NYSAC
NEW YORK STATE ASSOCIATION OF COUNTIES

Slowing the Spread of COVID-19, Part 1 of 3: Examining Wastewater to Detect Community Spread of COVID-19


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SARS2 Early Warning Wastewater Surveillance Platform

- Mary Collins – SUNY ESF – spatial modeling
- Hyatt Green – SUNY ESF - microbiology
- Brittany Kmush – SU – epidemiology
- David Larsen – SU – epidemiology
- Lee McKnight – SU – information systems
- Frank Middleton – SUNY Upstate – microbiology
- Teng Zeng – SU – chemistry

ESF

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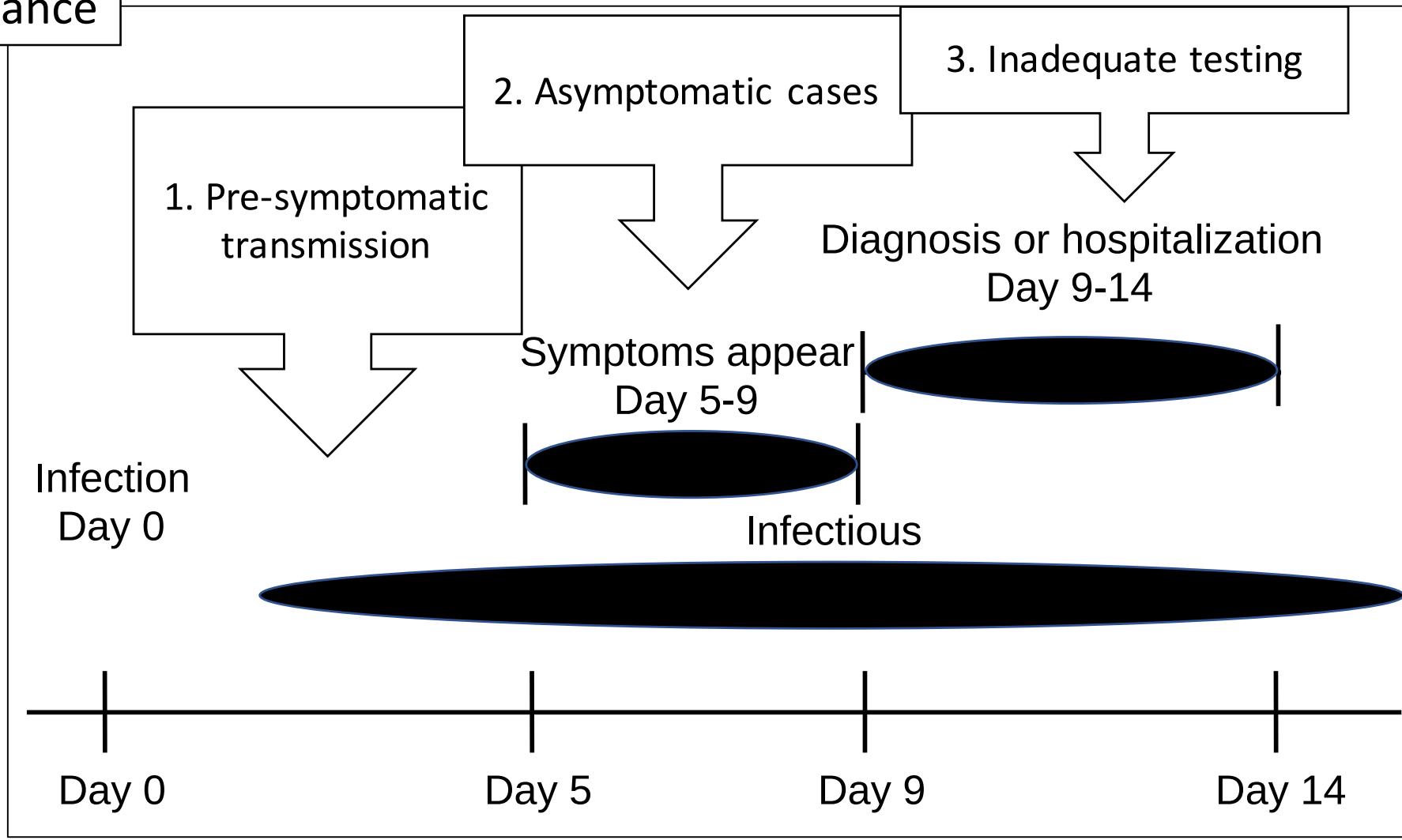
UPSTATE MEDICAL UNIVERSITY

Challenges in current surveillance

- Limited diagnostic availability or testing behavior
- Delays in treatment seeking behavior
- Asymptomatic infections and pre-symptomatic transmission
- Lag time between transmission and entry into health system surveillance



Goals of the SARS2 Early Warning Wastewater Surveillance Platform

1. Estimate SARS-CoV-2 transmission trends in real time
2. Provide instant feedback on social distancing and reopening phases
3. Predict hospitalizations from COVID-19
4. Give confidence in absence of transmission for areas with zero cases

COVID-19

Real-Time Transmission Tracking

Data Collection

Sample wastewater from treatment centers or pump stations

Identify/ Analyze

Analyze wastewater for SARS-CoV-2 RNA. Quantify viral load in catchment.

Aggregate & Relay

Aggregate and relay information. Deploy mobile response centers to enhance control.

Classify Transmission

Classify geographic areas as transmission present or absent. Identify early trends of increasing or decreasing transmissions

Save Money

Allocate Limited Resources

Lower Rate of Spread

Get us back to normal

Environmental surveillance for poliovirus

http://polioeradication.org/news-post/explaining-environmental-surveillance/

Title page

Title

Presence of SARS-Coronavirus-2 in sewage.

Authors and their affiliations

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First confirmed detection of SARS-CoV-2 in untreated wastewater in Australia: A proof of concept for the wastewater surveillance of COVID-19 in the community

le Bibby [c], Aaron Bivins [c], Jake W. O'Brien [d], Phil M. Choi [d],
n Tscharke [d], Rory Verhagen [d], Wendy J.M. Smith [g],
Kevin V. Thomas [d], Jochen F. Mueller [d]

Title: SARS-CoV-2 titers in wastewater are higher than expected from clinically confirmed cases

Authors: Wu FQ(1); Xiao A(1); Zhang JB(1); Gu XQ(2); Lee WL(2); Kauffman K (3); Hanage WP(4); Matus M (5); Ghaeli N(5); Endo N(5); Duvallet C(5); Moniz K(1); Erickson TB(6); Chai PR (6); Thompson J(7); Alm EJ(1,2

Temporal detection and phylogenetic assessment of SARS-CoV-2 in municipal wastewater

Artem Nemudryi[1], Anna Nemudraia[1], Kevin Surya, Tanner Wiegand, Murat Buyukyoruk, Royce Wilkinson, and Blake Wiedenheft[*]

Department of Microbiology and Immunology, Montana State University, Bozeman, MT 59717, USA

1 **Evaluation of lockdown impact on SARS-CoV-2 dynamics through viral genome**
2 **quantification in Paris wastewaters**

3

4 **Wurtzer S[1], Marechal V[2+], Mouchel JM[3], Maday Y[4+], Teyssou R[5], Richard E[1], Almayrac JL[6] & Moulin**
5 **L[1*].**

