PFAS Background Concentrations in CT

ENVE 3

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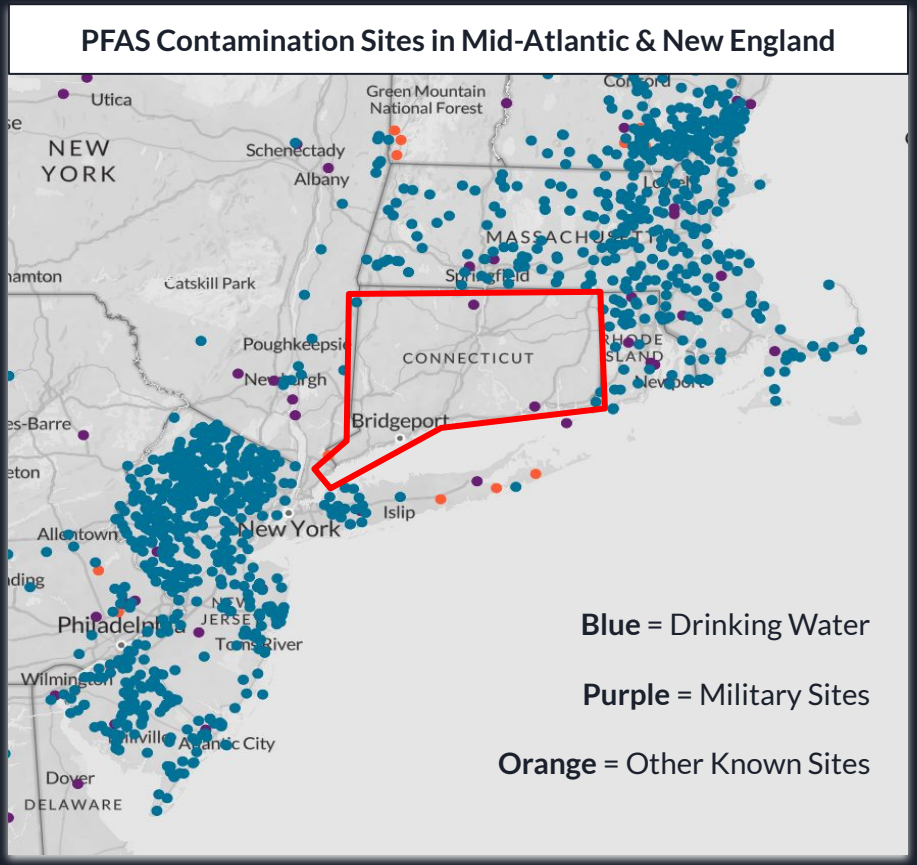
Sponsor

CT DEEP

What are PFAS and why do we care?

- **Per- & polyfluoroalkyl substances (PFAS)**- family of emerging contaminants; widespread, persistent, rapidly deployable in groundwater
- Need background concentrations to compare to actual contamination events
- Advances establishment of PFAS regulations → eventual clean up of PFAS sites across CT

Need for Sampling



From Environmental Working Group (https://www.ewg.org/interactive-maps/pfas_contamination/map/).

Project Overview

- **Goal: Identify background concentrations of PFAS in CT soils**
- Procedure:
  - Study GIS data
  - Identify Sample Locations
  - Obtain sampling approval for selected locations
  - Collect samples
  - Obtain lab results
  - Analyze results
- Findings are summarized in a final report

Scope of Services

Milestone 1 - Analysis of GIS Database

Evaluated sites for possible PFAS contamination by identifying layers in GIS that indicated potential sources

