USGS
science for a changing world

Ecosystem Mission Area | Environmental Health Program | Food Resources Lifecycle Integrated Science Team

Contaminants of Global Concern: Under-investigated Issues for the Greater Everglades

Maite De Maria: Cherokee Nation System Solutions, WARC

Dana Kolpin: Central Midwest Water Science Center

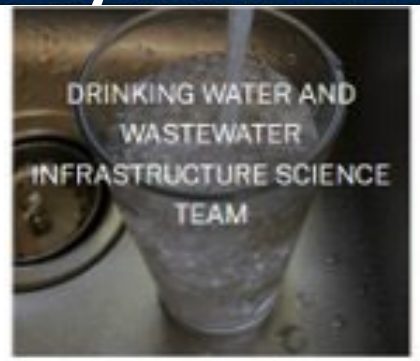
Michelle Hladik, Laura Hubbard, Margaret Hunter, Sarah Janssen, Rachael Lane, Erin Pulster

U.S. Department of the Interior
U.S. Geological Survey

USGS Ecosystem Mission Area's Environmental Health Program

EHP Drupal Story

EHP Geonarrative

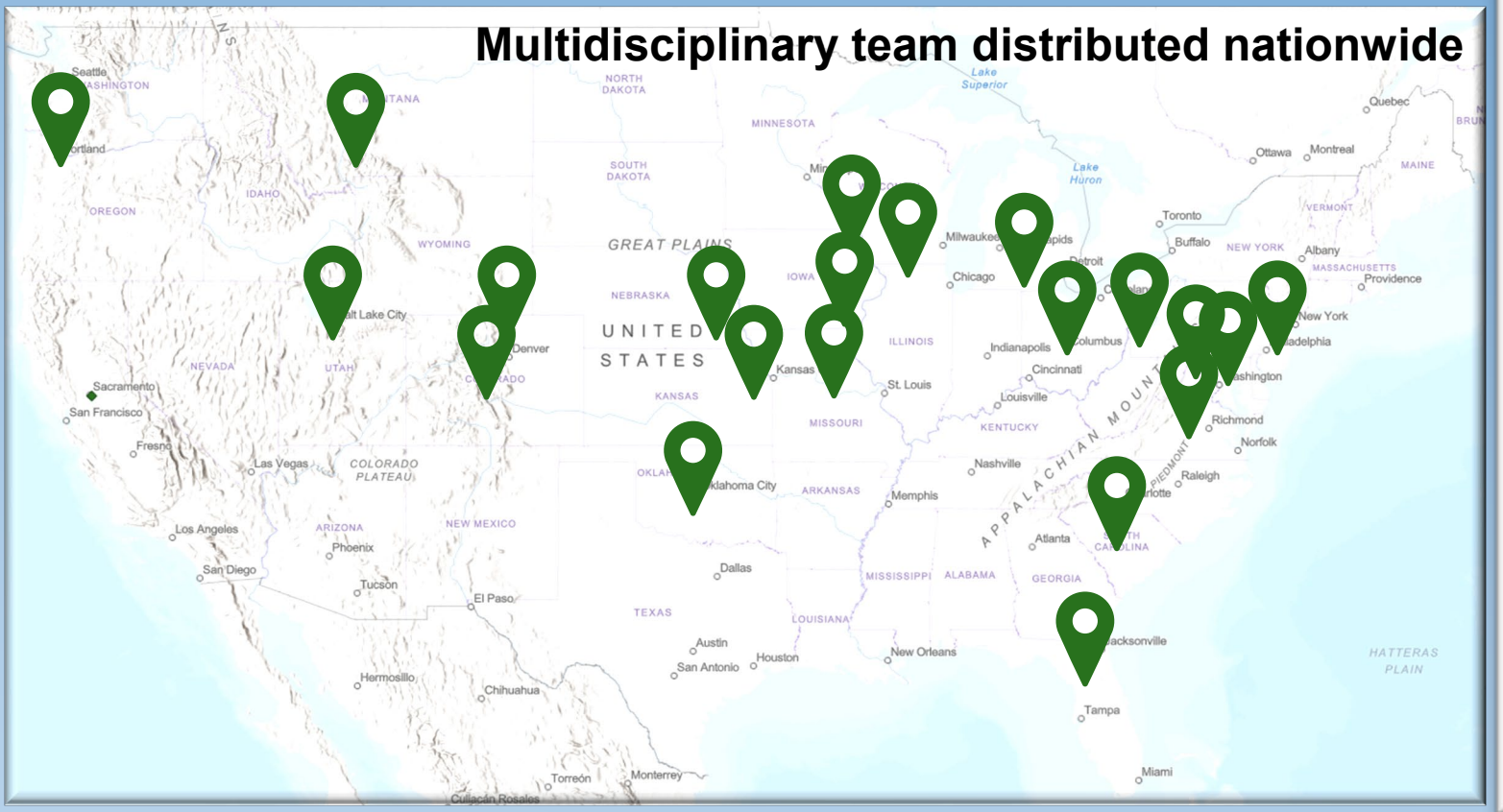


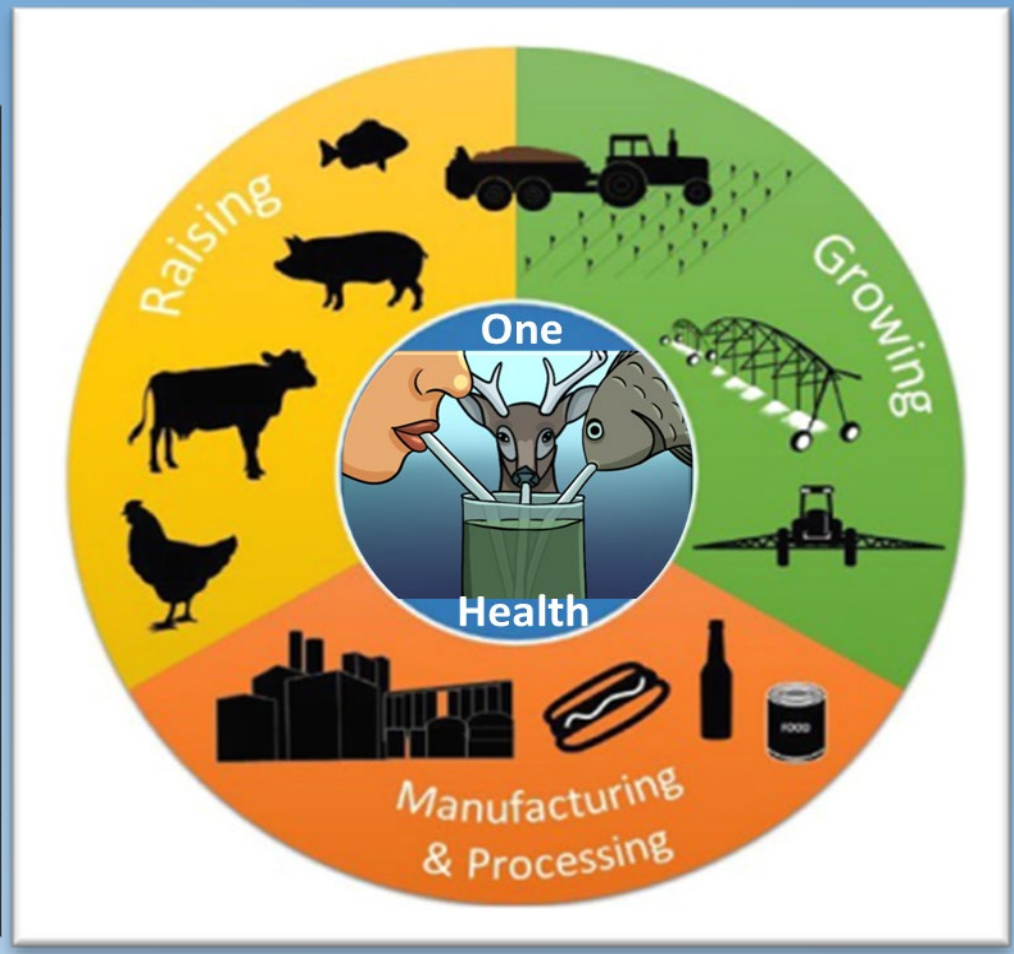
EHP Website

Food IST Geonarrative

Science to address priority issues related to human and wildlife exposures to contaminants of global concern

