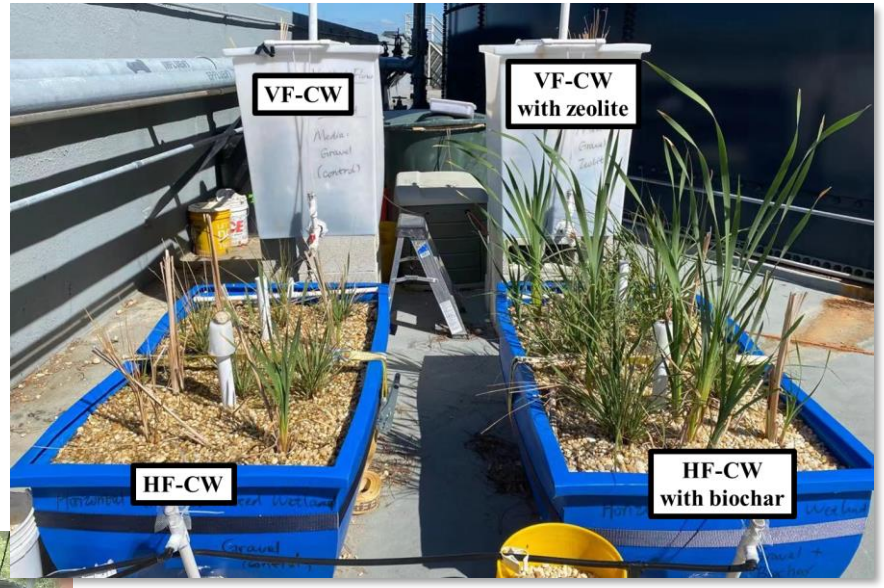
Sarina Ergas Environmental Biotechnology Research Group

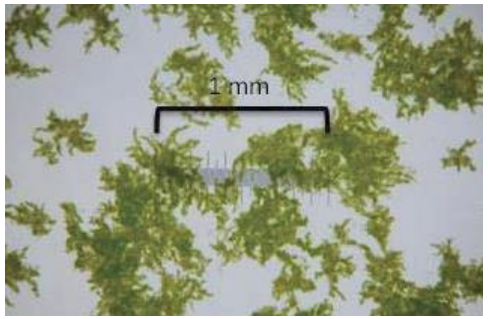
- Integrated multi-trophic aquaculture systems.
- Bioenergy production from brewery wastes.
- Hybrid Adsorption Biological Treatment Systems (HABiTS) for wastewater nutrient removal.
- Hybrid constructed wetlands for landfill leachate.
- Low impact development technologies for urban and agricultural runoff management.
- Modified biosand filters for fluoride and pathogen removal.



Landfill leachate wetlands amended with zeolite and biochar.

Rain Gardens in East Tampa

Pilot-scale bioreactor construction.



Algal-bacterial flocs.

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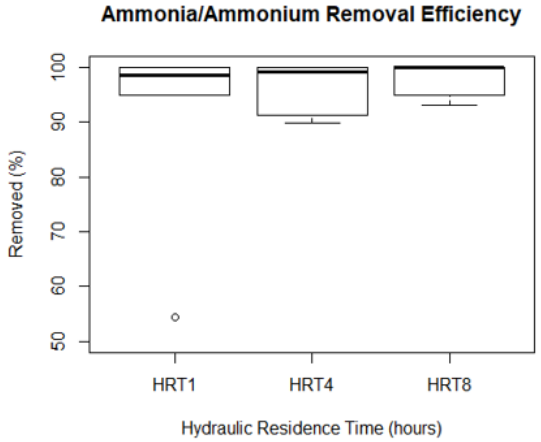
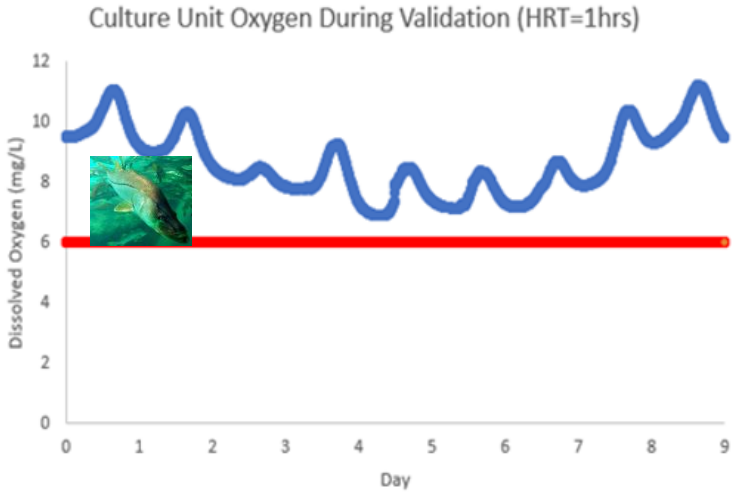
Adam Bell, Kevan Main (Mote Aquaculture Research Park, PI)

Hydraulic Regimes of an Aquaculture Periphyton Biofilter

Research Question: How do changes in the hydraulic regime effect the periphyton biomass, water quality, biological nutrient removal, and mass transport of a stand-alone periphyton biofilter?

