Community Lawyering for Environmental Justice Part 10: Environmental Justice Implications of PFAS

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Biogeochemistry of Global Contaminants HARVARD

STEEP Sources, Transport, Exposure & Effects of PFASs UNIVERSITY OF RHODE ISLAND SUPERFUND RESEARCH PROGRAM

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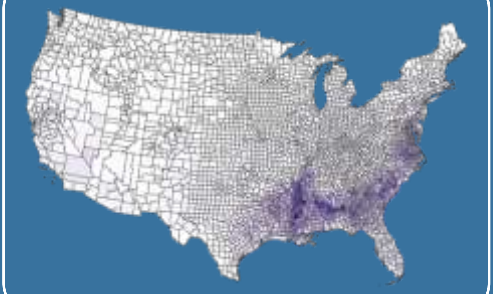
Mechanisms of environmental injustice related to drinking water



Natural environment

Climate

Hydrogeology

Soil

Built environment

Land use

Agriculture

Infrastructure

Sociopolitical environment

Planning/regulations

Settlement patterns

Social vulnerability

The Drinking Water Disparities Framework (Balazs and Ray, 2014)

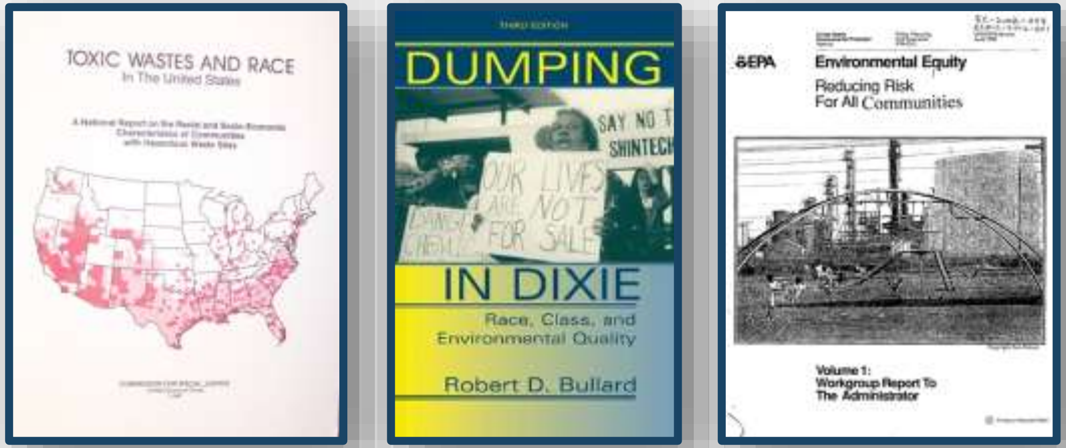
Insight on the mechanisms of environmental injustice

"One could still argue that there is an injustice—even an injustice at the level of racial groups when there are inequities in the simple correlations, even if these correlations are the result of socioeconomic processes. ***Simply because the inequity is mediated through some mechanism does not mean it isn't there****."*

Banzhaf et al., 2019a: "Environmental Justice: The Economics of Race, Place, and Pollution"

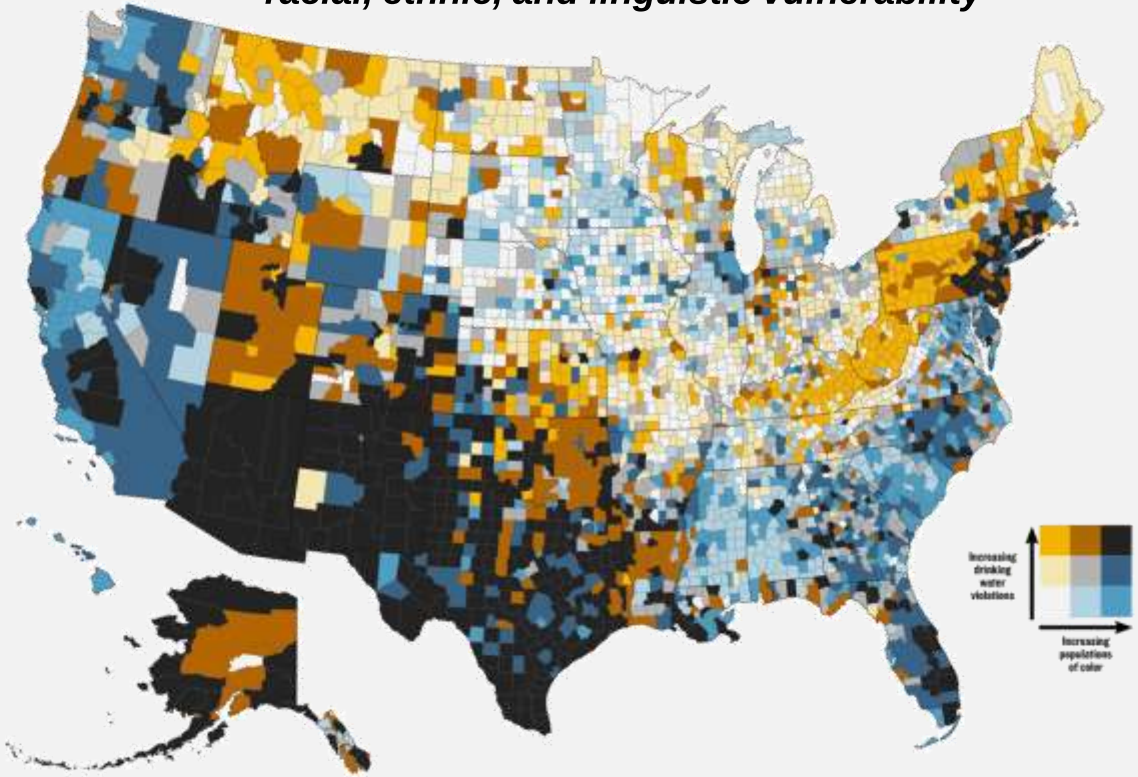
Several themes in the environmental justice movement have implications for PFAS

