Sustainability and Resilience Adaption Laboratory

Department of Civil and Architectural Engineering, University of Miami

MIAMI

SUREAL

The SUREAL Engineering Lab strives to create innovative, next-generation concepts and designs helping at-risk communities combat stressors due to climate change. Our solutions are practical, affordable and include the following focus areas: (1) *Fundamental & Applied Research*, (2) *Innovative Designs*, and (3) *Public Education &Workforce Development*.

Our Team

Dr. Esber Andiroglu
Ph.D., LEED AP, PE
Principle Investigator

Dr. Qiufeng Lin
Postdoctoral Associate
Innovative Water Treatment and Water Reuse Technology

Mr. Austin Perry
Ph.D. Student
Disaster Management, Workforce Development, and Onsite Wastewater Management Design

Mr. Drew Rich
Ph.D. Candidate
Building Supply Systems, Water Reuse, and Regression and Analysis on Water Consumption Patterns

Ms. Kyrah Williams
Ph.D. Student
International Green Building Code and Water Savings in the Built Environment

Ms. Nina Jean-Louis
Ph.D. Candidate
Cultural Landscape Resilience, Heritage Sites, Climate Adaptation, Reliability Engineering

Missions

To advance global resilience by developing integrative, data-driven models that reduce uncertainty in decision-making, enabling effective climate mitigation, adaptation, and recovery. Through strategic outreach and collaborative partnerships, we aim to deliver scalable solutions for a more sustainable and prepared future.

Research Fundings & Collaborative Partners

Office of Resilience and Sustainability

NORTH BAY VILLAGE EST. 1945

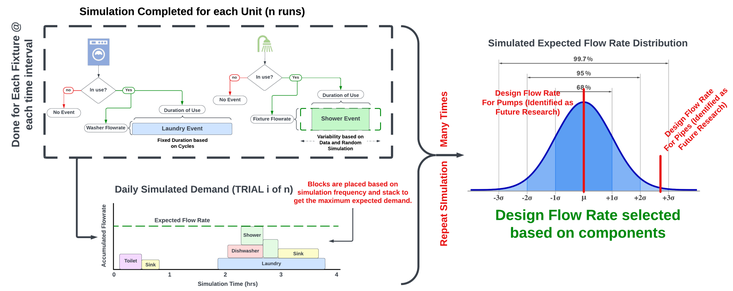
ICC INTERNATIONAL CODE COUNCIL®

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

MIAMI-DADE COUNTY

The Development of an International Computational Framework to optimize and Size Premise Plumbing Systems

The methodology used for sizing premise plumbing systems has remained largely unchanged since the early 1940s. Despite more than 80 years of innovation, evolving water use behaviors, and regulations that have significantly reduced fixture flow rates, current sizing practices still rely on outdated assumptions. The purpose of this research is to develop an international, network-based pipe sizing framework using stochastic simulations that more accurately reflect the structure and dynamic behavior of modern plumbing systems.



System diagram of stochastic simulation

Meeting the Demands of a Resilient and Sustainable Future through Education Outreach and Innovative Workforce Development Programs

This program blends classroom lessons with apprenticeships to speed entry-level workers into the skilled trades. Active faculty research—ranging from resilient materials to applied strategies—is embedded in every module, so apprentices practice tomorrow's techniques while they learn.

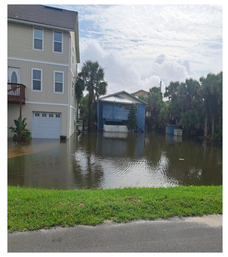
Graduates leave with certifications grounded in current data, supplying industry with job-ready technicians who can deliver smart, resilient infrastructure from day one.

University of Miami Project Management Apprentices (2024)

ICC 825 - Critical Infrastructure Building Standards Updates

The ICC 825 revision incorporates peer-reviewed resilience science and global field evidence into the International Code Council's onsite wastewater guidance. It adds scalable performance bands—covering hydraulic loading, nutrient removal, pathogen control, and climate-stress hardening—so communities can grow from basic low-capacity systems to advanced modular units as resources permit. Aligned with the university's research priorities, this standards work positions OSWT as a science-driven bridge between today's realities and tomorrow's needs.

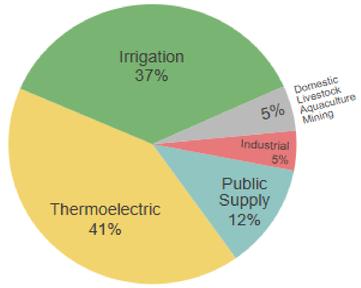
A Mix-Methods Approach in Assessing Cultural Landscape Resilience



Flooding challenges within the American Beach Landscape

Despite the pivotal role communities play in shaping, managing and sustaining cultural landscapes, efforts to quantify cultural landscape resilience remain limited and often overlook the inclusion of co-produced community assessments. To address this gap, new transdisciplinary approaches are needed. Proposed is the integration CBPR, reliability engineering and data visualization strategies to develop a composite resilience index assessing the capacity of cultural/natural assets and systems to withstand and adapt to identified climate-induced hazards.

Combatting Water Scarcity through Water Conservation Practices

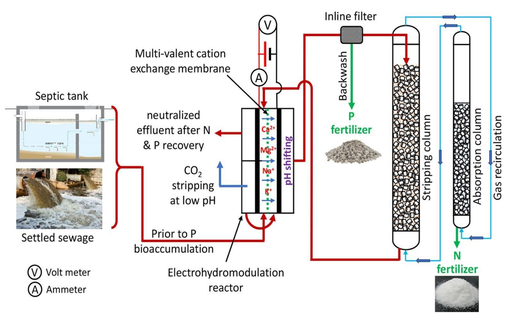


Water use by sector from U.S.G.S. (2015)

This research's intent is to evaluate water consumption in each building typology, potential areas of reduction through end-user strategies and source augmentation and maximize the potential aggregate of water savings for each city. The outcomes will assist in accomplishing the need to reduce water usage and meet water demands for each sector.

Chemical-Free Nutrient Recovery: Next-Generation Energy-Positive Water Treatment

Our team is piloting a residential-scale electrohydromodulation (EHM) system to recover nitrogen and phosphorus from septic tank effluent through chemical-free electrochemical pH adjustment. This initiative addresses national priorities by supporting agricultural nutrient supply, reducing wastewater treatment energy demand, and mitigating septic system failures in coastal regions impacted by climate change.



Continuous-flow nutrient recovery apparatus