NNBF

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

NNBF Performance

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NNBF Performance

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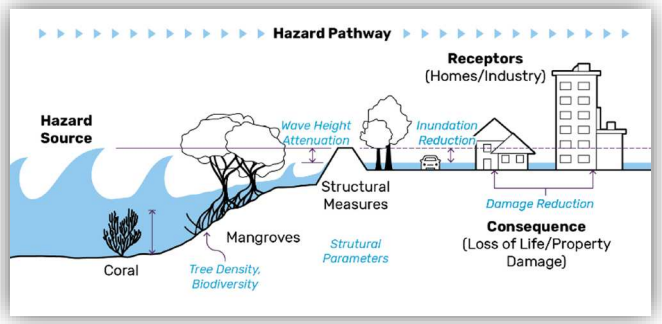
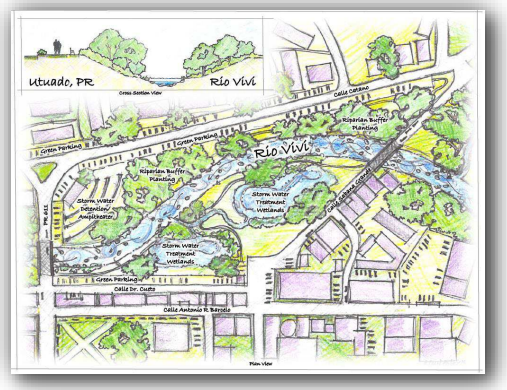
Introduction

- NNBFs provide flood risk management functions while also producing economic, social and environmental co-benefits
- ***Performance*** is the ability to meet desired objectives using pre-determined ***metrics***
- Performance should be assessed across the ***life cycle***
- Assessing NNBF performance is not different from assessing performance of conventional infrastructure



