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Participation in government cost-share conservation programs in the Kentucky River watershed: a county-level analysis

Abstract

In this study, the adoption of public conservation programs within the Kentucky River watershed is examined. The analysis identifies factors that influence farmers' decisions to participate in these programs. Secondary data collected for forty-eight counties of the level of producers' participation in the Environmental Quality Incentives Program (EQIP), Wildlife Habitat Incentives Program (WHIP), and the Conservation Reserve Program (CRP), are analyzed. Present payments for BMP adoption reveals that most of the EQIP and WHIP funding has been directed towards practices that may not directly contribute to the reduction of pollution, but are used as complements to other practices, that can reduce Nitrogen and Phosphorus contaminants. A regression analysis using aggregate county-level data shows that counties with more farms and larger farms will probably have more participation in the CRP. Adoption and funding could depend on land characteristics of individual plots of land such as slope, vicinity to water, etc.

Keywords: agricultural nonpoint sources, conservation programs, Kentucky River, producer participation.
JEL Classification: Q15, Q18, Q53.

Introduction

The Kentucky River watershed discharges significant amounts of nutrients and sediment into the Ohio River basin, which is one of the sub-basins that contribute to the discharge of these pollutants to the Mississippi basin and subsequently into the Gulf of Mexico. The excess nutrients carried into the Gulf of Mexico, mainly Nitrogen (N) and Phosphorus (P), increase algal production and the availability of organic carbon causing hypoxia, which most aquatic species cannot survive. The hypoxic zone in the northern Gulf of Mexico stretches along the Louisiana-Texas coast, and is the second largest hypoxic zone worldwide. The excess nutrients and sediments come from a wide range of sources of pollution, which are commonly classified as point sources (PS) and nonpoint sources (NPS) of pollution. PS can be traced to a single location such as a pipe. This often includes municipal sewage treatment outfalls, and industrial discharges. Conversely, NPS cannot be traced to a single location and can be characterized by runoff from atmospheric deposition, urbanized land, soil erosion, agricultural fertilizers, and animal feeding facilities. While NPS are difficult to trace and therefore control, these sources of pollution account for the majority of the water nutrient pollution (EPA, 2002).

The Kentucky Division of Water 2004 Kentucky Pollutant Discharge Elimination System (KPDES) Report to Congress on Water Quality (305[b] Report) shows that there are 1477.2 river miles within the Kentucky River watershed affected by agricultural sources of discharge. In order to protect surface and groundwater resources from pollution as a result of agriculture and forestry (silviculture) activities, Kentucky's Agriculture Water Quality Act (AWQA) requires all landowners with 10 or more acres being used for agriculture or silviculture operations to develop and implement a water quality plan based upon its state plan guidance [KY. REV. STAT. ANN. § 224.71].

In order to mitigate the pollution in the U.S. waterways including the Kentucky River watershed, which may help achieve major reductions in pollution in the Gulf of Mexico region, the U.S. government conservation programs provide financial incentives for farmers' participation in voluntary pollution control. Since the government provides financial assistance to farmers who are willing to adopt conservation practices, these programs are also commonly referred to as cost-share programs (Batte and Bacon, 1995). Information about the adoption of these programs and best management practices (BMPs) will be important to the achievement of more stringent standards and/or further cost reductions in water quality improvements, if a water quality trading market between point and nonpoint sources within the watershed is to be considered (EPA, 2004). To increase the effectiveness of such a trading scheme, information is needed regarding not only the impact of alternative BMPs on the reduction of N and P levels, but also the likelihood of adoption of such BMPs by the farmers.

Chouinard et al. (2008) provide evidence that some farmers are willing to forego some profit to voluntarily engage in farm practices without monetary incentives. Several studies have found that in general, higher levels of education attainment and higher cost-share percentages offered for each BMP correlate with higher rates of adoption (Paudel et al., 2008; Suter et al., 2008; Kurkalova et al., 2006).

Langpap et al. (2008) find that land-use policies based on monetary incentives and property acquisition programs can have relatively large positive impacts on watershed health, while policies that change the returns to land use are less effective. When farmers face stricter environmental standards, their profitability might be negatively affected, which may result in more willingness to participate in cost-shared conservation practices (Paudel et al., 2008).