Historical discrimination and segregation have shaped where/how industrial sources of pollution are patterned around the US



Commission for Racial Justice (1987),
Robert Bullard (1990), and US EPA (1992)

Intersection between MCL violations and racial, ethnic, and linguistic vulnerability



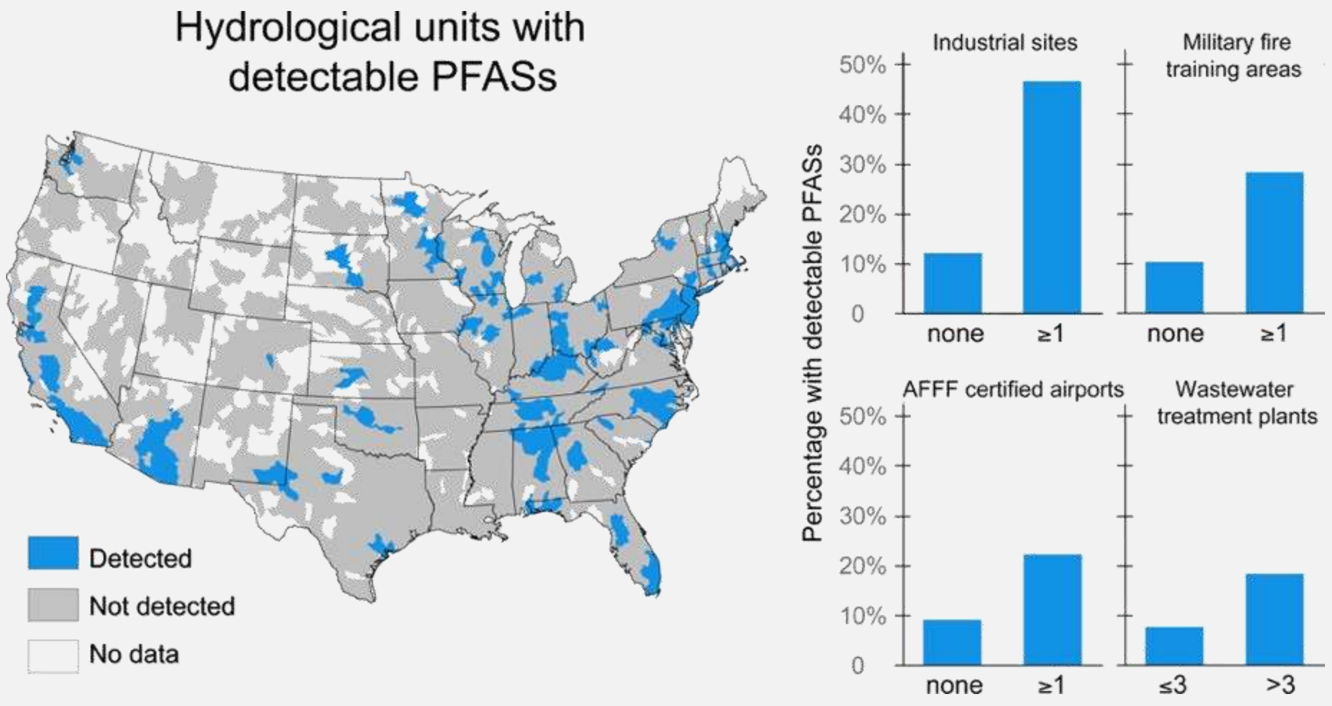
National Resources Defense Council (2019)

PFAS are drinking water contaminants

US EPA 2013-2015 nationwide survey included PFAS

Est. 200 million US residents exposed via drinking water

Since 2015, several states have monitored drinking water for PFAS and/or enacted regulations



Hu et al., 2016

Community water systems: public water systems that serve the same population year-round

