TeenShale Network: Combining Hands-on Field Experience with Data-Driven Hydrology Education Tools

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Abstract:

When high school students slip their feet into waders and step into a cold Pennsylvania stream to retrieve a data sensor, their learning leaps out of the textbook and beyond the classroom. Data-driven, place-based education connects students to real-world issues in their local communities through experiential learning that actively engages them with authentic scientific data. In the field, students learn to quantify their observations as they use standard instruments to collect data first-hand. As they share data and interact with researchers, they expand their knowledge, following the practice of scientists who collaborate with each other to understand complex systems.

The TeenShale Network is a multi-year project that focuses on two primary objectives: first, to monitor the quality of water in the Black Moshannon Creek in central Pennsylvania, located in close proximity to active hydraulic fracturing sites, and second, to engage students in authentic field research in collaboration with experts.

This study seeks to understand the perceived impact of outdoor classroom projects by asking "How does working with authentic data in place-based scientific inquiry affect student perception about their role in scientific research?" Research indicates that data-driven, place-based learning builds enthusiasm for scientific endeavors as it equips students to join the conversation about local environmental issues. In the process, they become more active citizens, better stewards of the natural world, and perhaps even scientists themselves.

Acknowledgements

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Secondary Data Discovery – HydroClient from CUAHSI:

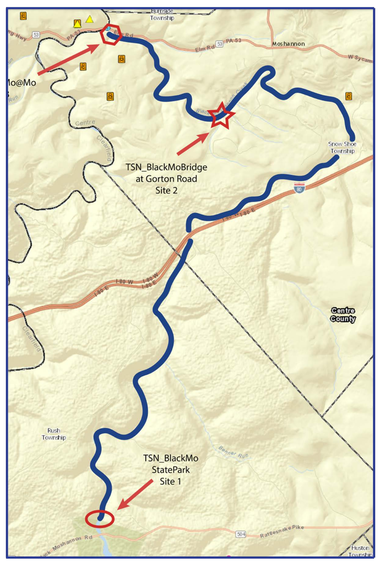
Students were introduced to HydroClient as an exercise during winter and encouraged to explore the search capacity of the hydrology tool. Features such as the topographic map with hydrology versus satellite imagery enhance visualization, thus stimulating group interactions, competitive searching, and discussions.

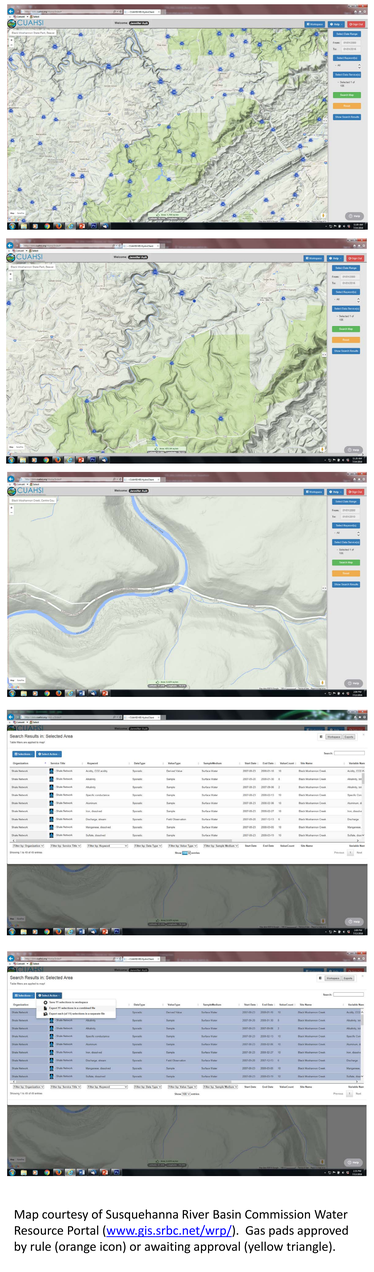
Utilizing HydroClient, students discovered 2007 data from Black Moshannon Creek. The eleven parameters measured previously are comparable to the student measurements.

