Roundtable on Science and Technology for Sustainability

Measuring Progress Towards Sustainability, Nov. 12, 2015

Characterizing the Issues Related to Models that Support Sustainability Decision Making

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UREx SRN

Implications of Alternate Framing Concepts

Adaptation	Transformation	Transition
Incremental Change	Potentially fundamental Change	Major change, outcome determined
Respond to shock	Action in anticipation	Action designed to achieve objective
Maintain previous order	Create order, open ended	Transition to desired order
Build adaptive capacity	Reorder system dynamics	Develop dynamics that result in desired system
Emergent Properties guide trajectory	Build agency, leadership, change agents	Trajectory and outcome predetermined

One Definition for Sustainability

Sustainable development is when:

1. Human well-being is enhanced
2. Ecological integrity is maintained
3. Social Equity is achieved

One Definition of Resilience

- The capacity of a system to experience shocks while retaining essentially the same function, structure, feedbacks, and therefore identity (Walker et al. 2006).
- It is about the operation of a system, its adaptive capacity

Resilience Theory Approach

- Origin in ecology, nature is optimal
- Change is normal, multiple stable states
- Experience adaptive cycle gracefully
- Result of change is open ended, emergent
- Concerned with system dynamics that enhance resilience
- Can be desirable or undesirable
- Stakeholder input on acceptable dynamics in the future

Sustainability Science Approach

- Origin in social sciences, society is flawed
- Envision the future, act to make it happen
- Utilize transition management approach
- Desired results of change are specified in advance
- Focus is on interventions that lead to sustainability measures
- Should only be desirable
- Stakeholder input is essential for future scenarios

Intellectual Misalignment: Hurdle to Comprehensive Indicators and Metrics

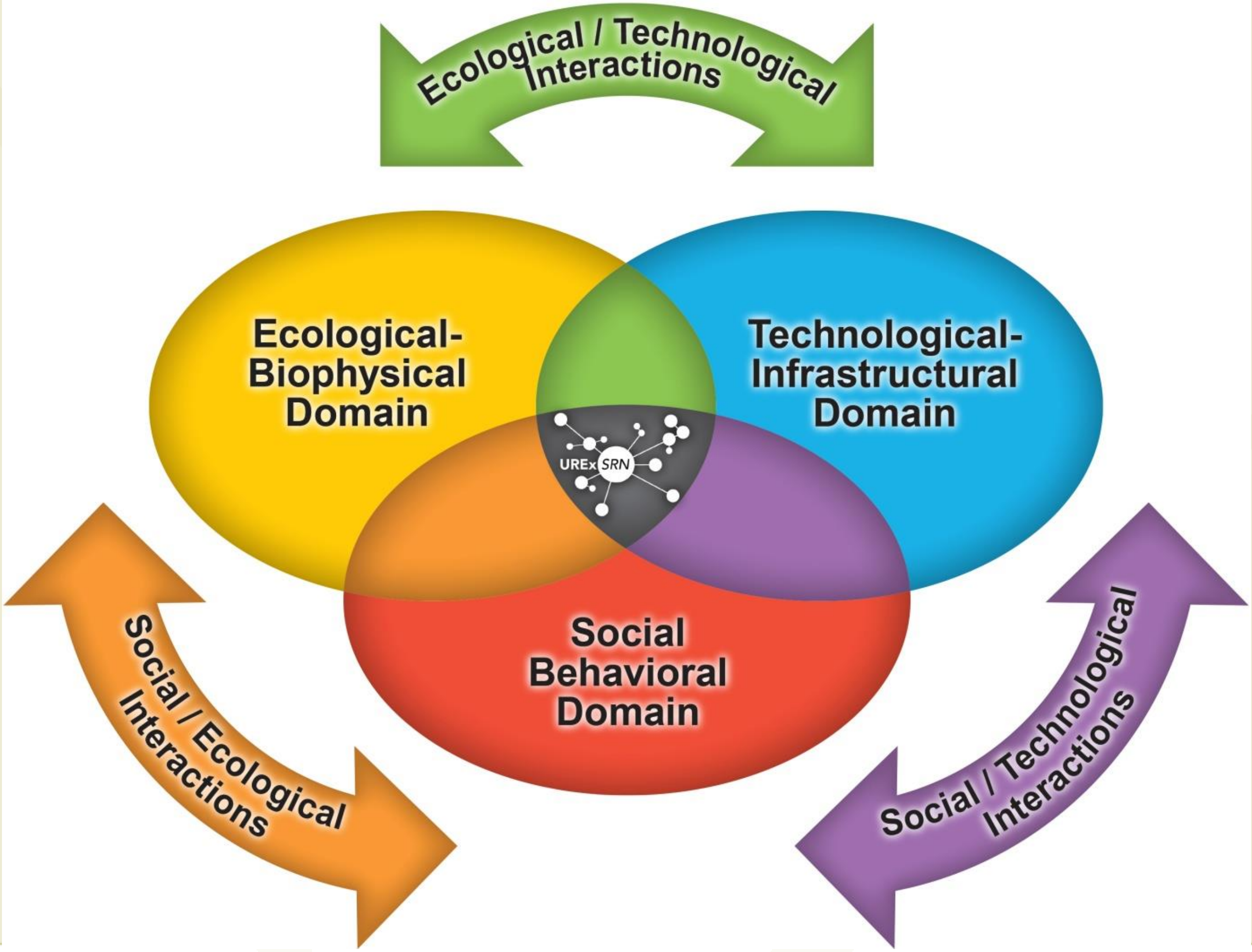
Each discipline is defined by its own set of rules