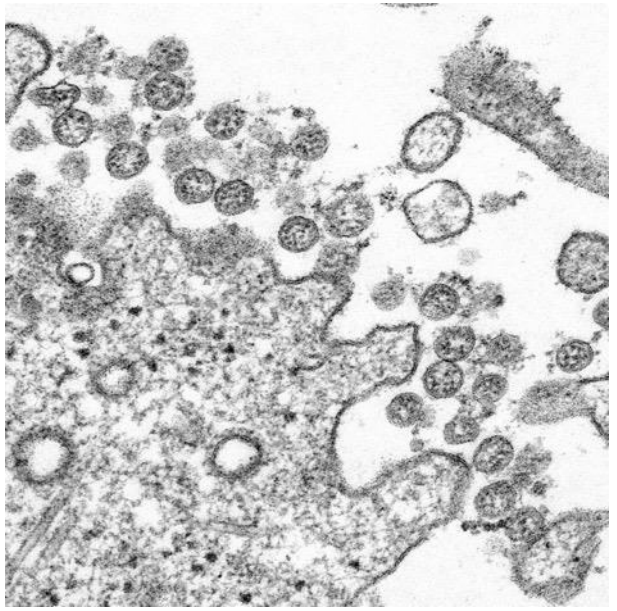
SARS-CoV-2 Wastewater Surveillance Workflow (Total: 5.5 hours following delivery of sample to laboratory)

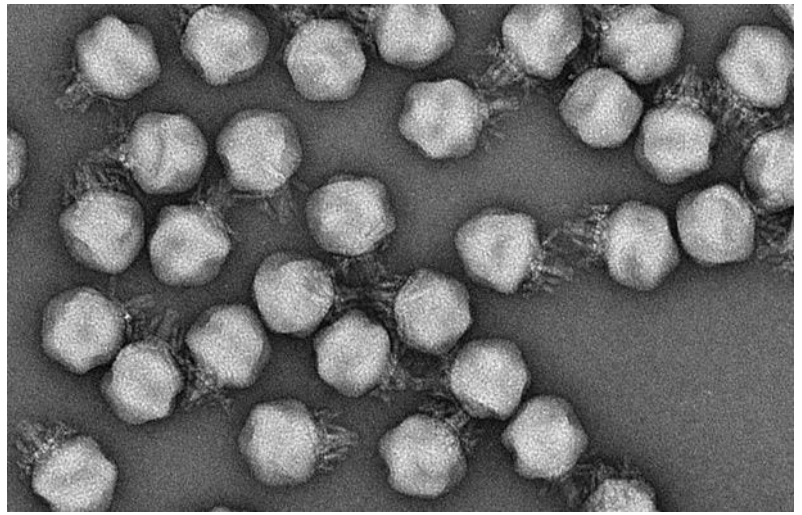
What	County collects and delivers wastewater (250 mls)	Load tubes (20 mls)	Spin for @ 150,000 X g	Resuspend pellet	Nucleic Acid Extraction
Time	24-hour composite or morning/evening grab sample	20 min	45 mins	20 min	2 hours

SARS-CoV-2 Wastewater Surveillance Workflow (Total: 5.5 hours)

Quantitative PCR/RT-qPCR (2 hrs)

- SARS-CoV-2
  - IP2 and IP4
- crAssphage
  - Benign, abundant, cosmopolitan member of the human gut flora
  - Indicates what level of human fecal material we are actually testing
- Likely retrieving the data the next morning





Detecting SARS-CoV-2 RNA:

Three separate RNA diagnostic tests done on the pellet

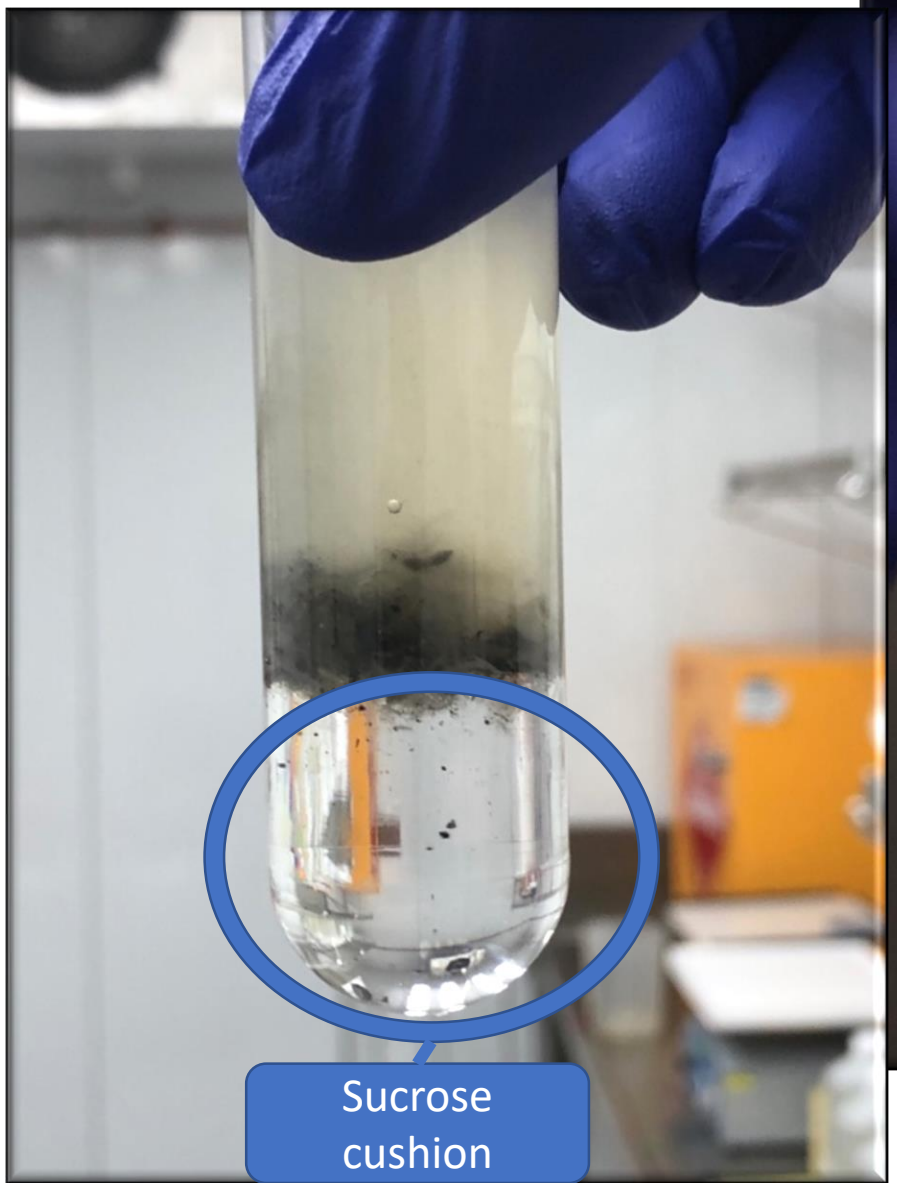
1- Provide a number out of three of positive hits

Useful for low transmission communities and providing confidence around communities being from transmission