Higher cost-share percentages offered for BMPs may be one solution for additional adoption of conservation practices within the watershed to meet stricter environmental standards. Targeting counties that have more farms, consistent land uses, and farm characteristics that favor adoption of certain practices can also contribute to a more effective trading scheme between PS and NPS of pollution in meeting stricter environmental standards.

In this study, the adoption of public conservation programs within the Kentucky River watershed is examined. The analysis also identifies factors that influence farmers' decisions to participate in these programs. Secondary data are collected for counties within the Kentucky River watershed that may explain the level of producers' participation in the Environmental Quality Incentives Program (EQIP), Wildlife Habitat Incentives Program (WHIP), and the Conservation Reserve Program (CRP). The differences among counties regarding the types of BMPs adopted and the effectiveness of these BMPs in reducing N and P in the water are examined. A regression analysis using aggregated county-level data is conducted to analyze factors such as land use and size of farm operation on farmers' willingness to participate in conservation.

1. Study area, data and analysis of present adoption patterns

The first of three programs to be examined in this study is the EQIP. It is a voluntary program that offers technical assistance and cost sharing of up to seventy five percent (75%) for implementing conservation practices to livestock operations, agricultural production, and nonindustrial private forestland. This program is offered through the Natural Resources Conservation Service (NRCS) in the United States Department of Agriculture (USDA). Its contracts generally last from one year after the last conservation practice is implemented to a maximum term of ten years.

The Natural Resources Conservation Service also administers the WHIP. It differs from EQIP primarily on its eligibility criterion. It allows conservation-minded landowners to develop and improve fish and wildlife habitat on agricultural land, nonindustrial private forestland, and tribal land (USDA NRCS Programs).

The third NRCS program considered in this study is the CRP, which includes the Wetlands Reserve Program (WRP), the Farmable Wetlands Program (FWP) and the Conservation Reserve Enhancement Program (CREP), which is not administered in the Kentucky River watershed. CRP takes land prone to erosion out of production for 10 to 15 years and devotes it to conservation uses. In return, farmers under CRP receive an annual per-acre rent and half the costs of establishing an approved permanent land cover (USDA NRCS Programs). All of these cost-share programs are used as incentives to support farmers' decisions to adopt conservation practices (BMPs) to conserve and protect natural resources and environment.

The study region is the Kentucky River watershed (basin), which comprises the North Fork Kentucky, Middle Fork Kentucky, South Fork Kentucky, Upper Kentucky, and Lower Kentucky sub-watersheds (subbasins) with their respective hydrologic unit codes (HUC-8) 05100201, 05100202, 05100203, 05100204, 05100205. The Kentucky River basin (Figure 1, see Appendix) extends over much of the central and eastern portions of the state. It includes all or parts of 46 counties and drains approximately 7,000 square miles.

Lynch and Lovell (2003) discuss the factors influencing participation in farmland preservation programs, specifically on both purchase of development rights and transfer of development rights. With a survey of 836 farmland owners from certain counties in the state of Maryland, they found that farmers' willingness to engage in a preservation program increases with farm size, growing crops, farm soils eligibility, the share of income from farming, and whether a child in the household plans to continue farming. They also found that the closer farmers' own land is to the nearest city, the less likely they are to join a preservation program. The size of farms was also found to be a key determinant in participation in CRP by Chang and Boisvert (2009).

According to the 2007 Census of Agriculture, from the National Agricultural Statistics Service (NASS), USDA, in the counties associated with the study region there are 27,841 farms, which represent 33% of all farms and 29% of the farmland area in the State. Around 45% of the total area of the Kentucky River watershed is farmland. The average size of farms in the Kentucky River watershed is around 148 acres per county (Table 1). The U.S. 2007 Census also reported that a total of $767,399.00 of CRP payments were made to farmers in that year in counties located fully or partially in the Kentucky River watershed. The NRCS reported in 2006-2009 period a total of $2,473,610.38 of EQIP payments and a total of $306,926.40 of WHIP payments. The average value of CRP payment per county was US$19,675.36, while the EQIP average payment per county was US$53,774.14 and the WHIP average payment per county was US$6,672.31 (Table 2).

