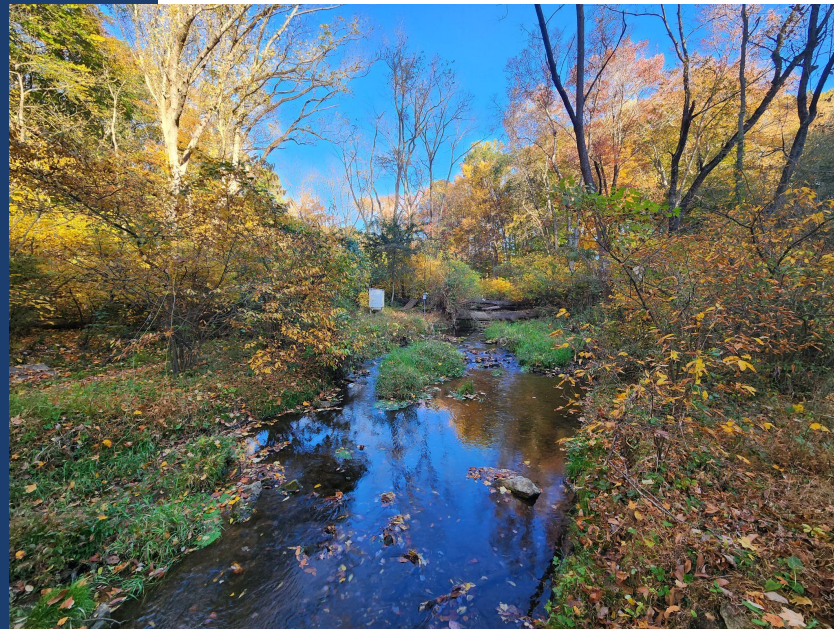


Overview of Stroud Water Research Center and Current Research on PFAS

**Citizenship Advisory Council Meeting
PA Department of Environmental Protection**

Diana Oviedo Vargas, PhD | 08/07/2025



White Clay Creek, PA



Assistant Research Scientist

**My research focuses on
understanding transport and
transformation of chemical
substances at the watershed scale**



McCorkles Run, Chester Co.

1. Stroud Water Research Center
2. Current research on PFAS
3. Questions and Discussion



**We advance
knowledge and
stewardship of
freshwater systems
through global
research, education,
and watershed
restoration.**



Guided by Science

The Stroud Center's independence, nonprofit status, and non-advocacy position ensure work is guided by science, not interests or agendas.

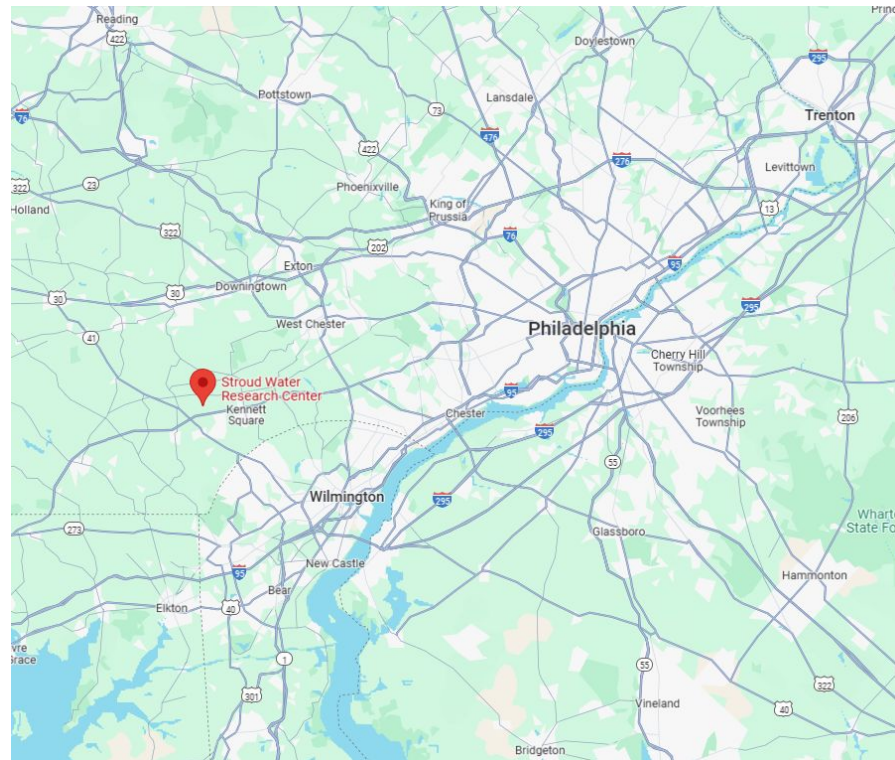
This fosters trust, credibility, and collaboration, empowering diverse partners and decision-makers with unbiased insights and allowing for nimble, mission-driven action focused on advancing knowledge and stewardship of fresh water.



Photo: Brian Preston Photography

Stroud Water Research Center

- Independent 501(c)(3) nonprofit organization
- Located in Avondale, Pennsylvania



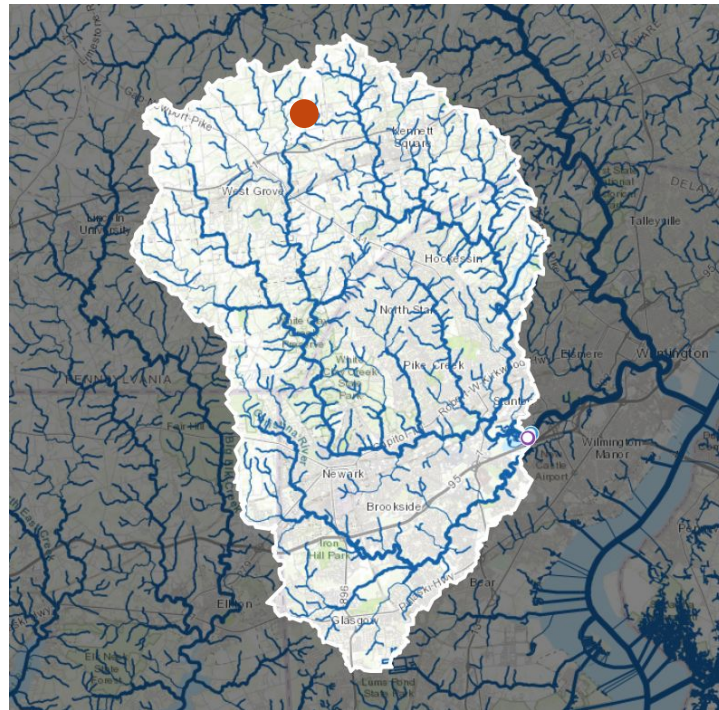
Stroud Water Research Center

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- Founded in 1967 as a field station of the Natural Academy of Sciences of Philadelphia



Stroud Water Research Center

- Independent 501(c)(3) nonprofit organization
- Located in Avondale, Pennsylvania
- Founded in 1967 as a field station of the Natural Academy of Sciences of Philadelphia
- On the banks of the East Branch of White Clay Creek



