

Use of Ecosystem Service Framework to Inform Policy Decisions on CCA and DRR

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Contents

1. Introduction to

- Ecosystem Service (ES)
- ES Modeling Approach: InVEST

2. ES Model Applications for Decision Making

- Build reef natural capital for CCA in GOM
- Coastal protection services in US coasts

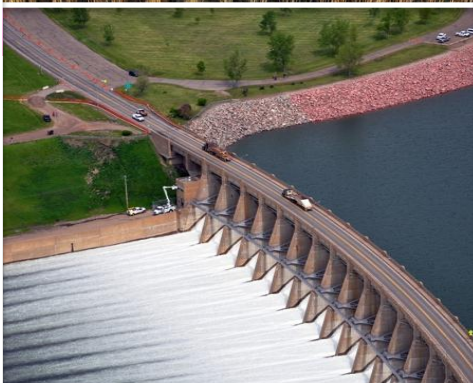
3. Summary & Discussion



Food, fuel,
fiber



Pollination



Coastal
protection



Clean
water

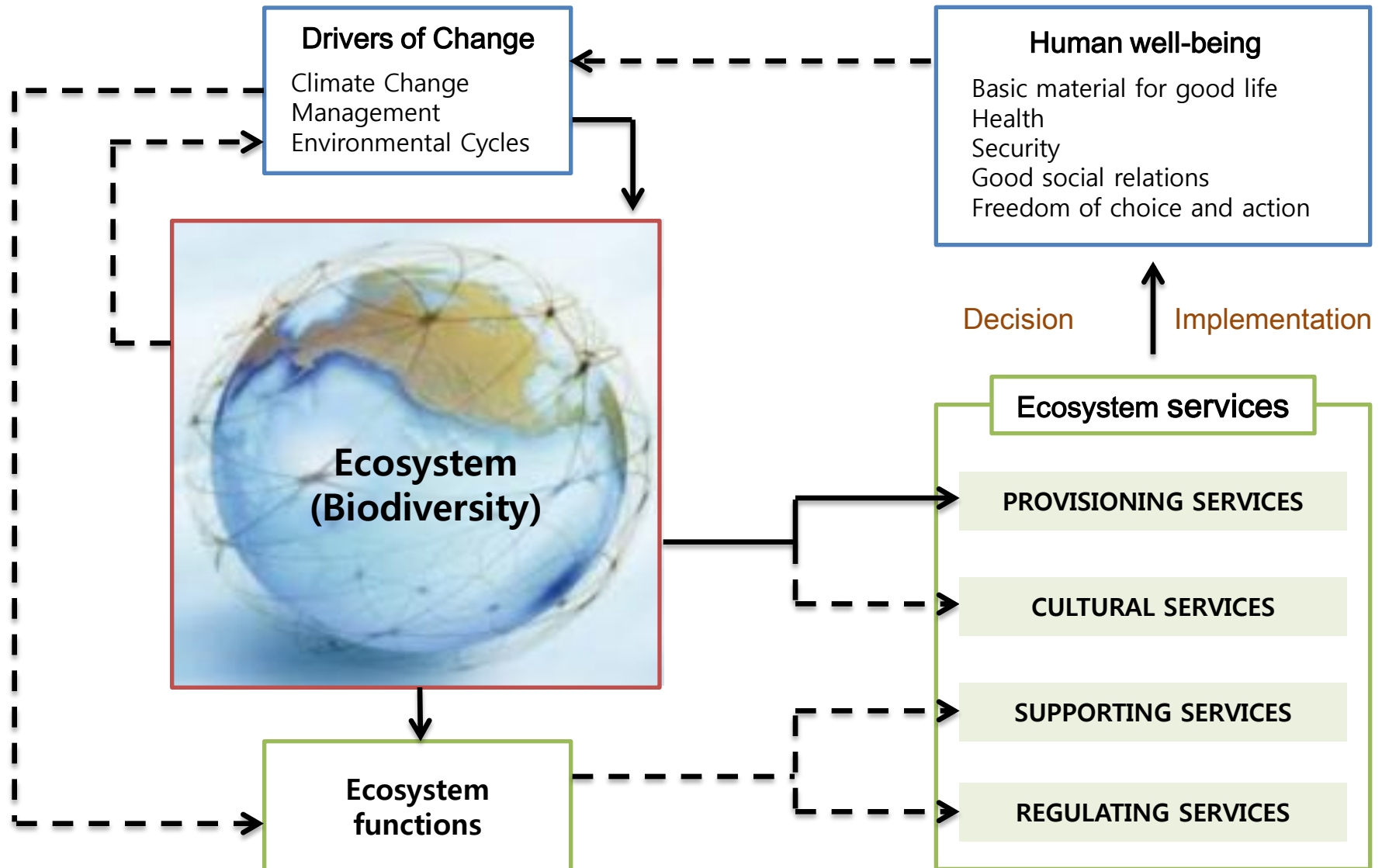


Recreation



Linkages among Ecosystem, Ecosystem Services, and Human Well-being

Modified from MA (2005)





Changes in ecosystems lead to
changes in ecosystem services and their
values

InVEST

integrated valuation of
environmental services
and tradeoffs

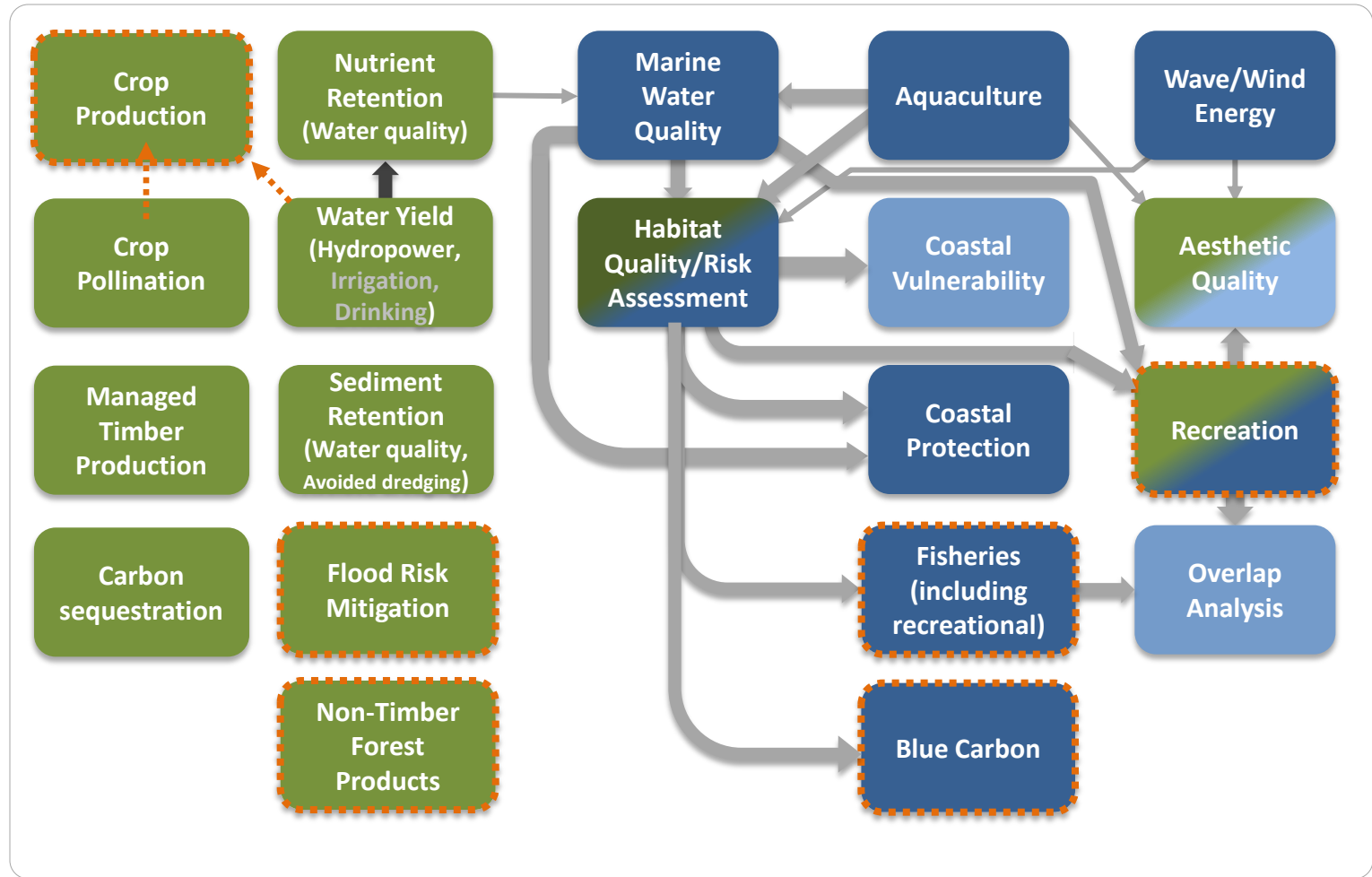
- **Multiple services and biodiversity**
- **Scenario-based analysis**
- **Biophysical and economic currencies**
- **Adaptable and flexible**

