

Systems Modeling to Protect Coral Reefs:

A Case Study Rooted in Community Partnerships

CHRISTINE PROUTY¹, LUIS GARCIA², LISA CARNE³, MAYA TROTZ¹

¹ CIVIL & ENVIRONMENTAL ENGINEERING, UNIVERSITY OF SOUTH FLORIDA

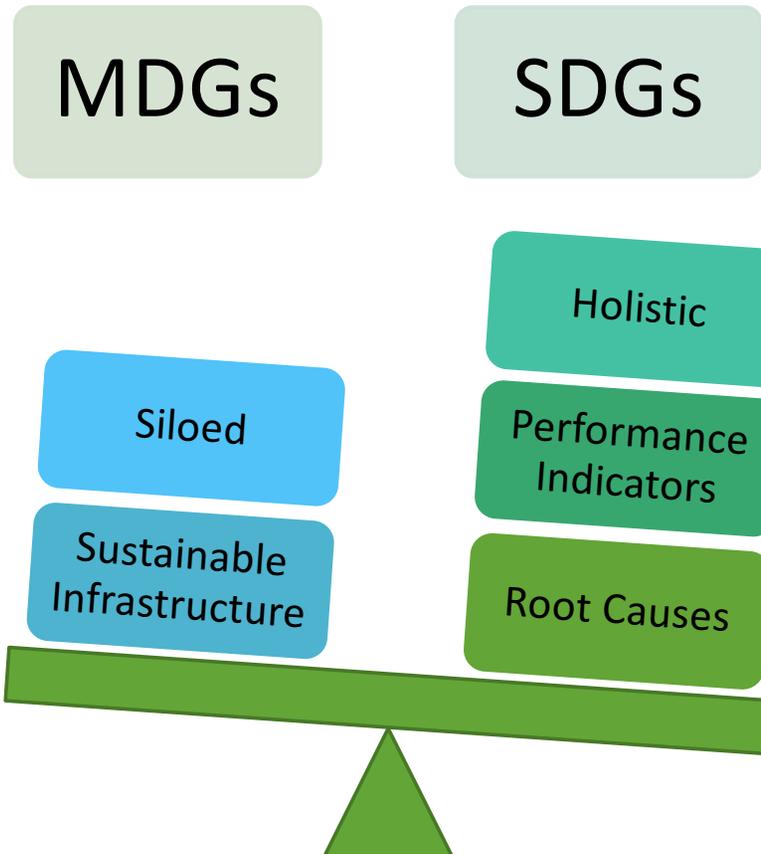
² ECOFRIENDLY SOLUTIONS, LTD.

³ FRAGMENTS OF HOPE

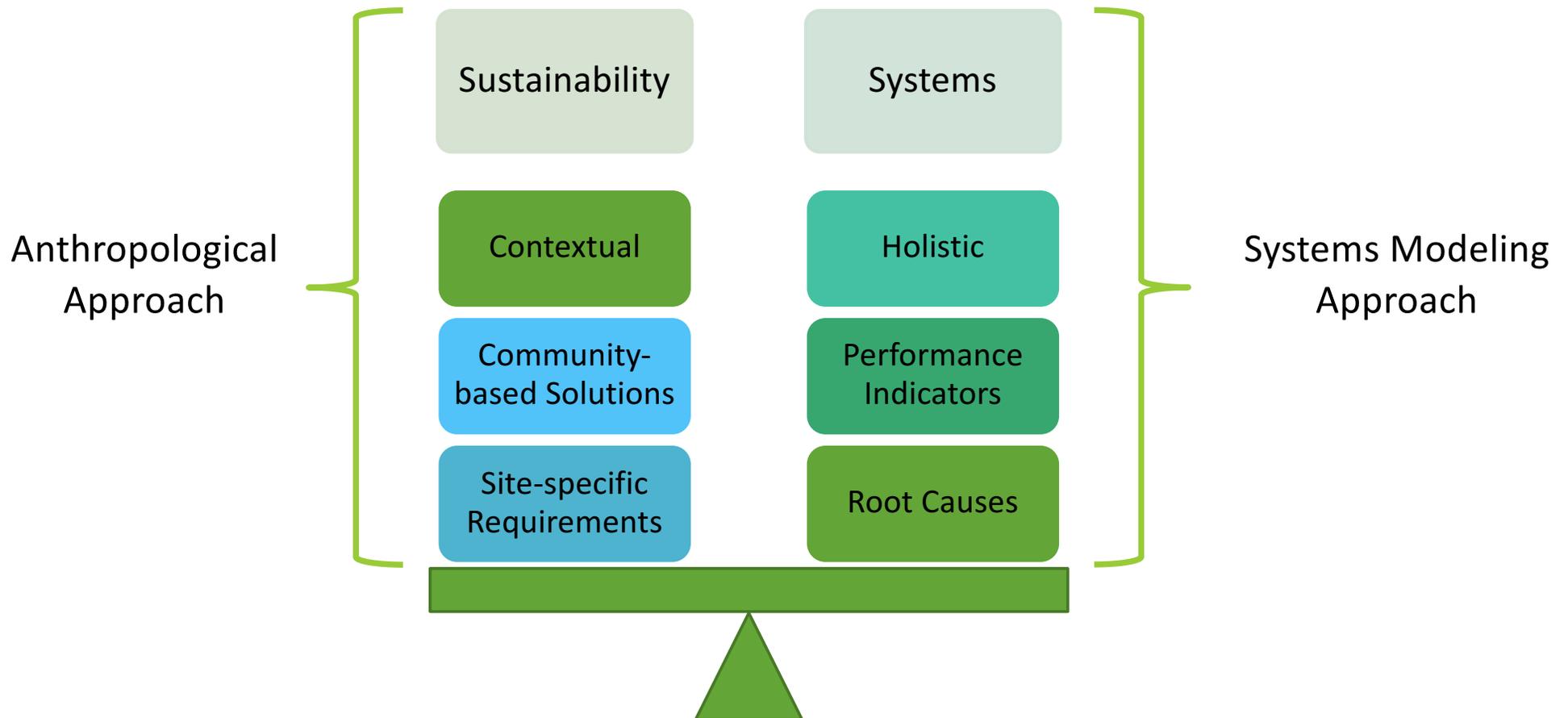


Sustainable Development Sector is Changing

“...the sector has evolved over years...[and] the emergence of a systems-based approach is the reaction to...[our] messy world. The world isn't linear.”