White Clay Creek Watershed, tributary of the Delaware

What We Do

Freshwater Research



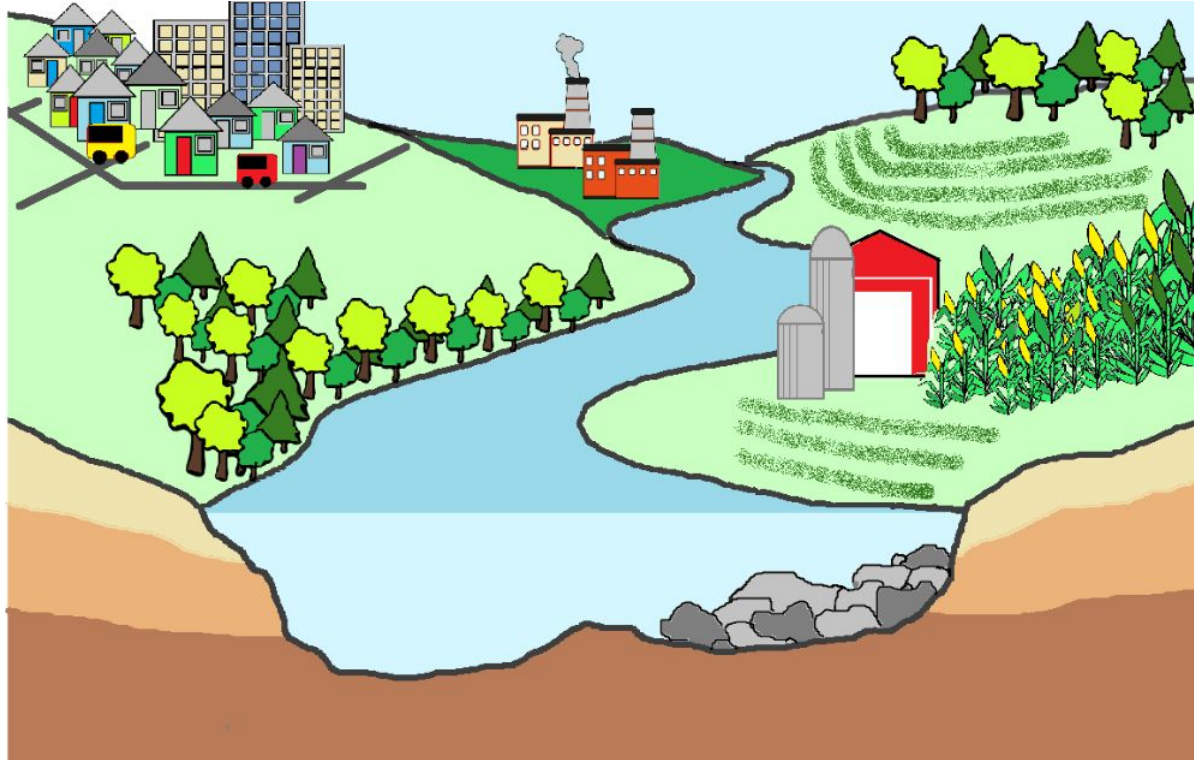
Environmental Education



Watershed Restoration



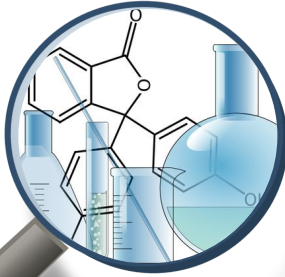
Watershed-scale approach



Watershed-scale approach



Research Groups



Biogeochemistry



Fluvial Geomorphology



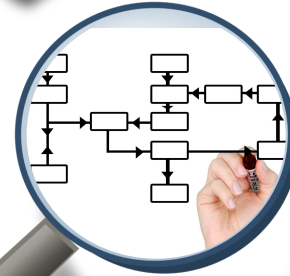
Entomology



Fish Ecology



Microbiology



Ecosystem ecology

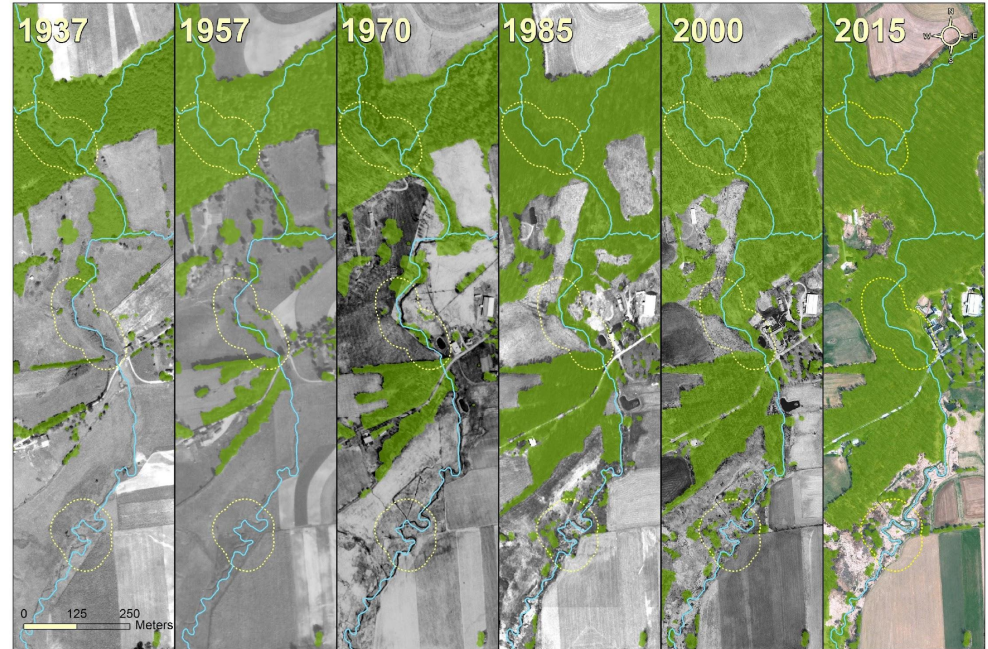
Facilities and Infrastructure

- White Clay Creek is our natural laboratory
 - National Science Foundation designations:
 - 1981: Experimental Ecological Reserve
 - 1998: Long-term research in environmental biology site
- River research at many spatial and temporal scales



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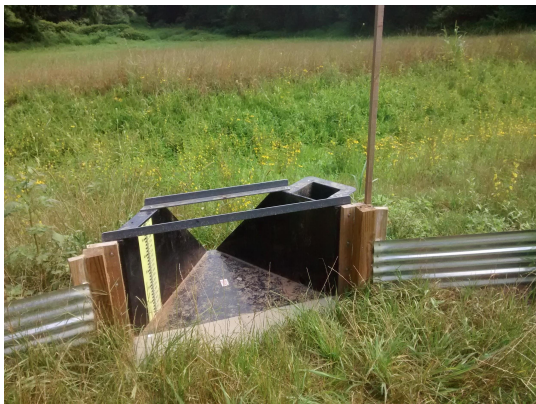
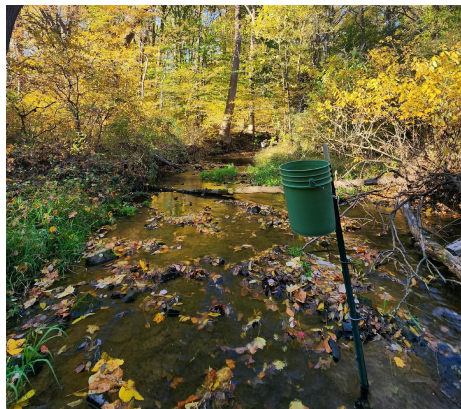


1980

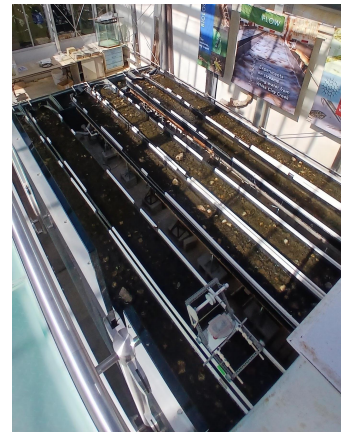


2015

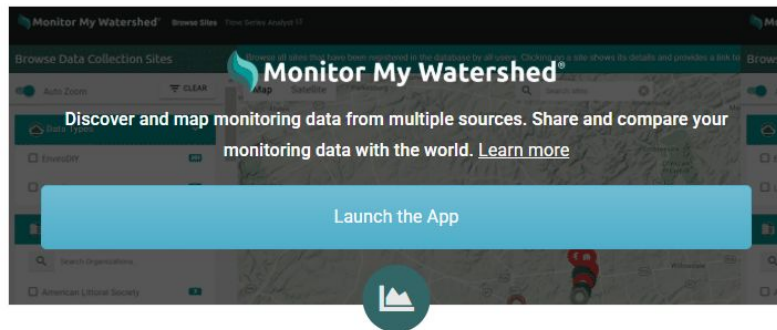
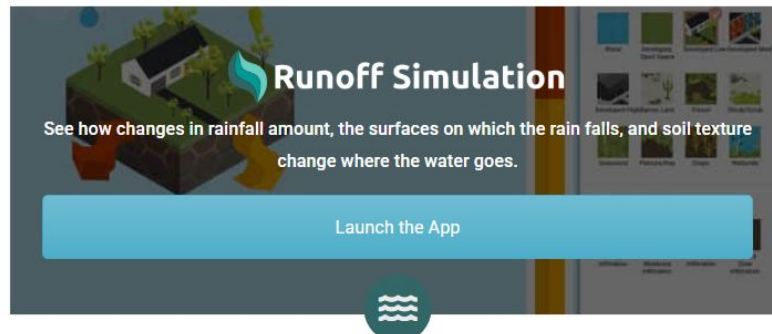
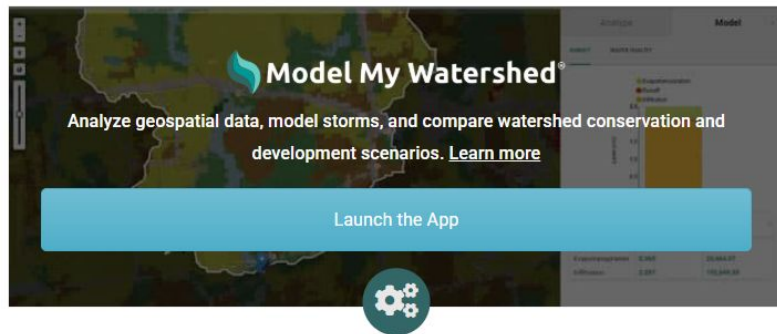
Facilities and Infrastructure