Performance framework



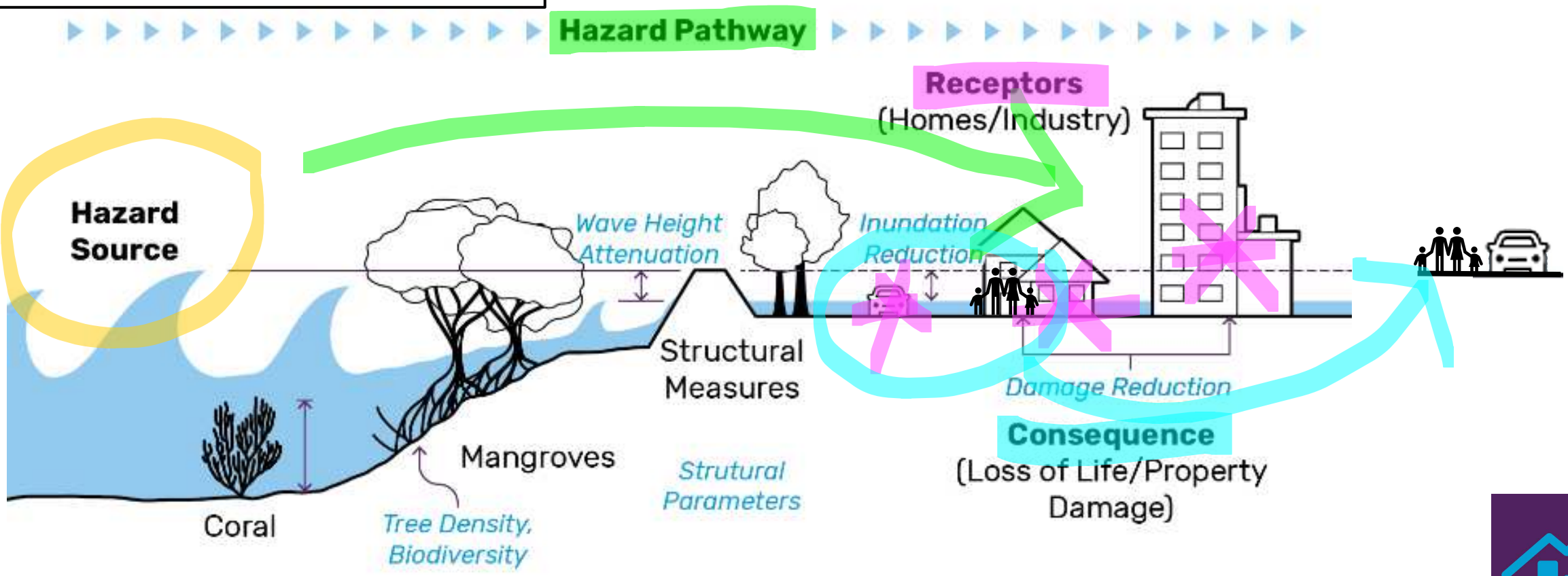
Metrics and assessment

Deterioration, damage, and failure

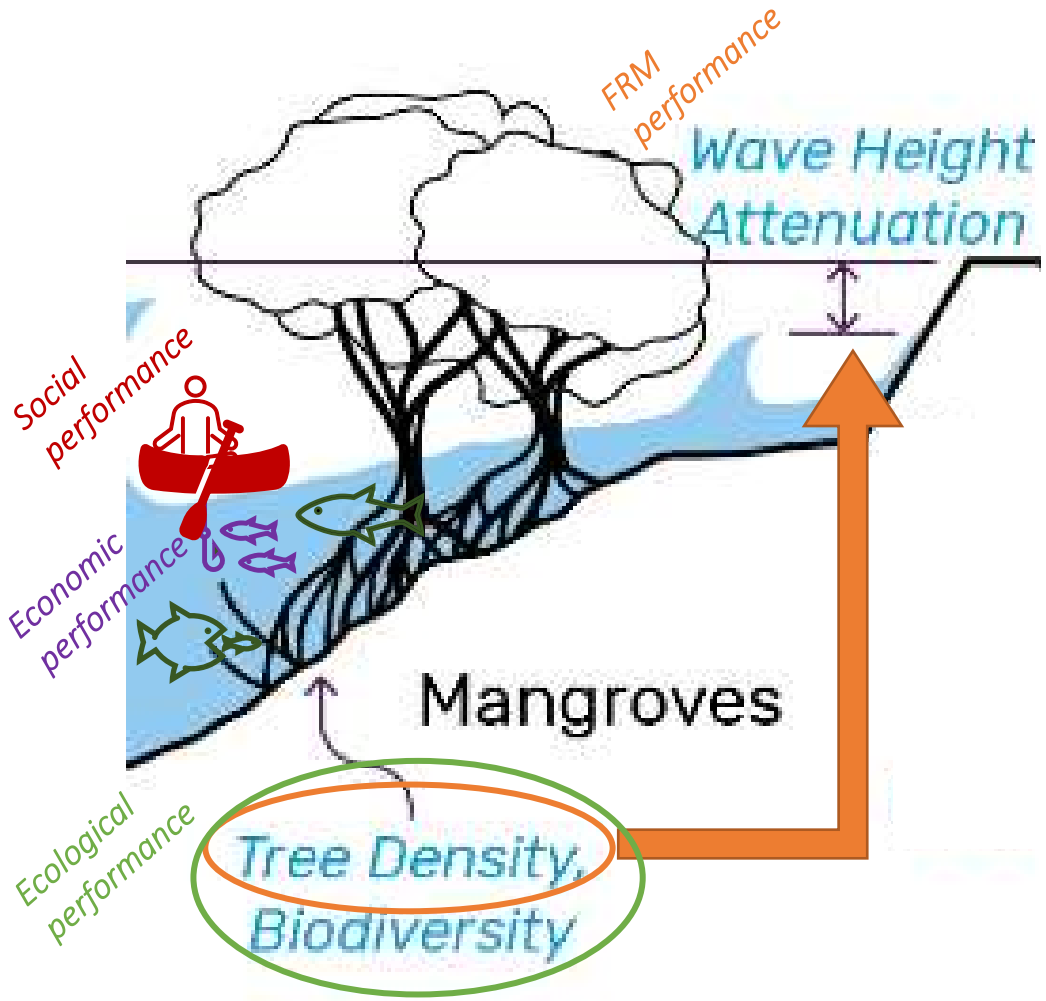
Conclusions

Flood Risk Management Performance Framework

Source-Pathway-Receptor-Consequence



Performance of NNBF is about more than flood risk management



What about ecological, social, and economic performance?

