USCRP
US COASTAL RESEARCH PROGRAM

Decadal Visioning Workshop 2024

THE FUTURE OF COASTAL PROCESSES RESEARCH

USCRP
US COASTAL RESEARCH PROGRAM

JUNE 11 – JUNE 13

Hilton St. Petersburg Bayfront – 333 1st Street, SE

Decadal Visioning Workshop

THE FUTURE OF COASTAL PROCESSES RESEARCH

2024

Welcome To Day 2

Linda Manning, The Council Oak

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2024

Examples of Co-developed Solutions to Coastal Challenges

Examples of Co-developed Solutions to Coastal Challenges

Session Objective: Provide examples of big-picture solutions to spur thinking for breakout sessions.

PRESENTERS

- **Amanda Tritenger**, Research Hydraulic Engineer and Deputy Program Manager for the Engineering With Nature Program, U.S. Army Corps of Engineers
- **Katy Serafin**, Assistant Professor, Department of Geography, University of Florida
- **A.R. Siders**, Assistant Professor, Disaster Research Center
- **Tracie Sempier**, Resilience Engagement Lead, Mississippi-Alabama Sea Grant

Examples of Co-developed Solutions to Coastal Challenges

Amanda Tritenger,

Research Hydraulic Engineer and Deputy Program Manager for the Engineering With Nature Program, U.S. Army Corps of Engineers

Engineering With Nature: Co-Developed Solutions to Coastal Challenges

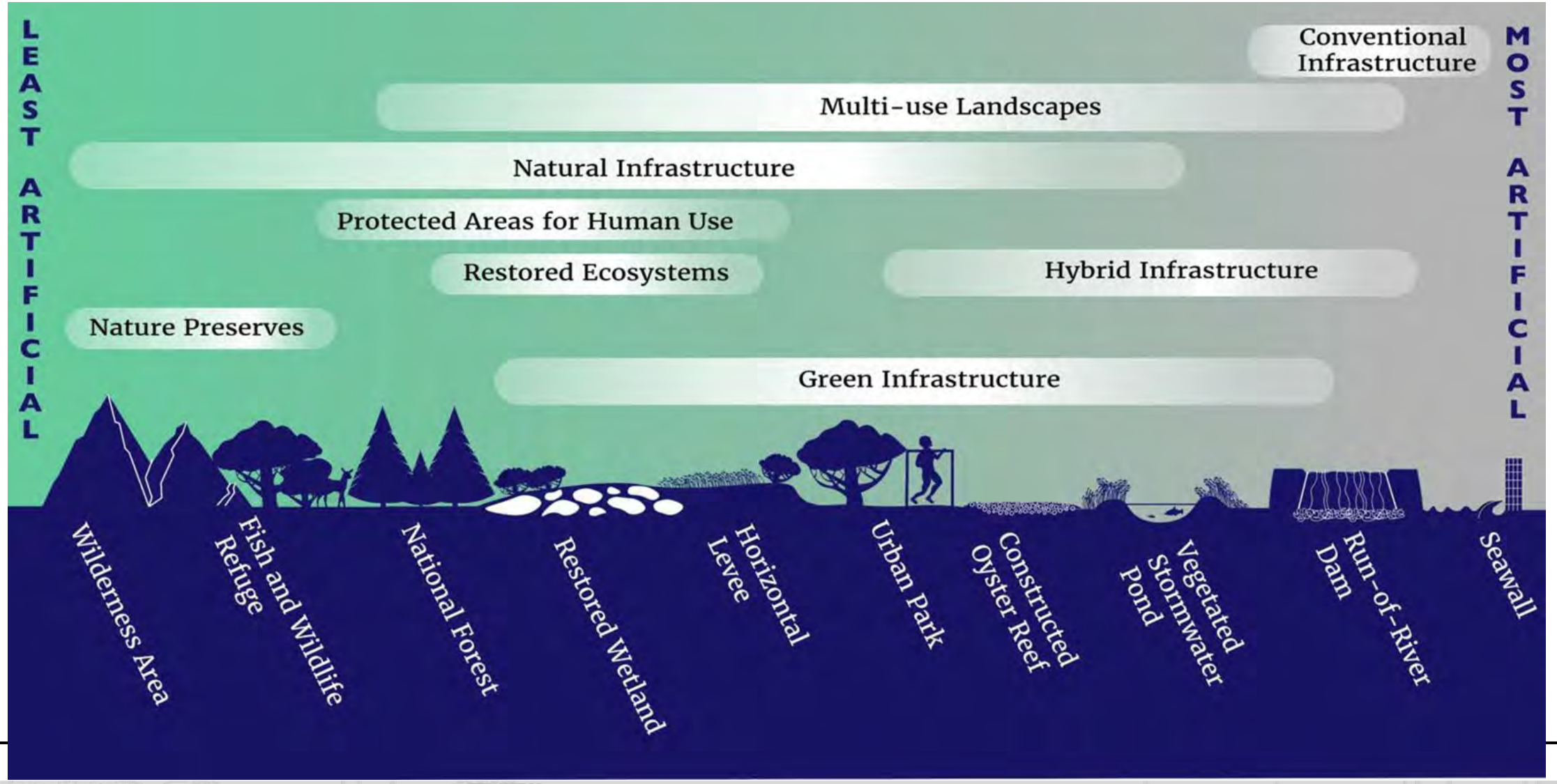
Dr. Amanda Tritinger
Deputy Program Manager,
USACE Engineering With Nature

USCRP Decadal Visioning Workshop
June 2024, St Petersburg, FL

U.S. ARMY

US Army Corps of Engineers®

Natural-Based Solutions (NBS) - A Continuum



EWN Engineering With Nature®

EWN is the intentional alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental and social benefits through collaboration.

Key Elements

- Producing Efficiencies
- Using Natural Process
- Broadening Benefits
- Promoting Collaboration

Engineering With Nature®

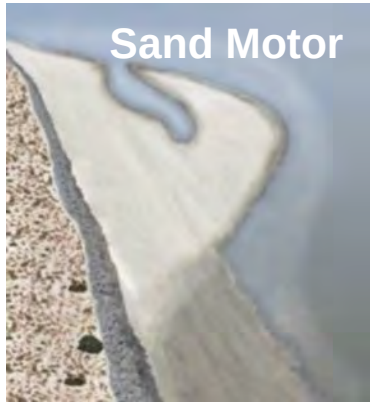
RESEARCH

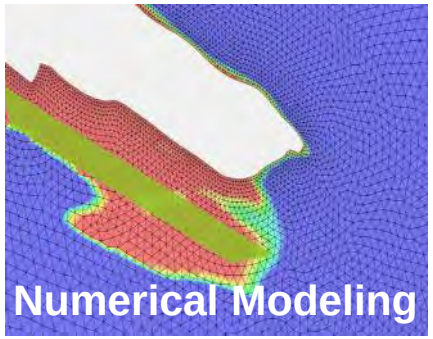
Expand EWN knowledge and expertise that aligns with national interests and the most urgent environmental, economic, and societal threats.

Quantifying The Efficacy Of Floating Vegetated Canopies For Shoreline Protection

60 Active Research Tasks

- Remote Sensing Methods for EWN Designs
- Best Practices for Financing Natural Infrastructure Projects
- Optimizing Nature-Based Solutions for Cold Regions
- Blue Carbon
- Maximizing EWN in Urban Environments
- Equitably Incorporating Wellbeing Benefits of Nature
- 3D Printing Nature Inspired Infrastructure from Dredged Sediment
- EWN Modeling Toolkit – Expansion R&D
- Quantifying the Efficacy of Floating Vegetated Canopies for Shoreline Protection
- Computational Modeling of Manmade Oyster Reefs: Life-cycle, Wave Attenuation, Performance, and Reliability
- Engineering With Nature® (EWN®) Jekyll Island “Sand Motor”
- Maximizing the Long-Term Function of Coastal Islands Derived from EWN Efforts
- Characterizing Engineering Performance of NNBF Combined with Conventional Measures
- More...

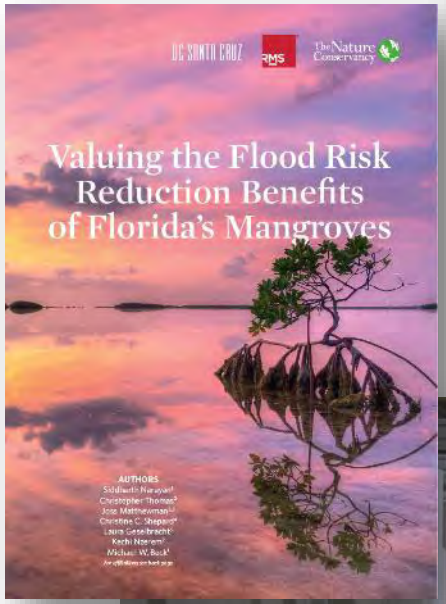




Leveraging Nature for Engineering Value: *Mangroves*

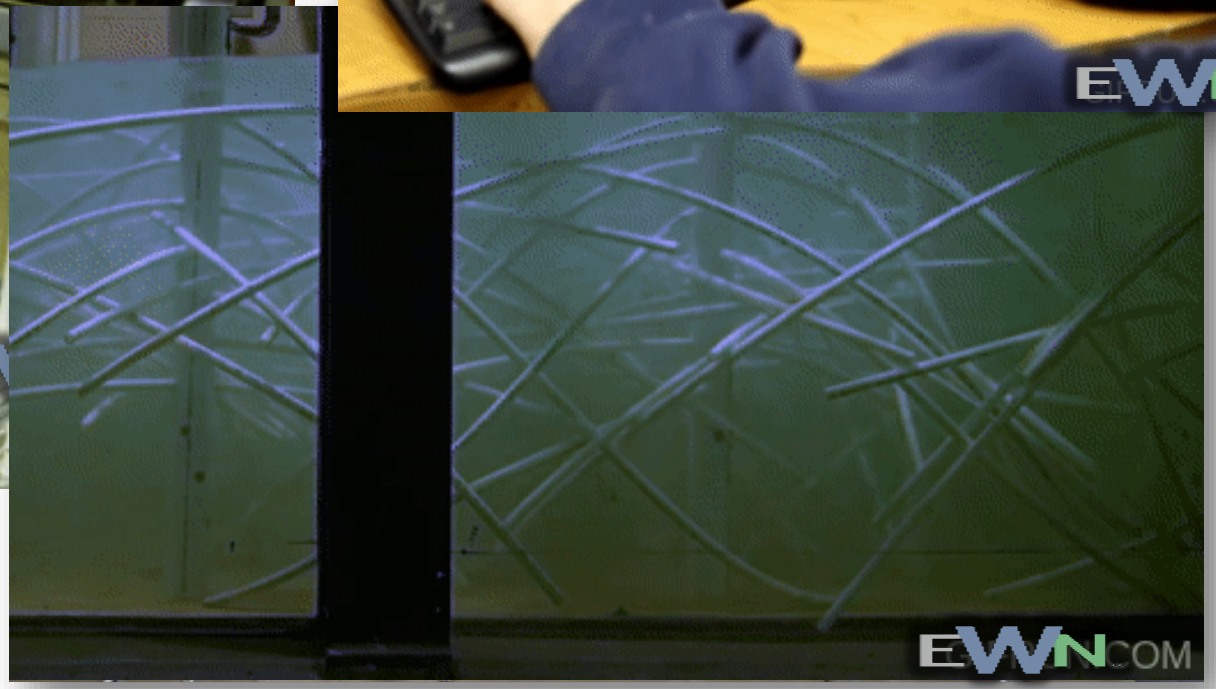
Mangrove Forests for Flood Risk Management:

- Used an insurance industry catastrophe model to quantify the flood reduction benefits of mangroves across Florida
- During Hurricane Irma:
  - Mangroves averted $1.5 billion in property flood damages
    - 25% savings in counties with mangroves
  - >600,000 people living behind mangrove forests saw reduced flooding across Florida



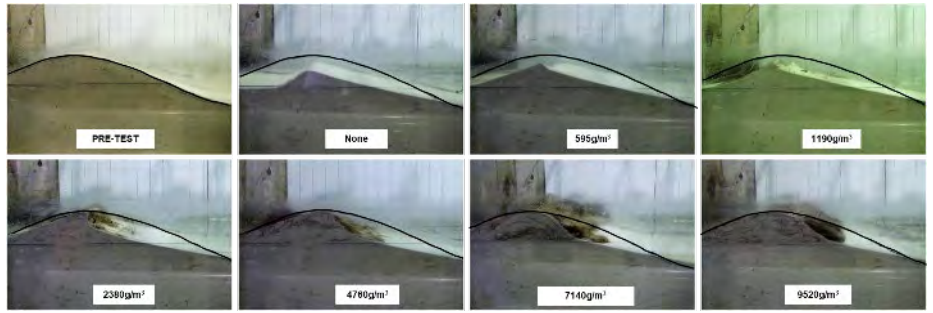
Menendez et al., 2020. *The Global Flood Protection Benefits of Mangroves.* https://www.nature.com/articles/s41598-020-61136-6

Leveraging Nature for Engineering Value: Mangroves



Engineering With Nature: The Role of Mangroves in Coastal Protection by Tori Tomiczek, Anna Wargula, Nia Hurst, Duncan Bryant, and Leigh Provost

Laboratory Model of Dune Erosion



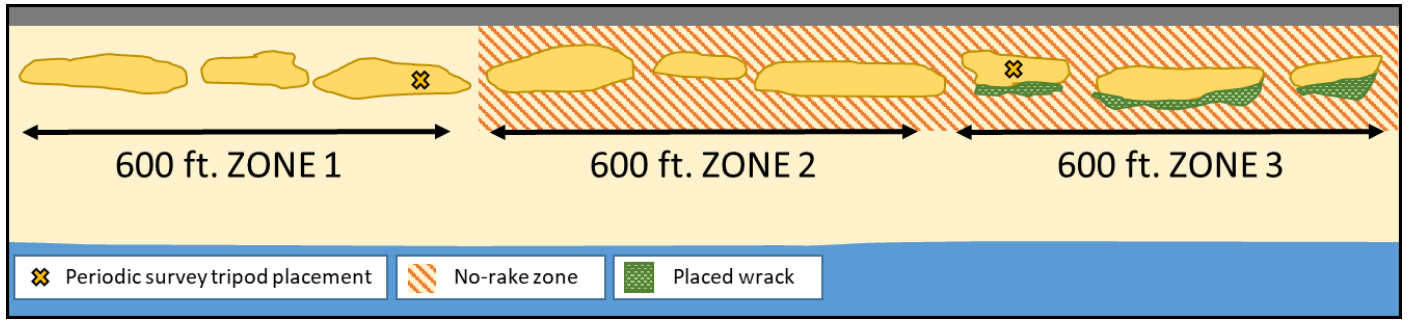
Allowing for Natural Processes… Data from the Field!

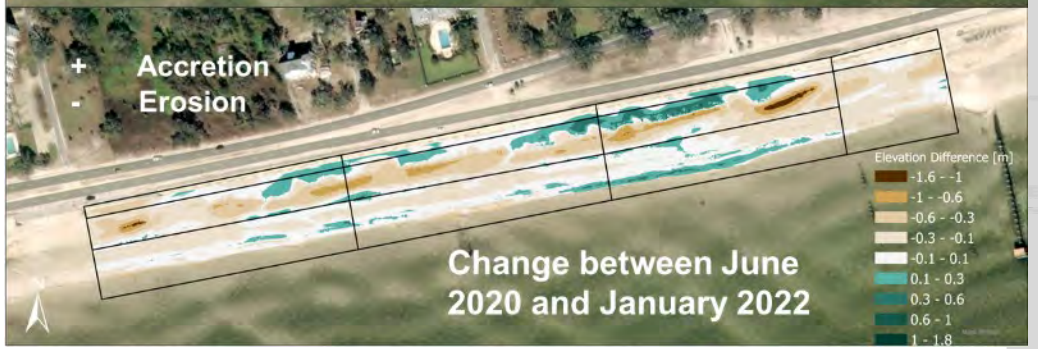
- Dunes with fully integrated biomass throughout the depth will be more resistance to erosion
- Results fit well with field observations showing:
  - Artificial dunes may not respond as natural dunes to storm processes despite being planted with native species, resulting in more rapid erosion. (Morton et al., 1994)

Wrack Management: Pass Christian, MS

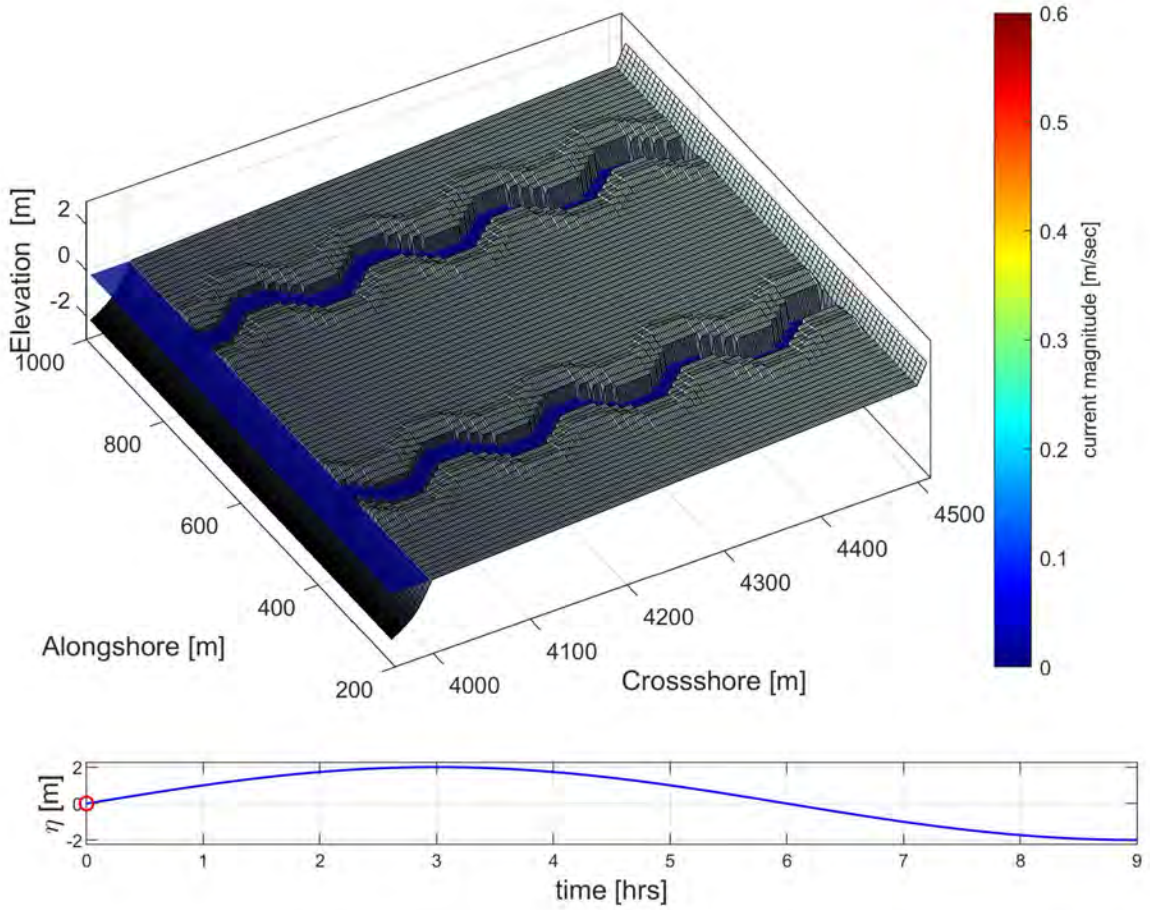
- County currently practicing beach grooming, raking of wrack-line to keep beach clear
- Approach: Place groomed wrack at toe of dune to encourage dune growth via Aeolian transport

Zone	Name	Description
1	Control	Typical beach grooming activities will occur (raking the beach and around dunes)
2	No Rake	Beach will be raked, but around dunes will be left un-raked for duration of study
3	No Rake & Treatment	Same raking practices as Zone 2. Wrack removed from the beach within Zone 3 will be placed on the dune.