Challenge for Sustainable Development



Defining Anthropology, Sustainability, Systems Modeling

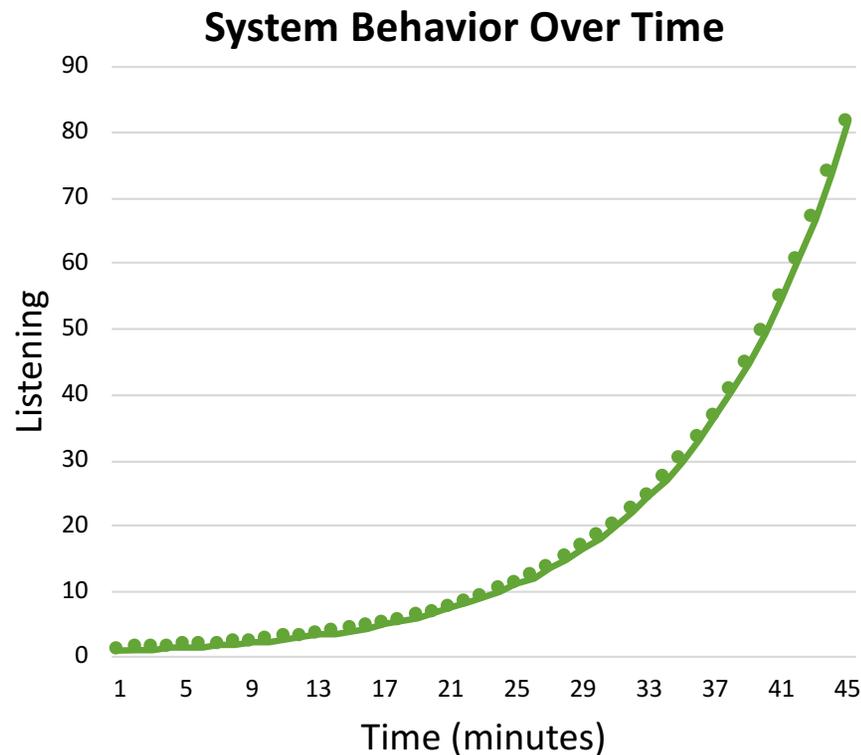
Anthropology

- The study human culture in all its breadth, depth, and complexity

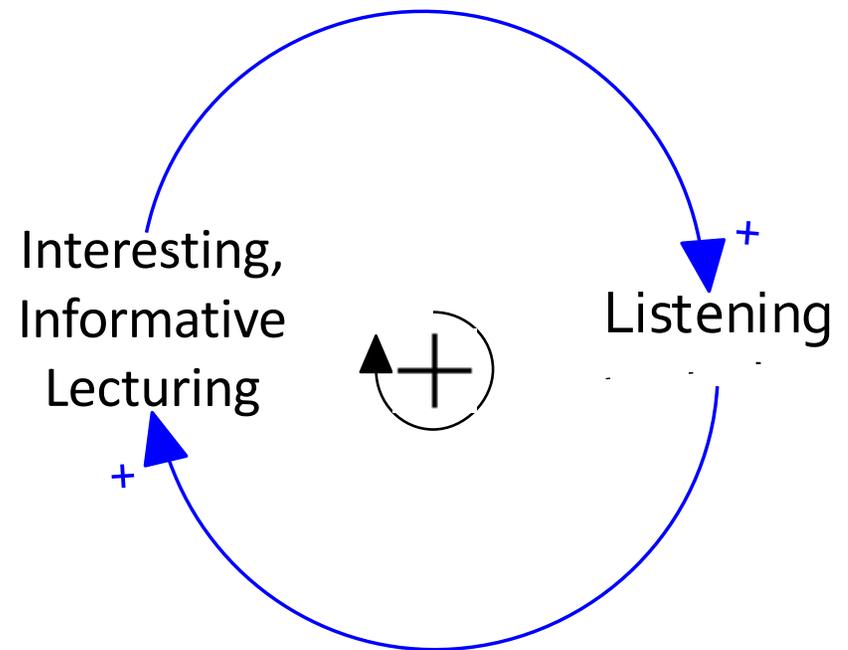
Sustainability

- “...the design of *human* and *industrial systems*
- to ensure that humankind’s use of *natural resources* and *cycles*
- do not lead to diminished *quality of life* due either to
- losses in future *economic opportunities* or to
- adverse impacts on *social* conditions, human *health*, and the *environment*.”

Defining Anthropology, Sustainability, Systems Modeling



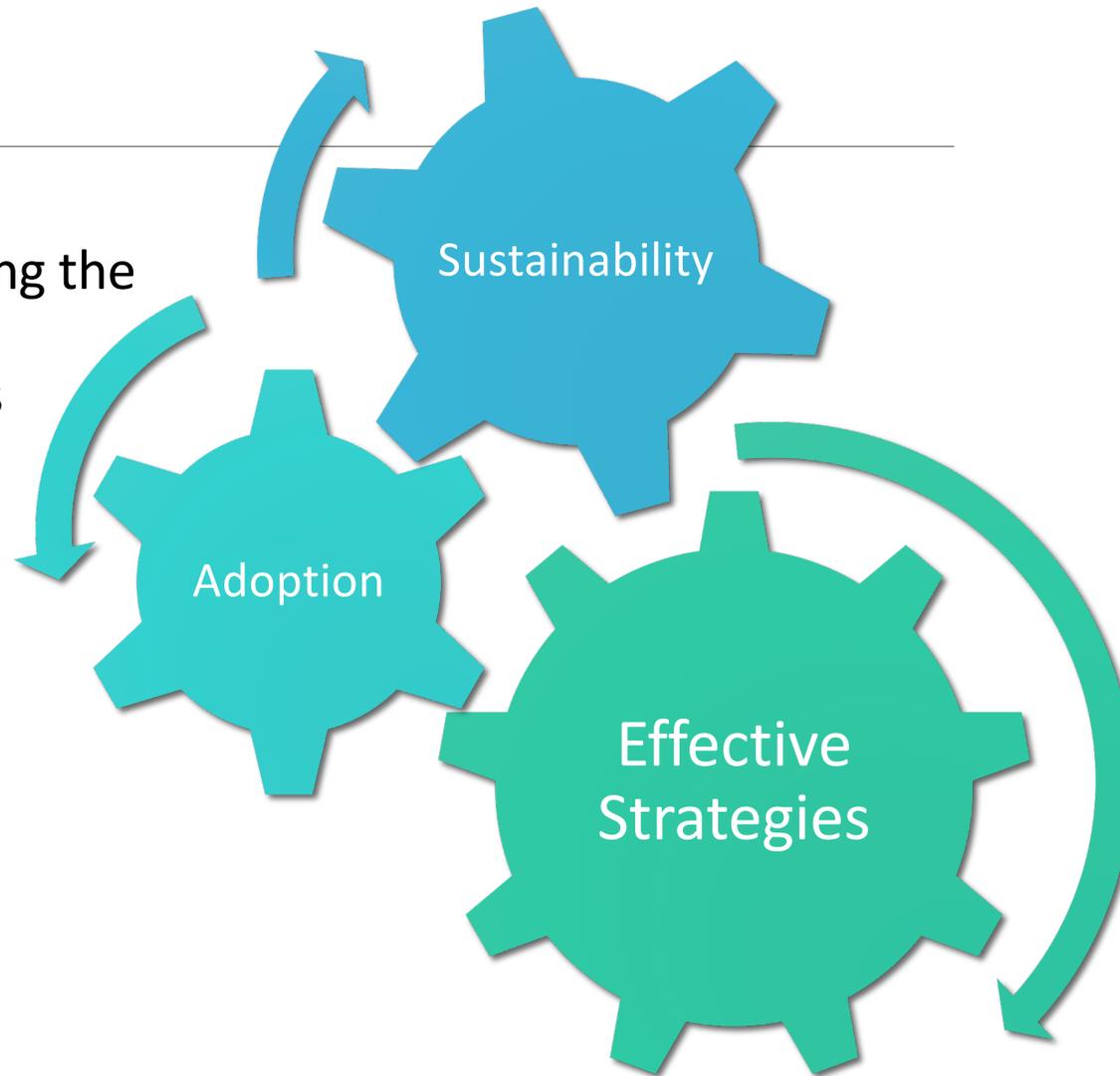
Causal Loop Diagram
(CLD)