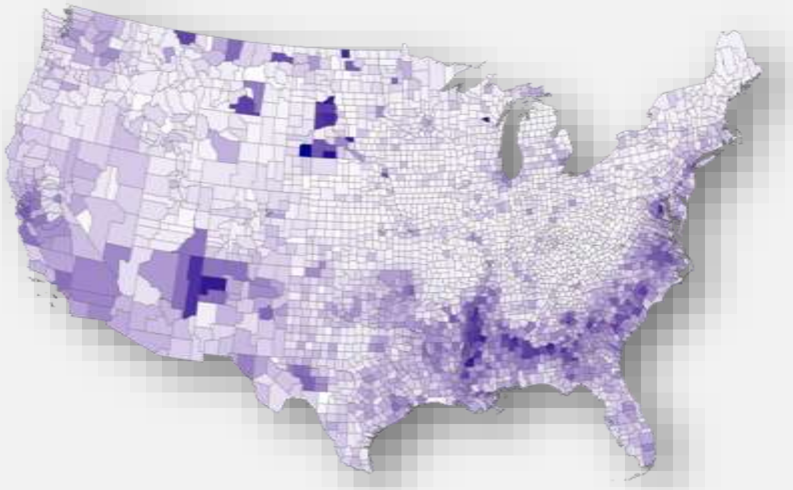
Research questions

1. **Are PFAS sources associated with PFAS concentrations in watersheds?**

2. **Are there sociodemographic disparities in the siting of PFAS sources in proximity to community water systems?**

3. **Are there sociodemographic disparities associated with detections of PFAS in community water systems?**

Synthesized PFAS statewide sampling data



US Census: racial/ethnic composition and socioeconomic factors

PFAS contamination sources (incl. airports, MFTAs, major facilities, landfills, and WWTP effluent)

Safe Drinking Water Information System (water system characteristics: population served, type, source water, county/counties served)

Combined with statewide monitoring of PFAS in 18 states (2016-2022)

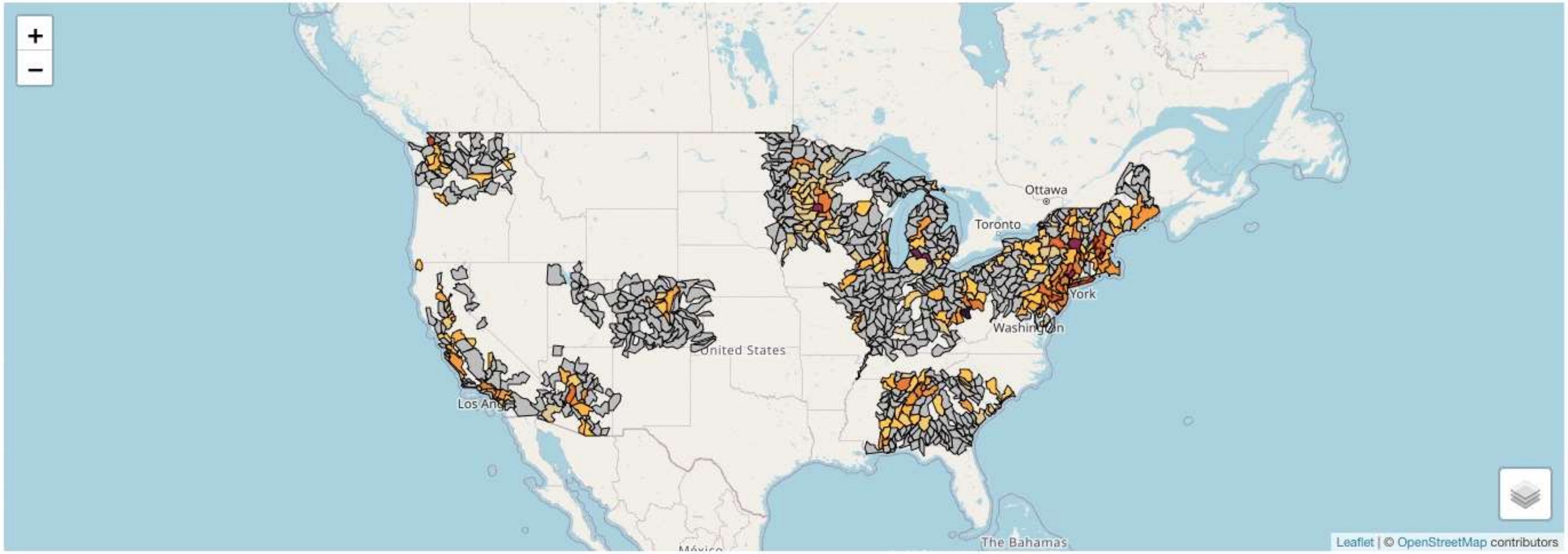
PFAS statewide sampling interactive map

Interactive PFAS map

The interactive map below shows PFAS drinking water data, county-level sociodemographic factors, and data on PFAS contamination sources obtained as part of a study cited below. These data were originally compiled as part of Liddie et al., 2023, which included data from 18 U.S. statewide monitoring campaigns.

The map below has since been updated and includes data compiled from 24 statewide monitoring campaigns of approximately 9,900 community water systems over 2016-2023.

