

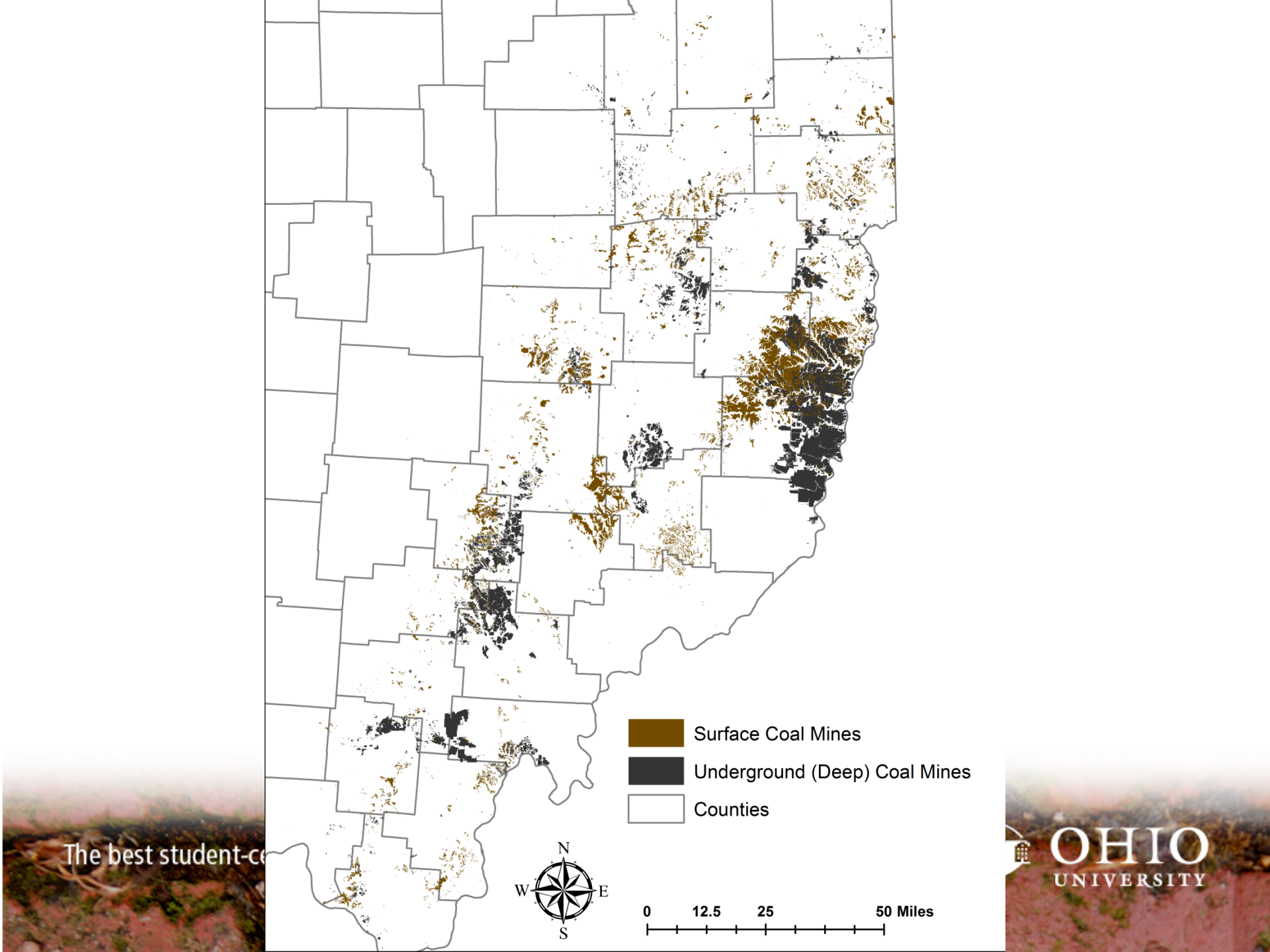
Development of a low-cost remote water quality monitoring system in AMD impaired watersheds

Dr. Natalie Kruse, Dr. Hans Kruse, Dr. Julio
Arauz, Dr. Shawn Ostermann, Godfrey
Ogallo, Siti Hj Abd Rahman, Sebastian Teas
Ohio University

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- Surface Coal Mines
- Underground (Deep) Coal Mines
- Counties



0 12.5 25 50 Miles

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Active Treatment of Abandoned Mines in Ohio

- 5 lime dosers installed:
 - 1 in Raccoon Creek
 - 1 in Leading Creek
 - 1 in Sunday Creek
 - 2 in Monday Creek (Jobs Hollow and Monkey Hollow)
- All in remote areas with no cell coverage.