Methods: design, build, operate system,
daily dosing,
tracer and flow study,
periphyton biomass,
water quality, data analysis





Results

High HRTs: low mixing, denitrification/assimilation, anoxic, nitrification

Low HRTs: mixing, short circuiting, oxic, nitrification

Graduate Assistantships in Areas of National Need (GAANN)

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Rachael Cooper, Mahmood Nachabe (co-PI)

Watershed Management for Nutrient Control

Lake Okeechobee → Taylor Creek

EPA

Ongoing & Future Research through USF's EPA HAB Project

How can nutrient management technologies control harmful algal blooms in Lake Okeechobee?

Task 1: *Technology & BMP Evaluation*

How does the sustainability of technologies across different pollution sources compare?

Task 2: *Emerging Technology Scale-Up*

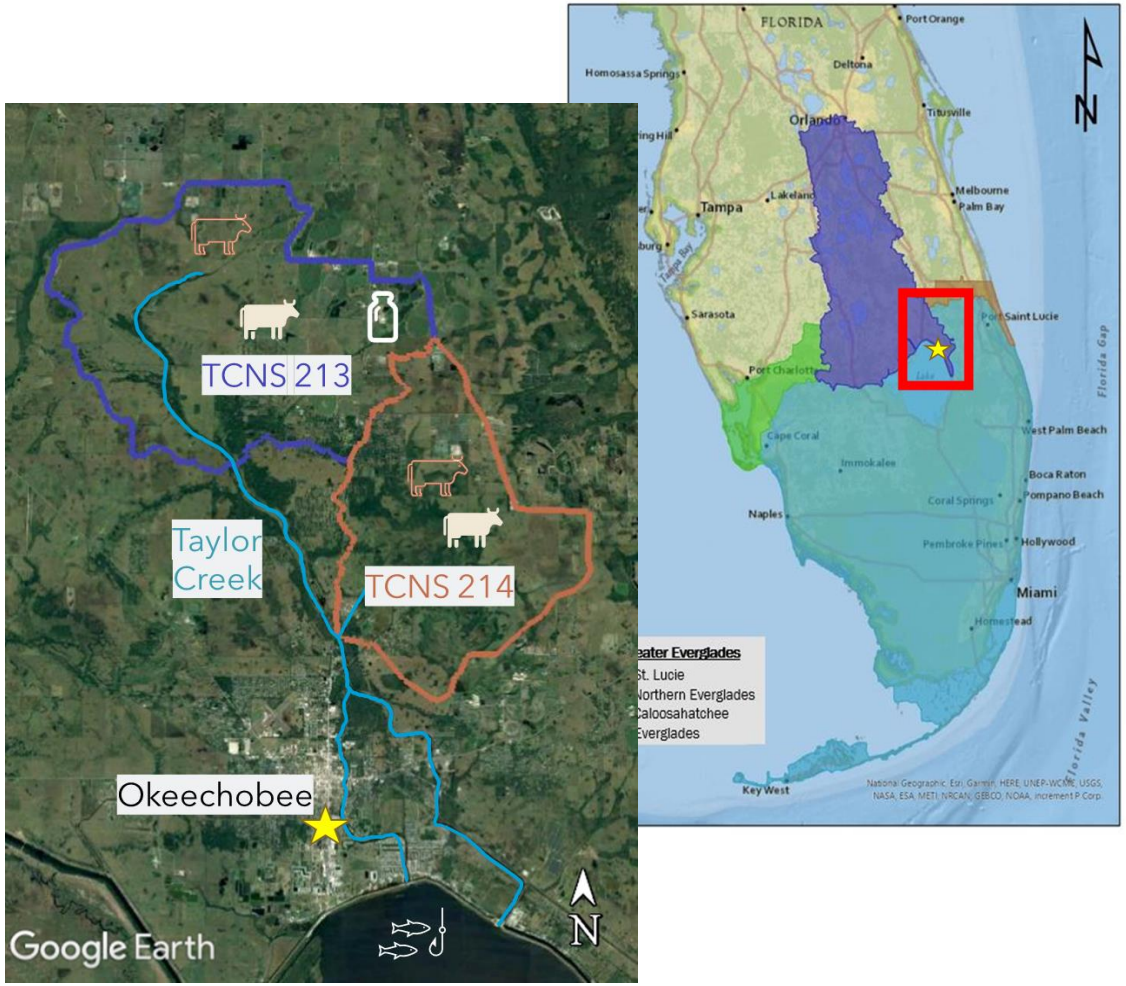
What is required for new technology to be implemented?

Task 3: Algae Production Prediction (Watershed & Lake Model)

Task 4: Decision Support Optimization Modeling

My Current Investigation

Reflecting on historical water quality trends (N & P) and watershed management practices at 2 sub-basins in Taylor Creek.