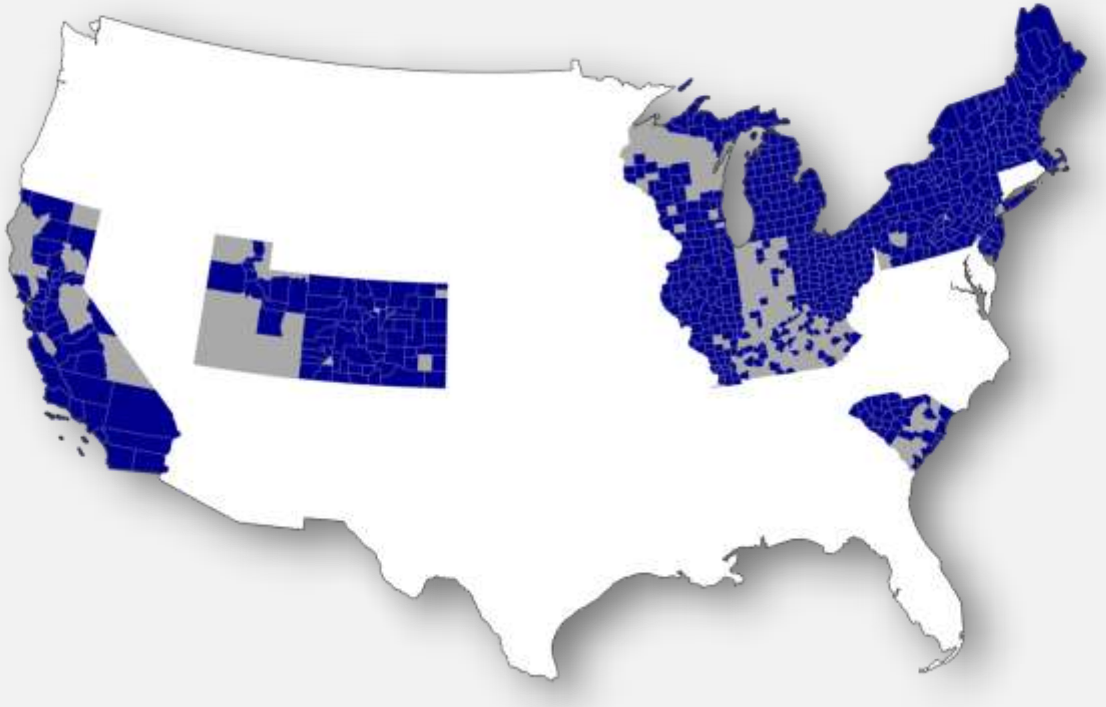
To change layers, click on the panel in the bottom right.



[Link here]

Synthesized PFAS statewide sampling data

Data presented here

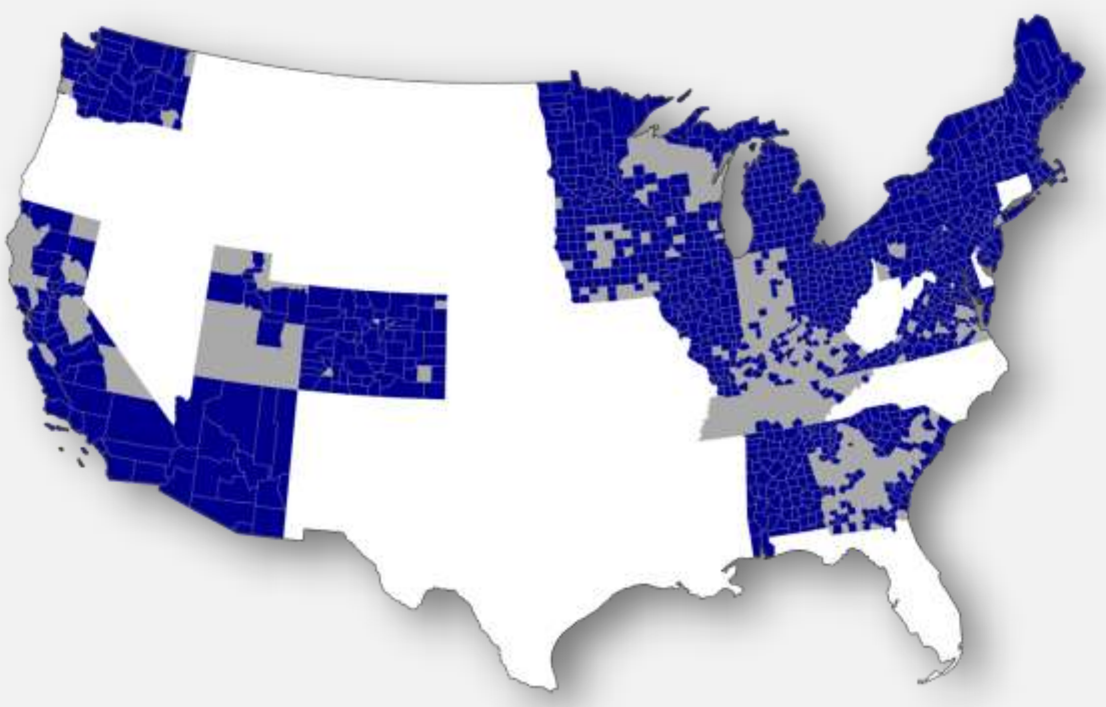


>7.8k community water systems serving 70 million people

Replication datasets available [here]

