WATERSHED KNOWLEDGE MAPPING PROJECT

Investigating Efforts To Monitor The Water Quality Impacts Of Marcellus Shale Development

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Many environmental problems require more extensive scientific research.

Sociologists study why science that is needed remains “undone” and how these unknowns affect communities and public policy.
RESEARCH OBJECTIVES

- Produce a comprehensive database and map of efforts to monitor watershed impacts of shale gas development in NY and PA.
- Identify regions and watersheds that may require greater monitoring by governments, researchers, and the public.
- Explain why water monitoring efforts are unevenly distributed across the region.
- Analyze the relationships and tensions between government, academic, and civil society research efforts.
OUTLINE OF PRESENTATION

- Explanation of research methods

- Water quality monitoring by government agencies
  - Do investments in monitoring match intensity of gas development?

- Water quality monitoring by civil society organizations (volunteers and environmental groups)
  - Where are civil society organizations monitoring the effects of shale gas development?
  - What are the aims and characteristics of these projects?
  - What challenges do they face?
RESEARCH METHODS & DESIGN

- Key informant interviews (scientists, regulators, volunteers)
- Survey of watershed monitoring organizations
- Large-scale spatial mapping
  - Intensity and quality of monitoring
  - Correlation with socio-demographic characteristics
  - Correlation with intensity of gas development activity
- Qualitative case studies
  - “Hot spots” and “cold spots” for monitoring efforts
- Participant observation in volunteer training sessions
WATER MONITORING BY PUBLIC AGENCIES

- New York State Department of Environmental Conservation: Rotating (5-year) Integrated Basin Studies
- US Geological Survey: Monitoring Stations and Field Samples
- Delaware River Basin Commission: Baseline Monitoring Program for Natural Gas
- SRBC: Remote Water Quality Monitoring Network (RWQN)
- Ohio River Valley Water Sanitation Commission (ORSANCO)
- Pennsylvania Department of Environmental Protection: Water Quality Network (WQN)
- Vermont Department of Environmental Conservation
- Hudson River Environmental Conditions Observing System (HRECOS)
- Local County Conservation Districts
- Municipal Agencies (e.g. Sewer and Water Departments)
Density of Water Monitoring Locations & Unconventional Gas Wells

Number of Wells
- 0
- 1 - 10
- 11 - 20
- 21 - 200
- 201 - 600
- 601 - 2437

Density of Government Monitoring
- USGS
- Interstate
- State

Marcellus Shale Boundary
HUC8 Boundaries
NYDEC 5-yr. Rotating
Continuous or Frequent Water Monitoring by Government Agencies in Watersheds with Most Shale Gas Activity

Watershed (Gas Wells)

Number of Monitoring Locations

Middle West Branch Susquehanna (117)
Owego-Wapaccaling (123)
Upper Susquehanna (141)
Chenango (152)
Kiskiminetas (171)
Clarion (181)
Connoquenessing (181)
Youthington (185)
Upper Genesee (187)
Upper Allegheny (447)
Middle Allegheny (476)
Upper Allegheny Redbank (286)
Lower Allegheny (481)
Pine (532)
Tioga (689)
Lower Monongahela (704)
Upper Susquehanna-Tunkhannock (2437)

State
Interstate
USGS
GOVERNMENT AGENCY MONITORING (by county)
Continuous or Frequent Water Monitoring by Government Agencies in PA Counties with Most Shale Gas Activity

County (Number of Unconventional Gas Wells)

Number of Monitoring Locations

- Butler (205)
- Fayette (270)
- Clearfield (284)
- Westmoreland (342)
- Greene (655)
- Lycoming (801)
- Susquehanna (833)
- Washington (885)
- Tioga (1030)
- Bradford (1785)

- County/Municipal
- Interstate
- USGS
- DEP
CIVIL SOCIETY MONITORING (by watershed)

Density of Civil Society Water Monitoring Locations & Unconventional Gas Wells

- Number of Wells:
  - 0
  - 1 - 10
  - 11 - 20
  - 21 - 200
  - 201 - 600
  - 601 - 2437

- Density of Civil Society Monitoring:
  - 1 - 29
  - 30 - 70
  - 71 - 165

- Major Cities:
  - Albany
  - Rochester
  - Buffalo
  - Erie
  - Pittsburgh
  - Syracuse
  - Allentown
  - Reading
  - Philadelphia

- Marcellus Shale Boundary
- Major Rivers
SURVEY OF CIVIL SOCIETY MONITORING

- Mailed to 219 civil society organizations in NY and PA (all known to be involved in watershed protection)

- 188 responses in total

- 76 are doing watershed monitoring of some kind

- 24 monitoring effects of shale gas development or gathering baseline data in anticipation of shale gas development

NOTE: the map of civil society monitoring represents data collected beyond the original 24 survey responses
OVERVIEW OF THE FIELD

- Monitoring in response to Marcellus Shale
  - 50% report local gas activity as moderate or high
  - 80% of groups have been around for 10+ years
  - 50% began their monitoring programs in the last 3 years

- Desire to maintain healthy watersheds
  - 2/3 rate their watershed quality as high or very high
  - 90% have mission to maintaining high water quality
AIMS OF MONITORING GROUPS