Food Resources Lifecycle Integrated Science Team (Food IST)

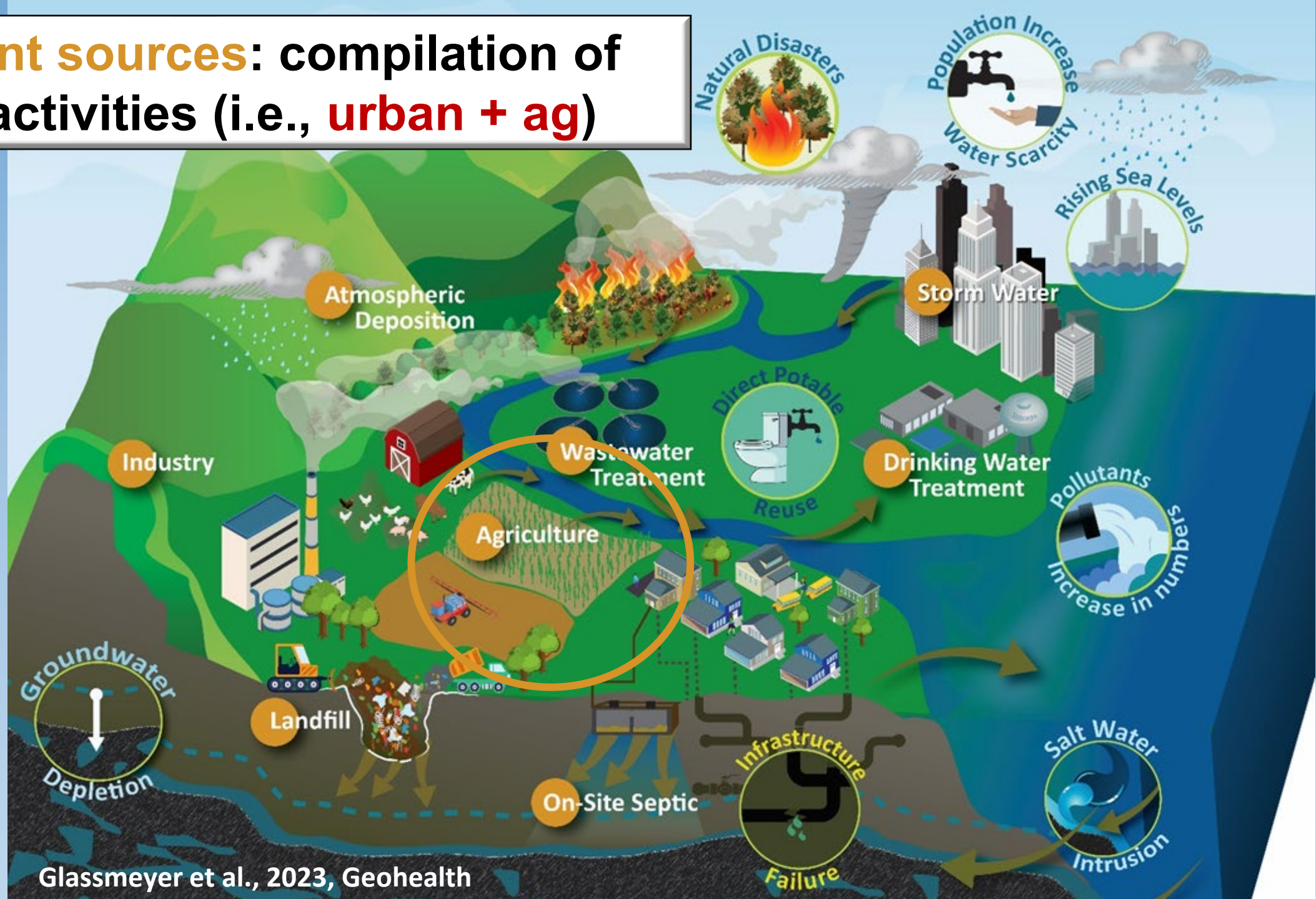




USGS

Food IST answers questions about the potential exposure and effects from complex chemical and biological contaminant mixtures associated with the growing, raising, processing, and manufacturing of plant and animal products.

Contaminant sources: compilation of all human activities (i.e., urban + ag)