- NNBF can produce co-benefits (e.g., habitat, fisheries, jobs)
- FRM benefits are produced in response storms and floods
- Co-benefits can be produced all throughout the life cycle

Ecological performance directly affects FRM performance and may affect social and economic performance as well

Performance of structural and non-structural measures should also consider co-benefits and impacts

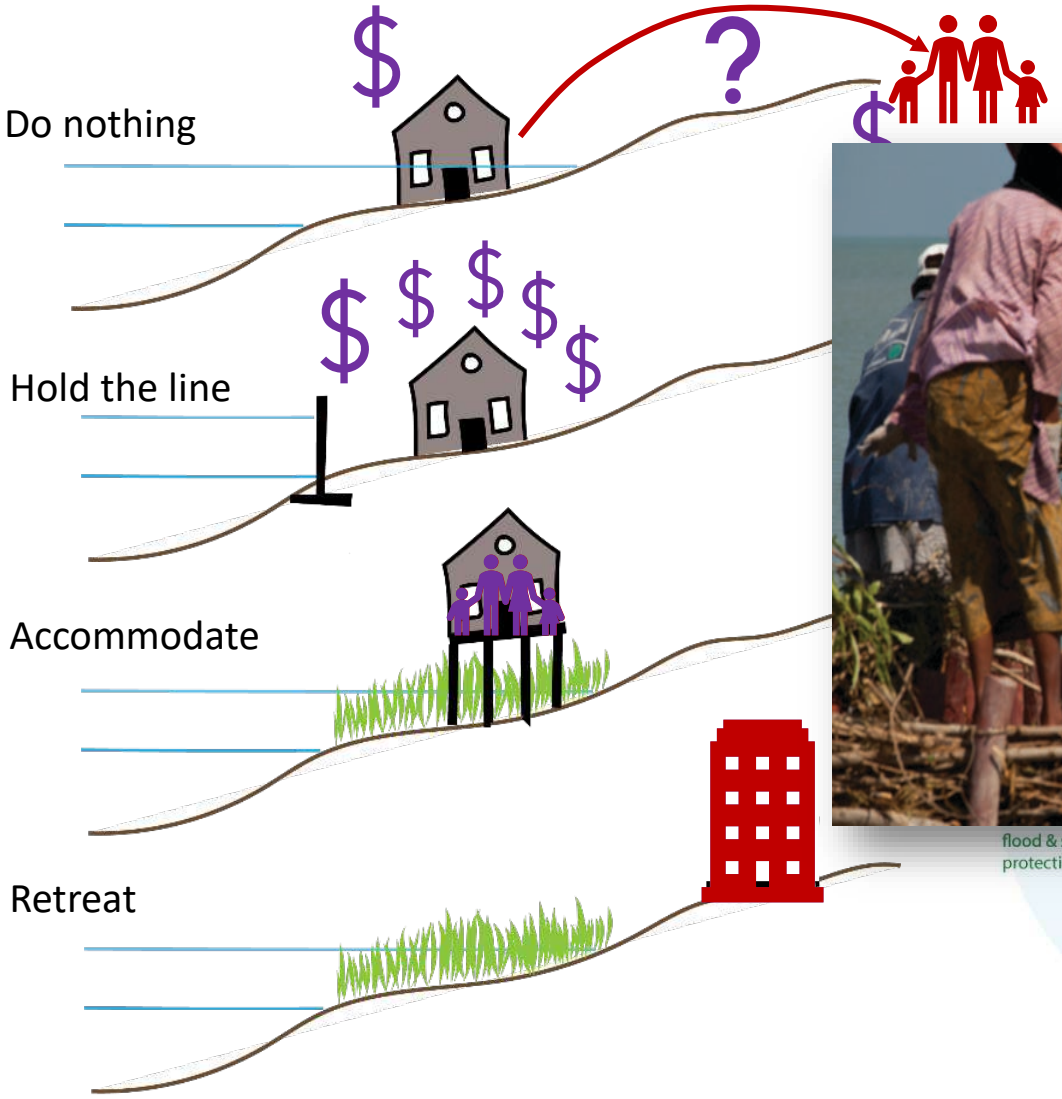
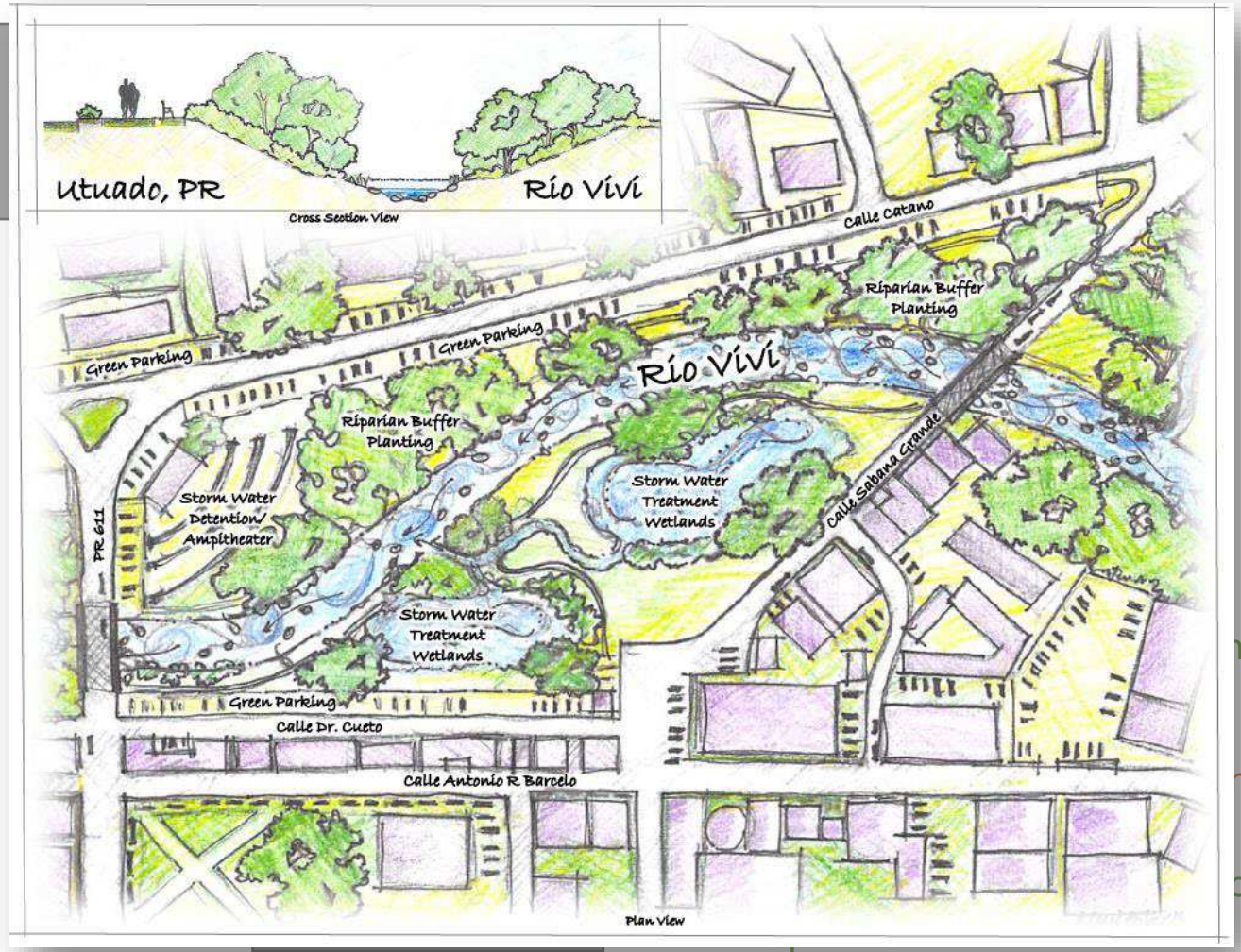


