Ocean Solutions: *Co-design and co-development*

National Academies
Decadal Survey of Ocean Sciences for NSF
Oct 24, 2023

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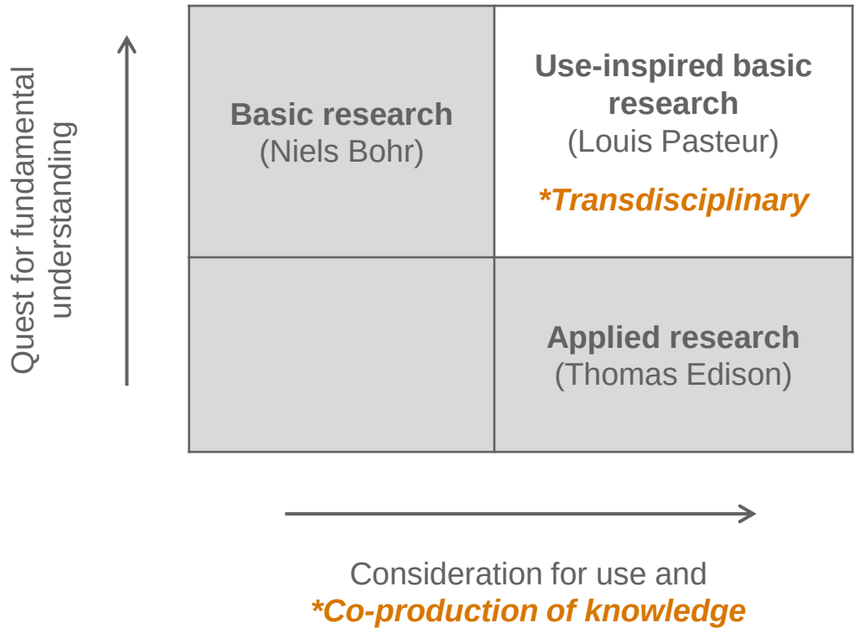
Transdisciplinary research

- Solutions oriented science
- Interdisciplinary
- Co-production of knowledge
- Research and policy outputs



References:

Clark et al. 2016. Crafting usable knowledge for sustainable development. Proceedings of the National Academy of Science

Arkema and Ruckelshaus 2017. Transdisciplinary research for conservation and sustainable development in Conservation in the Anthropocene Ocean

Stokes 1997. Pasteur's quadrant

Two examples of co-designed and co-developed research

Nature-based solutions to climate mitigation and adaptation

- Caribbean – Belize, The Bahamas

Renewable energy transitions in remote coastal and island communities

- United States – City of Bainbridge Island, Makah Tribe

Promise of blue carbon ecosystems and strategies

- Protection, restoration, and management of saltmarsh, seagrass, mangroves
- Store and sequester carbon in biomass and sediments
- Co-benefits: fisheries, tourism, coastal risk reduction, water quality

Belize – leading country in coastal and ocean management

- Caribbean coast of Central America
- Famous for Blue Hole and Mayan temples
- Progressive in planning for sustainability of natural resources