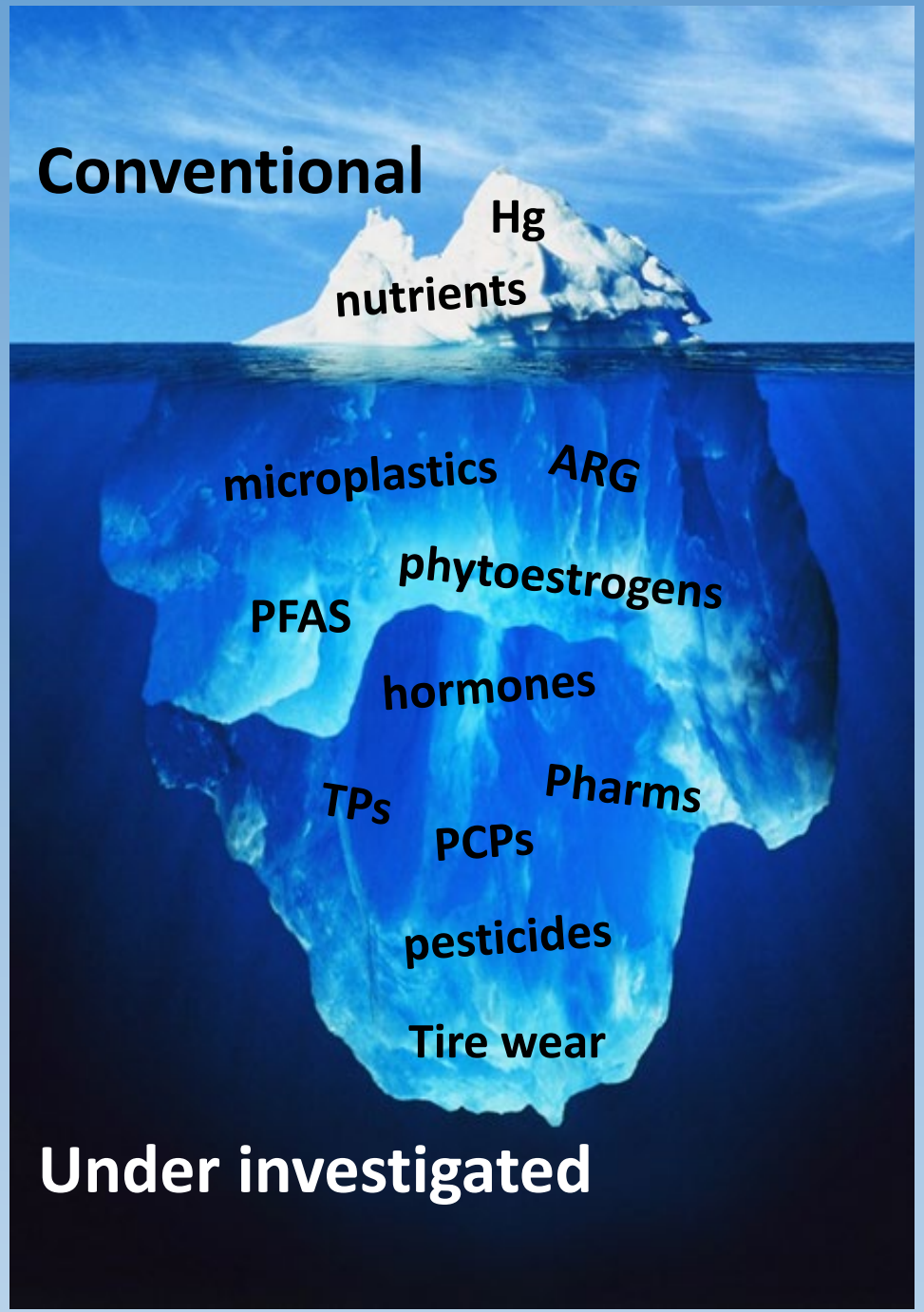


USGS

Glassmeyer et al., 2023, Geohealth

Contaminants of Global Concern (CGCs)

Our environment contains a complex mixture of contaminants. What we typically measure is just the tip of the iceberg in terms of what is actually present.



USGS

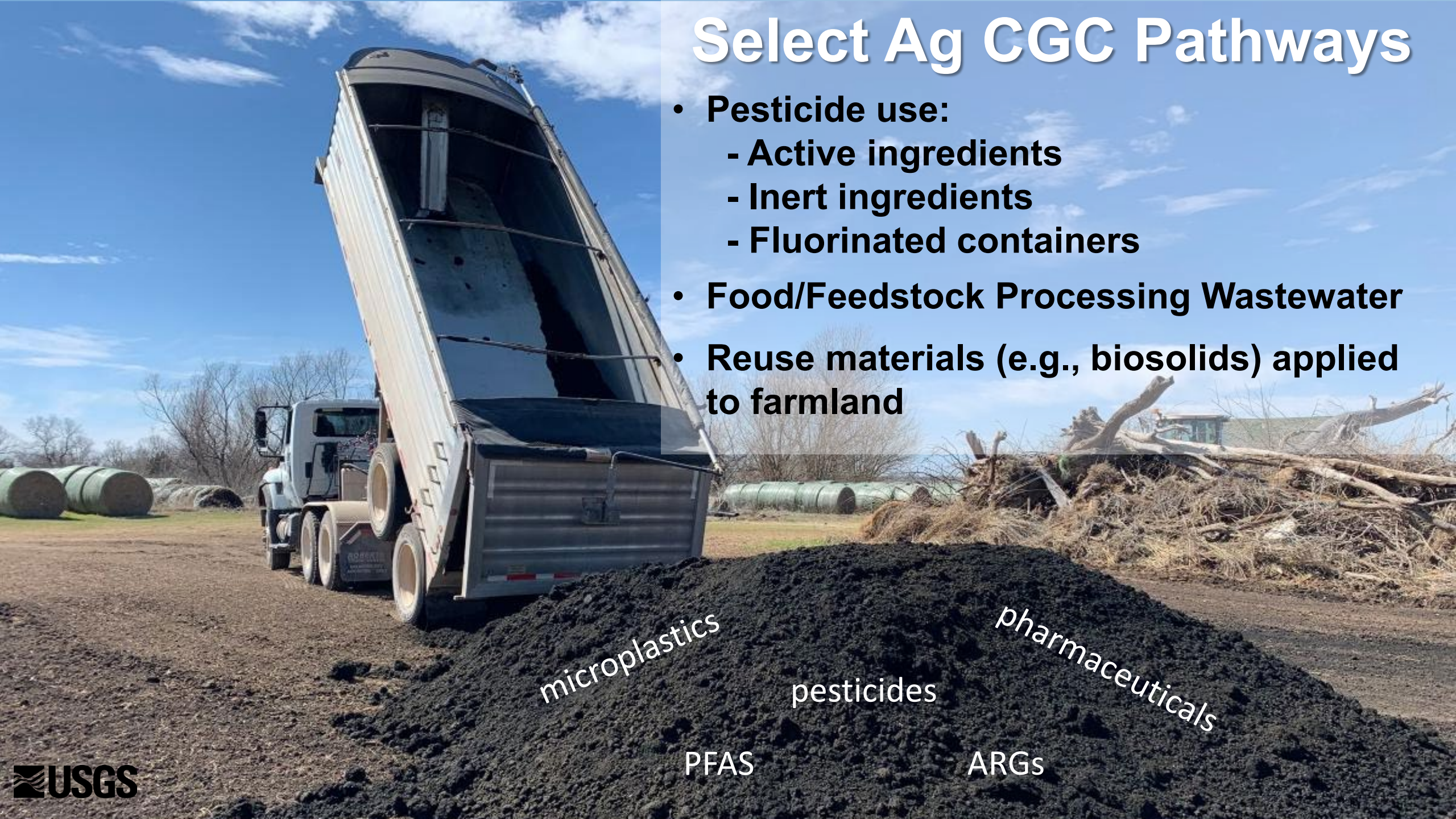
CGCs: Why do we care?

- Found in all environmental compartments (water, sediment, air, biota) on a global scale
- Mounting evidence of deleterious human and environmental effects
  - Pesticides: numerous effects
    - Neonics: likely adverse effect (>1000 species), existential threat (>200 species)
  - PFAS: lower birth weights, hormone interference, reduced immune response, and various cancers
  - ARGs: antimicrobial resistance is recognized as a global threat to human health

USGS

Select Ag CGC Pathways

- **Pesticide use:**
  - **Active ingredients**
  - **Inert ingredients**
  - **Fluorinated containers**
- **Food/Feedstock Processing Wastewater**
- **Reuse materials (e.g., biosolids) applied to farmland**



USGS

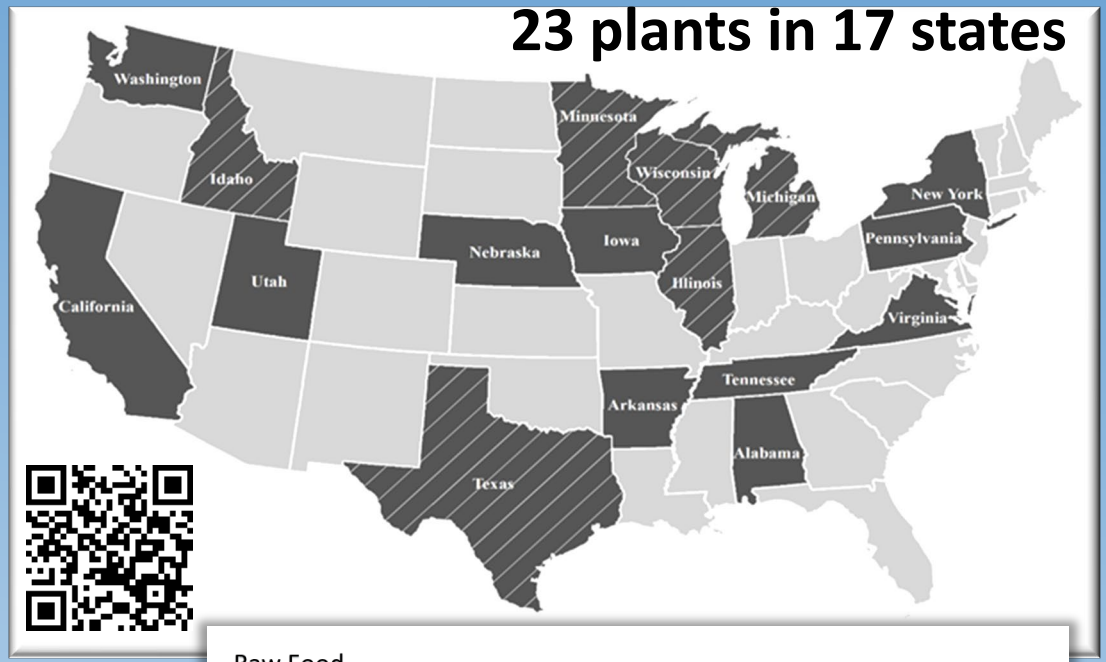
National Study of Food Processing Wastewater:

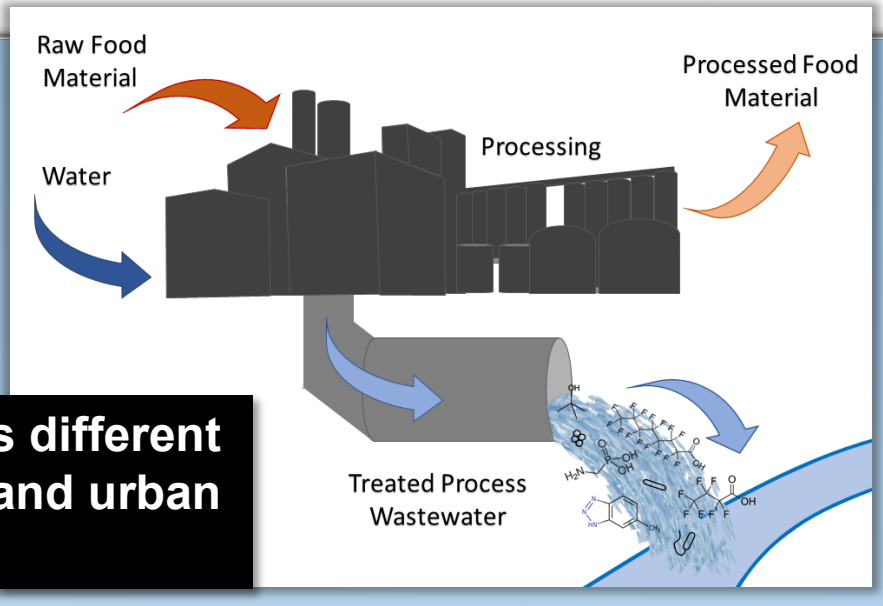
First national study (Hubbard et al., 2022)

- **Meat** (7), **Fruit/Veg** (6), **Beverage** (3), **Seafood** (2), **Dairy** (3), **Soy** (1), **Ethanol** (1)
- **Complex mixture of organic chemicals**

  PFAS, Pharms, Pesticides,….
- **Ubiquitous bacterial growth and resistance**
- **Biologically active**

  ER = 100%; AR = 39%





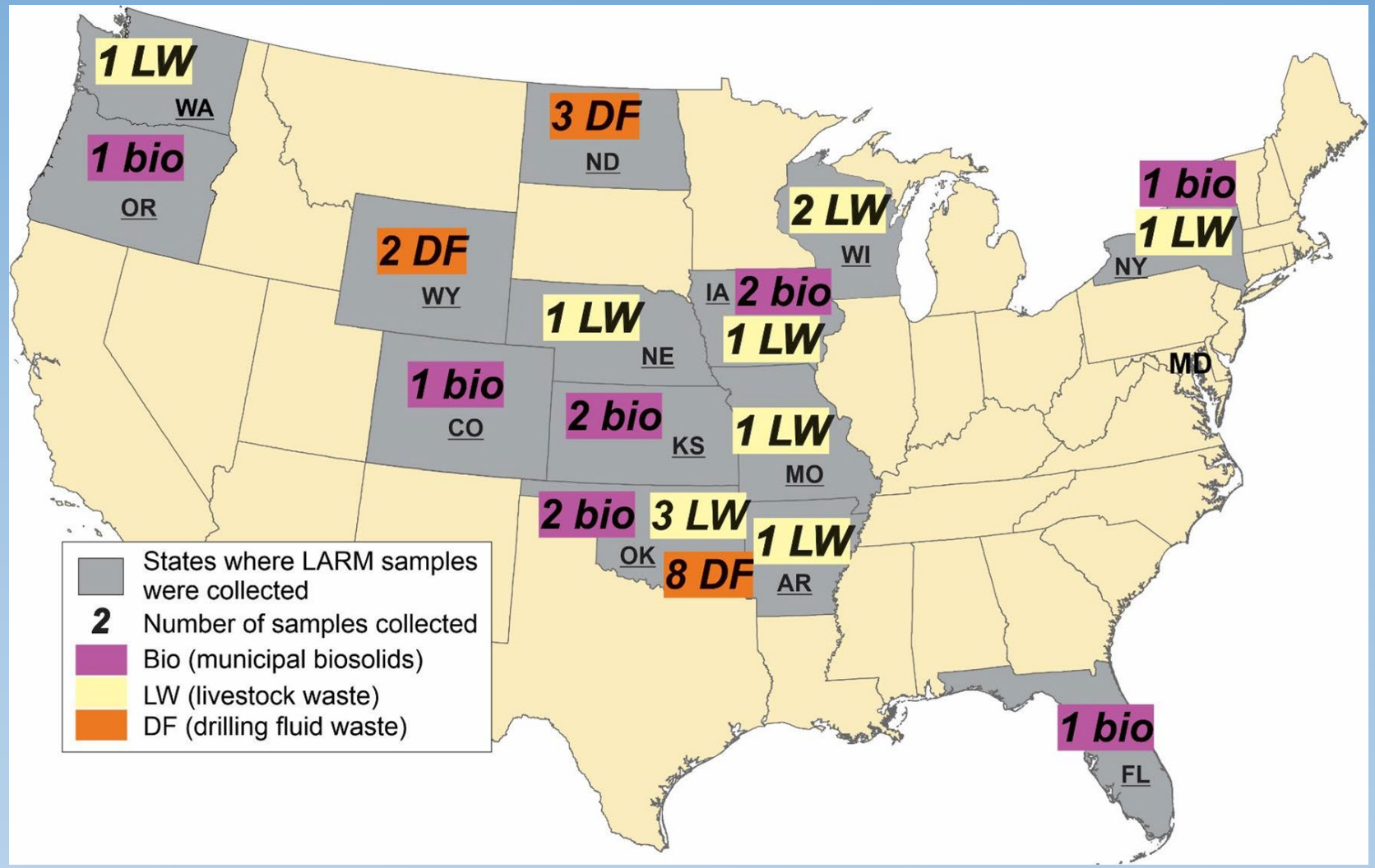
Environmental source of PFAS

- 65% of facilities (1 to 15 PFAS)
- **Max ΣPFAS = 185,000 ng/L**

Important source of CGCs different from municipal effluents and urban storm water

USGS

Characterizing Land Applied Reuse Materials



Municipal Biosolids

(53%: 12.4 billion kg)

- 9 Class – B
- 1 Class – A

Livestock Manure

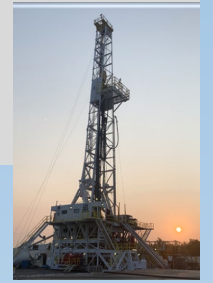
(100%: 1,270 billion kg)