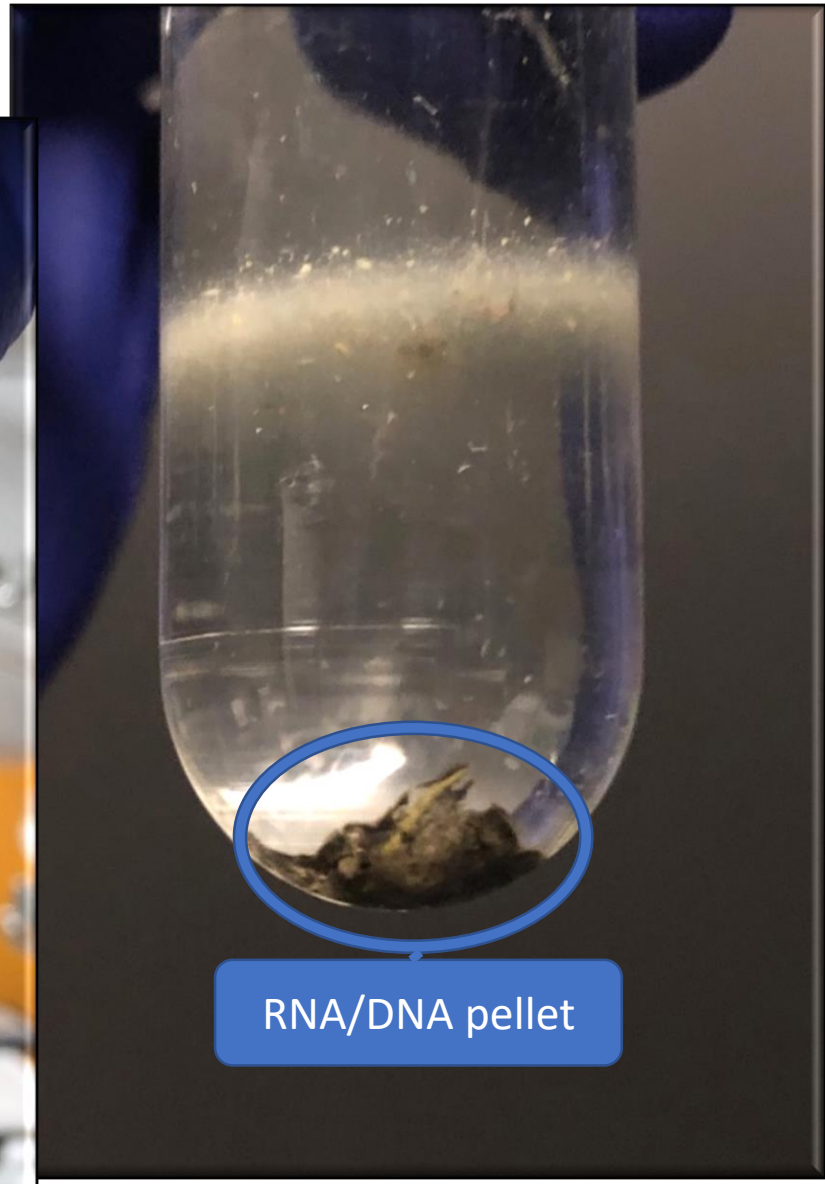
2- For samples with three positive hits, provide the average number of RNA copies

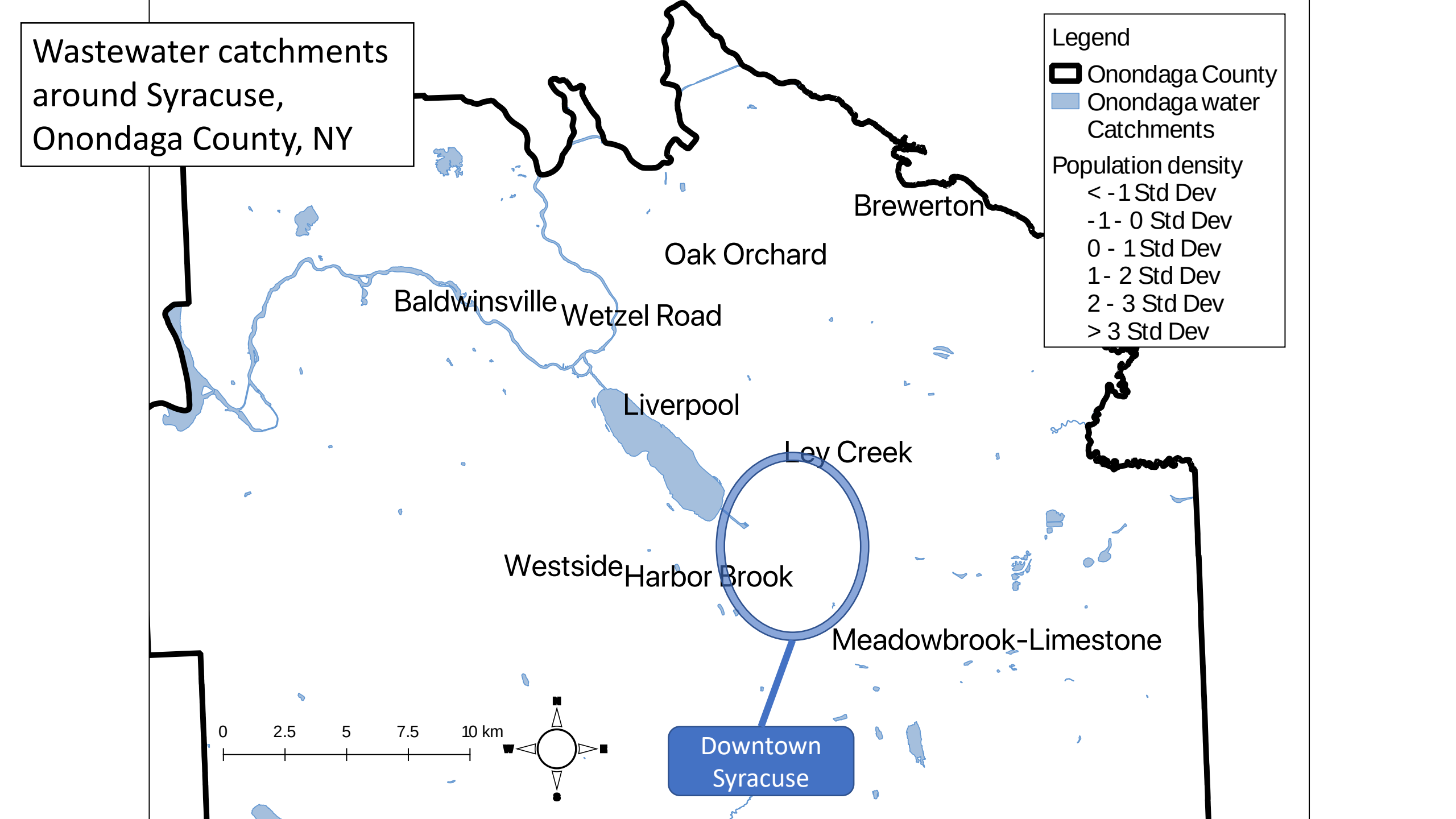
Useful as transmission increases and sensitive to rise and fall of transmission in communities