BELIZE COASTAL ZONE MANAGEMENT AUTHORITY & INSTITUTE

CEO, Chantalle Samuels

Transdisciplinary research team

World Wildlife Fund

Nadia Bood

Belize Coastal Zone Management

Arlene Young

Andria Rosado

Belize National Climate Change Office

Colin Mattis

Pew Charitable Trust

Courtnery Durham

Optimization analysis

Jade Delevaux

Peter Hawthorn

Co-benefits

Sama Winder

Jess Silver

Mary Ruckelshaus

Carbon

Lisa Beers

Co-developed research questions

Nature-based solutions to climate mitigation and adaptation

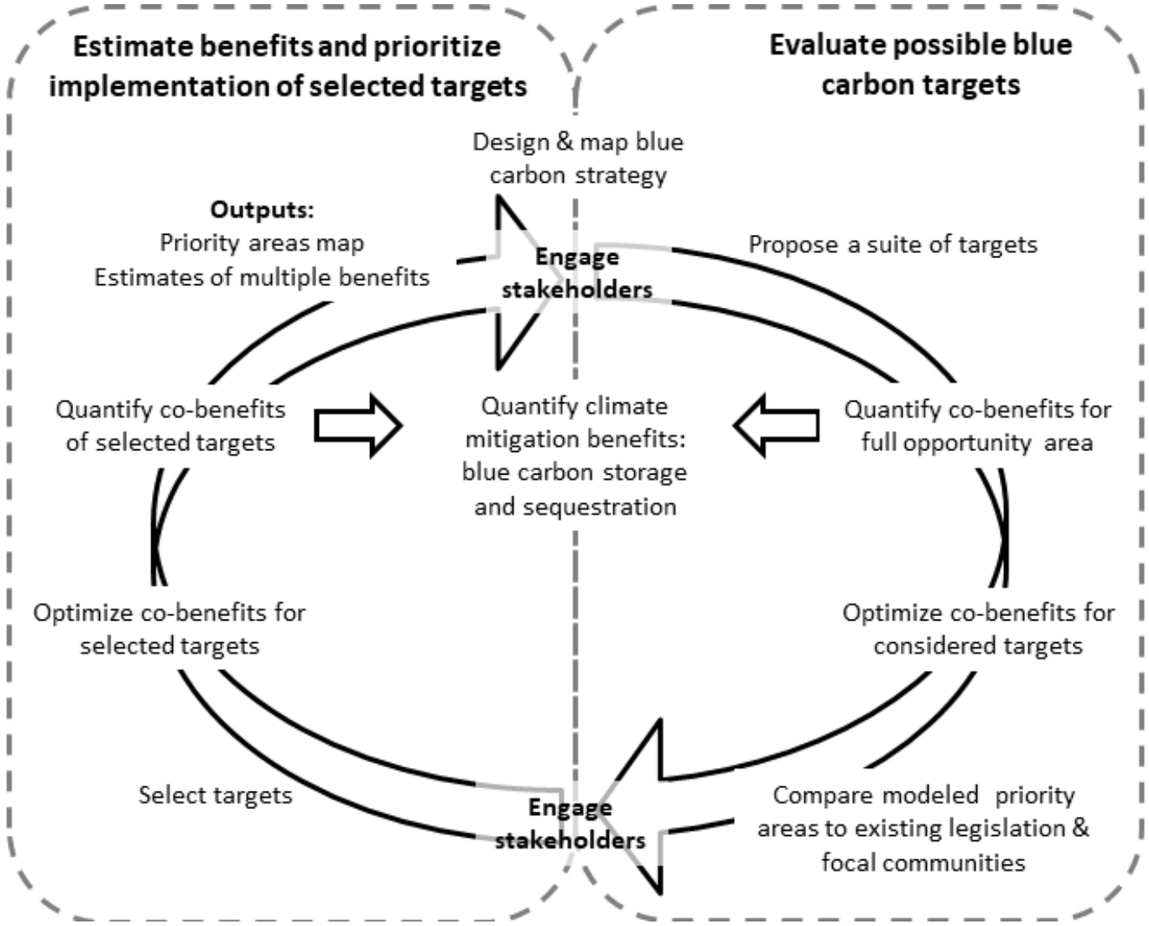
- What are the carbon mitigation and adaptation co-benefits produced by a range of potential blue carbon targets?

- Where should policies and actions be prioritized to provide a rich combination of co-benefits?