Free. Open source.

www.naturalcapitalproject.org

natural
capital
PROJECT

InVEST Models & Linkages



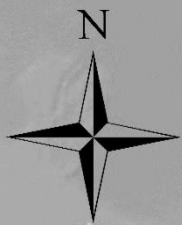
- Terrestrial/freshwater model: Tier 0
- Terrestrial/freshwater model: Tier 0
- Marine model: Tier 1
- Marine model: Tier 0
- Model coming soon!

- Optional model linkage
- Required model linkage

Economic valuation methods

- Market valuation
 - Carbon
 - Timber
 - Non-timber forest products
- Avoided damage costs
 - Water purification
 - Flood mitigation
 - Avoided erosion and flooding
- Production Economics
 - Fish for food
 - Pollination of agricultural crops





The Natural Capital Project

Incorporating nature's benefits into decisions



Spatial Planning

Payment for Ecosystem Services

Climate Adaptation Planning

Development Impacts and Permitting

Restoration Planning

Corporate Risk Management

0 5,000 10,000 Kilometers

Rebuild reef natural capital in GOM



Restore 100 miles of oyster reef to protect 1,000 acres of seagrass and marsh in the N. GOM

Full spectrum of benefits

- long-term sustainable harvests of oysters
- increased resilience to storms

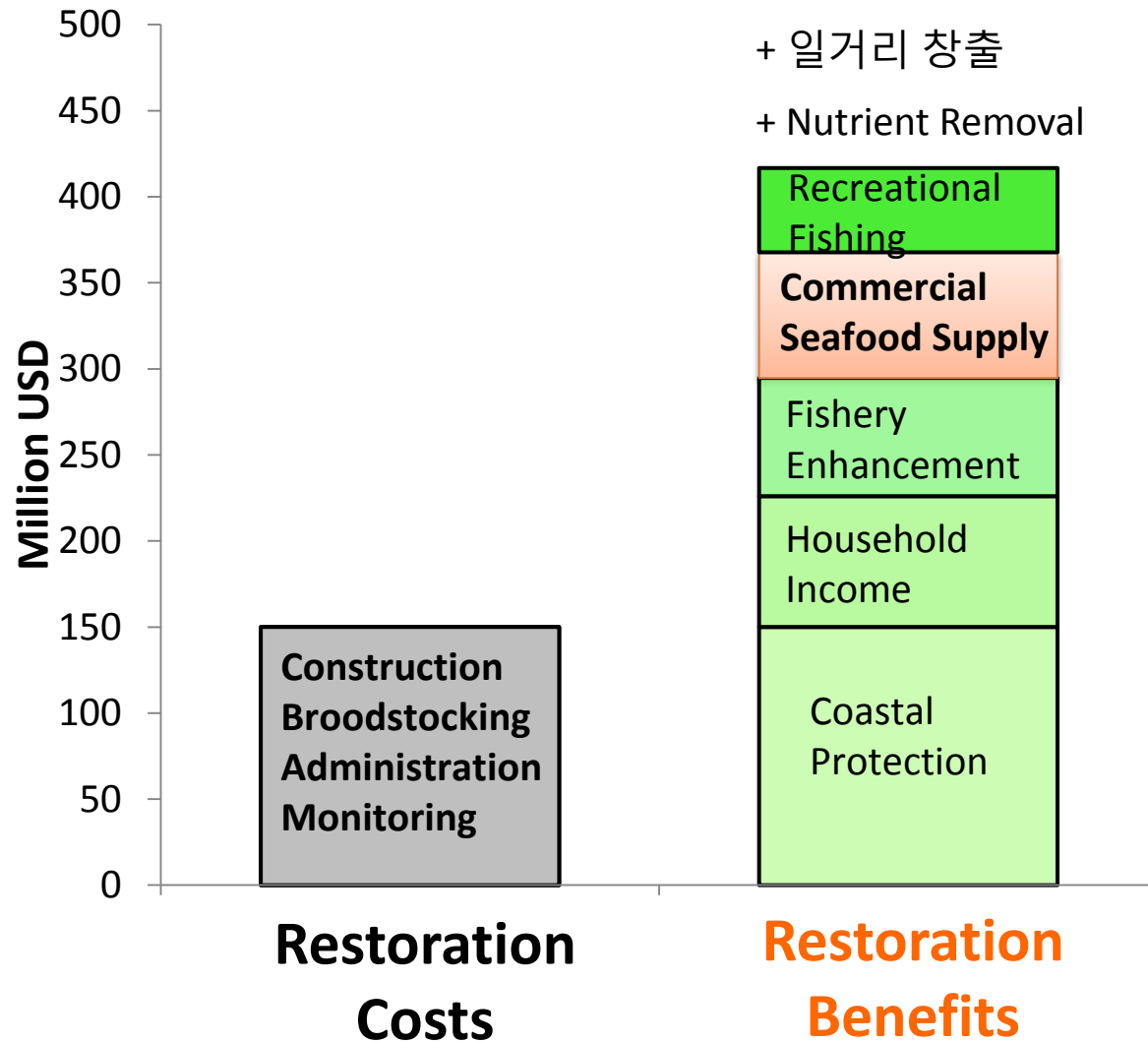
(The Nature Conservancy)

Living Shorelines – Oyster Reefs



(The Nature Conservancy)

Economic **benefits of restoration** across sectors can outweigh costs



Ecosystem-based adaptation in US coasts

nature
climate change

LETTERS

PUBLISHED ONLINE: XX MONTH XXXX | DOI:10.1038/NCLIMATE1944

Coastal habitats shield people and property from sea-level rise and storms



Coastal forests



Oyster reefs



Emergent marsh



Seagrass beds



Coral reefs



Dunes (high/low)

Question of this project

Where and to **what extent** do coastal ecosystems protect the most **vulnerable human** populations and valuable **property** from sea level rise and storms?