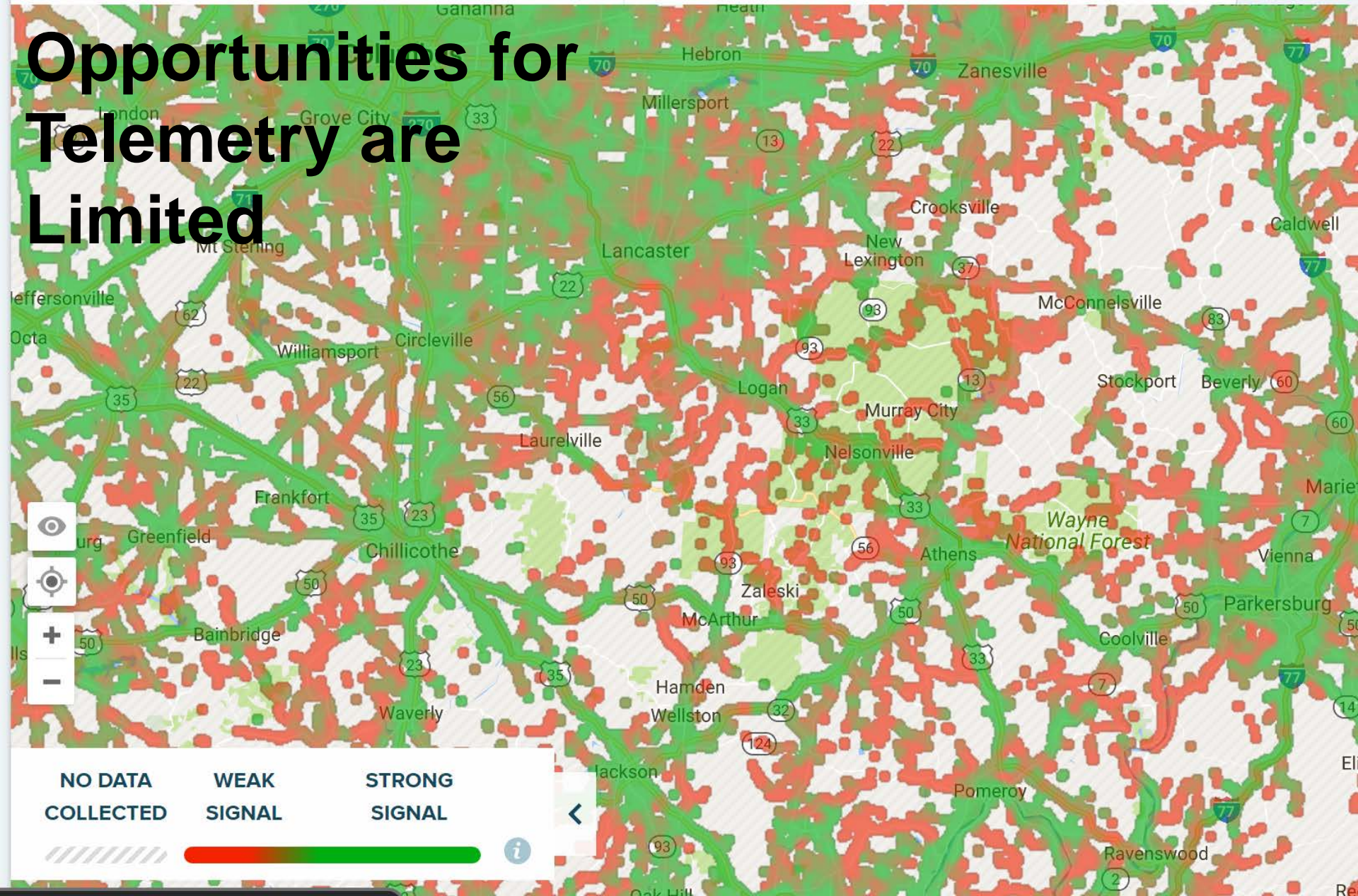
The Challenge:

Consistently
operating active
treatment systems
in remote areas.



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Opportunities for Telemetry are Limited



The Solution



June 21, 2016

New Solar System Internet Technology Debuts on the International Space Station



- Disruption tolerant networking
- Low cost probes
- Solar powered unit
- Low energy – low cost computing

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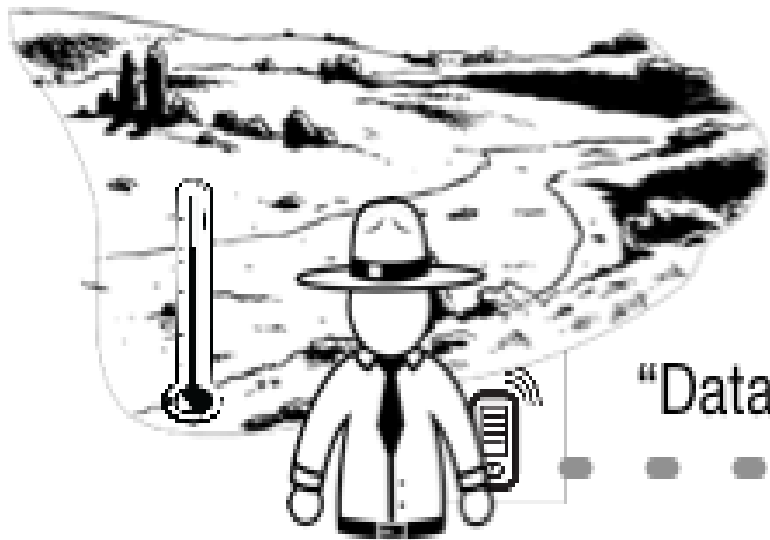
Disruption Tolerant Networking

- Developed for NASA
- DTN versus TCP/IP
- ‘Bundle protocol’