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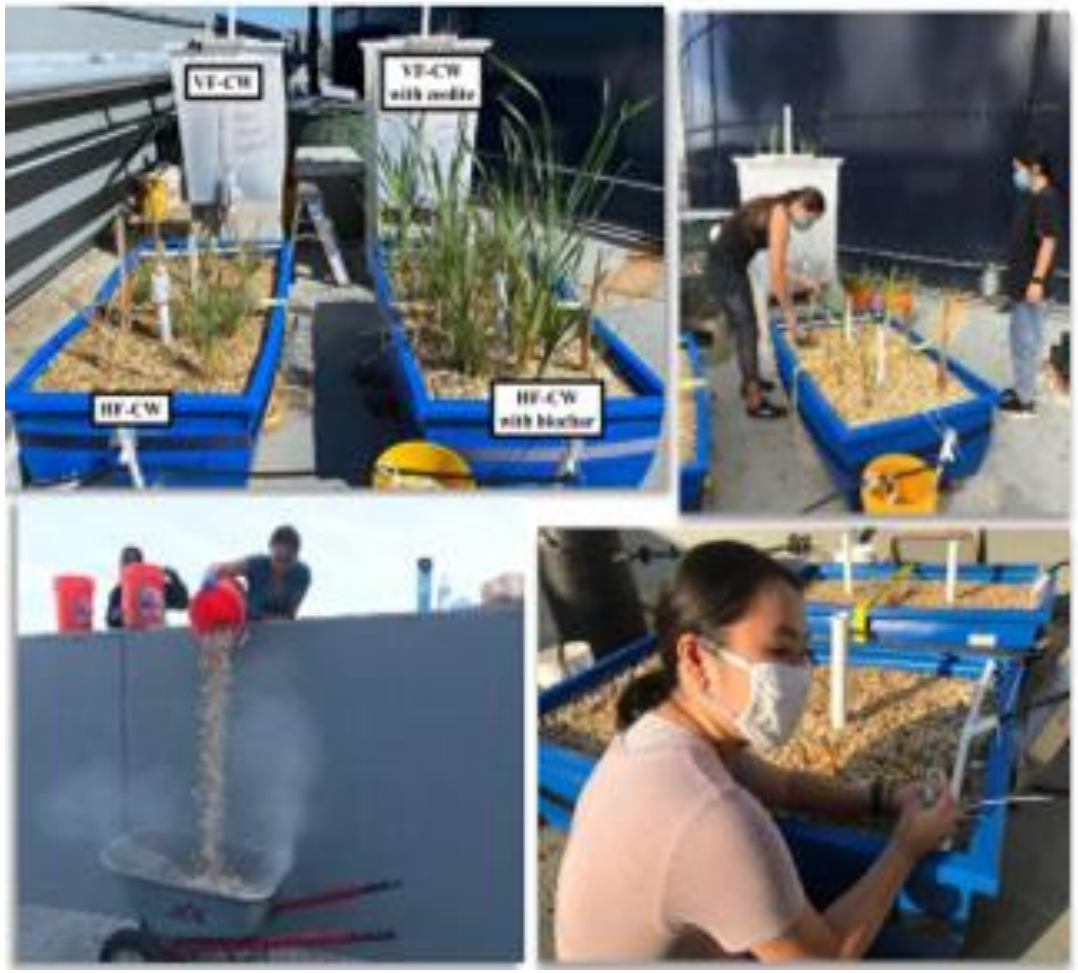
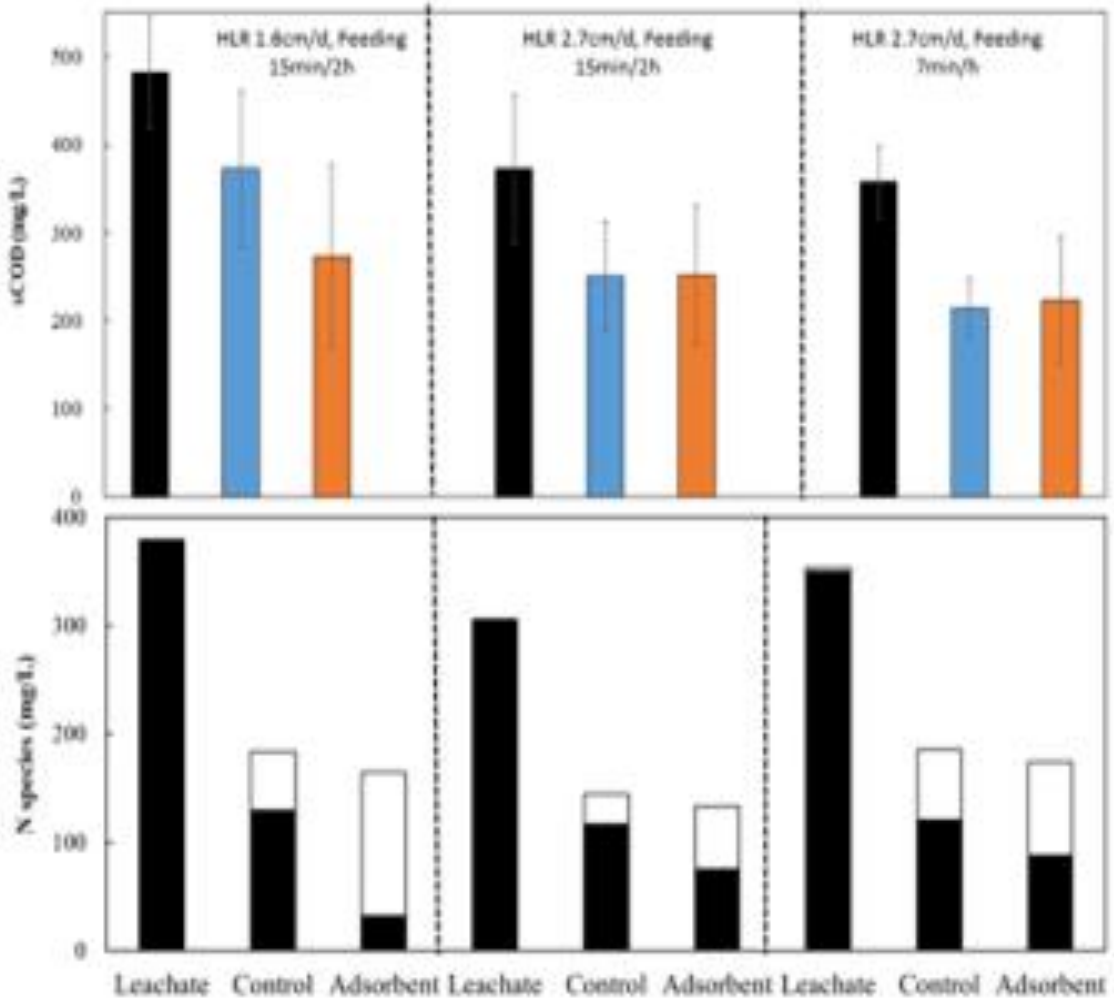
Xia Yang, Thanh Lam, Lillian Mulligan, Mauricio Arias (PI)