Facilities and Infrastructure

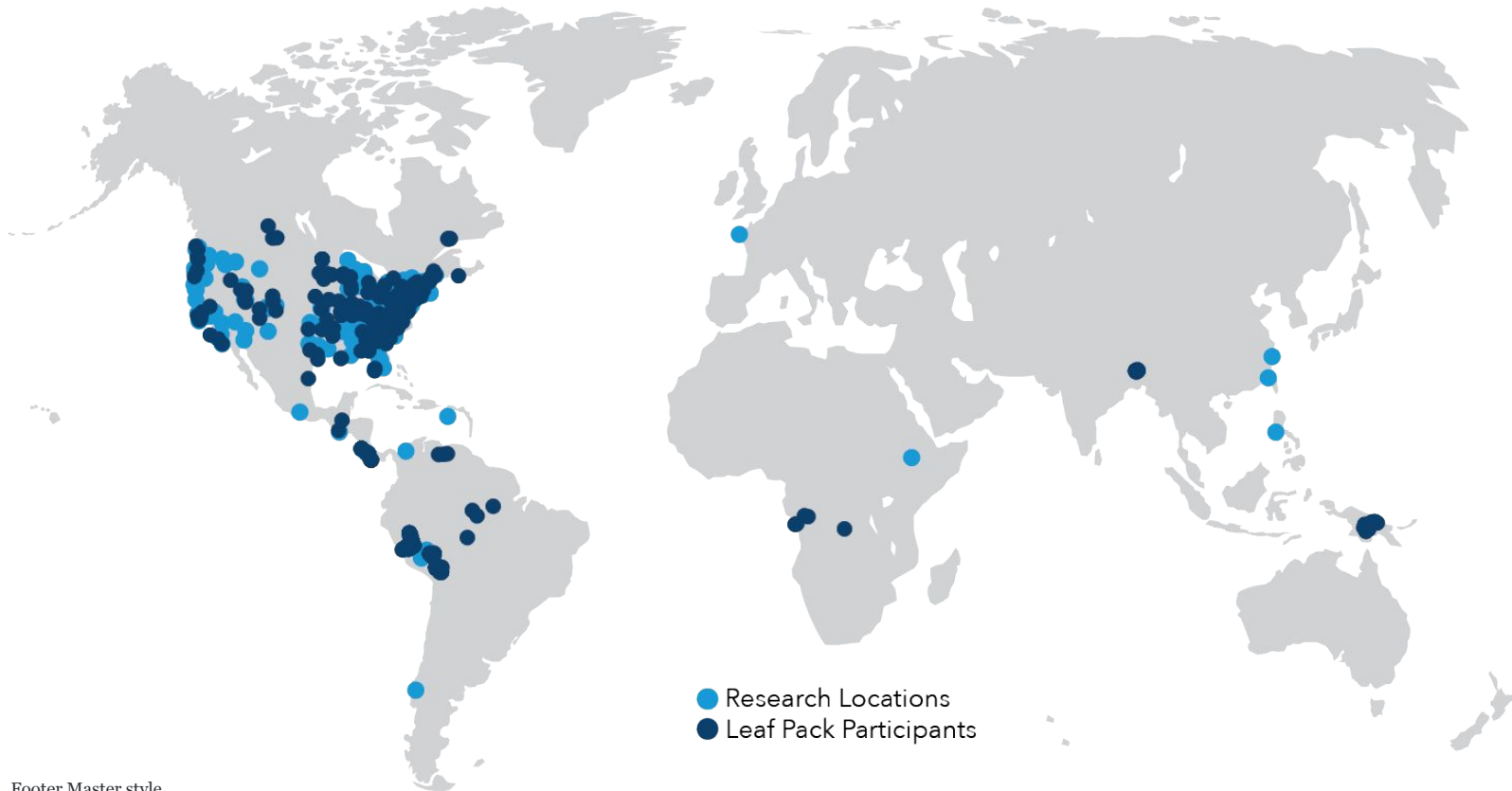


Cyber infrastructure and tools



WikiWatershed
<https://wikiwatershed.org/>

Research at local and global scales





McCorkles Run, Chester Co.

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What are PFAS?

Per and polyfluoroalkyl substances

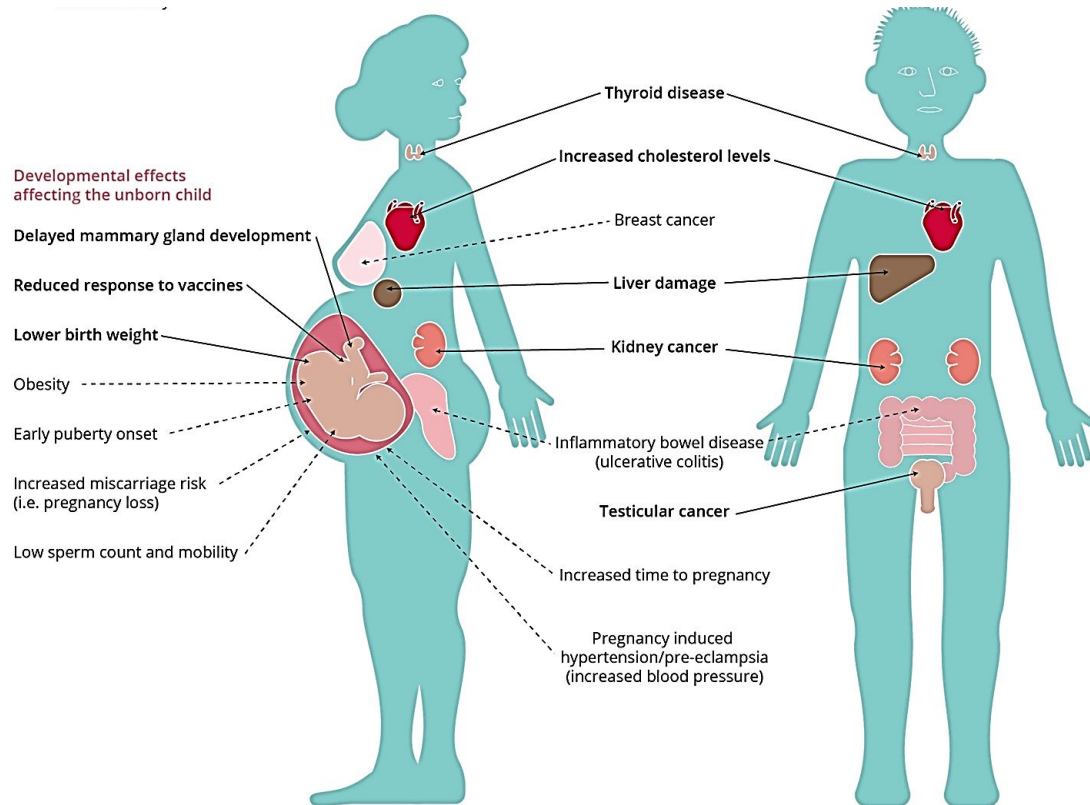
- Class of >12,000 anthropogenic chemicals.
- Intentional and unintentional products of fluoropolymer synthesis.
 - Global production >230,000 tons/year
 - (Global pesticide production ~2.5M tons/year)
- Used in hundreds of applications.
 - Surfactant properties
 - High chemical and thermal stability



Source: Gulge et al. *Environ. Sci.: Processes Impacts*, 2020, 22, 2345–2373

PFAS toxicity

to wildlife and humans

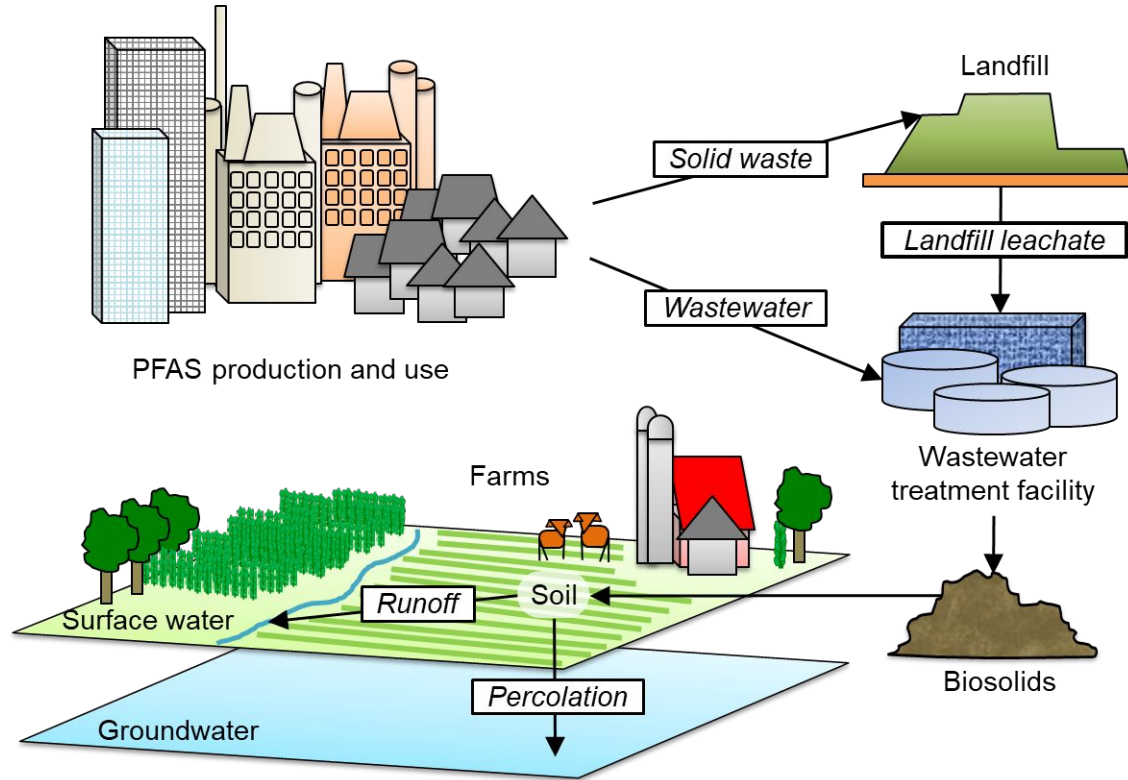


- Reproductive
- Endocrine
- Carcinogenic
- Neurotoxic
- Dyslipidemic
- Immunotoxic
- Bioaccumulate and biomagnify in wildlife

Source: Fenton et al., *Environ Toxicol Chem*, 2021, 40: 606-630.