Model Structure:
Reinforcing Loop

Purpose

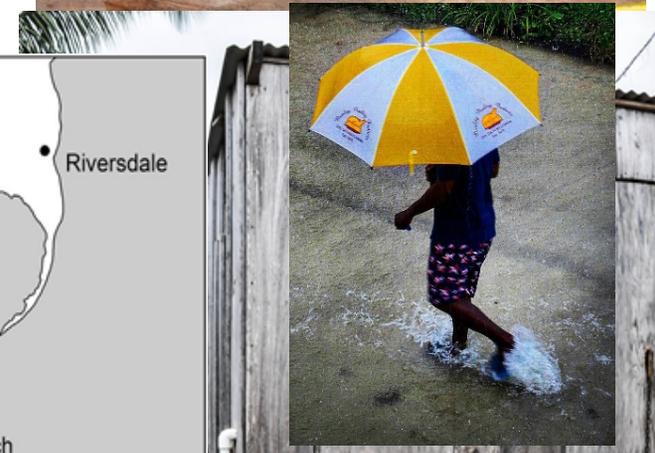
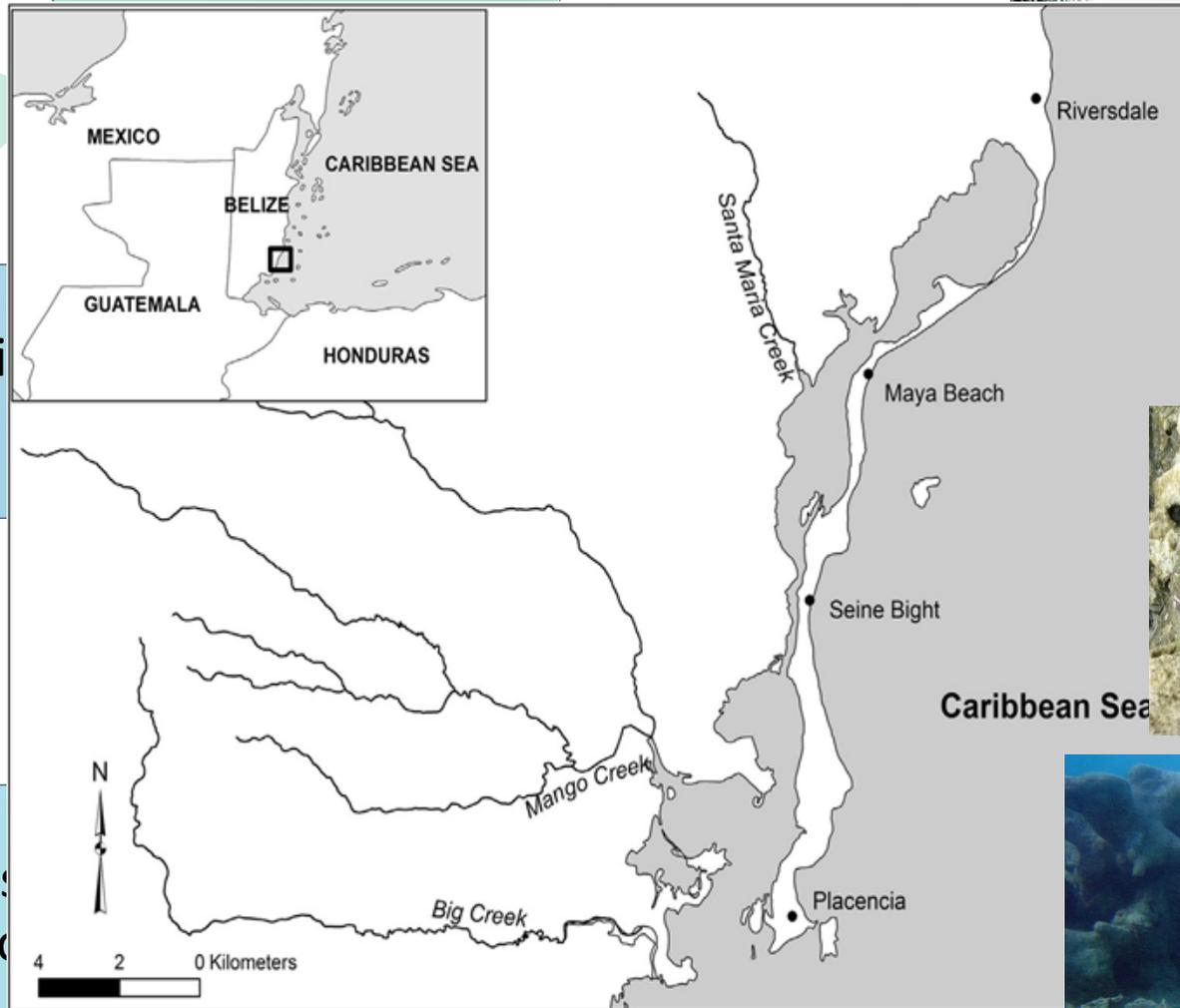
To develop a tool to determine effective strategies for increasing the *adoption* and *sustainability* of resource recovery (RR) systems