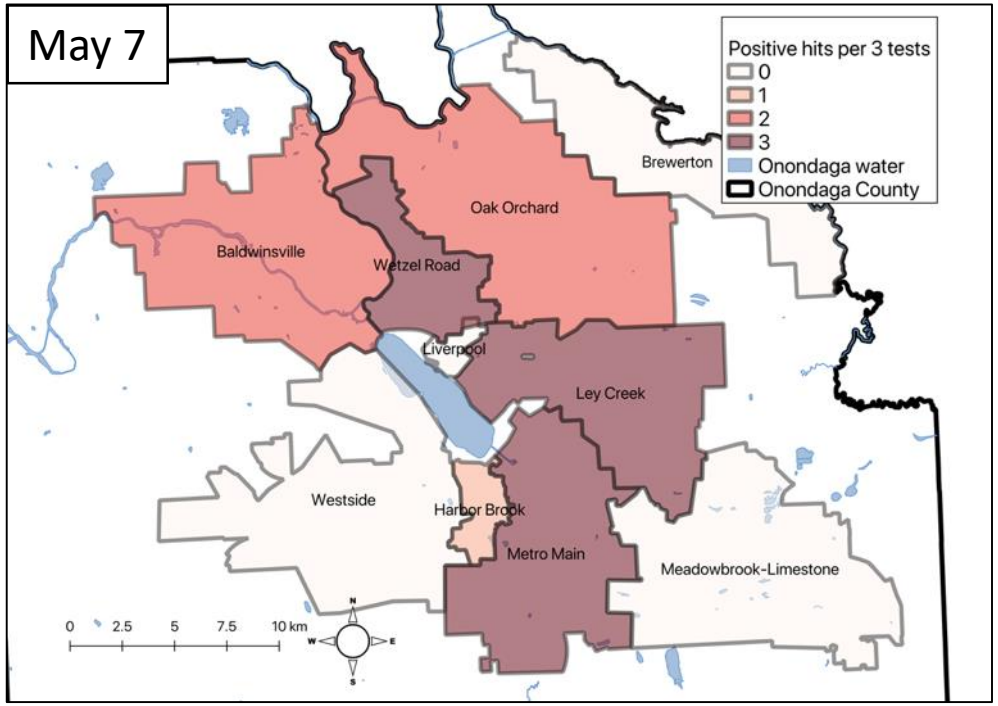
Pre-centrifigution

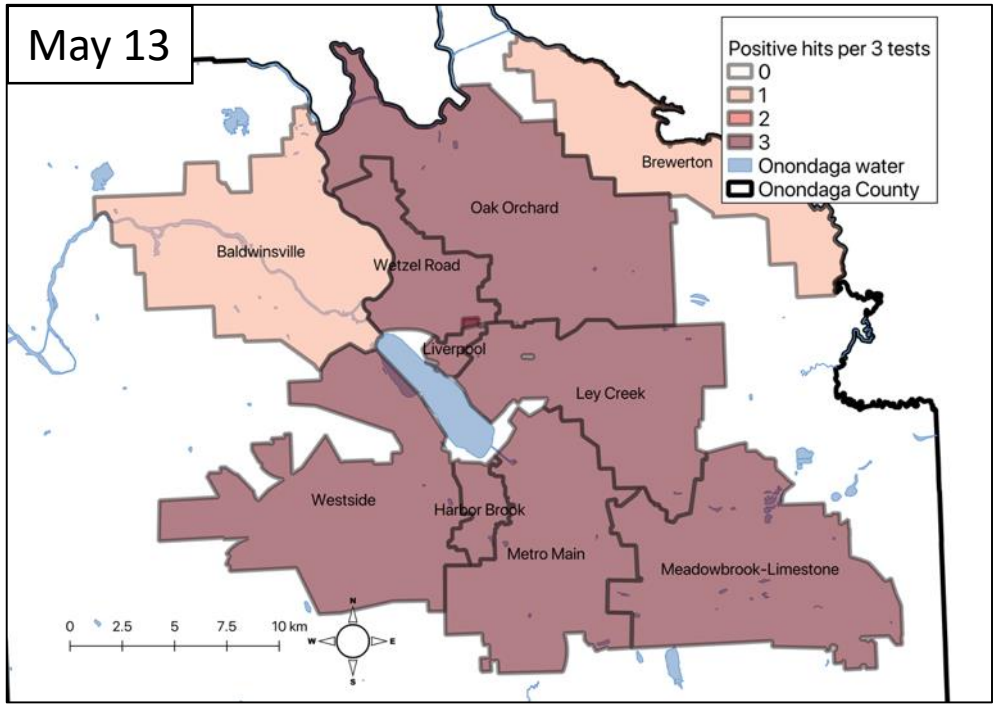


Post-centrifigution

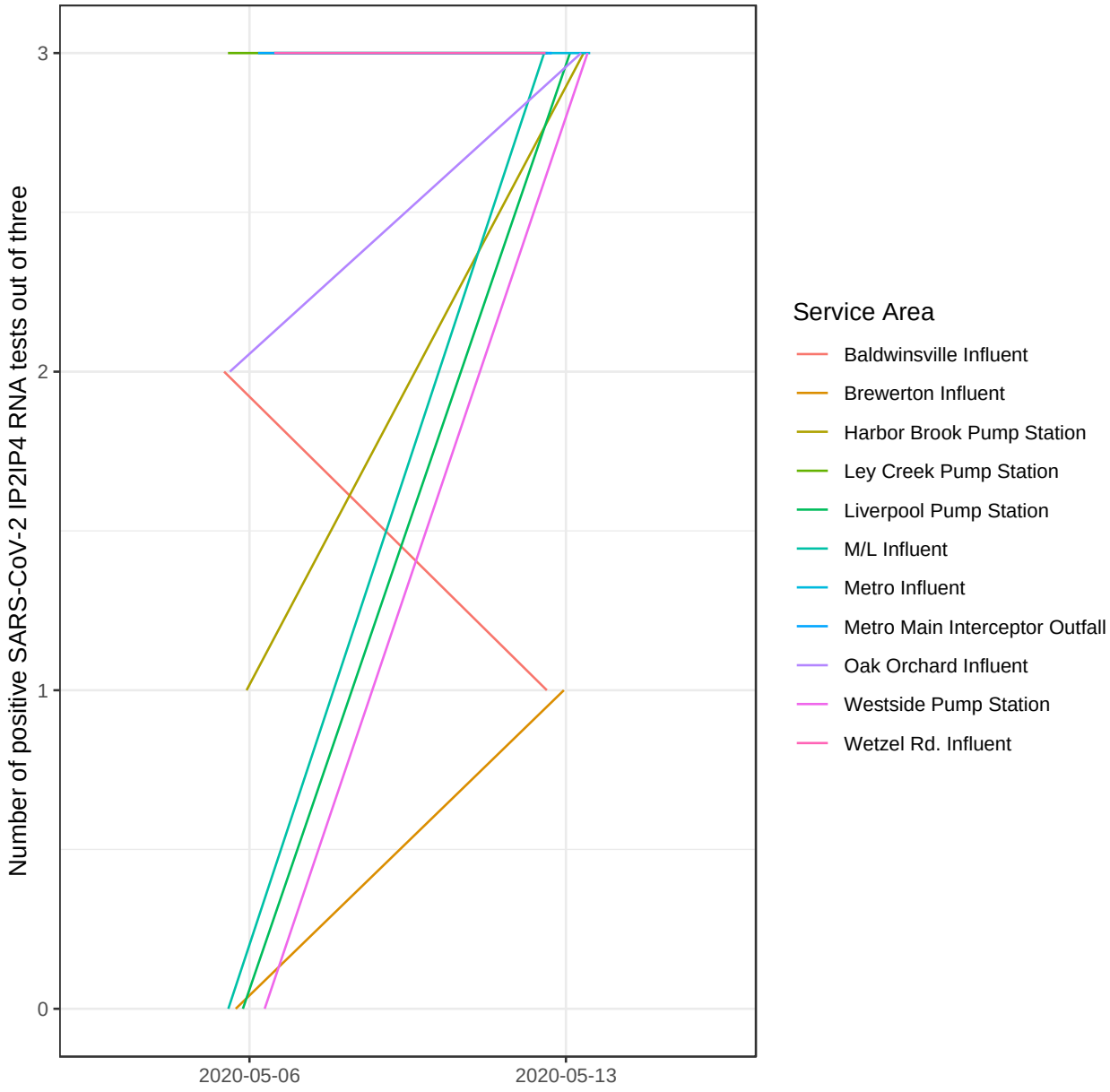


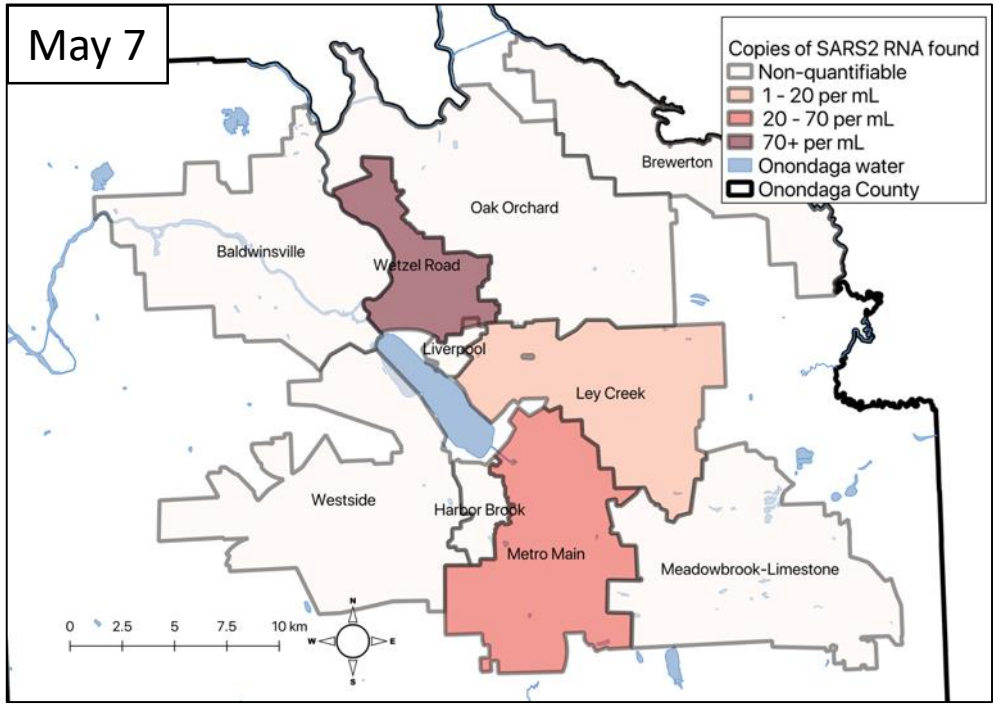

Wastewater catchments around Syracuse, Onondaga County, NY
Legend
Onondaga County
Onondaga water Catchments
Population density
< -1 Std Dev
-1 - 0 Std Dev
0 - 1 Std Dev
1 - 2 Std Dev
2 - 3 Std Dev
> 3 Std Dev
Brewerton
Oak Orchard
Baldwinsville
Wetzel Road
Liverpool
Ley Creek
Westside
Harbor Brook
Meadowbrook-Limestone
Downtown Syracuse
0
2.5
5
7.5
10 km

