

One Water and Public Health: Research to Action through Outreach and Education

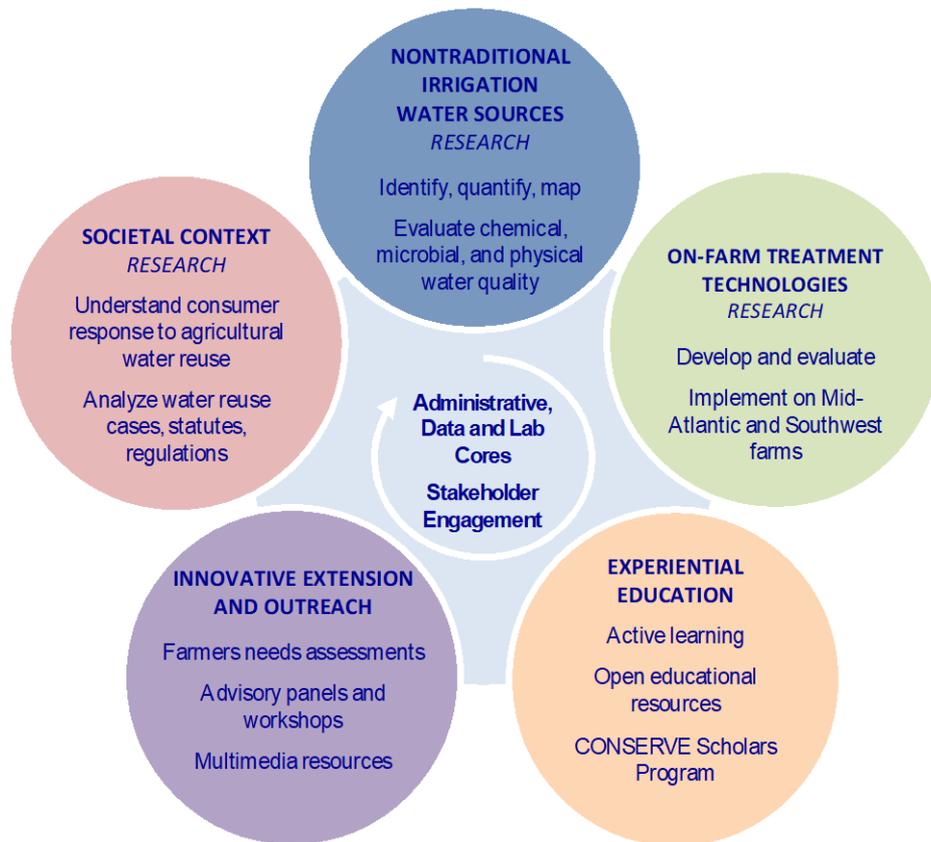


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Our Mission: To facilitate the adoption of transformative on-farm water treatment solutions that enable the safe use of nontraditional irrigation water on food crops.

