Perceptions and Realities of Watershed Health in the Lower Kaskaskia River: An Integrated Approach

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Introduction

Water quality is a persistent issue in Midwestern rural and urban communities. To be able to address these issues appropriately, community concerns and perceptions of water quality must be taken into consideration because community leaders' & citizens' perceptions often drive the allocation of resources to implement water quality management actions. Previous research has focused predominately on water quality and potential management strategies; however, research often fails to address the human dimension of watershed management. To address this research gap, this study presents findings from a subset of data collected and gathered as part of a regional, integrated watershed and community health project in which water quality data is being collected for 43 streams and community perceptions are being gathered in 4 communities of the Lower Kaskaskia Watershed. The objectives of this study are (1) to examine how community leaders' and citizens' perceptions relate to actual water quality data collected for two of the streams within the Lower Kaskaskia Watershed, and (2) assess community leaders' and citizens' perceptions for differences.

Study Area

We chose to investigate the community of Freeburg and the health of two subwatersheds of the Lower Kaskaskia Watershed: Broad Hollow and Kinney Branch. The predominate land cover in the Broad Hollow subwatershed is agriculture (>99%, Table 1). The Kinney Branch subwatershed includes the rural village of Freeburg and has more than 10% urban land cover (Table 1).

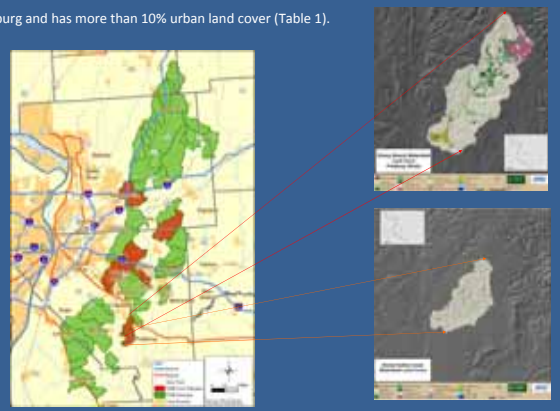


Table 1. Freeburg Streams Land Cover

	% Urban	% Agriculture	% Forest
Broad Hollow	0	99.4	0.6
Kinney Branch	10.3	78.7	11.0

Methodology

Qualitative Data

- 6 key informant interviews
- 1 focus group with Freeburg citizens
- Recordings transcribed and thematically analyzed with qualitative data software QSR NVivo

Water Quality Data

- Stream water grab samples (January 18, 2000 – January 17, 2009)
  - Every two weeks during wet season, once a month during dry season
  - Stream discharge measured with a Marsh McBirney flowmeter
- Lab Analyses
  - Total Suspended Solids (TSS)
  - Fecal coliform and *E. coli*
  - Nutrients
    - Ammonium, Chloride, Nitrate, Orthophosphate, Sulfate

Results

Table 2. Water Quality Means and Ranks for Freeburg Streams

Water Quality Parameters \ Land Cover Classification	> 10% urban land cover		< 2% urban land cover	
	Kinney Branch (baseflow)	Kinney Branch (stormflow)	Broad Hollow (baseflow)	Broad Hollow (stormflow)
Orthophosphate (mgL^{-1})	4.46 ± 0.60 **(2)**	2.02 ± 0.41 **(6)**	1.06 ± 0.26 **(21)**	1.48 ± 0.32 **(12)**
E. coli (Most Probable Number)	525.2 ± 176.5 **(20)**	2775.1 ± 1126.3 **(13)**	764.5 ± 460.3 **(11)**	1735.7 ± 155.0 **(25)**
Total Suspended Solids (mgL^{-1})	12.17 ± 3.87 **(41)**	379.8 ± 278.8 **(8)**	56.66 ± 24.67 **(5)**	137.9 ± 90.23 **(31)**
Ammonium NH_4-N (mgL^{-1})	0.80 ± 0.27 **(10)**	0.36 ± 0.04 **(23)**	0.30 ± 0.06 **(18)**	0.48 ± 0.12 **(7)**
Nitrate NO_3-N (mgL^{-1})	1.20 ± 0.32 **(4)**	0.46 ± 0.15 **(33)**	0.24 ± 0.06 **(41)**	0.17 ± 0.03 **(34)**

* Ranks are in parentheses and are out of 43 streams

Figure 1. Total Suspended Solids: Kinney Branch vs. All Other Studied Streams

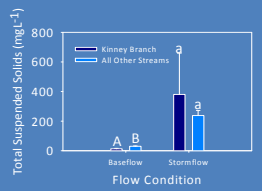


Figure 2. Orthophosphate: Kinney Branch vs. All Other Studied Streams

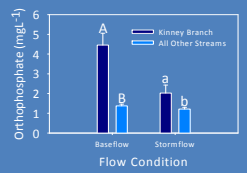


Figure 3. Nitrate-N: Kinney Branch vs. All other Studied Streams

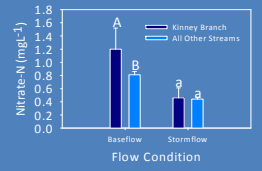
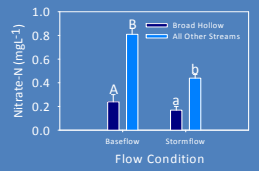


Figure 4. Nitrate-N: Broad Hollow vs. All other Studied Streams



* Within flow conditions, different letters represent significant difference at alpha = 0.05

Themes in Perceptions of Watershed Health

Community Leaders
- Clean
- Heavily regulated
- Potential Sources of Pollution
  - Urban runoff

Citizens
- Polluted
- Improved from past
- Erosion
- Flooding
- Potential Sources of Pollution
  - Development
  - Agricultural chemicals

Discussion

The results of our study revealed that there are differences between community perceptions of watershed health and measured water quality (Objective 1). Broad Hollow, the agricultural watershed, didn't have any of the impairments cited by citizens. However, *E. Coli* levels were higher than the U.S. EPA standard for recreational use (i.e., 235 colony-forming units per 100 mL). Conversely, Kinney Branch had both elevated nutrient and *E. coli* levels. Orthophosphate levels for were not only significantly higher than the other studied streams, baseflow concentrations were twice as high as stormflow concentrations. This indicates that phosphate entering the stream attached to sediment is not the dominant transport mechanism, but rather groundwater and point sources during baseflow. Therefore, probable sources of orthophosphate include septic/sewer systems and waste water treatment.

There were also notable differences in perceptions between citizens and community leaders (Objective 2). Community leaders were more likely to report healthy stream conditions. *". . . But in a lot of ways it's going too far the other way now to where the discharge limits are based on a laboratory's ability to find lower limits when they run the test. It gets to the point of how clean is clean and how much do you want to pay for?" (Interview #27, Freeburg Community Leader).* Freeburg citizens often cited concerns regarding water quality. *"I actually had pollution and flooding too, but one other one I had is the erosion we're having so badly in our area from all the heavy rains" (Freeburg Concerned Citizen Focus Group, Concerned Citizen).*

Conclusion

Possible limitations of the study were that only preliminary qualitative data was used with a small sample size, and that informants were not asked detailed questions about potential sources of water pollution in interviews and focus groups. Differences in perceptions and realities indicate a need for a collaborative learning process that fosters the incorporation of technical water data into a shared meaning of the health of this watershed. Disparities between citizens' and community leaders' perceptions should also be resolved through collaborative watershed management in which strong partnerships are formed to empower citizens to take responsibility of their water resources.

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