PFAS movement

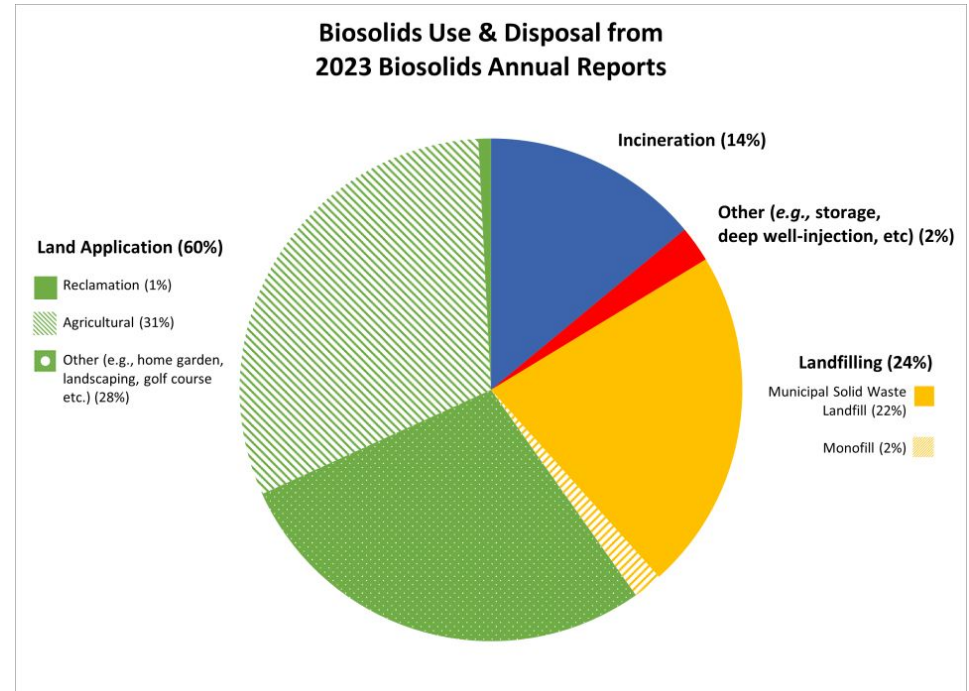
from points of production and use to farms soil and water



Biosolids use in the US

and their potential as a source of PFAS

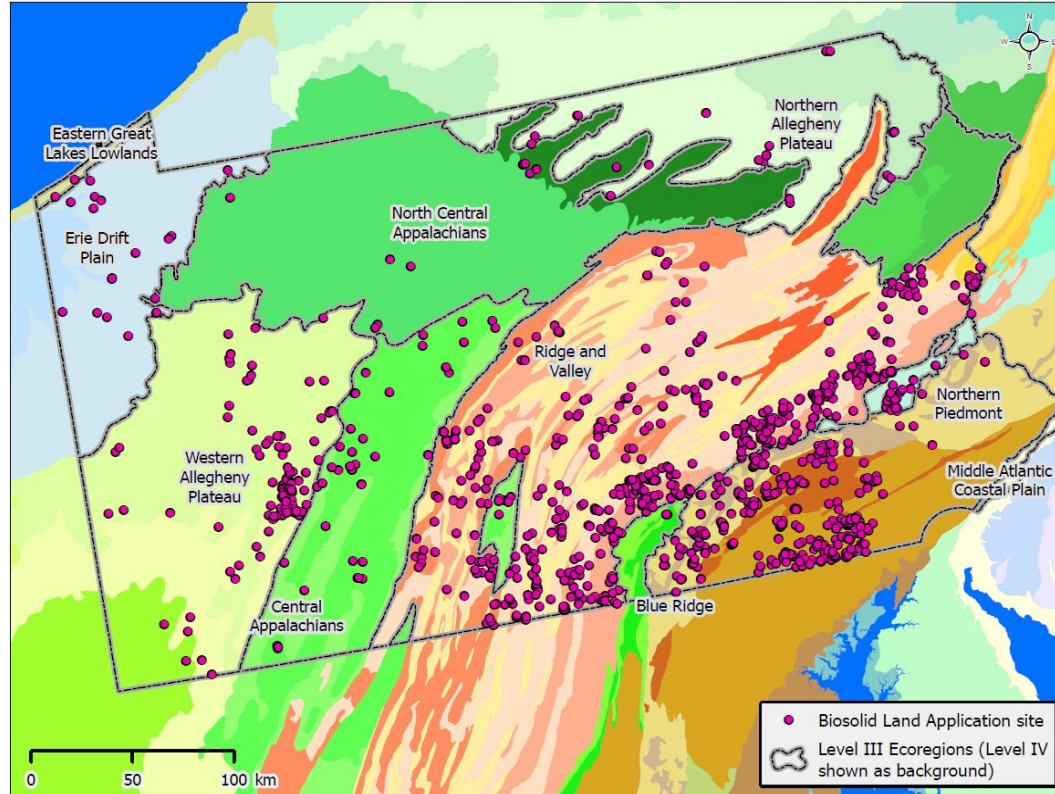
- Based on US EPA annual biosolids reports from roughly 2,250 larger facilities in 41 states. In 2023:
- Biosolids produced: ~4 million dry metric tons (dmt).
- Applied to agricultural land: 1.24 million dmt (~30%)



Source: <https://www.epa.gov/biosolids/basic-information-about-sewage-sludge-and-biosolids>

