

What do our existing water quality models tell us about conditions in vulnerable communities?

September 22nd, 2022

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What is a vulnerable community?

The conditions that affect public health often disproportionately impact specific communities due to a history of neglect and marginalization.

Compounding factors can increase vulnerability to disasters or long-term environmental hazards.



What is a vulnerable community?

Poverty, minority status, housing, and other factors can intensify human suffering and financial loss during a disaster.

The range of factors can be difficult to summarize for use by planners and public health officials.

**Enduring historical influences +
Present-day challenges +
Future climate change effects →
Increase in impacts on vulnerable communities**

Why focus on vulnerable communities?




Andrew Bawiec; CBP Student Story Map [Flooding Inequity in Maryland and Beyond \(arcgis.com\)](https://arcgis.com/storymaps/view/68484444-4044-4044-4044-404444444444)

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Why focus on vulnerable communities?



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Economic and Racial Inequality in FEMA SFHA Flood Zone Designations

The New York Times

CLIMATE FWD:

How Disaster Aid Favors White People

Federal money is widening racial inequality as climate change gets worse.

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E&ENews

POLICY

Advisers Rebuke FEMA for Racial Disparities in Disaster Aid


Disaster Aid

A federal panel set up after Hurricane Katrina warned that aid disproportionately helps wealthier areas

By Thomas Frank, E&E News on January 7, 2021

The New York Times

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E&E NEWS
POLICY

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Problems in Disaster Aid

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CLIMATE FWD:

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How Disaster Aid Favors White People

by [Kaitlyn Green](#) and [Kaitlyn Green](#) | [climate change](#)

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Economic and Racial Inequality in FEMA SFHA Flood Zone Designations

Why FEMA Aid Is Unavailable To Many Who Need It The Most

By Rebecca Hersher

By **Rebecca Hersher**
Published June 29, 2021 at 5:01 AM EDT

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Why focus on vulnerable communities?

PUBLIC HEALTH

People of Color Breathe More Unhealthy Air from Nearly All Polluting Sources

A trend of disproportionate exposure to deadly air pollution among Asian, Hispanic and Black people persists in most cases regardless of the emission source, a study finds

By Robin Lloyd on April 28, 2021

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April 28, 2021

Study Finds Exposure to Air Pollution Higher for People of Color Regardless of Region or Income

Published September 20, 2021



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PUBLIC HEALTH

People of Color Breathe Unhealthy Air from Near Polluting Sources

PM_{2.5} polluters disproportionately and systemically affect people of color in the United States

CHRISTOPHER W. TESSUM , DAVID A. PAOLELLA , SARAH E. CHAMBLISS , JOSHUA S. APTE , JASON D. HILL , AND, JULIAN D. MARSHALL [Authors Info &](#)

SCIENCE ADVANCES • 28 Apr 2021 • Vol 7, Issue 18 • DOI: 10.1126/sciadv.abf4491

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Redlining means 45 million Americans are breathing dirtier air, 50 years after it ended

Boyle Heights, a heavily Latino area in Los Angeles singled out for its 'detrimental racial elements,' has one of the highest pollution scores in California



By [Darryl Fears](#)

March 9, 2022 at 8:00 a.m. EST

Why focus on vulnerable communities?