Hinkley Center
for Solid and Hazardous
Waste Management

Treatment of Landfill Leachate Using Adsorbent Amended Hybrid Constructed Wetlands





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Joshelyn Guimaray, Lexi Fink, Kebrab Ghebremichael (co-PI)

Modified Biosand Filters Using Aluminum Hydroxide Coated Media for Fluoride Removal

THE JOY MCCANN FOUNDATION

Objectives

1. Compare different types of support media in batch and column studies.
2. Investigate potential to recoat media after breakthrough
   a. Adsorption capacity for recoated media

Parameters Measured

1. Fluoride
2. Turbidity
3. UV254
4. Aluminum
5. pH
6. Flux
7. *Escherichia coli (E. coli)*

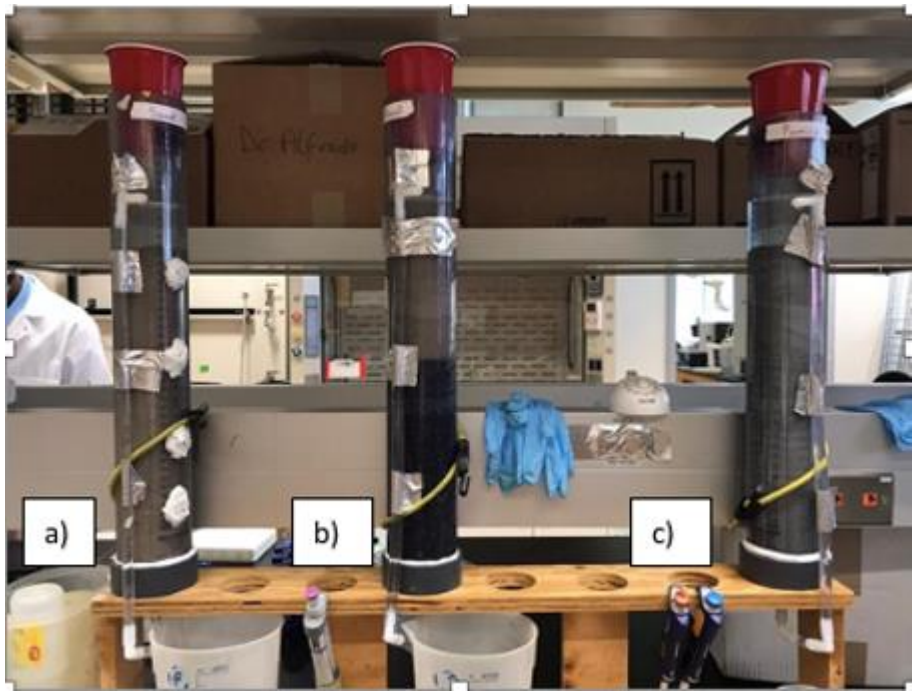

Figure1. a) uncoated sand - control, b) aluminum coated biochar, c) aluminum coated pumice