Length Scaling Modeling -> DESIGN

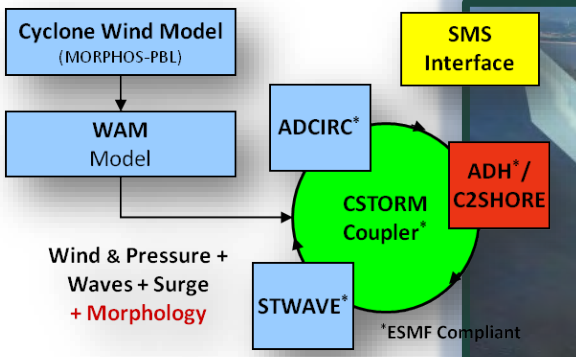


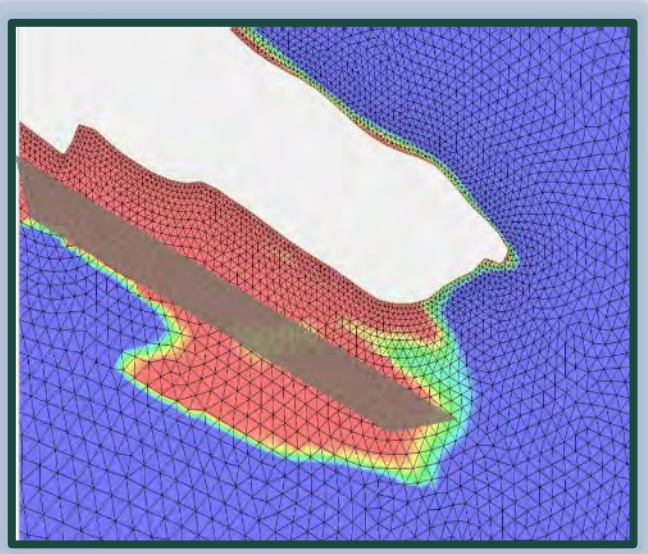
- Quantification of Attenuation Metrics of Marsh
- Tidal creeks promote tidal exchanges (flood & ebb)

EWN® Toolkit for Numerical Modeling

Streamlining & Standardizing Augmentation of Natural Based Solutions within the Numerical Modeling Framework

- **Develop workflow** using existing validated modeling (CSTORM) for digitizing NBS into existing hydrodynamic models.
- **Share Graphic User Interface** to represent that workflow, allowing for rapid representation of NBS in numerical models.





Nature-based Feature	Region	Grouped species	Mannings n	Drag Coefficient	Source
Mangroves	East coast	Rhizophora mangle	0.124 - 3.00 (depending on the range of Re and Fr)	0.4 – 10 (an inver relati betwe CD)	Narayanan et al 2012
	Gulf coast	Avicennia germinans, Rhizophora mangle (Florida)	0.124 - 3.00 (depending on the range of Re and Fr)	0.4 – inver relati betwe CD)	
Low and High marsh	East and Gulf coast	Spartina patens, Spartina alterniflora, Distichlis spicata;		0.1- 1-4 (coeff 3.2 (	
				properties[1])	
		Limonium		0.03	

Suggested Vegetation Roughne
Modeling in the Coastal Regio
Table tool
A journal publication *Title subject to change*

Inter-disciplinary Multi-Lab SME Team

Completed comprehensive, national scale, literature review to create look up table with

10+ NBS Type

Represented in report and in the Toolkit GUI.

US

Engineering With Nature®

COLLABORATE

Strengthening partnerships within and outside USACE for interdisciplinary solutions and efficiencies.

Nearly 200 volunteers helped install the shoreline in April 2016.
(Photo by South Carolina The Nature Conservancy [SCTNC])

THE NETWORK FOR ENGINEERING WITH NATURE

A network of vested organizations creating a resilient future by integrating conventional and natural infrastructure to improve societal well-being by sustainably delivering more value and benefits to people and ecosystems.

US Army Corps of Engineers.
Georgia Department of Natural Resources Coastal Resources Division
NYC Mayor's Office of Climate & Environmental Justice
University of Georgia Institute for Resilient Infrastructure Systems
UF University of Florida Center for Coastal Solutions
The Water Institute
Ducks Unlimited
NCCOS National Centers for Coastal Ocean Science
ASU Arizona State University
Tribal Nations Technical Center of Expertise
University of New Hampshire School of Marine Science and Ocean Engineering
CREW Center for Restoration of Ecosystems and Watersheds University of Oklahoma
University of California Santa Cruz
Science+ Resilience Institute Jamaica Bay · NYC
Biohabitats
Duke
Stantec
AECOM
San Antonio River Authority
City of Austin Founded 1839
moffatt & nichol
ECONCRETE
Natrx

EWN Engagement, partnering, and teaming

N-EWN.org

Evaluating Benefits: BCA Policy Research

Approach:

- **Summarize** historical and current alternative evaluation policies and practices
- **Identify** 6 historical planning studies that considered NBS alternatives suitable for case study analysis
  1. *Jacksonville Harbor (NAV, South East)*
  2. *Jamaica Bay Reformulation (CSRM, North East)*
  3. *Southwest Coastal (CSRM, Gulf Coast)*
  4. *South Platte River and Tributaries (FRM, North West)*
  5. *West Sacramento (FRM, Pacific)*
  6. *South San Francisco Bay Shoreline (FRM, Pacific)*
- **Review** updated valuation methods and planning frameworks that incorporate environmental and social benefits
- **Analyze** case studies using updated methods and exploratory analysis to look beyond current policy constraints

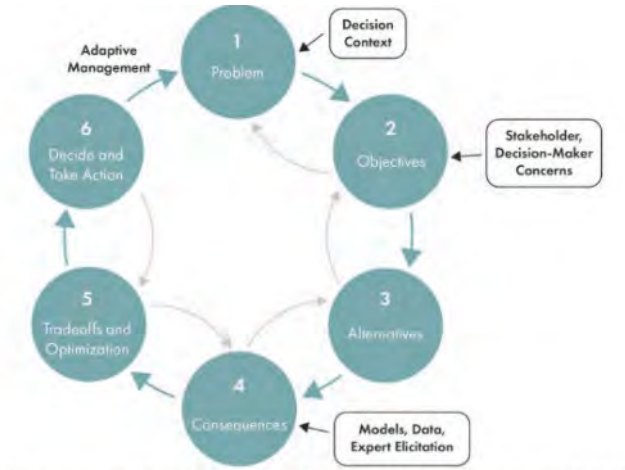


Figure 2-1. Visual representation of the PrOACT cycle used in Structured Decision Making. Source: adapted from Dalyander et al. (2021).

THE WATER INSTITUTE OF THE GULF

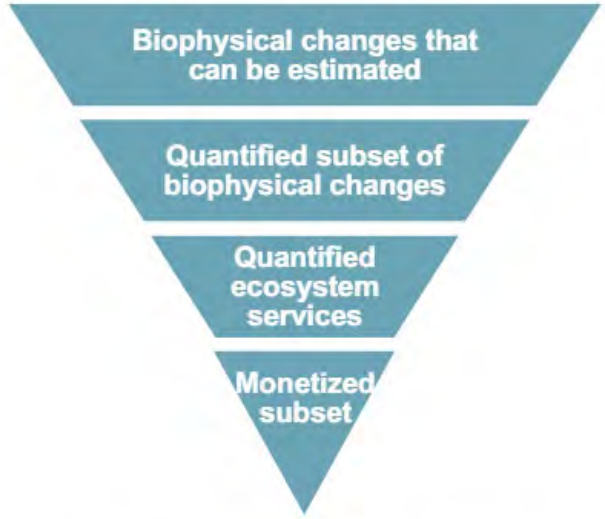
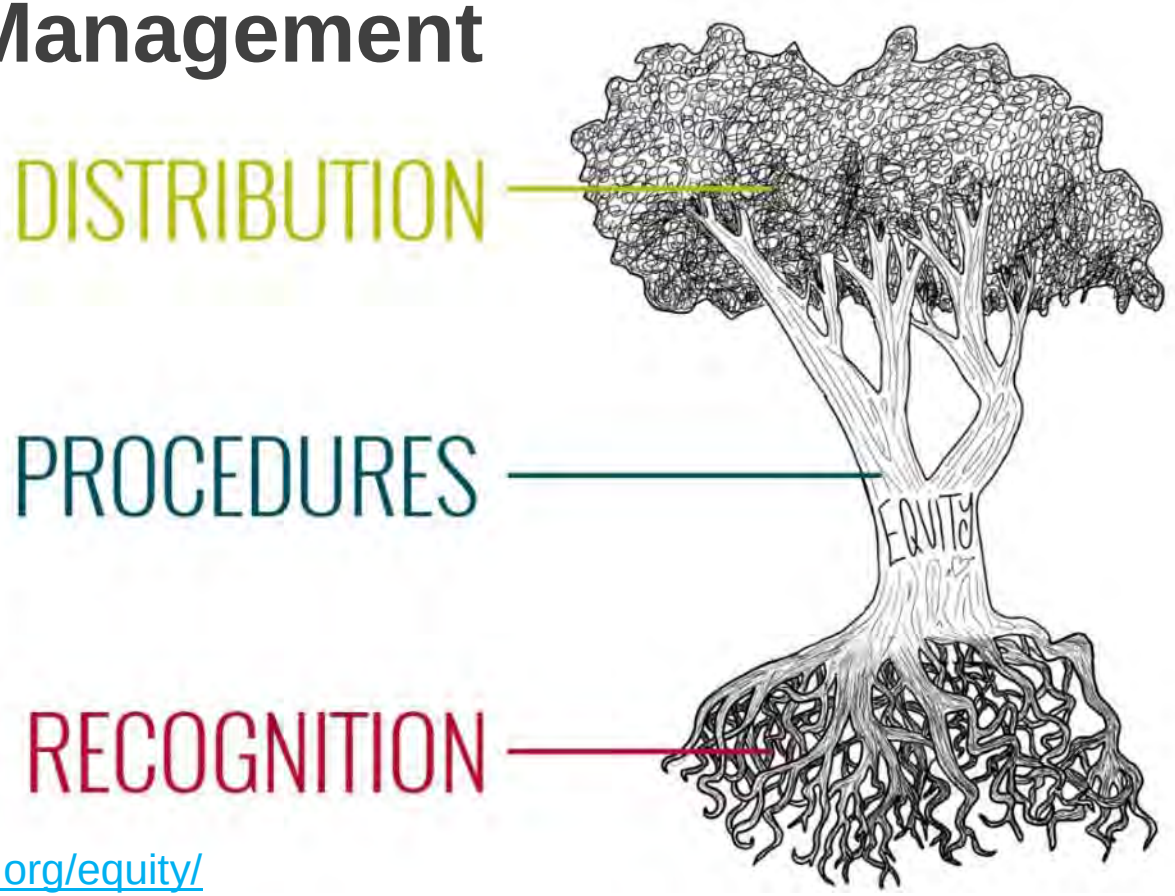


Figure 3-1. Flowchart showing analysis funnel concept

Overcoming Barriers to Including Equity in Water Management

- Incomplete conceptual understanding of equity
- A (perceived) lack of quantitative and qualitative equity metrics
- An unclear connection between equity and standard project planning frameworks
- The absence of detailed examples that incorporate equity in project planning and execution



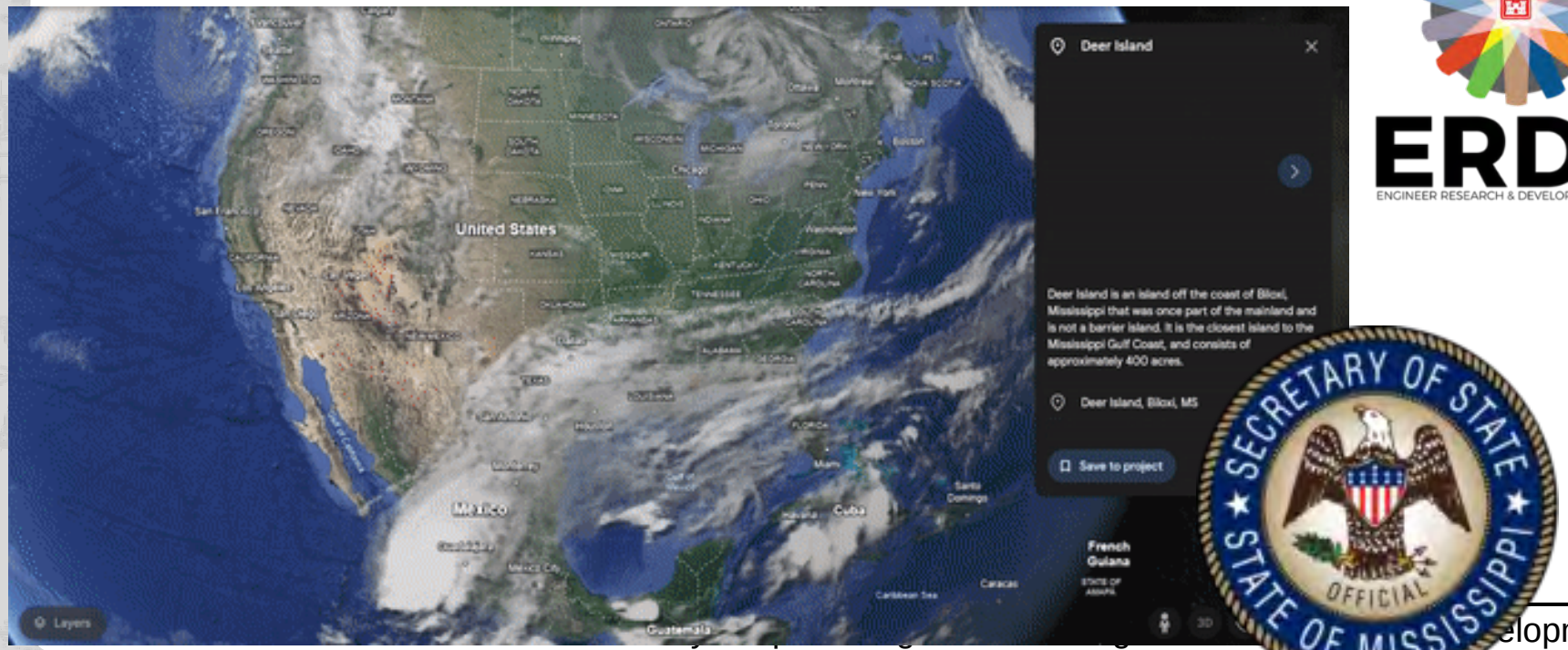
Why does equity matter for water resources? https://n-ewn.org/equity/

Seigerman C.K., McKay S.K., Basilio R., Biesel S.A., Hallemeier J., Mansur A., Piercy C., Rowan S., Ubiali B., Yeates E., and Nelson D.R. Operationalizing equity for integrated water resource management. Submitted to *Journal of the American Water Resources Association*.

Deer Island Restoration Project

- 3.5-mile long spindle-shaped island located just off the coast of Biloxi, Mississippi.

- The main goal of this project is to preserve and restore Mississippi's coastal ecosystems to perpetuate their natural characteristics, features, ecological integrity, social, economic, and aesthetic values for future benefit.



