Navigating Water Quality Outcomes in American Watersheds

ASPA 2024

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Under Contract with Cambridge University Press

> [Collaboration is a] process in which autonomous or semi-autonomous actors interact through formal and informal negotiation, jointly creating rules and structures to govern their relationships and ways to act or decide on the issues that brought them together; it is a process of shared norms and mutually beneficial interactions.
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> — *Thompson, Perry, & Miller (2007, 25)*

The Context and Challenge of Collaboration

- Varying Boundaries – Anthropogenic and Natural
- Varying Decision-Making Rules & Processes
- Varying Accountability Mechanisms
- Varying Time Scales
- Varying Needs and Demands

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The Context and Challenge of Collaboration (cont.)

- Presence of Institutional Fragmentation

- Presence of Incomplete but Overlapping Authority
- Presence of Collective Action Dilemmas
- Presence of Complexity & Uncertainty
- Presence of 1st and 2nd Generation Policy Responses/Challenges
- Presence of Climate Change

Enter Watershed Management

- Emphasis begins in mid-1990s as EPA begins to enforce Total Maximum Daily Load (TMDL) provisions of the Clean Water Act §303(d) under pressure of lawsuits
- Broad range of partners needed to represent environmental and economic interests and to address collective action problems
- Adoption of flexible and adaptive policy tools based on scientific learning
- Recognition of local conditions on the ground (and in the water) but supplemental to traditional institutions
- No one way to organize collaborative activities

Why Watersheds?

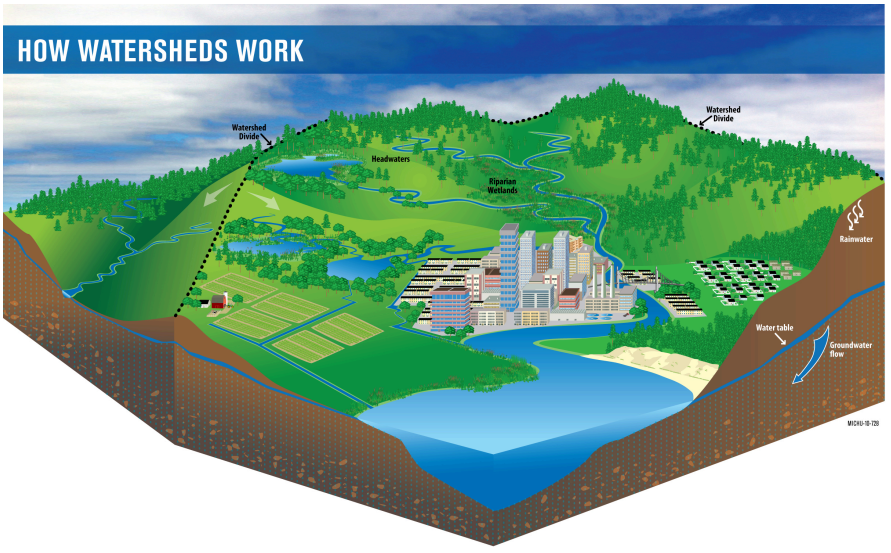

Image from Michigan Sea Grant Communications and Education Services

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Guiding Questions

1. Do the number and type of stakeholders impact measured water quality?
2. Do the number and type of stakeholders impact perceived water quality improvement?
3. Does water flow impact stakeholder perceptions of perceived water quality improvement?
4. Are stakeholder perceptions of water quality improvement associated with community characteristics?

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Guiding Questions (cont.)

5. Do collective action beliefs impact stakeholder perceptions of water quality improvement?
6. Do beliefs about watershed management decision-making process legitimacy impact stakeholder perceptions of water quality improvement?
7. Does the type and number of operational-level activities conducted in a watershed impact stakeholder perceptions of water quality improvement?

Our Data

Unit of Analysis: Watershed

- 2,256 US Watersheds; 564 included in our sample
- 4,261 Organizations -- 2,795 unique
- 1,427 Surveys Distributed; 532 returned (37%)

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Our Data (cont.)