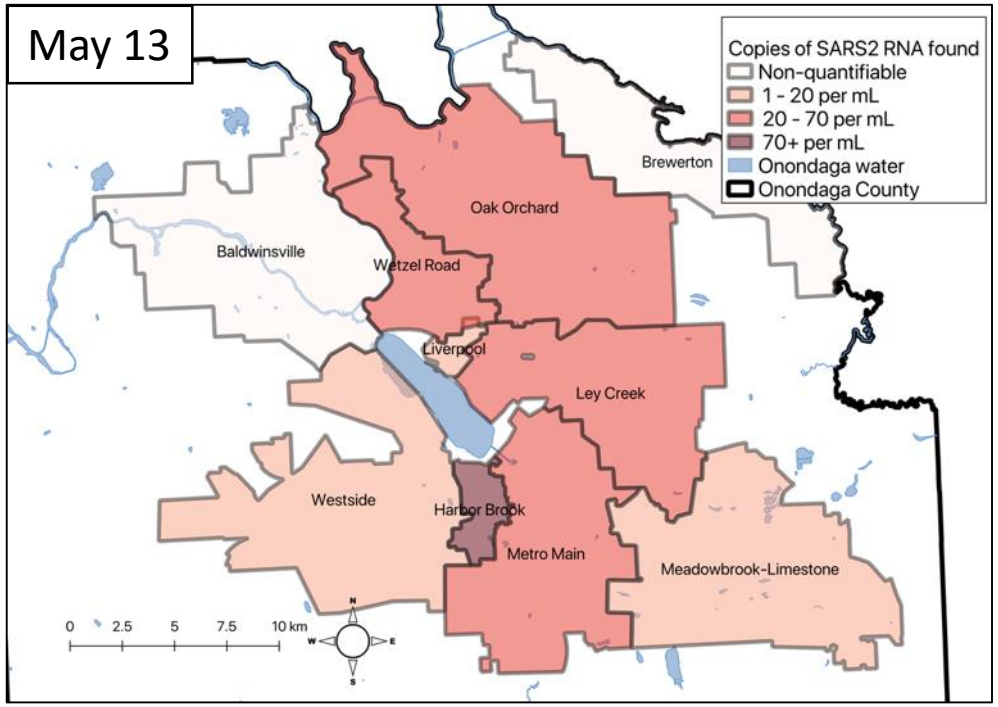




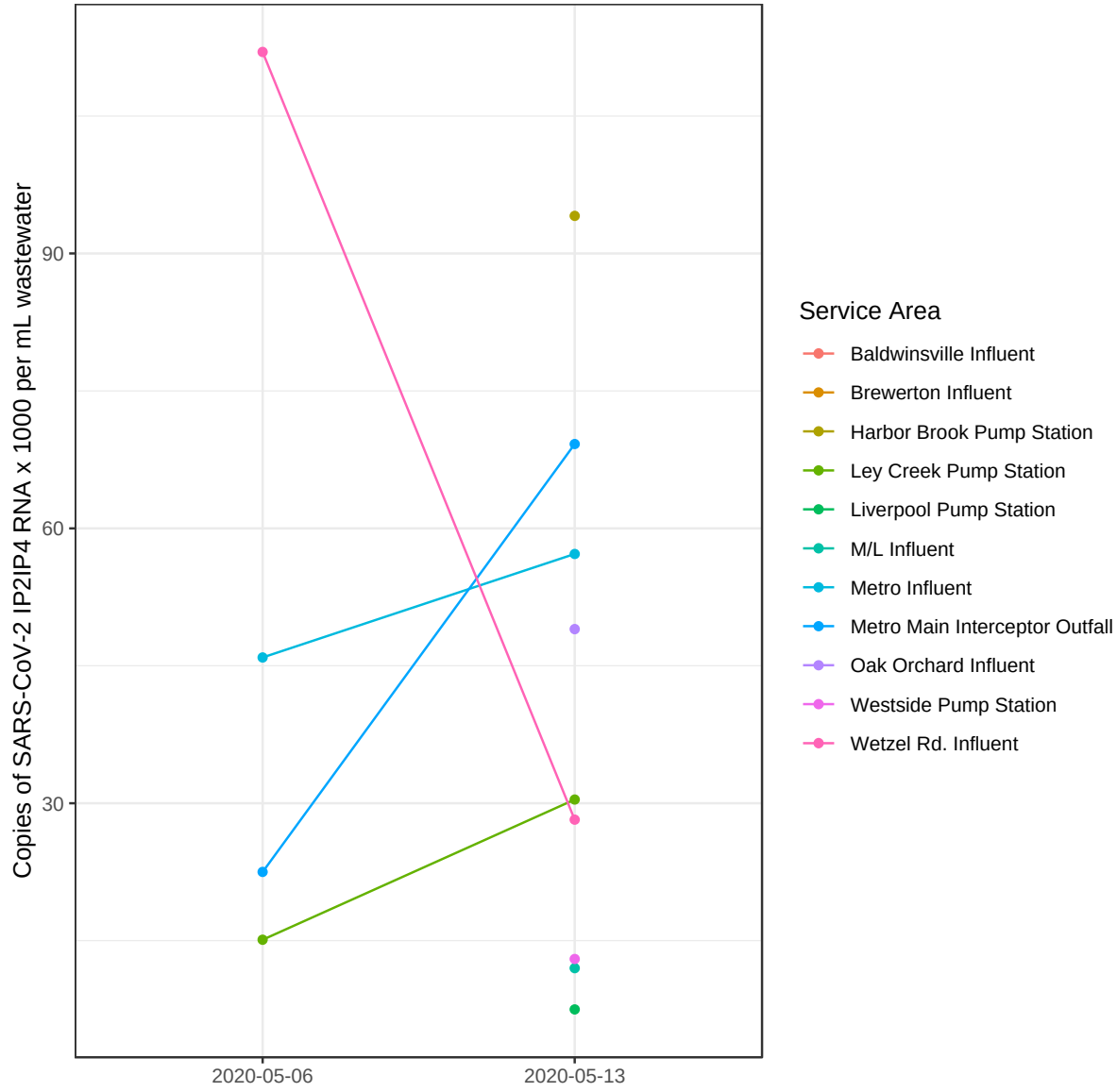
Number of positive hits in wastewater out of three