- 5 bovine
- 4 poultry
- 2 swine

Drill Fluids

(??: 1.3 billion kg in OK)

- 7 water-based
- 6 oil-based



452 organics + 114 inorganics + microbial analysis

USGS

Environmental Implications

Biosolids

- Median 84 organics
- PFAS, Pharmaceuticals, pesticides
- High Bacteria load

Livestock

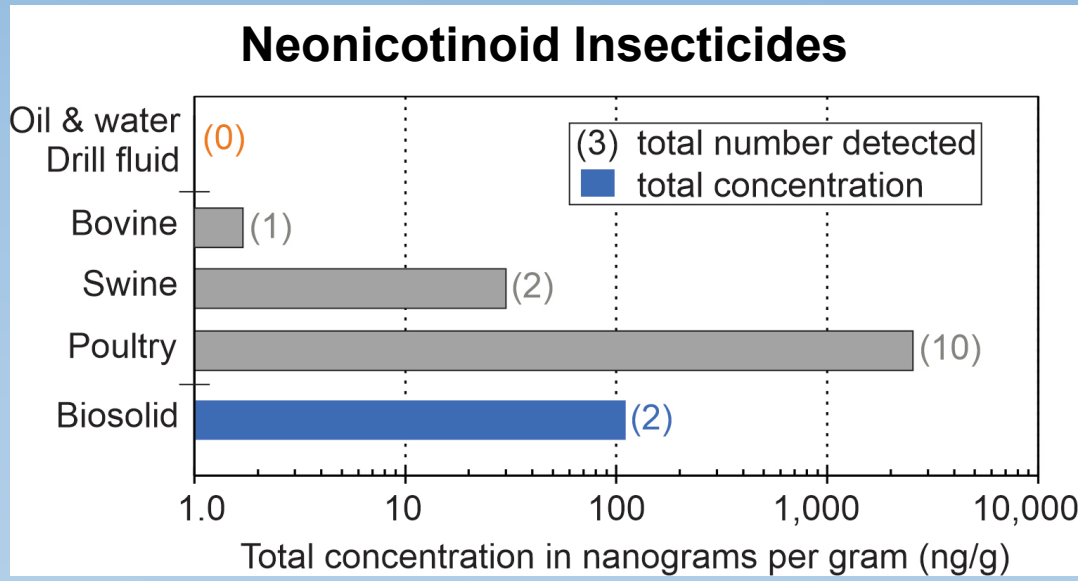
- Median 27 organics
- Hormones, phytoestrogens, pesticides, antibiotics, Antibiotic resistance gene and bacteria
- High bacteria load

Drilling fluids

- Median 9 organics
- BTEX, Polycyclic aromatic hydrocarbons (PAH)

Application to farmland provides an environmental pathway for contaminant redistribution

Developing method for MP



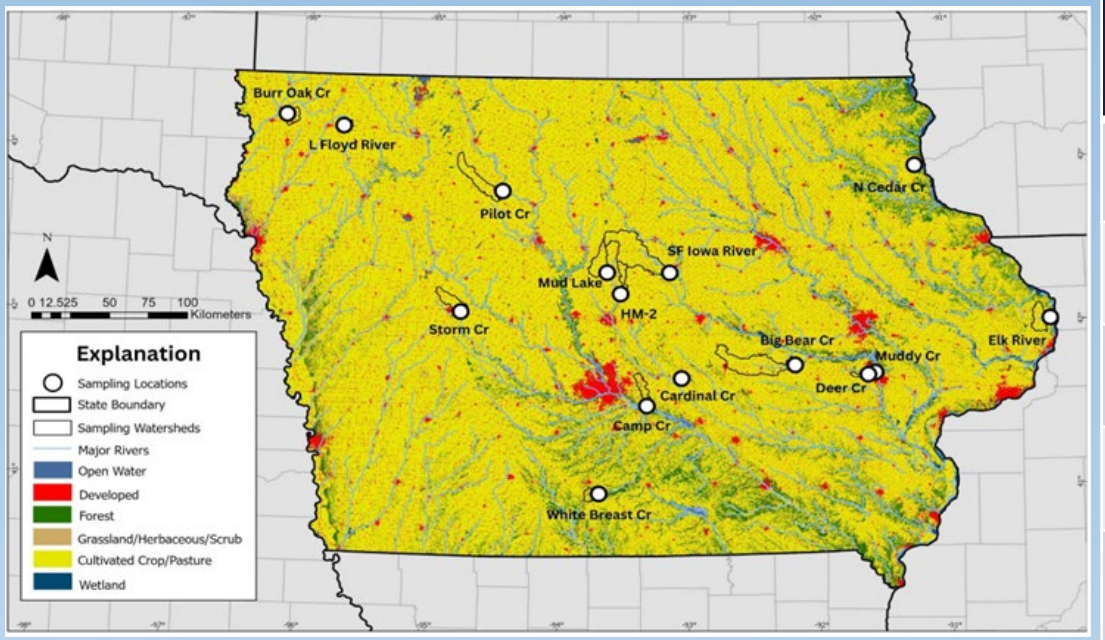
USGS

Wadable Ag Streams

Microplastics & PFAS: all sites and all matrices

Significant positive correlations with MP counts

- Water → Water clarity variables (turbidity, suspended sed)
- Bed Sed → total coliforms



Site	Water Counts/liter	Bed Sed Counts/gram	Fish Counts (total)
Muddy Creek	201	**9,551**	**199**
Pilot Creek	171	**61,799**	**295**
Big Bear Creek	~4,124	**109,435**	301
South Fork Iowa River	220	**17,193**	**877**
Deer Creek	246	**35,589**	**1,168**