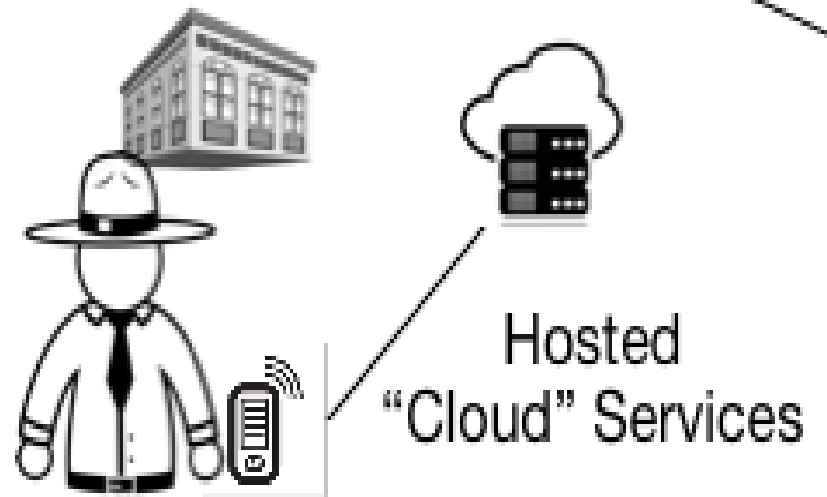


No Cell Coverage

Cell Service



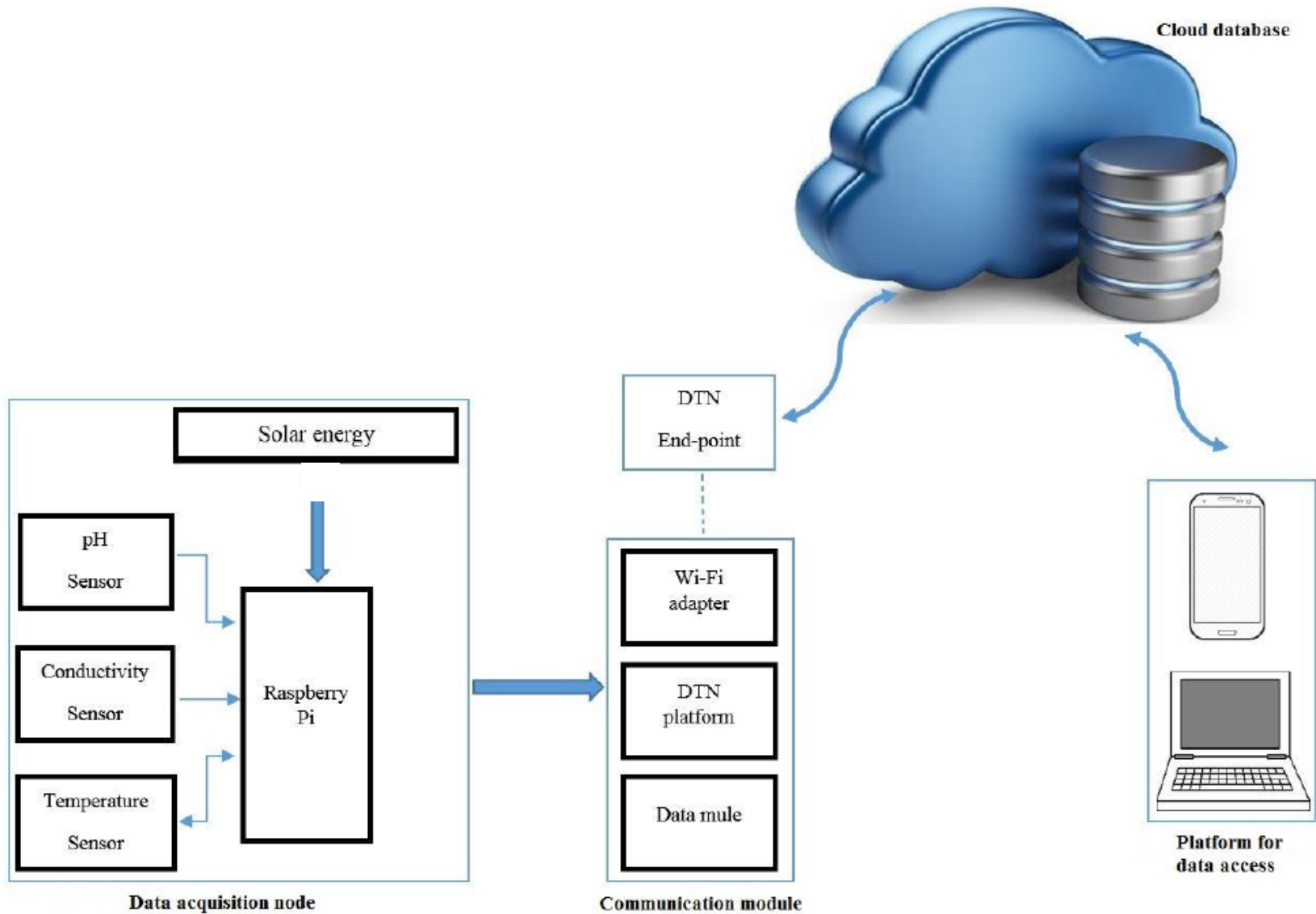
"Data Mule"