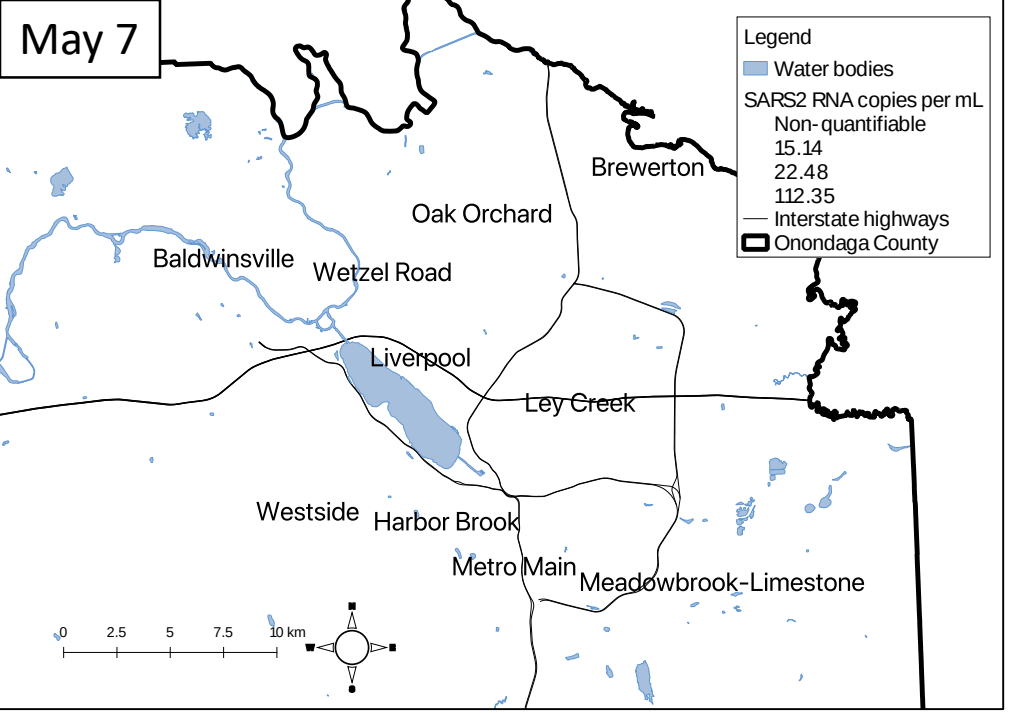


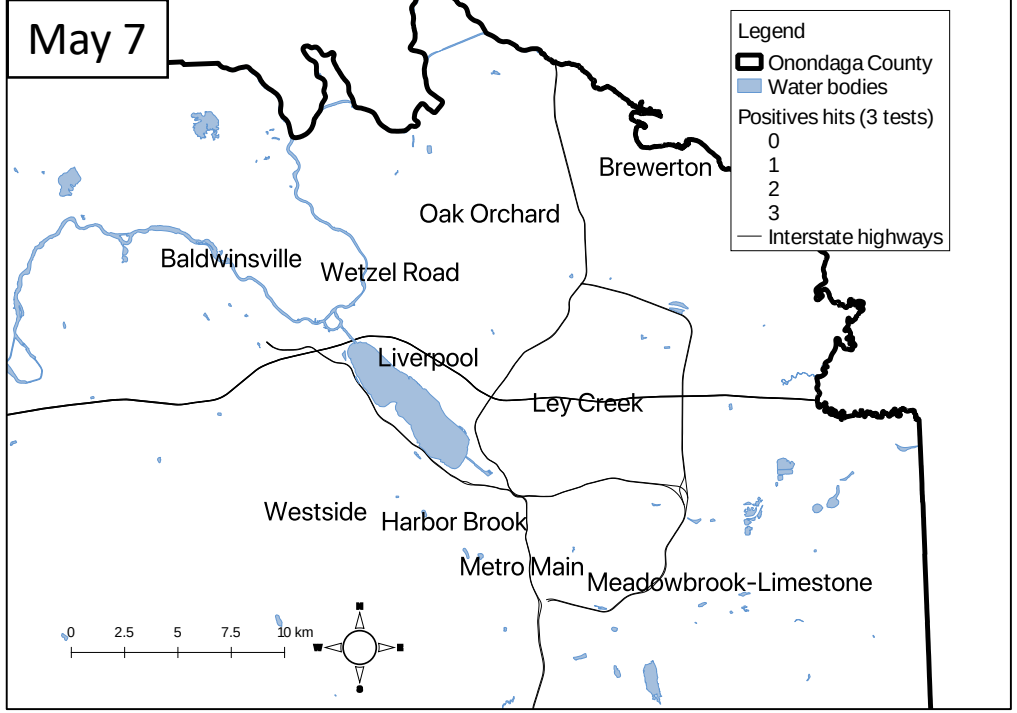


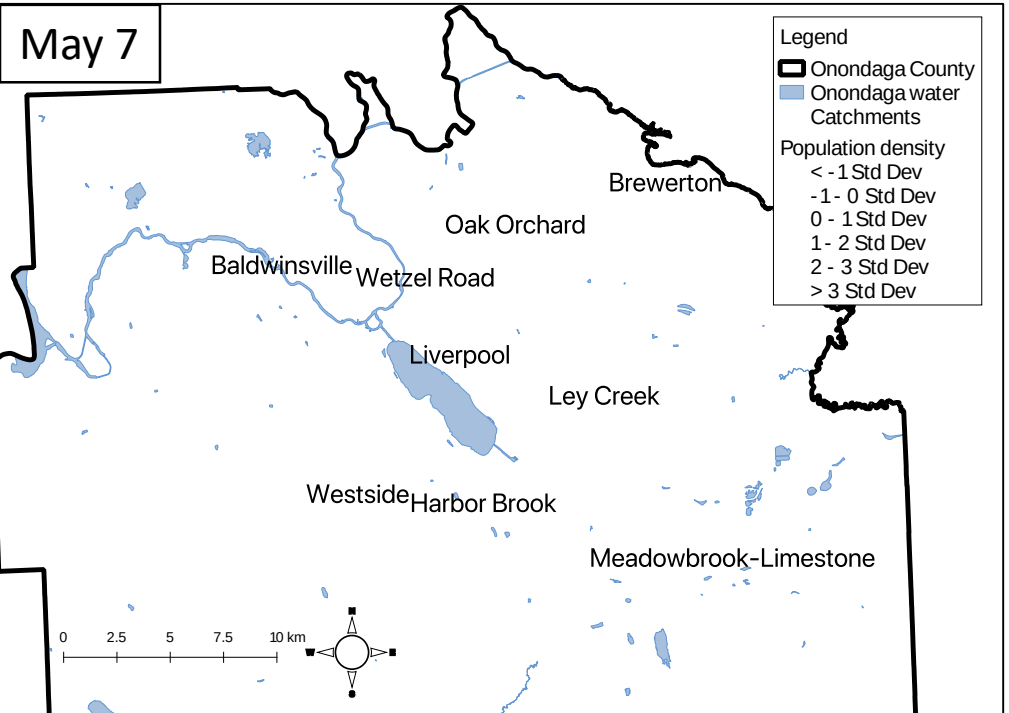


For areas with three positive hits, number of RNA copies found




May 7
Legend
Water bodies
SARS2 RNA copies per mL
Non-quantifiable
15.14
22.48
112.35
Interstate highways
Onondaga County
Brewerton
Oak Orchard
Baldwinsville
Wetzel Road
Liverpool
Ley Creek
Westside
Harbor Brook
Metro Main
Meadowbrook-Limestone
0 2.5 5 7.5 10 km


May 7
Legend
Onondaga County
Water bodies
Positives hits (3 tests)
0
1
2
3
Interstate highways
Brewerton
Oak Orchard
Baldwinsville
Wetzel Road
Liverpool
Ley Creek
Westside
Harbor Brook
Metro Main
Meadowbrook-Limestone
0 2.5 5 7.5 10 km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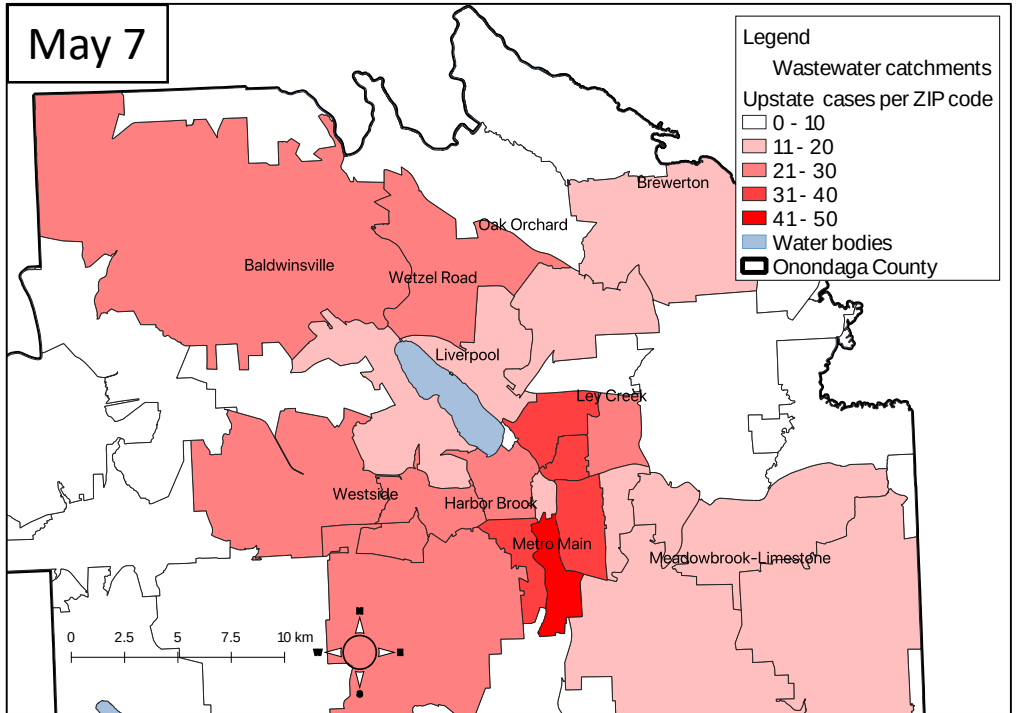
May 7
Legend
Wastewater catchments
Upstate cases per ZIP code
0 - 10
11 - 20
21 - 30
31 - 40
41 - 50
Water bodies
Onondaga County
Brewerton
Oak Orchard
Baldwinsville
Wetzel Road
Liverpool
Ley Creek
Westside
Harbor Brook
Metro Main
Meadowbrook-Limestone
0 2.5 5 7.5 10 km

Our group next steps

- Expansion – currently in 11 catchment areas in Onondaga county.
  - Expanding to more catchments in Onondaga County
  - First samples arrived today from Cayuga County
  - More counties?
- Funding
  - Multiple funding applications going out to various funding bodies
  - We have a price model ready for scale (~$200 per sample)
- Modeling
  - Ready to provide first evidence of reopening central New York
  - Need 100-150 data points and 1-2 months' time before beginning to model hospitalizations and trends

How can this platform help your county?