Iteration of engagement and modeling

InVEST

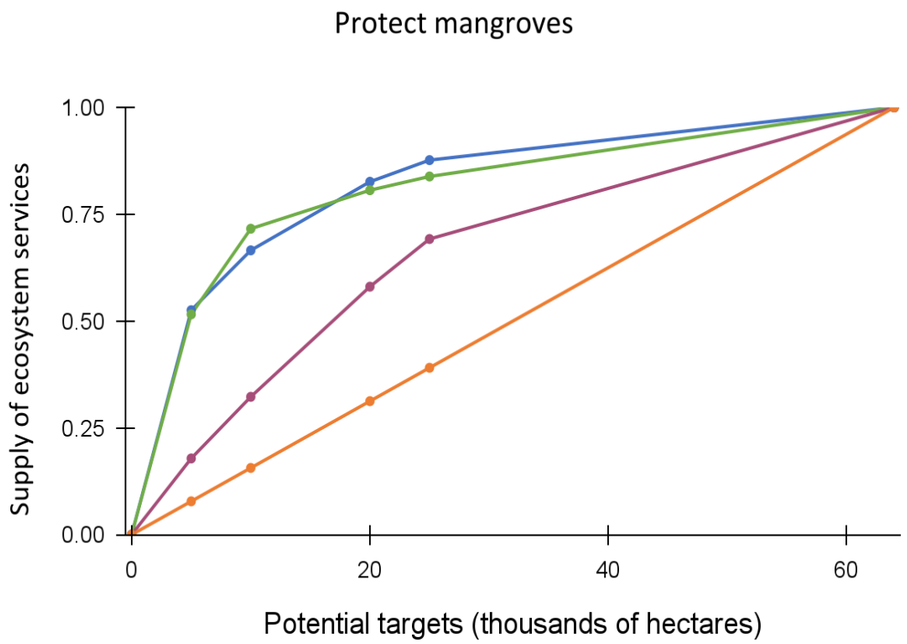
integrated valuation of ecosystem services and tradeoffs

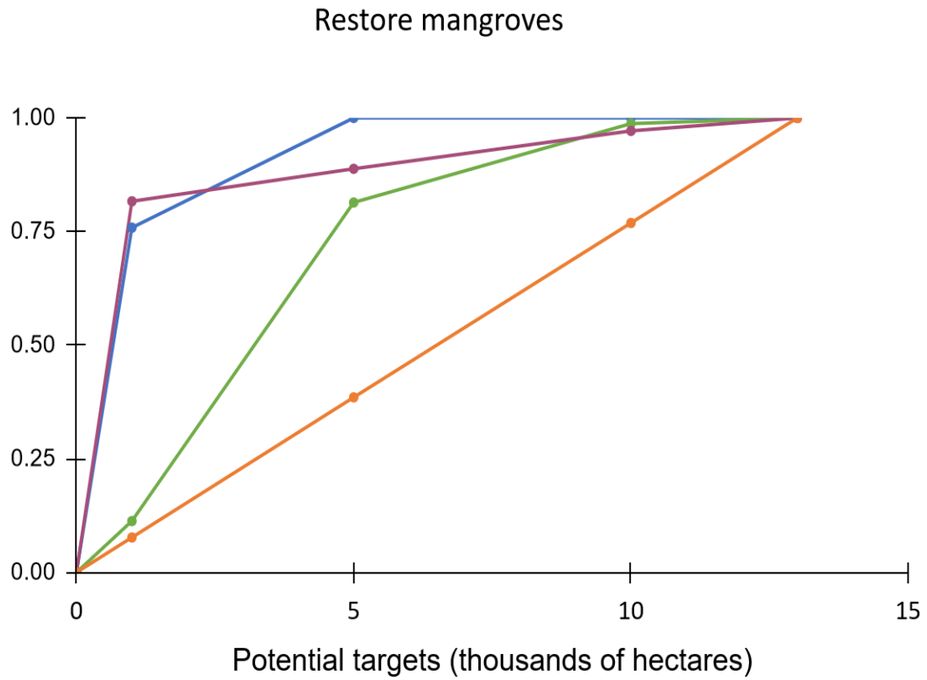


- In situ engagement
- Participatory mapping
- Communicate how community inputs integrated into process

Management relevant results - carbon and co-benefits

Increases in carbon benefits with larger investments in mangroves, while fisheries, tourism, and coastal risk reduction co-benefits grow initially and then plateau.