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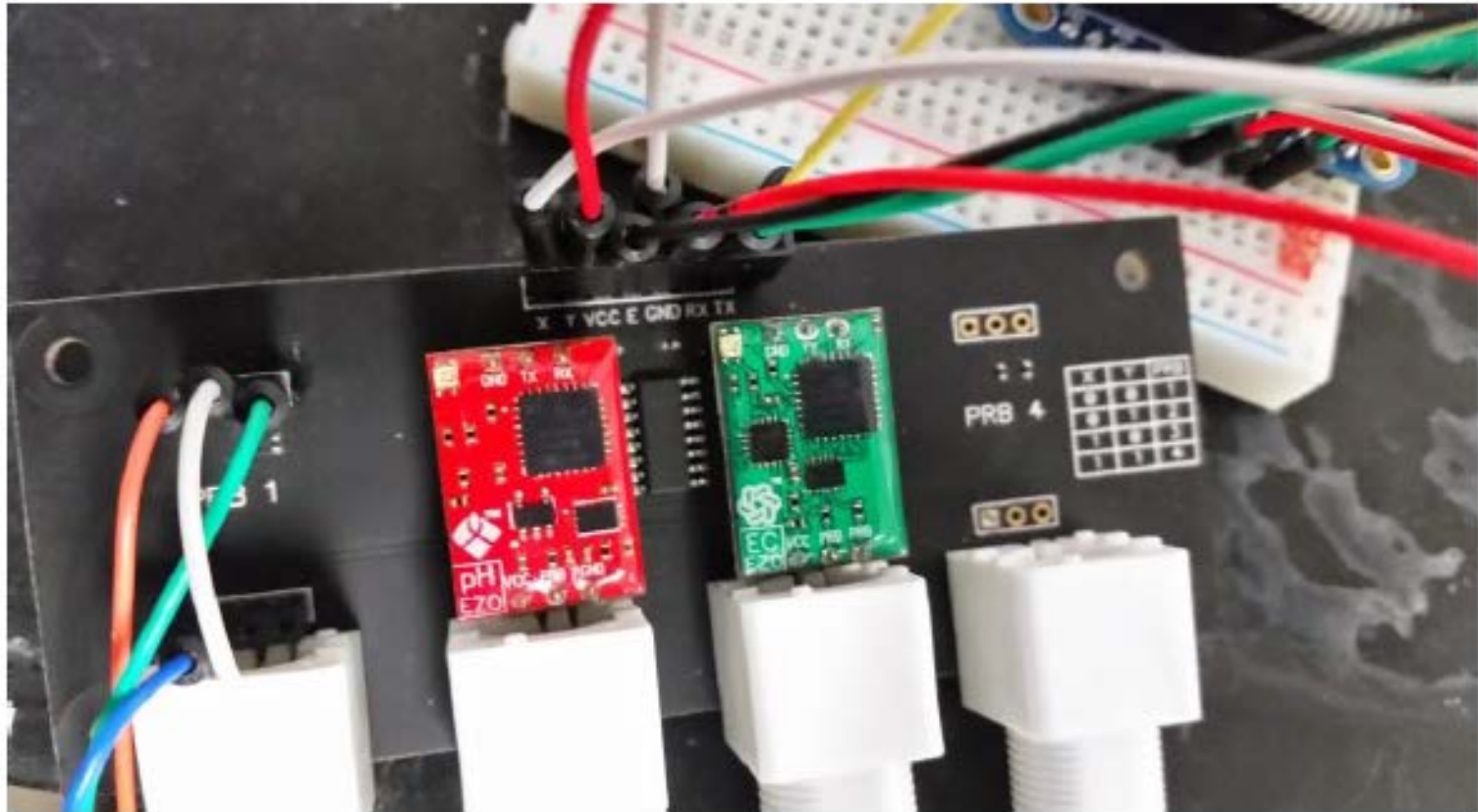
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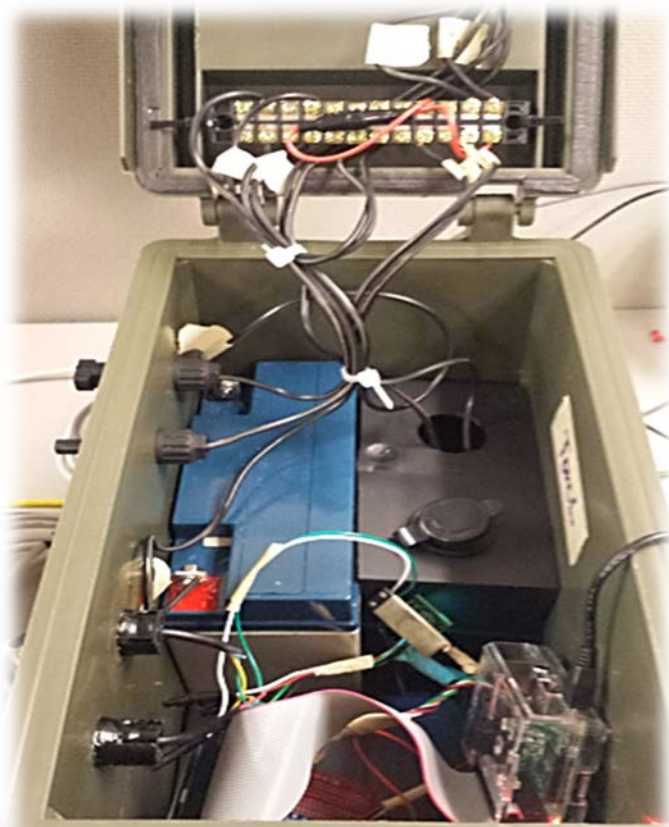
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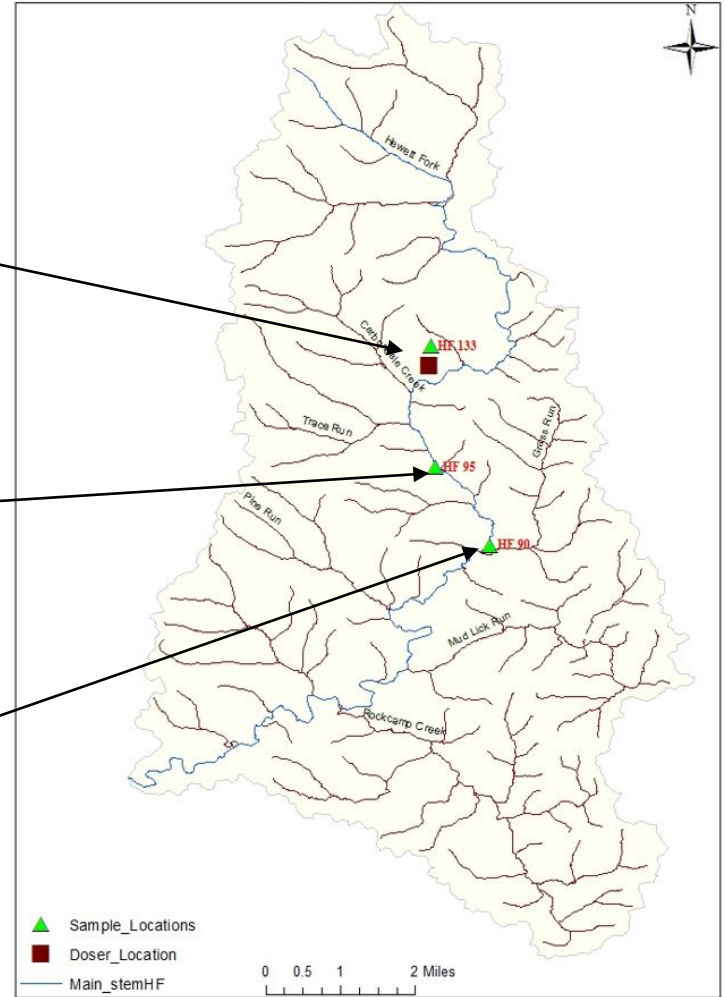
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Hewett Fork



