NATIONAL ACADEMIES Sciences Engineering Medicine

PFAS in Agricultural Systems

Guidance for Conservation Programs at USDA

Report Release Webinar

Presented by Committee Members Jim Ippolito, Jennifer Guelfo, and Tom Christensen

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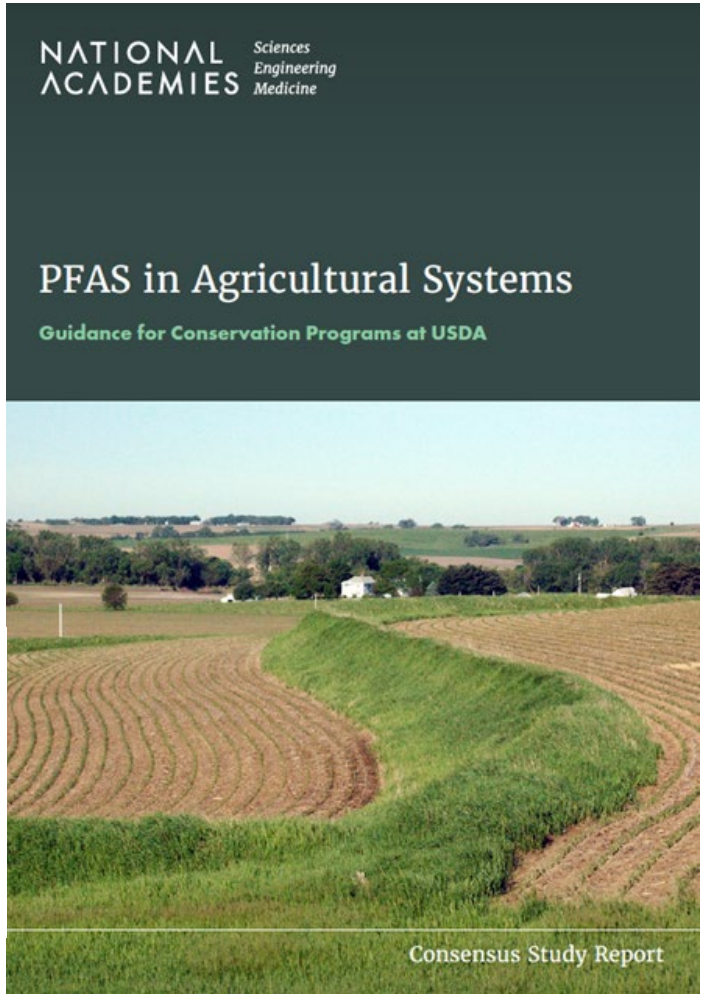
Our New Report

Committee on Assistance to the U.S. Department of Agriculture in Building a Framework for Addressing PFAS on Agricultural Land

Sponsor:

U.S. Department of Agriculture–Natural Resources Conservation Service

Report available at
https://www.nationalacademies.org/publications/29272



Consensus Study Committee

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Study Statement of Task

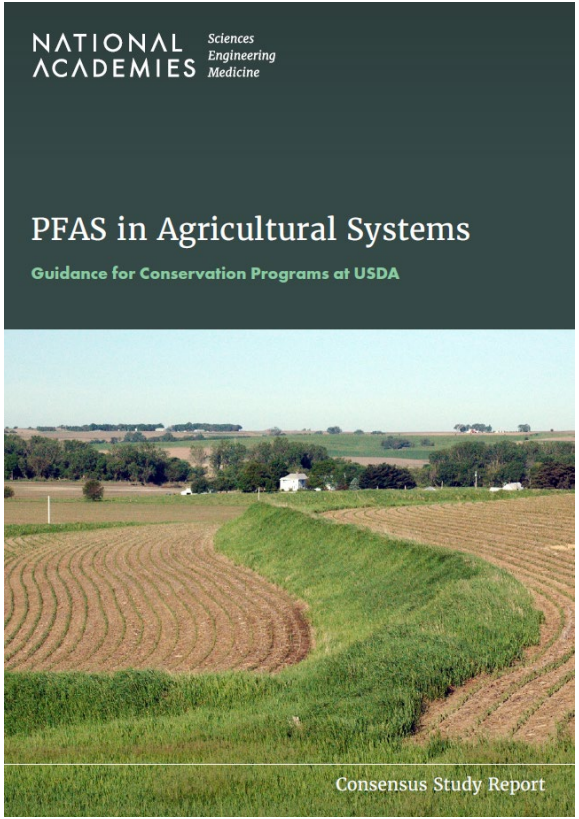
A committee appointed by the National Academies of Sciences, Engineering, and Medicine will provide an initial framework to guide the efforts of the U.S. Department of Agriculture's Farm Production and Conservation (FPAC) programs that directly deal with conservation on the land, including the Environmental Quality Incentives Program, the Conservation Stewardship Program, the Conservation Reserve Program, and the Agricultural Conservation Easements Program, to respond to the impacts of per- and polyfluoroalkyl substances (PFAS) contamination of agricultural land. In a consensus report, the committee will:

