RHODE ISLAND WATER RESOURCE CENTER

RIWRC supported **four** research projects, **three** outreach and professional development activities.

TOTAL RESEARCH EXPENDITURES

2021-2022

$260,000

Four

Graduate students SUPPORTED

2021-2022

OVERALL RESEARCH EXPENDITURES

2012-2023

$3.3M

The RIWRC supports water resources technology, management, education, and communications innovation in Rhode Island.

Projects Supported by the Rhode Island Water Resource Center 2022-2023

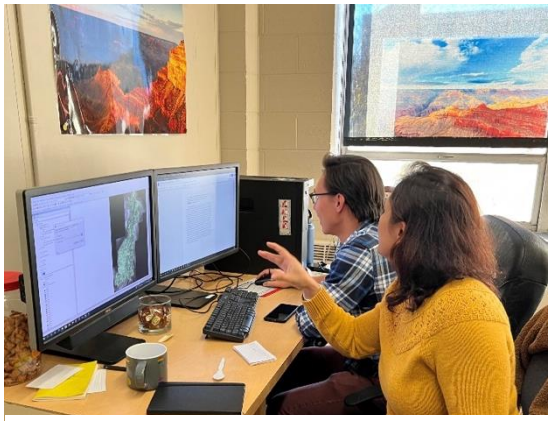
PFAS in Rhode Island Septic Systems

Dr. Alissa Cox, Clinical Assistant Professor and Graduate Student Owen Placido, College of the Environment and Life Sciences, University of Rhode Island.

Perfluoroalkyl substances (PFAS) are a wide range of human-made organic compounds. They are highly resistant to degradation and persist in the environment for long periods. PFAS are found worldwide in soil, air, water, and humans and animals. Even at low levels, they can harm human and animal health. We know that PFAS are present in various household items and food and water in small amounts, so the water that leaves our homes as waste contains these compounds. Centralized wastewater treatment plants release PFAS into the environment, but the contribution from onsite wastewater treatment or septic systems has yet to be understood entirely. In Rhode Island, much of our most crucial surface and drinking water resources are in areas where septic systems are used instead of sewers. These systems could be releasing PFAS back into these vulnerable areas. With this project, we aim to quantify the amount of several PFAS compounds in various RI septic systems so that we can begin to understand the total contribution of PFAS to the environment from residential wastewater.

1- Masters Student Owen Placido from the departament of Civil and Environmental Engineering collecting field water samples for his project.

Water Availability Assessment through the integration of hydrologic model and water management optimization tool for Chipuxet River Watershed, Rhode Island



2- Ian Tulungen (Graduate Student) and Prof. Soni M. Pradhanang working with the data produced during the project.

Dr. Soni M Pradhanang, Associate Professor, Graduate Student Ian Tulungen Department of Geosciences, University of Rhode Island. Collaborator: Rhode Island Water Resource Board.

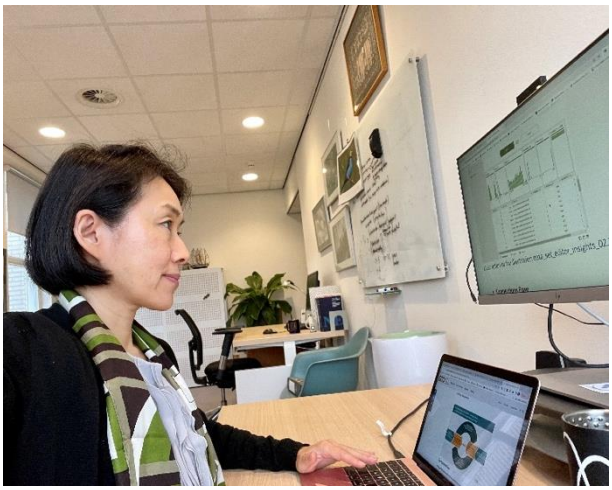
Water availability and scarcity have emerged as crucial water issues in Rhode Island and nationally. Demand projections suggest managing and conserving water and finding alternative water sources to support the ever-increasing water demand. In this study, we proposed evaluating past and future water availability by integrating hydrologic, groundwater, and management optimization models. Hydrologic model (ArcSWAT) and groundwater model (MODFLOW) model development have been

the focus of the past two months. A preliminary MODFLOW groundwater model has been completed for the Chipuxet Basin, RI. The initial model shows groundwater flowing toward Worden Pond in the Southwest region of the watershed. Two preliminary models were completed with successful runs at the end of October. With the successful completion of the models, the next steps in the project involve calibrating each model to the current conditions recorded in the watershed. The model output currently shows that the watershed is baseflow dominated. Though the initial ratio of 75% baseflow indicates, more calibration is needed with a focus on adjusting the effects of snow in all basins. Once calibrated, the hydrologic response units generated from the models will be roughly input into the WMOST model to assess current water use in the region. Further calibration of all three models will enable the input of climate change-affected reduction in precipitation and increased temperature numbers into all models. Those results will then be input into the validated water use WMOST model to show which aspects of the aquifer will be stressed when drought conditions affect the watershed. This will give us a better picture of how the watershed will respond to high water demand in peak withdrawal months during drought seasons.