The series of screenshots to the right walks through the discovery process using HydroClient for the Black Moshannon Creek.

Data was downloaded and graphed using Google Sheets for quick visualization and Microsoft Excel for analyses and poster presentation.

Study sites: Black Moshannon creek meanders approximately 25 kilometers from Black Moshannon State Park to the confluence with Moshannon Creek at the Clearfield County line.



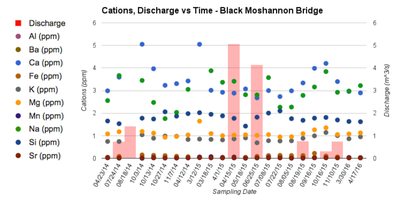


Map courtesy of Susquehanna River Basin Commission Water Resource Portal (www.gis.srbc.net/wrp/). Gas pads approved by rule (orange icon) or awaiting approval (yellow triangle).

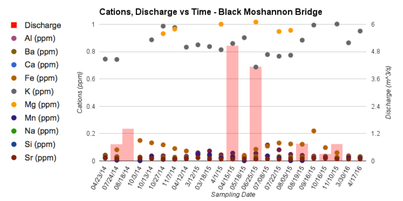
Graphing and Analysis:

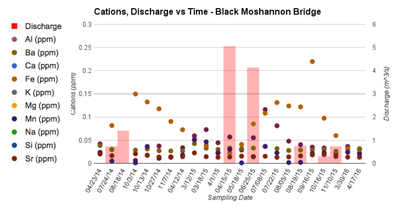
Participants engaged in discussions of data presented in table versus graphed formats, learning to recognize trends over space and time.

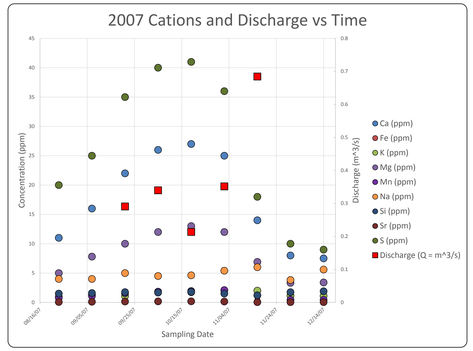
Below are examples of a series of graphs created by the TSN 2015-2016 participants. Knowledge has been gained in formatting for comparison between series, specifically types of graphs, colors and size of markers, use of trendlines, dual axes, scale, and use of units with the analytes.

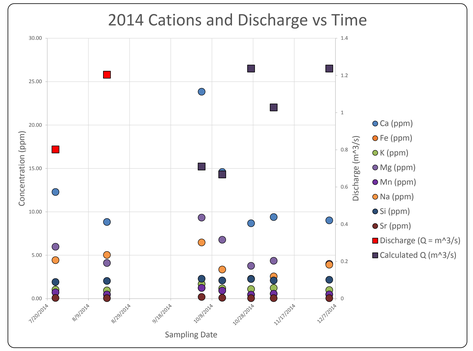


On the above graph, for date 3/12/15, the sodium data point is not shown (10.97 ppm)









Perspectives:

"I feel like in the classroom you learn more about theory, and in the field you apply what you learned," said Valeria Soler Pelaez, a 9th grader. "You make more connections to the real world. And I feel like this helps it stay in your brain. It helps you remember by making these connections you've never thought about."

"Not only can you gather realistic scientific data, but it's for a cause," said Emily Redmond, an 8th grader. "I think the experience can encourage students to learn more about fracking and its effects on the environment. It's a once in a lifetime opportunity because I bet not many other people are doing this kind of experiment."

"It's not a typical classroom lab where the teacher knows the answer," Eugene Ruocchio, faculty mentor, said. "The answer could take years to find."