MISSISSIPPI DEPARTMENT OF MARINE RESOURCES
ENHANCE ★ PROTECT ★ CONSERVE

ERDC
ENGINEER RESEARCH & DEVELOPMENT CENTER

US Army Corps of Engineers
Mobile District

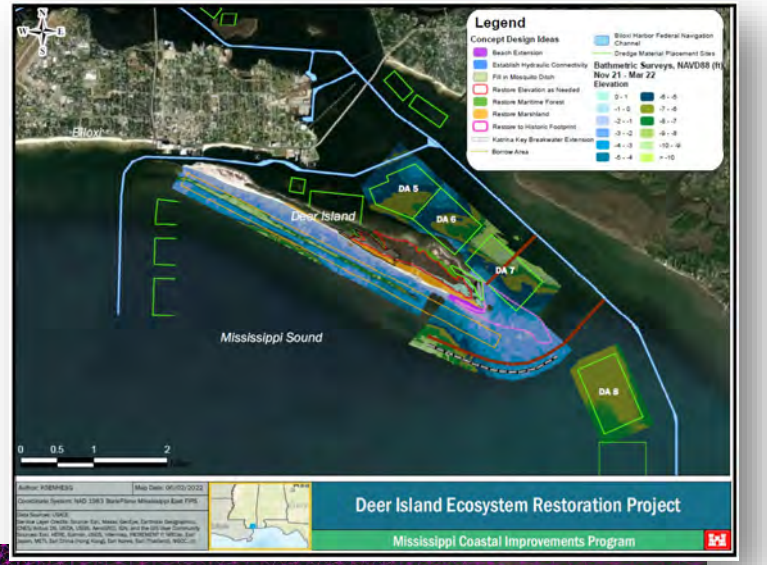
EWN®
Engineering With Nature

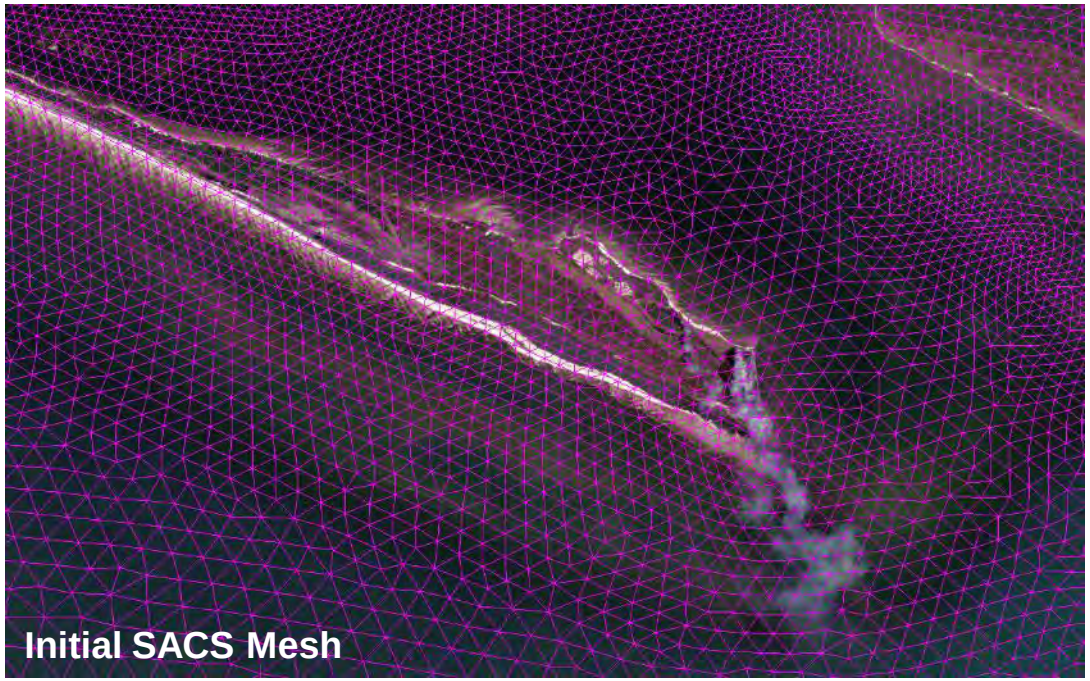
USGS

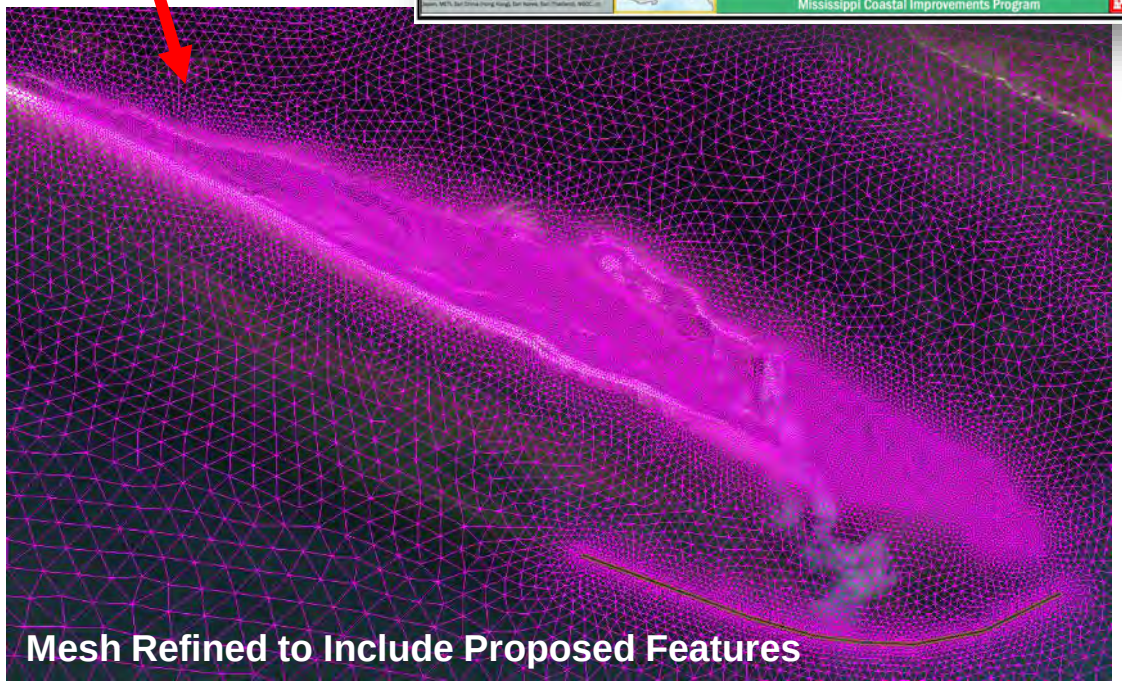
SECRETARY OF STATE
STATE OF MISSISSIPPI
OFFICIAL

elopment Center

Deer Island Modeling Approach







Engineering With Nature®

IMPLEMENT

Increase EWN implementation capacity **with tools, guidance, and demonstration to aid practitioners and communities in NBS implementation.**

Use of Vegetation: Restoring stream and floodplain habitat for migrating salmon. Horsetail Creek, OR.

Engineering With Nature

The Atlas Series

EngineeringWithNature.org

Producing Efficiencies

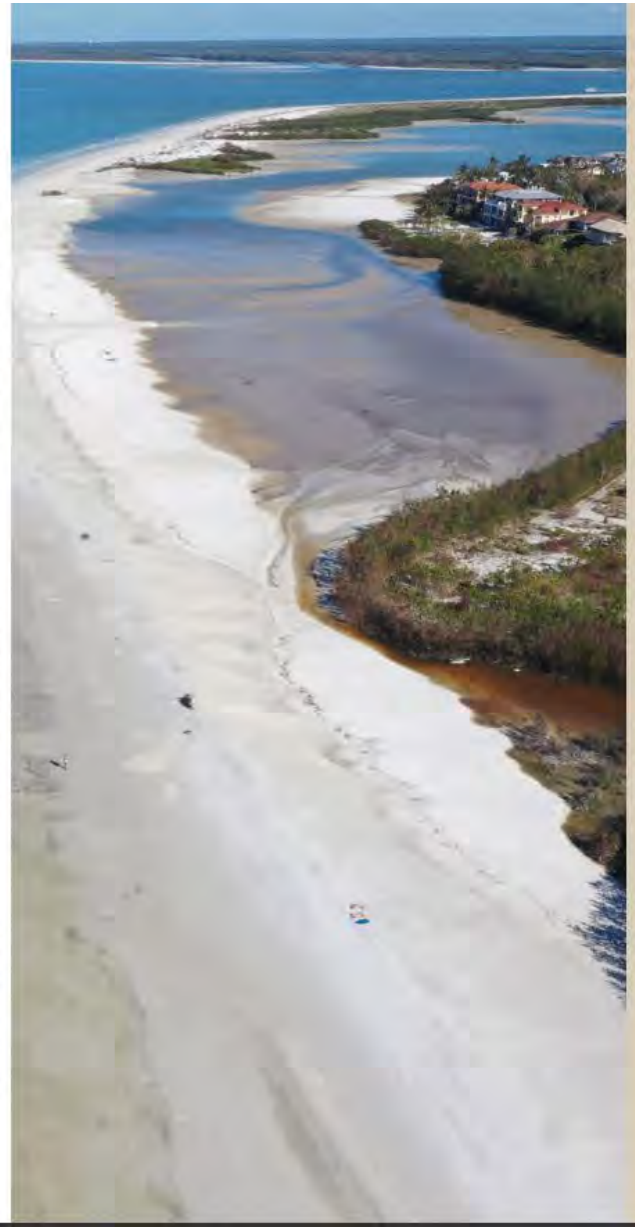
The highly productive lagoon habitat, consisting of hectares of mangroves, seagrass beds, and shallow foraging areas, was in decline as the Sand Dollar Island spit migrated landward, covering seagrasses and eventually reaching the mangroves. Restoration of this ecological system included relocating the existing spit seaward to where it was approximately five years ago. This enlarged the existing waterway to prior conditions and provided enhanced sediment management at the Big Marco River, where excess shoaling required frequent maintenance dredging. The project established a sand trap where nuisance sediment is accumulating, using that to reconstruct the thinning and retreating Sand Dollar Island spit.

Using Natural Processes

The project relocated nuisance sediment shoaling to areas where it provides enhanced protection from wave and coastal storm impacts. Sand from Sand Dollar Island erodes either toward the sand trap or adjacent Marco Island Beaches, providing supply to that area, creating a natural cycle and beneficial downdrift effects. This beneficial use of dredged materials will ensure continued supply to downdrift beaches and provide natural recirculation to the sand trap. Periodic maintenance of this sand spit will provide coastal protection that is adaptive to sea level rise.

Previous page: Aerial view of the flow channel and restored wetland. Restoration of over eight hectares of lost tidal wetlands occurred since 2017. A tidal flow channel was established, reconnecting the lagoon south end at Tigertail Beach Park with gulf tidal flow. (Photo by Humiston & Moore Engineers)

Right: Aerial view of flow channel preconstruction. Restoration of the gulf shoreline improved tidal flushing, water quality, and recreational park attractions. (Photo by Humiston & Moore Engineers)



Broadening Benefits

The Tigertail Lagoon and Sand Dollar Island ecosystem is a protected natural preserve and a critical wildlife area that provides valuable habitat for a variety of birds, sea turtles, manatees, and seagrasses and valuable Marco Island recreational resources for residents and tourists for birding, fishing, kayaking, paddle boarding, kitesurfing, and, on the northern half, boating. The project design included enhanced terrestrial habitat for shorebirds and nesting sea turtles. Beneficial use of sediment was applied by taking sediment from the areas of shoaling to be applied to areas of erosion and retreat, providing economic and sustainable adaptability for future management.

Promoting Collaboration

Project design elements included integrated efforts with the upland community, the City of Marco Island, state and federal agencies, Rookery Bay National Estuarine Research Reserve, and Critical Wildlife Area administration to maintain the integrity of the natural barriers system for protection and management of coastal flooding vulnerability and wildlife habitat. Community outreach included engagement and feedback from local groups, such as Friends of Tigertail Beach and the upland property owners. Designs were provided and input solicited from each stakeholder throughout the design and permitting stages. This led to several design modifications to incorporate additional beneficial features.

Top: Aerial view of the lagoon entrance posiconstruction. (Photo by Humiston & Moore Engineers)

Middle: American flamingo (Phoenicopterus ruber) present in Tigertail Beach Park. The beach is one of 510 points on the Great Florida Birding and Wildlife Trail and is considered one of the best all-around birding spots in southwest Florida. (Photo by Jack Hartfelder, Turrell Hall & Associates)

Bottom: Beachgoers enjoying postrestoration conditions along Tigertail Beach Park. (Photo by Mohamed Dabees, Humiston & Moore Engineers, and Jack Hartfelder, Turrell Hall & Associates)

Tigertail Lagoon / Sand Dollar Island

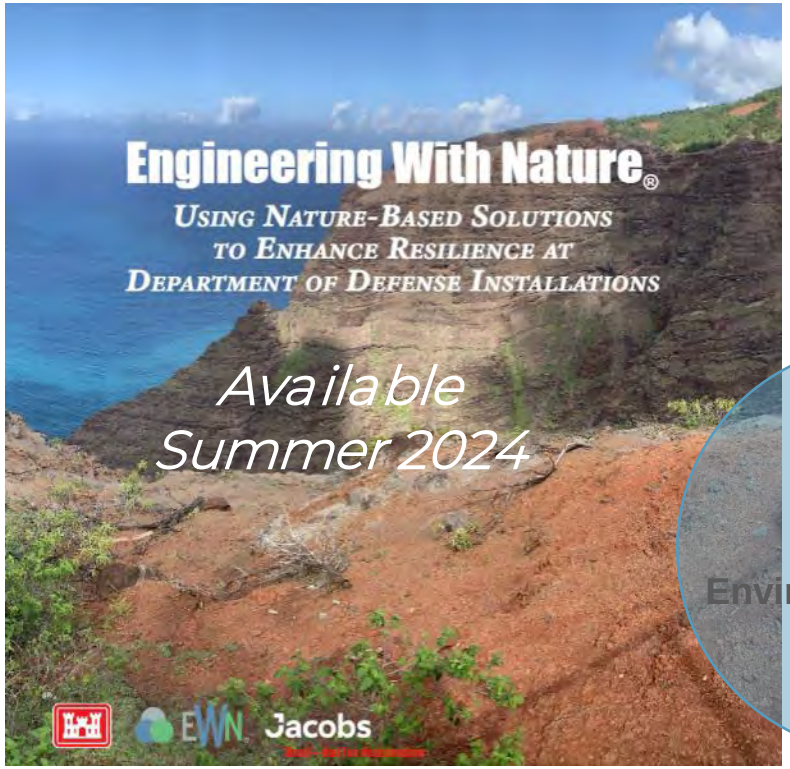
Marco Island, Florida, United States

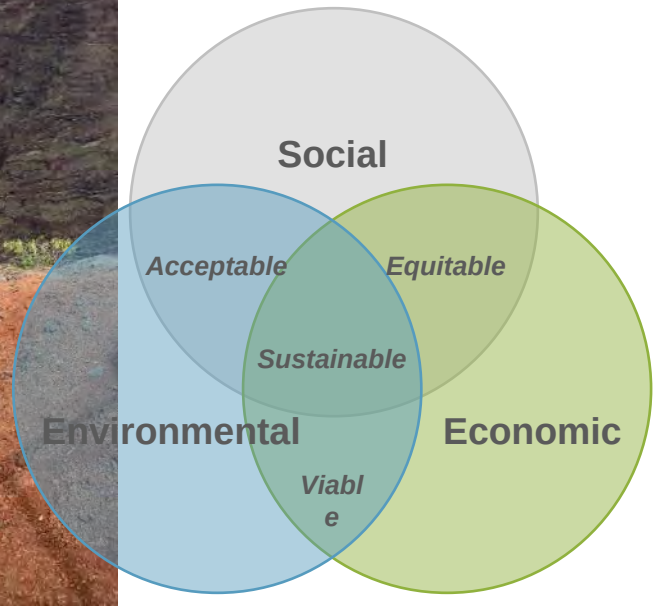
Increasing coastal resiliency through a multitiered coastal barrier system. Shaped by the natural sand bypassing processes at the Big Marco River, landward migration of emergent shoals since the 1990s has formed a lagoon sheltered by an attached sand spit known as Sand Dollar Island. Natural processes led to continued landward migration of the spit, pinching the tidal channel and reducing coastal protection. The mangrove-lined back bay was next to be eroded. The Tigertail Lagoon and Sand Dollar Island Ecosystem Restoration project area lies on the northwest part of Marco Island in a state-administered Critical Wildlife Area adjacent to the City of Marco Island, Florida, a barrier island community with over 16,000 full-time residents that rises to over 40,000 during winter months. The project restored the three-kilometer-long sand spit, a coastal lagoon, and mangrove shorelines by reestablishing an adequate flow channel. Restoration of the sand spit and lagoon provides continued and enhanced coastal protection to over a quarter of the Gulf-facing shoreline while maintaining a large and productive natural coastal ecosystem that is accessible to the public. Adaptive management of this area will ensure that the natural environmental functions of this dynamic coastal system will remain in place, providing habitat and coastal protection into the future.

Islands

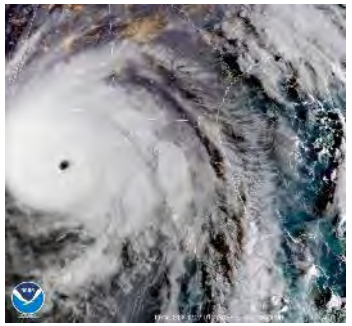
Engineering With Nature for the Department of Defense (DoD)

- Provide system-level natural hazard and vulnerability assessments
- Evaluate the use of EWN strategies to increase mission resilience
- Provide technical expertise to installations when implementing, operating, and maintaining the recommended infrastructure solutions
- Optimize, design, and evaluate nature-based solution resilience strategies