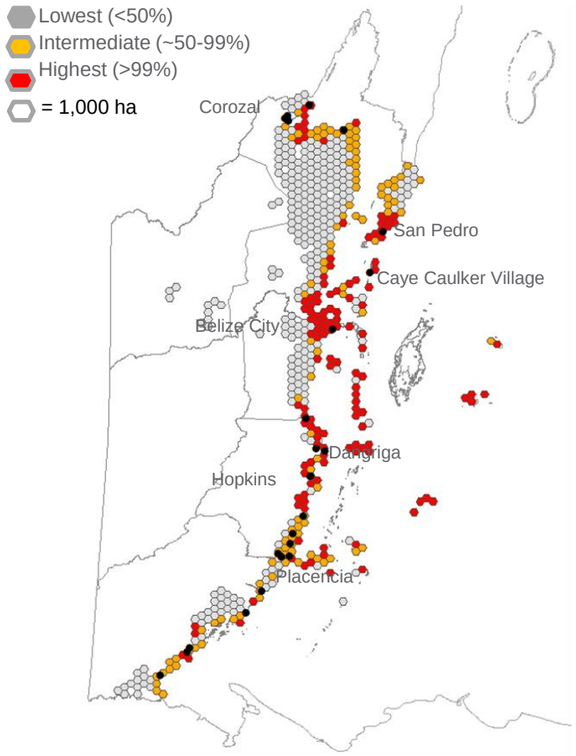
Carbon Tourism Fisheries Coastal Risk Reduction

Arkema et al. 2015 PNAS, Arkema et al. 2023 Nature Ecology and Evolution

Management relevant results - change in co-benefits for selected mangrove protection target

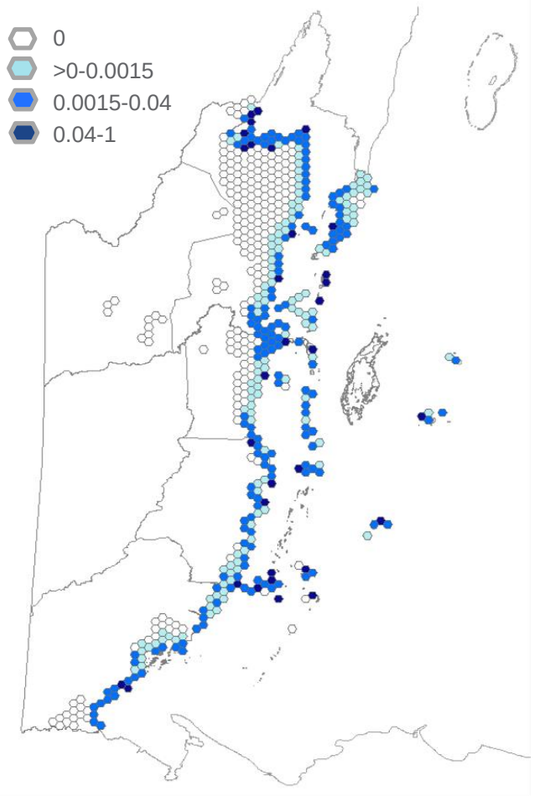
Results show where greatest co-benefits would be realized for least area of investment and highlight spatial variation among services.

