2020 Watershed Congress
September 21 – September 25

Artwork by Jon Bond
Watershed Congress Organizers

The 2020 Watershed Congress is presented by the Delaware Riverkeeper Network, its partner organizations, and private individuals.

Current Partners:

Berks County Conservation District • Berks Nature • Bucks County Conservation District • Cadastral Consulting, LLC • Center in the Park / Senior Environment Corps • Delaware Nature Society • Delaware River Steamboat Floating Classroom, Inc. SPLASH • Delaware Valley University • Friends of the Wissahickon • Green Valleys Watershed Association • Barry Isett & Associates • A.D. Marble & Company • Meliora Design • Montgomery County Community College • Montgomery County Conservation District • Octoraro Native Plant Nursery • Partnership for the Delaware Estuary • Penn State University, Pennsylvania Sea Grant • Pennsylvania Department of Conservation & Natural Resources • Pennsylvania Department of Education • Pennsylvania Environmental Council • Reading Area Community College • Schuylkill Action Network • Schuylkill River Greenways NHA • Stroud Water Research Center • Sustainable Choices, LLC & Philadelphia Water • Temple University • Valley Forge Trout Unlimited • The Water Center at Penn • The Write Beat • Yellow Springs Farm

Boldface indicates sponsorship
Engagement During Sessions

- **Presentation Sessions** - During these sessions, questions will be asked after the presentation by our speakers. **We will be using the Question & Answer (Q&A) feature** to take questions for presenters so please post questions you may have there.

- **Q&A Sessions** - During these sessions, our presenters will be answering questions about their pre-recorded presentations (available in the 2020 Watershed Congress playlist on the Delaware Riverkeeper Network’s YouTube channel). Participants should have watched the prerecorded videos prior to attending. **We will be using the Raise Hand feature** to take live questions. The Chat feature will be open for sharing resources with others.

- **Panel Sessions** - Our panelists will be answering questions throughout these sessions. We will begin with some prepared questions for our panelists, but we also hope to present your questions to our panelists. **We will be using the Q&A feature** to take questions for presenters so please post questions you may have there.
Spatio-Temporal Patterns of Stream Conductivity and Temperature in the Delaware Basin

*Online, September 23, 2020, Watershed Congress*

Diana Oviedo-Vargas, Marc Peipoch, and David Bressler
Stroud Water Research Center

Part 1, Introduction to the project and continuous data, David Bressler
Parts 1-3

- Part 1 – Introduction to the project and continuous data, David Bressler

- Part 2 – Spatio-temporal patterns of specific conductivity in streams and rivers of the Delaware River Basin, Diana Oviedo-Vargas, PhD

- Part 3 – Spatio-temporal patterns of water temperature in streams and rivers of the Delaware River Basin, Marc Peipoch, PhD
Part 1

- Project overview
- Overview of continuous data
  - What is continuous data?
  - Why is it useful?
  - What it takes to get good continuous data?
Project

Citizen science using EnviroDIY monitoring stations in the Delaware Basin

Delaware River Watershed Initiative

Working across four states to protect one shared source of clean water
What is continuous data?

Measurements taken in regular intervals automatically with an instrument installed in the stream
Basic EnviroDIY monitoring station

*Stations designed, programmed, and built by Stroud Center (Shannon Hicks, engineer)

Conductivity, Temperature, Depth

Turbidity
Station deployed across the Delaware Basin

>70 Stations in DRB

Owned by >40 watershed groups
Utility of continuous data

- Fuller story
- Know where you’re at presently
- Track where you came from
- Predict where you might go
Continuous data

Measurements taken automatically – no person necessary(?) Less time and effort(?)

[Image of various equipment used for data collection]
Standard, Single point measurements

Alternate to continuous, lots of time and effort!

Hand held meters

Grab samples for lab analysis
Common conductivity patterns we see

Stormwater enters stream, conductivity goes down – dilution of ions

Goose Creek at Greenfield Park
Common conductivity patterns we see

Road salt and de-icer pollution events

Naylors Run at Drexel Garden Park, 2019
Common conductivity patterns we see

High conductivity in urban streams
Common temperature patterns we see

Seasonality

Angelica Ck downstream of The Nature Place, 2019-2020
Common temperature patterns we see

Diel (day and night)

Hosensack Creek at Hwy 29, 2020
Utility of continuous data

Thermal pollution during summer storm events

Valley Creek at Valley Creek Park, 2020
Utility of continuous data

Temperature considerations for trout management

[Graph showing temperature changes from March 1 to December 31, 2019, with annotations for NJ DEP Trout Maintenance, NJ DEP Trout Production, and Ideal trout temperature maximum.]
Utility of continuous data

Non-storm events

Conductivity spikes during baseflow conditions

Pickering Creek at Montgomery School, 2018
What it takes to get Diana and Marc good data