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HF133



HF090

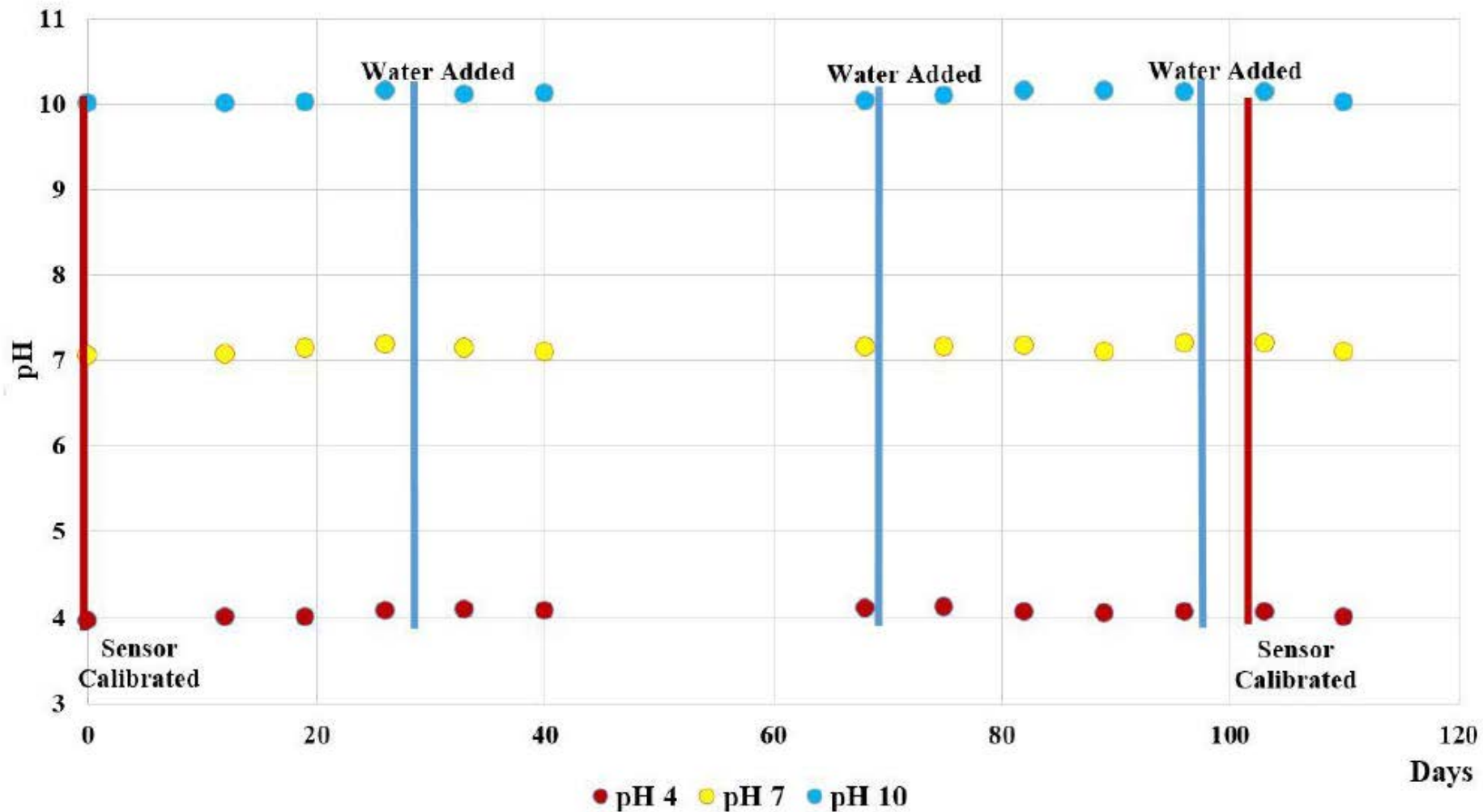


HF095

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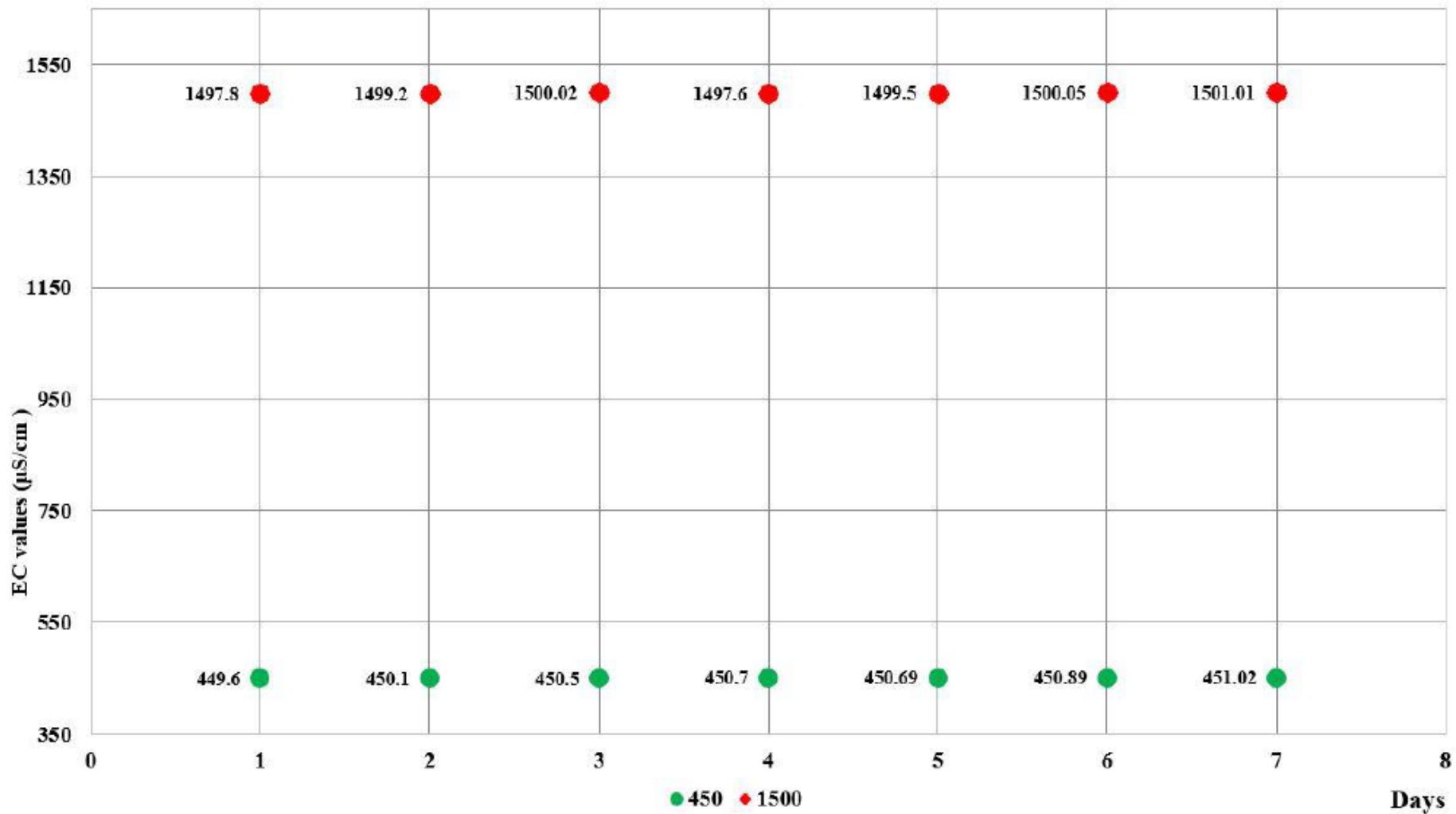
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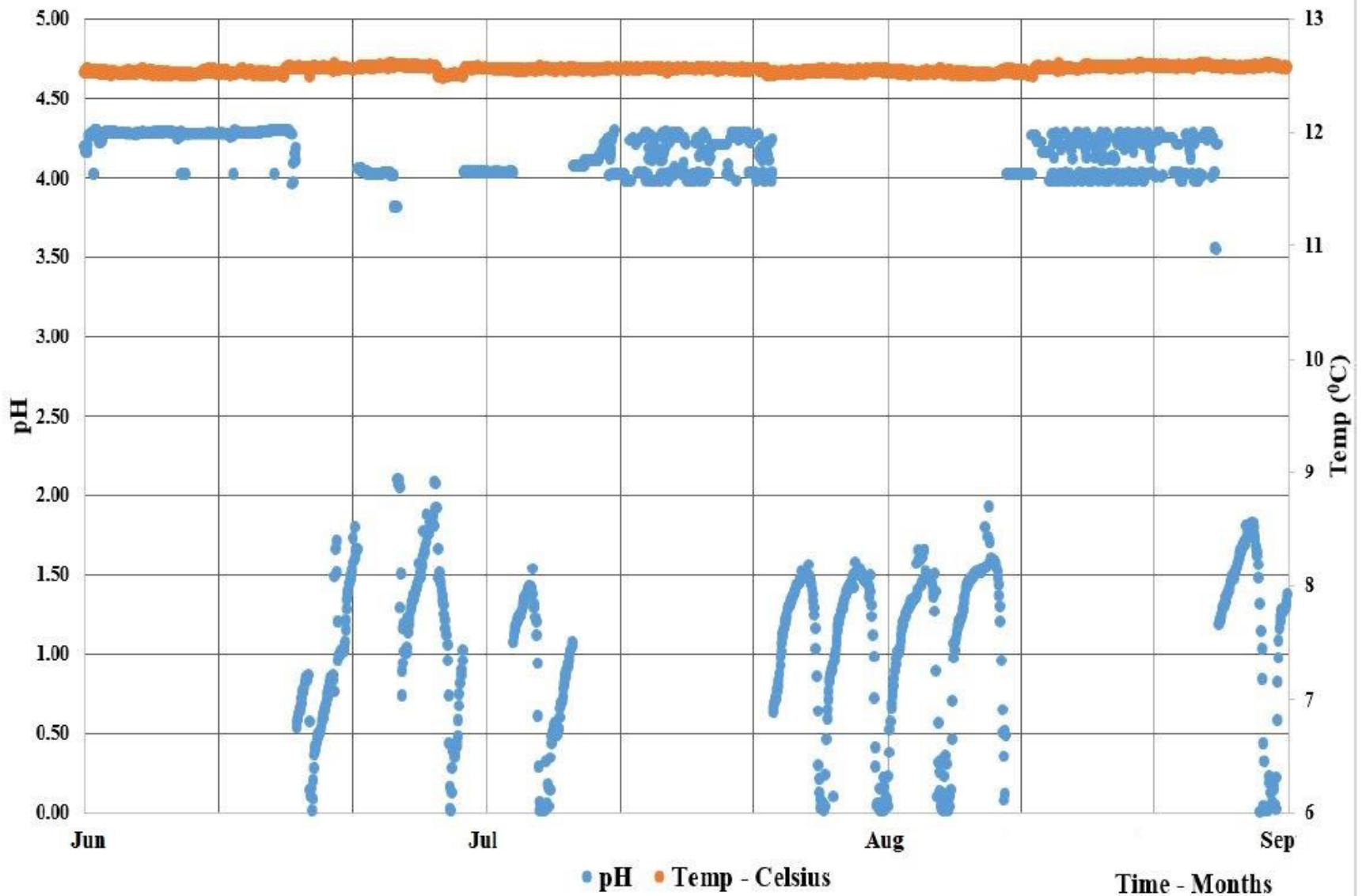
