = \frac{\delta L_{2012} - L_{2007}}{L_{2007}} * 100\%$$

where L_{2007} and L_{2012} denote market values of land and buildings in 2007 and 2012 respectively, and δ =0.9 is the deflation index.

Local community characteristic effects include rural effect, urban effect, residential effect, and local farm business effect. We measure rural and urban effects by using a metro indicator and a rural index calculated from the 2013 Urban Influence Codes (UICs) of the USDA ERS[1]. The UICs distinguish all counties, county equivalents, independent cities in the U.S. into 2 categories (metro and non-metro counties) with 12 groups. The metropolitan counties are divided into two groups by the population size. The nonmetropolitan counties are categorized into 10 levels by degree of urbanization and adjacency to metro areas. In our studies, if respondents locate at the metropolitan counties, metro dummies equal to one, but rural indexes equal to zero; if

[1] The USDA ERS releases UICs data every ten years. The 2013 UICs data is the closet date to match our survey data conducted in 2012.

respondents locate at the nonmetropolitan counties, metro dummies equal to zero, and rural indexes equal to corresponding UIC levels of nonmetropolitan counties.

We approximate residential effects by using the housing density and the residential housing value. The housing density is total numbers of residential housing units in the 2010 divided by the corresponding county area. The residential housing value is the 5 years average median housing value of owner-occupied housing units from 2008 to 2012. Both residential housing units and values are obtained from the U.S. census data.

Our study selects the equine business to capture the local farm business effect. Based on the Kentucky equine survey (2012), the value added effect of total equine industry impacts, which is defined as new income paid to workers, profits earned by businesses or dividends paid to shareholders, is estimated to be 1.4 billion dollars in Kentucky. As one of major agricultural industries in Kentucky, farms with equine business also demands better environmental quality and amenity. Most of respondents in our survey located at counties with large amount of equine inventory, for example the Fayette county, the Bourbon county, and the Woodford county are top three equine inventory counties in Kentucky. The increasing amount of equine inventory will motivate farm households to adopt the environmental friendly practices, in order to fulfill the increasing demand of environmental quality from equine business. As a result, we use inventory of horses and ponies owned by farms from the U.S. census of agriculture to measure the effect of local farm business on BMP adoption.

Previous studies find that farming plans also determine BMP adoption (Wu and Babcock 1998). When farmers start to adopt BMPs, they would evaluate whether the BMP is compatible with their farming plans. In our research, we consider farming plans from two aspects. First, we investigate whether current BMP plans have impact on the future adoption. We measure current

BMP plans by a series of dummy variables indicating whether farmers are currently using five BMPs. Second, we also examine the effect of synergy of BMP on the adoption decision. The synergy effects are captured by farmers' choices of other BMPs.

Socioeconomic variables include age, gender, education level, water recreation activities and farming experiences. Farm characteristics consist of farm sizes, whether farms have crop or livestock production, rent percentage, whether farms have surface water on the farmland, participation in Conservation Reserve Program (CRP) and Working-Land Program (WLP). In the end, as we introduced before, we use three dummy variables to measure the effect of information treatment of WQT knowledge on BMP adoption.

Empirical Results

Table 3 reports results of Probit models estimating decisions of five BMPs. In the table, the first column is the model investigating common factors explaining BMP adoption. The model results show that farmers' current experiences of BMPs, shares of farm investment, gender, education level, and water quality near their farms can influence their adoption decisions. If respondents are currently using any BMP on their lands, they tend to adopt additional BMPs through the WQT compensation to abate more agricultural runoff from their farms. Households with large shares of farm investment are more likely to invest on BMP adoption in the future. Male respondents are more likely to implement BMPs; farmers with higher education level prefer to use BMPs. Poor water quality near farms would motivate farmers to adopt BMPs. However, there is no statistical evidence found that land values and local community characteristics would affect BMP adoption.

In models of specific BMPs, results show that factors affecting the adoption of different types of BMP are varied. For the land value effect, increasing land values between 2007 and 2012 encourage farmers to adopt riparian buffers, but cannot affect the adoption of other BMPs. As we discussed in the literature review, riparian buffers can improve farm landscape observably, and contribute to the land value as amenity. If farmland values are increasing in the last five years, farm owners are more likely to expect returns from the farmland investment, and thus are willing to invest on riparian buffers to obtain the additional economic benefit in the future.