Biosolids use in Pennsylvania

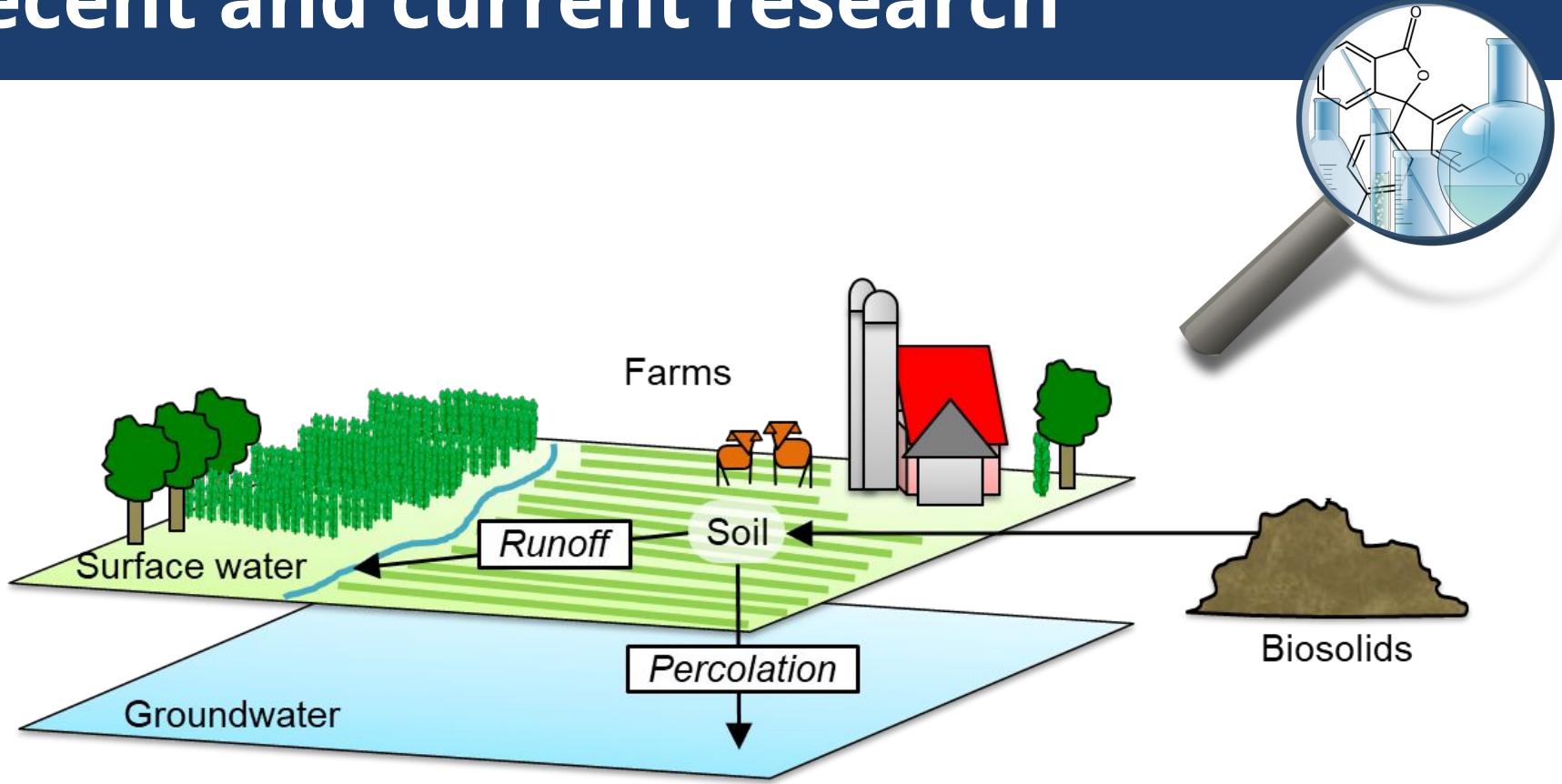
and their potential as a source of PFAS



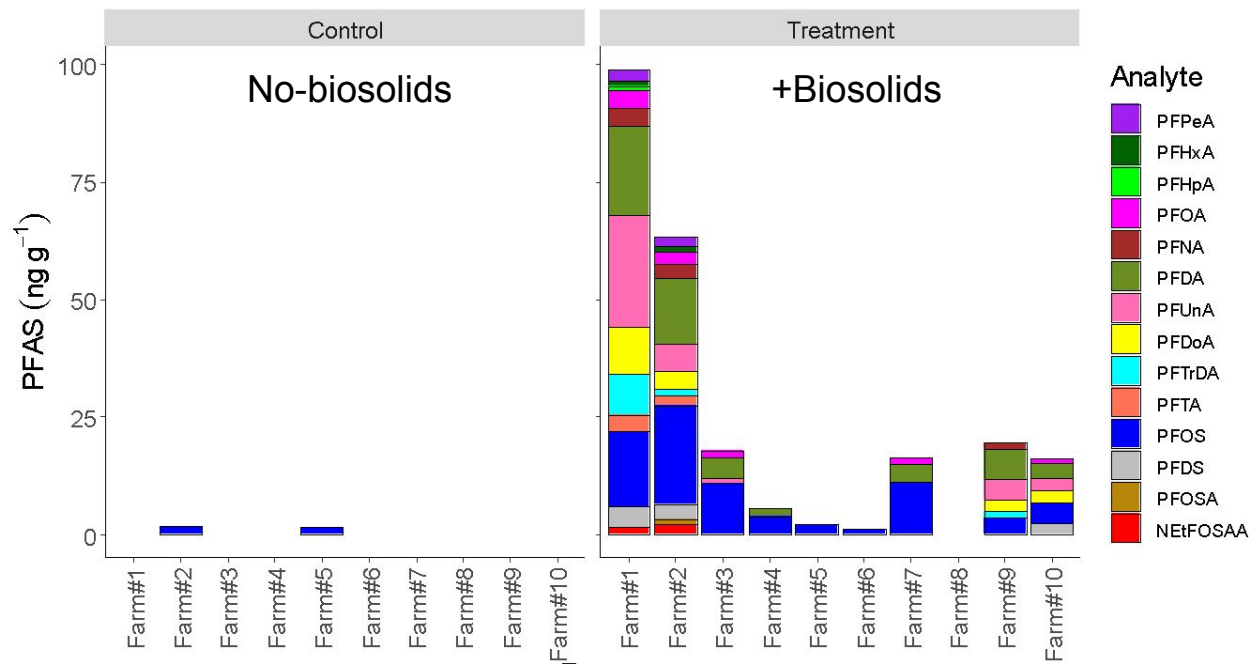
Source: PA Department of Environmental Protection

- Agricultural parcels in PA permitted to receive biosolids applications (includes active and inactive sites).

Recent and current research

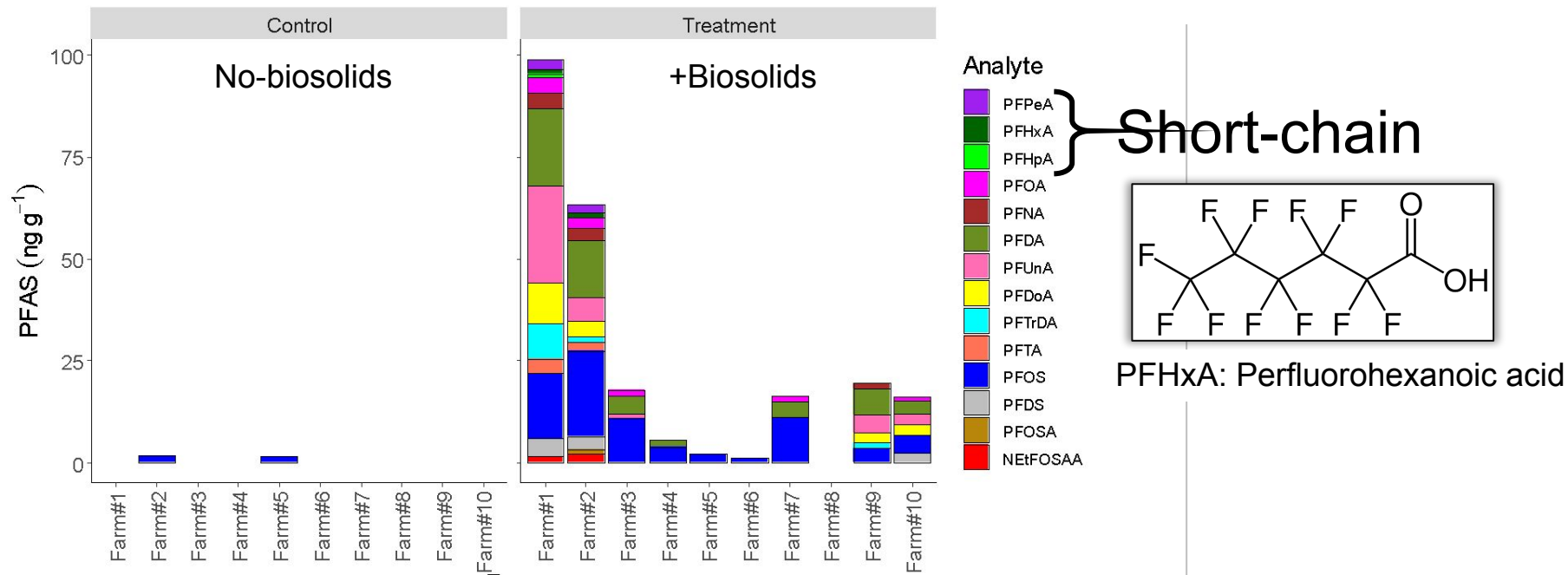


PFAS in biosolids-amended soils in PA farms

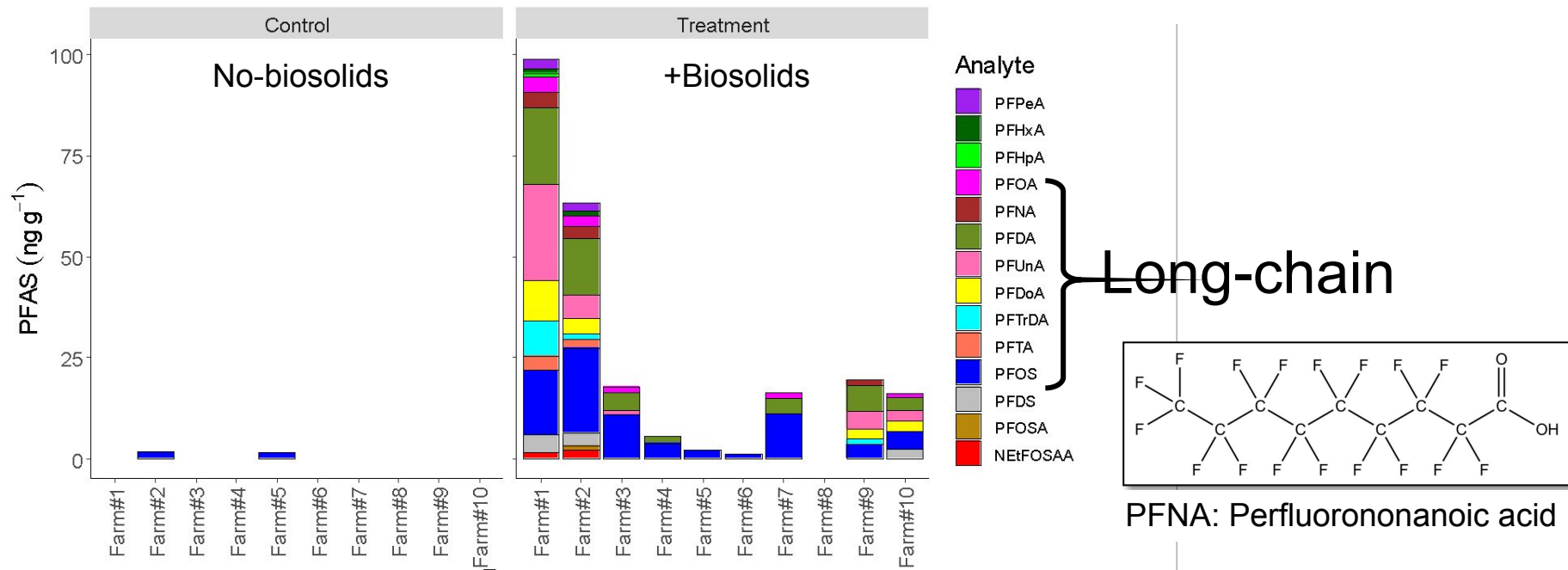


- Most soils treated with biosolids had measurable concentrations of at least one PFAS compound.