The CRP data obtained from the Census consisted of all direct payments from CRP, WRP and FWP. Paudel et al. (2008) and Rahelizatovo and Gillespie (2004) find that if farmers have land with specific characteristics that can improve its eligibility to be involved in the cost-share programs, they are more likely to adopt the BMPs. These land characteristics may include cases where a stream runs through the property. These authors, including a study by Breetz et al. (2005), also find that the availability of technical assistance, such as contact by the USDA cooperative extension service personnel, may also increase participation.

To investigate this factor, we analyze data regarding agricultural extension programming in our study area. According to the Kentucky Cooperative Extension System reports from the University of Kentucky, the number of contacts made by extension specialists to farmers averages 13,393.59 per year per county from the period of 2006-2009 (Table 1, see Appendix). The number of contacts refers to the number of individuals attending face-to-face meetings or telephone calls initiated by college extension personnel for business purposes. Email contacts were not included.

Data from the Kentucky NRCS were collected regarding which conservation practices are used by EQIP and WHIP program adopters (Table 3, see Appendix). In addition, the relative efficiency of these practices in reducing N and P pollution in surface and groundwater quality is presented as calculated by NRCS. For each conservation practice NRCS calculated the physical effect on water quality and weighted it with the costs of implementing the practice. The data on the relative efficiency of BMPs is based on a scale that ranges from -1 to 24. Smaller numbers indicate less efficiency, while negative figures suggest that certain practices can have impacts on the quality of the water not justified by the cost of implementing that BMP. Conversely, the practices with higher numbers show that certain practices can improve water quality efficiency.

The conservation practices Riparian Forest Buffer, Filter Strip, Conservation Cover and Nutrient Management seem to be the most effective in abating N and P for both ground and surface water in the watershed. In the case of surface water, the practices access control, prescribed grazing, critical area planting and grassed waterway also appear to have relatively good performance. Moreover, practices such as stream bank and shoreline protection, waste storage facility, stream crossing, watering facility, and spring development have the highest cost per unit. Pipeline and fencing are the ones with the most units being implemented.

In Table 3, the individual BMPs are separated in terms of their application for pastureland, cropland, woodland and wildlife. For each BMP, the number of contracts awarded by NRCS to farmers and completed during the period of 2006-2009 is provided. For each BMP, the total payments received by the farmers and landowners in the watershed as well as are the total number of units adopted for each BMP and its per unit cost is reported.

The overall effectiveness of the practices funded by EQIP and WHIP can be compared to the amounts of the programs' payments made to farmers and the number of times each practice was funded for the period of time (Table 2). Most of the EQIP and WHIP funding had been directed towards what would seem ineffective conservation practices in abating N and P. This is true for both groundwater and surface water quality. Watering facilities received 25 percent of the total BMP funding, pipeline received 22 percent, and fence received 20 percent. It is clear that many practices (such as fence, pipeline, etc.) have associated benefits for improvements in water quality, due to technical complementarities among practices. Watering facilities may not directly contribute to the reduction of pollution but if used as complements to other practices, they could help reduce livestock access to streams. This subsequently decreases concentrations of bacteria and suspended sediments and associated N and P contaminants.

Table 3 also shows the conservation practices funded by EQIP and WHIP, separated by categories of land use observed in the 2007 Census of Agriculture county data for the total study region. The top funded and the more frequently funded practices are related to pastureland use. Also the majority of the incentives are for practices that impact conservation in pastureland use. This is probably due to the high percentage of pastureland in the watershed (28% of the acreage in the area is pastureland). The highest percentage of land use in the watershed is cropland (44%), but it is not known what part of it meets eligibility requirements (slope, vicinity to water, etc.) in conservation programs that fund certain BMPs.

According to the data collected from the NASS (USDA) 2007 Census of Agriculture of county land uses, and the Natural Resources Conservation Service (NRCS), there is a diverse range of farm sizes, number of farms, quantity of farmland, and land uses per county in relation to total CRP payments received by county. The average CRP, EQIP and WHIP payments received per county vary considerably within the region and can be observed in Table 2. Shelby, Bourbon and Casey counties receive the highest payments from CRP, whereas Mercer, Harrison and Menifee counties receive the highest EQIP payments. Harrison, Henry and Owen counties receive the highest WHIP payments.