DOI: 10.7910/DVN/0C06MR

UPDATED version (2024): 27 states



>10k community water systems serving 94 million people

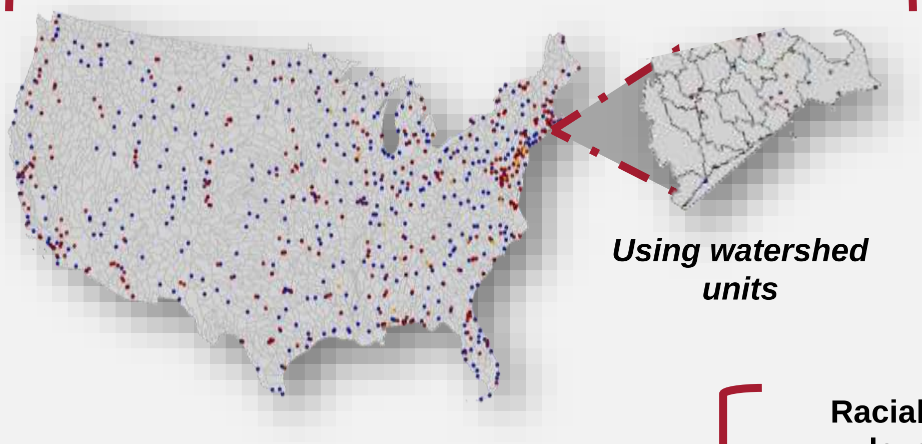
Representative dataset available [here]

DOI: 10.7910/DVN/8LPLCF

Feel free to contact me for additional requests

Analysis overview

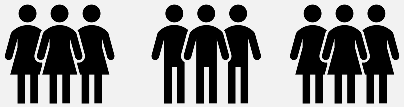
Question 1
PFAS contamination sources → PFAS drinking water concentrations?



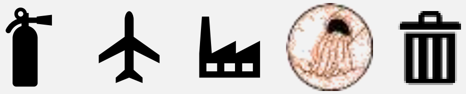
Using watershed units

Question 2
Sociodemographic factors → PFAS contamination sources?

Racial/ethnic composition and area-level socioeconomic measures

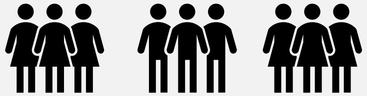


Locations of MFTA, airports, major facilities, landfills, and WWTP effluent

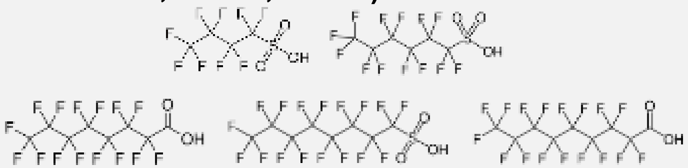


Question 3
Sociodemographic factors → PFAS contamination?
> 5 ng/L and > state regulations

Racial/ethnic composition and area-level socioeconomic measures



Detection of 5 PFAS (PFBS, PFHxS, PFOS, PFOA, PFNA) and ≥1 PFAS



Brief data summary

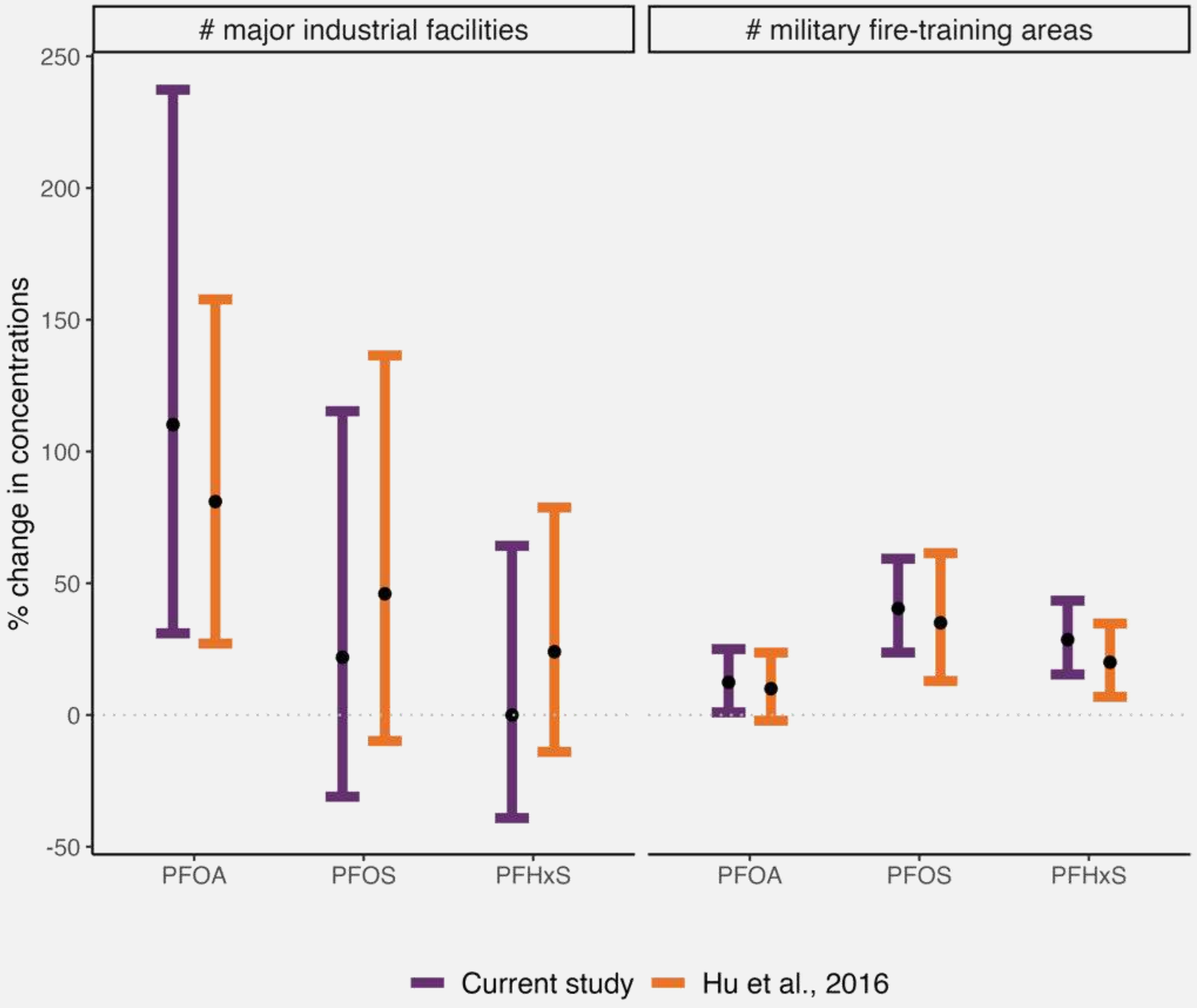
CWS analyzed in this study serve an est. 70 million US residents