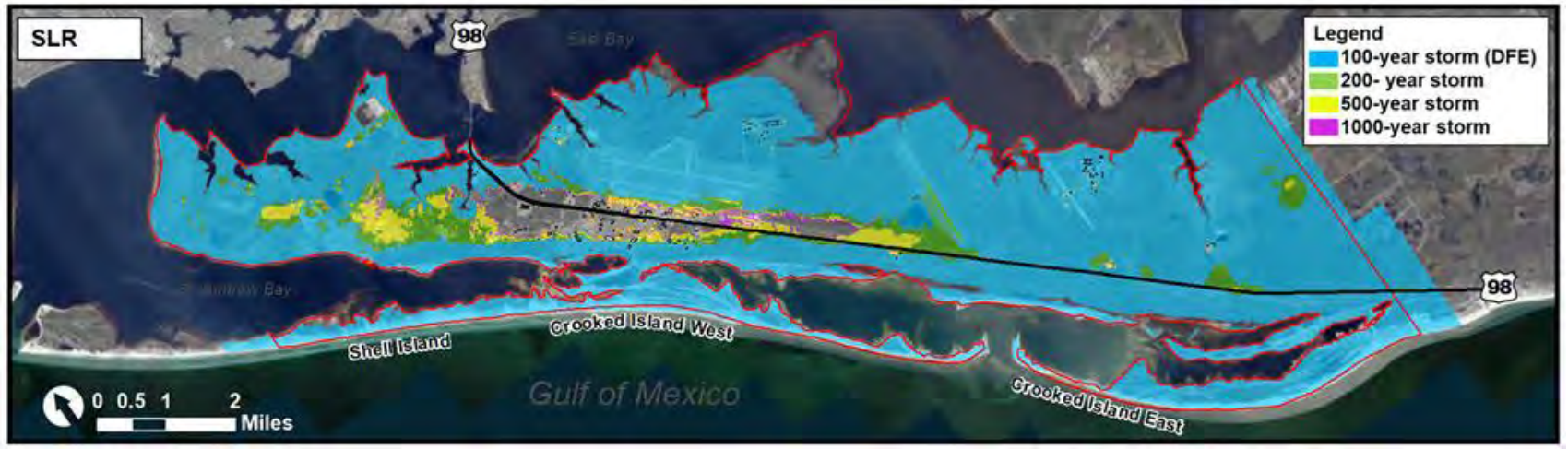


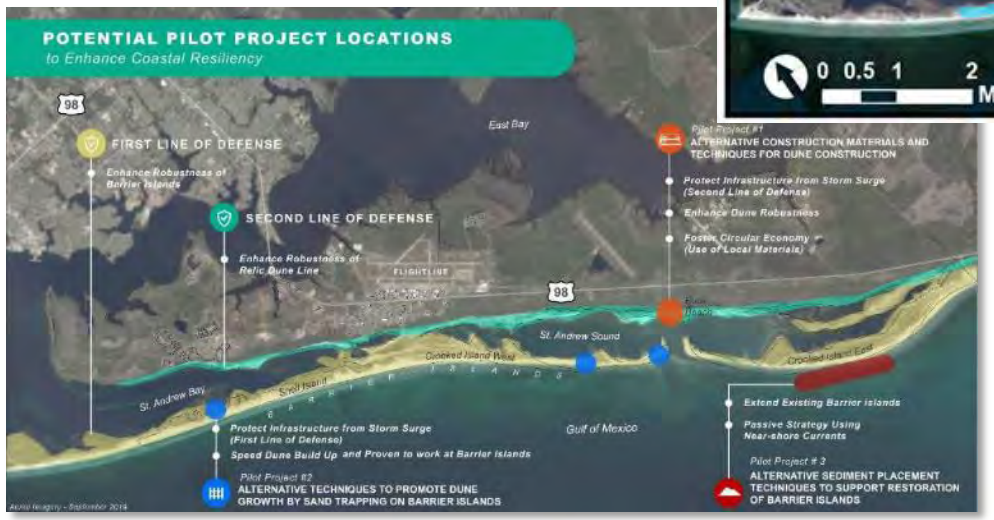


EWN® Applied to Tyndall Air Force Base for Coastal Resilience



Hurricane Michael, 10-11 OCT, 2018



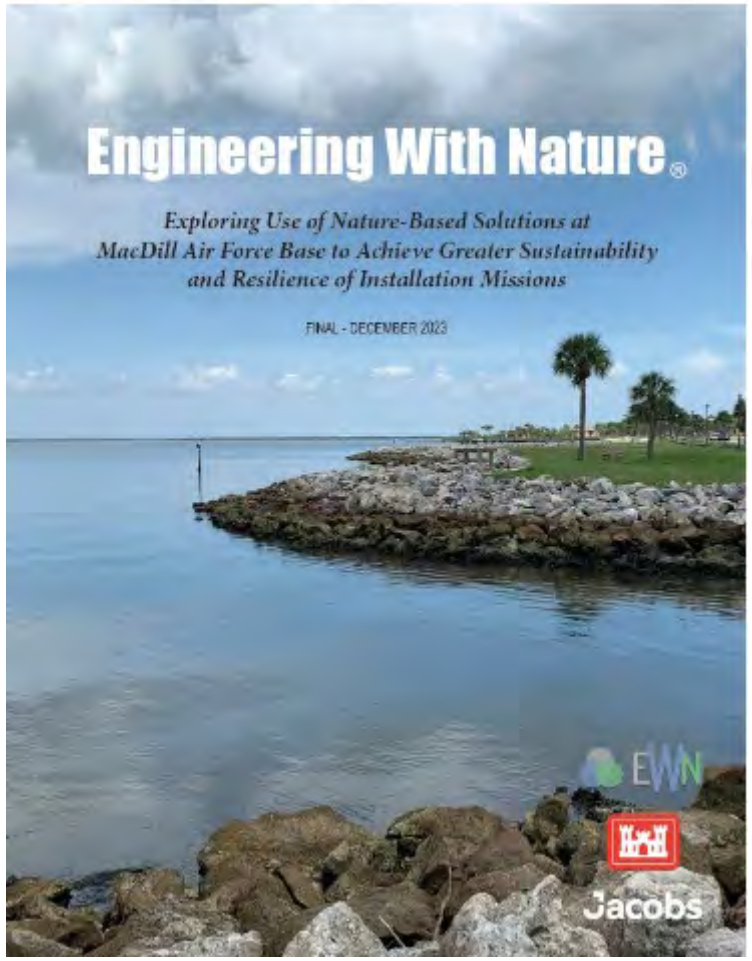


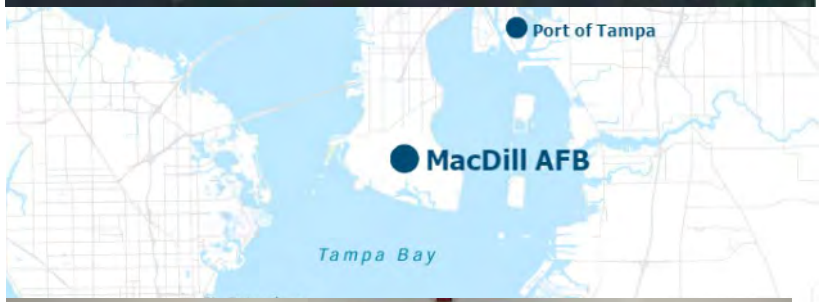
Tyndallcoastalresilience.com

- EWN Podcast Season 1, Episode 3: BG Melancon
- *Winner*: 2021 UK Environment Agency Flood & Coast International Excellence Award

US Army Corps of Engineers • Engineer Research and Development Center

Ex: Workshop Report for MacDill Airforce Base





Credit: Courtesy of Jacobs

The Next Step:
NBS Engineering Guidance

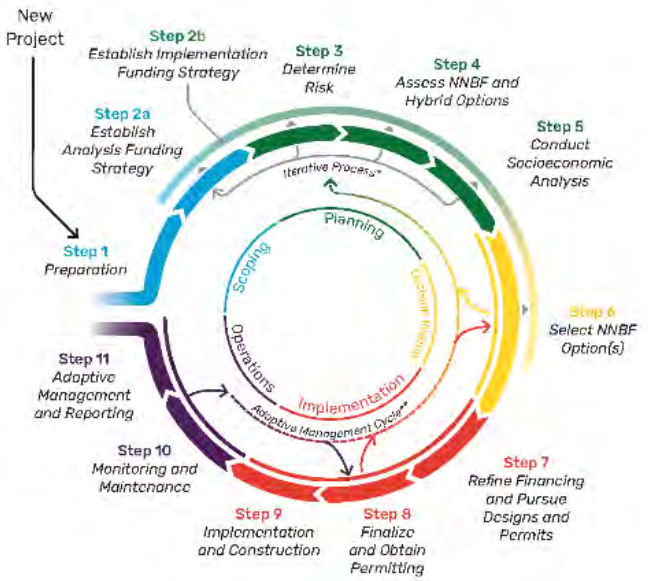
Design + Construction Guidance

FOR **NATURE-BASED SOLUTIONS**

US Army Corps of Engineers®

Engineering With Nature

Jacobs



Engineering With Nature®

COMMUNICATE

Spark dialogue, share experiences, and learn with others to close the gap between research, practice, and community needs.

Reclaiming a river corridor for native wildlife: Wood-filled backwater channel and pond in Clackamas. (Photo by Metro Parks and Nature)

Publications

Journal of Environmental Management 323 (2022) 116138

Contents lists available at ScienceDirect

Journal of Environmental Management

journal homepage: www.elsevier.com/locate/jenvman

Discussion

Engineering coastal structures to centrally embrace biodiversity☆

Burton C. Suedel [a,h], Jon Calabria [b,h,*], Matthew V. Bilskie [c,h], James E. Byers [d,h], Kelsey Broich [e,h], S. Kyle McKay [f,h], Amanda S. Tritinger [a,h], C. Brock Woodson [g,h], Emily Dolatowski [b,h]

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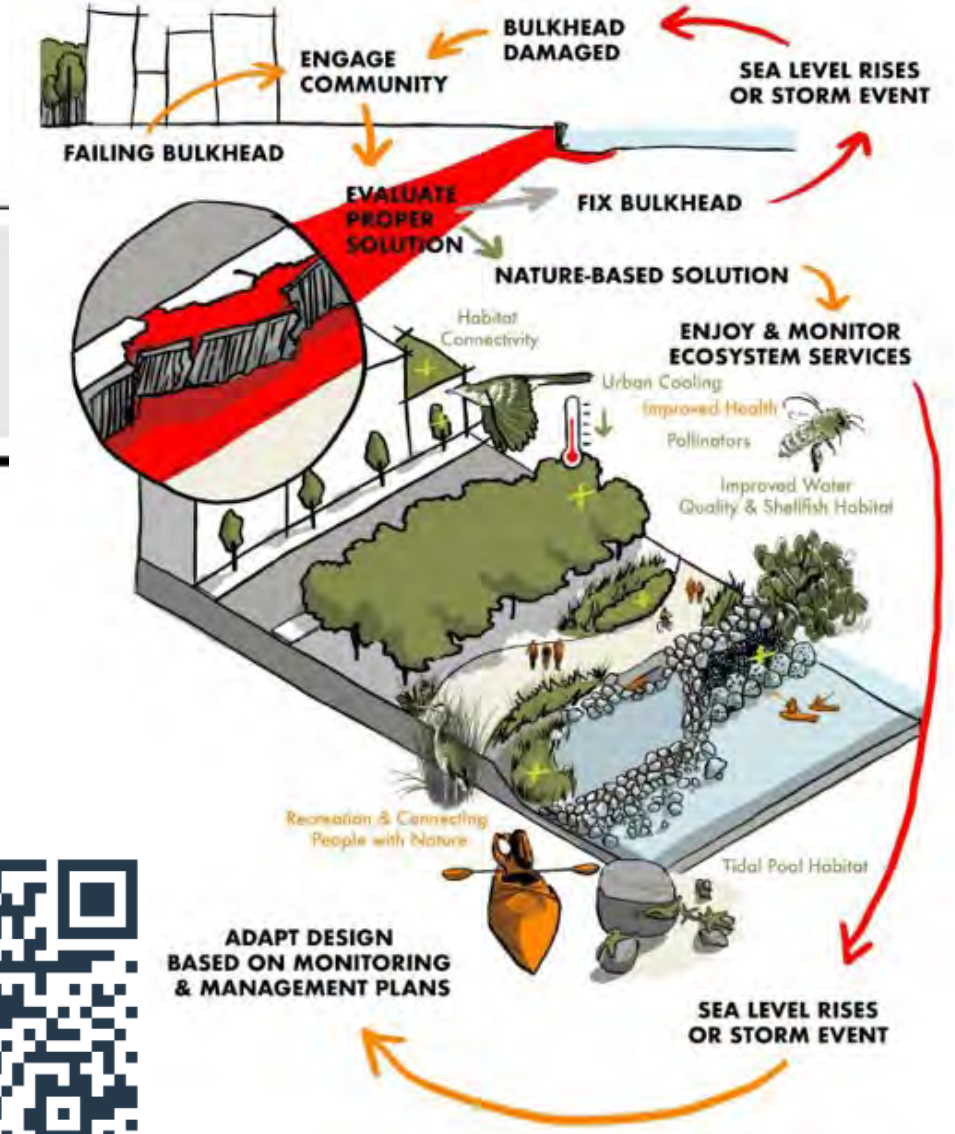
[h] The Institute for Resilient Infrastructure Systems (IRIS), University of Georgia, Athens, GA, USA



International Guidelines on the Use of Natural and Nature-Based Features for Flood Risk Management

A collection of international expertise, across sectors, using NNBF for flood risk management while expanding and diversifying project value through economic, environmental and social benefits.

- Published September 2021
- Multi-author: government, academia, NGOs, engineering firms, construction companies, etc.
- Addressing the full project life cycle
- 4 Parts
  - Overarching Topics
  - Coastal Applications
  - Fluvial Applications
  - Conclusions

Podcast

▶ Read Summary

S5 Trailer – The Engineering With Nature® Podcast
Realizing the Value of Nature Length: 18 minutes, Air Date: November 16, 2022 Season 5 of the Engineering With Nature® Podcast launches on November 30. Host Sarah Thorne recently talked about highlights from Season 4 and what's ahead for Season 5 with Todd Bridges, Senior Research
View Episode

S5 E1 – ERDC Labs Collaborating on Leading Edge 3D Printing Nature-Ba...
In the premier episode of Season 5 of the Engineering With Nature® Podcast, host Sarah Thorne, and Burton Suedel, Research Biologist at the Engineer Research and Development Center (ERDC), are talking with two ERDC colleagues – Alan Kennedy, who is in the Risk Branch of the Environmental
View Episode

S5 E2 – Nature-Based Solutions from the Halls of the Exec Office of the P...
What happens when a nation focuses on addressing the critical challenges posed by climate change by investing in nature? That's what we're talking about in Season 5, Episode 2, of the Engineering With Nature® Podcast.
View Episode

S5 E3 – What do You Want to Know about Nature? The National Nature A...
The first ever National Nature Assessment (NNA) is currently underway to better understand how nature is faring in the United States and what it means to all our lives. That's the focus of our discussion in Season 5, Episode 3, of the Engineering With Nature® Podcast.
View Episode

S5 E4 – Measuring What Matters
How do we measure what's most important to us? And how do we translate those values into decisions about infrastructure projects so that they can deliver a diverse set of economic, environmental, and social benefits? That's the focus of our discussion in this episode of the
View Episode

S5 E5 – Accelerating NBS Progress through N-EWN Multisectoral Collabo...
The Network for Engineering With Nature (N-EWN), which we introduced in Season 1, Episode 10, is a community of researchers, practitioners, and educators who are working together to advance the practice of Engineering With Nature (EWN). We're back in Season 5, Episode 5, to talk with N-EWN's
View Episode

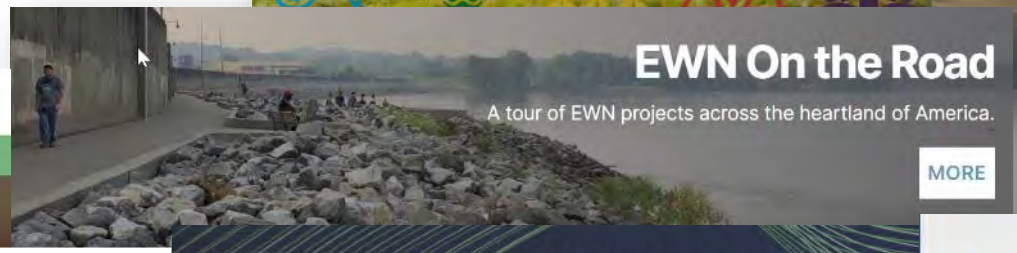
S5 E6 – A Conversation about EWN, Innovation, and Leadership with LTG ...
In this episode, Lieutenant General Scott Spellmon joins Todd Bridges, Senior Research Scientist for Environmental Science and National Lead for the Engineering With Nature (EWN) Program, and host, Sarah Thorne, as their special guest. Lt. Gen. Spellmon is the 55th Chief of Engineers and the
View Episode

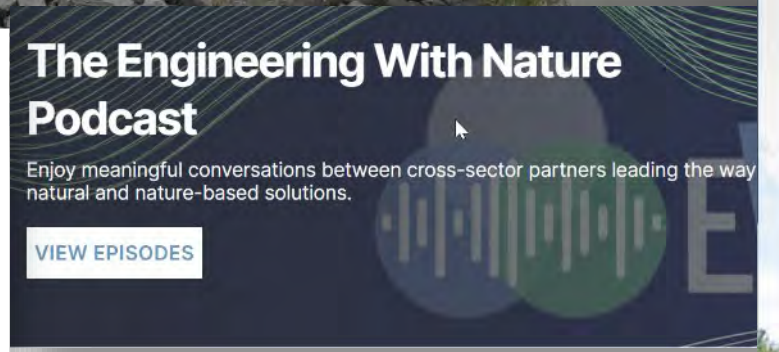
S5 E7 – Celebrating the 30-Year USACE Career of Todd Bridges
This very special episode of the EWN Podcast features Todd Bridges, Founder and National Lead of the Engineering With Nature Program. We're celebrating his 30-year career and retirement from the US Army Corps of Engineers (on February 28, 2023), and discussing his visionary leadership of EWN
View Episode

US Army Corps

Engineering With Nature

Any Questions?





US Army Engineer Research & Development Center

www.EngineeringWithNature.org

THE NETWORK FOR ENGINEERING WITH NATURE

N-EWN.org

US Army Corps of Engineers • Engineer Research and Development Center

Examples of Co-developed Solutions to Coastal Challenges

Katy Serafin,

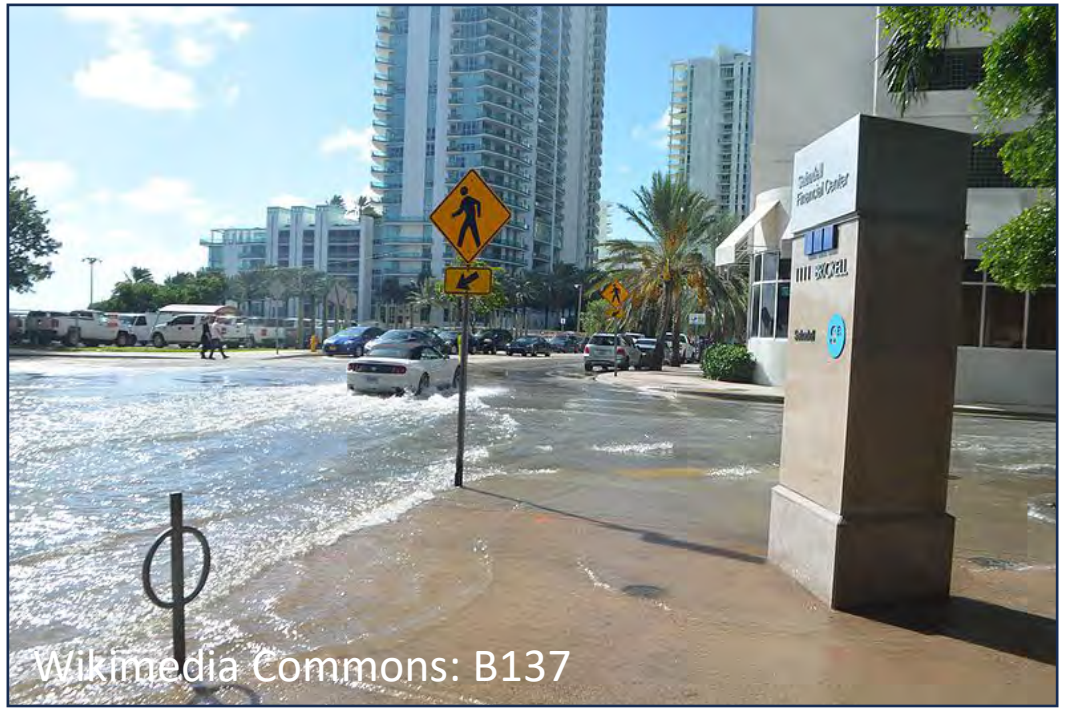
Assistant Professor, Department of Geography, University of Florida

Coastal community resilience in the face of increased flooding and sea level change

Dr. Katy Serafin

Assistant Professor, Department of Geography

Historical Marker Database

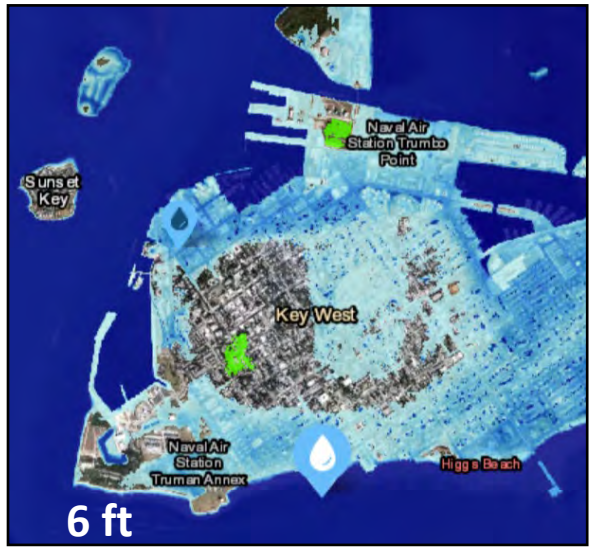

Wikimedia Commons: B137

USCRP Decadal Visioning Workshop
June 12, 2024

UF College of Liberal Arts and Sciences
Department of Geography
UNIVERSITY *of* FLORIDA

Sea level rise is increasing the frequency and magnitude of coastal flooding events.