America the Beautiful



Justice40 Initiative



Executive Order 14008



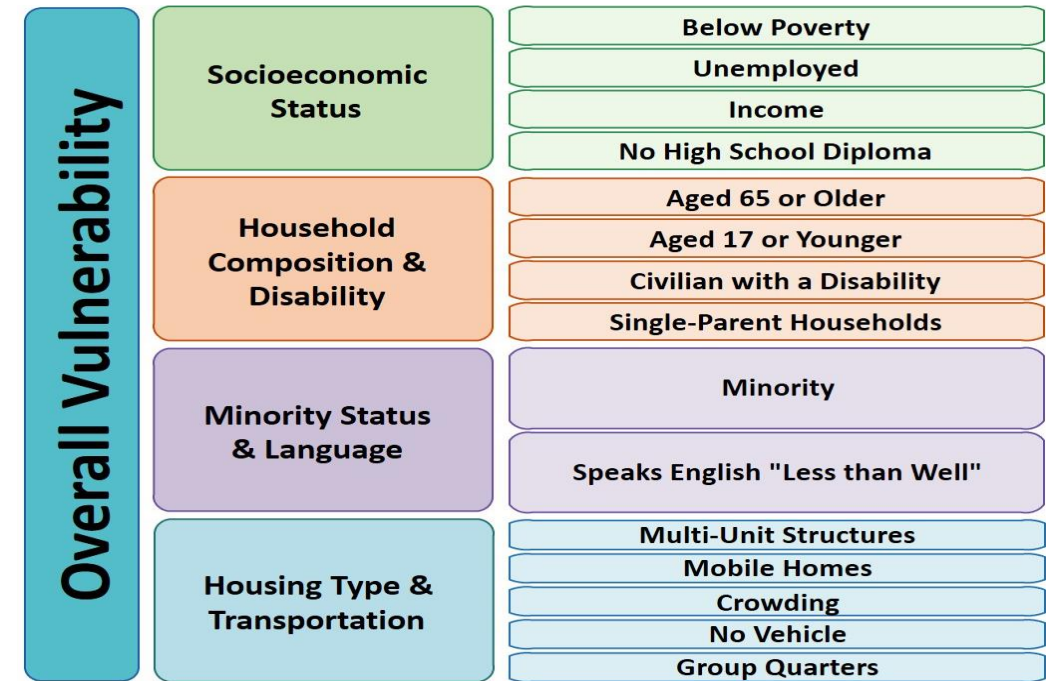
- Conserve America's Lands and Waters
- Support Healthy Communities
 - Address the Climate Crisis
 - Empowering Workers
 - Securing Environmental Justice
- Remediation/Reduction of legacy pollution
- Clean water infrastructure

...and it's the right thing to do!

CDC Social Vulnerability Index

The Centers for Disease Control (CDC) combines a set of factors into a social vulnerability index (SVI).

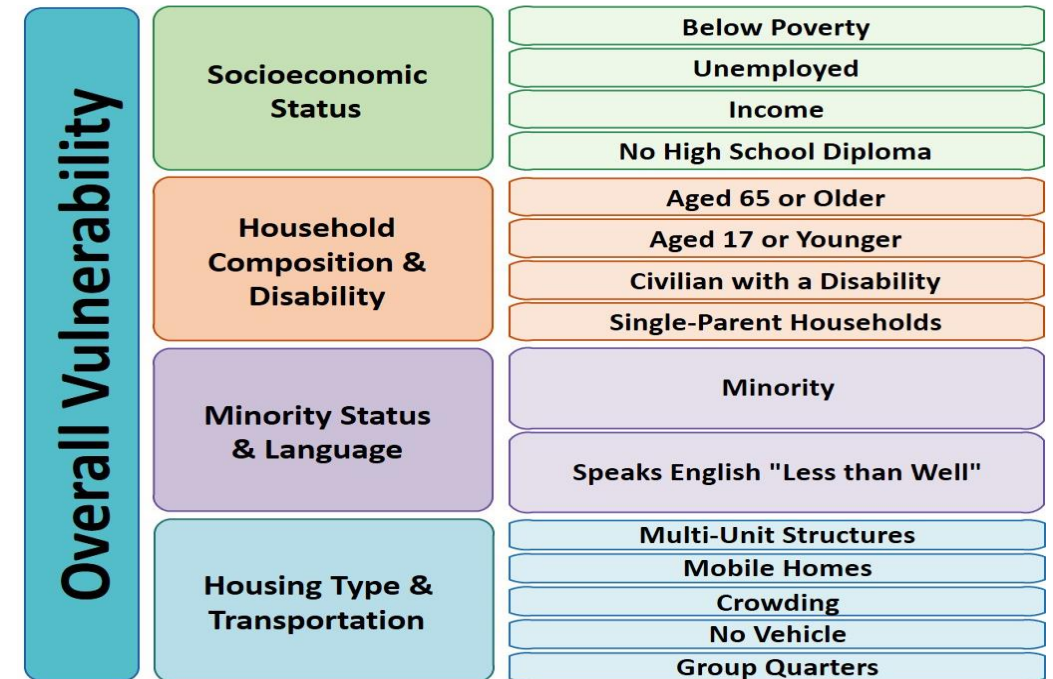
The SVI is calculated at the Census tract scale for select years from 2000 to 2018.