Placencia, Belize

Impacts Public Health

Affects Resources



Adopting & Sustaining RR Systems

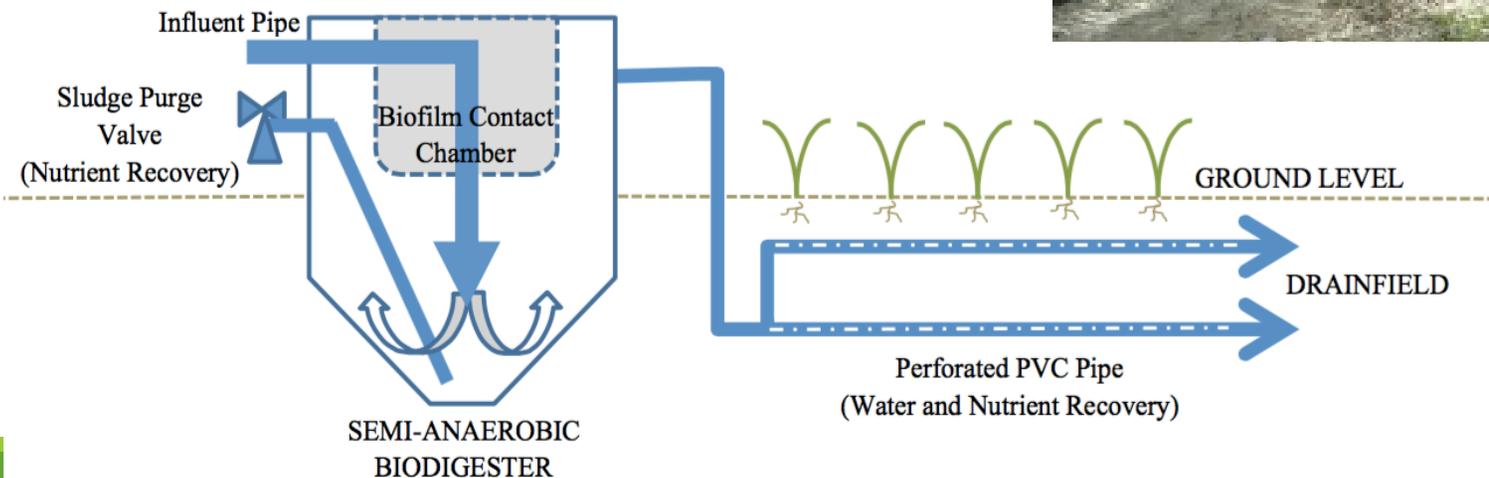
Decision making about adopting, sustaining RR systems

- Occurs at household (or business) level

Existing wastewater regime = septic tanks

Performance Measures

- Adopt = install RR system
- Sustain = RR system affordably meets water quality standards