Our results also find that local community characteristics have significant impacts on BMP adoption. If farms locate at metro areas, farmers are less likely to adopt riparian buffers. When farms locate at rural communities, farmers are less likely to fence off livestock from water resources. Farms located at communities with large amount of equine inventory are more likely to adopt animal fences and nutrient management. Residential housing values have negative effects on implementing animal fences.

Our results show that increasing the compensation is more likely to incentivize farmers to adopt riparian buffers, animal fences, and waste storage facilities. The explanation of WQT programs focusing on cost saving information is more likely to encourage farmers to adopt animal fences and nutrient management. Explanation of WQT programs including both cost saving and environmental benefit information is more likely to persuade farmers to consider the riparian buffers.

Our results also show some evidences of synergy of BMP adoption. If farmers would like to use riparian buffers, they are more likely to adopt animal fences or nutrient management together. If farmers would like to build up animal fences on their land, they tend to implement riparian buffers, build up waste storage facilities, and adopt no till on their farms. If farmers would adopt more no till on their land, they are more likely to use waste storage facilities and nutrient management at the same time. If farmers would like to build up waste storage facilities, they are more likely to build up riparian buffers and animal fences, and use nutrient management through the WQT program as well. If farmers tend to use nutrient management in the future, they are more likely to implement no till, and build up animal fences and waste storage facilities at the same time.

In addition, if farmers are currently using BMPs, they are more likely to expand the scope of BMPs through our proposed incentive payment program in the future. If farmers are currently using a BMP on their farm, they are more likely to adopt more of the same BMP in the future, except for waste storage facilities. If farmers are currently having riparian buffers on their farms, they are more likely to adopt waste storage facilities. However, not all of current experiences of BMPs have positive effects on the adoption of other BMPs. If farmers are currently having waste storage facilities on their farms, they are less likely to implement riparian buffers and nutrient management. If farmers are currently using nutrient management, they are less likely to adopt no till and build up waste storage facilities.

For demographic and socioeconomic variables, factors affecting BMP adoption include farming experiences, land area, rent area, surface water on farmland, percentage of household income from farming, total household income reinvested back to farm, age, gender, education level, income level, water recreation activities, current participation in conservation reserve programs and working land programs, water quality, and minority. Farmers with more farming experiences prefer to adopt additional no till, but may be less likely to use riparian buffers. Large-size farms are less likely to build up animal fences. Farmers who rent more farmland are less likely to adopt no till. Farms with surface water resources are more likely to build up riparian buffers and waste storage facilities to intercept agricultural run-off diffusing into water resources, but are less likely to build up animal fences and use nutrient management on their farms. The percentage of income coming from the farm has the positive significant impact on the adoption of animal fences. If farmers invest large shares of their income on their farms, they tend to build up more riparian buffers and waste storage facilities. Older farmers are more likely to adopt riparian buffers, but are less likely to build up animal fences and use no till and nutrient management. Male famers are more likely to use animal fences but are less likely to build up waste storage facilities. Farmers with higher education are in favor of having additional animal fences and nutrient management. Farmers with water related recreation activities at least once a year prefer to adopt riparian buffers. The farm household income has the negative effect on the adoption of waste storage facilities. Poor water quality near farms would lead farmers to use more riparian buffers, animal fences, no till, waste storage facilities and nutrient management in the future. If farmers are currently participating in conservation reserve programs, they are less likely to adopt no till; if farmers are currently participating in working land programs, they would not like to adopt nutrient management in the future. Minority farmers are more likely to use waste storage facilities on their land.

Conclusion

Our study attempts to take into account effects of land values and local community characteristics in explaining BMP adoption. We aggregate our survey data on BMP adoption conducted between 2011 and 2012 in Kentucky and the public data from the census data through the geographic information. Land values are measured by percentage differences of the estimated market value of land and buildings between 2007 and 2012; local community characteristics include rural effect, urban effect, residential effect, and local farm business effect.

Our results show that increasing farmland values encourage the adoption of riparian buffers. If farms locate at the metro area, farm owners are less likely to adopt riparian buffers; when farms locate at the rural communities, they are less likely to fence off animal from water resources. If farms locate at counties with large amount of equine inventory, they are more likely to build up animal fences and use nutrient management. Residential housing values have the negative effect on the adoption of animal fences. In addition, our result also find that increasing the cost coverage compensation can incentivize farmers to further implement riparian buffers, animal fences, and waste storage facilities. One of interesting findings is that farmers who are currently using BMPs are more likely to expand the scope of their current adoption to abate more agricultural run-off. Our results can help policy maker design a more cost-effective payment scheme, and target willing sellers in the water quality trading market.

