Fecal Contamination Source Tracking in the Rondout-Wallkill Watershed

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Outline

1. Initial & evolving goals
2. Rondout-Wallkill Microbial Source Tracking (MST) Project
3. What to do with the data
1. Initial & Evolving Goals
We started with the community of river users
Our initial Entero monitoring project goals

1. Fill a data gap
2. Get the public interested in water quality (broadly) through recreational interest
3. Reduce sewage contamination
We quickly learned that tributaries have more fecal contamination than the main Hudson.
Our monitoring program expanded into tributaries & we gained partners.

- 16 rivers, creeks & waterfront project areas
- 400 sites
- 5,000+ samples
Today’s Community Science
Program goals reflect our experience

Community science data collection is the foundation on which we build and support active data-based communities that are empowered to highlight issues of public concern, advocate for local solutions and lobby effectively in order to engage governments to improve water quality.
Define Policy Needs

Set Policy & Budget

Identify local issues

Apply policy & budget to local issues

Active Data Based Community
2. Rondout-Wallkill Microbial Source Tracking Project
Microbial Source Tracking Project
Partners

Cornell University
Dr. Ruth Richardson
Post-docs: Dr. Yolanda Brooks, Dr. Catherine Spirito
Students: Anna Hong, Desiree Sausele
There are multiple potential sources of *Enterococcus*

- Combined sewer overflows
- Separate sewer overflows
- Septic system failures
- Street runoff
- Illicit connections
- Agricultural runoff
- Livestock
- Wildlife
- Contaminated sediment
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- Agricultural runoff
- Livestock
- Wildlife
- Contaminated sediment

To remove the contamination, you need to know the source
“Toolbox Approach” helps identify fecal contamination sources

Some of the tools in the toolbox:

- *Enterococcus* (& *E. coli*)
- Nutrients
- Detergents
- Macroinvertebrate communities
- Infrastructure data
- Land use
- Microbial source tracking
Enterococcus Monitoring Results: Hudson River Watershed Snapshot

*Enterococcus* is an indicator of fecal contamination. Bars show the geometric mean, a weighted average, of all non-tidal samples. Results are from 14,937 samples collected May-October, 2010-2018. Date ranges vary by watershed. Samples were collected and processed by a network of community scientists and labs.

- Upper Hudson River: 33
- Mohawk River: 54
- Catskill Creek: 47
- Rondout Jansen Kill: 27
- Sawyer Kill: 235
- Rondout Creek: 170
- Wallkill River: 502
- Pocantico River: 385
- Sparkill Creek: 779
- Saw Mill River: 369
- Bronx River: 420

**Note:** Geometric Mean compared to EPA Threshold (30 cells/100 mL).
Rondout Creek
Enterococcus
Enterococcus
Enterococcus
Enterococcus
Enterococcus
CowM3

Horse Bact

GFD

Enterococcus
Enterococcus

CowM3
Horse Bact
GFD
HF183 B. theta

Children poop too
Grown-ups poop

CowM3
Horse Bact
GFD
HF183 B. theta

Enterococcus
Enterococcus

CowM3

Horse Bact

GFD

HF183 B. theta

Children poop too

Grown-ups poop too
Enterococcus
Microbial Source Tracking Study Site Selection

![Graph showing Enterococcus count (cells/100 mL) against miles upstream from mouth. The graph has a dotted line with data points indicating a peak at around 25 miles upstream, with a gradual decrease as distance from the mouth decreases.]
Microbial Source Tracking Study Site Selection
Microbial Source Tracking Study

Sites

Rondout: 8 sites in 2 clusters
Wallkill: 16 sites in 3 clusters
Microbial Source Tracking Study

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Our broad conclusions about watersheds are based on these clusters of sites
Microbial Source Tracking Study Sites

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Our broad conclusions about watersheds are based on these clusters of sites.