- Characterize the scope of PFAS challenges in agriculture and the capability of the conservation programs, practices, and initiatives to address on-farm PFAS contamination and mitigation.
- Identify what factors FPAC agencies may consider when evaluating the risk that on-farm actions supported by FPAC conservation programs could cause or exacerbate PFAS soil or water contamination on or off the farm.
- Identify cost-effective and implementable options within the FPAC remit to support PFAS mitigation on farms (e.g., crop changes, land retirement, changes to on-farm water infrastructure), the research needed to inform the efficacy of these options, and considerations of actions to mitigate risk and the impacts of contamination in agricultural systems.

Study Statement of Task (continued)

- Identify other actions, including conservation practices, that could mitigate or avoid PFAS contamination in agricultural systems but are outside the FPAC remit or may not yet be economically or technically feasible to implement at a large scale.
- Identify applied research gaps for land management of PFAS contamination as they relate to conservation practices on the ground.
- Provide guidance for decision making based on what is currently known as well as emerging information about the fate and transport of different PFAS in agricultural systems.
- Provide considerations for the development of an agricultural working definition of PFAS in the context of PFAS for which the U.S. Environmental Protection Agency has determined Regional Screening Levels.

Organization of the Report



Summary
Chapter 1: Introduction and Scope of Report
Chapter 2: PFAS Structure and Entry and Movement in Ag Systems
Chapter 3: Conservation Practices, Programs, and Initiatives and PFAS
Chapter 4: Decision-Making Under Uncertainty
Chapter 5: Applied Research Gaps
Appendixes

Per- and Polyfluorinated Substances

Strength of the carbon–fluorine bond and presence of multiple fluorine atoms per carbon contribute to valuable properties of PFAS (e.g., stability, repellency)

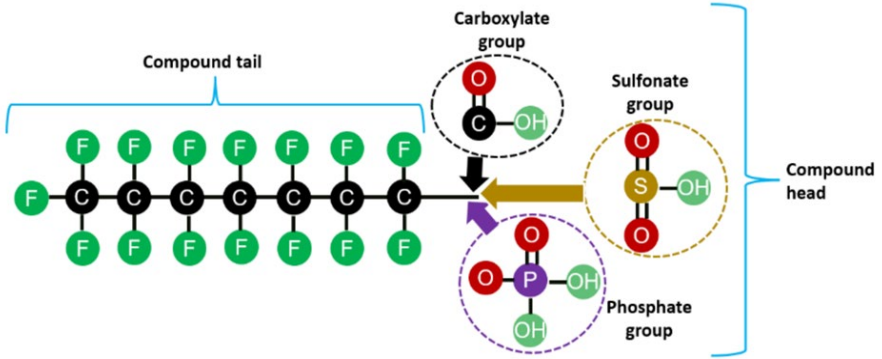
- Also make many PFAS persistent in the environment