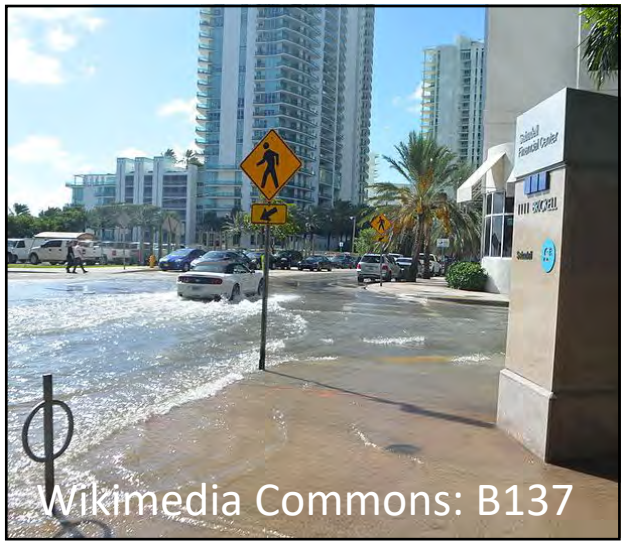
Permanent inundation

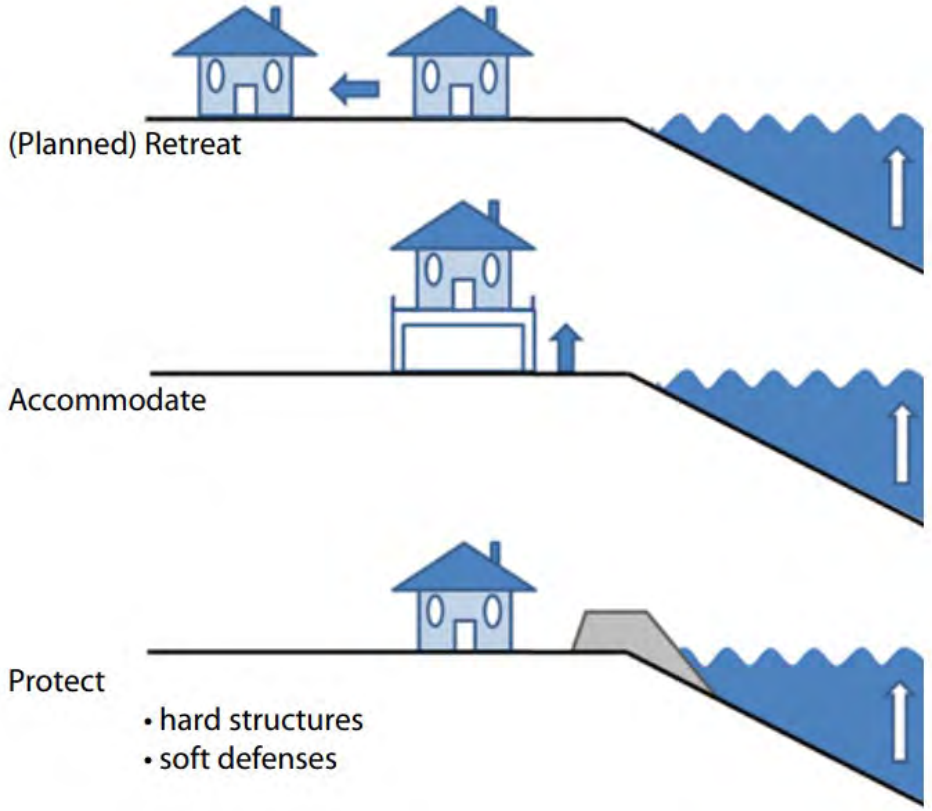


Tides reach farther inland

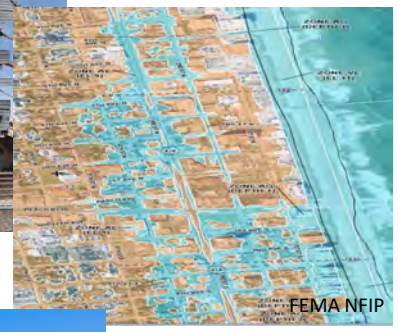
Increasing extent of storm-induced flooding

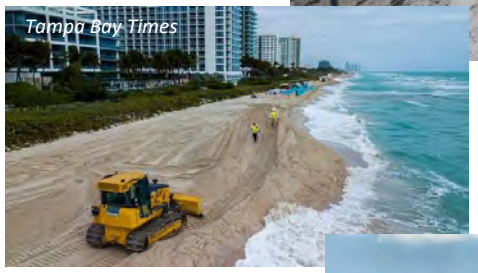
Communities must prepare for both the catastrophic and the chronic…



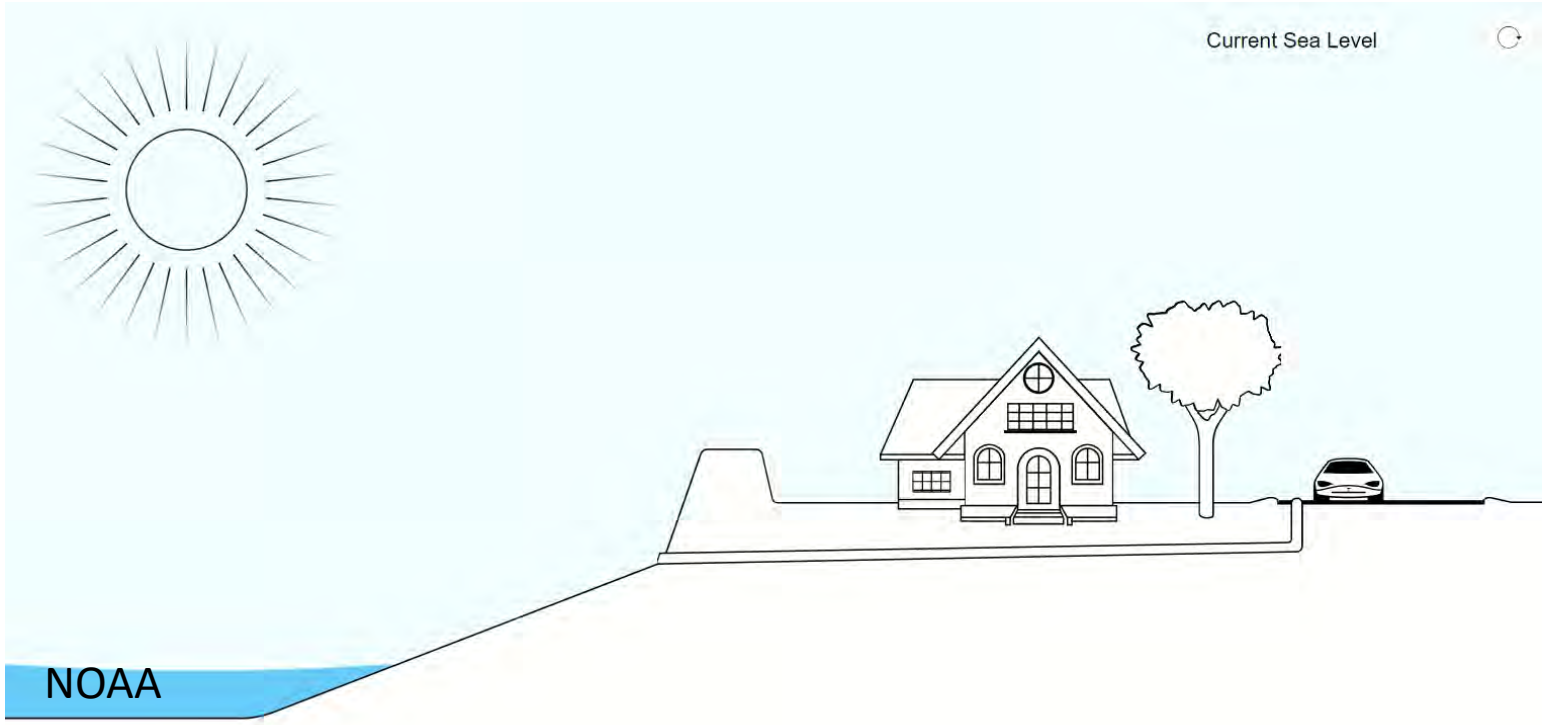


Nichols, 2011. Planning for the impacts of sea level rise. *Oceanography* 24(2):144–157, doi:10.5670/oceanog.2011.34



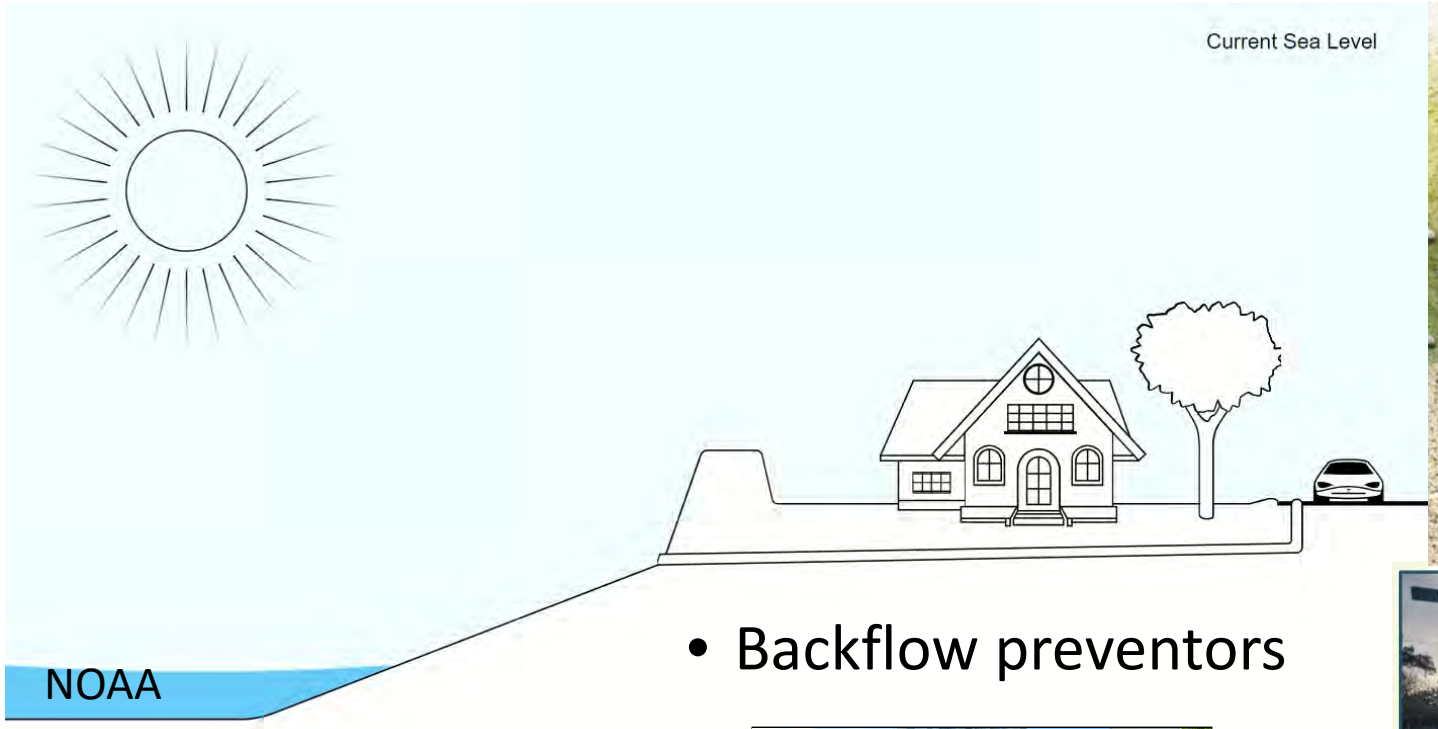


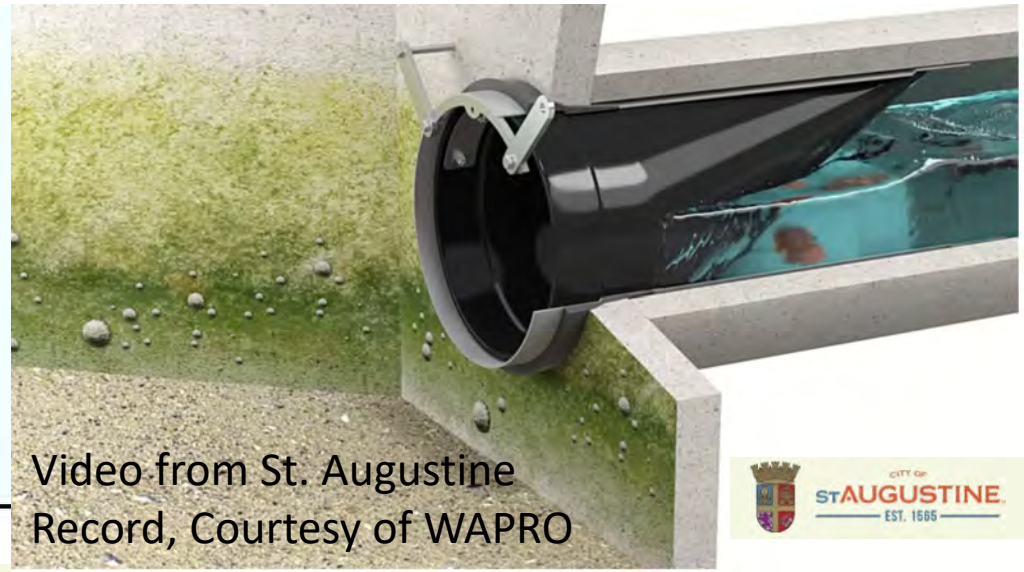
High tide flooding is more than twice as likely now than it was in 2000*



*NOAA

High tide flooding is more than twice as likely now than it was in 2000*





Video from St. Augustine Record, Courtesy of WAPRO

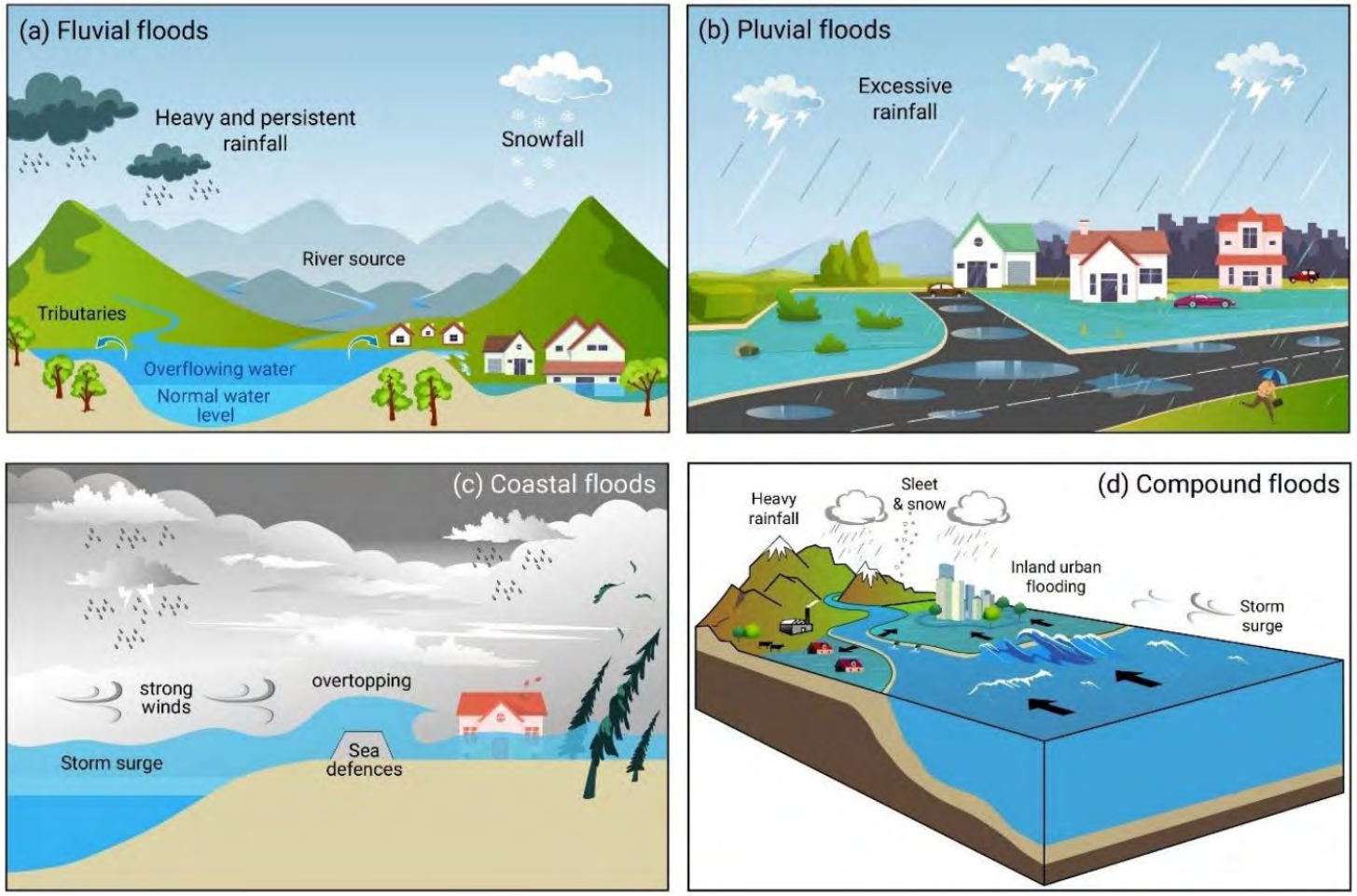
- Backflow preventors

OF-0117 (Before): street flooding during King Tide event (October 2017) due to non-functioning valve

OF-0117 (After): no street flooding during King Tide event (December 2017) - tidal flooding eliminated

*NOAA

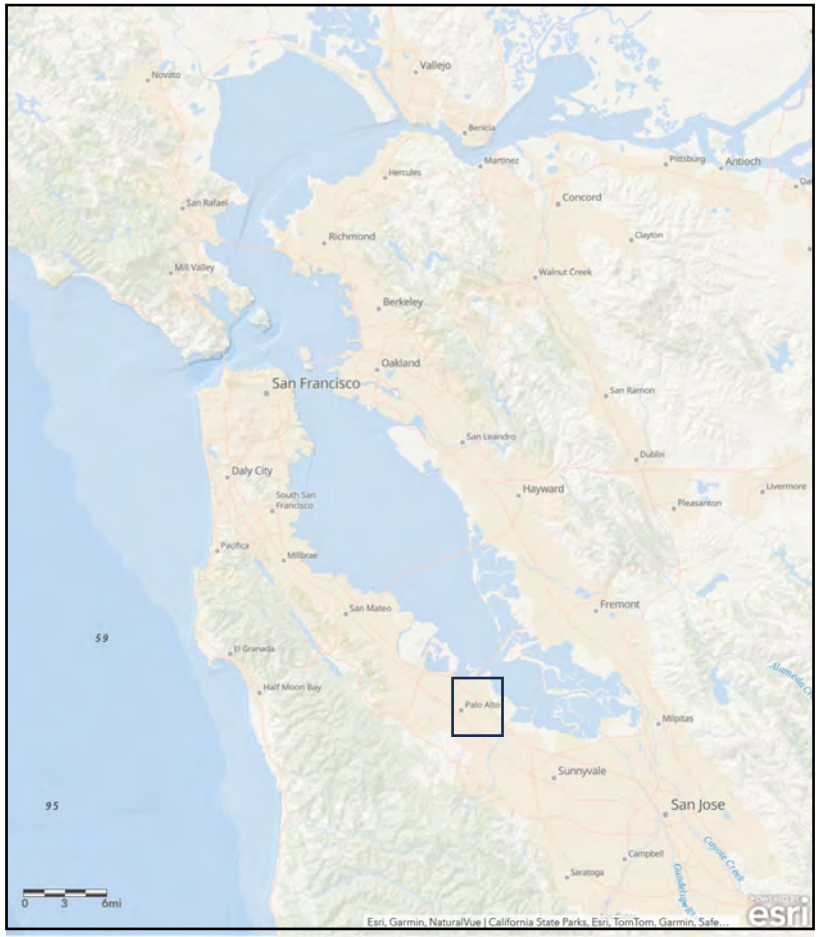
Communities must prepare for both the catastrophic and the chronic…



while also considering multiple flood drivers!