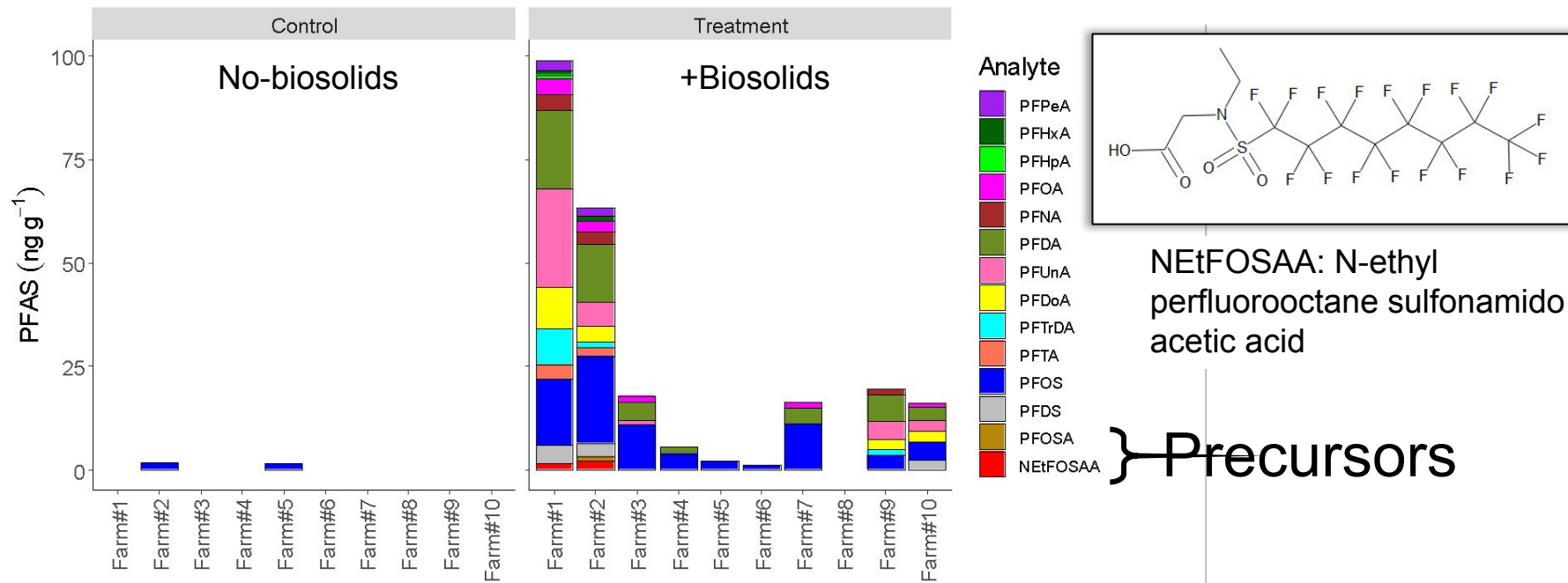
PFAS in biosolids-amended soils in PA farms



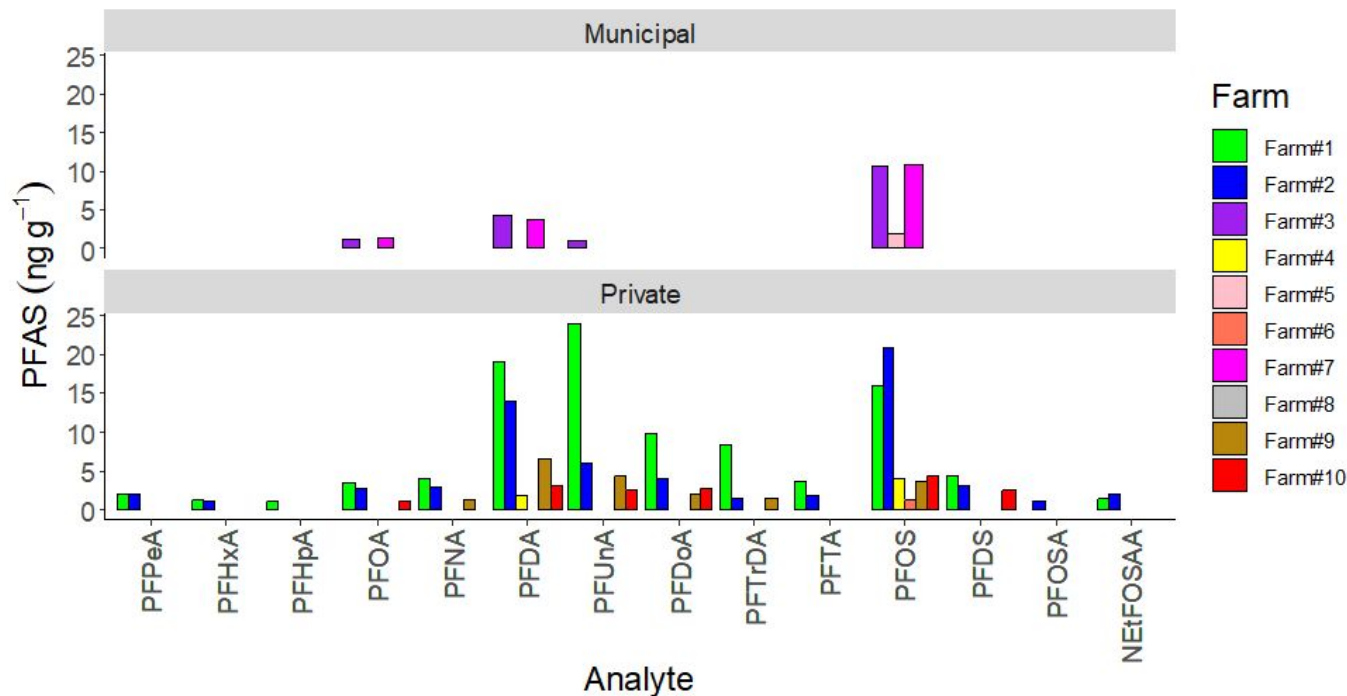
PFAS in biosolids-amended soils in PA farms



PFAS in biosolids-amended soils in PA farms



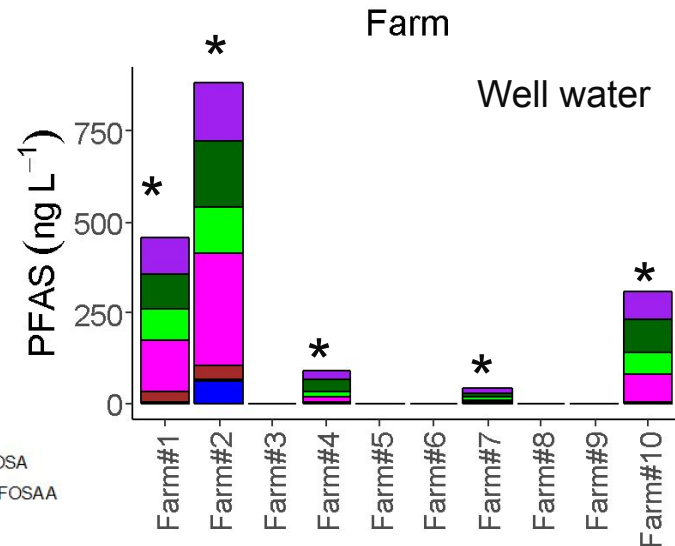
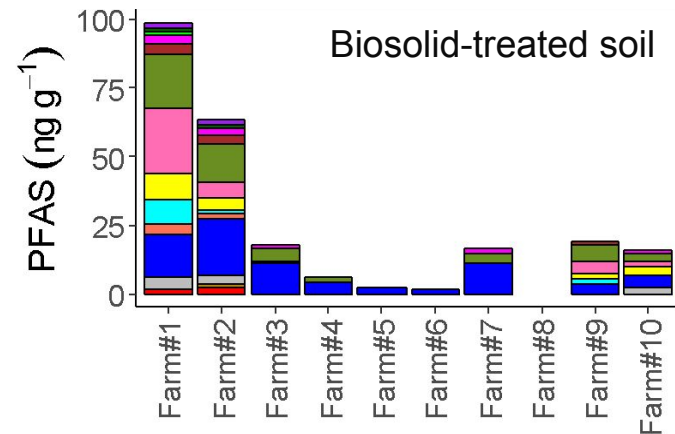
PFAS distribution based on biosolid source



- Biosolids from private applicators had more detectable compounds and in generally higher concentrations

PFAS in water from wells of PA farms

- Five farms* receiving biosolids had PFAS in well water at levels above the drinking water maximum contaminant level (MCL = 4 ng/L)
- Different PFAS profile
 - Well water dominated by shorter-chain (9 C or less) compounds.
- A direct connection between biosolid application and groundwater contamination cannot be confirmed at this time.**



