The Role of Stakeholders' Perceptions in Addressing Water Quality Disputes in an Embattled Watershed

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Abstract

Preliminary results of a survey of agricultural and non-agricultural stakeholders in the Lincoln Lake Watershed suggests discrepancies exists in different groups perceptions of water quality, the sources of water pollution, and the roles of local, county, state and federal officials in meeting water quality objectives.

JEL codes: Q25, Q53, Q59

Introduction

The Lincoln Lake watershed is a sub-watershed within the Illinois River basin located in Northwest Arkansas and Eastern Oklahoma. It is a rapidly growing area that is home to poultry and cattle farms, urban dwellers and industry (see Figure 1). The landscape of the Ozark Highlands is a complex arrangement of geologic features, soil types, vegetation, and land use. Nonpoint source (NPS) transport of nutrients, sediment, and pathogens from agricultural activities is a major concern in this area (Edwards and Daniels, 1992; Edwards et al., 1997). Rolling hills in this region are home to thousands of poultry farms and pastures that produce abundant forage for numerous beef and dairy cattle. The predominant use of animal manure in the area has been as a fertilizer for perennial forage crops. There is growing concern that excess land applications of animal manure can lead to surface and ground water pollution due to increased runoff losses of nutrients such as nitrogen (N) and phosphorus (P), sediment, and

pathogens (e.g., Edwards et al., 1996). Increasingly, watersheds are unable to utilize/degrade the high levels of fertilizers and animal manure applied to them. The result is increases in noxious, oxygen consuming and sometime toxic algal blooms, deteriorations of fisheries, and general degradation of water quality (Park et al., 1994; Sharpley et al., 1994).

The Illinois River has long been a subject of political and environmental debate due to nutrient enrichment. As surface waters traverse state and county borders, lawsuits abound, not only across state lines but among agricultural landowners, poultry producers, environmentalists, and other stakeholders within the watershed itself. In 1992, the U.S. Supreme Court ruled that EPA may require upstream states to adhere to downstream states' water quality standards. The Illinois River has been listed as a scenic river in Oklahoma and therefore is subject to a total phosphorus (TP) criterion of 0.037 mg/L established by the Oklahoma Water Resources Board (OWRB, 2002).

A 2005 CEAP project was established within the Lincoln Lake Watershed that integrates research, extension, and education activities through a stakeholder-guided process to measure, model, and predict watershed scale water quality. This stakeholder-guided process will help ensure that a water quality management plan can be developed that cannot only effectively reach water quality goals but do so in a manner that is understood and acceptable to stakeholders in the watershed. The stakeholder study has three objectives: 1) to collect Lincoln Lake Watershed stakeholders perceptions of watershed water quality and sources of water pollution 2) to understand how stakeholders view the roles of local, county, state and federal officials in meeting water quality objectives, and 3) to determine how that information can be used to help move stakeholders from conflict to cooperation in meeting desired water quality goals.

Stakeholders are defined as landowners, business owners and other households within the watershed. They have been placed into two groups - agricultural and non-agricultural stakeholders. In this paper we present the preliminary results of the first two objectives of the stakeholder study. This will represent the first such detailed dataset of its kind in the region.

Methods

Two surveys were developed for watershed stakeholders – one survey for agricultural producers (agricultural stakeholders), the other for all other land/home/business owners (non-agricultural stakeholders). These surveys solicited stakeholders' perceptions of: 1) watershed water quality, 2) potential sources of water quality degradation and 3) their interaction with policy makers on water quality issues. Additionally, agricultural stakeholders were asked about the adoption, effectiveness, risk and profitability associated with 15 locally relevant agricultural best management practices (BMPs) that can be used to address nutrient runoff and sediment.

Washington County assessor's office records were used to identify all land and business owners within the Lincoln Lake Watershed. These individuals were then placed in the relevant stakeholder category (75 agricultural and 243 non-agricultural stakeholders). Survey data were collected during meetings held within the watershed during the months of July through September (separate meetings for agricultural and non-agricultural stakeholders). Mail surveys were sent to stakeholders absent from these meetings in October and November. Due to the holidays, a final reminder will be sent to all absent from the meetings in late January. Summary statistics have been calculated for all responses and Chi-square and Fisher's Exact tests have been conducted for responses of selected questions. Further statistics analysis will begin in late January when the data collection period has ended.