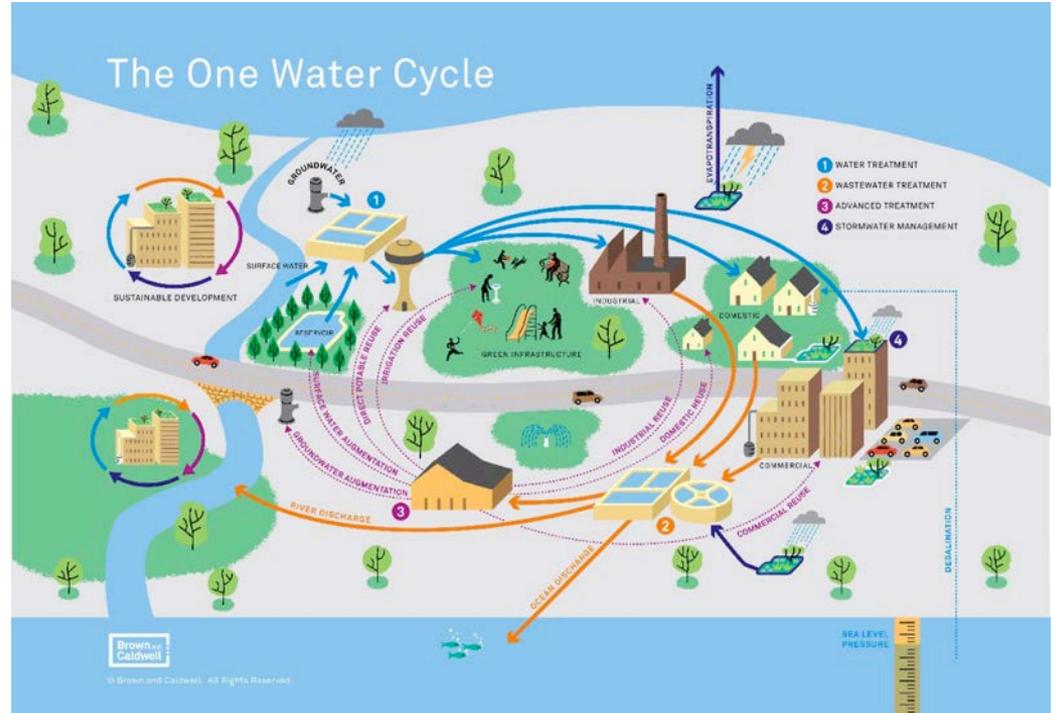


ONE WATER APPROACH

“All water has value—drinking water, wastewater, stormwater, and everything in between—and should be managed in a sustainable, inclusive, integrated way.”

Water

- One of the most important bacterial habitats on the planet
- Reservoir of antibiotic resistance genes
- Pathway for disseminating bacteria and genes between animal and human populations and varying environments



“Source water protection” for all water types is critical

THE DIVERSE MICROBIOME AND ANTIBIOTIC RESISTOME OF WATER



JESSICA CHOPYK

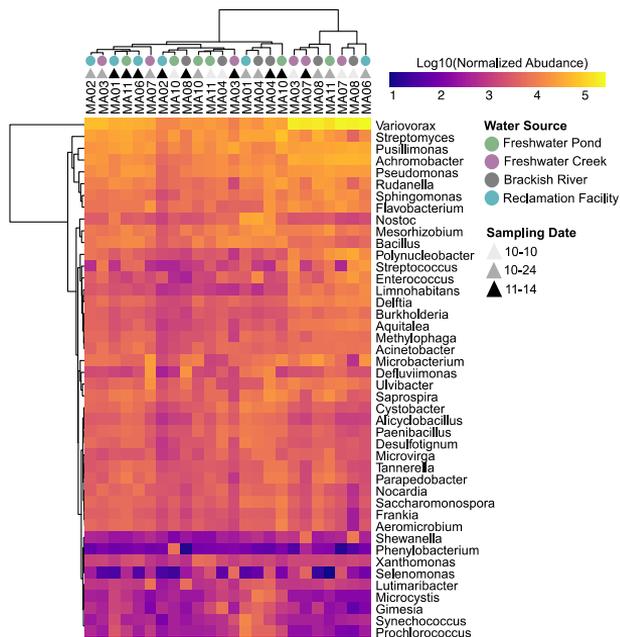


Figure 2: Taxonomic heatmap of the bacterial communities present in reclaimed and untreated surface water sites at each sampling date. Heatmap based on the log-transformed normalized abundance of the most dominant genera (>1% in at least one sample). Normalized abundance measured as contig coverage divided by the sum contig coverage per million.

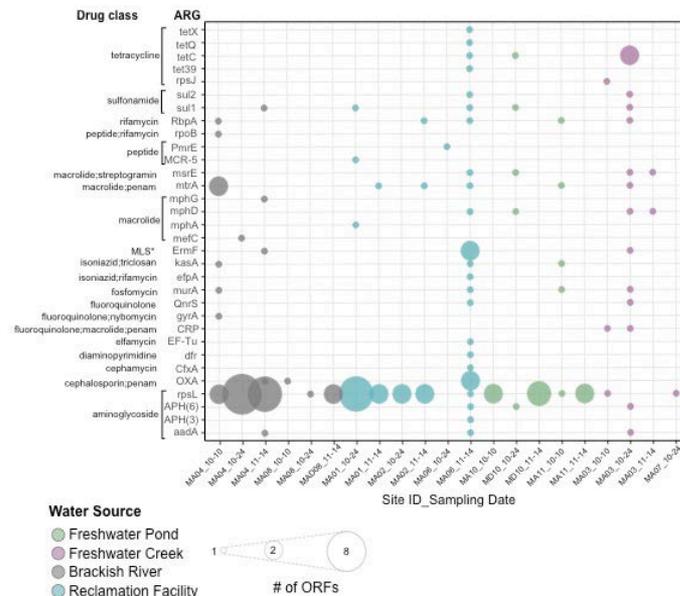


Figure 4: Antibiotic resistance genes (ARGs) predicted in reclaimed and untreated surface water sites at each sampling date. Dotplot showing the ARG-like ORFs present at each water site, with the size of each dot equivalent to the number of ORFs with homology to each ARG listed on the y-axis, and the color representative of the water type. *MLS: macrolide, lincosamide, streptogramin antibiotic.