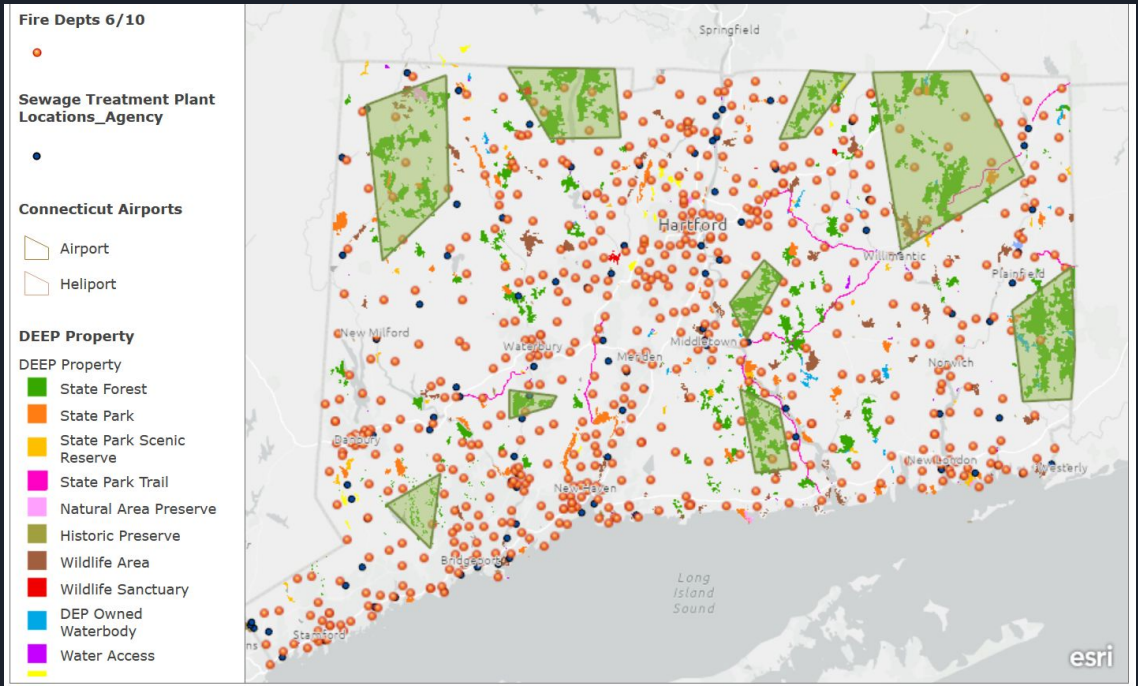
What determines sampling locations?

Relevant layers indicating potential PFAS sources:

→ Fire service locations

→ Airports

→ Sewage treatment plants



Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS | Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS | CT DEEP, USGS | USGS, CT DEEP | USDA NRCS | USDA - NRCS | USDA-NRCS,USGS, US EPA | USFW | UCONN CLEAR, CT DEEP | https://portal.ct.gov/dph http://magic.lib.uconn.edu/connecticut_data.html | CT DEEP

Scope of Services

Milestone 2 - Development of Sampling Plan

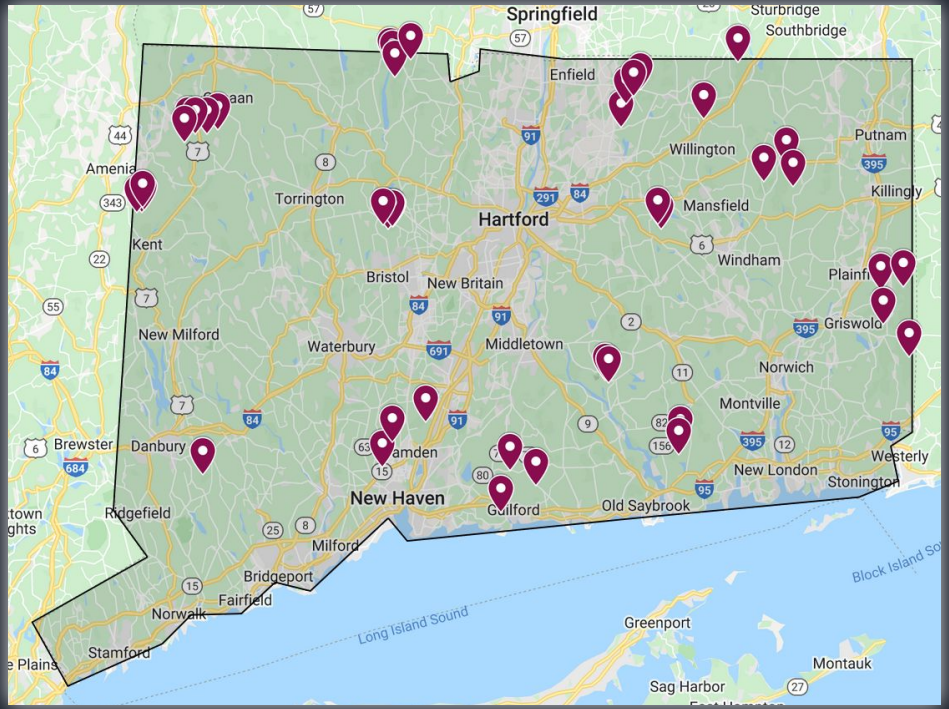
Applied identified locations from GIS database to a sampling plan following the state of Vermont's PFAS Soil Study