NEARSHORE WAVES AND EROSION

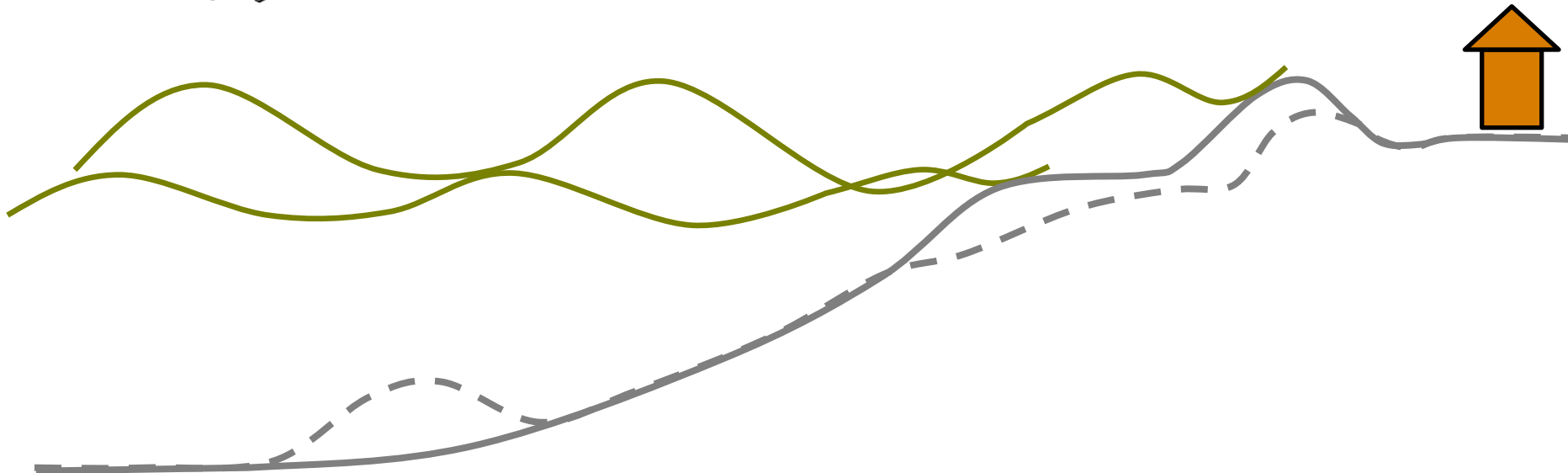


NEARSHORE WAVES and EROSION

MODEL INTRODUCTION

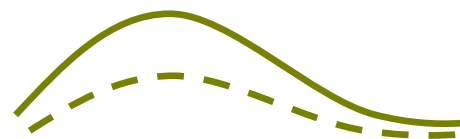


 : Water Level



NEARSHORE WAVES and EROSION

MODEL INTRODUCTION



mangroves



seagrass beds



marshes



coral reefs

sand dunes

oyster reef

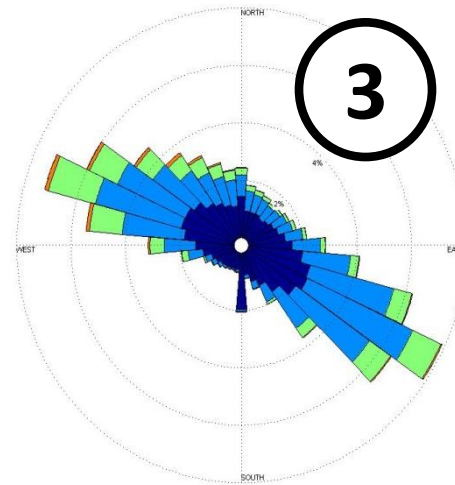
Coastal hazard index and data layers (exposure)