2. Factors affecting participation in CRP

The next goal of this study is to conduct statistical analysis to explain the adoption pattern of conservation practices based on land uses and other variables by county. It will also test the interaction between different programs with different criteria for land characteristics eligibility. The dependent variable is the amount of cost-share payments each county in the study region received. This study is limited to the examination of CRP program due to the availability of data for the study region. An examination of EQIP and WHIP (95% of which goes to pastureland) were also conducted using the variables in Table 1 but the data for these two variables did not have enough variation to allow clear identification of impacts from independent variables. As a result, the CRP program was chosen as the target of our analysis. Data used in the analysis were reported in Table 1 with the respective means and standard deviations.

The CRP data as reported by the National Agricultural Statistics Service (NASS), USDA, gives the total amount expended in a given county. Although the amount of payments to the farmers, per county, would vary given different rental rates for land productivity, these data is not available. The Kentucky Agriculture Statistics bulletin collected from the Kentucky Department of Agriculture (USDA, NASS) reports the yields of major crops for each county in Kentucky. However, an analysis of these yields shows little variation for the region of the Kentucky River watershed. For example, the average corn yield for the watershed is 109 bushels per acre with a standard deviation of 8 bushels of corn and insignificant differences.

Information on CRP payments for conservation practices by county could be explained by the following equation:

$$CRP = \beta_0 + \beta_1\, NFarms + \beta_2\, AVGFarm + \beta_3\, TPCropuse + \beta_4\, TPPastureuse + \beta_5\, EQIP + \beta_6\, WHIP + \beta_7\, EXTENSION + \varepsilon. \quad (1)$$

The independent variables used in the equation are the number of farms in a county (*NFarms*), the average farm size per county (*AVGFarm*), the total percentage of cropland in a county (*TPCropuse*), the total percentage of pastureland in a county (*TPPastureuse*), the dollar amount of EQIP payments made to farmers per county (*EQIP*), the dollar amount of WHIP payments made to farmers per county (*WHIP*), and the number of the State of Kentucky Extension Service Specialists contacts to farmers per county (*EXTENSION*). The parameter estimates of each explanatory variable in the equation are represented respectively by β_0 through β_7, and the error term is represented by ε.

The level of government payments for conservation practices is tested to investigate whether counties receiving more incentives from the EQIP or WHIP payments may also be more likely to receive CRP payments. There is no reason to expect a high correlation between the three programs as they target very different environmental concerns. In fact, the correlation matrix shows low correlation coefficients for all independent variables. It is expected that multiple program participation may have positive impact on payments received because information related to adoption of some of the programs is available through the same source, such as the USDA and the Kentucky NRCS.

The number of farms is included to understand whether it would positively correlate with payments for conservation practices. One may expect that the larger the number of farms in a county, the higher the tendency of the information about program benefits being spread which results in higher rates of adoption. Also, it has been hypothesized that larger farms with lower capital costs and higher managerial ability might be more aware of future regulations and are more likely to take advantage of the government benefits (Alvarez and Arias, 2003).

The percentage of cropland in a county is included to investigate whether it tends to be positively correlated with government payments to adopt conservation practices (Lynch and Lovell, 2003; Ghazalian et al., 2009). One could expect that the higher the percentage of pastureland in a county, the lower the payments, because most programs are targeted for land retirement, rewarding conversion of cropland into grasslands or forestlands.

Finally, the number of extension contacts, made by the Kentucky agriculture extension specialists, is incorporated. Previous studies have found that similar education and outreach measurements have positive impact on participation in conservation (Breetz et al., 2005; Paudel et al., 2008; Rahelizatovo and Gillespie, 2004; Ghazalian et al., 2009). Estimation results of the OLS model for the equation on CRP payments are presented in Table 4.

R^2 for the tested model is 0.628; therefore 63% of the variation in CRP payments can be explained by the independent variables included. The F-test shows that the model is significant at 1% level.