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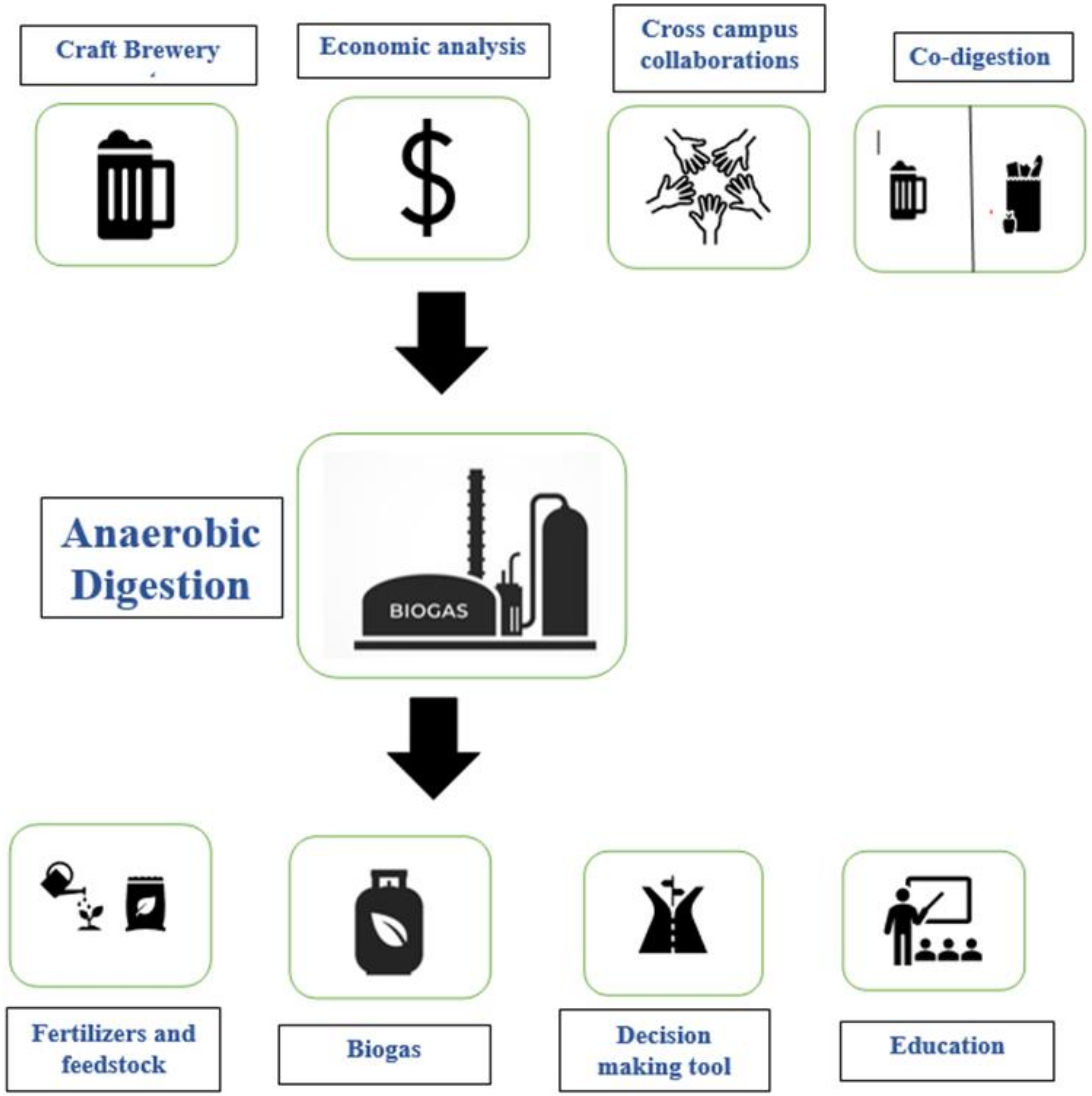
Dhanashree Rawalgaonkar, Yan Zhang, Qiong Zhang and Paul Kirchman (co-PIs)

Anaerobic digestion of brewery waste



Objectives

1) Brewery waste characterization
2) Look at biomethane potential of brewery waste for resource recovery
3) Possible co-digestion substrates
4) Economic and life cycle analysis

Motivation

- ❑ High strength waste

- ❑ Resource recovery
- ❑ High energy requirements of breweries
- ❑ Diversion of waste from treatment plants

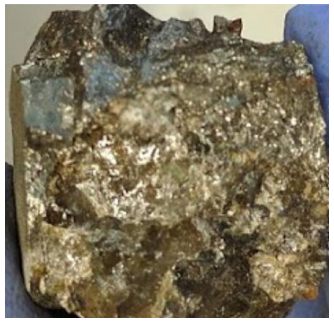
Investigating denitrification performance of S minerals - Erica Dasi

- Metal sulfides support N & P removal during denitrification:

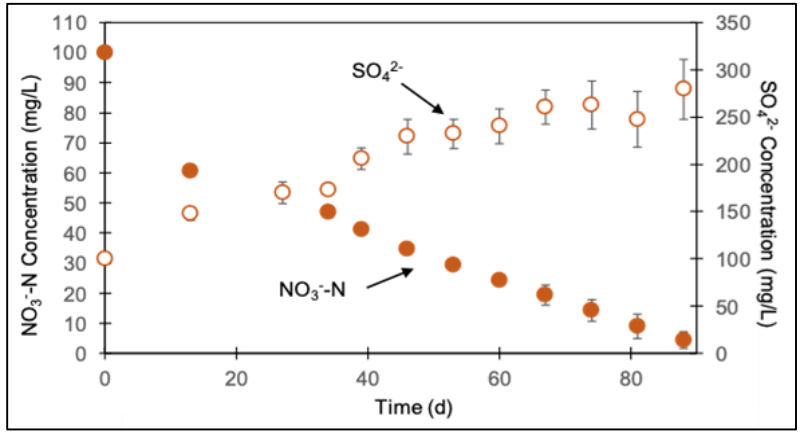
$$0.556FeS + NO_3^- + 0.889H_2O \rightarrow 0.5N_2 + 0.556SO_4^{2-} + 0.556Fe(OH)_3 + 0.111H^+$$