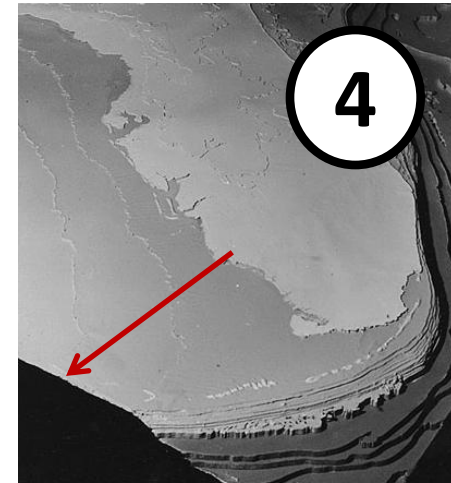
GEOMORPHOLOGY



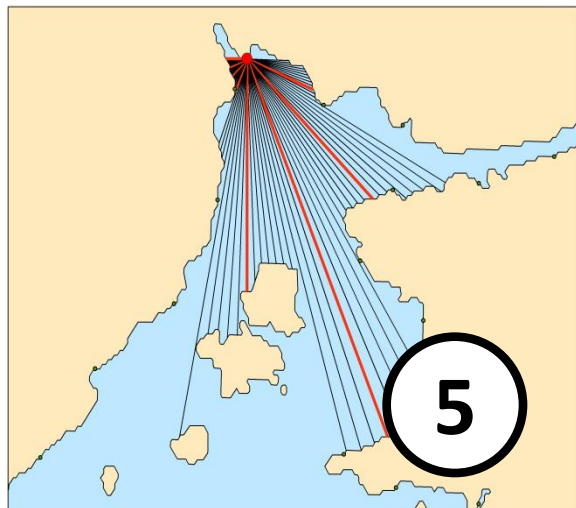
COASTAL HABITATS



WIND EXPOSURE



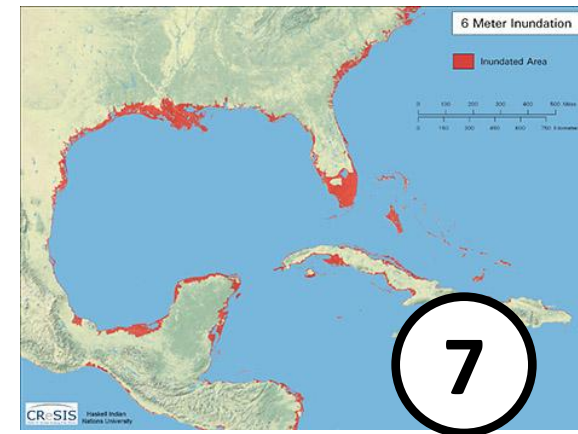
SURGE POTENTIAL