Green, J., Haigh, I.D., Quinn, N., Neal, J., Wahl, T., Wood, M., Eilander, D., de Ruiter, M., Ward, P. and Camus, P. (2024). A comprehensive review of coastal compound flooding literature. *arXiv preprint arXiv:2404.01321*.

Flood risk mitigation planning along an urban river




Jim Wiley,
courtesy of the San Francisquito Creek Joint Powers

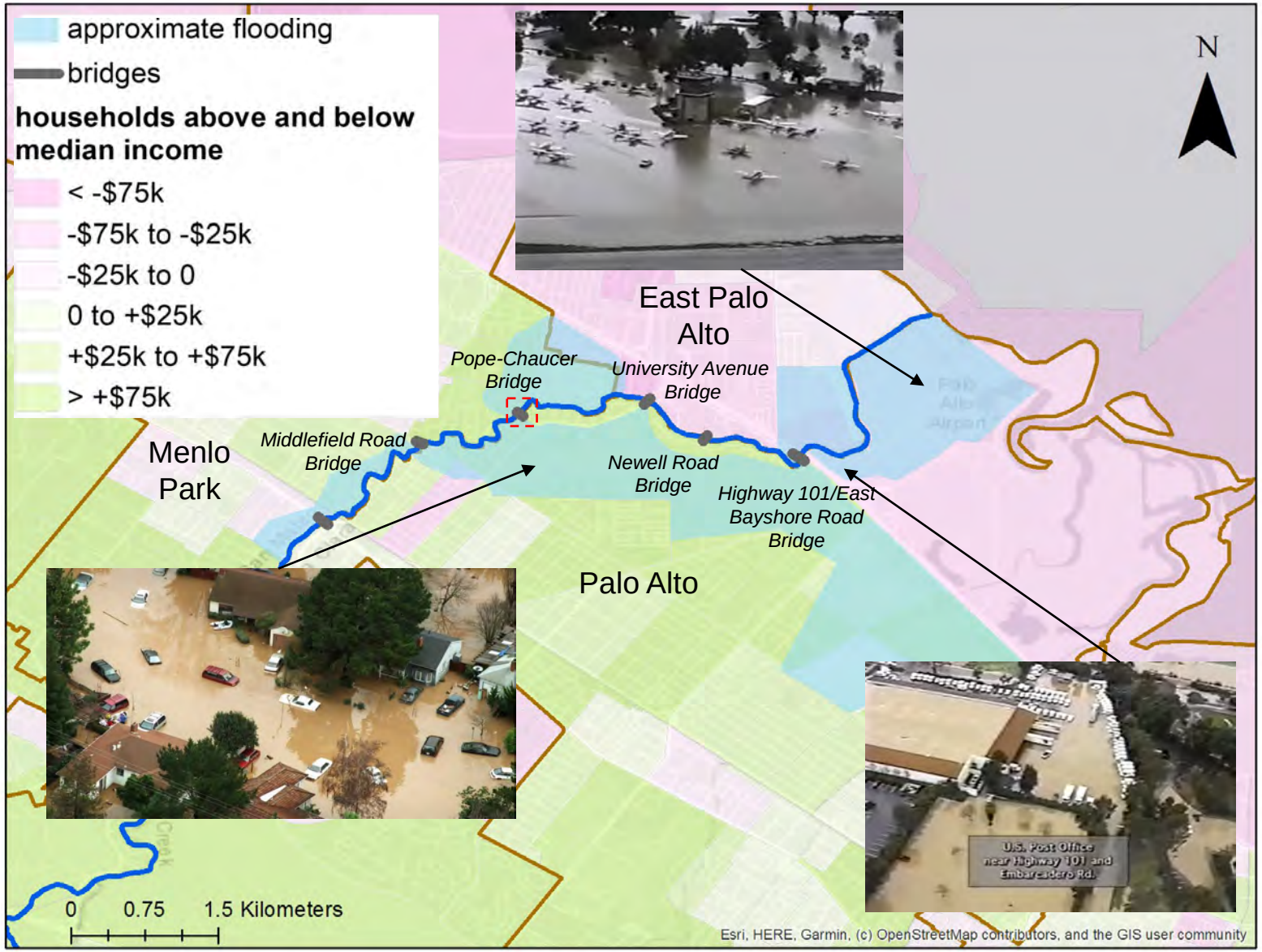
UF UNIVERSITY of FLORIDA

Stanford | Doerr School of Sustainability

THE BILL LANE CENTER FOR THE AMERICAN WEST
STANFORD UNIVERSITY

Serafin, K.A., Koseff, J.R., Ouyang, D., and Suckale, J. (2024). Moving from total risk to community-based risk trajectories increases transparency and equity in flood risk mitigation planning along urban rivers, *Environmental Research Letters, 19(6), 064039.*

The flood of record occurred in 1998, causing millions of dollars in damage.



SAN FRANCISQUITO CREEK JOINT POWERS AUTHORITY

- City of East Palo Alto
- City of Palo Alto
- City of Menlo Park
- San Mateo County Flooding and Sea Level Resiliency District
- Santa Clara Valley Water District

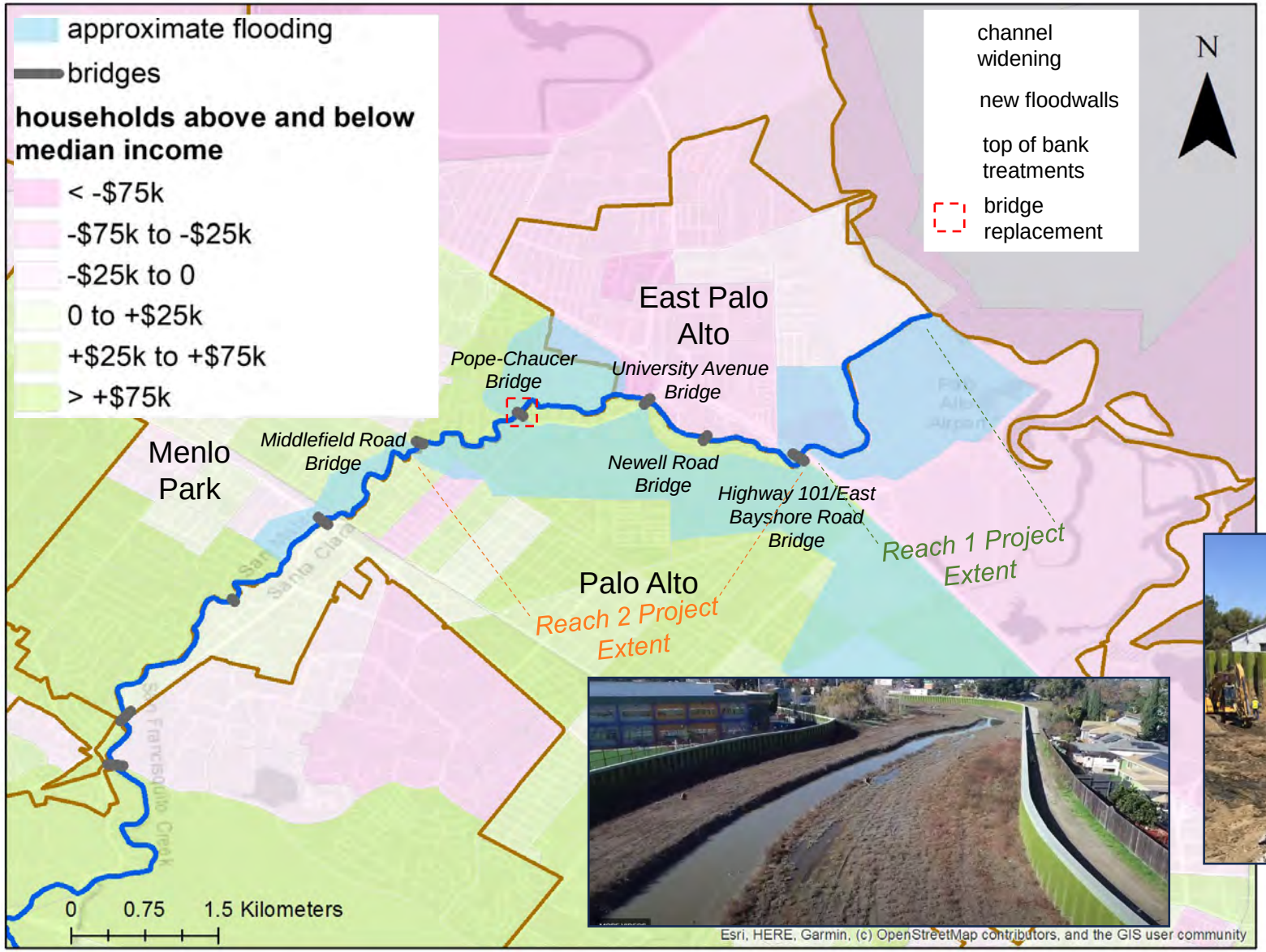
… to lead projects to mitigate the risk of along-river and bay flooding

Since then, several changes have taken place/been proposed to reduce flooding hazards.

Increasing bridge capacities

Channel widening

Top of bank treatments to avoid overtopping

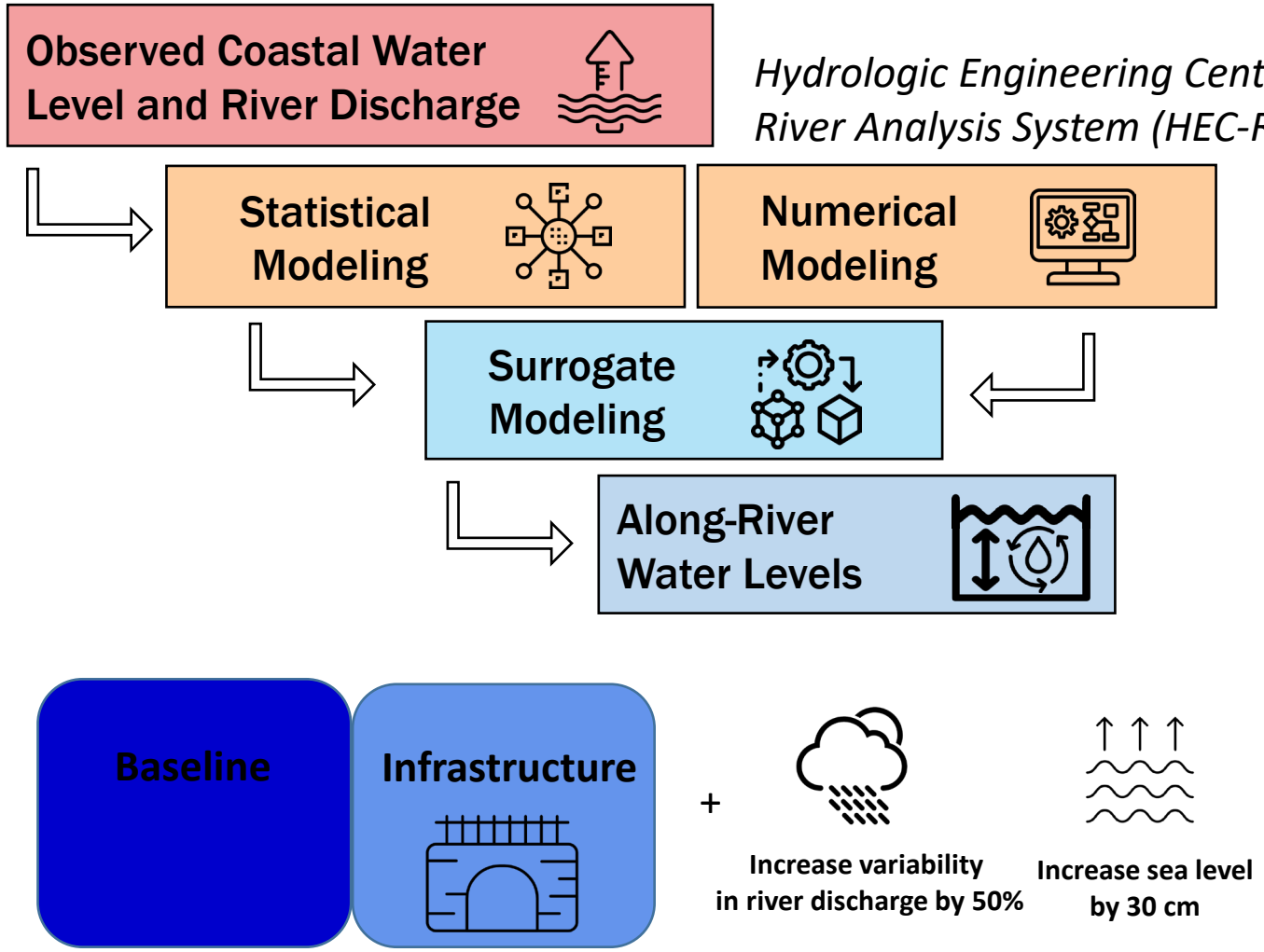


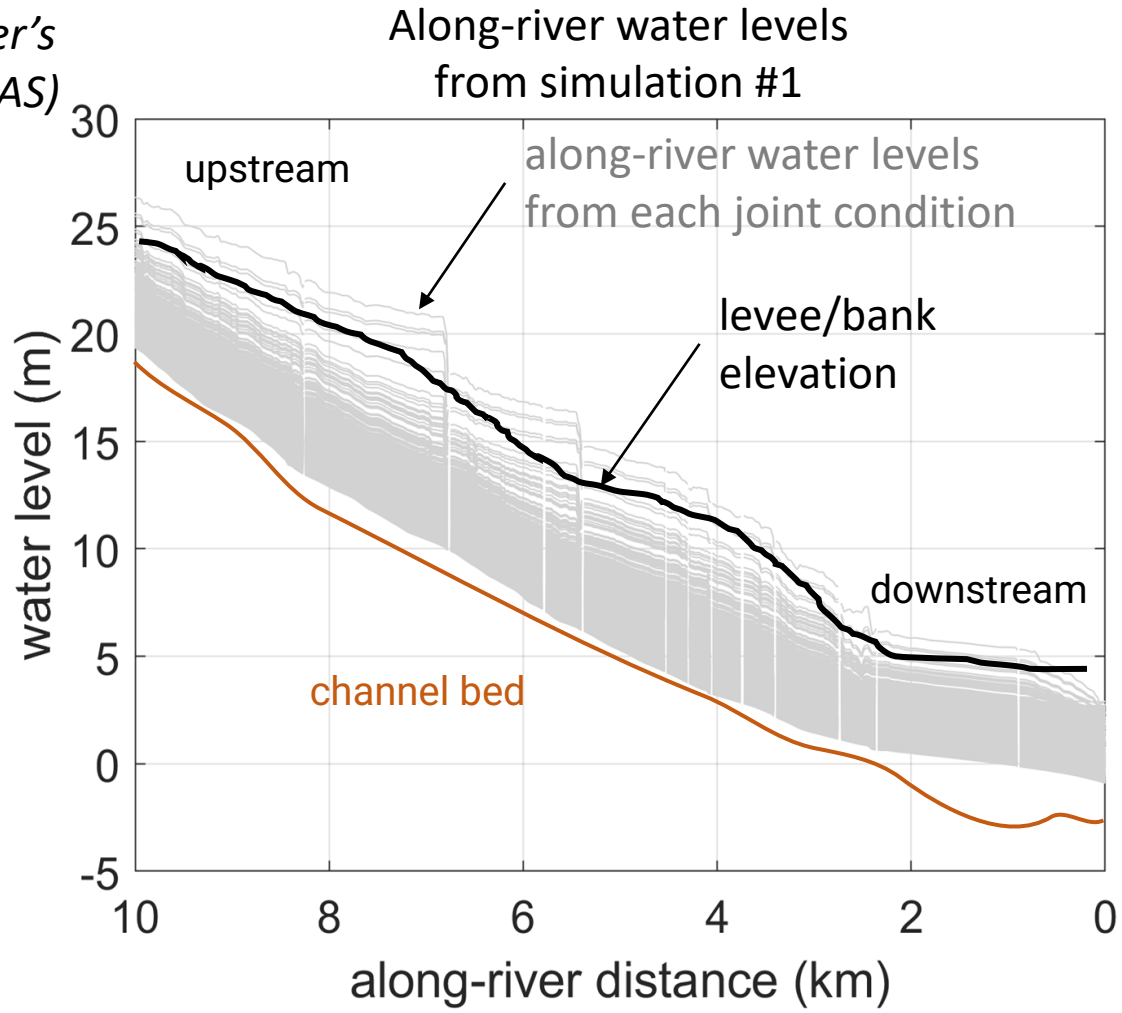
Channel widening

Installation of floodwalls

Increase in bridge capacity

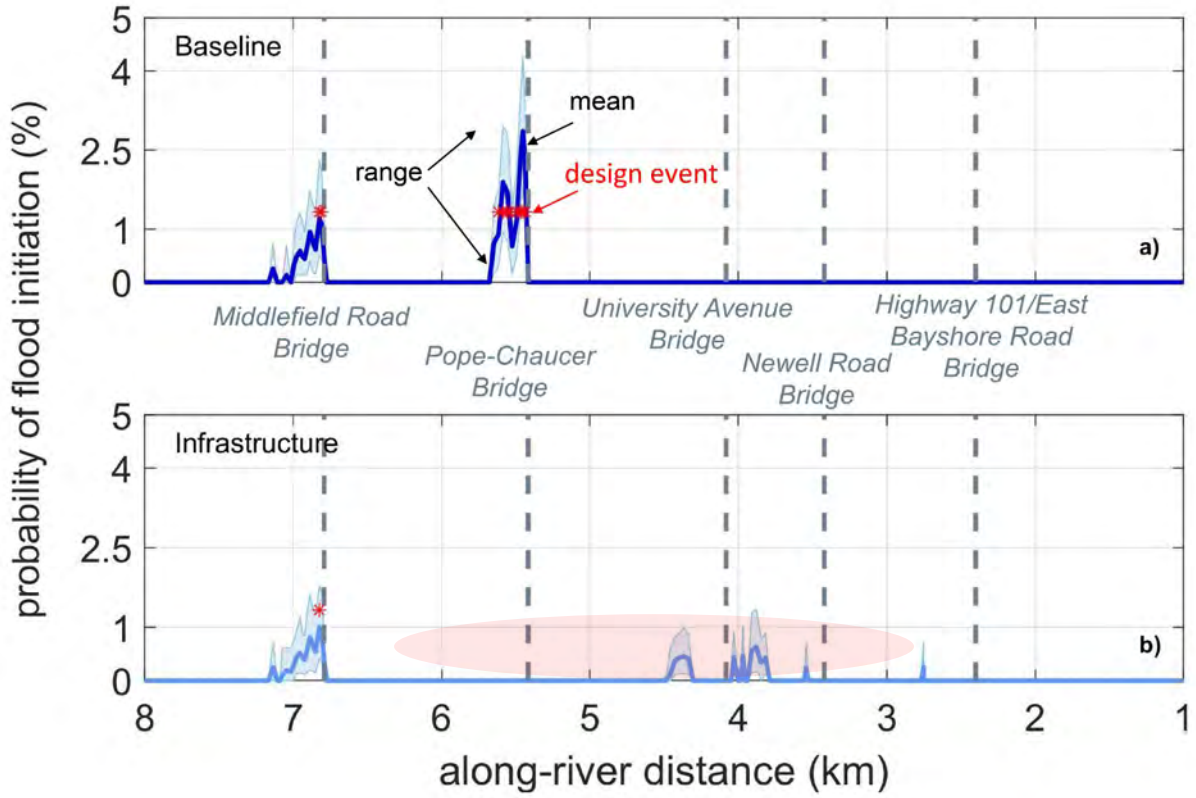
We use a hybrid statistical-numerical modeling framework* to generate computationally efficient yet realistic water level estimates for multiple locations along-river



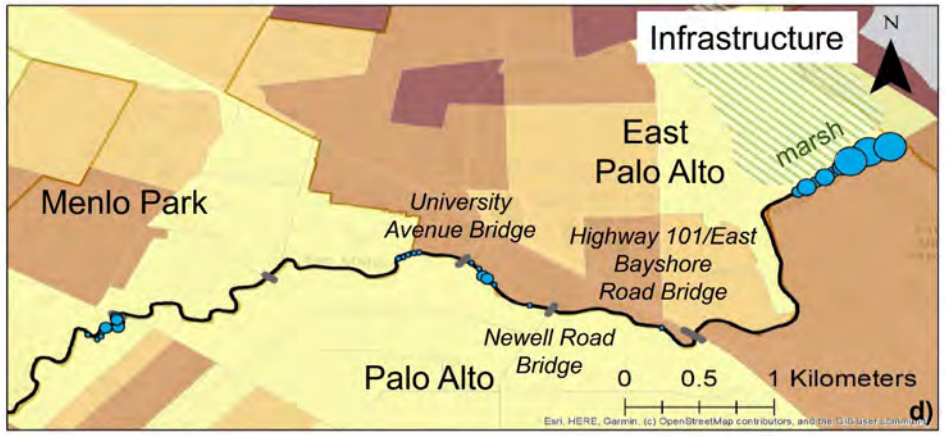


Framework: Serafin, K. A., Ruggiero, P., Parker, K., & Hill, D. F. (2019). What's streamflow got to do with it? A probabilistic simulation of the competing oceanographic and fluvial processes driving extreme along-river water levels. *Natural Hazards and Earth System Sciences*, *19*(7), 1415-1431.