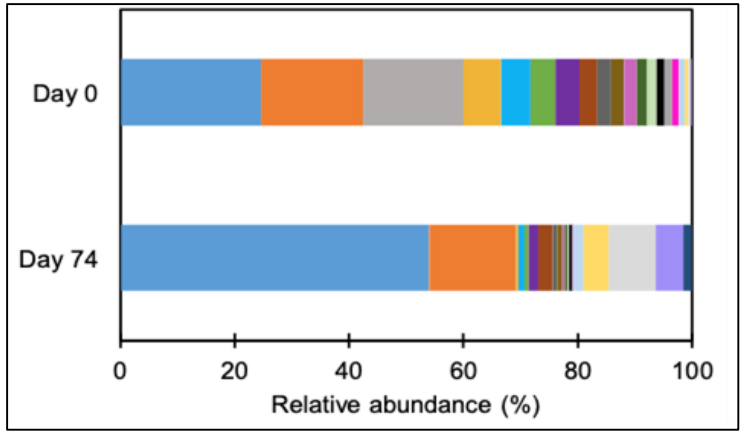
General equation for iron-sulfur denitrification

- Research applies <u>integrated approach</u> to study denitrification performance of untested metal-sulfides



Sphalerite ((Zn,Fe)S)





Design & operate lab-scale reactors → **Monitor reactor chemical profile** → **Characterize reactor microbiome**

Approach supports comprehensive understanding of nutrient removal during denitrification process, which can be used for real-world implementation

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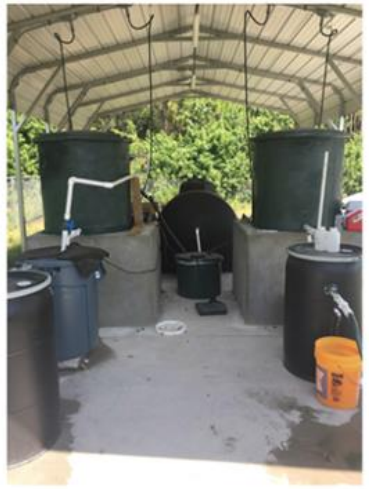
Michelle Henderson, Kebreab Ghebremichael (PI), Nancy Diaz Elsayed (PI), Zeev Ronen (PI)