Identify Locations from GIS Database

- Using the identified areas, determined **exact coordinates** for sampling locations
- Considerations:
  - Easily accessible from the road or trail
  - In a sunny area (shaded areas will be harder to dig)
  - Land access approval

Property	Relative Description of Sampling Location(s)	Coordinates of Sampling Location(s)
Nipmuck State Forest	Northernmost parcel in Union, northwest corner of forest's boundaries, west of Paine Hill Rd	42.02332, -72.18688
	Southernmost parcel in Willington, between Polster Rd and the Roaring Brook	41.93101, -72.25954

Preliminary Sampling Locations



16 properties

State forests & parks

110 soil samples

0-6” depth sample at each pinned location

18-24” depth sample at each property

Alternative Plan

- Challenges with original plan:
  - Time constraints
  - Extensive traveling
- Focus on one section of the state (2 counties)
  - Increase number of soil samples for a strong representation of a smaller area

Final Decision: take fewer soil samples across entire state to compare all counties

Sampling Materials

- Containers supplied by CET labs
- Large bore soil sampler with acetate liner
- PFAS free water (Poland Springs)
- Clothing/materials to avoid on site:
  - Raincoats or other waterproof or water-resistant fabrics
  - Rite in the Rain notebooks

Scope of Services

Milestone 3 - Execution of Sampling & Results

Gathered samples using decontaminated equipment and sent to lab for analysis, aiding in the establishment of background concentrations




Lab Work - CET Labs

- Samples delivered to the lab with a chain of custody
- **EPA method 8327** was performed on the samples
  - Samples prepared using solvent dilution or extraction
  - Analyzed by liquid chromatography / tandem mass spectrometry using external standard calibration
- Results given for **18 PFAS compounds** in concentrations of ug/kg
- Field and equipment blanks analyzed to ensure no contamination of the materials used or the environment

Cost Estimate

Sample Collection - Existing equipment provided by CT DEEP ($15,000)