Precursor PFAS transform into other PFAS

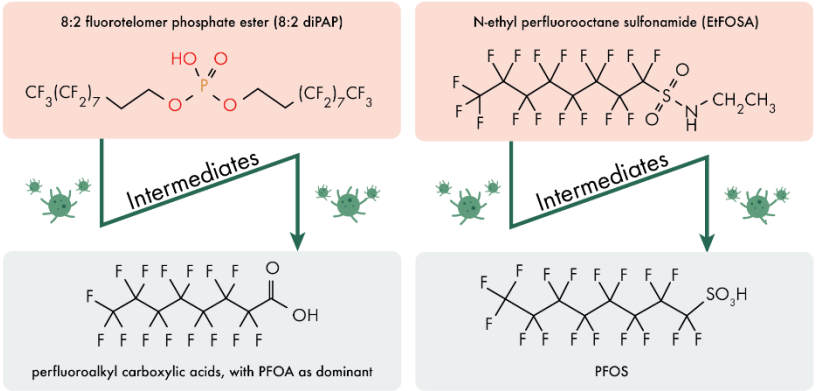
- Terminal products resistant to mineralization and microbial degradation

Fate and transport influenced by:

- PFAS characteristics
- Soil properties and interfacial areas
- Other factors



PFAS structure example



Example of microbially mediated transformation of precursor PFAS to terminal PFAS

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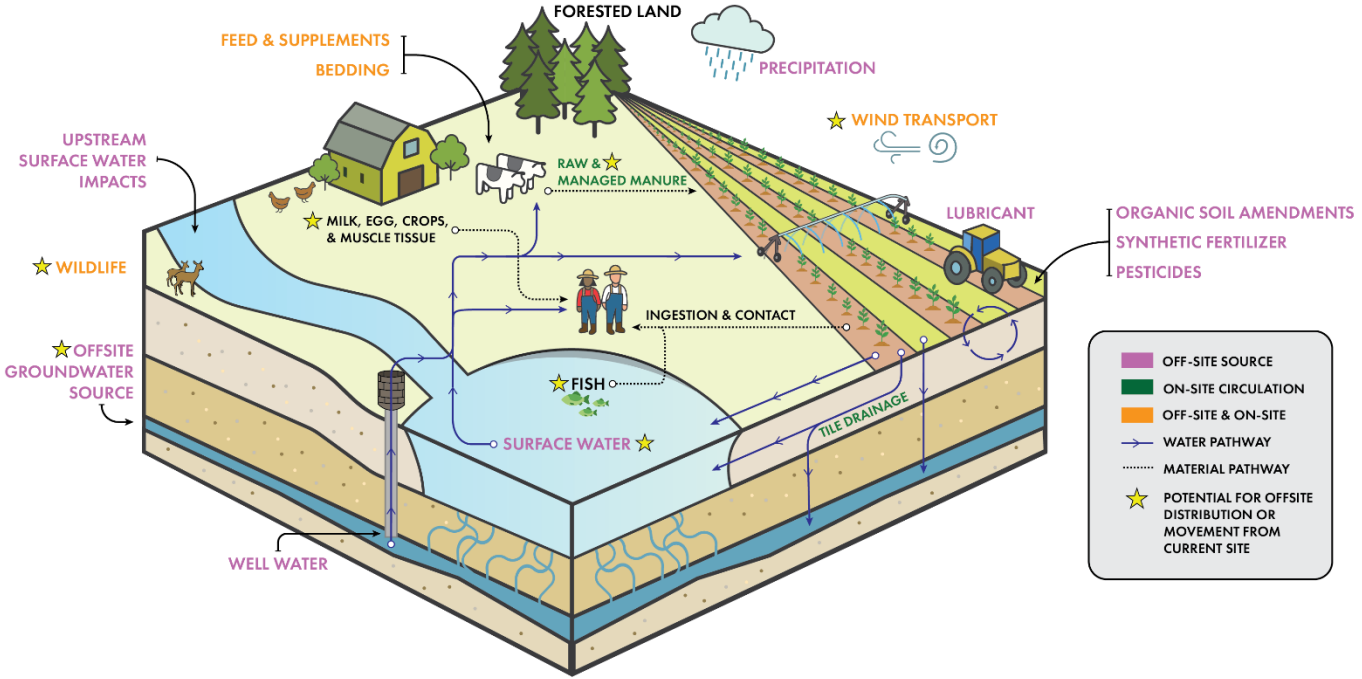
Entry and Cycling in Agricultural Systems



Programs, Practices, and PFAS

Conclusion 3-1: There are opportunities within the statutory, policy, and operational frameworks of EQIP, CSP, and CRP to help address on-farm PFAS contamination and mitigation. For example, PFAS could be identified as a priority for funding through existing program features and procedures. Pilot initiatives could be pursued within programs to target the avoidance or mitigation of PFAS contamination on agricultural lands.