Water Reuse in Onsite Wastewater Treatment System

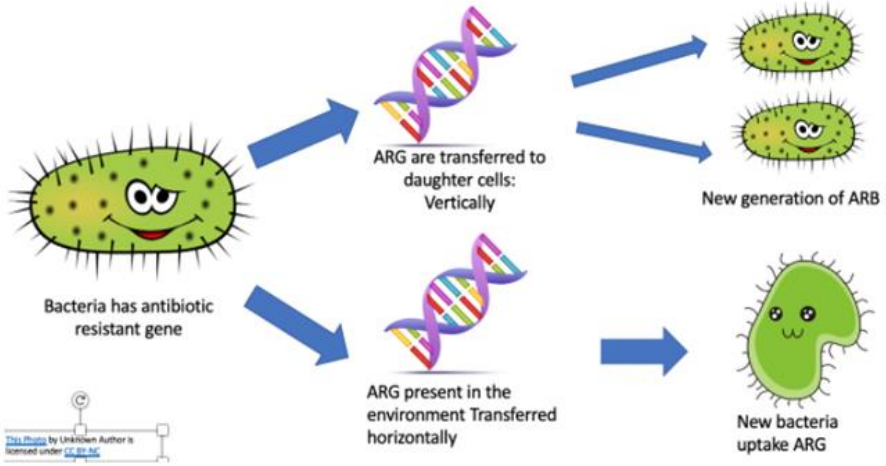
Recirculation and Forward Flow

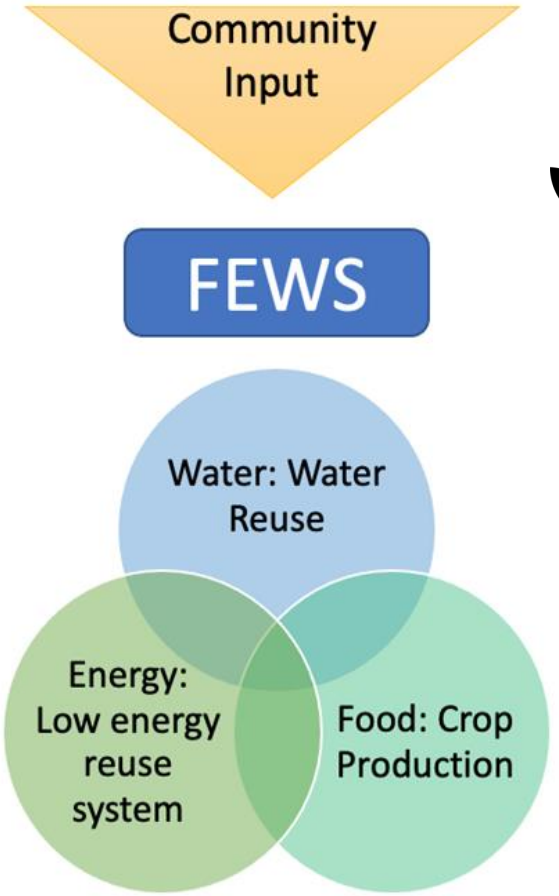


Chlorination System

Pilot Scale Water Reuse System and Life Cycle Assessment

Antibiotic Resistance Genes and Bacteria in Constructed Wetlands





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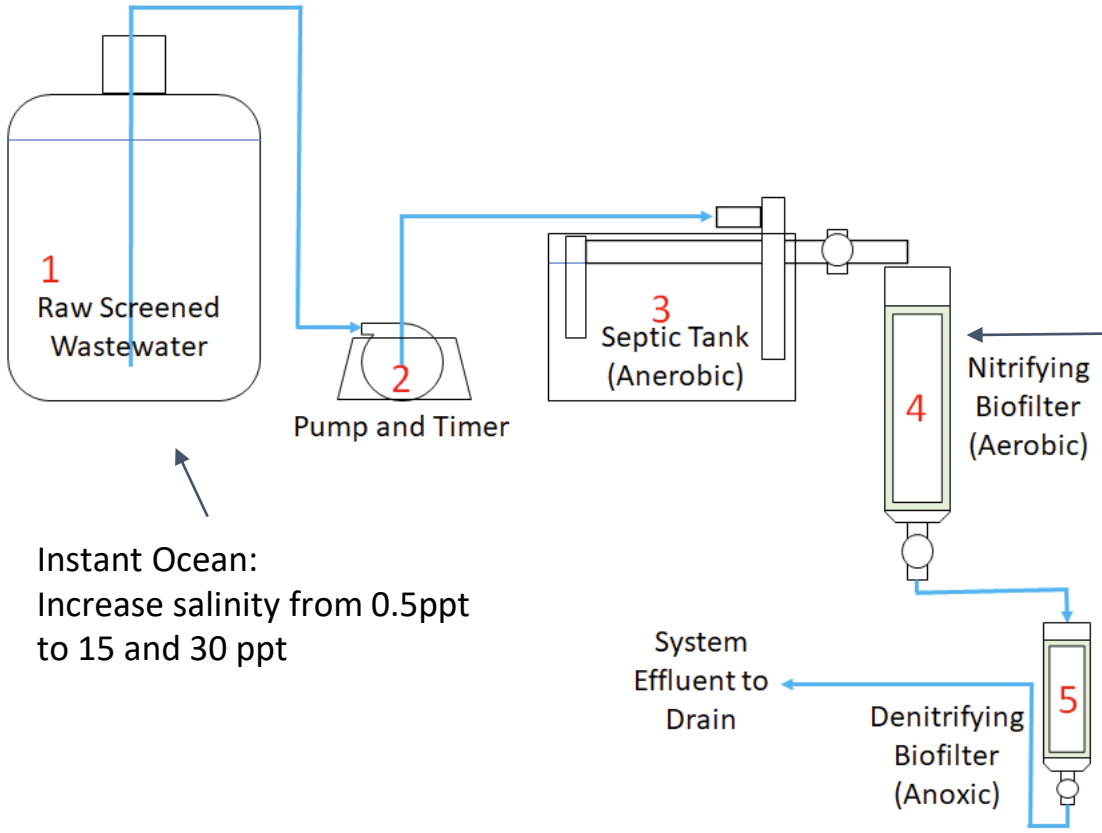
Daniel Delgado, Tione Grant

High Saline Biological Nitrogen Removal: Onsite-Wastewater Treatment Systems

- How does salinity affect treatment processes?
- What are promising electron donors for a passive OWTS using BNR?

Graduate Assistantships in Areas of National Need (GAANN)