CDC Social Vulnerability Index

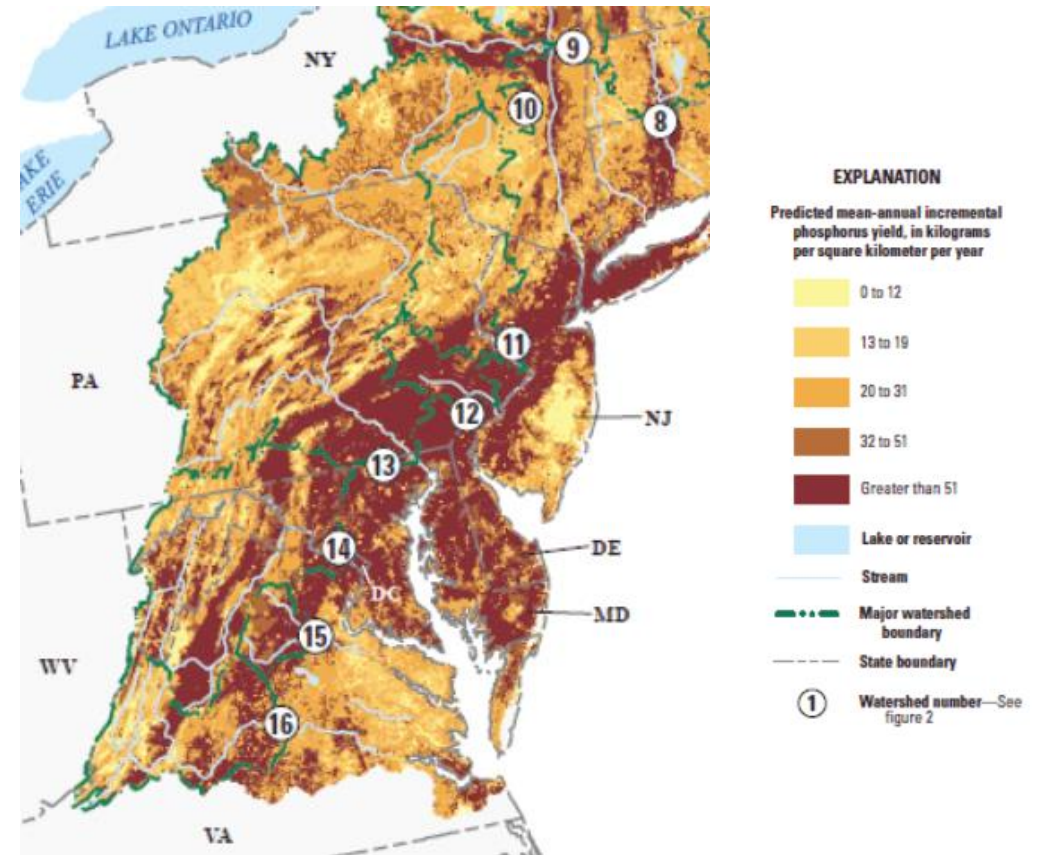
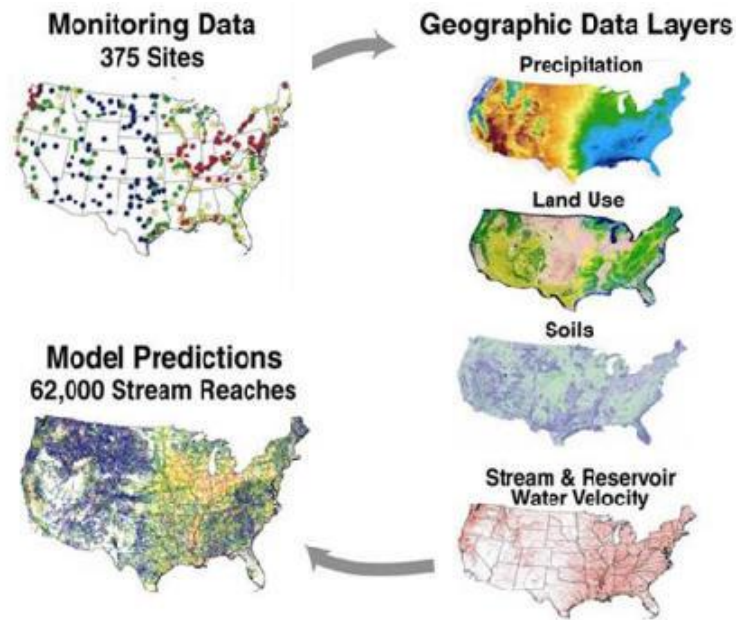
A census tract receives a “flag” if it is in the top 10% of values to indicate high vulnerability.