The results of the regression analysis show that the average numbers of farms per county and average farm size per county of the study region have a positive relationship with participation in the CRP. Holding all other factors constant, a county with one additional farm within its border is likely to receive $44.80 more in CRP program payment. This is an expected result as the payment is awarded to a specific farm. The larger number farms indicate larger number of candidates to receive the payment holding other factors unchanged.

In addition to the number of farms, holding all other independent variables fixed, if the average farm size of a county increases by one acre (i.e., every farm in the county increase by one acre), the CRP payment is projected to increase by $300.92 for the county. Thus, counties with more farms and larger farms tend to collect more CRP incentives. Land use type is found to be insignificant for CRP participation.

The insignificant coefficients associated with the variables representing EQIP and WHIP payments are not surprising. Although one would anticipate the willingness to participate in these government cost-share programs to be positively correlated, the total amount of payment could be highly related to the number of farms and average farm size in each county. Controlling these two factors, as in the current regression model, explains a large portion of the variation in total payment amount. Furthermore, the requirements for participation in these programs are different.

The number of contacts made by the state extension service personnel was also insignificant. It is recognized that outreach information, delivered by the extension services, may demand some time to be spread and absorbed by communities targeted before the action of engaging in conservation programs may take place. It is possible that there exists a time lag between when the contacts were made and when the farmers' fully understood the contents of these programs, submitted an application, and finally received the shared cost. One way to investigate this possibility is to collect data from previous periods. However, most of the variables used in the analysis are from the census data, which were aggregated at the county level and lacked variation across the years. This makes a panel data analysis infeasible. Another approach is to use lagged extension contact variables to explain the amount of CRP payment received. Several such lagged variables were used and tested such as one-period or higher-order lagged extension contact variable but none were significant. If one believes that the contacts made by extension services may be an important factor determining the county-level cost-share receipts, further study is apparently warranted.

Conclusions

An analysis of present payments for BMP adoption in the Kentucky River watershed targeting reductions of N and P reveals that the BMP that had the highest level of funding was watering facilities, with 25 percent of received payments, followed by pipeline with 22 percent and fence with 20 percent. These BMPs are a necessary complement to other livestock-pollution-targeting BMPs. An examination of the improvements in water quality related to N and P associated with each BMP reveals that riparian forest buffer, filter strip, nutrient management, conservation cover, cover crop, prescribed grazing and waste storage facility provide the highest improvement in groundwater quality. Riparian forest buffer, filter strip, access control, conservation cover, prescribed grazing, field border, critical area planting, grassed waterway, pasture and hay planting and cover crop provide the highest improvement in surface water quality. This information is important in a possible water quality trading scheme between PS and NPS to meet stricter environmental standards in the watershed, which could reduce the levels of N and P in the watershed while minimizing the overall cost of abatement.

The voluntary nature of farmer and landowner participation in present conservation programs requires studying the factors that may lead to this participation. Previous studies conclude that farmers respond to monetary incentives if the right compensation for their opportunity costs is offered. One could also think that farmers would be influenced by possible penalties if they do not comply with the mandates of the Agricultural Water Quality Act.

Based on the findings from the literature, this study tested the relationships between CRP participation with a number of characteristics of counties in the Kentucky River watershed. Factors include farms per county, average farm size per county, percentage of cropland per county, percentage of pastureland per county, EQIP payments per county, WHIP payments per county, and the number of extension contacts made by KY state extension specialists on farmers located in each county in the study region.

Results show that counties with more farms and larger farms will probably have more participation in the CRP. Adoption and funding could depend on land characteristics of individual plots of land such as slope, vicinity to water, etc.

Further refining the participation model may offer additional explanation of participation in government-funded conservation programs in the Kentucky River watershed. For that purpose, it would be useful to obtain farm-level information. Farm-level information could be obtained by a survey where farmers can be asked for their willingness to participate in such a scheme. A survey could also be used to determine the price of water quality "credits" at which PS and NPS will want to trade with each other. Other than land use features, as previous studies revealed, farmer characteristics such as the age of primary operator, education attainment, the source of information a farmer receives for its agriculture activities, farm income, and farm net returns are some examples of factors that can also be crucial determining participation.