Dependent Variables

- Measured Water Quality (TMDL Data) and Perceived Water Quality

Independent Variables

- Number and Type of Stakeholders
- State-level NPS Policy Activism and Water Rights
- Contextual Characteristics
- Measured Water Quality (TMDL Data)

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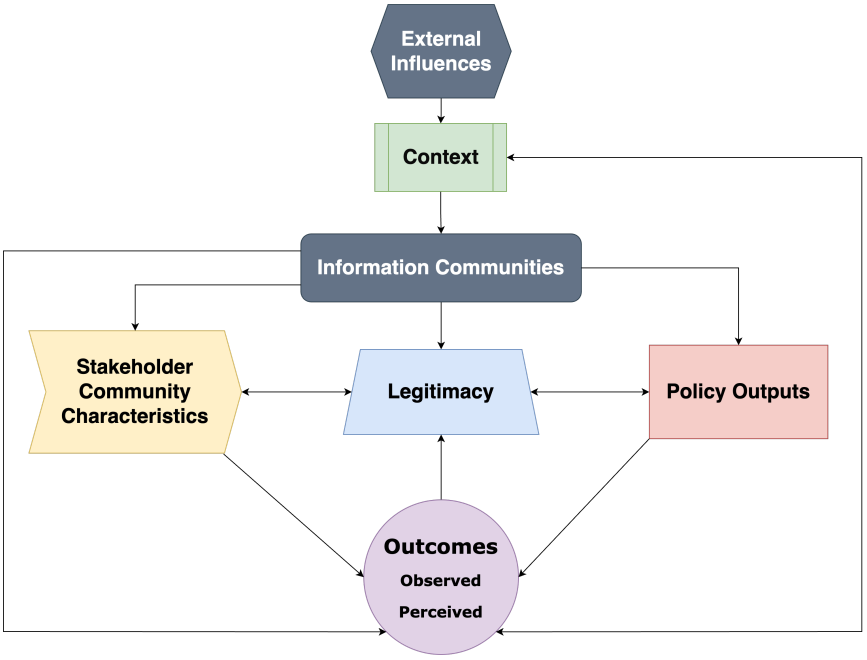

Theoretical Model

Research Design in Two Phases

Phase 1: A Multilevel Mixed-Effects Modeling Approach

$$\begin{aligned} \text{Watershed Level: } & Y_{ij} = \beta_{0j} + \beta_{1j} X_{ij} + r_{ij} \\ \text{State Level: } & \beta_{0j} = \gamma_{00} + \gamma_{01} W_j + u_{0j} \\ & \beta_{1j} = \gamma_{10} + \gamma_{11} W_j + u_{1j} \end{aligned}$$

Early Findings

- Each additional Regional NGO is associated with a 4% reduction in the percentage of insufficient water quality.
- Higher percentages of white populations are associated with lower levels of insufficient water quality.
- Insufficient quality in 2002 is associated with insufficient quality in 2010 (49% insufficient in 2002 versus 41% insufficient in 2010 ($\rho = .39$; $p < 0.01$).
- State-level factors account for 30% of water quality variability.

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Early Findings (cont.)

- Higher percentages of white populations increase the odds of perceiving water quality improvement.
- Greater population densities increase the odds of perceiving water quality improvement.
- Watershed partnerships increase the odds of perceiving water quality improvements.
- Odds of perceiving improvement equal .93 (CI: .85, 1.00) when a partnership is present.

Going Forward

1. Further analyze the hypothetical model (presented in the handout) to account for causal relationships between variables.
2. Utilize Network analysis of actors to analyze and compare relationships and water quality
3. Explore activities conducted beyond the on-the-ground operational-level

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The Big Question:

Does Collaboration Matter?

Still can't answer it, but early findings offer some intriguing insights.

Thank You!

Questions? Comments? Concerns?

Phase 2: A Qualitative Study

- Organizations asked to name most recent activity conducted related to water quality improvement.
- Using pattern matching to tease out themes and trends, responses were separated by partnership membership and organizational type and then coded by operational-level activities.

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Phase 2: A Qualitative Study (cont.)

$$\frac{\Pr(y=1|\mathbf{x})}{\Pr(y=0|\mathbf{x})} = \frac{\Pr(y=1|\mathbf{x})}{1-\Pr(y=1|\mathbf{x})},$$

where $y =$ aggregate organizational responses about whether water quality has improved (1) or not (0) since involvement in the watershed.

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Phase 2: Early Findings

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Level of Stakeholder Activities

When Partnerships are Present

1. Restorative Activities
    - Local Nongovernmental Organizations
    - Special Districts
2. Educational Activities
    - Local Governments

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Level of Stakeholder Activities

When Partnerships are Absent

1. Restorative Activities
    - Local Nongovernmental Organizations
    - Regional Nongovernmental Organizations
2. Educational Activities
    - State Nongovernmental Organizations