Flags are calculated for individual factors and can be summed for theme and overall values.



What do our existing water quality models tell us about conditions in vulnerable communities?

SPARROW models provide wall-to-wall predictions of water quality conditions.



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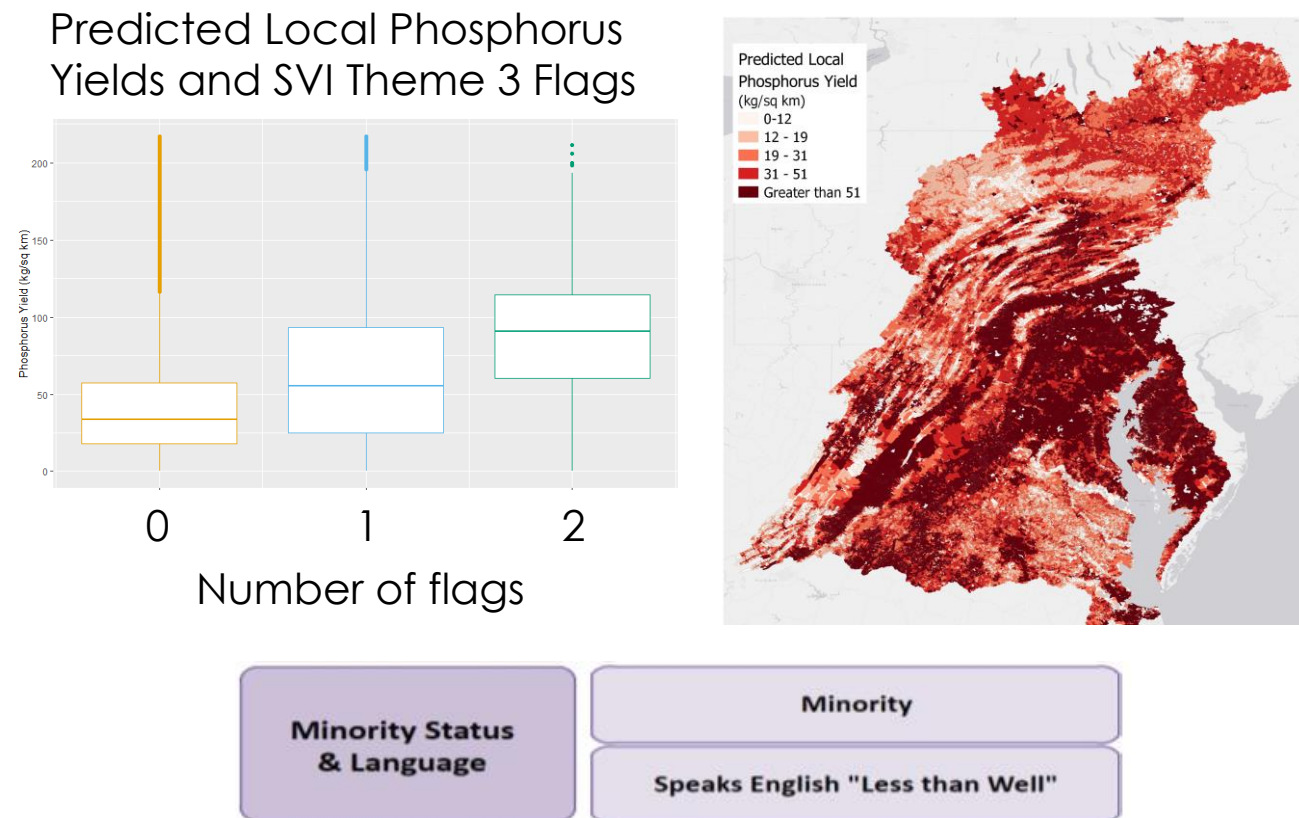
Ator, S.W., 2019, Spatially referenced models of streamflow and nitrogen, phosphorus, and suspended-sediment loads in streams of the Northeastern United States: U.S. Geological Survey Scientific Investigations Report 2019–5118, 57 p., <https://doi.org/10.3133/sir20195118>