Relative priority areas



Priority locations

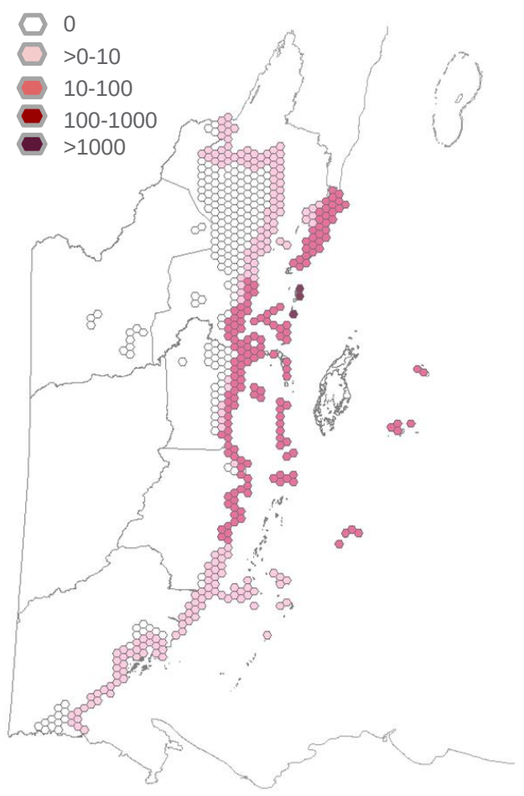
Change in coastal risk reduction/ha



Coastal risk reduction

1/3 population at risk

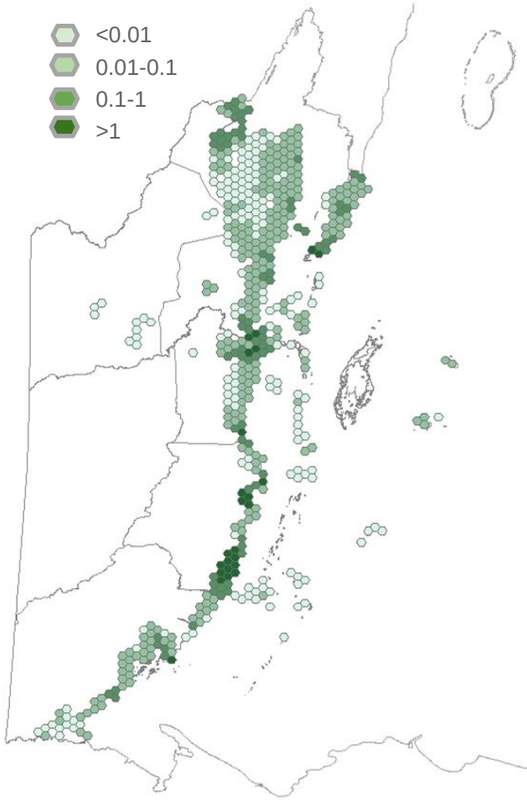
Change in lobster catch lbs/yr/ha



Fisheries

300,000 lbs, $2.5M BZD

Change in visitors/yr/ha



Tourism

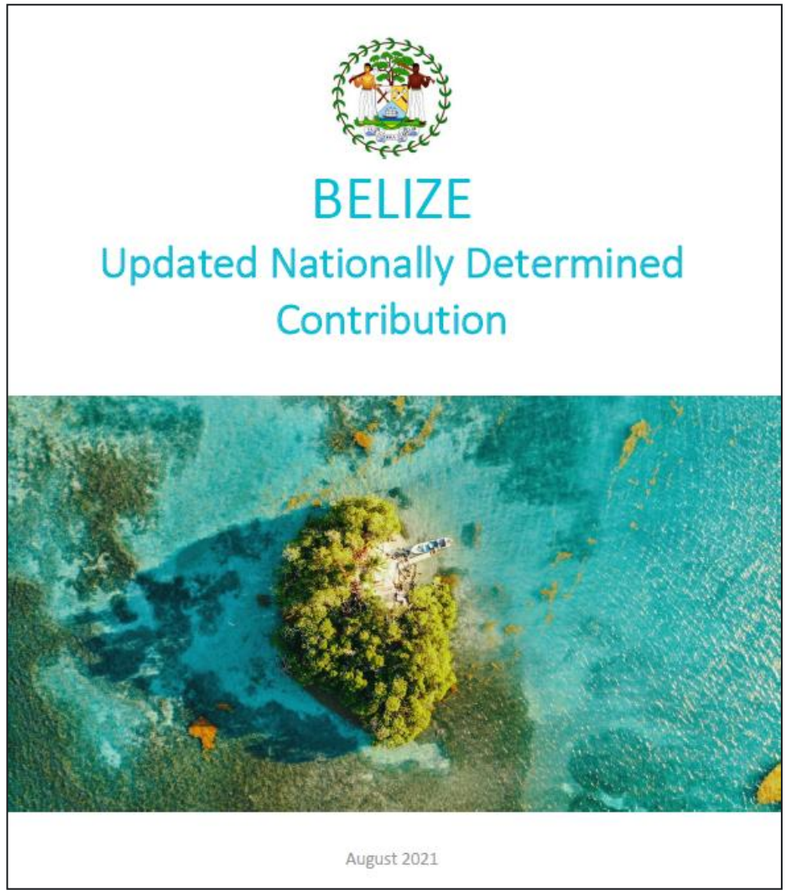
$800,000 BZD expenditures

Policy outcomes informed by research - Selected targets submitted in updated Nationally Determined Contributions (NDCs)