- EQIP is already widely accessible to customer base, and practices mostly to likely to address on-farm PFAS issues are already used by existing participants
  - Opportunities for innovation and refinement within CIG subprogram
- Opportunity to identify or develop specific CSP enhancements or bundles that support PFAS mitigation
- Statutory ability for lands affected by PFAS to be deemed eligible for CRP
- Pilot programs, Conservation Reserve Enhancement Program, and Monitoring, Assessment, and Evaluation funds also available under CRP

Programs, Practices, and PFAS

Conservation Program	Primary Target Participant	Fund Obligation Vehicle	Key Potential PFAS Mitigation Mechanisms	Not Applicable	Medium Potential	High Potential
EQIP	Individual	Contracts	Conservation practices and activities on working lands			✓
CIG	Entity	Agreements	Trials of innovative practices, technologies, tools, and approaches for working lands			✓
CSP	Individual	Contracts	Enhancements, enhancement bundles, and conservation practices for working lands		✓	
CRP	Individual	Contracts	Vegetative conservation covers on PFAS-contaminated sensitive lands through regular CRP, a legislatively authorized pilot program, and/or through Conservation Reserve Enhancement Program with a partner entity, plus Monitoring, Assessment, and Evaluation studies			✓
ACEP	Individual or Entity	Easements and Agreements	Restoration of wetlands and supporting practices and protection of cropland and grassland to limit non-agricultural use	✓		

Programs, Practices, and PFAS

Conclusion 3-2: PFAS could be addressed in a conservation plan through existing resource concerns, such as those pertaining to the transport of pathogens and chemicals to water, or through the creation of a standalone resource concern, much as nutrient transport to surface water and groundwater are standalone resource concerns. There are pros and cons to either approach.

Use Existing Resource Concerns

- Pros
  - No additional process needed
  - 'PFAS' could be explicitly added to the title of an existing concern
- Con
  - Binning PFAS contamination with existing resource concern might not achieve desired planning and practice results

Create Standalone Resource Concern

- Pros
  - Provide clear planning and technical guidance to field conservationists as an issue that needs attention
  - Create opportunity to examine current and new practices as relates to PFAS
- Cons
  - Vetting processes needed
  - Could bring unwanted attention to customers affected by PFAS
  - PFAS fate and transport is not uniform

Programs, Practices, and PFAS

Conclusion 3-3: There are opportunities for NRCS to increase the capabilities of conservation practices to address on-farm PFAS contamination and mitigation. These include:

- *Supporting on-farm conservation field trials, such as through EQIP's Conservation Innovation Grant subprogram, on the basis of proven research to improve existing conservation practice standards or develop new standards that address PFAS concerns.*

- *Including PFAS as an explicit contaminant of concern in existing conservation practice standards whose purpose and the conditions where the practice applies have relevance to PFAS contamination, mitigation, or both.*

Conservation Planning

USDA–NRCS

Identifying PFAS of Concern on Agricultural Land

Options

- Compound structure
- Analytical considerations
- Specific, regulated PFAS
- Total PFAS
- Thresholds of concern