The clusters were chosen based on high-Entero sites, but not every site sampled in the MST study was a high-Entero site.
Microbial Source Tracking Study
Results: Wallkill

![Bar Chart]

- **Human**: 0% detected
- **Bird**: 100% detected
- **Cow**: 10% detected
- **Horse**: 0% detected
- **None**: 0% detected

Legend:
- Wallkill
- Rondout
Microbial Source Tracking Study
Results: Rondout

Percentage of Samples With Marker Detected

- Human
- Bird
- Cow
- Horse
- None

[Bar chart showing the percentage of samples with marker detected for each category (Human, Bird, Cow, Horse, None) for Wallkill and Rondout.]
Microbial Source Tracking Study
Results: Both watersheds

![Graph showing percentage of samples with marker detected by source for Wallkill and Rondout watersheds.](image-url)
1. Wild birds were the most commonly observed source in both waterways.
Microbial Source Tracking Study
Results: Both watersheds

![Bar chart showing percentage of samples with marker detected for different categories: Human, Bird, Cow, Horse, None. The chart compares Wallkill and Rondout watersheds.](chart.png)
2. Human fecal contamination was also common, and showed different distributions in the two waterways.
Microbial Source Tracking Study
Results: Both watersheds

Percentage of Samples With Marker Detected

- Human
- Bird
- Cow
- Horse
- None

Wallkill
Rondout
1. Wild birds were the most commonly observed source in both waterways.

2. Human fecal contamination was also common, and showed different distributions in the two waterways.

3. Both human and avian contamination were more common in the Wallkill than the Rondout.

4. Cows were a source of fecal contamination, but much less common than human or bird.

5. We never detected horse fecal marker in the Wallkill, but it was a source in the Rondout.

6. In some samples, and more frequently in the Rondout than the Wallkill, we detected zero of the source types we looked for.

Microbial Source Tracking Study Results: Both watersheds

3. Both human and avian contamination were more common in the Wallkill than the Rondout.
Microbial Source Tracking Study
Results: Both watersheds

Percentage of Samples With Marker Detected

- Human
- Bird
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Wellkill
Rondout
4. Cows were a source of fecal contamination, but much less common than human or bird.
5. We never detected horse fecal marker in the Wallkill, but it was a source in the Rondout.
Microbial Source Tracking Study

Results: Both watersheds

 ![Graph showing percentage of samples with marker detected for different sources in Wallkill and Rondout watersheds.](image)
Microbial Source Tracking Study Results: Both watersheds

6. In some samples, and more frequently in the Rondout than the Wallkill, we detected none of the source types we looked for
Microbial Source Tracking Study
Results: Both watersheds

Percentage of Samples With Marker Detected

- Human
- Bird
- Cow
- Horse
- None

Wallkill
Rondout
In both streams:
- average Entero count of samples with 1+ marker detected was greater than average Entero count with 0 markers detected
- average Entero counts without markers detected were order of magnitude above EPA threshold
Microbial Source Tracking Study: Key Takeaways

- Human sewage is a problem.
- Wildlife (birds) is also a significant source.
- Neither cows nor horses are significant sources in the areas studied.
- Other significant sources, if any, remain unknown.
3. What To Do With the Data
There are many ways to use the data

8 years of water quality monitoring:
- Sparked creation / revitalization of 2 watershed groups
- Built community prepared to respond effectively to Harmful Algal Bloom
- Drove state action by demonstrating importance of water to local community
- Mobilized / coalesced watershed groups around septic policy gaps
- Opened conversation about sustainable wastewater systems
- Contributed to peer-reviewed journal article
There are many ways to use the data

Sparkill Creek Watershed Alliance

9 years of water quality monitoring:

- Attracted multiple academic research projects, deepening global understanding of wastewater impacts
- Attracted funding and support for water studies from state and federal agencies
- Provided factual basis for SCWA to request sewer system investigation and infrastructure investments from town
There are many ways to use the data

- Brought town & village governments and environmental boards, Preserve stewards and water quality stewards together around common interest
- Led to self-design, self-funding & implementation of additional Entero sampling
- Mobilized community around septic policy gaps

8 years of water quality monitoring:

Trib 13 / Mill Brook Community Group
There are many ways to use the data

53 water quality monitoring partners:

- Demonstrate the value of water
- Motivate elected & agency officials to act on water quality
- Provide factual basis for our lobbying
- Educate us about policy needs
- Act as “eyes on the water” to identify broad range of issues – chronic and acute

Riverkeeper Water Quality Program
Thank you!