Pathogens cultured from the same samples



Genome Trakr

ANTIBIOTIC CONCENTRATIONS IN RECLAIMED WATER AND POND WATER



SURAJ PANTHI

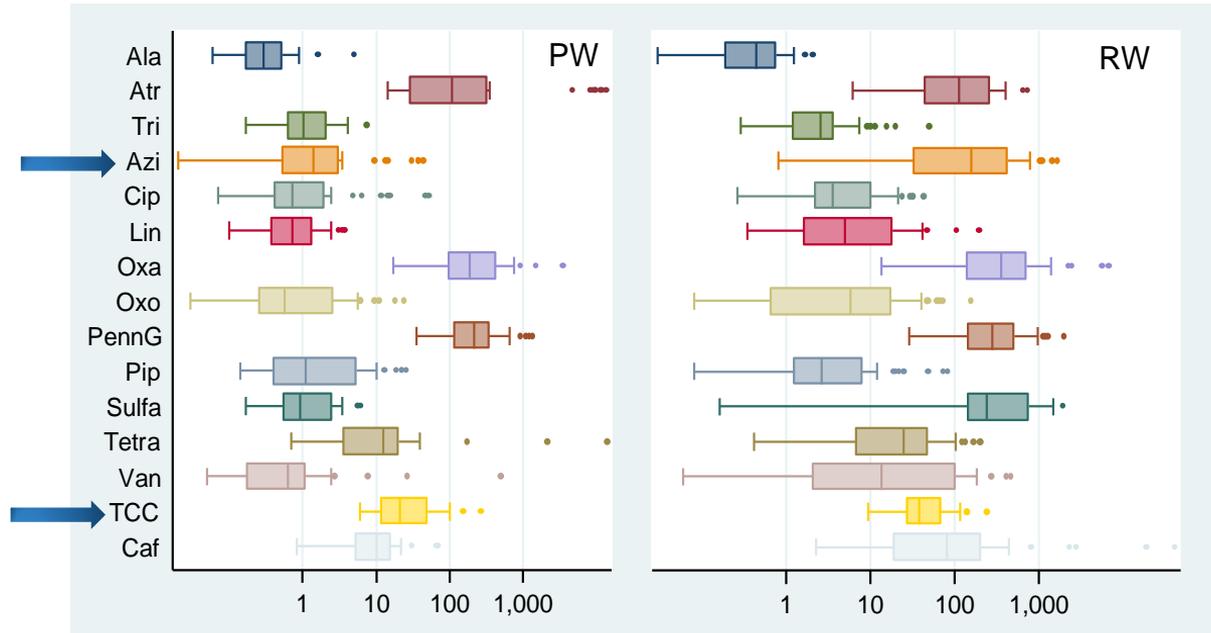
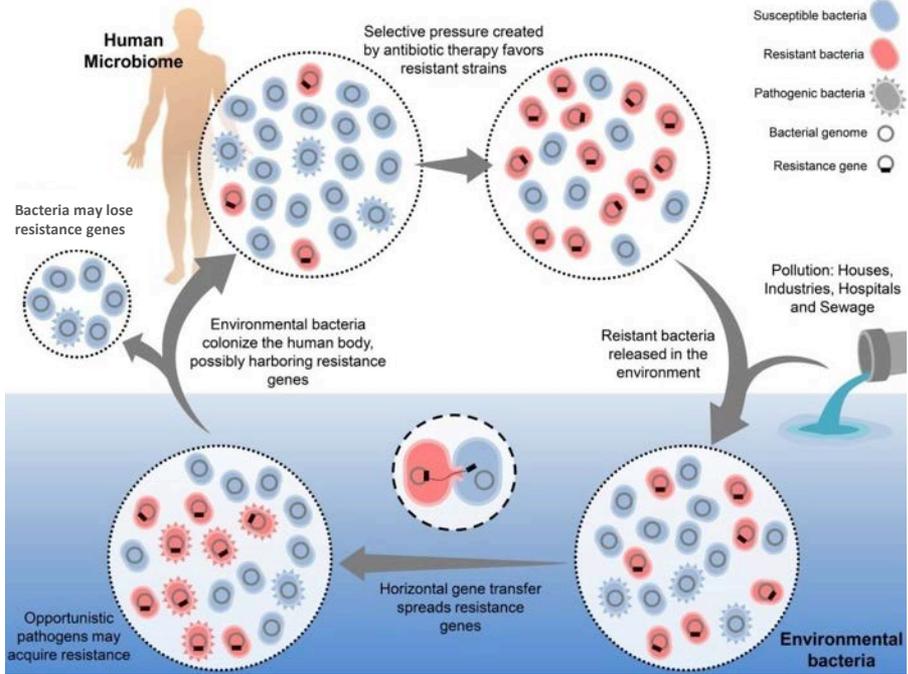