Study Farm in Southern Pennsylvania

With long history of biosolids use

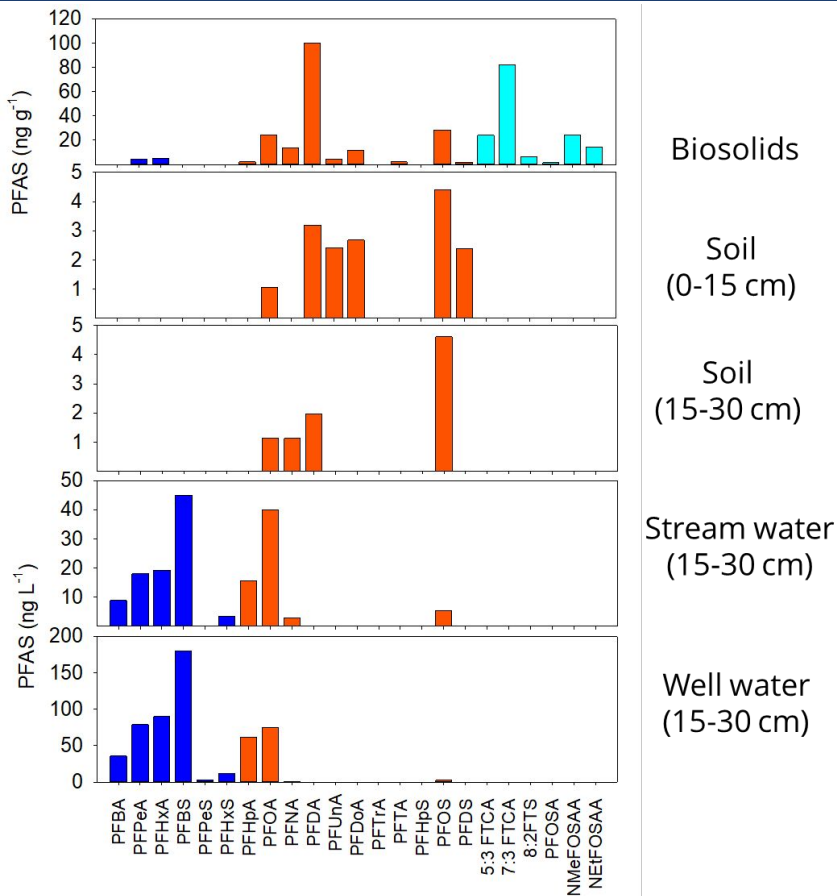
- Pennsylvania Farm
- Biosolids applied annually
- 2000-2022
- Most of the farm occupies the watershed of a 2nd order tributary of the Schuylkill River



Study Farm in Southern Pennsylvania

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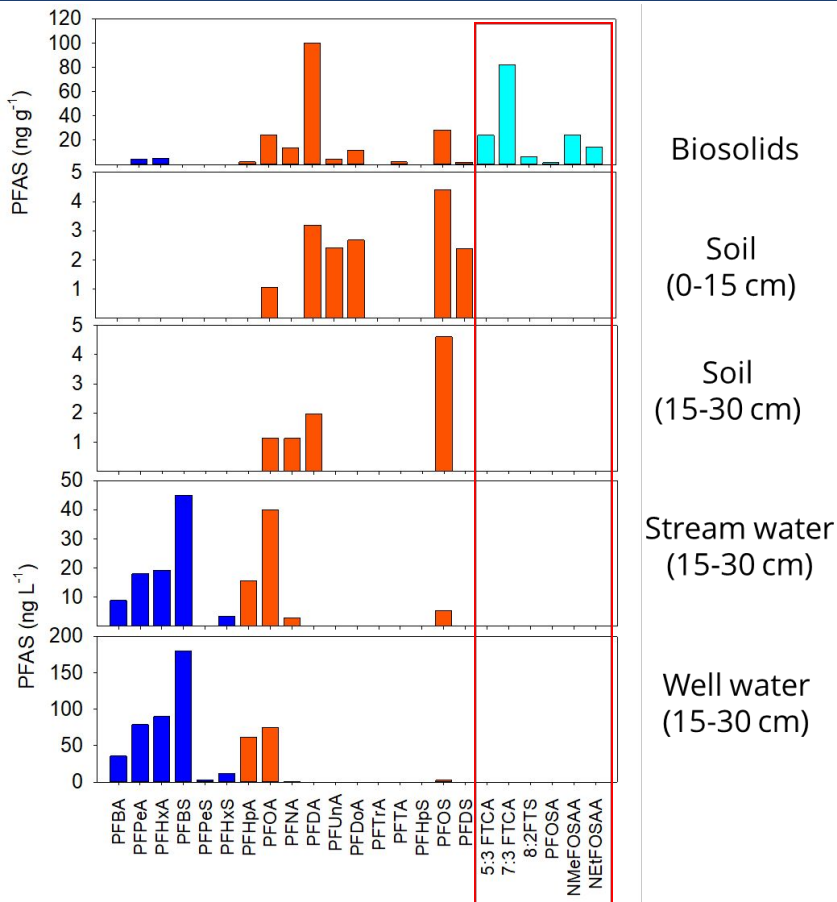
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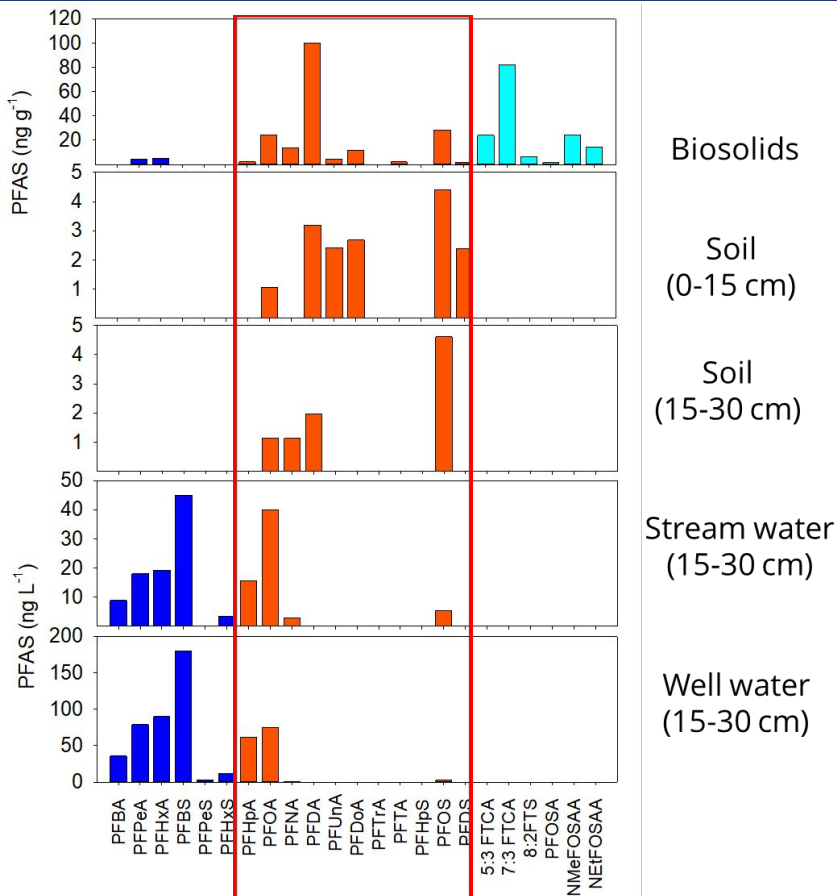
- Precursors only present in biosolids
 - Likely break down



Study Farm in Southern Pennsylvania

With long history of biosolids use

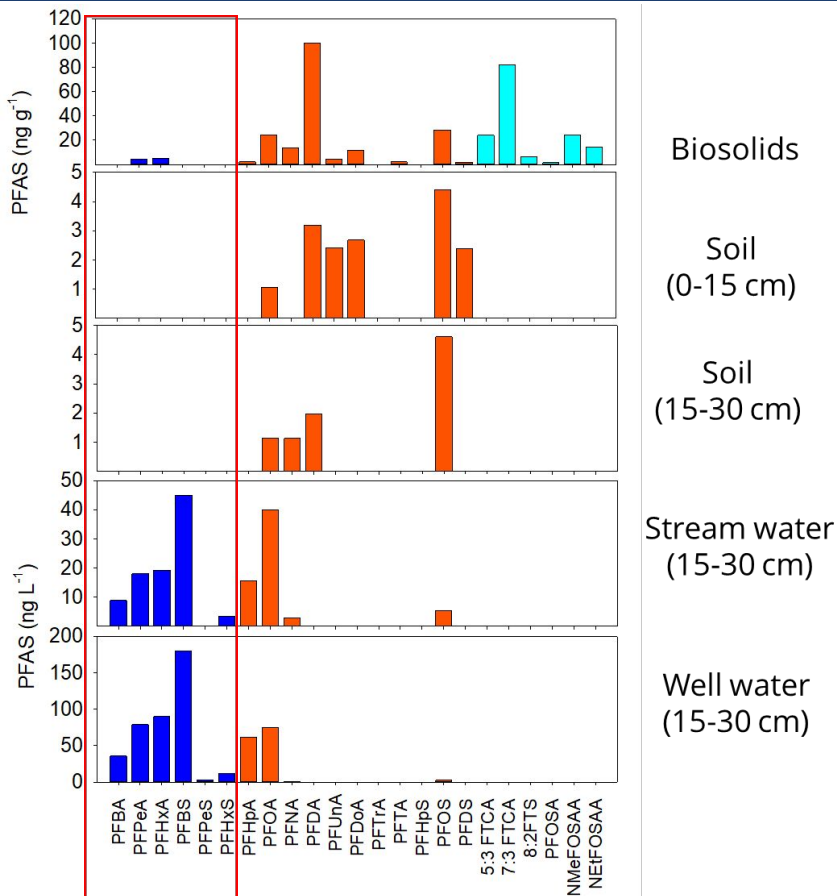
- Long-chain mostly in soils but not in water
 - Hydrophobic
 - Likely “sticking” to soils



Study Farm in Southern Pennsylvania

With long history of biosolids use

- Short-chain mostly in soils but not in water
 - Hydrophilic
 - Likely mobilizing with water



New research question

- What are temporal dynamics of the PFAS in the soil and stream compartments?
 - Long-chain compounds will mobilize via overland flow during storm events
 - (sorbed to suspended sediments =particulate fraction).