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Table 1 All variables and summary statistics for the entire sample (N=356)

Variable	Definition of Variables	Mean	Std. Dev.
Current BMPs adoption:			
y_1	Currently using any BMPs (=1); otherwise (=0)	0.739	0.44
y_2	Currently using riparian buffers (=1); otherwise (=0)	0.367	0.483
y_3	Currently using fencing off animals (=1); otherwise (=0)	0.465	0.499
y_4	Currently using no-till (=1) ; otherwise (=0)	0.311	0.464
y_5	Currently using waste storage facility (=1) ; otherwise (=0)	0.067	0.251
y_6	Currently using nutrient management (=1) ; otherwise (=0)	0.241	0.428
Cost coverage compensation:			
Offer	The percentage that treatment plant or factory will cover the cost of implementing the BMPs if the farmer uses the additional BMPs, there are ten different levels of compensation. Those levels are 0.75, 0.8, 0.85, 0.9, 0.95, 1, 1.05, 1.1, 1.15 and 1.2.	0.97	0.15
Explanatory variables:			
Land size	Land size includes renting size for operating and owning size for operating. (unit: 1000 acre)	0.282	0.537
Rent percent	Rent size for operating / Land size for operating	0.142	0.275
Surface water	Surface water on farmland (=1) ; otherwise (=0)	0.86	0.348
Returns from farms	Share of pre-tax household income from farming (see table 2)	2.417	1.815
Investment to farms	Share of pre-tax household income back to farming (see table 2)	2.529	1.542
Crop farms	Farms earning revenue from crop or farmers planting crop in their land (=1) ; otherwise (=0)	0.423	0.495
Livestock farms	Farms earning revenue from livestock or farmers raise livestock (=1) ; otherwise (=0)	0.798	0.402
Age	Farmer’s age	60.154	11.908
Male	Male =1; otherwise (=0)	0.857	0.35
Education	The education level of farmer (see table 2)	4.078	1.92
Income level	The household annual pre-tax income level (see table 2)	4.359	1.499
Farming experience	Farming experience (year)	32.22	15.307
Water recreation	Participating in water related recreation at least once a year (=1) ; otherwise (=0)	0.661	0.474

Continued

Table 1 Continued

Variable	Definition of Variables	Mean	Std. Dev.
CRP	Currently participating in Conservation Reserve Program (CRP) (=1) ; otherwise (=0)	0.118	0.323
WLP	Currently participating in Working-Land Program (WLP) (=1); otherwise (=0). WLP includes Conservation Stewardship Program (CSP), Environmental Quality Incentives Program (EQIP), Wildlife Habitat Incentives Program (WHIP)	0.204	0.404
Water quality	The water quality nearest to farmers' property	5.038	1.365
Beginning farmers	Farming less than ten years (=1) ; otherwise (=0)	0.12	0.326
Minority	Operator's race is not white (=1) ; otherwise (=0)	0.045	0.207
Information: The survey was designed with 4 levels of information explaining the meaning of WQT programs			
Level 1	The least detailed information level (=1); otherwise (=0)	0.235	0.425
Level 2	The less detailed information level(=1); otherwise (=0)	0.261	0.44
Level 3	The more detailed information level(=1); otherwise (=0)	0.21	0.408
Level 4	The least detailed information level(=1); otherwise (=0)	0.294	0.456
Farmland value			
Farmland value in 2007	Estimated market values per acre of land and buildings in 2007 obtained from the 2007 U.S. census of agriculture.	3293.927	1682.897
Farmland value in 2012	Estimated market values per acre of land and buildings in 2012 obtained from the 2012 U.S. census of agriculture.	3678.815	2384.489
Local community characteristics			
Metro indicator	Respondents locate at metropolitan counties defined by the Urban Influence Codes 2013 (=1)	0.30618	0.461554
Rural index	The categorical variable of rural index is measured by the UICs of nonmetropolitan counties.	3.463483	3.357785
Housing density	$\frac{\text{Residential housing units}}{\text{the county area}}$ Residential housing units of county level are obtained from the U.S. census data in 2010.	88.34666	132.9384
The residential housing value	The 5 years average median housing value of owner-occupied housing units from 2008 to 2012 obtained from the U.S. Census. (1000 dollars)	116.618	42.6562
Equine inventory	The inventory of horses and ponies owned by farms are collected from the 2012 U.S. census of agriculture (1000 units).	2.01	2.14

