

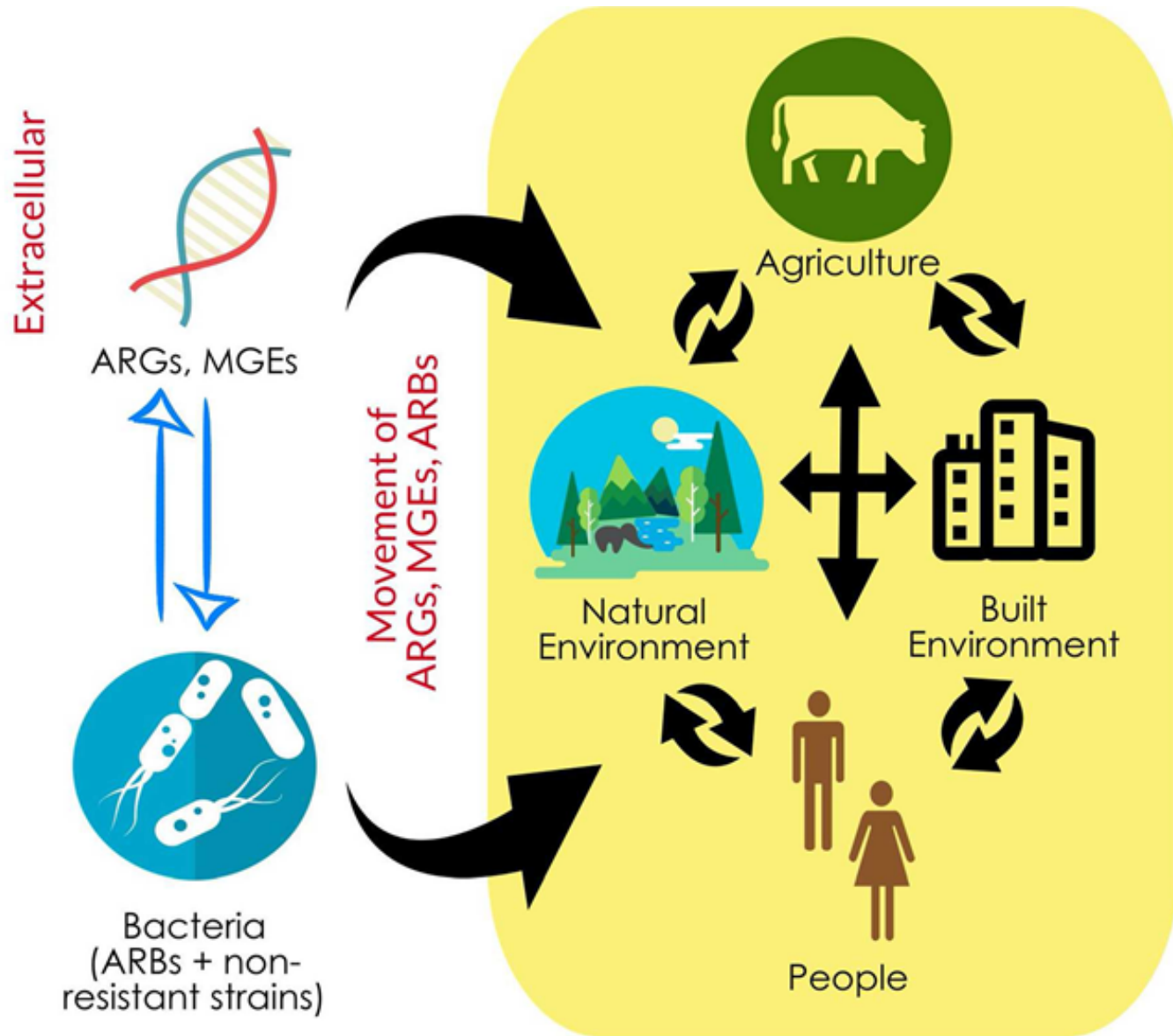


# NARMS Surface Water Pilot Overview

Jay L. Garland, Ph.D. Research Scientist  
US EPA Office of Research & Development  
[Garland.jay@epa.gov](mailto:Garland.jay@epa.gov)

National Institute for Animal Agriculture  
November 4, 2020

# The Challenge



# The Response

## Initiatives for Addressing Antibiotic Resistance in the Environment: *Current Situation and Challenges*

<https://wellcome.org/sites/default/files/antimicrobial-resistance-environment-report.pdf> (2018)

- **Environmental waters one of the areas in the report**
  - Geospatial distribution of resistance to inform risk
  - Sources & selective pressures for amplification/transmission
  - Define & standardize sampling/analysis methods

“Following the NARMS Review Subcommittee recommendations to incorporate the three major domains of the One Health model (humans, animals, environment), an important theme of this strategic plan is the expansion of testing to examine resistance in animal pathogens and the environment. For environmental monitoring, what constitutes the best sampling points will be refined over time. Surface waters as confluence points of ecosystems differentially affected by built environments is a starting point.”