- Environmental protection
  - Protect biodiversity (20/24)
  - Prevent pollution (19/24)
  - Protect recreational uses (18/24)
  - Protect human health (16/24)
- Increase knowledge & understanding
  - Contribute to scientific knowledge (19/24)
  - Increase public awareness (18/24)
- Build community ties (14/24)

- Advocacy to change industry behavior
  - Improve regulation of the gas industry (9/24)
  - Change industry behavior (8/24)
  - Support litigation (6/24)
CAPACITY BUILDING EFFORTS
Training, Financing, and Logistics

- **Training Resources**
  - ALLARM (Dickinson College)
  - Community Science Institute (CSI) - Ithaca NY
  - Local Conservation Districts
  - Occasionally DEP, USGS, PA Fish & Boat

- **Major Financial Sources**
  - Private: Colcom, Norcress Wildlife, PA Conservancy
  - State: DEP, DRBC
  - Donations from volunteers & patrons

- **Logistical Support & Advocacy**
  - Environmental NGOs (Advocacy, Administrative)
  - Universities (Computing, Laboratory, Grant Mgmt.)
  - Watershed Associations (Facilities, Personnel)
METHODS OF MONITORING
Chemical / Visual / Biological Sampling

- 90% of Groups Monitor for Chemical Indicators
  - Marcellus-centric consensus: conductivity, TDS, pH, temp.
    - Can be done with $100 pocket meter + basic training
  - Also noted: total hardness, dissolved oxygen
    - Chemistry kits: additional $100 + longer training

- 80% of Groups Monitor for Visual Indicators
  - Roadway runoff, stream-bank erosion, sedimentation
  - By inspection + field notes, sometimes with cameras

- 75% of Groups Monitor for Biological Indicators
  - Benthic macroinvertebrates (BMI) most common
  - Often done by local watershed associations
  - Less frequently than chemical or visual monitoring
METHODS OF MONITORING
Frequencies and Quality Control

- **Frequency of Monitoring**
  - Most baseline done on a monthly basis
  - Groups often change to weekly when/after drilling
  - Some do no monitor during winter, or low-water

- **Time in the Field**
  - Average day of monitoring can take 1-5 hours
  - A Single volunteer adopts as few as 1, as many as 5 sites
  - Some sites may be abandoned and/or added upon drilling

- **Quality Control**
  - 2/3 of groups report QA/QC procedures in place
  - Common are tool calibration & duplicate samples
  - 1/2 of these groups also send split samples to a laboratory to check for accuracy
Many monitoring organizations are part of networks with capacity building groups, advocacy groups, and other monitoring groups.

These networks take two main forms:
- Centralized networks: “hub” organization with multiple affiliates
- Decentralized networks: connected organizations, with no central hub
CENTRALIZED NETWORK
Example: Pennsylvania Trout Unlimited

- Founded in 1963, affiliate of national Trout Unlimited, environmental NGO & sports org.
- Oversees 50 state-level chapters, 12,000 members
- Coldwater Conservation Corps (CCC) monitoring program
  - Began in 2009, expanded to many chapters
  - Chapters have small budgets (under $1000)
- Training in partnership with ALLARM & by CCC leaders
- Close contacts with PA Fish & Boat Commission
A smaller watershed association in Washington County PA

Founded in 1999 to protect the Chartiers Creek watershed

17 volunteers doing baseline monitoring
  - Also oversees several data-logger stations

No full time staff, monitoring budget under $1000
  - Funding from private donations &
  - Regional county water alliance

Initial training from ALLARM
  - Subsequent training in-house
CHALLENGES FOR CIVIL SOCIETY MONITORING

- Data Quality
  - Laboratories not necessarily state or federally certified
  - Metadata can be scarce (for contextualizing data)

- Regulatory Recognition
  - Civil society monitoring operates external to regulatory oversight
  - Concerns about volunteer expertise & accuracy

- Resource Constraints
  - Many have small budgets (under $1000, no staff)
  - Logistical work tends to be managed by a few dedicated volunteers
  - Retaining volunteers long-term as the hydrofracking debate continues
CHANGES AND EMERGING EFFORTS

- Many new groups are coming online
  - Sierra Club NY Water Sentinels !!!
  - ALLARM & CSI rapidly trained more groups in summer ’11/’12

- Additional funding sources becoming available
  - 3 River Quest ($700,000 to expand into PA)
  - Penn. Org. for Watersheds & Rivers (POWR)
  - Expanding SRBC network / new DCNR stations

- Increased attention to QA/QC
  - Notable push for groups to do split samples w/labs
  - ALLARM & CSI doing follow-up assessments with trainees

- Efforts to aggregate data into GIS systems
  - Shale Network / 3RQ / FracMapper
CONCLUSION & FUTURE RESEARCH

Conclusions:

- Investments in monitoring by public agencies vary widely across watersheds
- Civil society monitoring groups are mobilizing to fill knowledge gaps, engage in resource management
- Great diversity in objectives, orientations, and available resources
- Challenges ahead, but groups are adapting to demands for quality assurance & requesting more regulatory recognition

Next Steps in the Research:

- Generate more detailed spatial mapping of public monitoring efforts
- Conduct in-depth case studies of “hot spots” and “cold spots” in selected watersheds/counties
THANK YOU

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For more information visit:
http://www.watershed-mapping.rpi.edu/

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