Five PFAS (PFOA, PFOS, PFBS, PFHxS, PFNA) were measured and reported consistently in the 18 states

About 1 in 4 residents were served by CWS that detected at least one of five PFAS above 5 ng/L

Image generated by Midjourney

Several PFAS sources are predictors of drinking water concentrations

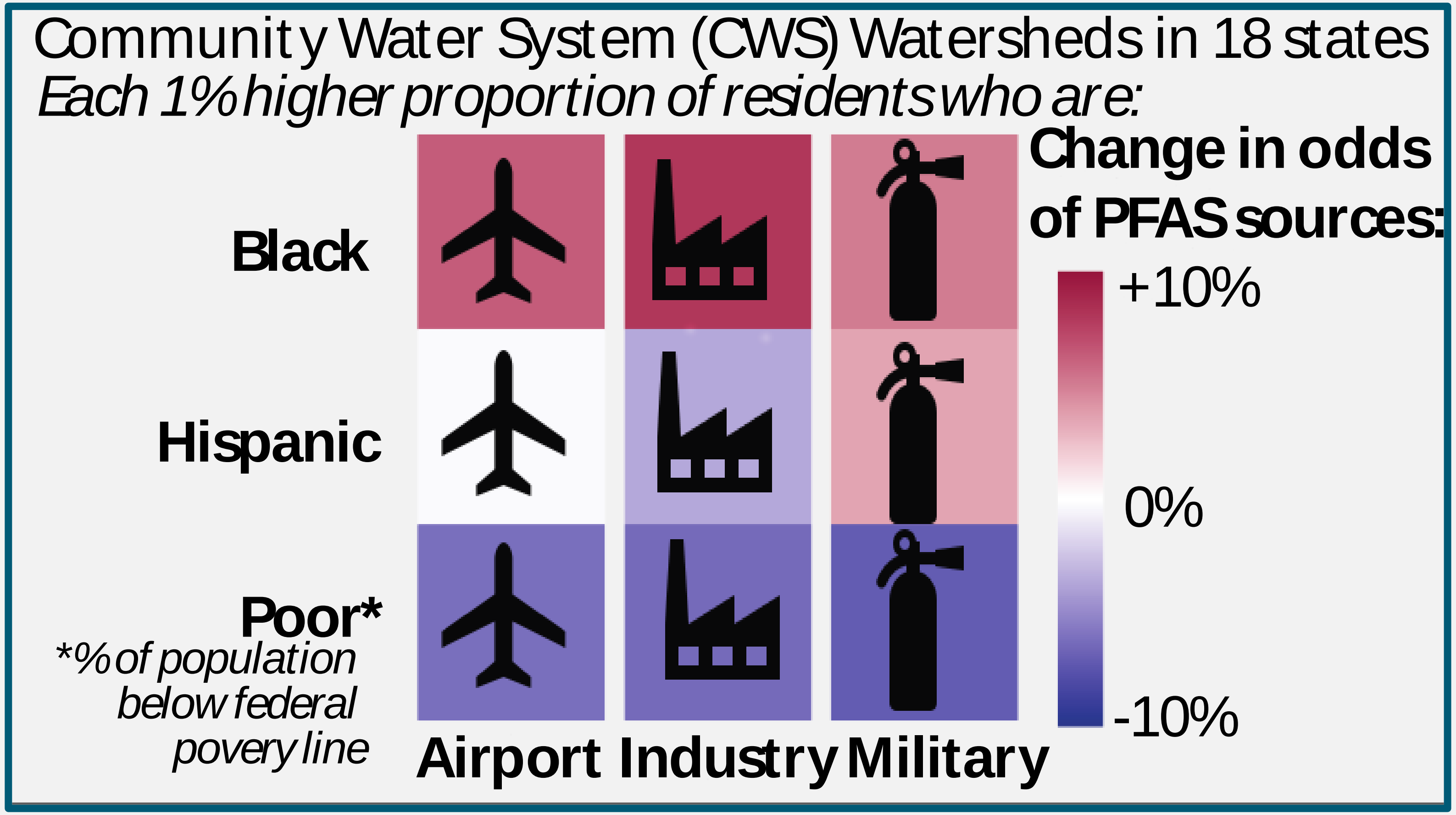


Major industrial facilities, military fire training areas, and airports associated with largest increases in PFAS concentrations