Figure 1: Concentrations of antibiotics, herbicides and caffeine in pond water and reclaimed water (ng/L). PW=pond water; RW=reclaimed water. Ala=alachlor; Atr=atrazine; Tri=triflurin; Azi=azithromycin; Cip=ciprofloxacin; Lin=linezolid; Oxa=oxacillin; Oxo=oxolinic acid; PennG=penicillin G; Pip=pipemidic acid; Sulfa=sulfamethoxazole; Tetra= tetracycline; Van=vancomycin; TCC=triclobarban; Caf=caffeine.

POTENTIAL PATHWAYS FOR THE TRANSFER OF ANTIBIOTIC-RESISTANT BACTERIA BETWEEN WATER AND HUMANS



HUMAN EXPOSURE PATHWAYS



LAKES, RIVERS, GROUNDWATER, WASTEWATER



ANTHROPOGENIC SOURCES

Adapted From: Ahmad I and Ahmad M. 2013. Perspectives in Water Pollution. Chapter 1: Antibiotic Resistance in Aquatic Environments of Rio de Janeiro, Brazil, by Coutinho et al. ISBN 978-953-51-1076-7.

OUTREACH AND EDUCATION: BUILDING A WATER CULTUR



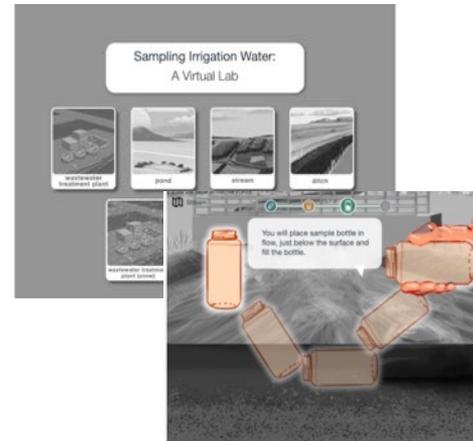
- Outreach to agricultural communities and the general public
- Engagement with policy makers and regulators
- Education
 - Training the next generation in systems thinking and team science
 - CONSERVE Scholars Program
 - UMD Global STEWARDS NSF National Research Traineeship (NRT) program
 - Interdisciplinary research and team science at the Food-Energy-Water nexus
 - Emphasis on increasing the number of women and underrepresented minorities in STEM fields
 - Preparation for diverse career pathways



[Water, Food and Our World](#)



[Humans and Food Are Part of the Water Cycle](#)



Virtual Water Sampling Lab



UMD Global STEWARDS
Inaugural 2019 Cohort

RECOMMENDATIONS FOR NATIONAL ACTION PLAN FOR COMBATING ANTIBIOTIC-RESISTANT BACTERIA

○ Needed Research

- Role of water (e.g. wastewater, recreational water, drinking water) in the transfer of resistant bacteria to humans and subsequent impacts on the human microbiome and human health (Objective 4.1)
- Include questions on water-related exposures to existing CDC surveillance efforts (Sub-Objective 2.4.1)

○ Needed Action

- Incorporation of One Water perspectives
- Source water protection for all water types, including wastewater
 - Reducing amount of antimicrobials disposed down the drain
 - Strengthening the FDA 2017 ban on triclosan, triclocarban and other antimicrobials (currently limited to over-the-counter antibacterial hand and body washes; does not include toothpaste and other personal care products)
 - As part of State Antibiotic Resistance (AR) Prevention (Protect) Programs, initiate consistent programs for consumers to return unused drugs to pharmacies, and employ targeted messaging about protecting water sources and how this can improve public health

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