Highlight unintended consequences (blindspots) /uncertainty to increase transparency of risk

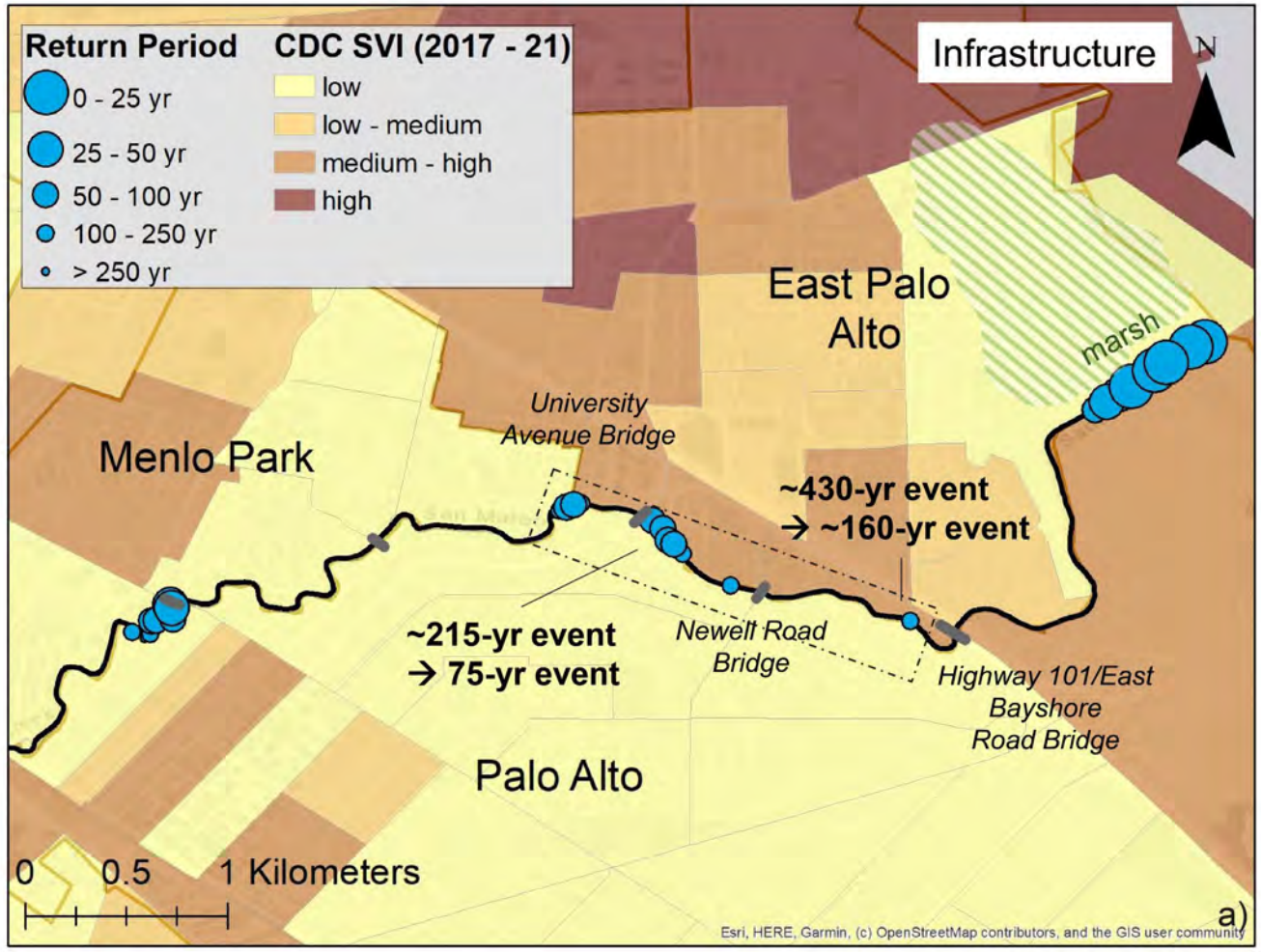


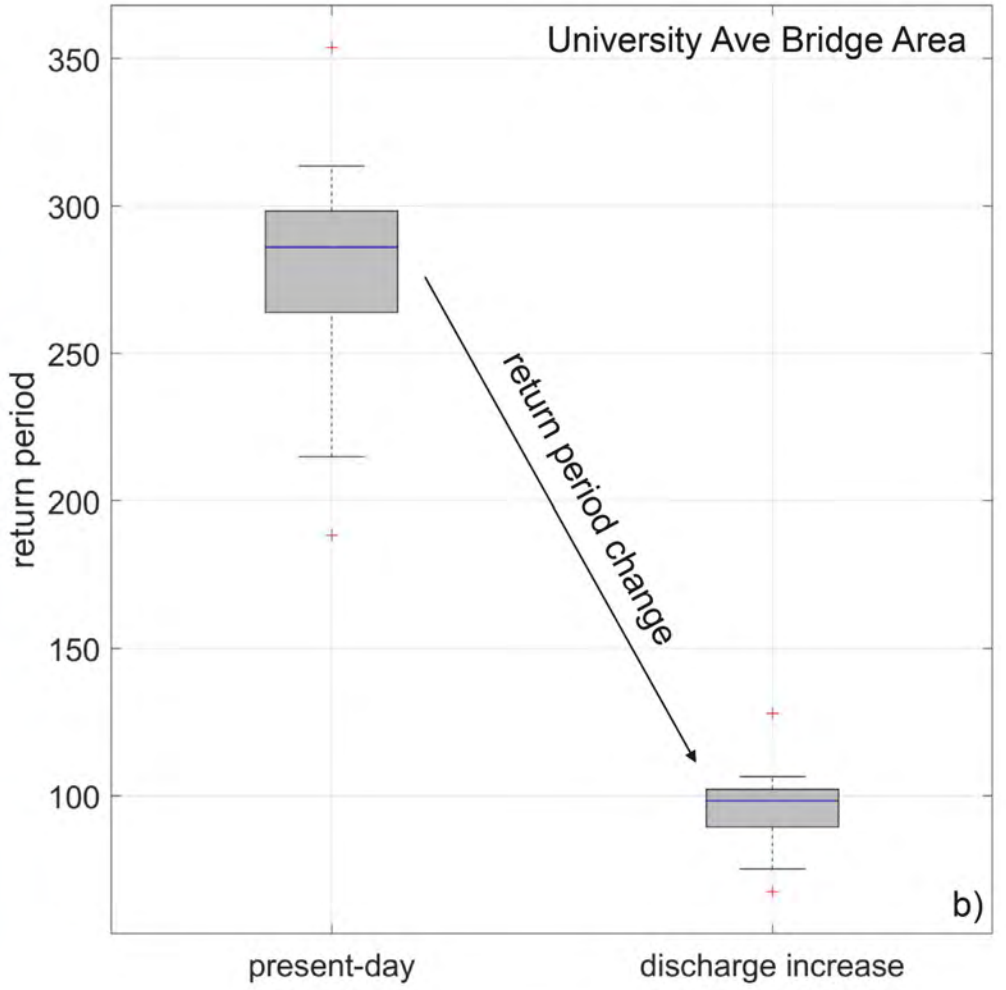
Re-designing the upstream bridge provides adequate protection from the design event and cuts the along-river flood risk in half!



While the total flood risk is decreased, flood risk *rarer than the design event* is transferred downstream to communities with higher vulnerability.

Future increases in discharge increase the probability of flood initiation beyond acceptable levels of risk

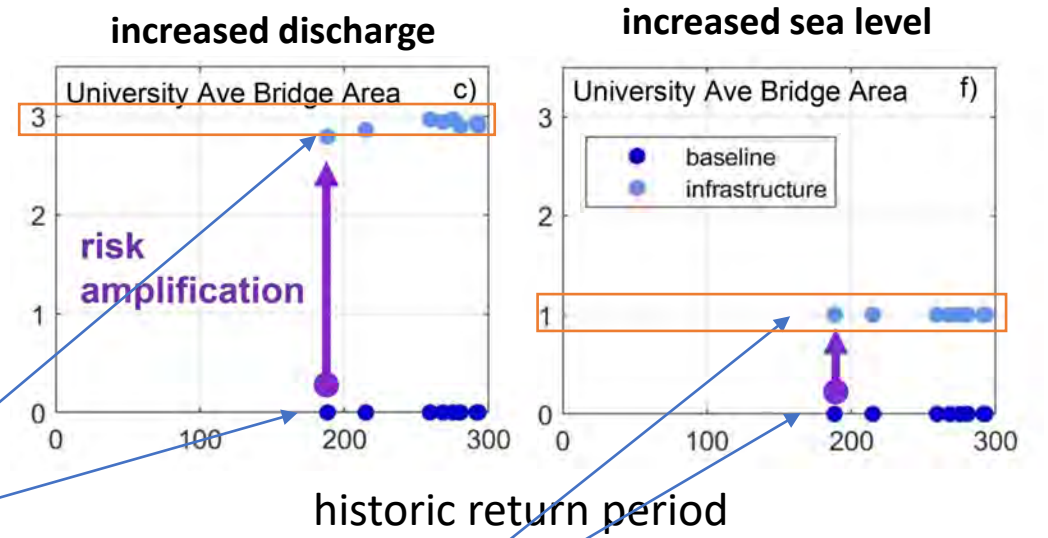




Planning with a focus on future changes to one flood process could still leave vulnerabilities

flood amplification factor =
prob. of flooding future climate/
prob. of flooding present climate

flood amplification due to:



The largest change in flood risk comes from the planned infrastructure updates, rather than changes to climate.

Flood risk amplification is caused by increasing river discharge, rather than sea level rise.

The path towards action: integrating flood model metrics with multi-tier engagement

Once the City of East Palo Alto's concerns were validated, we developed a strategic partnership with the SFCJPA, which assisted in altering the proposed project plans!

SAN FRANCISQUITO CREEK
JOINT POWERS AUTHORITY

sfcjpa.org

Climate Change Impact Assessment Reach 2 (Urban Reach) Project

- *Increased height of walls by 1 foot to accommodate potential increased river water levels in future years*
- *Low spots in top of banks near University Avenue will be raised with a structure of up to 2 feet in height*

Serafin, K.A., Koseff, J.R., Ouyang, D., and Suckale, J. (2024). Moving from total risk to community-based risk trajectories increases transparency and equity in flood risk mitigation planning along urban rivers, *Environmental Research Letters, 19(6), 064039.*

The path towards action: integrating flood model metrics with multi-tier engagement

- The utilization of trusted models (HEC-RAS) already used in the planning process
- Continued engagement with partners for 5+ years!
- Community-specific metrics/risk trajectories

Serafin, K.A., Koseff, J.R., Ouyang, D., and Suckale, J. (2024). Moving from total risk to community-based risk trajectories increases transparency and equity in flood risk mitigation planning along urban rivers, *Environmental Research Letters, 19(6), 064039.*

As we continue to think about solutions to future coastal flooding risks and our growing stakeholder challenges…

1. **Consider multiple flood forcings**
   - strategies focused on mitigating impacts from future changes to one process could still leave vulnerabilities!
2. **Highlight unintended consequences/uncertainty to transparently define risk**
   - consider chronic and catastrophic/rare and events beyond the design event!
3. **Determine metrics that matter for communicating risks in a changing climate**
   - not necessarily a 1-1 relationship between hazard, hazard change, and impacts!
   - impacts may be due to preexisting vulnerabilities (e.g., road networks (Kasmalkar et al., 2020), financial risks/burdens (Bick et al., 2021)) rather than climate itself changing
4. **The consequences of coastal flooding can extend far beyond the coastline!**
   - cascading impacts beyond direct damage/population exposure → commute/transportation disruption, business disruption, isolation, public health issues, exacerbation of poverty, decreasing home values…

Dr. Katy Serafin
Assistant Professor
kserafin@ufl.edu

USCRP Decadal Visioning Workshop

UF College of Liberal Arts and Sciences
Department of Geography
UNIVERSITY of FLORIDA

Examples of Co-developed Solutions to Coastal Challenges

A.R. Siders,

Assistant Professor, Disaster Research Center

A.R. Siders, JD, PhD

@siderSadapts | siders@udel.edu

Climate Change Hub | Disaster Research Center

Biden School | Geography | Marine Policy

Sidersadapts.com

RETREAT OCCURRING

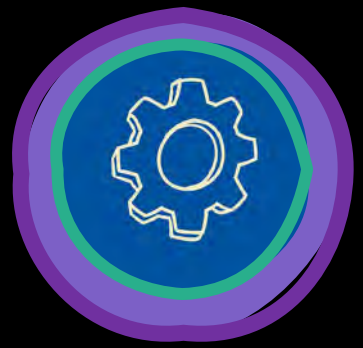
MORE DEMAND THAN ABILITY

NUMEROUS VARIATIONS

INSUFFICIENT EVIDENCE FOR TAILORING

EXPERTISE > CHALLENGES

NOT ENOUGH LEARNING & DIFFUSION

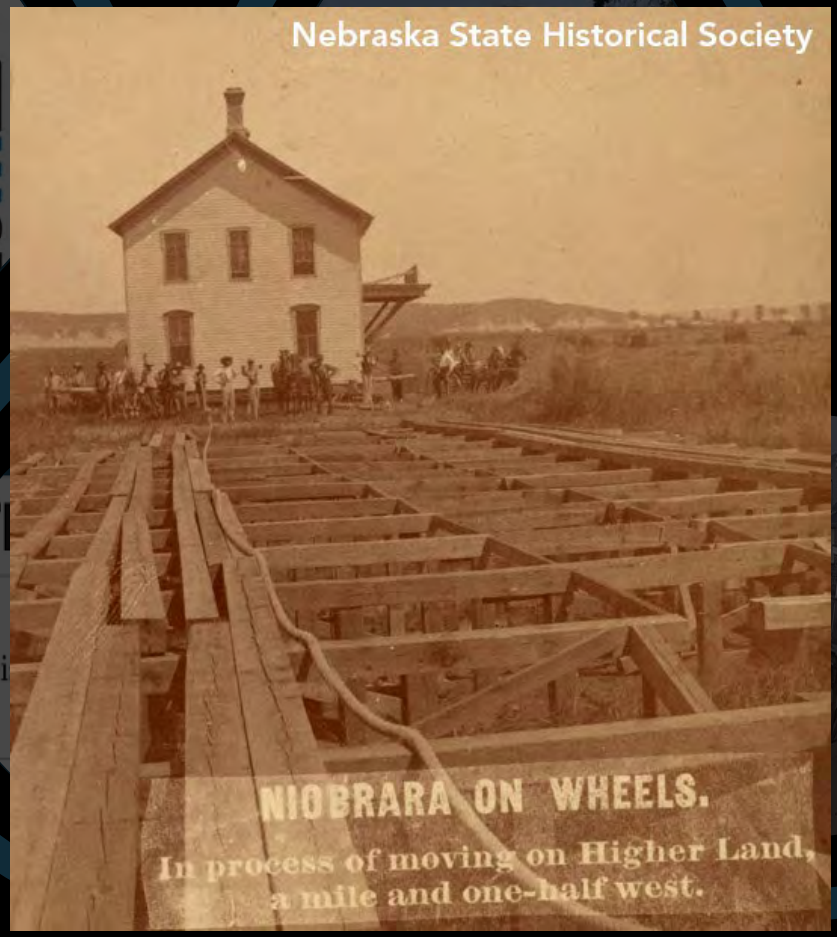


INTEGRATION IS CRITICAL

Historically: Private or Local

Brighton Beach Hotel
1888 Coney Island
New York

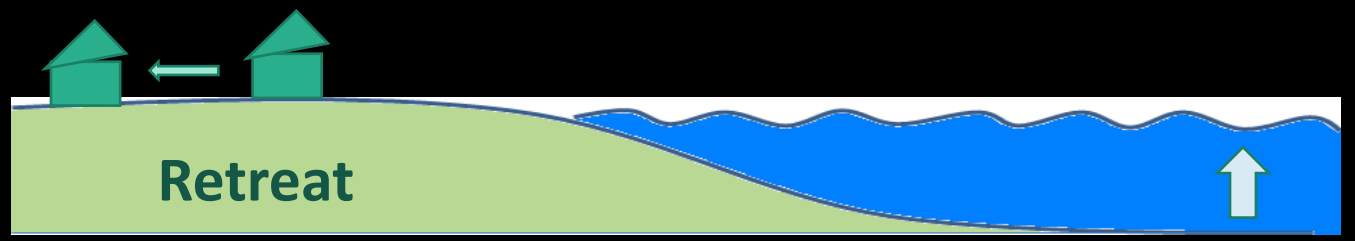
Long Point Cape
Cod 1850s



Niobrara, Nebraska
"The Town Too Tough to Stay Put"
(Nebraska Historical Society)

1700s & 1800s
Primary responsibility local

See Pinter 2021 Lost Histories



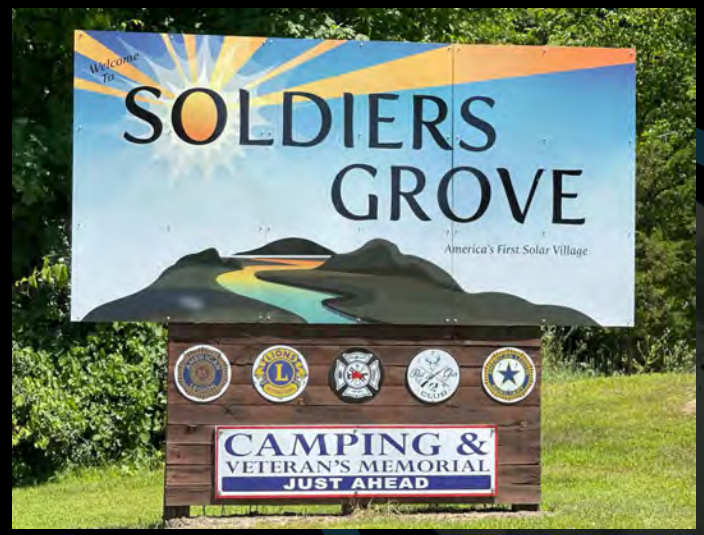
VARIETY OF TOOLS AND PRACTICES AVAILABLE

- Easements (fixed and rolling)
- Setbacks (fixed and rolling)
- **Property acquisitions (eminent domain, voluntary acquisition, buyouts)**
- **Community relocation**
- Removal of defenses (realignment)
- Avoidance (e.g., zoning, density regulations)
- Condemnation
- Attraction (placing services in less risk-prone areas, e.g., businesses, schools)

Neal et al. 2005; Siders 2013; Dyckman et al. 2014

1970s

Informal / ad hoc funding
e.g. Soldiers Grove



Soldiers Grove WI

NATIONAL FLOOD INSURANCE PROGRAM

Valmeyer IL

Pattonsburg MO – St. Joseph Press Photo

The Stafford Act

Robert T. Stafford
Disaster Relief and Emergency
Assistance Act, *as Amended*

1980s & 90s

1989 FEMA buyout program
1990s Midwest town relocations
Individual property acquisitions (rivers)

FEMA-Funded Buyouts

Data on non-FEMA programs not analyzed in academic literature
HUD, USACE, USDA etc.