Results

To date, data have been collected on 63 (84%) of agricultural stakeholders. The characteristics of the agricultural stakeholder respondents are presented in Table 1. Over half of the agricultural respondents listed cattle production and hay production as their primary agricultural activity. Broiler and other poultry production represented the primary agricultural activity for roughly 35 percent of agricultural respondents. Roughly 61 percent of respondents were from the Moores Creek section of the watershed and 29 percent were from Beatty Branch.

Data have also been collected from 62 (26%) of non-agricultural stakeholders. Of these stakeholders, 81.36 percent stated that their land was used as their primary residence; another 22.03 percent stated their land was used for a business operation (Table 2). Over 80 percent of non-agricultural respondents own land in the Moores Creek section of the watershed. The higher response rate in Moores Creek is attributed to the long term relationship that exists between residents/business owners there and University of Arkansas Division of Agriculture personnel who conducted the survey.

Both agricultural and non-agricultural stakeholders were asked to give their perceptions of the quality of three bodies of water within the watershed – Lincoln Lake, Moores Creek and Beatty Branch (Table 3). Significant differences exist ($p = 0.01$) in opinions regarding the quality of all three water bodies between agricultural and non-agricultural stakeholders. In general a higher percentage of agricultural stakeholders feel that the water quality in these water bodies is acceptable. At least 54% of agricultural stakeholders agreed that all three water bodies to have acceptable levels of water quality where only 19 to 22 percent of nonagricultural stakeholders agreed.

Respondents were further asked how suitable these water bodies were for three particular uses – drinking, swimming and fishing (9 water body/use combinations). Significant differences existed between stakeholder groups for seven of the nine combinations (Table 4). Additionally, in all cases, a greater percentage of agricultural stakeholders believed the quality of all water bodies were good for all uses. Forty-three to 79 percent of agricultural stakeholders found the water quality good where as in most cases only 18 to 58 percent of non-agricultural stakeholders felt the same way. In both stakeholder groups, more respondents thought the water quality was better for drinking and fishing than for swimming.

All stakeholders were then asked if they felt water quality problems existed, how much of a contribution seven different groups made to those problems (Table 5). Significant differences ($p = 0.01$) existed in stakeholder responses for only one group – agriculture. Over 42 percent of non-agricultural stakeholders believe that agriculture is a large contributor to water quality problems in the area, only five percent of agricultural respondents felt the same way. Non agricultural respondents most often selected agriculture, new construction, city sewer system and industry (in that order) as large contributors to pollution while agricultural respondents most often selected “other groups” (in which they mentioned golf courses, timberland, and pond construction), new construction, industry, city sewer system industry and households as the largest contributors.

Respondents were then asked their opinions as to who of those seven groups mentioned above) should be responsible for cleanup. Responses mirrored their opinions as to who contributed to the problem (Table 6). Significant difference again only existed for agriculture; 42 percent of non-agricultural stakeholders believe that agriculture has a large responsibility for the clean up while only 8 percent of agricultural stakeholders share that opinion.

As shown in Figure 1, agriculture pasture land dominates the land use in the watershed. Therefore, all stakeholders were asked their opinions regarding the effectiveness of 15 possible best management practices (BMPs) that agricultural producers could use to protect water quality in the watershed. While 15 BMPs could be used, only five of those practices have been widely adopted. Table 7 presents the opinions of responding stakeholders regarding the effectiveness of those five BMPs that are most often adopted in the watershed. Significant differences in opinions regarding the effectiveness of three practices exist (Table 7). A greater percentage of agricultural producers thought all practices were effective, with the exception of the comprehensive nutrient management plan, where roughly 50 percent of both groups found this to be an effective practice. Similarities in responses, but not the relatively low confidence in the practice, are expected as educational efforts have been provided to both agricultural and non-agricultural stakeholders regarding the purpose and benefits of a comprehensive nutrient management plan (CNMP). Similar education efforts regarding other BMPs have not likely reached many non-agricultural stakeholders.