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Appendix

Table 1. Descriptive statistics of county characteristics and cost-share payments

Variable	Mean	Std. dev.	Min	Max
CRP payments (US$) per county (2007)	19,675.36	24,043.65	268	99,640.00
# farms per county (2007)	605.24	403.97	23.00	1,651.00
avg. farm size (acres) per county (2007)	148.15	35.25	55.00	245.00
% pastureland per county (2007)	0.14	0.12	0.00	0.42
% cropland per county (2007)	0.22	0.16	-	0.50
EQI payments (US$) per county (2006-2009)	53,774.14	74,259.00	-	293,034.98
WHIP payments (US$) per county (2006-2009)	19,675.36	24,043.65	268.00	99,640.00
# extension contacts per county (2006-2009)	6,672.31	12,403.89	-	50,136.58
# extension contacts	13,393.59	14,508.19	-	92,248.00
n = 46 counties				

Source: Cooperative Extension Service, NASS, FSA, USDA Kentucky NRCS.

Table 2. Kentucky River watershed conservation payments

#	Counties	CRP payments	EQIP payments	WHIP payments
1	Anderson	$18,756.00	$0.00	$4,245.73
2	Bell	$0.00	$0.00	$0.00
3	Boone	$5,775.00	$140,874.55	$32,621.00
4	Bourbon	$97,370.00	$5,158.22	$0.00
5	Boyle	$15,720.00	$107,637.87	$0.00
6	Breathitt	$1,468.00	$0.00	$5,143.52
7	Carroll	$9,630.00	$0.00	$0.00
8	Casey	$66,021.00	$159,084.12	$34,781.70
9	Clark	$26,271.00	$58,841.83	$0.00
10	Clay	$3,500.00	$0.00	$0.00
11	Estill	$18,960.00	$57,427.32	$8,620.00
12	Fayette	$22,080.00	$70,129.53	$0.00
13	Franklin	$5,048.00	$42,929.56	$6,948.20
14	Gallatin	$268.00	$0.00	$8,474.17
15	Garrard	$15,111.00	$0.00	$4,983.20
16	Grant	$6,648.00	$59,469.28	$13,674.50
17	Harlan	$0.00	$0.00	$0.00
18	Harrison	$48,960.00	$264,772.68	$50,136.58
19	Henry	$21,926.00	$109,988.19	$37,393.00
20	Jackson	$6,732.00	$185,492.33	$0.00
21	Jessamine	$8,708.00	$82,897.82	$0.00
22	Kenton	$9,562.00	$116,546.01	$28,470.00
23	Knott	$0.00	$0.00	$0.00
24	Knox	D	$21,719.00	$1,896.40
25	Laurel	$4,602.00	$0.00	$0.00
26	Lee	$6,479.00	$113,257.32	$0.00
27	Leslie	$0.00	$0.00	$0.00
28	Letcher	$0.00	$0.00	$0.00
29	Lincoln	$50,820.00	$0.00	$4,436.00
30	Madison	$48,375.00	$27,369.04	$4,968.21
31	Magoffin	$1,944.00	$0.00	$0.00
32	Menifee	$918.00	$214,315.16	$3,432.66
33	Mercer	$17,052.00	$293,034.98	$0.00
34	Montgomery	$32,800.00	$36,928.22	$0.00
35	Morgan	$16,422.00	$0.00	$3,415.25
36	Owen	$15,582.00	$22,115.74	$36,113.28
37	Owsley	$513.00	$10,483.67	$0.00
38	Perry	D	$0.00	$0.00
39	Pike	$879.00	$9,212.41	$0.00
40	Powell	$6,489.00	$0.00	$0.00
41	Rockcastle	$16,758.00	$7,806.99	$0.00
42	Scott	$7,520.00	$9,927.99	$0.00
43	Shelby	$99,640.00	$105,251.75	$9,414.00
44	Trimble	$14,916.00	$11,453.00	$0.00
45	Wolfe	$5,980.00	$28,493.87	$7,759.00
46	Woodford	$11,136.00	$100,991.93	$0.00
	Total	$767,339.00	$2,473,610.38	$306,926.40

Source: USDA, National Agricultural Statistics Services (NASS) – 2007 CENSUS of Agriculture; USDA KY NRCS.
Note: (D) Cannot be disclosed.