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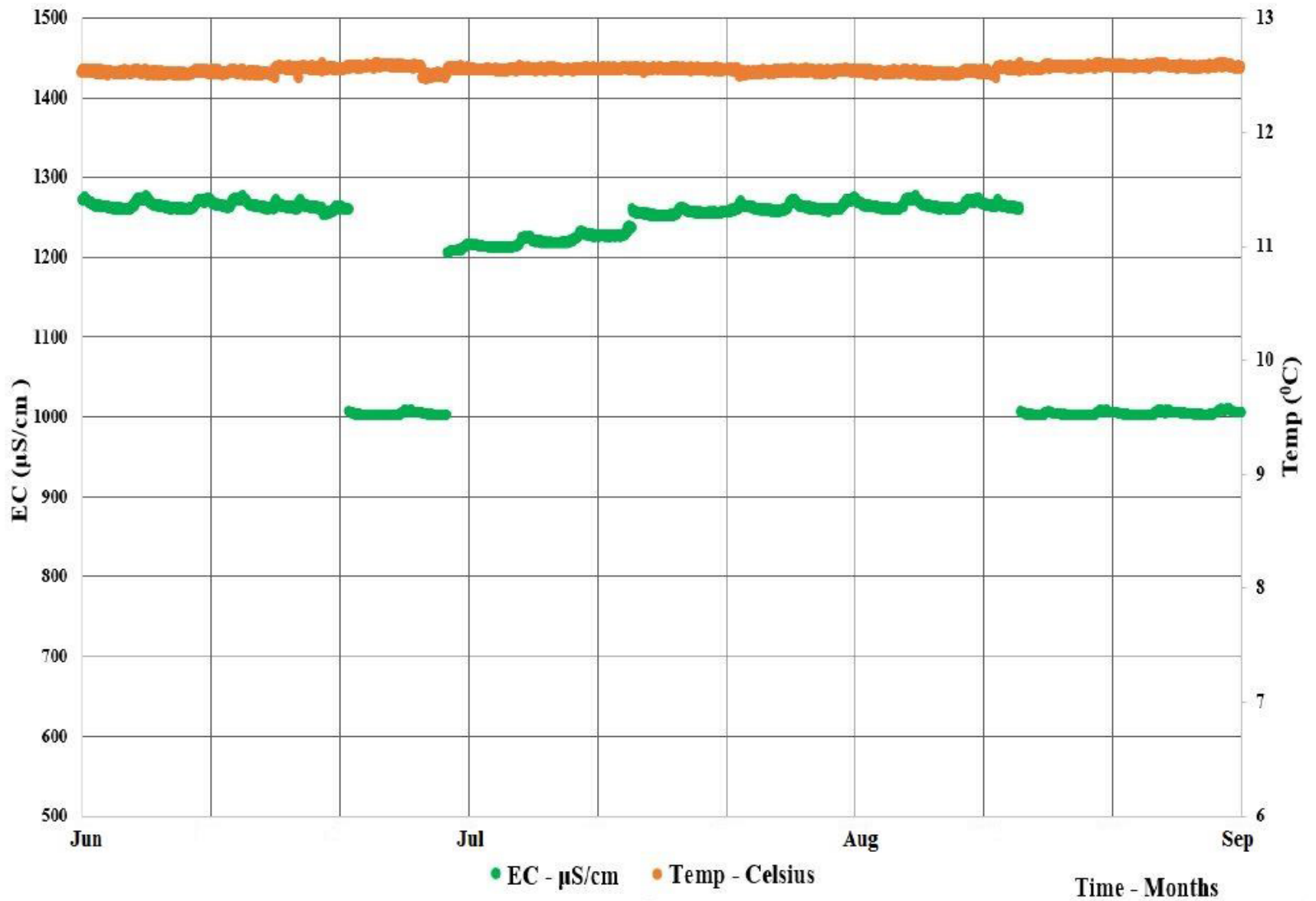
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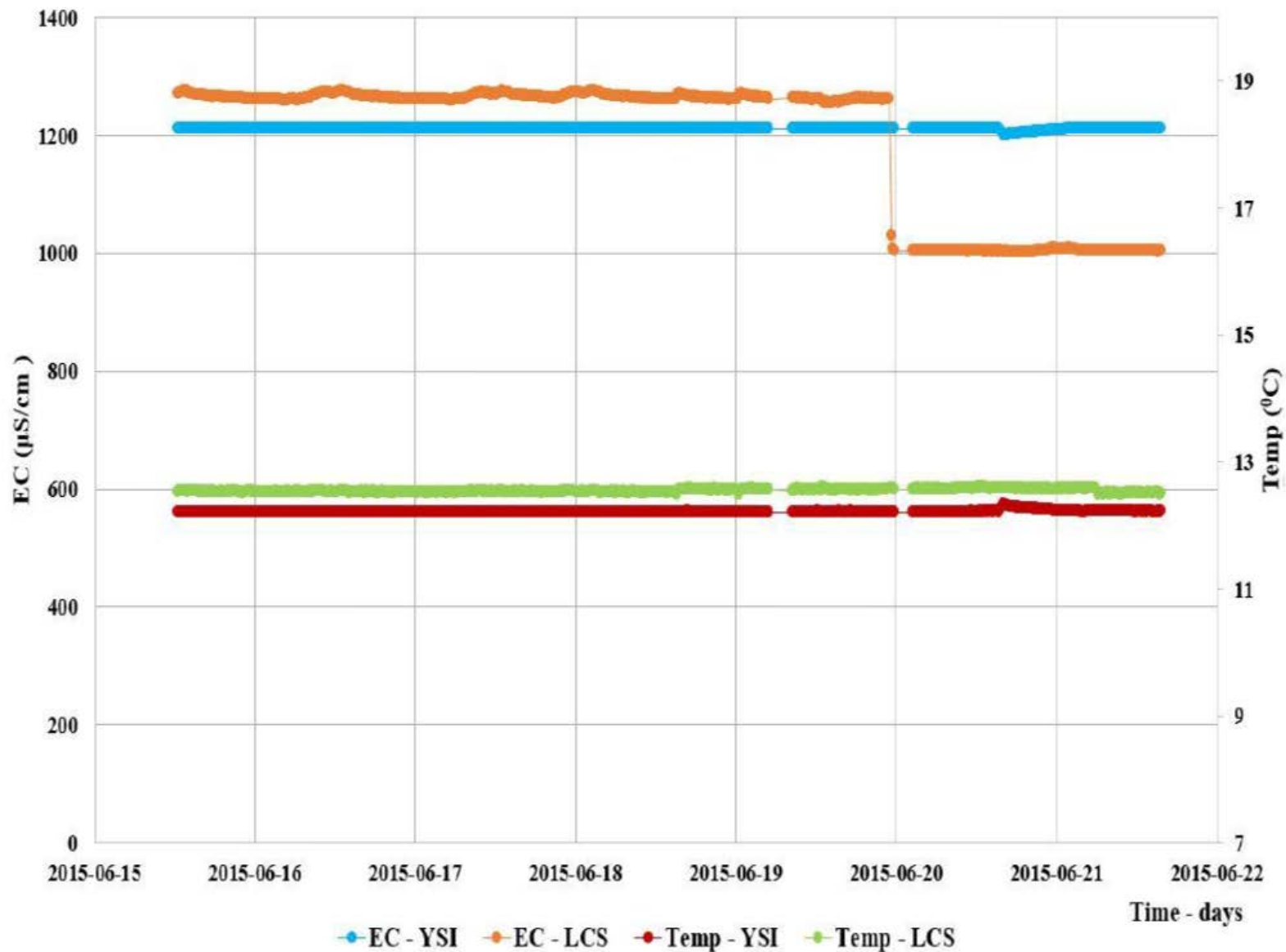
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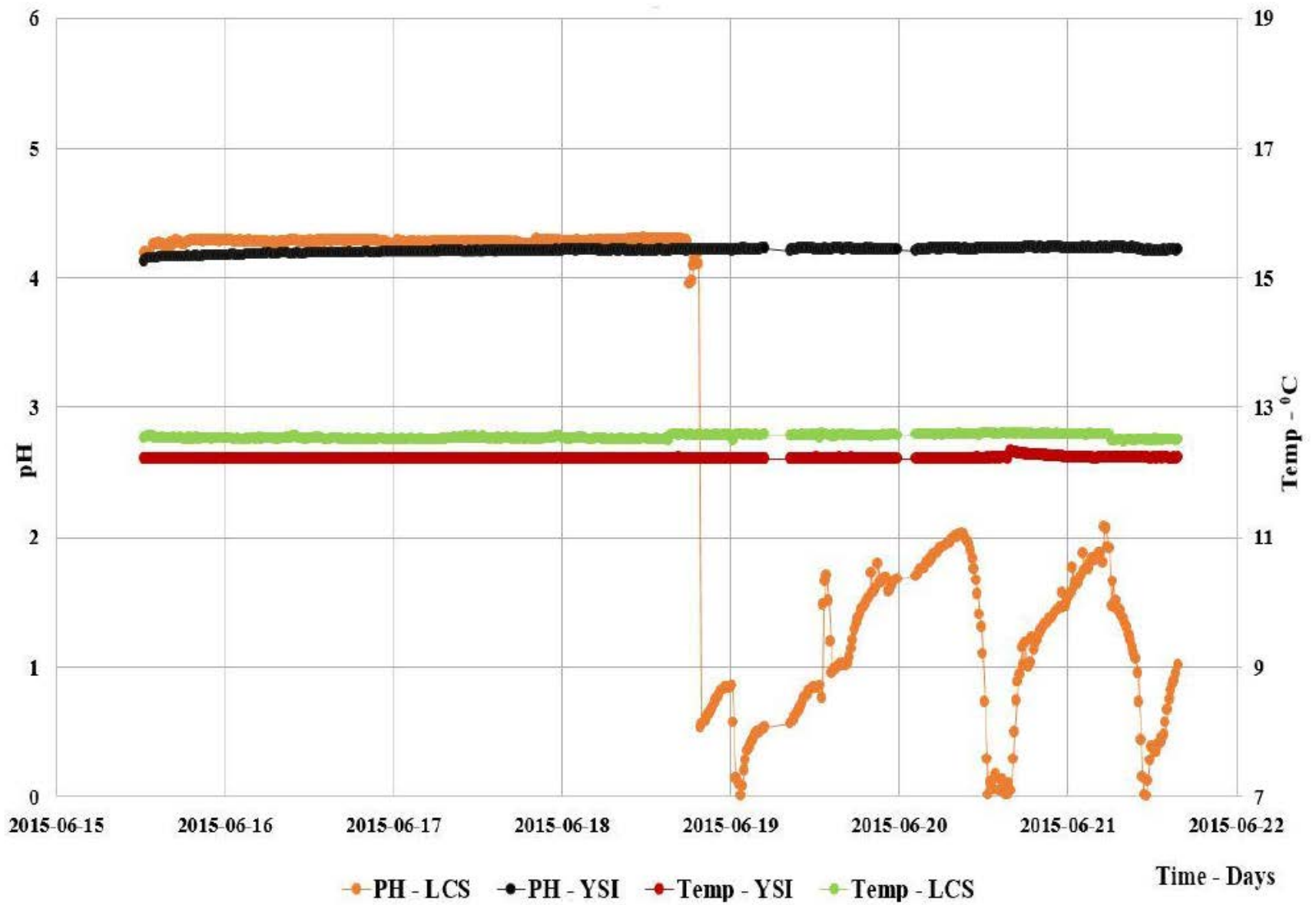