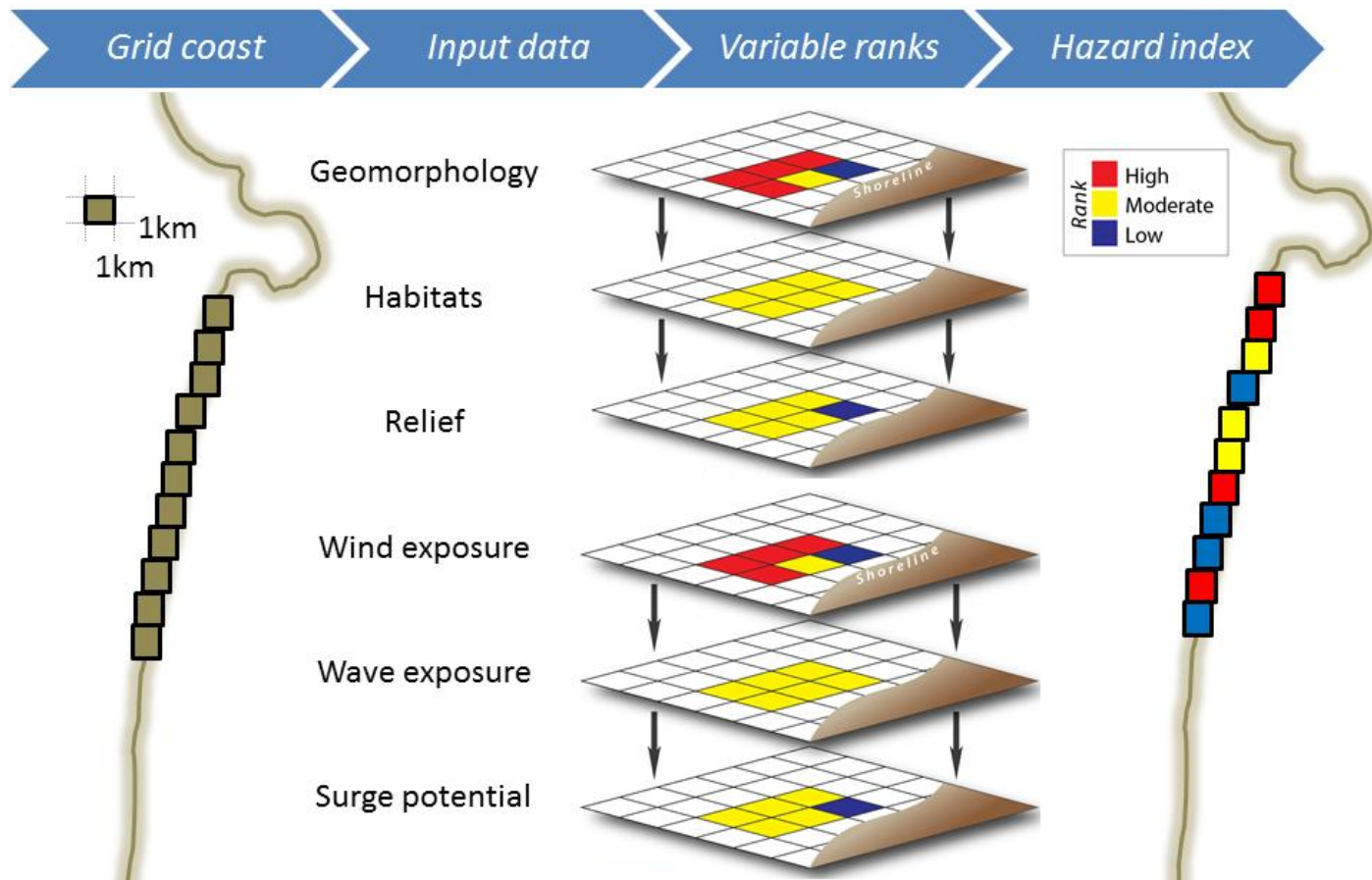
WAVE EXPOSURE



RELIEF



SEA LEVEL RISE



$$VI = \sqrt[2]{\frac{R_{Habitats} R_{Geomorphology} R_{Relief} R_{SLR} R_{WindExposure} R_{WaveExposure} R_{SurgePotential}}{7}}$$