Mixed Methods

Surveys, interviews, focus groups



Water quality testing

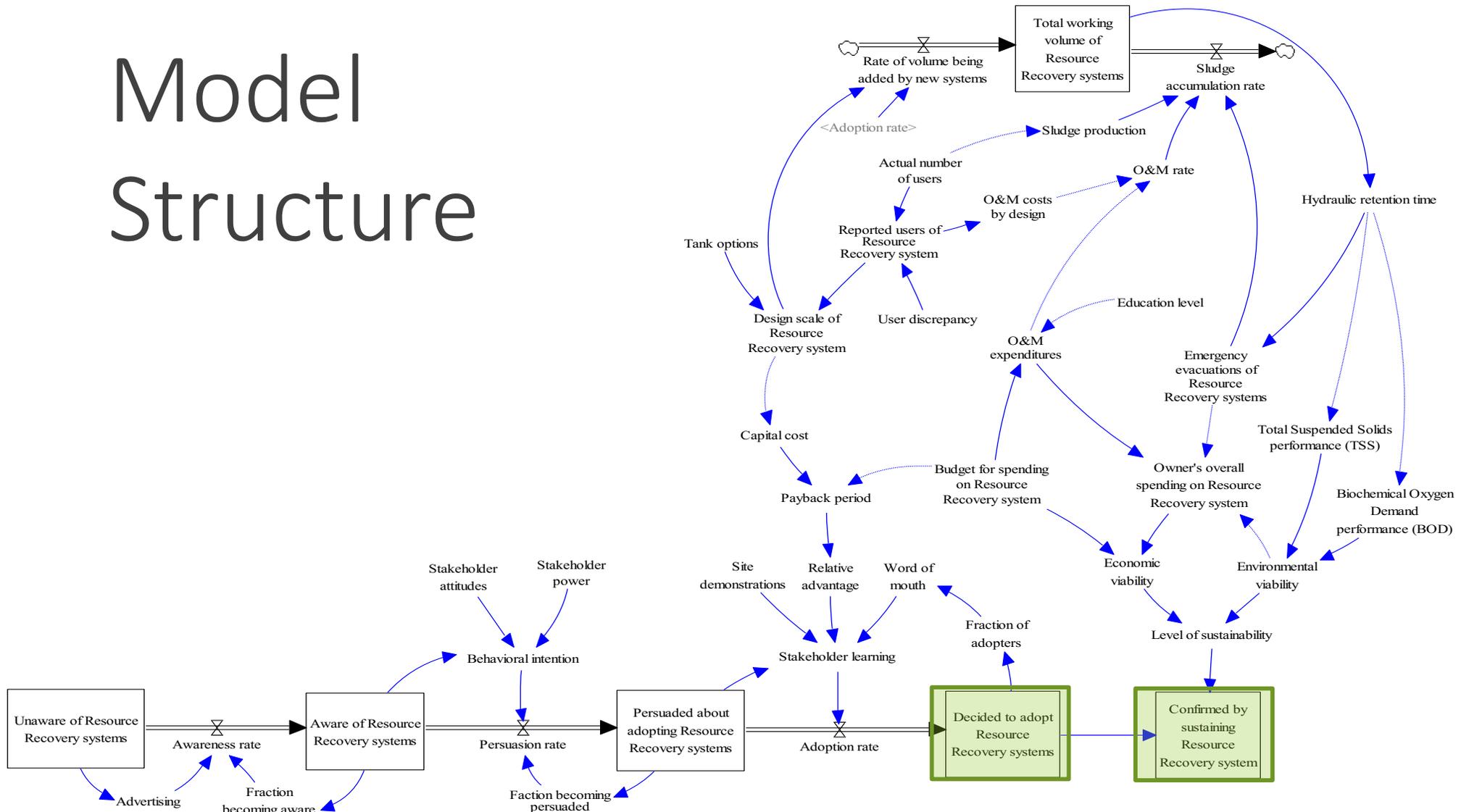


Participant observation

Literature review



Model Structure



Advertising

Attitudes,
Access to Information

Stakeholder Learning,
Tank Options

O&M Rate,
RR System Performance

Knowledge

Persuasion

Decision

Confirmation

Structure → Behavior Over Time

Adoption

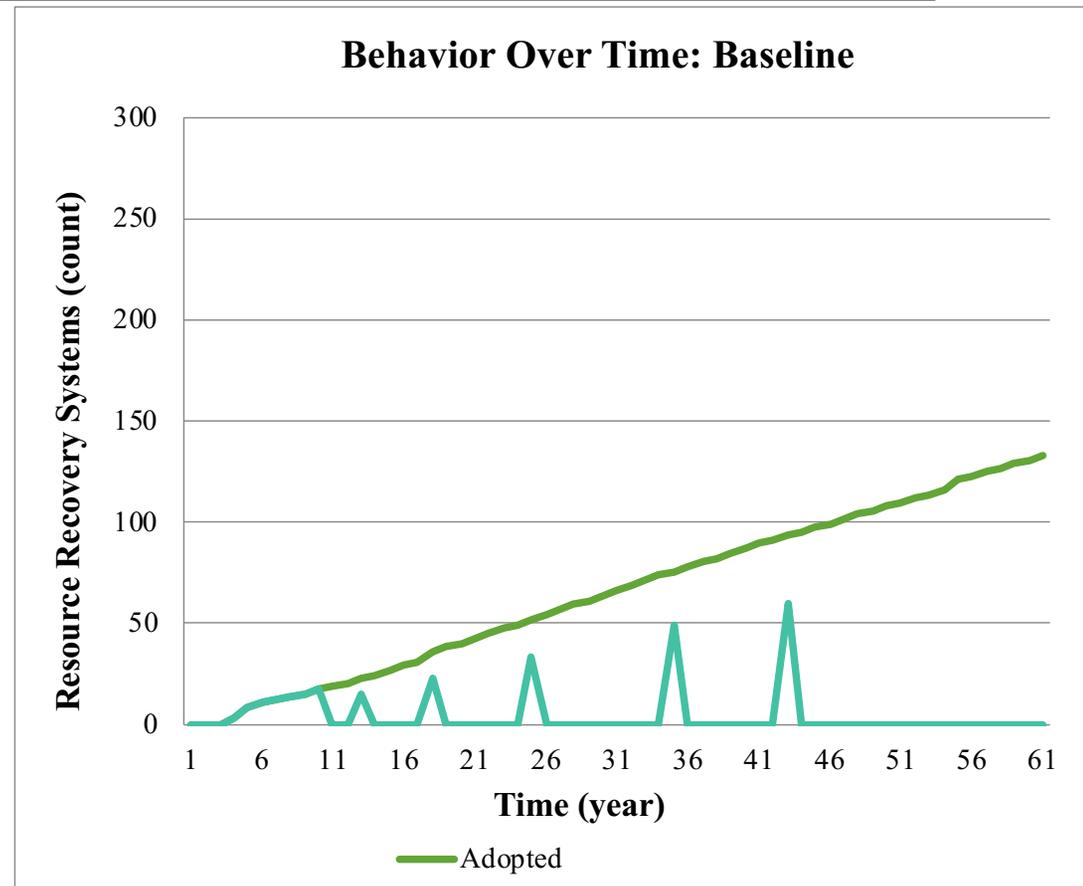
- Sequential process
- Limits to the growing stock of adopters over time

Sustainability

- Binary distinction
- Portion of adopters perform behaviors to operate, maintain systems

Strategies

- Improve adoption and sustainability behavior



Socio-technical strategies

Advertising

- Increase frequency of multi-media promotions
- Marketing

Site Demonstrations

- Implement regular, formal/informal tutorials
- Marketing

Stakeholder Power

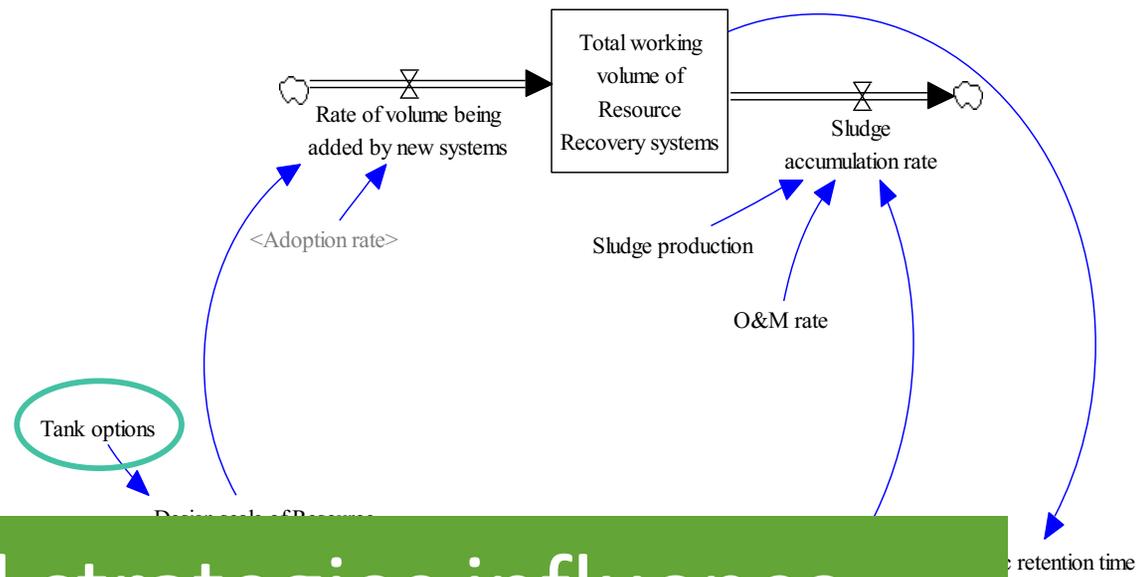
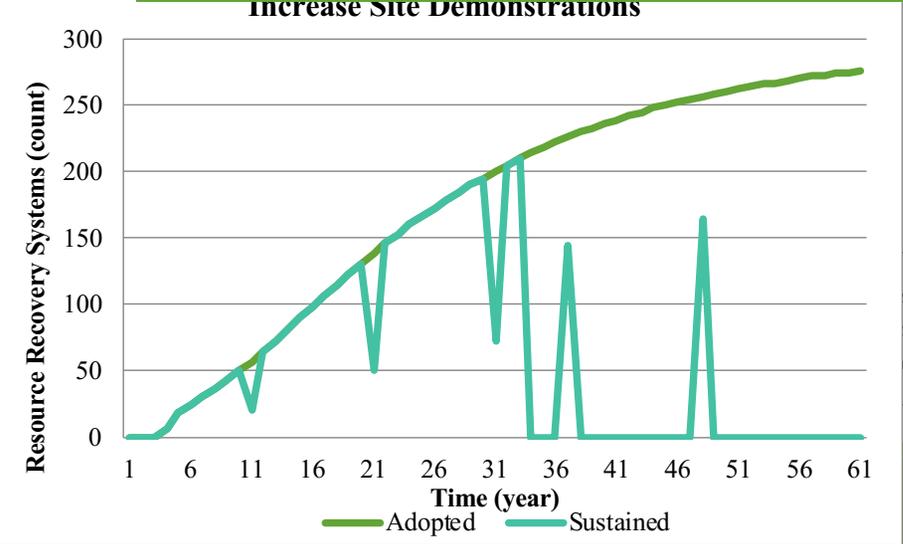
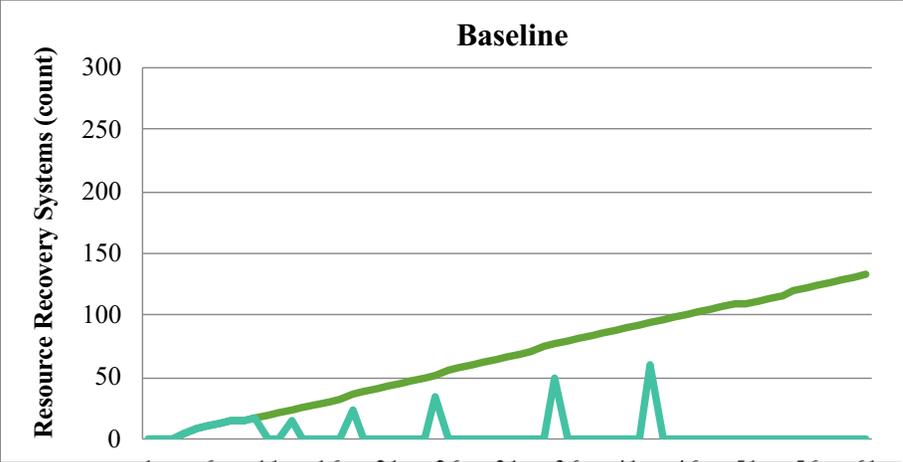
- Improve access to gov. planning information
- Social