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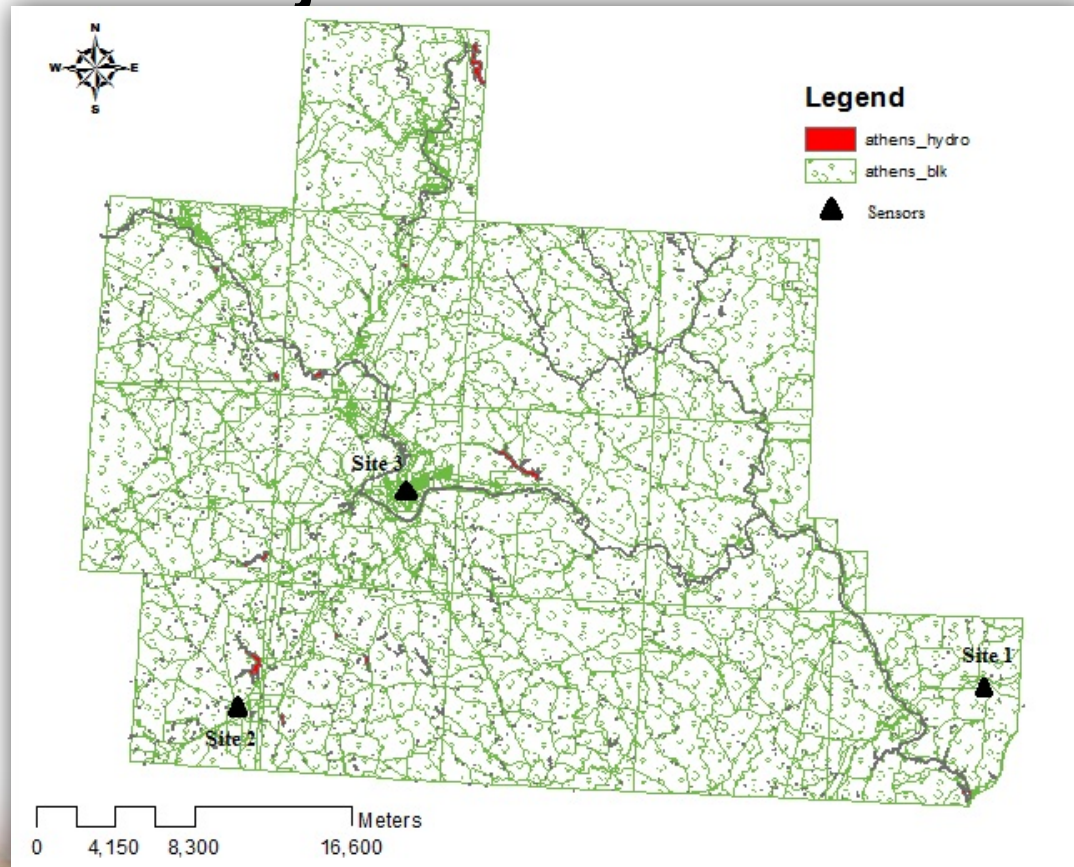


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Next Steps

- Improved reliability
- Ensure accuracy is fit for purpose
- Adaptation of technology to:
 - Brine spills
 - Edge-of-field nutrient discharge
- Communication by WiFi, 3G, and 1G

Deployment Downstream of Injection Wells



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Thank you for your attention!



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Voinovich School of
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