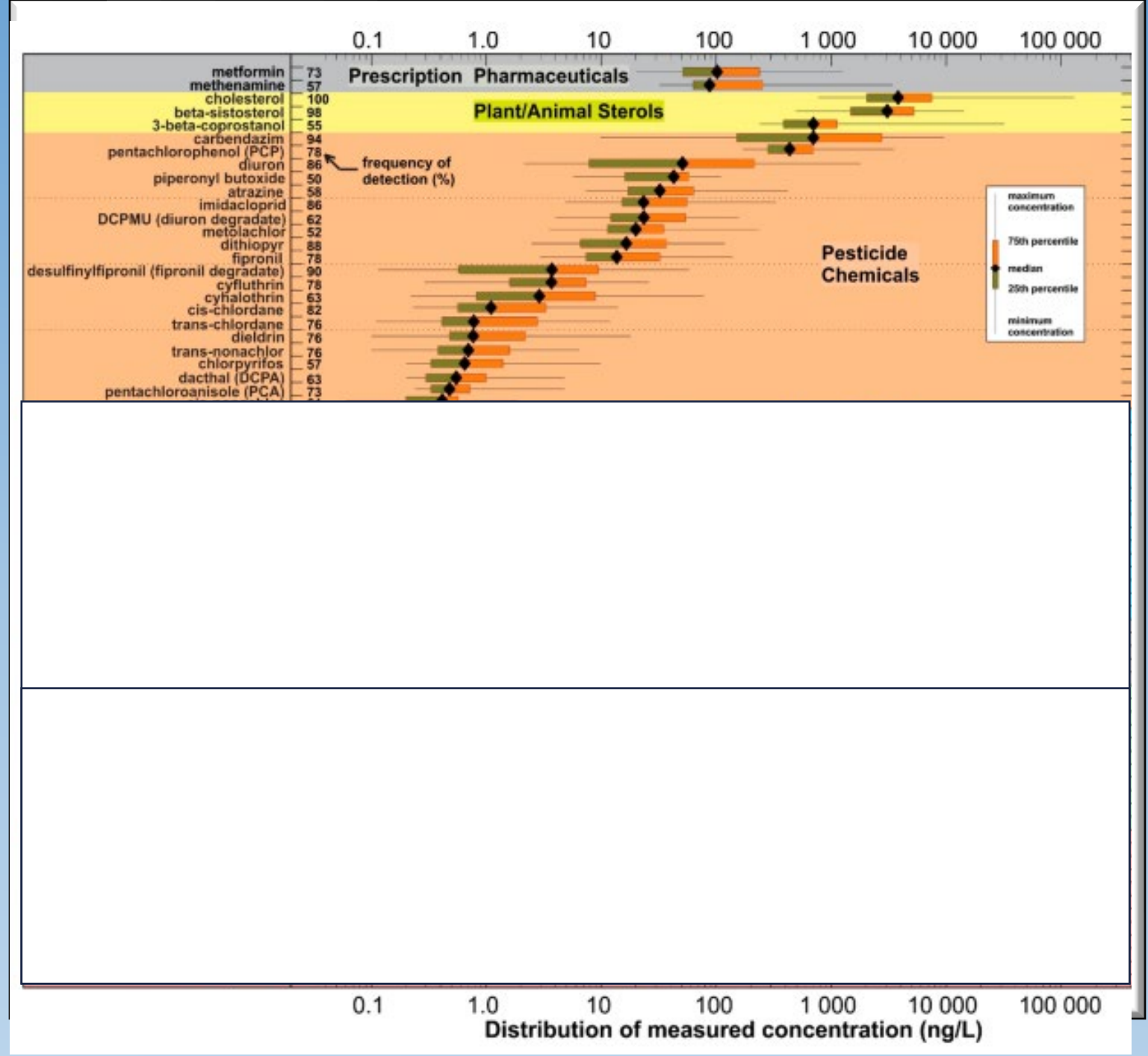
USGS

Journal article

Data release *(live soon)*

National Urban Stormwater Study

- 50 runoff events at 21 sites in the U.S
- PAH, bioactive contaminants (pesticides, pharmaceuticals)
  - Median detected: **73/site**
- >10,000 ng/L individual concentrations concern for **Potential environmental effects during runoff events**



Masoner, J.R., Kolpin, D.W., et al., 2019

USGS

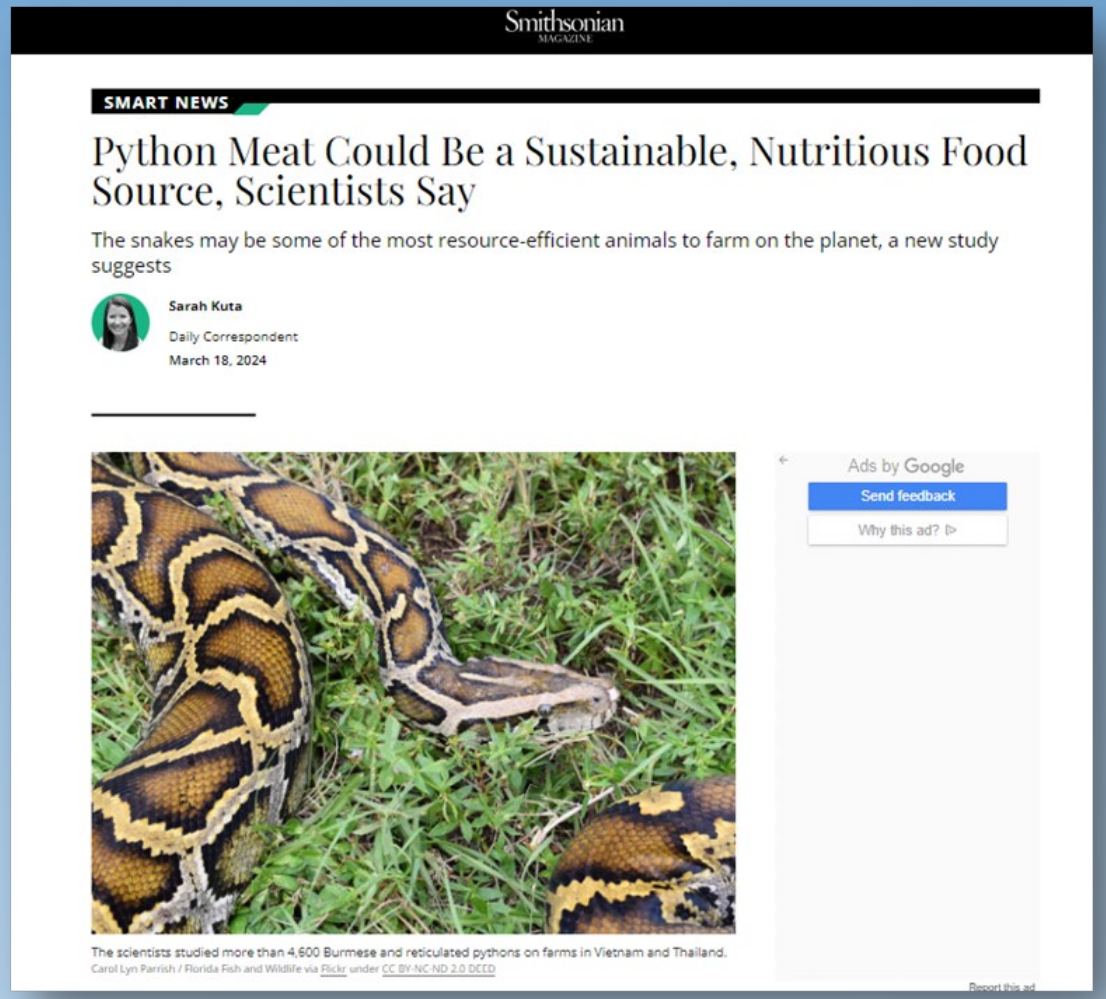
Food IST: Florida Python Study

Why: Invasive species inhabiting the Everglades→ meat as a potential food resource?

- Top predator generalist in the Everglades National Park → high mercury levels
  - Other contaminants of global concern?

Pilot Study

- Available Hg results used to select 60 **python tail clippings** from the Shark River Slough and coastal areas
  - Target analytes: PFAS + pesticides



Smithsonian MAGAZINE

SMART NEWS

Python Meat Could Be a Sustainable, Nutritious Food Source, Scientists Say

The snakes may be some of the most resource-efficient animals to farm on the planet, a new study suggests