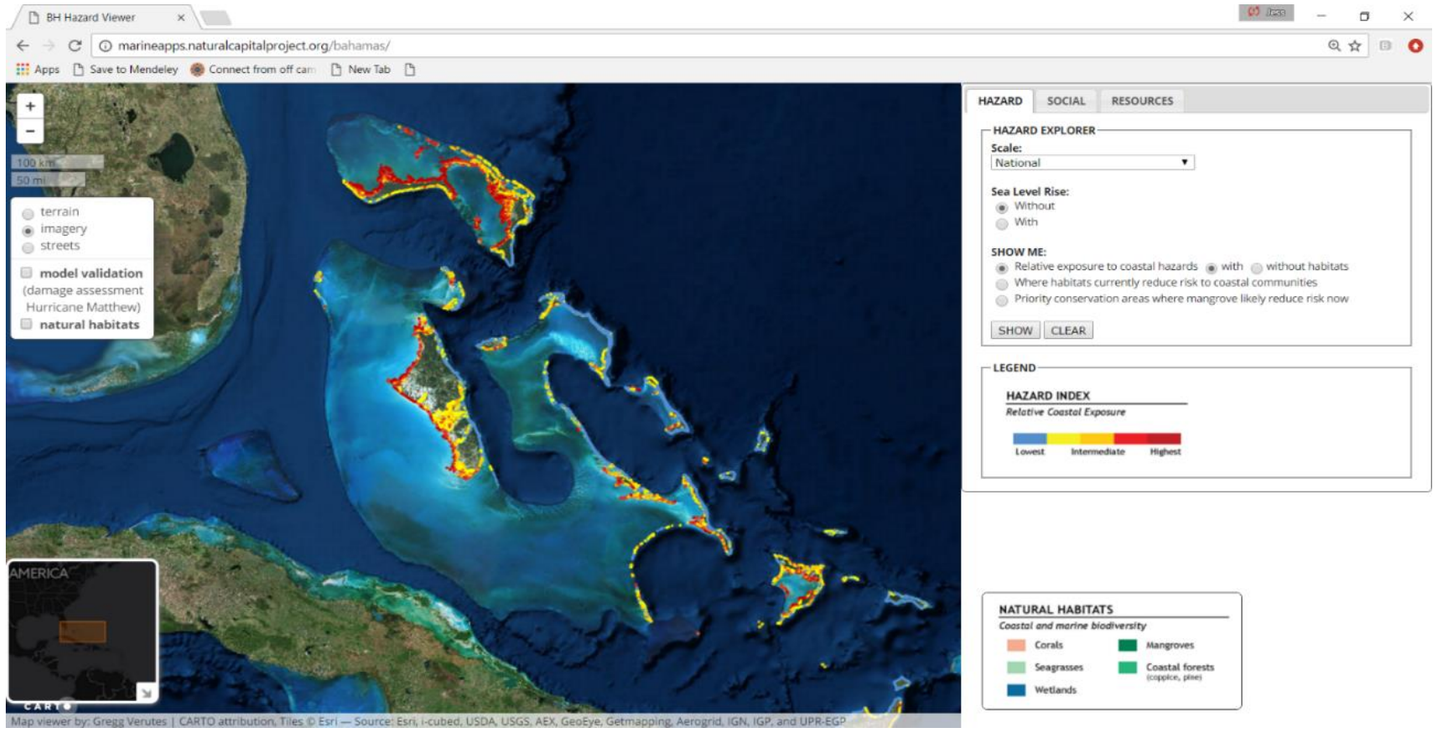
2 time-bound targets for blue carbon

1) Protection of 12,000 ha of mangroves beyond existing protected areas by 2030.