Tank Options

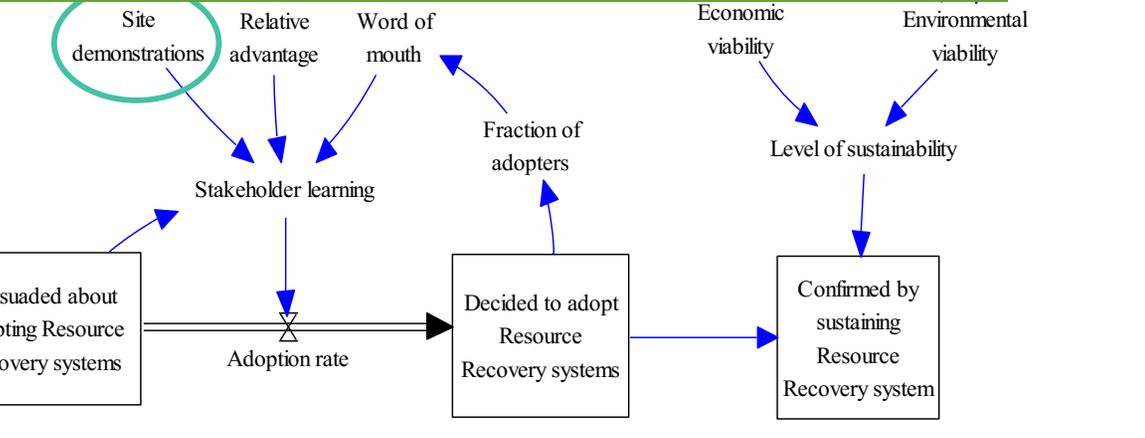
- Broaden system configurations
- Technical