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SPARROW water quality model predictions were compared with SVI theme 3 flags.

Preliminary statistical analysis suggests a possible relationship between predicted in-stream nutrient loads and SVI risk factors.

Excessive nutrients in streams and waterbodies can lead to harmful algal blooms, drinking-water treatment issues, and other negative health effects.



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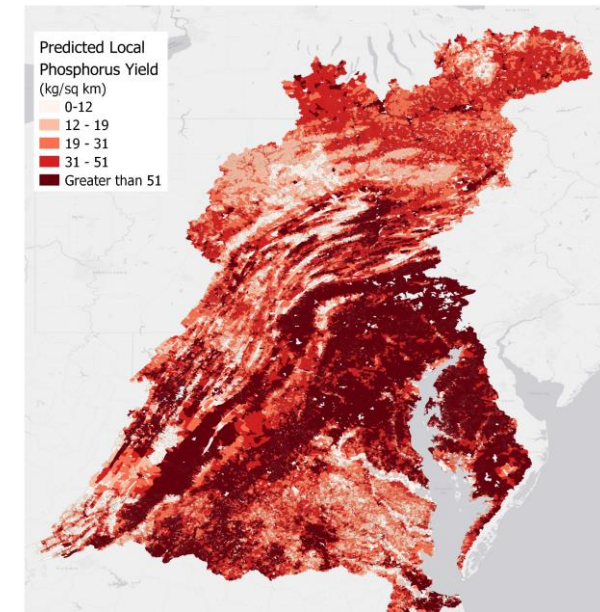
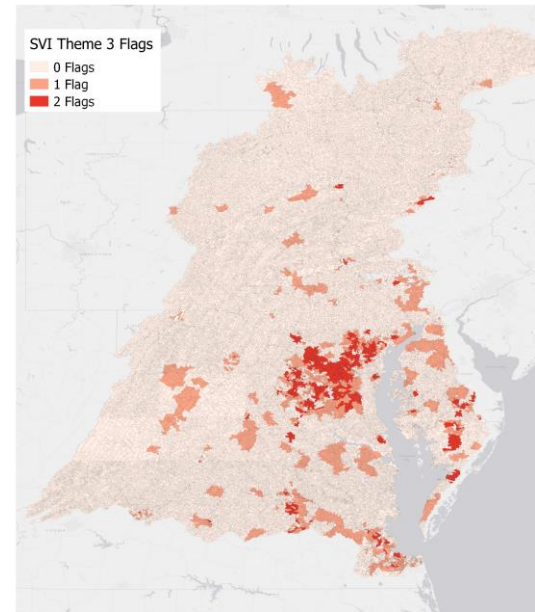
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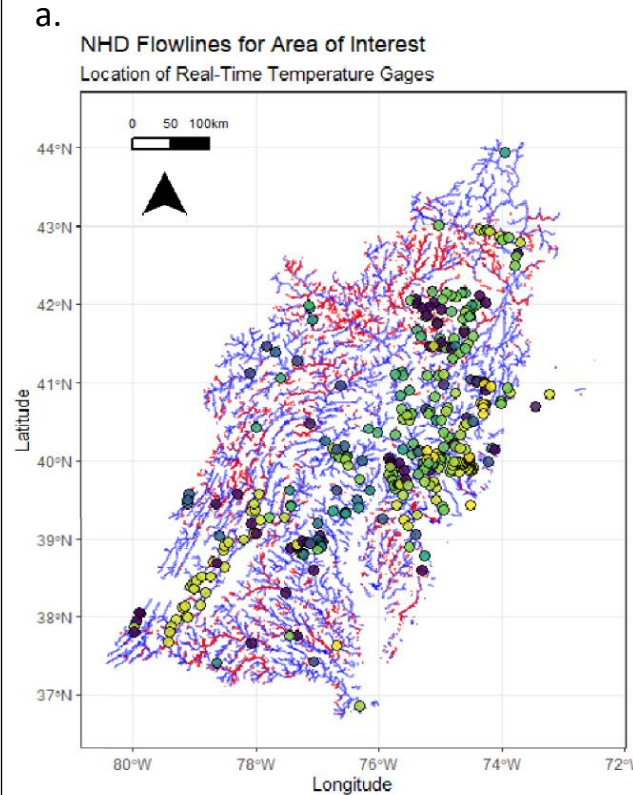
Does our current monitoring network represent the full range of social conditions?