NARMS Strategic Plan 2020-2025

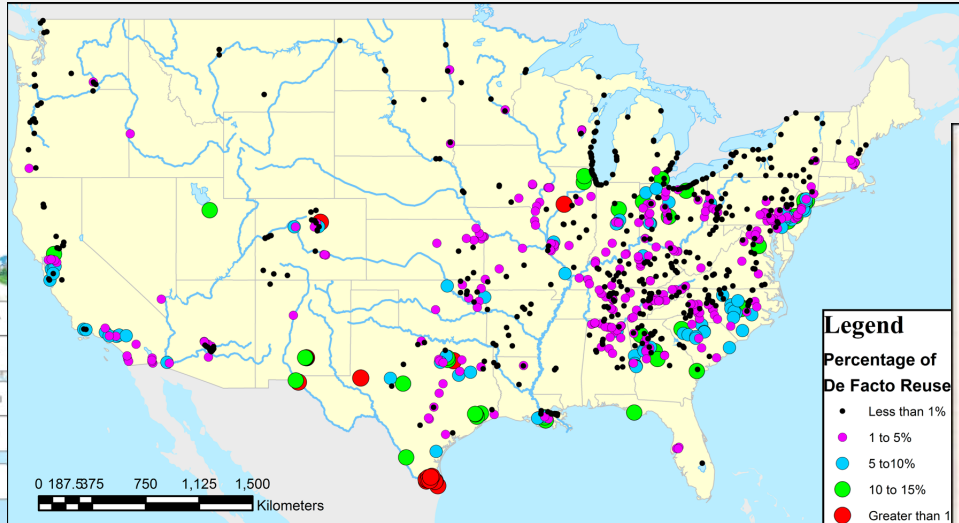
# Surface Water AMR Monitoring (SWAM)

## *Objectives*

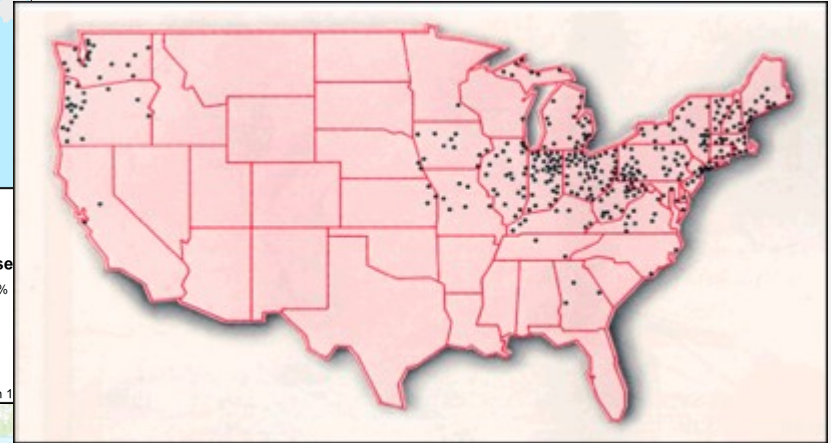
- A pilot environmental effort within a One Health focused NARMS
- Develop a national-scale, quantitative assessment of AMR within surface water:
  - A. Standardized measure (and library of samples) to monitor trends as part of NARMS
  - B. Input to models of AMR risks for various end uses of water (recreational, drinking, agricultural, water reuse).
  - C. Help quantify drivers of occurrence and selective pressures for potential amplification
  - D. Identify critical control points and assess current and new mitigation strategies

# Why Water?

Rice J. and P. Westerhoff. 2015. Spatial and temporal variation in de facto Wastewater reuse in drinking water systems across the USA ES&T 49, 982



## Human Wastewater



## Animal Manure

<https://enviroatlas.epa.gov/enviroatlas/DataFactSheets/pdf/ESN/Manureapplication.pdf>