Sounds easy! The station does it all!
What it takes

Yes but…

- Water and weather are destructive
- Sensors foul easily and regularly
- People and creatures can damage
What it takes

- **People!** Time and training of Citizen Scientists
  - Clean sensors and station
  - Monitor live feed of data for station function and anomalies
  - Quality Control cross checks of station data
What it takes

Clean sensors

329 uS/cm before cleaning

356 uS/cm after cleaning
What it takes

Monitor live data feed for station function

Rcky Run at Marriott
What it takes

Quality Control cross checks using calibrated hand-held meter and/or grab samples

314.8 uS/cm ↔ 380 uS/cm

Red flag! Numbers not matching up! Suggests a problem with continuous data
Take home

- Continuous data help to develop a fuller picture of a stream

- Long-term patterns, short-term and rare events can all be detected

- Although automated, stations need attention and quality control to ensure reliable data
  
  *State agencies and other regulators beginning to accept and incorporate these type of data*
Parts 1-3

- Part 1 – Overview of EnviroDIY monitoring stations and citizen science in the Delaware River Basin, Bressler

- Part 2 – Spatio-temporal patterns of specific conductivity in streams and rivers of the Delaware River Basin, Diana Oviedo-Vargas, PhD

- Part 3 – Spatio-temporal patterns of water temperature in streams and rivers of the Delaware River Basin, Marc Peipoch, PhD
Thank You!

Special thanks to:

• Carol Armstrong and George Seeds, Chester/Delaware Co. Master Watershed Stewards
• Shannon Hicks, Rachel Johnson, Christa Reeves, John Jackson, Stroud Water Research Center
• All the watershed groups, stewards, schools, and universities that own and manage the stations!

David Bressler
Stroud Water Research Center
dbressler@stroudcenter.org
410-456-1071 mobile
NOTES

- Bressler intro (5-7min) overview of data, site spatial distribution, why continuous sensors why cond, variability across sites, why temp - introduce the whys - this will connect to the take-homes from Marc and Diana; partnerships - your ability to understand the site is dependent on others maintaining sensors for comparison (e.g., punches provides perspective for other berks stations; first state sites); importance of QC and grab samples for additional info

- Show audience that single point measurements on temp for instance the diel shift in temp is big so comparing between sites can be tough; also show oxygen and temp related - naturally driving DO down as temp goes up therefore all animals have possibility of diff metabolic challenges

- Intro should talk about this is the advantages of what continuous data can do, why monitoring continuous data, what it takes, what it gives you, why temp important - what it means to talk about thermal pollution (annual, daily, seasonal basis - varies among sites that can be close together; salt - remind about underlying geology (<500 uS/cm but generally below 300 uS/cm), give basics of ions, softwater versus hardwater stream under natural conditions, seasonality of cond, groundwater contamination and summer salt loads, winter spikes, toxicity and temperature; the harder the water (e.g., limestone) the more you can absorb salt and less toxic (best guess is that calcium balances out osmotic challenges that road salts present - road salt is an osmotic challenge); sensor tells you what grab sample misses (everything between grab samples); Cl regulation in states (Iowa and Illinois but EPA moved off of this because these were not totally protective - tests on ceriodaphnia; additional work on mussels and mayflies showed they were more sensitive than ceriodaphnia) that have it is related to associated hardness (have to pay attention to hardness and temp in salt toxicity);
Dave, From my part nothing has changed since we talked. If you can introduce the overall project (1-2 slides) and explain why sensors? what do sensors tell us that discrete samples do not? why do we need grab samples? etc.

So you don't work day and night:

some thoughts related to Marc's
show difference between grab sample and continuous record
Show different sensors - CTD plus the expensive sensors such as our research sondes
Highlight that both are important, depending on the question/issue of interest of significance
When **diel variation** is important - nighttime DO sags, deicing spikes,
When **weekly/seasonal variation** is important, especially if they reflect unpredictable variability - thermal bottleneck
5 summers, DO impacts of leaf fall or a maintenance pattern (dropping yard waste into streams, spreading compost, thermoelectric management plans (flow or temperature)
When **rare events** are of interest (storms, droughts, heat waves, spills or regular, unknown discharges, industrial failures)
regular pattern than Mike B had?
Where planning needs to know **extremes** - what is to be avoided
Where/when there is a need to compare extremes - perspectives from sites with and without a stressor (references)
Emphasize that continuous data are a lot of work to collect, analyze, interpret, communicate - only propose to do a grab sample is sufficient, and it often is, then keep it simple. Many people take their "big data" and distill it down to close to matching the mean of monthly or bimonthly grab samples.

Just some thoughts.

I assume you will also describe the network, show a map with the 70+ locations and how long (in general) they have been collecting data.
I am saving my presentation here \STROUDSAS\Research\WilliamPenn_Delaware River\CitSci\Stroud data analysis\Abstracts and presentations\Oviedo_WatershedCongress2020_09202020.pptx
Not finished yet but you can have an idea.
Diana