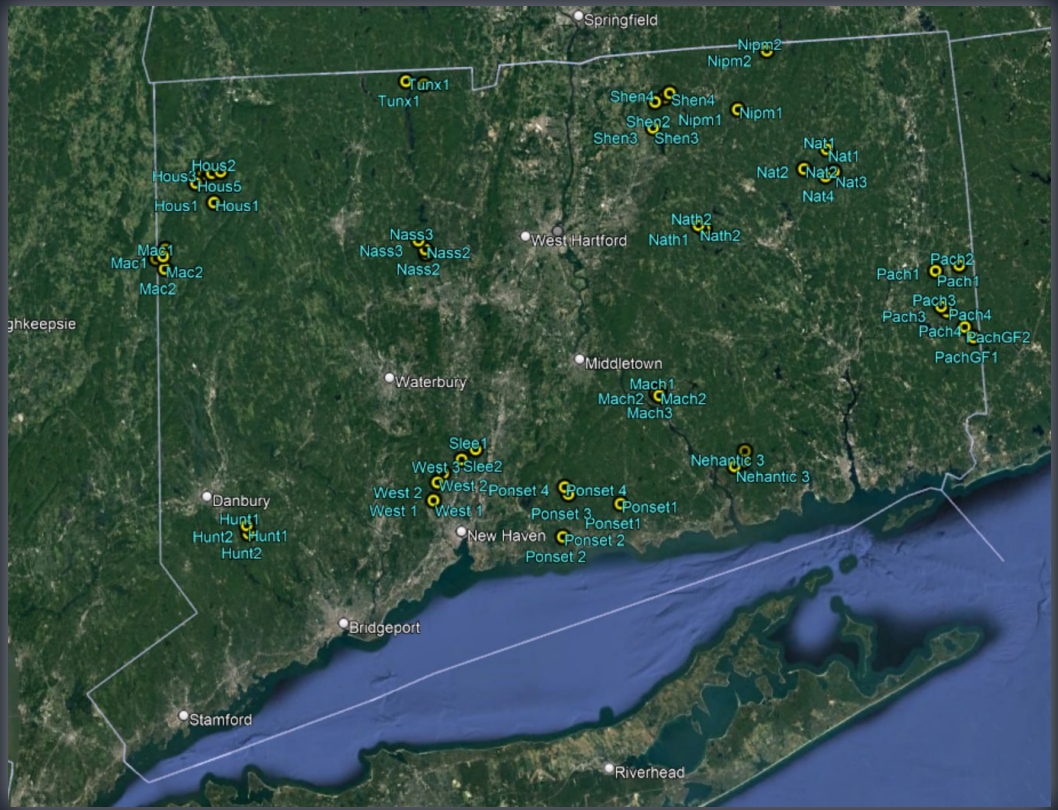
Sample delivery - Gas money will have to be sourced independently ($2,000)

Sample Testing - Jeff running samples for free ($26,400)

Total Cost - $43,400

Note: this project has no actual funding aside from participants donating personal time and money