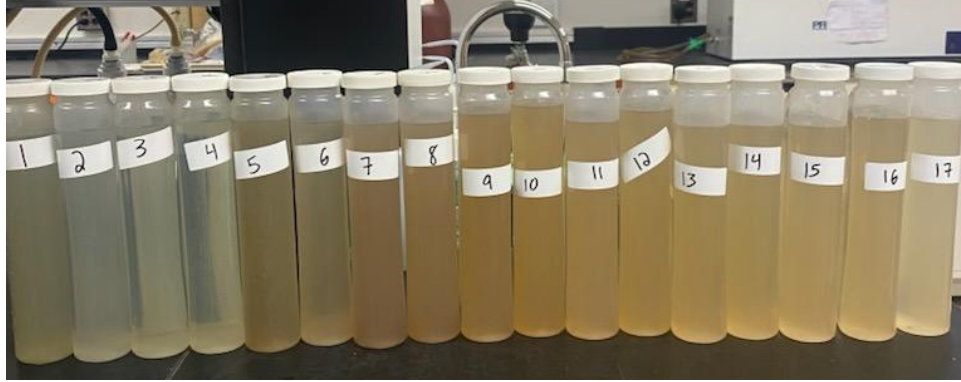


New research question

- Weekly stream water and sediment sample collection
 - Storm sample collection
 - Water sample analysis for:
 - Suspended sediments
 - Dissolved organic carbon
 - Anions
 - PFAS (USEPA 1633) (40 compounds)
 - Total
 - Dissolved (by centrifugation)
 - Particulate (difference between total and dissolved)
 - Sediment sample analysis for:
 - Organic matter content
 - PFAS (USEPA 1633) (40 compounds)
- QA/QS for sampling equipment, field and lab blanks

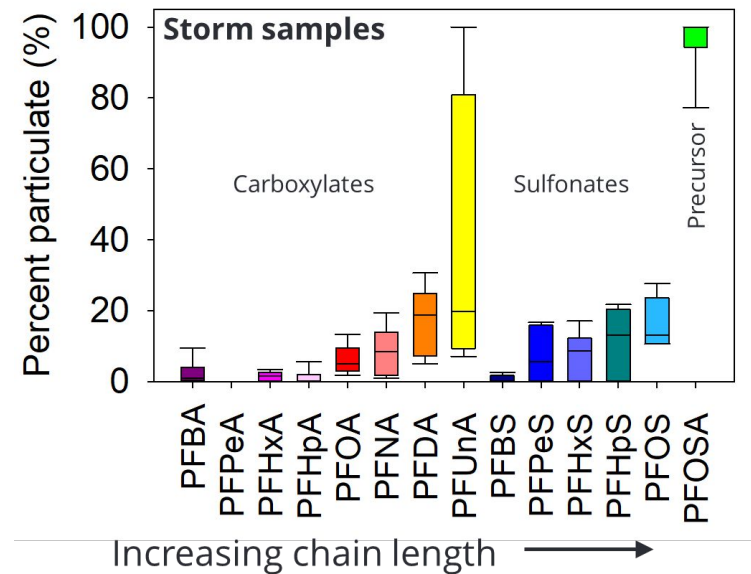


Preliminary Results from first storm



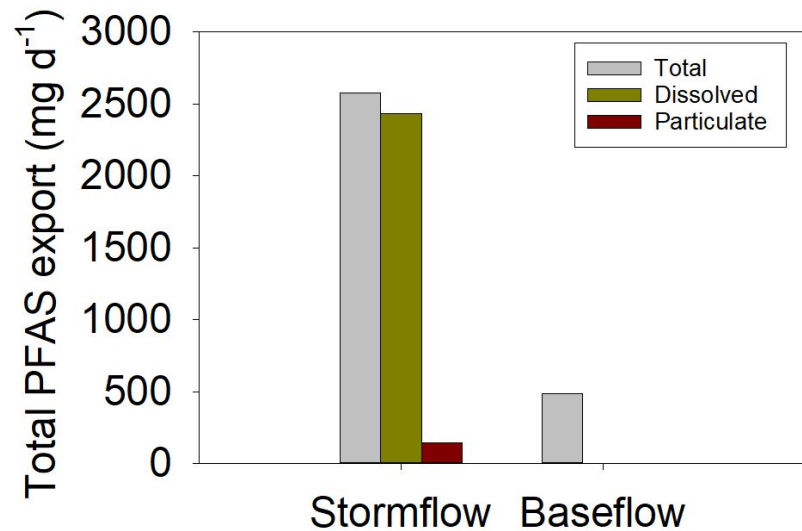
Preliminary Results from first storm

- Contribution of particulate fraction to total PFAS concentration increased with chain-length.
- PFOSA (precursor) dominated the particulate fraction.

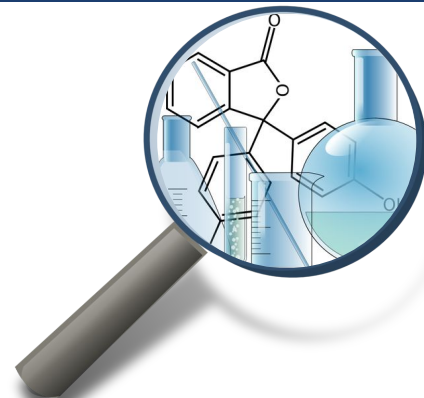
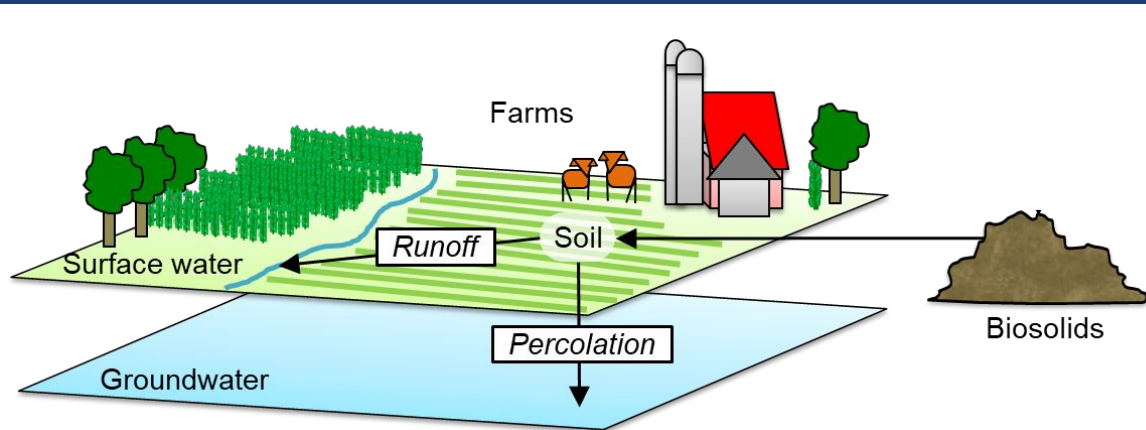


Preliminary Results from first storm

- Overall contribution from the particulate fraction was small.
- Total PFAS export was ~5x higher at stormflow conditions.



What have we learned so far?



- Biosolids used in Pennsylvania can be a significant source of PFAS contamination to farming soils, adjacent surface waters and potentially local drinking water supplies.
- Not all biosolids are created equal, not a widespread problem.
 - What is/are the source(s) of the biosolids and what kind of waste does the sourcing WWTP(s) receive?
- Different PFAS compounds behave differently in the agroecosystem.
- Stormflow conditions may represent hot moments for export of PFAS to downstream ecosystems.

Acknowledgments

- **Staff scientists:** Stephanie Bernasconi, Mike Gentile, Kristen McCarthy, David Montgomery & Cooper Reilly
- **Funding Agencies**
 - Foundation for Food and Agricultural Research
 - US Department of Agriculture
- **Farmers** for access to their farms



Questions?

Thank you!

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