Mach et al., Science Advances, 2019

FEMA & HUD have funded buyouts in every single state (including HI & AK)

Most buyouts small & rural; Most studies on big & urban programs

buyouts are:

voluntary* government acquisition of flood-prone properties to convert land to open space** and reduce flood exposure

---

* Harris County exceptions are beyond scope here (see work by Zavar)

** HUD uses *intent* and post-acquisition *land use* to distinguish *buyout* from *acquisition*

CAVEAT: Far more nuance & variation than captured here!

climate mobilities

autonomous; often w/o government coordination or support

- **migration** — internal (domestic) vs international (cross border); temporary vs permanent
- **refugee** — fleeing persecution
- **displacement** — forced (internally displaced persons receive special rights protections)
- **abandonment**

managed / strategic realignment — removal of flood protection structures

also strategic / planned / coordinated

- **managed retreat** — movement as result of an organized process / program / intervention
- **relocation**
- **resettlement**

MR: strategic, organized, supported effort to move people out of at-risk areas

Relocation/resettlement: specific types of managed retreat that involve a "to" destination as well as a "from"

- **acquisition** — purchase
- **buyout** — purchase w/ intent to reduce risk exposure & prevent redevelopment

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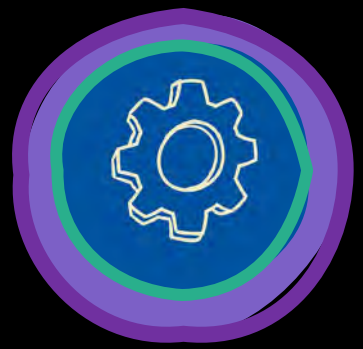


INTEGRATION IS CRITICAL

Common FEMA/HUD Voluntary Property Acquisition “Buyout”

Typical Step	Hazardous event	Local government acquires funds	Local government offers buyouts using pre-disaster fair market value	Property owners decide whether to accept the offer; if they accept, they move out	Building moved or demolished; Land maintained as public open space
Common Variations	Sudden disaster (e.g., wildfire, hurricane) or recurring damage (e.g., nuisance floods)	Local funds (e.g., stormwater management fee), state programs, private partnerships, or federal grants	State may also administer but most often county; Purchase price may be current, post-disaster value or include bonuses and incentives; Replacement value & additional supports	Rental tenants must move if the property owner accepts a buyout; Residents may already have moved post-disaster; Some temporary leasebacks	Some use land to benefit community (e.g., as parks or gardens); Some lease for private use; More often land remains open but unused

State of Science:

Creating Nuance from Discrepancies

- "**Optimal**" acquisition strategy = contiguous lands?
  - Depends on context & goals

from Siders, Perry World House 2021

State of Science:

Creating Nuance from Discrepancies

- **Equity**
  - More buyouts to white or BIPOC residents? Why?
  - Implications? For practice? For research?

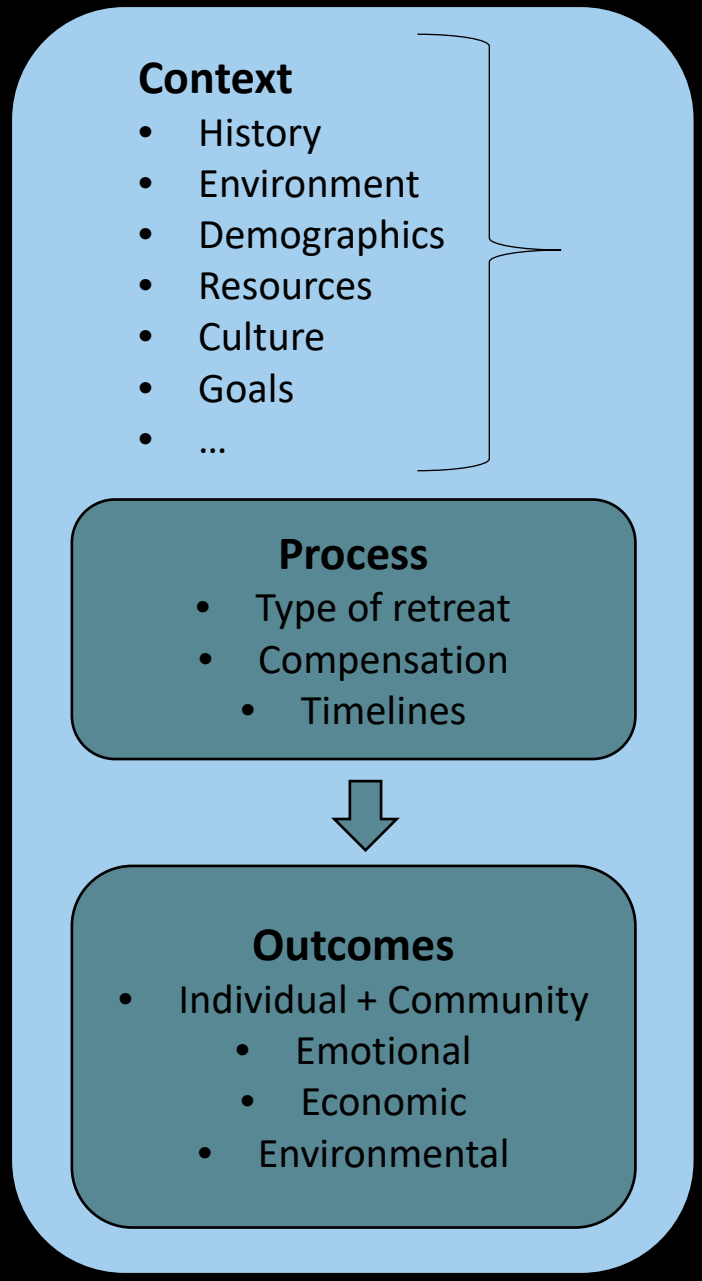
State of Science:

Creating Nuance from Discrepancies

- **Social** / emotional outcomes (see Koslov et al. 2021)
  - What timeline?
  - Compared to what baseline?
  - How compare tradeoffs?

State of Science:

Creating Nuance from Discrepancies



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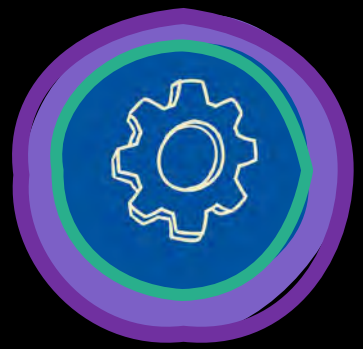

INTEGRATION IS CRITICAL

Expected Challenges

- Funding (Local match)
- Finding replacement housing
- Recruiting participants
- Slow

Numerous possible solutions exist

IF there is political will or
IF the administrator has expertise

Sources of State and Local Funding

- federal programs (FEMA, HUD, USDA, SBA)
- state budgets (often provide 12.5% funding from state, 12.5% local, 75% federal)
- water conservancy or flood control districts
- water quality programs
- stormwater management fees
- sales tax
- corporate tax
- lottery funds
- bond (e.g., resiliency or adaptation bond)
- in-kind costs (e.g., staff time)
- fire department time & equipment for a controlled burn exercise (also reduces demolition costs)
- environmental trust funds
- private partnerships
- homeowner donation (e.g., accepts price less than fair market value or agrees to pay closing costs)

Siders & Gerber-Chavez, 2021 Lessons Learned US Buyouts

State / Local funding fast, flexible, consistent

- Reduce time from 2-5 years to 3-18 months
- Allows actions not permitted (e.g., land swap, leasebacks)
- Hire experts who build relationships & trust

Examples:

- MN Flood Damage Reduction Grant Assistance Program
- WI Flood Control Grant (25% reduced to 12.5%)
- Georgia Governor's Emergency Fund
- NJ Corporate Tax Revenue
- Charlotte-Mecklenburg NC, Tulsa OK stormwater fee
- Davenport, Iowa sales tax; same Neosho Missouri & Austin Minnesota
- Harris County Flood Control District flood bonds
- WI Kenosha County reserved funds
- Nebraska Environmental Trust Fund
- Washington "Floodplains by Design" public-private partnership with foundation

Expected Challenges

- Funding (Local match)
- Finding replacement housing
- Recruiting participants
- Slow

Relocation support:

- Relocation assistance ($31k FEMA) (high paperwork)
- Show alternative homes nearby
- Moving costs
- Negotiate lower mortgage rates / provide letters
- Down payment assistance
- Coordinate with housing authorities
- Integrate into smart planning & economic development planning

Lessons

- Numerous options available with political will and/or expertise
- Build new, relocate houses, real estate support, buyouts in batches over time

Expected Challenges

- Funding (Local match)
- Finding replacement housing
- Recruiting participants
- Slow

Described Challenges

- Prioritizing waitlist – equity, compensation, relocation support

Lessons

- Numerous options available with political will and/or expertise
- Build new, relocate houses, real estate support, buyouts in batches over time

Siders & Gerber-Chavez, 2021

see Greer & Binder, 2017 Learning or Just Failing?

Expected Challenges

- F
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- Slow

Described Challenges

Local expertise determines:

- Whether to pursue a buyout
- Success in getting federal $
- Amount offered to local homeowners
- Cooperation (relationships with locals / state / federal officials + contractors)
- Provision of relocation assistance or extra services
- Negotiating power with federal agencies
- Speed of the buyout

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- **<u>Local capacity</u>** & expertise
- Federal bureaucracy

Lessons

- Numerous options available with political will and/or expertise
- Build new, relocate houses, real estate support, buyouts in batches over time
- State funding (consistent, flexible)
- State support, consultants, NGOs, partnerships other gov agencies
- Buyout as **<u>process</u>**

Siders & Gerber-Chavez, 2021

"[You're] building a miles-long floodwall, but you're doing it piece by piece as the money becomes available, and it might take you a decade or two, and maybe you won't build the sections in order, so you need to have a clear vision of what you're doing"

"It may take a long time to get all the parcels you need to build that park or levee or whatever, so you've got to be in it for the long-haul."

Buyouts are a Long-Term Process

Requires Vision

Current policies are one-time efforts; Probably the WRONG design

"We need to talk more about coordinating buyouts with your long-term vision for your community."

"If the end game is 30 years out – we want to be done before the town is completely underwater – then it doesn't have to all happen tomorrow."

Siders & Gerber-Chavez, 2021

RETREAT OCCURRING

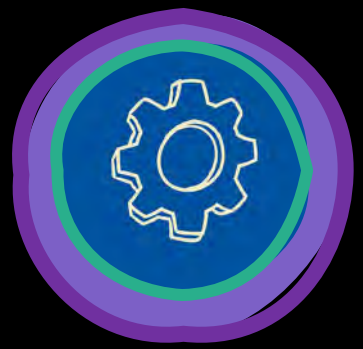
MORE DEMAND THAN ABILITY

NUMEROUS VARIATIONS

INSUFFICIENT EVIDENCE FOR TAILORING

EXPERTISE > CHALLENGES

NOT ENOUGH LEARNING & DIFFUSION



INTEGRATION IS CRITICAL

QUESTIONS?

siders@udel.edu

Examples of Co-developed Solutions to Coastal Challenges

Tracie Sempier,

Resilience Engagement Lead,
Mississippi-Alabama Sea Grant

ENGAGEMENT STRATEGIES FOR AWARENESS, EVACUATION, AND DECISION MAKING

DR. TRACIE SEMPIER, MISSISSIPPI-ALABAMA SEA GRANT CONSORTIUM

Sea Grant
MISSISSIPPI-ALABAMA

QUICK SUMMARY

- **Define your audience:** Engagement strategies differ depending upon the audience
- **Prioritize your primary and secondary audiences:** Who needs the information you are disseminating? Who is most likely to act upon it?
- **Craft an engagement plan specifically for the audience:** It is important to know the purpose of the engagement when crafting strategies
- **Evaluate effectiveness of engagement:** This can be formal or informal but is necessary to improve future efforts

EXAMPLE 1

TARGET AUDIENCE: POINT-AU-CHIEN TRIBE

NATIVE PLANT NURSERY AND SHORELINE STABILIZATION

FORMING PRODUCTIVE AND EQUITABLE PARTNERSHIPS

- **Consideration of Time:** be upfront and honest about the expectations for time and make sure there is an understanding that some work may occur outside the parameters of a common workday
- **Commitment to Resources:** discuss what each partner brings to the table and make sure it is clear how these will be accessed
- **Clear Communication:** are we using a common shared language and having open dialogue where everyone feels safe to contribute; clearly outlining expectations from all partners
- **Commitment against Harm to the Community:** is there consent for information that is disclosed and shared
- **Valuing Local Knowledge and Input:** respect and consider this knowledge to better comprehend values, needs and capabilities of the community

FORMING PRODUCTIVE AND EQUITABLE PARTNERSHIPS

- **Flexibility:** be adaptive so that products will be more useful to the community; this also helps when planning meetings (not during cultural celebrations, when convenient for all parties)
- **Inclusion of the Entire Community:** not everyone has access to e-mail or availability for calls
- **Placing the Vision of the Community First:** willingness to collaborate is a gift and the highest priority should be placed on the needs and concerns of the community; service-oriented leadership
- **Reflection:** continual evaluation to ensure best collaborative practices are being followed and consistently asking questions that are most relevant to the community
- **Mutually Beneficial:** strong partnerships are not unidirectional or extractive, this does not foster long-term partnerships

Holes for the pilings were dug by members of the tribe.

Donald Dardar (Second Chairperson) explains his vision for the wind turbine and rain barrels.

Potluck meetings where each person contributes.

Oyster bags deployed off boat

Reinforcing the shoreline to prevent further erosion and to tribal mound

EXAMPLE 2

TARGET AUDIENCE: MOBILE-MANUFACTURED HOME OWNERS

SAFE SHELTERING FOR MOBILE & MANUFACTURED HOME PARK RESIDENTS

Prior Storm Damage

Storm Drainage Ditch

Severe Weather
Awareness Expo

Biloxi

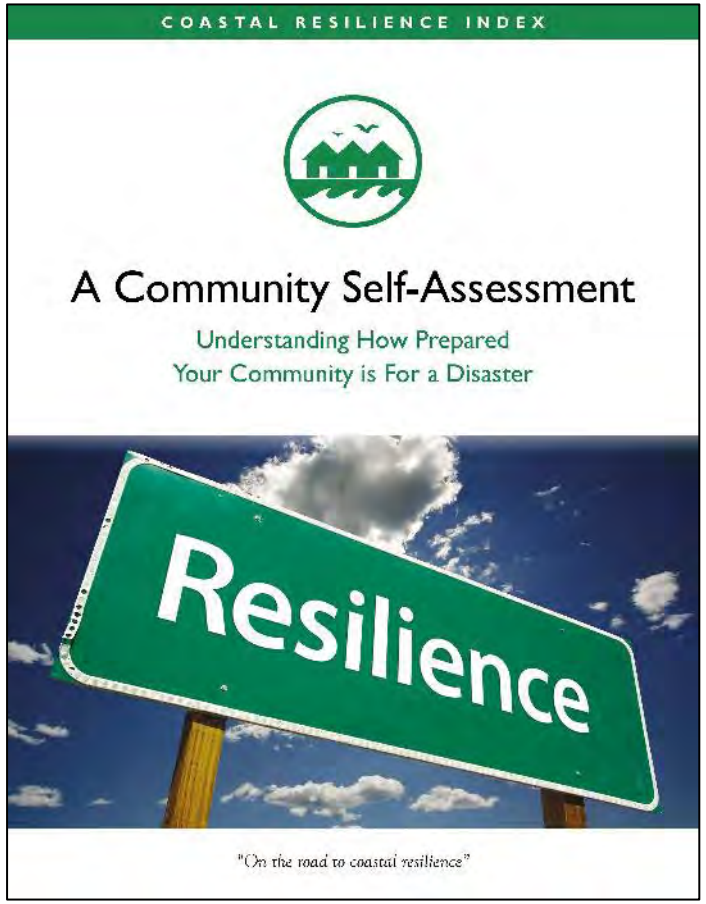
Sea Grant
Mississippi-Alabama

SAFE SHELTERING FOR VULNERABLE POPULATIONS

EXAMPLE 3

TARGET AUDIENCE: LOCAL GOVERNMENT OFFICIALS

SELF-ASSESSING VULNERABILITIES



- Completed self-assessment
- Applied for small grant award of $44,000
- Funds were used to support the development of a Business Continuity Plan. The city worked with the Chamber of Commerce to identify standards and offer grants to local businesses to share the cost of preparing the plans.

BUSINESS CONTINUITY WORKSHOP

- Sharing BCPs between local businesses and city government is a valuable step in preparing for future storm events. This project found the process of working together to develop BCPs can assist with identifying resources that may be needed immediately following a storm, help to stage resources and/or services (i.e. medical services, equipment such as generators), and build relationships necessary to communicate effectively after a disaster.

EXAMPLE 4

UTILIZING AN EXISTING COMMUNITY OF PRACTICE TO REACH YOUR AUDIENCE(S)

COP EQUITY PROJECT TEAM

Climate and Resilience
COMMUNITY OF PRACTICE












ADVISORY COMMITTEE ON EQUITY (ACE)










QUESTIONS?

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