Finally all stakeholders were asked questions regarding their inclusion in the water quality policy making process. Roughly 44 percent of both stakeholder groups felt government officials invited them to participate in the process but only 19 percent of agricultural and 28 percent of nonagricultural respondents felt that officials listened to their opinions. The majority of both groups felt that local/county level officials best represented their water quality needs and concerns (Table 8) and at least 65 percent of both stakeholder groups believe that local/county level officials need some or a lot more power/authority to carry out water management polices (Table 9).

Summary and Conclusion

A preliminary review of the collected data suggests that, opinions vary widely between the two stakeholder groups regarding the quality of the water and the sources of water pollution within the watershed. Non-agricultural stakeholders were not very satisfied with the quality of the water bodies in the watershed and most often pointed to agriculture as a large contributor to water quality issues in the watershed. Very few agricultural producers felt that way. In general agricultural stakeholders felt the quality of the water in the watershed was good and acceptable for many uses; if problems do exist in the watershed, new construction, industry and others were to blame. While these results are expected, survey data also provide insights regarding best management practice adoption and stakeholders perceptions of their effectiveness that were heretofore unsubstantiated.

Collecting information regarding water quality perceptions from different watershed stakeholders and BMP use is also critical for modeling and predicting water quality more accurately. Involving all types of watershed stakeholders from the planning stage to the implementation stage is important to promote cooperation among stakeholders, policy makers and regulators. In addition, it helps researchers to understand the adoption of certain BMPs as well as to understand the challenges and limitations faced by different groups. It is hoped that these results help identify the research educational needs within the watershed that will help guide the development of a water quality management plan that is acceptable to different types of stakeholders within the Lincoln Lake Watershed and that the methods and tools developed here can be applied across the nation where effective water quality management is a challenge in embattled watersheds impacted by excess application of animal manure.

References

Edwards, D.R., and T.C. Daniel. 1992. Effects of poultry litter application rate and rainfall intensity on quality of runoff from fescuegrass plots. *J. Environ. Qual*. 22:361-365.

Edwards, D.R., T.C. Daniel, H.D .Scott, J.F. Murdoch, and P.F. Vendrell. 1997. Effect of BMP implementation on storm flow water quality of two northwestern Arkansas streams. *Trans. ASAE* 40:1311-1319.

Edwards, D.R., T.C. Daniel, H.D. Scott, J.F. Murdoch, M.J. Habiger, and H.M. Burks. 1996. Stream water quality impacts of best management practices in a northwest Arkansas basin. *Water Resour. Bulletin* 32:499-509.

Park, S.W., S. Mostaghimi, R.A. Cooke, and P.W. McClenllan. 1994. BMP impacts on watershed runoff, sediment, and nutrient yields. *JAWRA*. 30:1011-1023.

Sharpley, A.N., S.C. Chapra, R. Wedepohl, J.T. Sims, T.C. Daniel, and K.R. Reddy. 1994. Managing agricultural phosphorus for protection of surface waters: issues and option. *J. Environ. Qual.* 23:437-451.

Table 1. Selected characteristics of survey respondents by agricultural activity in 2005

Activity	Percent of respondents in activity	Number (houses, head or acres)
Broiler production	19.67	48 [a]
Other poultry	14.75	31 [a]
Beef cattle	60.66	2,294 [b]
Other livestock	16.39	168 [b]
Hay production	59.02	1,048 [c]
Pasture production	42.62	1,033 [c]
Other activities	18.04	216 [c]

a = houses, b = head, c = acres

Table 2. Land use of non-agriculture survey respondents

Land Use	Percent of Respondents
Primary residence	81.36
Business operations	22.03
Rental property	13.56
Land preservation	10.17