Image of storm damage from Rincon from USACE Public meeting presentation

from Van Dolah et al., 2020
Marsh Migration, Climate Change, and Coastal Resilience: Human Dimensions Considerations for a Fair Path Forward

To assess NNBF benefits and co-benefits, we need to select appropriate metrics

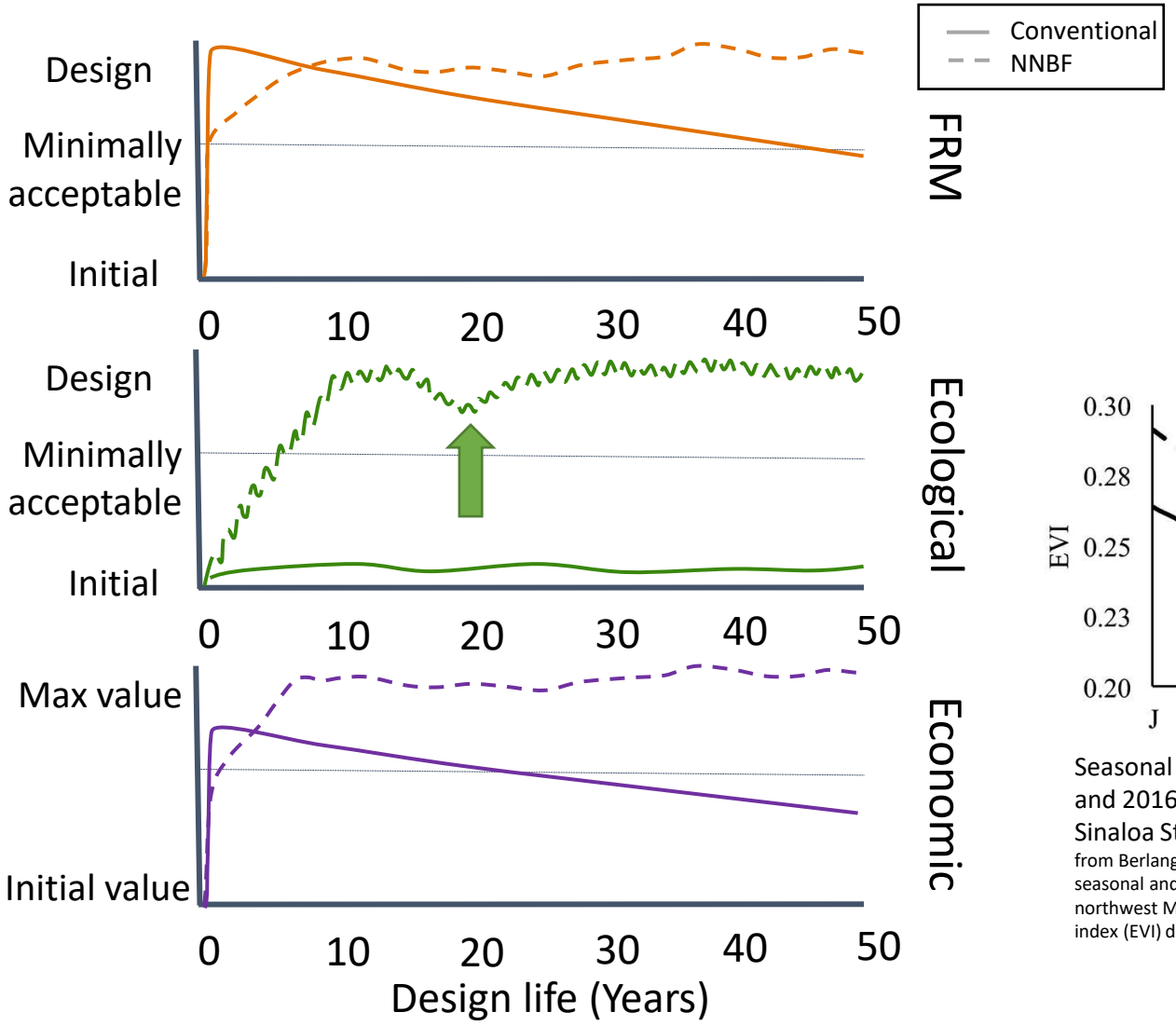


Metrics should:

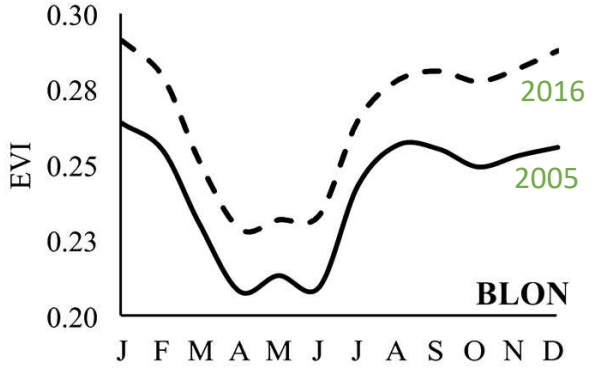
- tell you something about whether you met your objective
- help you design your project
- suit your monitoring budget
- inform critical performance criteria
- (ideally) inform multiple types of performance.

Metrics can be directly measured, indirectly measured, or modeled and may evolve through project stages