USGS gage networks are designed for a variety of objectives and with different constraints.

Objectives generally are not related to a community's social vulnerability.

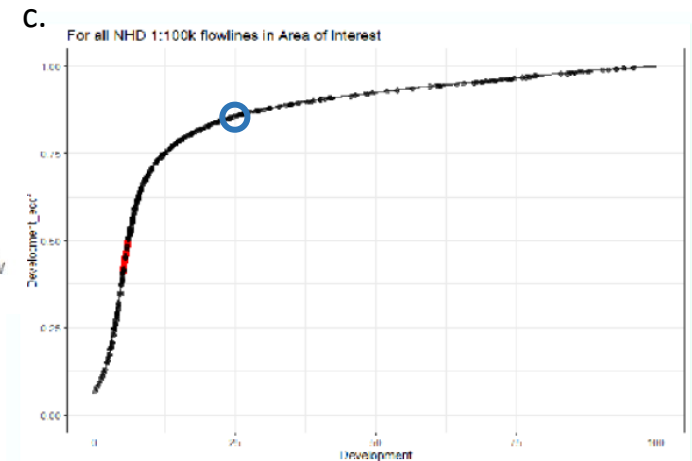
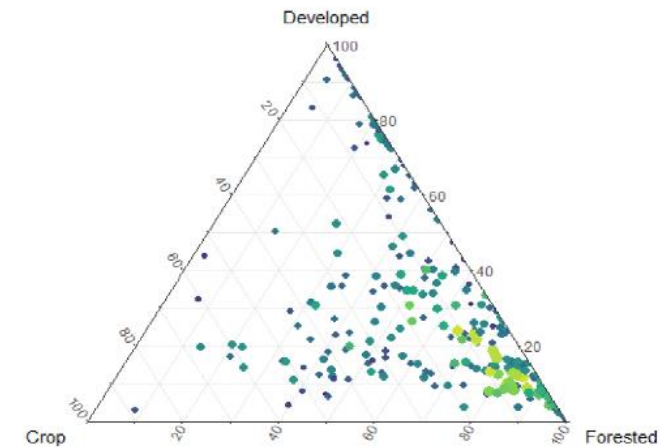
Network analyses identify gaps for monitoring and modeling.

Including SVI risk factors could identify disadvantaged communities that lack sufficient monitoring of flood conditions or exposure to poor water quality.



Workflow in development by Cashman et al.

b. ChesBay Gage Locations
342 Water Temp Gages



Next steps

Identify funding!

Evaluate relationships between all SVI factors and water quality predictions.

These analyses could also be performed with other models or spatial data layers (CAST, pesticides, toxic contaminants, etc).

Perform gage network analysis to identify the range of social conditions represented in our monitoring network.

These analyses would contribute to current federal priorities and initiatives.