Additional predictors: wastewater treatment effluent, municipal waste landfills

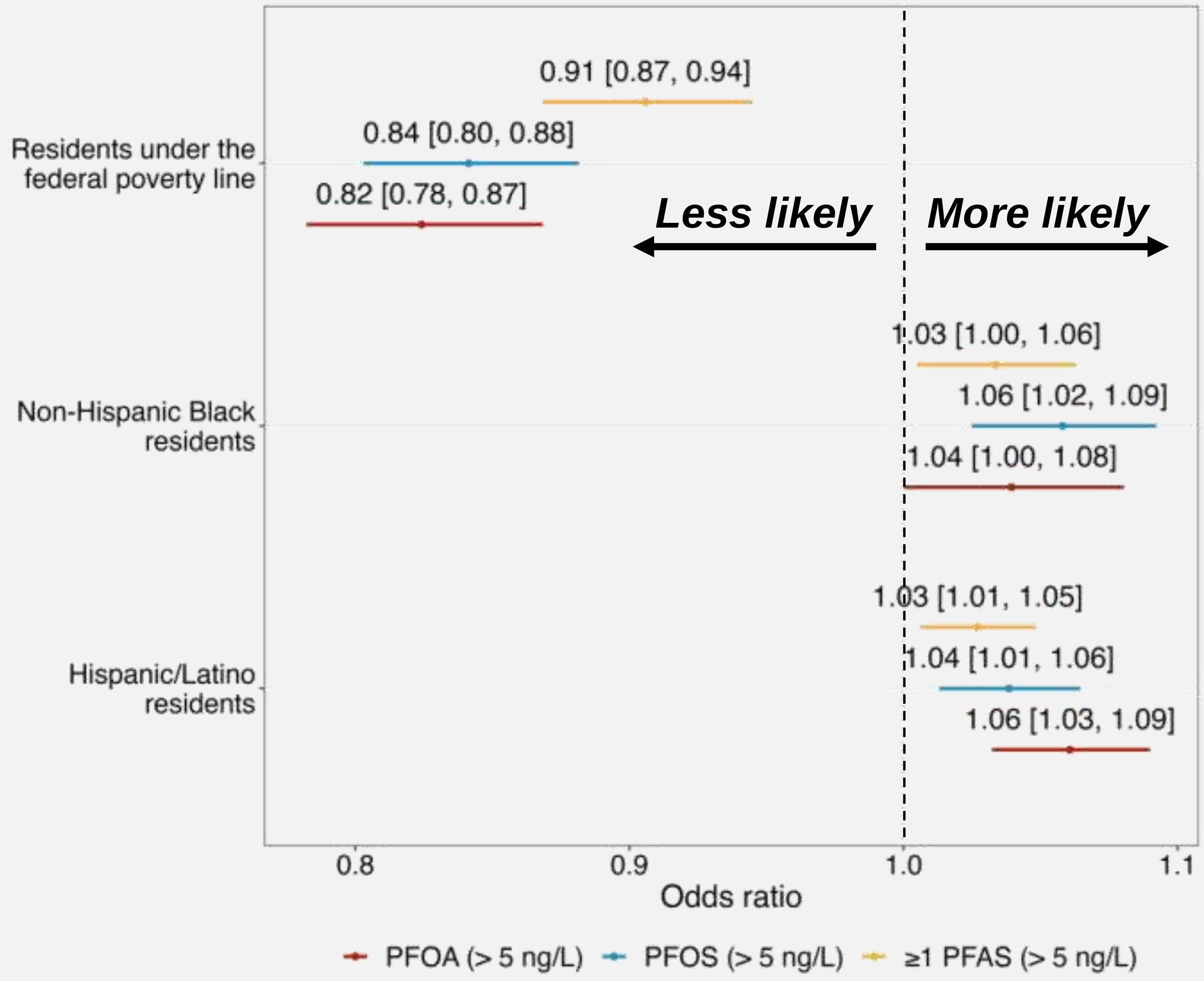
Liddie et al., 2023 and Hu et al., 2016

Community water systems sharing watersheds with PFAS sources served higher proportions of people of color



Liddie et al., 2023

Community water systems with detectable PFAS served greater proportions of people of color



Greater proportions of non-Hispanic Black and Hispanic/Latino residents → more likely to detect several PFAS