Note: the discrete levels in table are interpreted in table 2

Table 2 The explanation for discrete levels of variables

Level	Returns from farms	Investment to farms	Education	Income level ($)	Water Quality
1	0-15%	0-15%	Not a high school graduate	0 to 14999	Lowest quality
2	16-30%	16-30%	High school graduate	15000 to 24999	Lower quality
3	31-45%	31-45%	Some college, no degree	25000 to 49999	Low quality
4	46-60%	46-60%	Associate degree	50000 to 74999	Fair quality
5	61-75%	61-75%	Bachelor degree	75000 to 99999	High quality
6	75-90%	75-90%	Master degree	100000 to 149999	Higher quality
7	above 90%	above 90%	Professional degree	above 150000	Highest quality
8	-	-	Doctorate	no response	-

Note: The “no response” in the income level is replaced by the median value.

Table 3. Probit model estimating decisions of BMP adoption

	All BMPs included	Riparian buffers	Animal fences	No till	Waste storage facility	Nutrient management
Land value and local characteristics						
Percentage differences of land value between 2007 and 2012	0.687	29.349***	-0.004	0.738	-2.774	-1.243
	(0.785)	(11.397)	(2.317)	(2.05)	(1.843)	(2.194)
Housing density in 2012	0	0.001	0	-0.002	0	0
	(0.001)	(0.007)	(0.002)	(0.003)	(0.003)	(0.003)
Metro area (=1)	0.096	-5.669***	-1.144	-0.271	-0.373	-0.269
	(0.317)	(2.038)	(0.794)	(0.855)	(0.81)	(0.941)
Rural level	-0.022	-0.106	-0.502***	-0.011	0.049	0.128
	(0.05)	(0.24)	(0.163)	(0.108)	(0.095)	(0.164)
Equine Inventory (1000 unit)	-0.015	-0.922	0.409*	-0.057	0.048	0.517*
	(0.085)	(0.57)	(0.215)	(0.212)	(0.234)	(0.269)
5 years median housing value of owner-occupied housing units (1000 dollars	-0.002	-0.02	-0.034***	0.004	0.004	0.012
	(0.005)	(0.027)	(0.012)	(0.01)	(0.01)	(0.017)
Information provided in the survey: hypothetical cost coverage compensation and explanation of WQT						
Offer	0.004	5.866**	2.967*	0.439	2.707**	0.037
	(0.51)	(2.766)	(1.531)	(1.337)	(1.361)	(1.665)
Cost saving info	0.071	-2.138**	1.181*	-0.039	-0.113	1.552**
	(0.215)	(1.03)	(0.657)	(0.487)	(0.462)	(0.718)
Environmental info	-0.033	0.563	-0.446	0.398	0.707	-0.613
	(0.228)	(0.924)	(0.68)	(0.546)	(0.516)	(0.852)
Joint info	-0.058	1.993*	-0.626	-0.579	0.006	1.1
	(0.208)	(1.026)	(0.551)	(0.465)	(0.524)	(0.679)
Synergy of BMPs: choices of other BMPs						
Choice of Riparian	-	-	2.675***	-0.31	-0.324	2.044***
	-	-	(0.73)	(0.518)	(0.432)	(0.758)
Choice of fence	-	4.697***	-	0.834*	1.171***	0.011
	-	(1.362)	-	(0.485)	(0.413)	(0.525)
Choice of no till	-	1.373	0.153	-	0.89**	1.557***
	-	(0.904)	(0.5)	-	(0.418)	(0.569)
Choice of waste management	-	-0.75	1.989**	0.848*	-	3.878***
	-	(0.917)	(0.81)	(0.495)	-	(0.886)
Choice of nutrient management	-	1.499	0.993*	1.363***	2.003***	-
	-	(0.953)	(0.542)	(0.462)	(0.474)	-
Current usage of BMPs						
Current use a BMP	0.746***	-	-	-	-	-
	(0.187)	-	-	-	-	-
Current Riparian	-	2.121***	-0.622	-0.729*	0.798*	0.402
	-	(0.788)	(0.491)	(0.408)	(0.424)	(0.482)
Current Fencing	-	-0.815	2.718***	0.369	-0.339	0.063
	-	(0.833)	(0.617)	(0.442)	(0.387)	(0.532)
Current No till	-	0.847	-0.724	2.83***	-0.122	0.825
	-	(1.018)	(0.707)	(0.633)	(0.459)	(0.602)
Current Waste	-	-7.584***	1.067	-0.399	0.353	-2.029**
	-	(2.441)	(1.348)	(0.769)	(0.6)	(0.925)
Current Nutrient	-	-0.907	-0.847	-1.128**	-1.32***	1.841***
	-	(0.84)	(0.548)	(0.562)	(0.495)	(0.566)