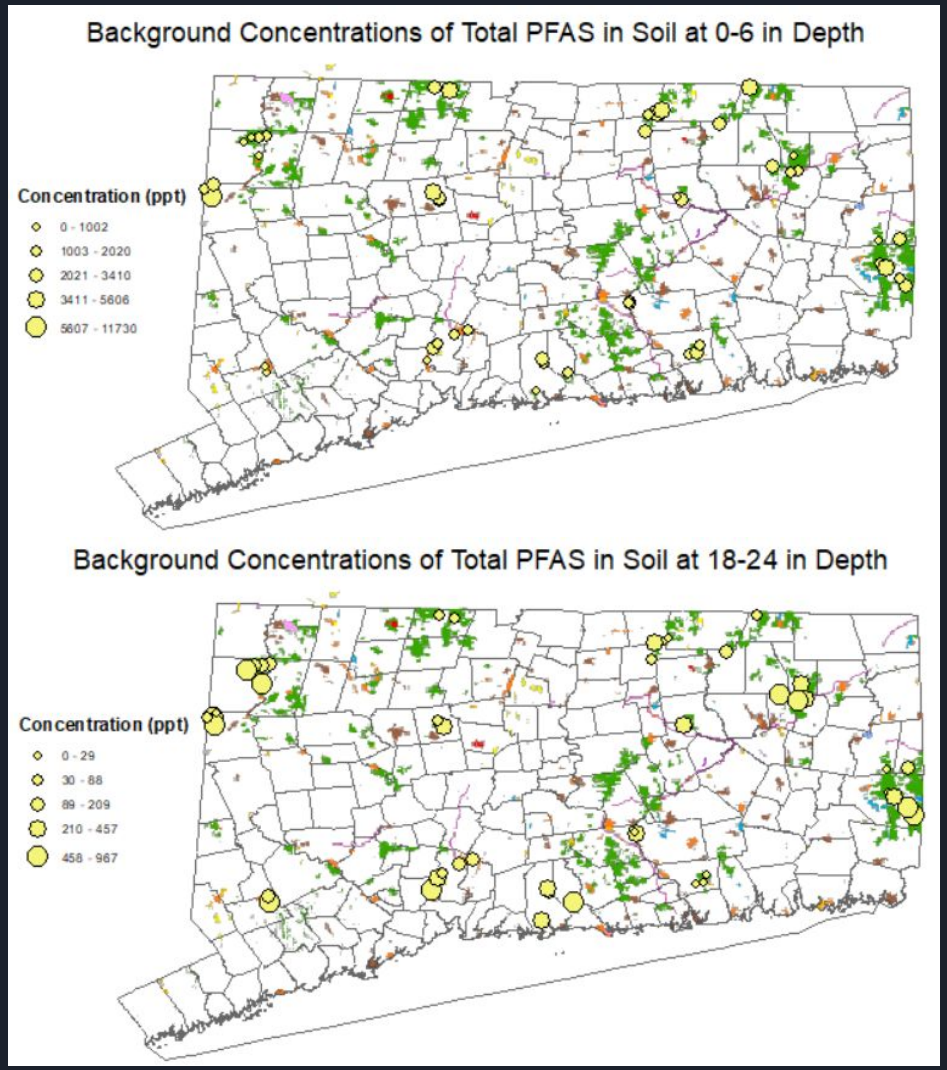
Final Sampling Locations



- GPS coordinates of all final locations
- Attempted to follow preliminary locations as close as possible
- Inaccessibility issues resulted in slightly adjusted locations

Results

- Concentration Scale
  - Concentrations at 0-6 in: 0-11,730 ppt
  - Concentrations at 18-24 in: 0-967 ppt
- High concentrations are due to HFPO-DA contamination
- Widespread distribution in shallow soils
- More consistent concentrations in deeper soil
  - Lower concentrations than shallow soil