Performance is dynamic and some co-benefits take time to develop



- NNBF are more dynamic than structural measures
- Performance expectations should reflect development rate of ecological processes
- Different benefits and co-benefits may need to be assessed at different times and frequencies

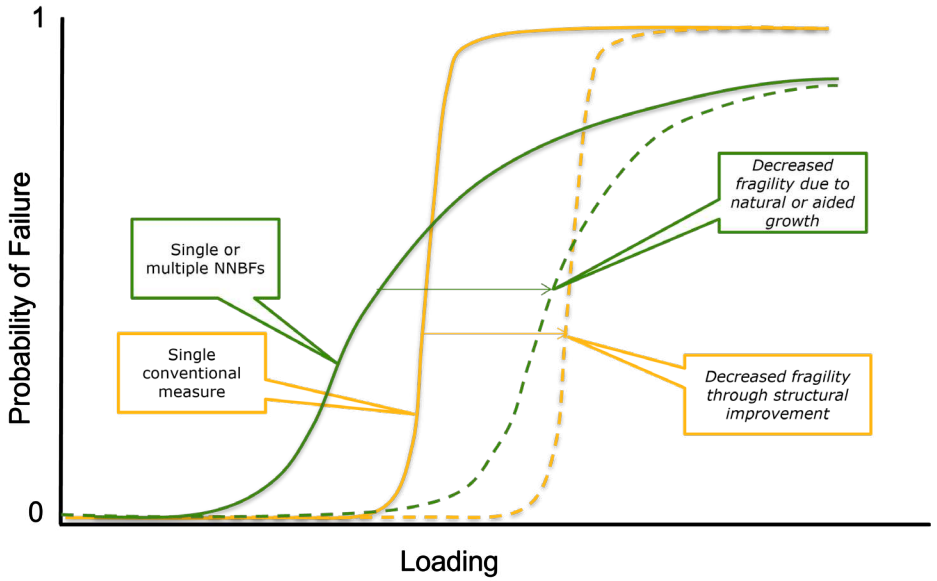


Seasonal changes in mangrove canopy in 2005 and 2016
Sinaloa State, Mexico
from Berlanga-Robles, C. A., & Ruiz-Luna, A. (2020). Assessing seasonal and long-term mangrove canopy variations in Sinaloa, northwest Mexico, based on time series of enhanced vegetation index (EVI) data.