Education

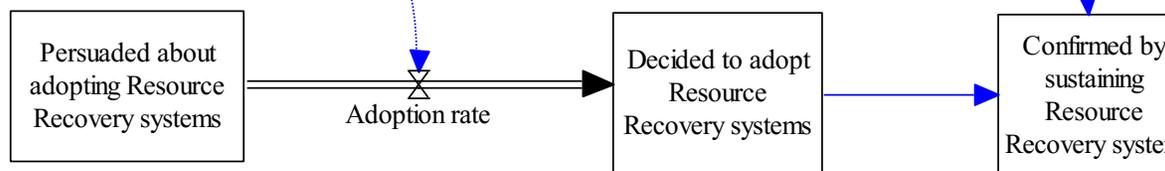
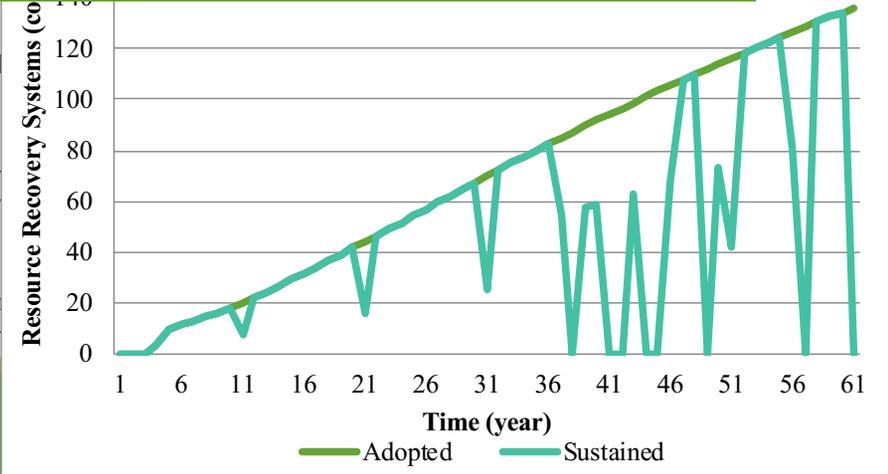
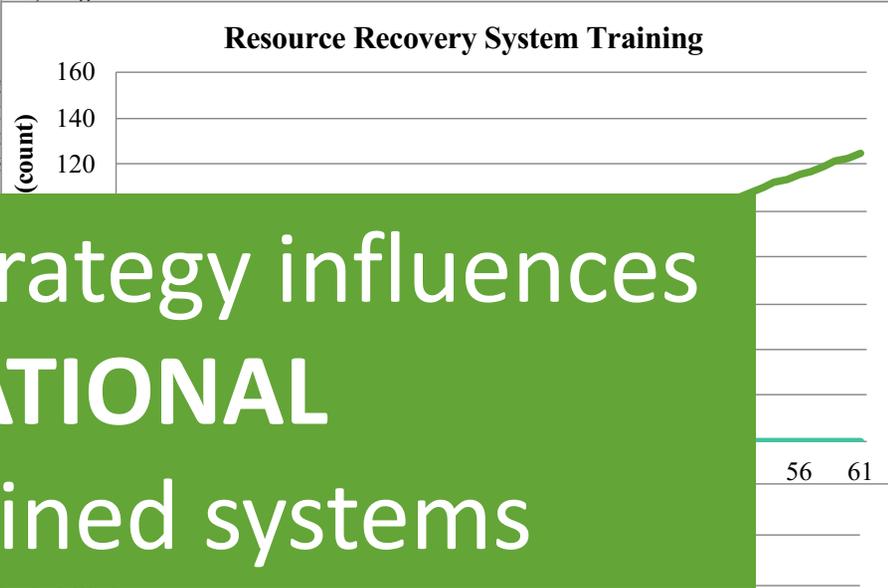
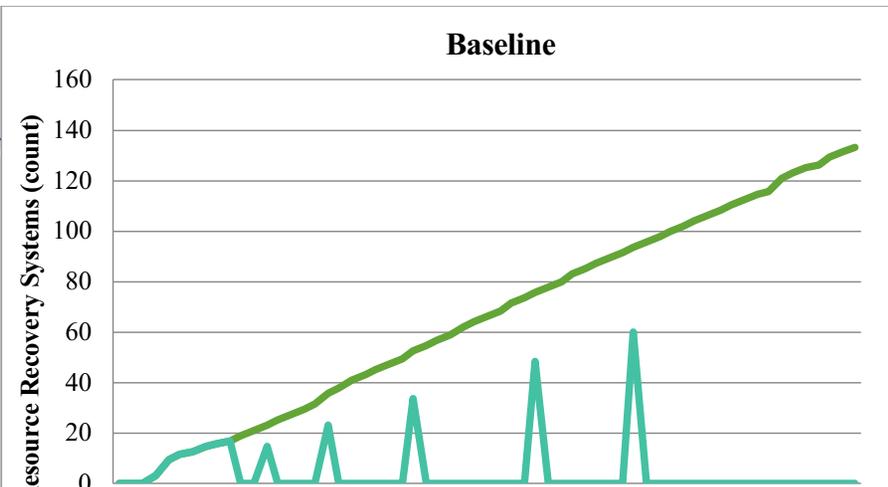
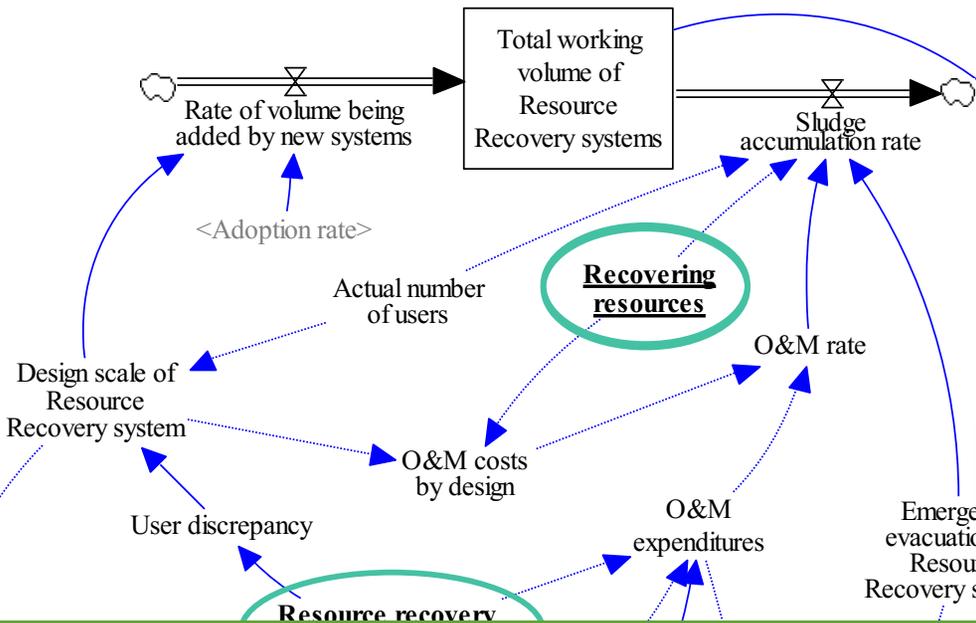
- Expand understanding of wastewater treatment
- Social



Socio-technical strategies influence **INCREMENTAL** impacts to adopted and sustained systems



The behavior change strategy influences
TRANSFORMATIONAL
 change in the sustained systems