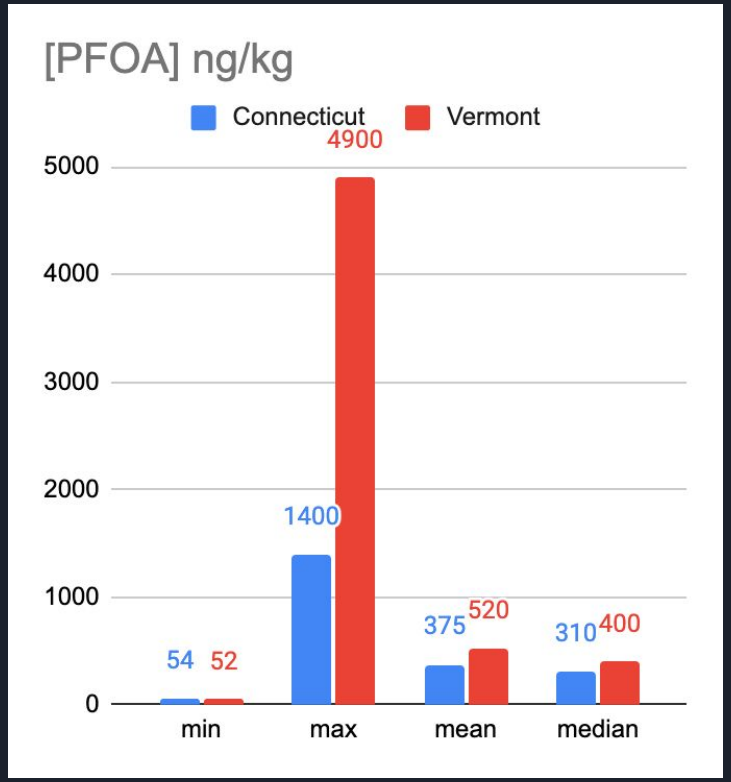
Analysis

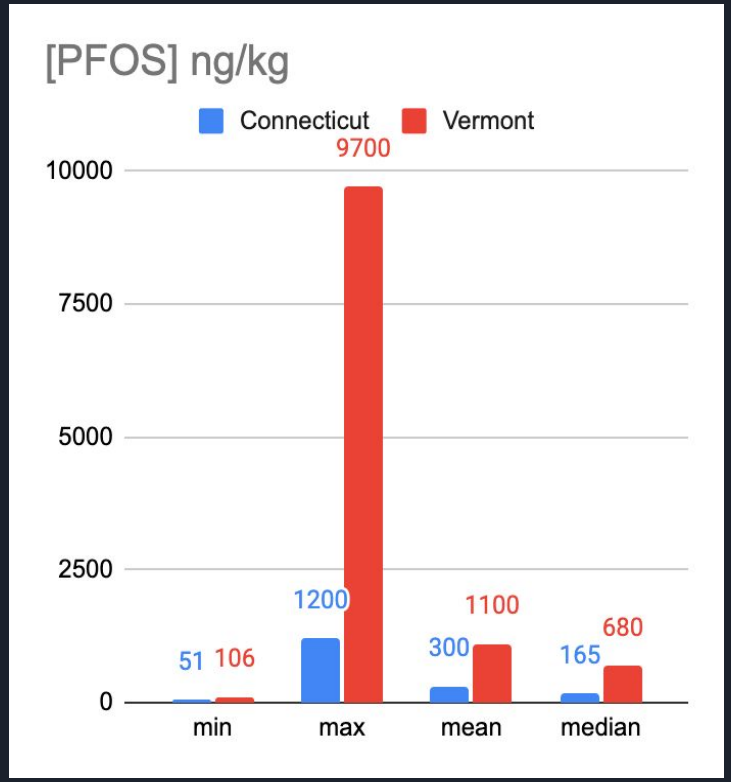
Number of Carbons	4	5	6	7	8	9	10	11	12
PFCAs	Short-chain PFCAs				Long-chain PFCAs				
	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnA	PFDoA
PFSAs	PFBS	PFPeS	PFHxS	PFHpS	PFOS	PFNS	PFDS	PFUnS	PFDoS
	Short-chain PFSAs		Long-chain PFSAs						

Mueller, R., & Yingling, V. (2020, April). *History and use of per- and polyfluoroalkyl substances (PFAS)*. Interstate Technology Regulatory Council.

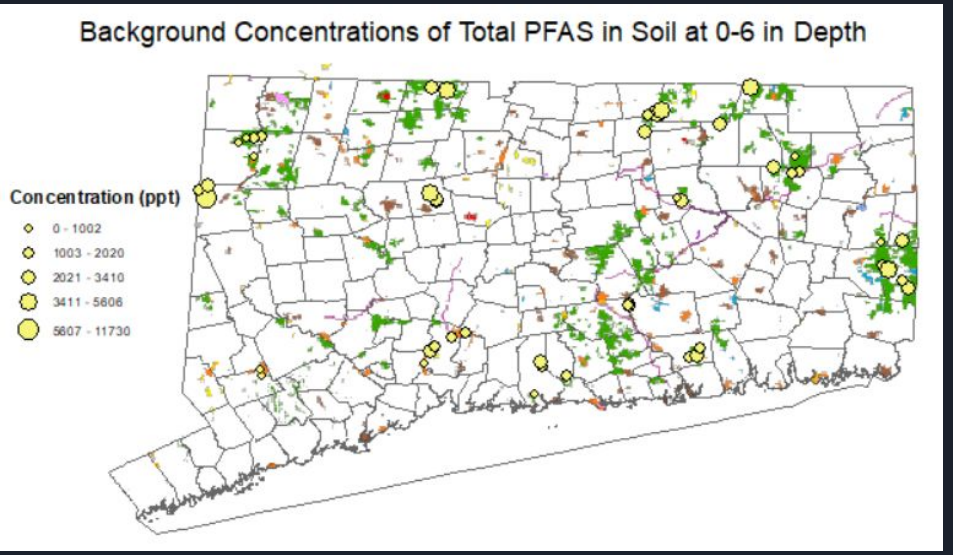
- **Short chain PFAS** compounds have a higher sorption potential than long chains
  - Should have higher concentrations than longer chain compounds in deeper soils
  - Newer to the industry
- PFOA and PFOS more prevalent in the environment but are more soluble in water
  - Been manufactured unregulated since the 1950s
  - Concentrations decrease with depth
- Higher concentrations of total PFAS in shallower soils → atmospheric deposition