2) Restoration of at least 4,000 ha of mangroves by 2030.



Capacity building through simple online tools



Silver et al. 2019. Frontiers in Marine Science

Two examples of co-designed and co-developed research

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Renewable energy transitions in remote coastal and island communities

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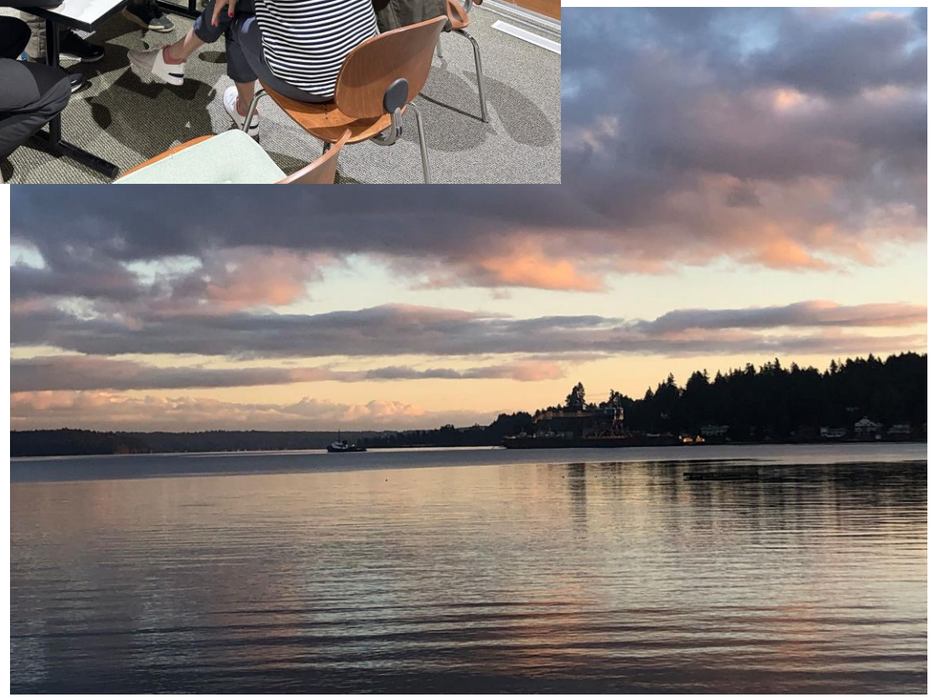
Renewable energy transition – Bainbridge Island, WA

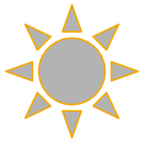
City of Bainbridge Island, WA

- 100% Renewable Energy by 2040
- Increased Energy Resilience for Emergencies and Climate Change

Analyze pathways to 100% renewable energy and explore and develop options for increasing energy resilience in the face of natural hazards.

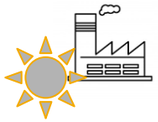


Pathways to 100% Renewable Energy



#1 - City-led solar on-island - City properties are developed for solar then City shares lessons learned, sparks interest, and explores incentive programs to engage other public entities to install solar.

#2 - Community-led solar on-island - All reasonable public and private properties are developed for solar in the near term.