What do we mean by “failure”?

Failure is a vague term. Do we mean?

- deterioration (wear and tear)
- damage (fragility)
- breach (gap or break in measure)
- collapse (complete loss)



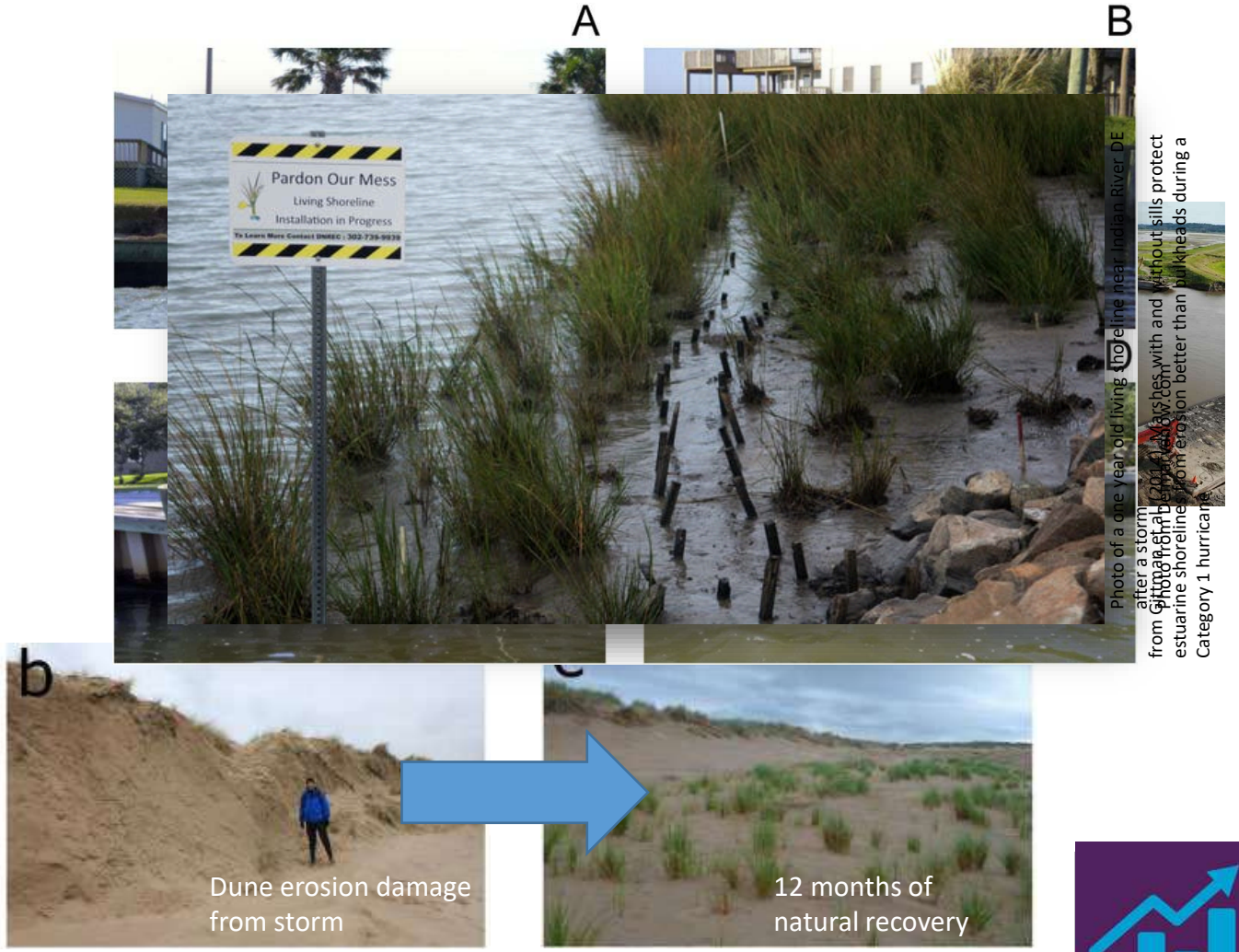
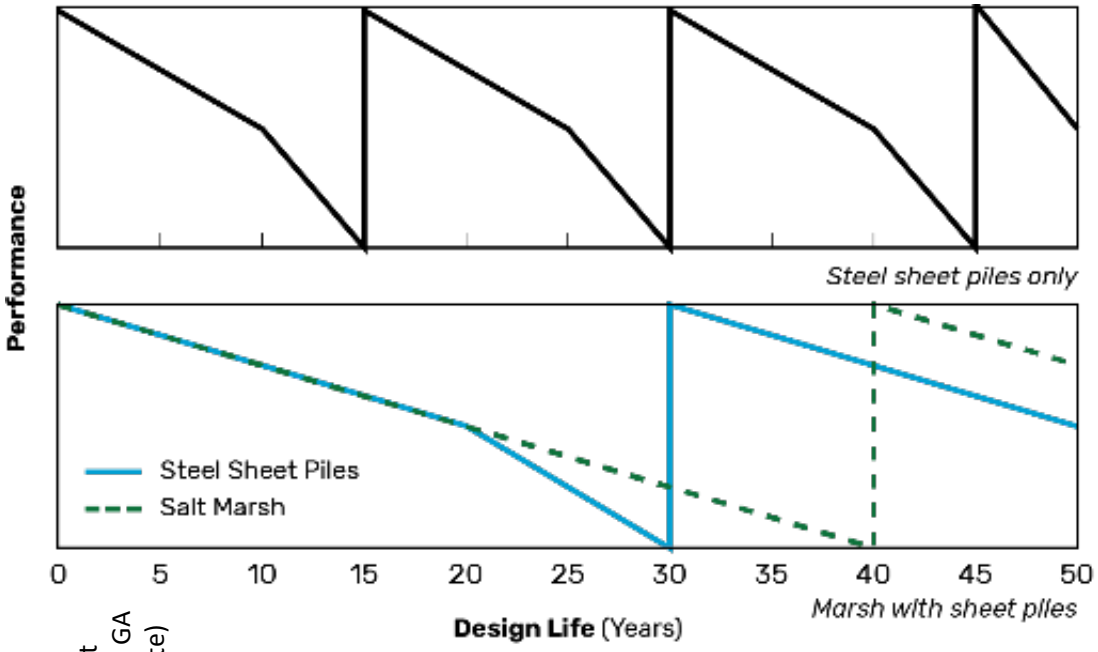