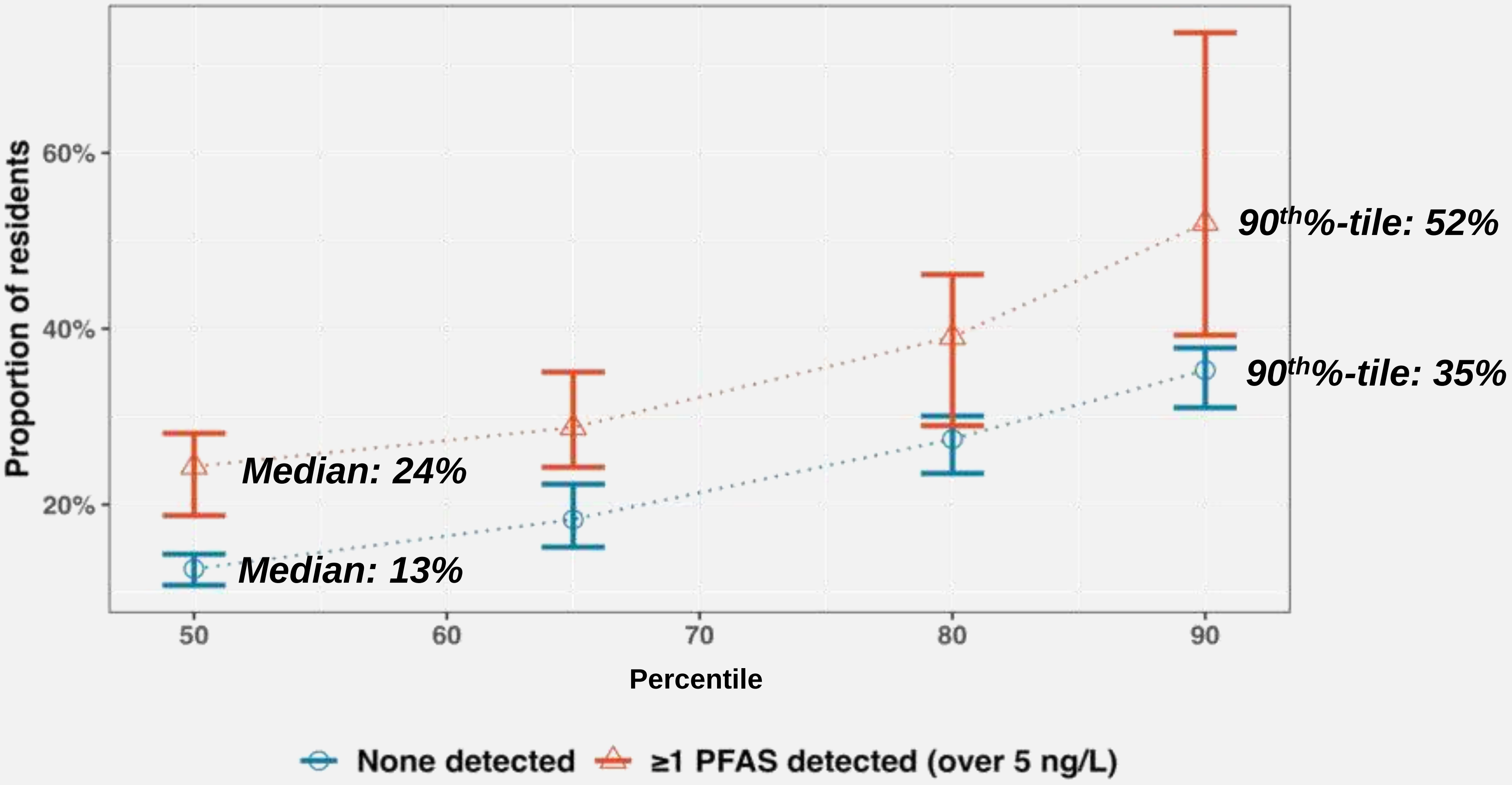
Higher proportions of residents under the poverty line → *less* likely to detect several PFAS

Note: levels analyzed here are above US EPA regulations

Liddie et al., 2023

Across the distribution, systems with detectable PFAS served greater proportions of people of color

Percentiles of % people of color served by CWS with and without PFAS contamination



Analysis of data from Liddie et al., 2023

Rural and urban areas may differ in potential socioeconomic disparities

Among all water systems…
Residents under the poverty line was negatively associated with contamination

Among urban water systems…
Residents under the poverty line was negatively associated with contamination

Among rural water systems…
Residents under the poverty line was positively associated with contamination

Key conclusions of this work

Statewide monitoring data show sociodemographic disparities in PFAS exposures through drinking water

These appear to occur, in part, to siting-based disparities in sources analyzed here

Several PFAS sources are predictors of PFAS concentrations in community water systems

Liddie, J. M., Schaider, L. A., & Sunderland, E. M. (2023). Sociodemographic Factors Are Associated with the Abundance of PFAS Sources and Detection in U.S. Community Water Systems. Environmental Science & Technology. [*https://doi.org/10.1021/acs.est.2c07255*](https://doi.org/10.1021/acs.est.2c07255)

Key data gaps moving forward

1. There are gaps in drinking water monitoring nationally

Systems analyzed here are similar to systems nationwide, but generalizability is limited to 18 states

These gaps are a concern for public health monitoring more broadly, but data are quickly becoming available

2. There is limited granularity to characterize sociodemographic composition

Our analysis uses county/counties served by community water systems to ascertain their sociodemographic composition

However, these systems often serve populations at more granular scales

3. Numerous other exposure routes exist for PFAS

Exposures via drinking water are only one of many possible routes of exposure to PFAS

Research attention also needed for other key routes of exposure with an environmental justice lens

Federal PFAS drinking water regulations are a historic development

Marginalized communities may face additional barriers to reduce drinking water exposures

Broadly, environmental justice concerns should be a component of efforts to mitigate risk

Image generated by Midjourney