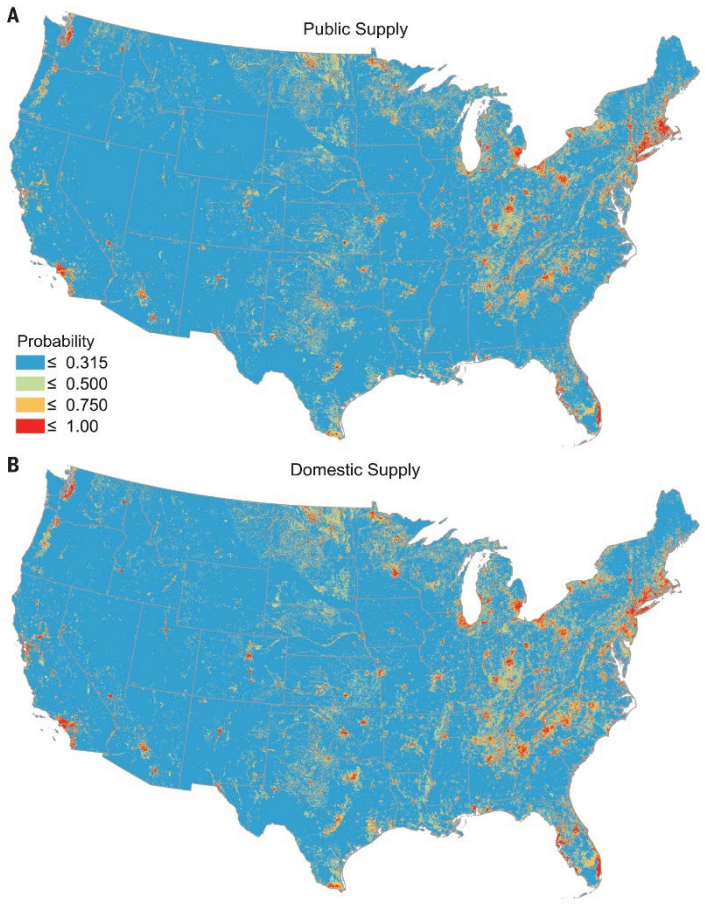
Additional considerations

- Complication of mixtures
- Ongoing evaluation

Conclusion 4-1: A working definition of PFAS for agriculture may need to consider structural features of the compounds, the ability to detect a specific PFAS, and thresholds for deciding when detected concentrations merit further investigation. Federal guidance on thresholds of PFAS in agricultural lands would benefit conservation planners in contextualizing PFAS occurrence at agricultural operations.

Data-Driven Approaches

Conclusion 4-2: Based on existing data-driven efforts to predict PFAS occurrence in groundwater and soil, it is possible to develop large, regional models that could help identify agricultural land at risk of PFAS contamination. NRCS could work with other agencies to build, train, and test such predictive models.



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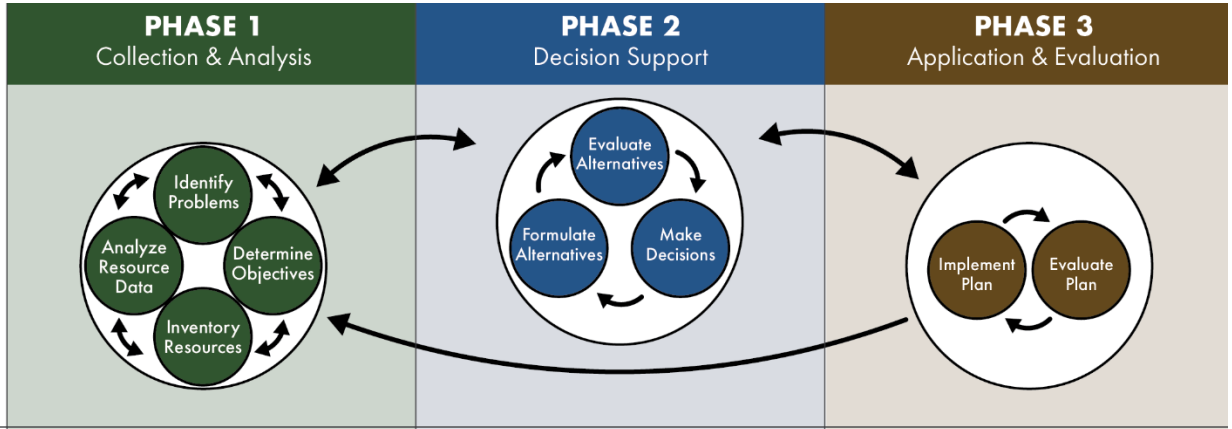
Framework for Conservation Planning and Practice Implementation to Address PFAS Concerns