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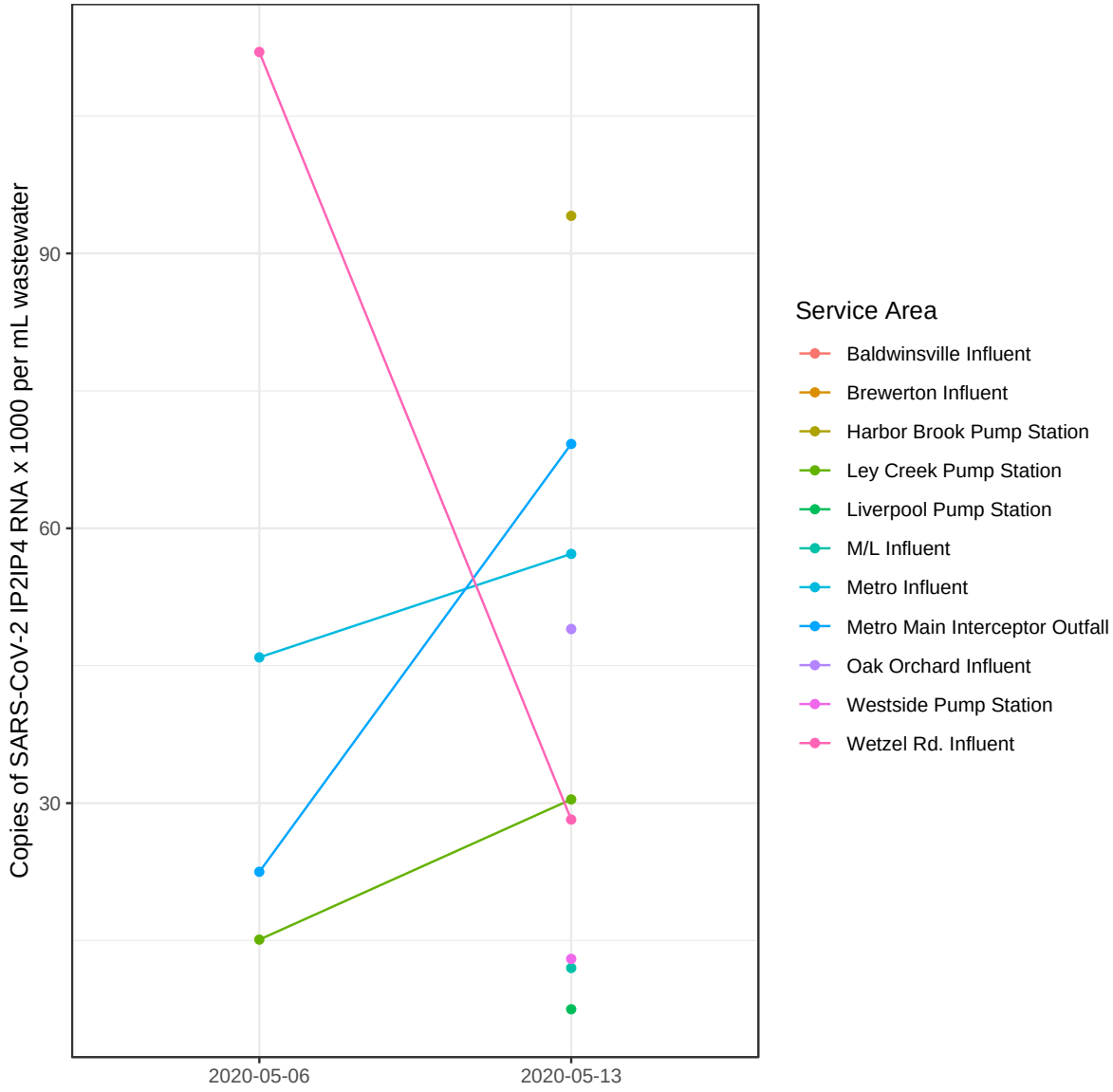
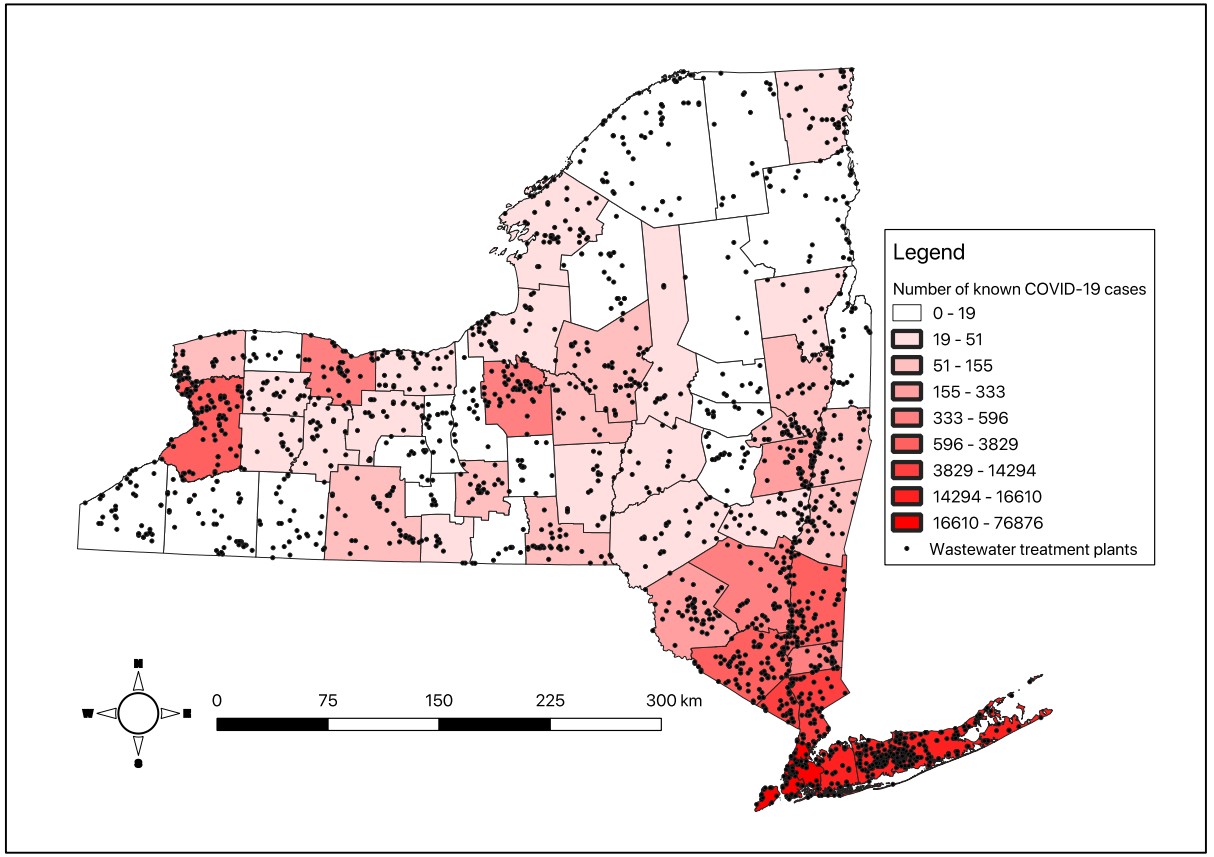


What can your county do to scale wastewater surveillance?

1. Work with us as a county.
   - Email Pruthvi Kilaru (pkilaru@syr.edu) to set up consultations with our team
2. Request statewide scale from the Governor's office, Congress, and Senate. We can scale this statewide within weeks for $4 – 5 million.
   - Would inform reopening.
   - Would be early warning for second wave, which could be mitigated with early intervention



Thank you

SARS2 Early Warning Wastewater Surveillance Platform

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Q & A

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