Table 3. Conservation practices efficiency estimates vs. EQIP/WHIP incentives received – groundwater and surface water

Land use category	Practice code	Practice name	Number of contracts	Payments received	Total units	Unit type	Estimated costs/unit	Ground water quality efficiency	Surface water quality efficiency
Pastureland	614	Watering facility	220	$1,920,836.34	7,693.4	Each	$2,408.73	0	0
	516	Pipeline	220	$1,684,264.93	1,080,756.1	Feet	$2.44	0	0
	382	Fence	147	$1,528,761.61	959,409.9	Feet	$2.45	1	4
	472	Access control	80	$654,912.77	13,515.6	Acre	$60.60	6	13
	512	Pasture and hay planting	60	$437,836.90	3,509.7	Acre	$452.16	7	10
	378	Pond	36	$342,971.38	56.0	Each	$6,623.93	0	5
	580	Stream bank and shoreline protection	6	$254,715.55	5,095.0	Feet	$117.96	0	9
	313	Waste storage facility	8	$233,231.70	10.0	Each	$6,494.17	8	9
	528	Prescribed grazing	68	$145,846.00	8,274.0	Acre	$47.75	8	12
	561	Heavy use area protection	28	$121,644.81	46.9	Each	$864.72	1	7
	327	Conservation cover	28	$88,078.57	567.6	Acre	$287.63	10	13
	578	Stream crossing	32	$65,842.88	51.0	Each	$3,769.68	0	0
	575	Animal trails and walkways	21	$51,276.32	15,653.0	Sq. ft.	$1.53	0	0
	574	Spring development	32	$39,378.50	43.0	Each	$2,301.33	0	6
	606	Subsurface drain	4	$3,348.35	3,340.0	Feet	#N/A	7	0
			990	$7,572,946.61					
Cropland	590	Nutrient mgmt.	17	$43,971.90	2,113.1	Each	$1,988.51	10	13
	340	Cover crop	4	$29,562.51	298.4	Acre	$188.40	8	9
	342	Critical area planting	28	$29,359.19	71.7	Acre	$1,980.81	4	11
	386	Field border	5	$3,416.90	29,648.0	Acre	$351.21	8	12
	393	Filter strip	8	$1,144.29	506.3	Acre	$417.93	10	24
	484	Mulching	1	$248.96	73.8	Acre	#N/A	-1	9
			63	$107,703.75					
Woodland	666	Forest stand improvement	36	$123,431.84	1,028.7	Sq. ft.	$298.89	4	6
	391	Riparian forest buffer	5	$2,923.16	11.4	Acre	$484.05	11	24
	655	Forest trails and landings	1	$905.48	1.0	Acre	$3,112.89	0	0
			42	$127,260.48					
Wildlife / Other	395	Stream habitat improvement & mgmt.	1	$103,950.00	4.0	Acre	#N/A	0	6
	410	Grade stabilization structure	7	$15,969.46	13.0	Each	$3,434.93	0	3
	412	Grassed waterway	7	$12,315.50	7.0	Acre	$5,680.23	0	11
	642	Water well	3	$11,828.65	202.0	Feet	#N/A	0	0
	645	Upland wildlife habitat mgmt.	12	$8,842.54	1,499.9	Sq. ft.	$36.28	0	0
	646	Shallow water development & mgmt.	1	$5,714.62	2.0	Acre	$2,375.24	1	7
	643	Restoration and mgmt. of rare & declining habitats	1	$4,741.88	27.8	Sq. ft.	$184.03	0	2
	468	Lined waterway or outlet	1	$4,400.00	88.0	Lft.	$52.05	0	2
	490	Tree/shrub site preparation	2	$1,010.80	22.2	Acre	#N/A	0	0
	620	Underground outlet	1	$374.98	225.0	Feet	#N/A	0	3
			36	$169,148.43					
Total			1,131	$7,977,059.27					

Source: USDA – KY NRCS.