Considerations

PHASE 1 Collection & Analysis	PHASE 2 Decision Support	PHASE 3 Application & Evaluation
Are PFAS a significant concern at this site? What is the source of irrigation water used on the farm? Has organic material from an off-site source been applied to the land? Is there a source of PFAS proximate to the farm?	What is known about the effects of PFAS on the condition of the soil, water, air, plant, and animal resource bases? For example, are the PFAS present long-chain and likely to stay in soil or short-chain and likely to be taken up by plants? Do the proposed conservation practices have the potential to: • mitigate a PFAS problem? • limit transport of PFAS off-site? • introduce PFAS? • exacerbate a PFAS problem? • transport PFAS off-site?	When implementing the practice, take care not to: • introduce PFAS. • exacerbate a PFAS problem. • transport PFAS off-site. When evaluating, employ adaptive management for new information (e.g., new practices or adjustments to existing practices)

	Phase 1 Collection & Analysis	Phase 2 Decision Support	Phase 3 Application & Evaluation
Existing Resources	• Prescreening tools, including existing datasets • Web Soil Survey information on PFAS behavior • PFAS testing results, if available and shared	• Potentially PFAS-relevant conservation practices	• Potentially PFAS-relevant conservation practices • Possibilities under CIG • Cooperative agreements to monitor, assess, and evaluate conservations projects on CRP land
Needed Resources	• Standards for PFAS of concern in agricultural context • Agricultural working definition of PFAS • PFAS incorporated into conservation practice standards and/or resource concerns • Predictive modeling of PFAS in soil and water • Applied research • Development of conservation practice standards specific to PFAS • PFAS-specific training for field conservationists	• Application of research results • Eligibility for CRP	• CRP pilot programs • PFAS as conservation challenge of concern under CREP

Decision-Making Under Uncertainty

Conclusion 4-3: Even though many knowledge gaps about PFAS exist, there are sufficient opportunities within the conservation planning process, the conservation practice standards, and the conservation programs, as well as sufficient data about PFAS, for the FPAC agencies to create a framework for responding to the impacts of PFAS contamination on agricultural land. The development of federal guidance on PFAS thresholds in agricultural lands and the evaluation of additional data on PFAS in agricultural soils nationwide—which could be used to train predictive models—would enhance the ability of conservation planners to respond to PFAS concerns.

Conclusion 4-4: There is a need for coordinated training of NRCS field conservationists in the basics of PFAS and agriculture and for each NRCS state office to maintain a list of available resources for PFAS-affected farmers and contacts.

Applied Research Gaps

- PFAS fate and transport in varying soil types
  - Effect of soil properties and PFAS type on sorption
  - PFAS desorption hysteresis
- Trapping or sequestering PFAS
  - Sorbents: biochars, modified clays, drinking water treatment residuals
  - Trapping options: removal structures and bioreactors
  - PFAS site index
- Understanding plant uptake
  - Wider variety of crops, diverse field conditions, multiple years of study
  - Research into transpirational flow and rates
  - Variation in crop management and appropriate vegetative covers
- Mitigating PFAS uptake in livestock
  - Study of more PFAS
  - Manure management
  - Feed and water management practices

Applied Research Gaps

Conclusion 5-1: Applied research that advances understanding of PFAS fate and transport in different types of soils, develops better mechanisms by which to trap or sequester PFAS, and minimizes PFAS uptake in plants and animals could improve the ability of conservation practices to address PFAS contamination on agricultural land.

Conclusion 5-2: A coordinated, national network of researchers focused on the identified areas of applied research would help close information gaps and provide practical knowledge for managing PFAS contamination in U.S. agricultural systems.

Conclusion 5-3: The results of such research and coordination could be used to continually improve existing resources and provide needed resources identified in the suggested framework to advance the ability of the FPAC agencies to respond to the impacts of PFAS contamination on agricultural land.

Thanks for listening!

We invite your questions.

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