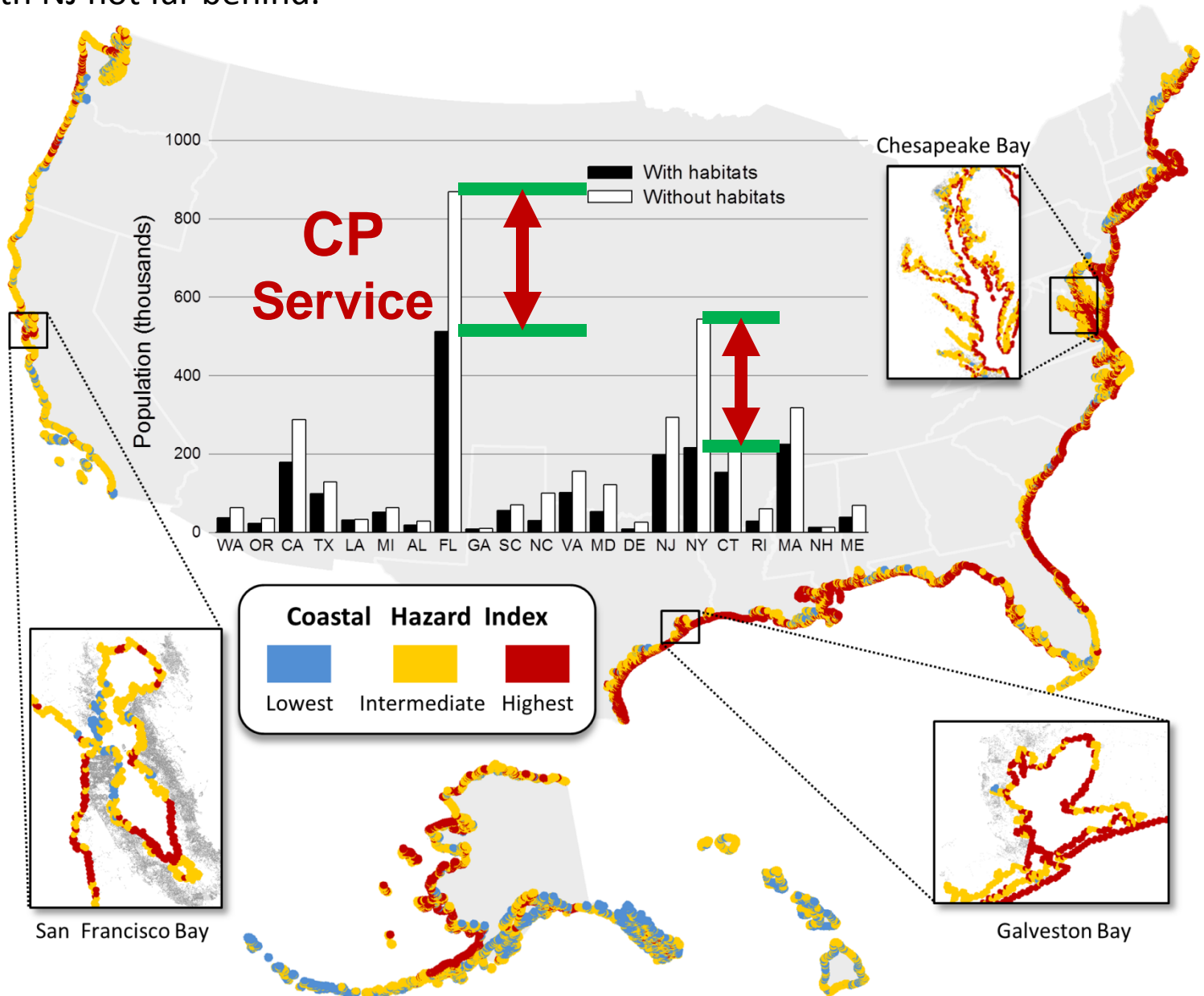
Census data (social vulnerability)

Dasymetric Mapping

- Distributing people and properties

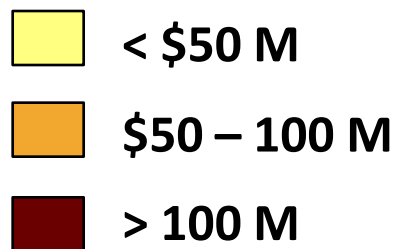


Gulf coasts are most exposed to coastal hazards. Habitats provide **protection** for the greatest number of people, socially vulnerable populations, and property in Florida, New York and California with NJ not far behind.



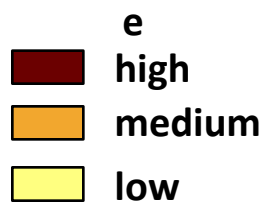
Economic

Difference in Property Value



A2

Habitats reduce exposure



proportion of
poor/elderly people

Poor
families

A2

Elderly
people

A2

Social

Summary

Ecological Economics (Ruckelshaus et al. 2013)

- ✓ Applying a **BES approach** is most effective in leading to policy changes
- ✓ **Simple ecological production function models** have been useful in a diverse set of decision contexts
- ✓ **Training local experts** in the approaches and tools is important for building local capacity, ownership, trust, and long-term success
- ✓ Decision makers and stakeholders prefer to **use a variety of BES value metrics**

Summary: challenges

- ✓ An important **science gap exists** in linking changes in BES to changes in livelihoods, health, cultural values, and other metrics of human wellbeing
- ✓ **Communicating uncertainty** in useful and transparent ways remain challenging
- ✓ **Limited Data Availability** in different scale in time and space