- Communication Differences (e.g., vocabulary)
- Objectives of research (answers we seek)
- What is acceptable knowledge?
- Disciplinary methods (i.e., what is data, what is accepted as proof, what are appropriate methods)

Does the system being created have a distinctive logic reflecting the dominant discipline behind it?

Sustainability is highly context dependent, hence do universal systems miss the mark?

Social-Ecological-Technical Systems Conceptual Framework

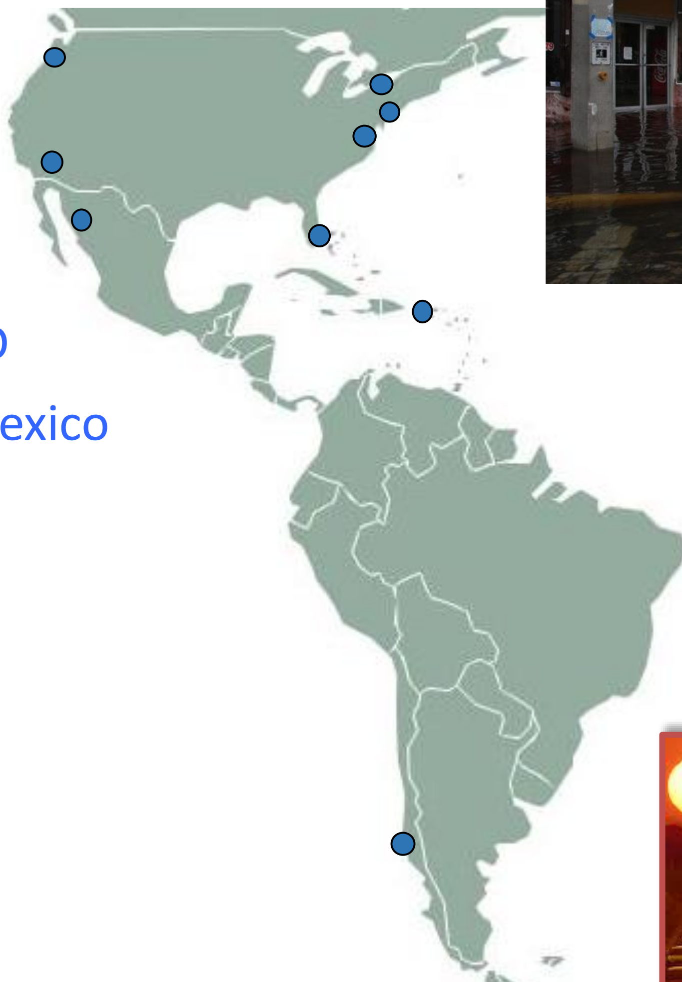


Usually focus on interaction of two domains

1. **Social/Ecological interaction**
   e.g., Resource management
2. **Ecological/Technological interaction**
   e.g., Green Infrastructure
3. **Social/technological interactions**
   e.g., Introduction of internet