Table 4. OLS estimation results

Variable	Coefficient	Std. err.
Constant	-63,686.000***	19,383.00
# farms	44.804***	12.46311
Avg. farm size (acres)	300.919***	110.82851
% pasture land	80015.000	55,971.00

Table 4 (cont.). OLS estimation results

Variable	Coefficient	Std. err.
% cropland	-80604.000	61,539.00
EQIP payments (US$)	0.005	0.04088
WHIP payments (US$)	-0.022	0.2329
# extension contacts	-0.011	0.18999
R^2	0.628	-
Adj. R^2	0.544	-
F-value	7.470***	-

Notes: *, **, and *** indicate significant at the 10%, 5%, and 1% significance levels respectively.
Sources: Cooperative Extension Service, NASS, FSA, USDA – Kentucky NRCS.

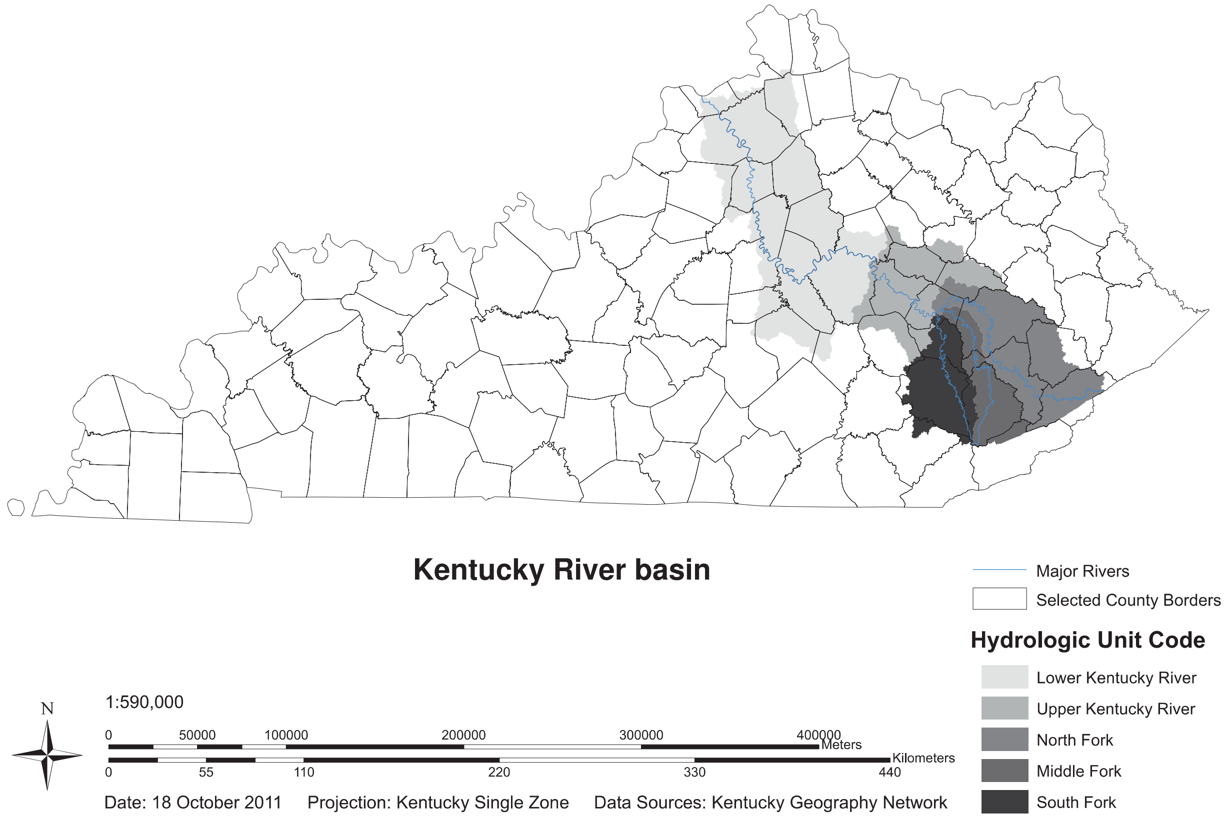

Fig. 1. Kentucky county boundaries and the Kentucky River watershed