Media:
Oyster Shells,
Lightweight Expanded Clay

Instant Ocean:
Increase salinity from 0.5ppt to 15 and 30 ppt

Media:
Sugarcane Bagass
Sulfur Pallets

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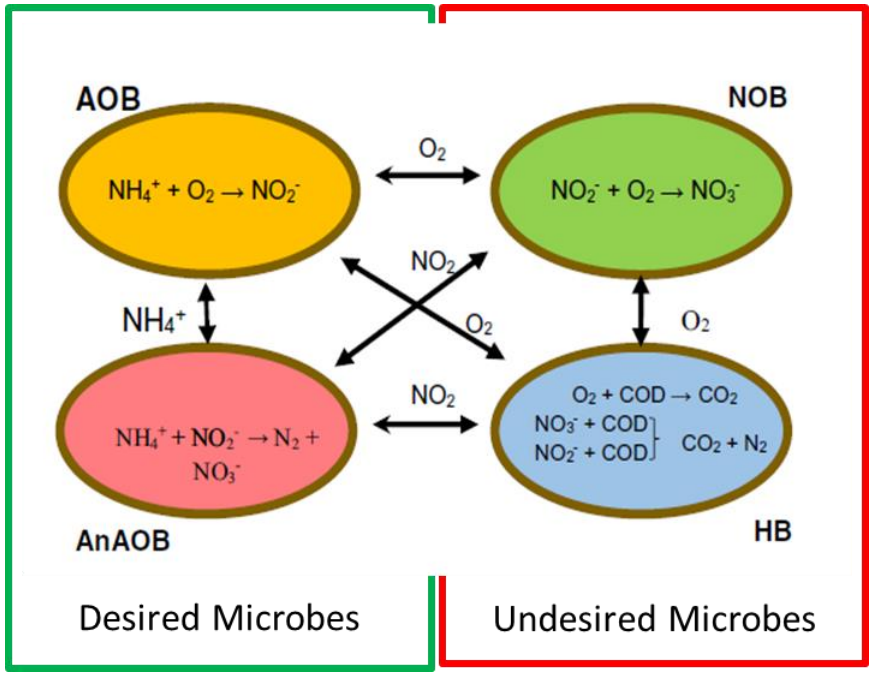
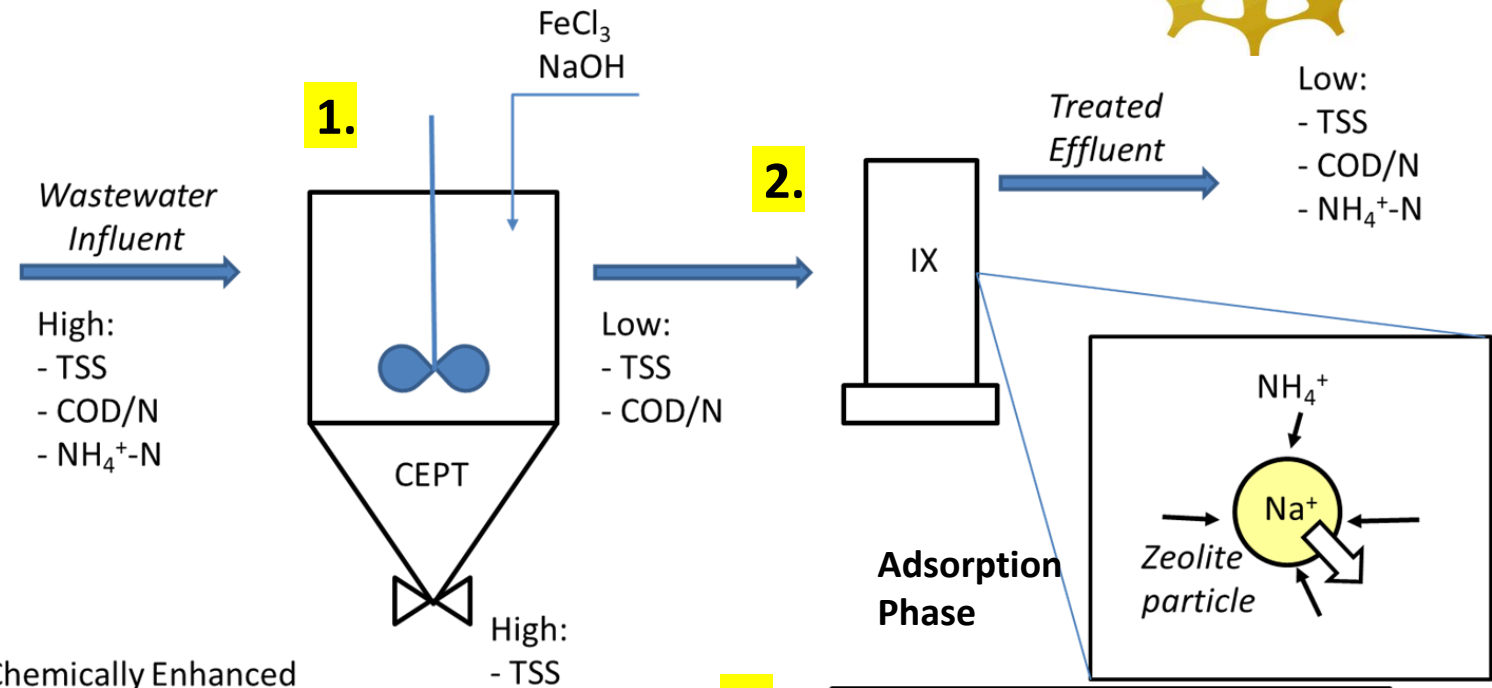
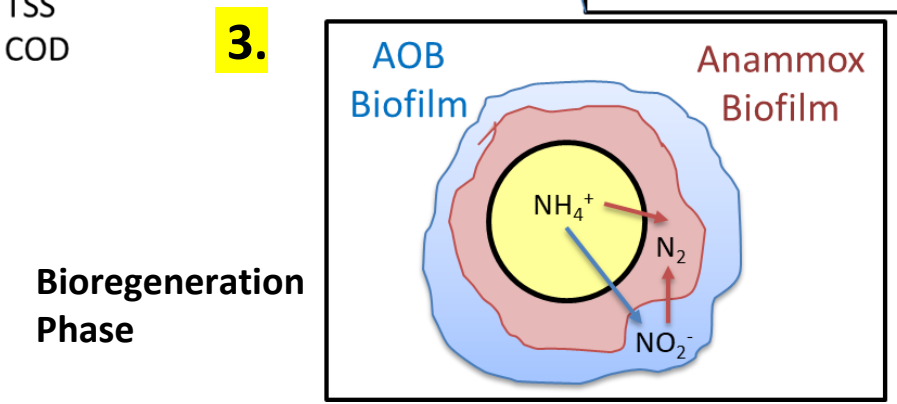
Sheyla Chero-Osario, Daniel Delgao, Tione Grant, John Kuhn (co-PI)

Ion Exchange-Partial Nitritation/Anammox (IX-PN/A) in Mainstream Municipal Wastewater





CEPT: Chemically Enhanced Primary Treatment
IX: Ion Exchange



Research Plan:

1. **Organic matter removal to inhibit HB**
2. **Ion Exchange to capture ammonium**
3. **Bioregeneration by AOB and AnAOB with a controlled aeration and high ammonium**

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Nusrat Sharmin, Mahmood Nachabe (co-PI)

Use of Modified Biochar for P Removal

EPA