Public perceptions and willingness to pay to mitigate microplastic fibers from the Narragansett Bay Watershed

Dr. Emi Uchida, Professor, Department of Environmental and Natural Resource Economics

Microplastic pollution in water is an emerging challenge for Rhode Island, putting its fishing industries and aquatic ecosystems at risk. This study focuses on microplastic fibers, one of the significant sources of microplastic waste in the Narragansett, which is released into the waterways when households and commercial firms wash synthetic fabrics. Mitigating microplastic fiber pollution from households will require cost-effective solutions and appropriate technologies—and perhaps the most challenging--people's willingness for behavioral change. To what extent is the public aware of microplastic fiber pollution's health and ecological impact? How much are people willing to pay for technologies to prevent microplastic fibers from getting into our waterways? Can we "nudge" people to adopt such technologies and wear products without microplastic fibers? To start investigating these questions, faculty and students in environmental economics at URI will design and implement an online survey and a social experiment. First, the survey aims to understand (i) public perceptions about where microplastic pollution comes from and its environmental and health impacts; (ii) preferences and willingness to pay (WTP) for technologies to filter microplastic fiber, as well as alternative products to synthetic fabrics to prevent microplastic pollution using hypothetical settings. Next, we will design and implement a social experiment to test whether we can "nudge" households toward behavioral change to address this problem. We will test whether these nudges will induce the public to mitigate plastic fiber "at the source" by purchasing products with less plastic fiber or to minimize the pollution "at the pipe" by buying and using washing



3- Professor Emi Uchida working at the lab with the data collected for the project.

machine filters in their homes. The results are expected to provide rigorous empirical evidence of the effectiveness of the nudges. In addition, it will provide credible estimates of WTP for preventive technologies and substitute products. Combined, the findings will provide valuable insights for policymakers, industries, and the public about new technologies, alternative products, and public policies to mitigate microplastic fibers from our waterways.

URI Engineering Analytical Core

Dr. Vinka Oyanedel Craver, Civil and Environmental Engineering. Graduate Student Nicoly Welter, Department of Civil and Environmental Engineering

The RIWRC also supports a graduate student to assist the center's director and coordinate the Engineering Analytical Core operations. This facility provides analytical support to several researchers working on RIWRC-funded projects and others addressing pressing water issues. Nicoly Welter, a graduate student, coordinates activities in the facility and plans training sessions for new and advanced users. She mentions that

"Working at the Engineering Analytical Core, I have the chance to work with instruments and techniques that I have never before. It certainly added a lot to my engineering expertise. It has been a great experience."

We would also like to thank the graduate student Tania Oliveira from the Department of Chemical Engineering for her excellent work in the past semesters at the Engineering Analytical Core.

Products 2021-2022

- Nusrat, F., Haque, M., Rollend, D., Christie, G. and Akanda, A.S., 2022. A High-Resolution Earth Observations and Machine Learning-Based Approach to Forecast Waterborne Disease Risk in Post-Disaster Settings. *Climate*, 10(4): 48.
- Wagner, F., Nusrat, F., Thiem, L. and Akanda, A.S., 2022. Assessment of Urban Water-Energy Interactions and Heat Island Signatures in Rhode Island. *Energy Nexus*, 7, p.100093.
- Panthi, J., Pradhanang, S.M., Nolte, A., Boving, T.B., 2022. Saltwater intrusion into coastal aquifers in the contiguous United States — A systematic review of investigation approaches and monitoring networks. *Sci. Total Environ*., in review.
- Davies, AJ, Suckling, CC, Davis, S. 2022. Rhode Island Sea Grant Coastal State Discussion Series, *Marine Plastic Pollution in Narragansett Bay*.
- Dunn, M., Becanova, J., Snook, J., Ruyle, B., & Lohmann, R. Calibration of perfluorinated alkyl acid uptake by a novel tube passive sampler in water. *In preparation.*
- Dunn, M., Vojta, S., Becanova, J., Pickard, H., & Lohmann R. Seasonal and source dynamics of perfluorinated alkyl substances (PFAS) in an estuary impacted by textile mills. *In preparation*.