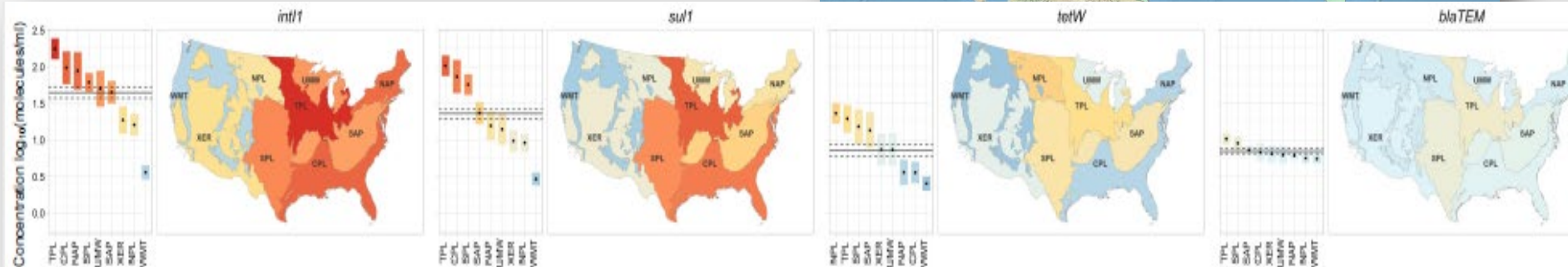
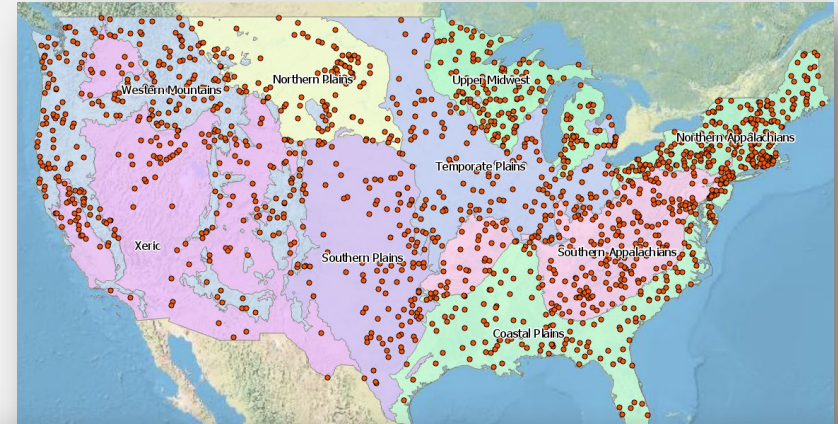
# Multiple Inputs to Watersheds



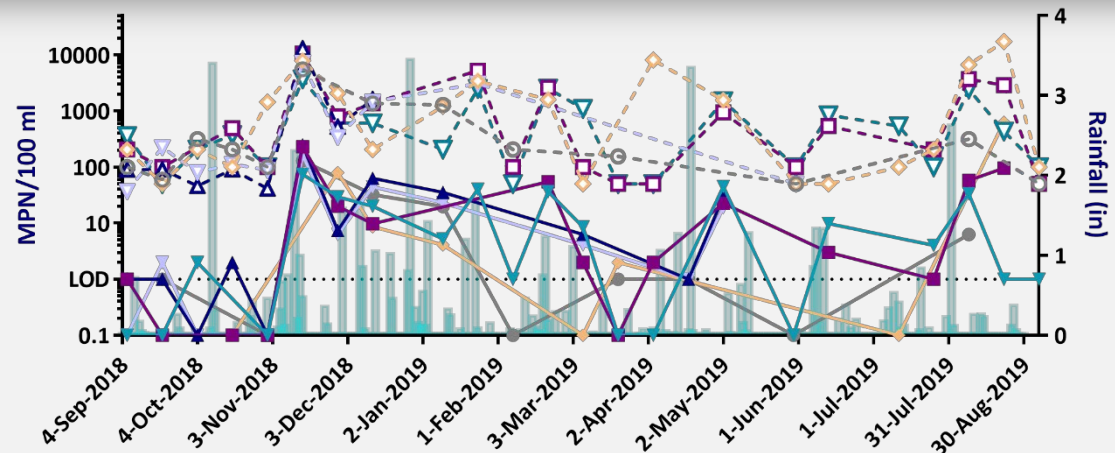
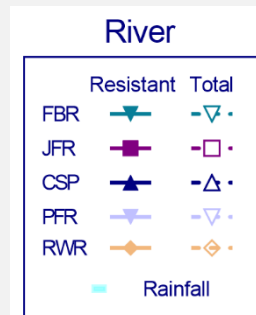
# Designing the Study

## *Go Big and Slow?*

**EPA National Rivers and Streams Assessment**  
5 year, probabilistic survey of aquatic resource



## *Or Small and Fast?*



# Analytical Targets

There is a need for rigorous QA/QC in data collection, as well as agreement in the community regarding standardized methods and reporting. Until priority monitoring targets are agreed on, analysis of a suite of culture-based and molecular based indicators is logical

Pruden et al. 2018 *Environmental science and engineering framework for combating antimicrobial resistance*

## Culture

*Enterococci, E.coli*: links to existing water method

*Salmonella*: links to NARMS, food cycle

## Targeted Gene

Quantitative measure

Defined panel, including fecal source trackers

## Metagenomics

Deeper view

Link resistance genes to hosts?

# *Timeline*