Table 3. General perceptions of water quality in the Lincoln Lake Watershed

Lake/Stream	Water Quality is … (Percent of Respondents)				
	Agricultural		Non-Agricultural		P Value
	Unacceptable	Acceptable	Unacceptable	Acceptable	
Lincoln Lake	15.87	55.56	38.33	20.00	0.0002
Moores Creek	14.75	54.10	32.73	21.82	0.0013
Beatty Branch	10.17	54.24	27.08	18.75	0.0005

Table 4. Perceptions of water quality in the Lincoln Lake Watershed by use

	The water is GOOD for... (Percentage of Respondents from Each Stakeholder Group)								
	Drinking			Fishing			Swimming		
Water Body	**Agricultural Stakeholders**	**Non-Agricultural Stakeholders**	**P Value**	**Agricultural Stakeholders**	**Non-Agricultural Stakeholders**	**P Value**	**Agricultural Stakeholders**	**Non-Agricultural Stakeholders**	**P Value**
Lincoln Lake	79.37	57.89	0.0389	77.42	72.88	0.5485	58.06	22.41	<0.0001
Moores Creek	79.03	52.83	0.0093	60.66	43.64	0.1611	45.90	20.37	0.0015
Beatty Branch	78.69	44.68	0.0012	58.33	34.00	0.0265	43.33	18.00	0.0148

Table 5. Respondents' perceptions as to who contributes to any existing water quality problem

Group	Agricultural (Percent of Respondents)		Non-Agricultural (Percent of Respondents)		P Value
	Small	Large	Small	Large	
New construction	38.71	51.61	41.51	37.74	0.1616
Industry	50.00	29.03	49.09	25.45	0.8206
City sewer system	54.10	26.23	58.49	28.30	0.6527
Households	56.45	24.19	58.18	23.64	0.9800
Other groups	28.37	57.14	0.00	18.18	n/a
Outdoor recreation	40.98	4.92	42.59	9.26	0.6182
Agriculture	75.81	4.84	50.88	42.11	<0.0001

n/a – statistical tests not conducted on category

Table 6. Respondents' perceptions as to who should be responsible to clean up

Group	Agricultural (Percent of Respondents)		Non-Agricultural (Percent of Respondents)		P Value
	Small	Large	Small	Large	
New construction	36.07	54.10	46.00	40.00	0.3296
Industry	50.00	37.10	48.98	36.73	0.9775
City sewer system	53.23	25.81	48.00	36.00	0.4819
Households	55.74	24.59	54.90	25.49	0.9937
Other groups	28.57	28.57	0.00	30.77	n/a
Outdoor recreation	47.46	5.08	38.78	16.33	0.1479
Agriculture	66.67	8.33	43.64	41.82	0.0002

Table 7. Top five best management practices respondents' believe can reduce sediment and/or nutrient loss from their lands

Group	Percentage of respondents that believe this is an effective practice		P Value
	Agricultural Stakeholders	Non-Agricultural Stakeholders	
Soil Test	86.44	70.45	0.0625
Use of Manure Instead of Commercial Fertilizer	82.14	46.51	0.0009
Basing Fertilizer Application on Soil Test Results	80.00	63.41	0.1721
Pasture Grass Management	82.46	53.66	0.0050
Comprehensive Nutrient Management Plan (CNMP)	51.79	52.38	0.9992

Table 8. Percentage of respondents that feel a specific level of government represents their water needs and concerns best

Government Level	Agricultural Stakeholders	Non-Agricultural Stakeholders
County	83.05	68.09
State	13.56	23.40
Federal	3.39	8.51

$p = 0.1833$

Table 9 Percentages of stakeholders who believe that government should be given three different levels of additional power

Government Level	Agricultural Stakeholders			Non-Agricultural Stakeholders			P Value
	None	Some	A Lot	None	Some	A Lot	
Federal	81.67	13.33	5.00	69.57	28.26	2.17	0.1368
State	51.67	36.67	11.67	58.00	32.00	10.00	0.8017
County	26.67	31.67	41.67	34.62	30.77	34.62	0.6226

Figure 1. Location and land use of Lincoln Lake watershed in Arkansas