Sarah Kuta
Daily Correspondent
March 18, 2024

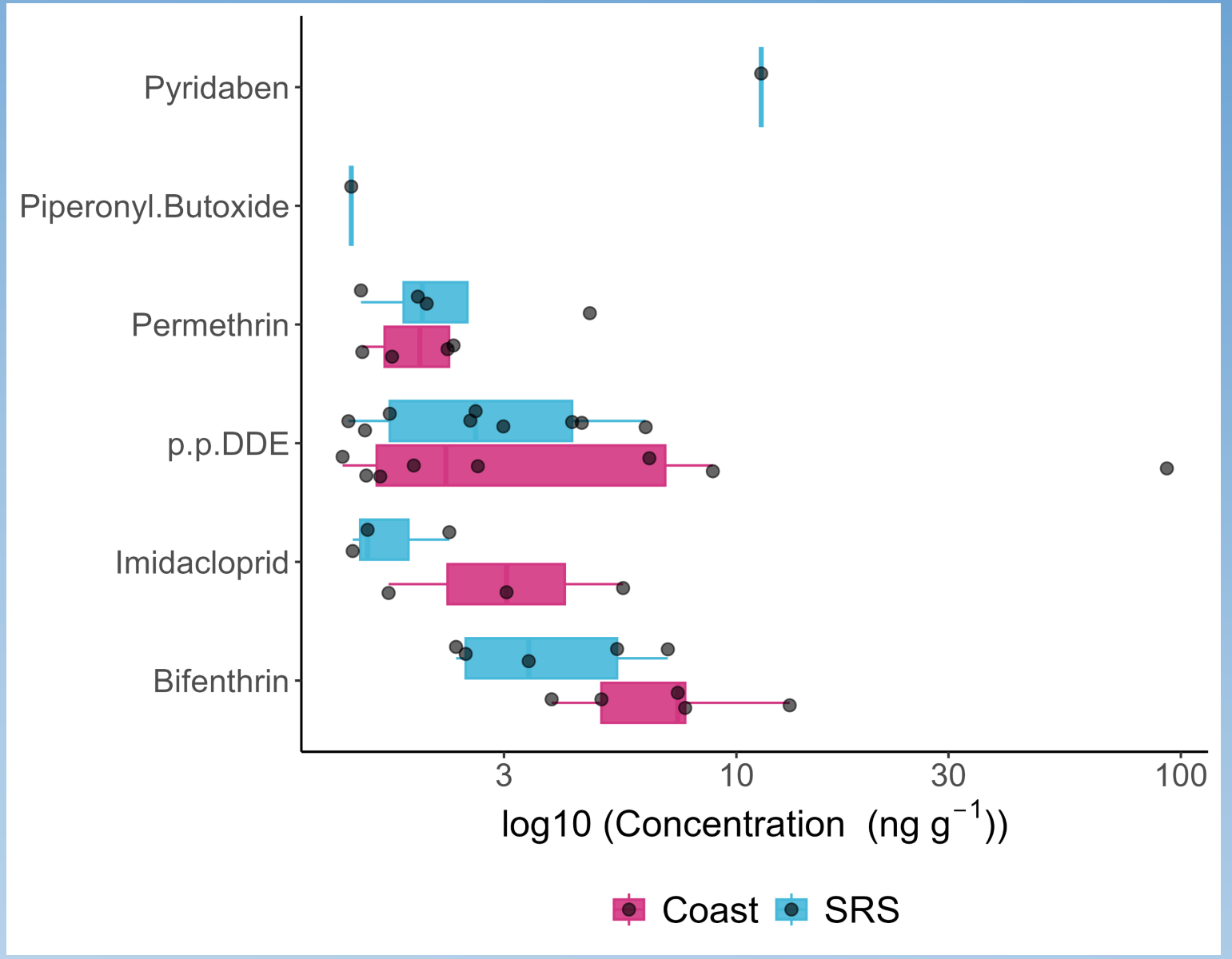
The scientists studied more than 4,600 Burmese and reticulated pythons on farms in Vietnam and Thailand.
Carol Lyn Parrish / Florida Fish and Wildlife via Flickr under CC BY-NC-ND 2.0 DEED

Ads by Google
Send feedback
Why this ad?

Preliminary Python Results

Pesticides found in 53% (31 of 58) of samples.

- 6 insecticide compounds
  - piper butoxide: 1.7%
  - pyridaben: 1.7%
  - imadacloprid: 10.3%
  - permethrin: 13.8%
  - bifenthrin: 17.2%
  - p,p'-DDE: 29.3%



USGS

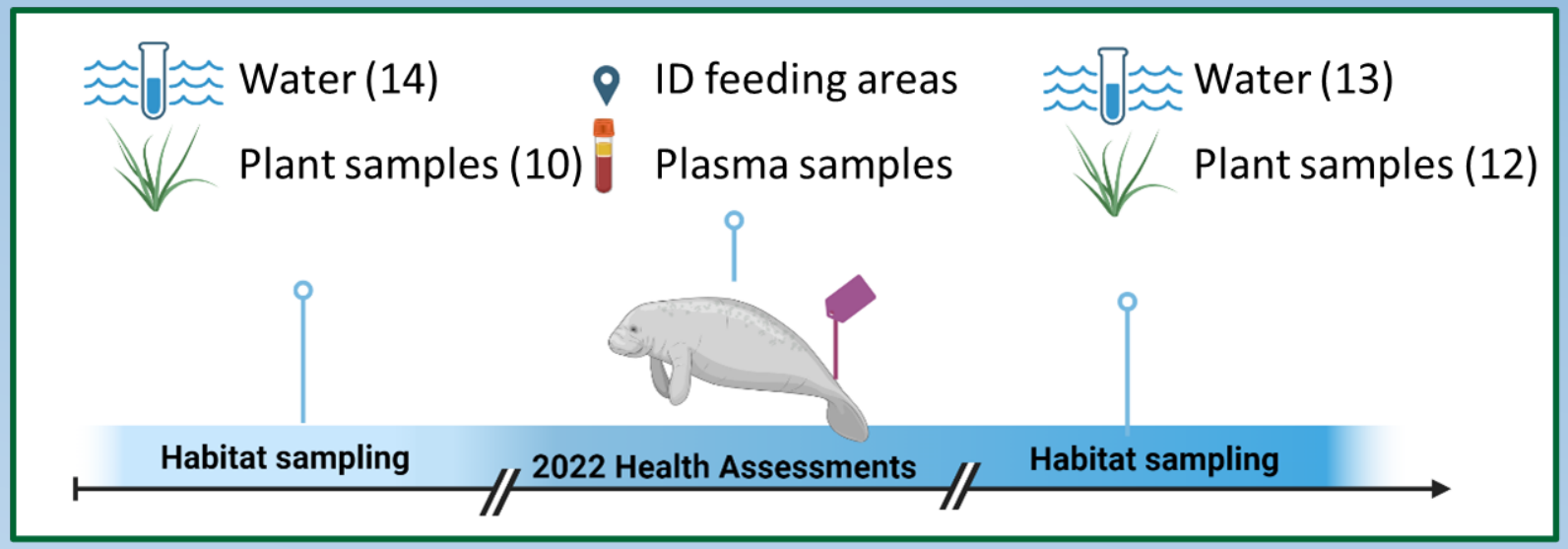
Assessing Manatee Exposure to Pesticides

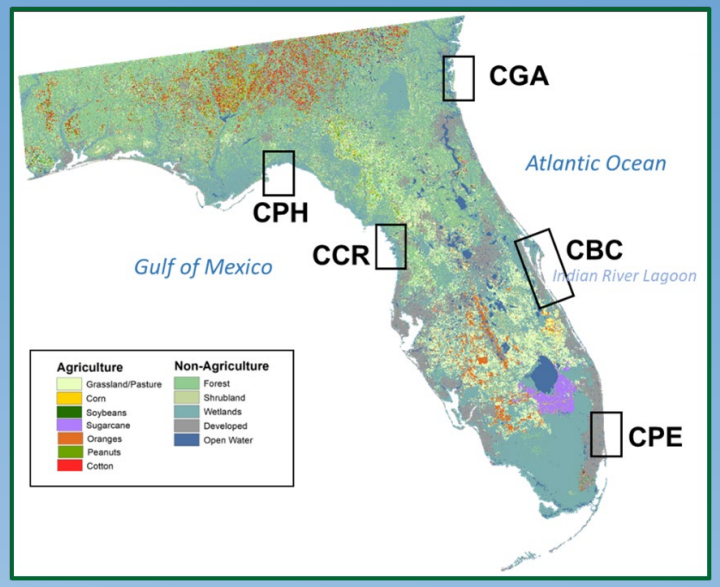
Pesticides detected in manatee plasma and habitat