Conclusions

Modeled Performance

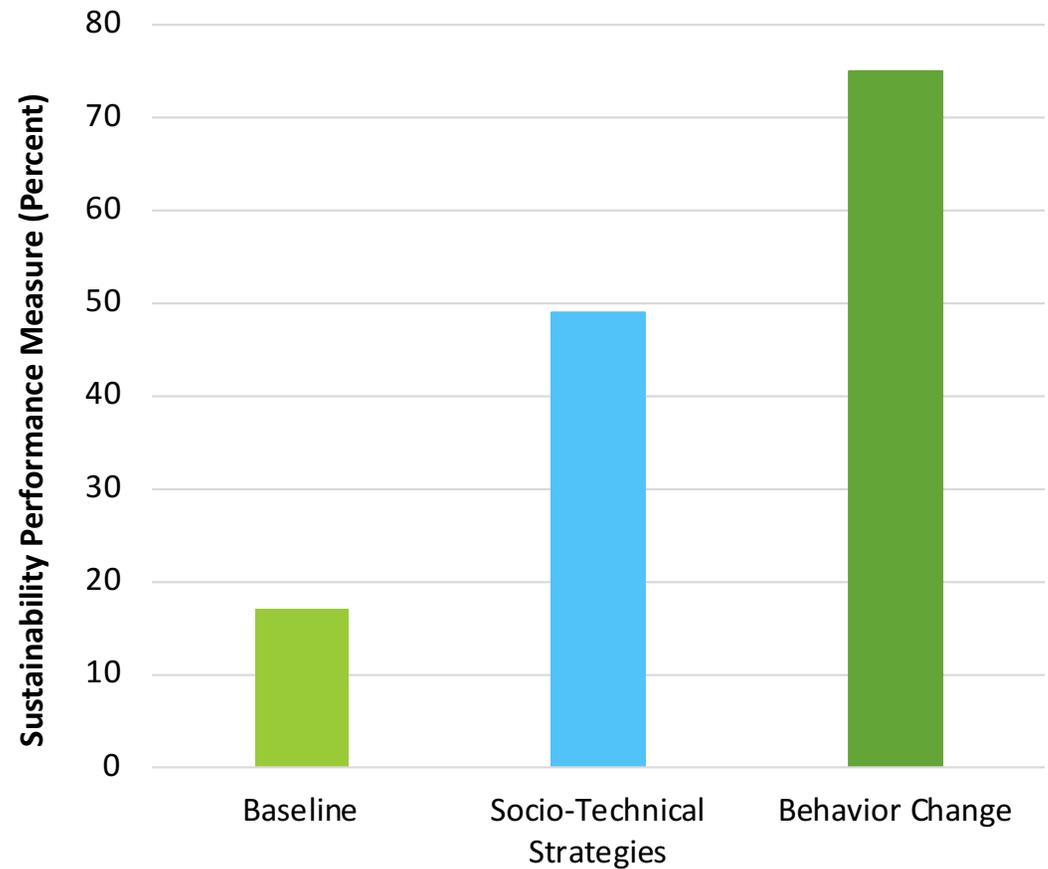
- RR System adoption and sustainability

Developed Strategies

- Incremental improvements

Simulated Behavior Change

- Transformative impacts





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Rapid assessment framework for modeling stakeholder involvement in infrastructure development



Christine Prouty^{a,*}, Eric S. Koenig^b, E. Christian Wells^b, Rebecca K. Zarger^b, Qiong Zhang^a

^a Department of Civil and Environmental Engineering, University of South Florida, 4202 E. Fowler Ave., Tampa, FL 33620, USA

^b Department of Anthropology, University of South Florida, 4202 E. Fowler Ave., Tampa, FL 33620, USA

Uniqueness

Learned, Exercised Interdisciplinary Skills

- Data Collection, Analysis Methods

Bridged Disciplines, Community Discussions

Mentored Students

- University of Belize, University of South Florida

Interdisciplinary, Community Publications

Ongoing Community Engagement





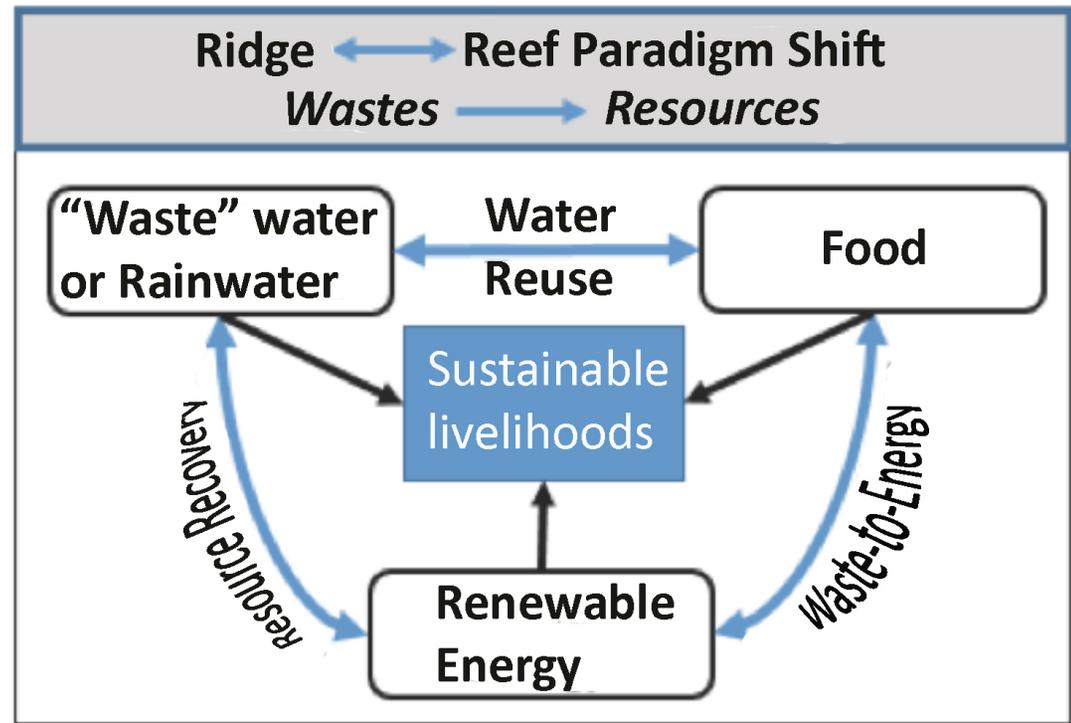
Next Steps: Strong Coasts

NSF RESEARCH TRAINEESHIP PROGRAM

Systems Training Research **ON** Geography-based Coastal Food-Energy-Water Systems Research

GUIDING RESEARCH QUESTION

What are the leverage points (technological, regulatory, organizational) in food-energy-water systems (FEWS) in a specific geographic context to improve the sustainability of the overall system across different scales?



Potential Case Study: Wastewater Project

ENVIRONMENTAL ENGINEERING

Develop systems-based approach to recover nutrients from wastewater to grow food, reduce fuel consumption for transporting food, reduce nutrients entering adjacent surface waters



MARINE SCIENCE

Employ in-situ sensors to measure nutrient concentrations for pre/post implementation of resource recovery system

ANTHROPOLOGY

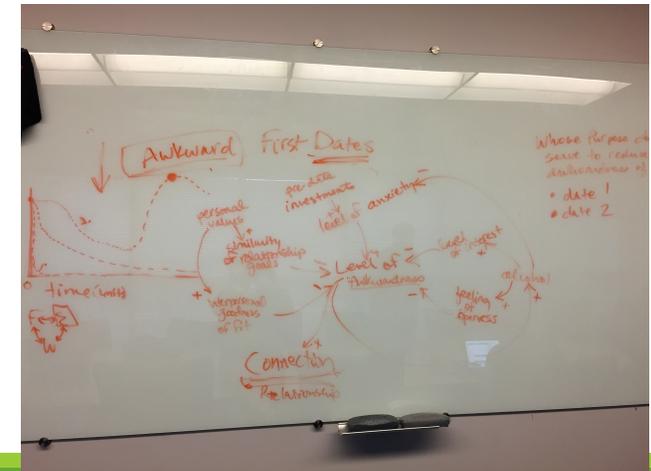
Investigate risks, perceptions, and necessary regulatory environments for promoting resource recovery and markets for food grown on recovered resources



Program Deliverables

Train student cohorts with 21st century skills, global competency, and technical and methodological flexibility to address the complexity within the FEWS nexus

Develop interdisciplinary partnerships among students and domestic/international communities that co-create systems-based FEWS solutions



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Thanks for your attention!

Additional questions or information?

Dr. Christine Prouty cprouty@mail.usf.edu or on Twitter [@cprout1](https://twitter.com/cprout1)

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