Coastal Flooding	Extreme Heat	Drought	Urban flooding

Urban Resilience to Extremes SRN



Baltimore, MD

Hermosillo, Mexico

Miami, FL

New York, NY

Phoenix, AZ

Portland, OR

San Juan, PR

Syracuse, NY

Valdivia, Chile

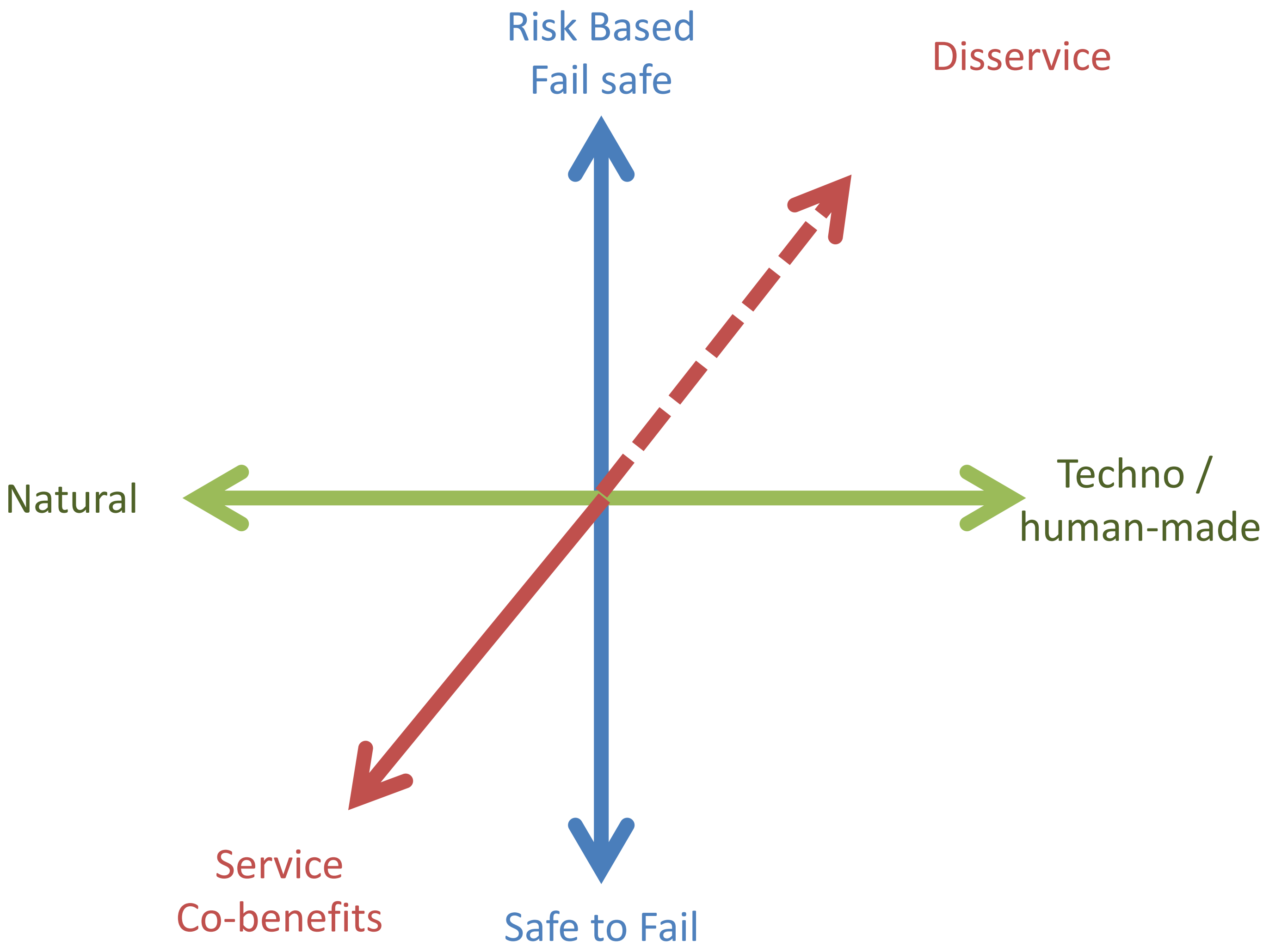
Traditional Solution

“Fail safe” – low likelihood,
High consequence of failure
highly modified Infrastructure

Resilient Solution

“Safe to fail” –
more frequent failure, but
minimal consequence

- Flexible
- Multifunctional


Risk Based
Fail safe
Disservice
Natural
Techno /
human-made
Service
Co-benefits
Safe to Fail

Basic Conundrums to be Solved

- **We need to experiment with new approaches for the future, yet the risk of experimenting with a city is unacceptable**
- **Optimizing efficiency of resource use and movement, such as in smart cities, may enhance aspects of sustainability, but may undermine resilience**
- **How can we ensure that resilient dynamics that emerge from open, participatory approach will also lead to a more sustainable set of outcomes?**
- **How do we convert avoided future costs into current revenue streams?**
- **How can long term sensibilities and values be integrated into short term management and decision making?**