- Water > sea grass > manatee plasma

Are pesticides limiting food sources for manatees? (indirect effect)

Does chronic exposure to pesticides alter immune response? (direct effect)





USGS

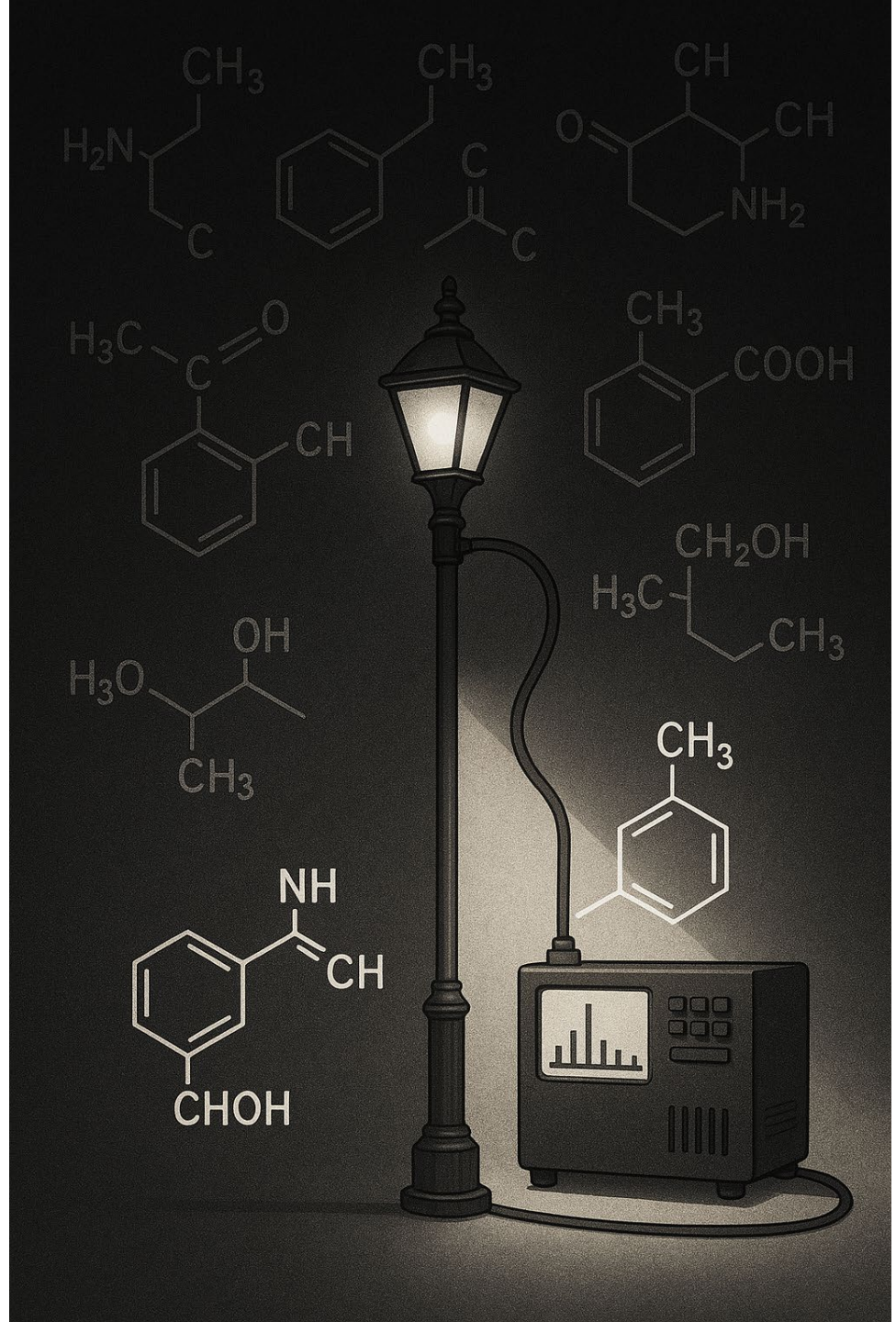
Contaminants of global concern related to plant and animal production emphasizes the potential challenges for restoration in the Greater Everglades, especially when considering the restoration efforts of natural water flow.

USGS

Questions?

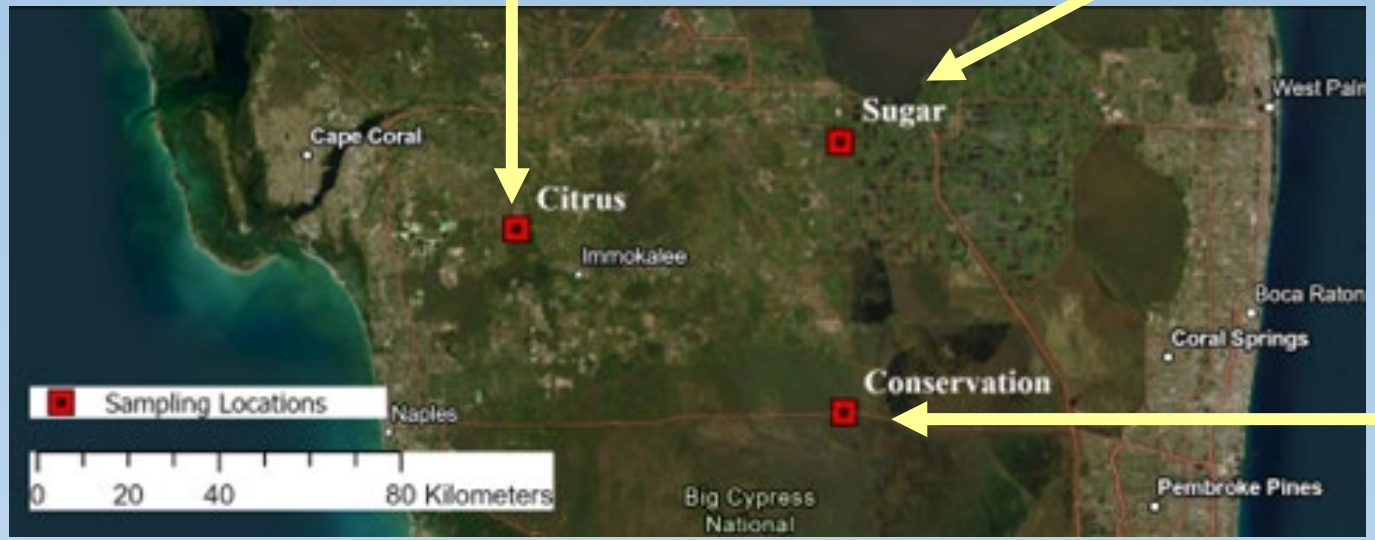
Maite De Maria

mdemariamulet@contractor.usgs.gov


CH3
H2N
C
CH3
C
C
CH
O
CH
NH2
H3C
C
O
CH
CH3
COOH
CH2OH
H3C
CH3
OH
H3O
CH3
CH3
NH
CH
CHOH

USGS

Pesticide Example



USGS

Florida Gulf Coast University

Pesticide Example : Summary Results

	Water (ug/L)				Bed Sediment (ug/kg)			
Stream site	T_hits	Sum C	AMPA	glyphosate	T_hits	Sum C	AMPA	glyphosate
Conservation	0	0	<0.02	<0.02	1	0.35	<1	<1
Storm water	5	10.8	<0.02	<0.02	2	0.91	296	<1
Citrus	16	487	5.63	1.81	8	11	129	86.7
Sugar Cane	8	101	0.188	0.475	2	0.74	24.3	44.0

USGS