Photo of a one year old living shoreline near Indian River DE after a storm from Gittman et al. (2014). Marshes with and without sills protect estuarine shorelines from erosion better than bulkheads during a Category 1 hurricane

from Bateman et al. (2017). Can sand dunes be used to study historic storm events?

Deterioration processes can be slowed with addition of NNBF



Degraded culverts and channels in Yabucoa (photos from USACE)

Conventional stormwater channels and culverts can be prone to sedimentation, reducing the amount of stormwater they can handle

Salt marsh in front of a bulkhead at Skidaway Oceanographic Institute, GA (photo from UGA Skidaway Institute)

Experimental rain garden at Albert Einstein High School (photos from EPA)

Adding lots of small-scale green infrastructure can be used to slow sedimentation and deterioration of conventional infrastructure

Concluding Thoughts

- (co-)Benefits go beyond just FRM
- Performance metrics should reflect all project objectives (not just the FRM ones)
- Understand how your project fits into the system
- Plan to assess performance throughout the project life
- Understand what failure means for your project
- Understand what role the NNBF plays (reducing flood risk directly vs. decreasing maintenance needs of other measures)

Questions?

EngineeringWithNature.org

Download

- Executive Summary (70 pages)
- International Guidelines on NNBF for Flood Risk Management (1,000 pages)