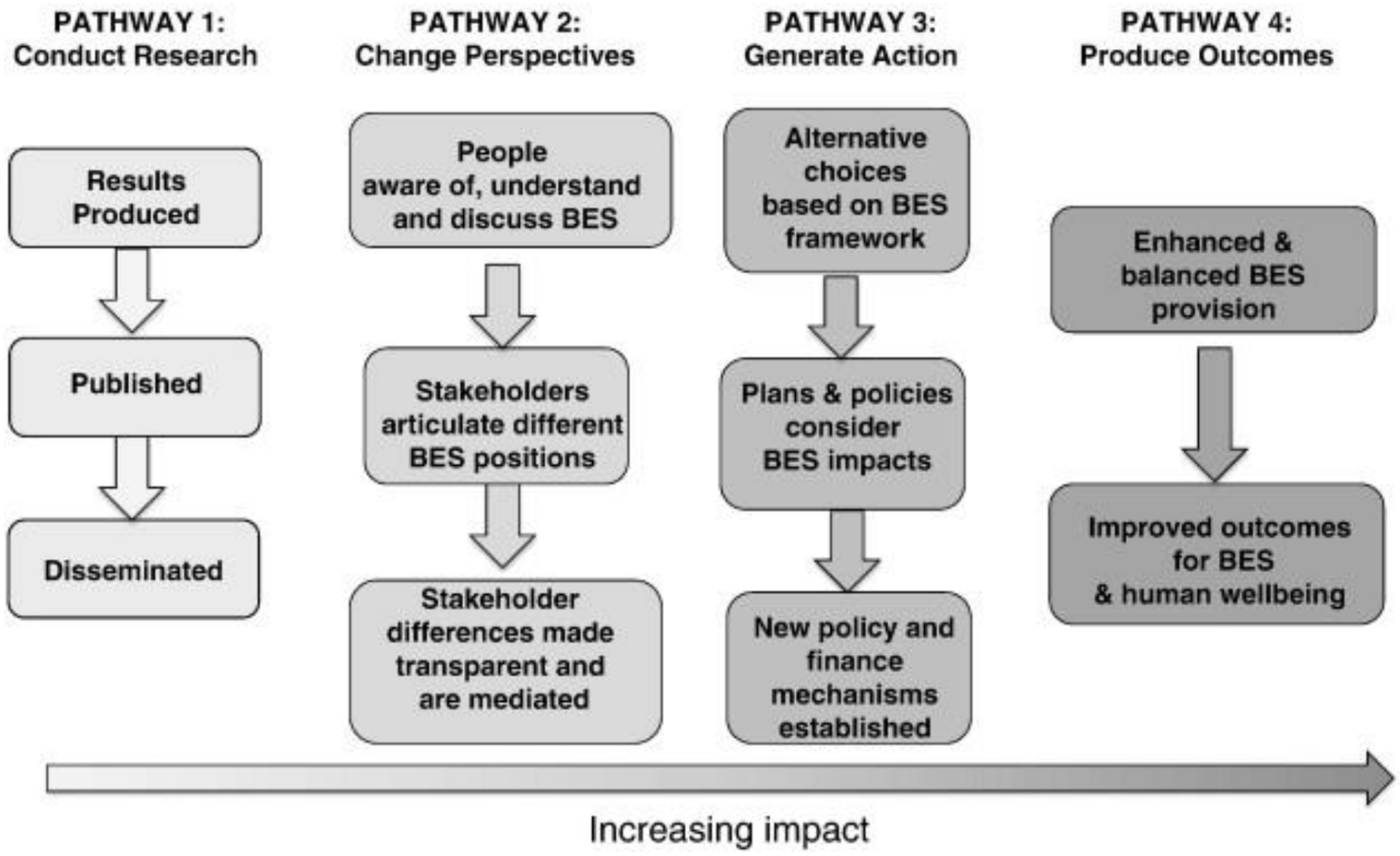


#3 - Solar + Waste-Energy + Buy the rest - All reasonable city properties are developed for solar. An anaerobic biodigester to match existing waste stream is installed. Additional power needed to meet goals is purchased.

#4 - Solar + Small scale wind + Buy the rest - All reasonable city properties are developed for solar. The permitting process for one wind turbine is started. Additional power needed to meet goals is purchased.

#5 - Solar + Tidal energy + Buy the rest - All reasonable city properties are developed for solar. The permitting process for one marine energy converter is started. Additional power needed to meet goals is purchased.

Impact of co-designed social-ecological research



Ruckelshaus et al. 2015 Ecological Economics

Challenges, successes, and future co-produced research

- Invest in iteration and long-term relationships
- Advance qualitative and quantitative scenario development
- Explore multiple, interdisciplinary outcomes that resonate with diverse audiences
- Support capacity building for communities, scientists, and decision-makers