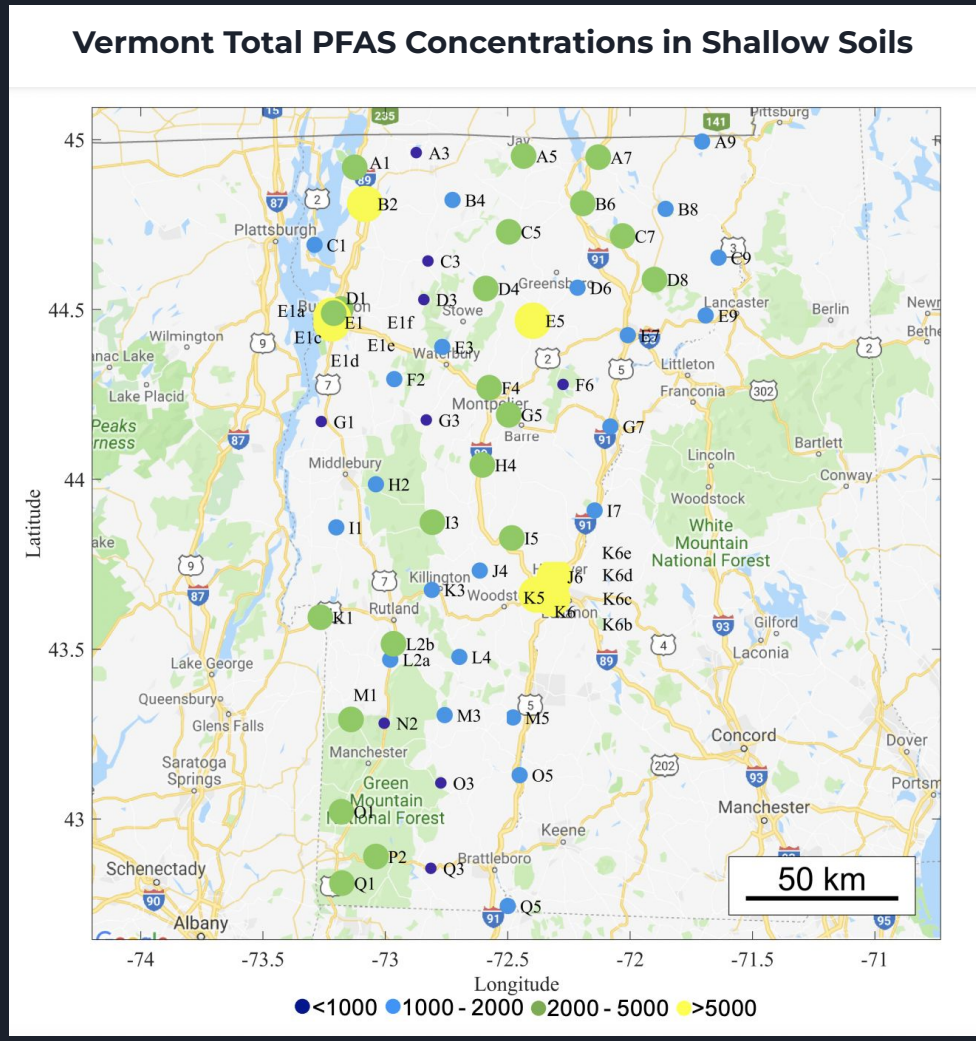
Connecticut Vs. Vermont Results





Connecticut Vs. Vermont Results





What is Next?

- Further studies by CT DEEP:
  - Effects of air currents on PFAS distribution
  - Groundwater sampling and analysis
  - Sampling on privately owned land
  - Sampling near known point sources
- PFAS regulation
- PFAS remediation

Questions?