Demographic and socioeconomic variables						
Experience	0.001	-0.135***	0.02	0.042**	-0.021	0.036
	(0.008)	(0.046)	(0.021)	(0.019)	(0.017)	(0.023)
Land area	0.038	-0.449	-1.635*	0.514	0.056	-0.21
	(0.163)	(0.401)	(0.945)	(0.613)	(0.218)	(0.253)
Rent percentage	-0.122	0.576	-0.541	-1.373*	-0.402	0.373
	(0.29)	(1.431)	(0.792)	(0.765)	(0.642)	(0.815)
Surface water	-0.043	2.623**	-1.242*	0.228	1.079**	-1.874**
	(0.223)	(1.104)	(0.715)	(0.704)	(0.54)	(0.922)
Percentage of household income from farming	-0.003*	-0.152	0.493**	0.033	-0.113	-0.07
	(0.058)	(0.227)	(0.214)	(0.15)	(0.12)	(0.177)
Total household income reinvested back to farm	0.113**	1.411***	-0.059	-0.016	0.451***	-0.074
	(0.063)	(0.437)	(0.225)	(0.161)	(0.147)	(0.209)
Farms with crop	0.364	-1.137	-0.174	0.67*	-0.264	1.131**
	(0.159)	(0.785)	(0.464)	(0.402)	(0.346)	(0.454)
Farms with livestock	0.038	-1.114	-0.104	-1.502**	-0.114	0.667
	(0.205)	(0.833)	(0.71)	(0.592)	(0.514)	(0.856)
Age	-0.012	0.121**	-0.08***	-0.068***	0.009	-0.05*
	(0.008)	(0.051)	(0.03)	(0.023)	(0.019)	(0.027)
Male	0.443**	-1.339	2.473***	-0.779	-1.43**	1.291
	(0.224)	(1.09)	(0.851)	(0.705)	(0.702)	(0.827)
Education	0.077*	0.082	0.335**	0.021	-0.05	0.442***
	(0.044)	(0.177)	(0.137)	(0.108)	(0.093)	(0.169)
Income level	0.083	-0.01	0.104	0.153	-0.227*	-0.141
	(0.057)	(0.237)	(0.149)	(0.143)	(0.132)	(0.209)
Water recreation activities (=1)	0.185	3.576***	0.556	0.414	-0.578	0.746
	(0.16)	(1.321)	(0.437)	(0.384)	(0.388)	(0.484)
CRP	-	-1.616	-1.272	-2.007***	0.612	1.059
	-	(1.076)	(0.843)	(0.609)	(0.445)	(0.839)
WLP	0.182	-0.445	-0.309	-0.177	0.682	-1.109*
	(0.197)	(0.771)	(0.583)	(0.448)	(0.422)	(0.609)
Water quality	-0.115**	-0.523**	-0.584***	-0.273*	-0.234*	0.312*
	(0.058)	(0.231)	(0.219)	(0.143)	(0.133)	(0.187)
Beginning farmer	0.064	0.522	-0.987	-0.119	0.553	1.057
	(0.302)	(1.061)	(0.972)	(0.674)	(0.685)	(0.92)
Minority farmer	0.204	-1.487	2.493	1.838	2.497**	0.505
	(0.378)	(1.481)	(2.218)	(1.484)	(1.23)	(1.581)
Constant	-0.332	-7.671	4.971*	3.414	-2.902	-7.228
	(1.077)	(6.138)	(2.857)	(2.816)	(2.55)	(3.623)
N	356	149	182	177	150	175
Pseudo R2	0.173	0.717	0.671	0.58	0.477	0.68

Note: 1. *, **, and *** imply 10%, 5%, and 1% significance levels, respectively.
2. Standard errors are below coefficients.