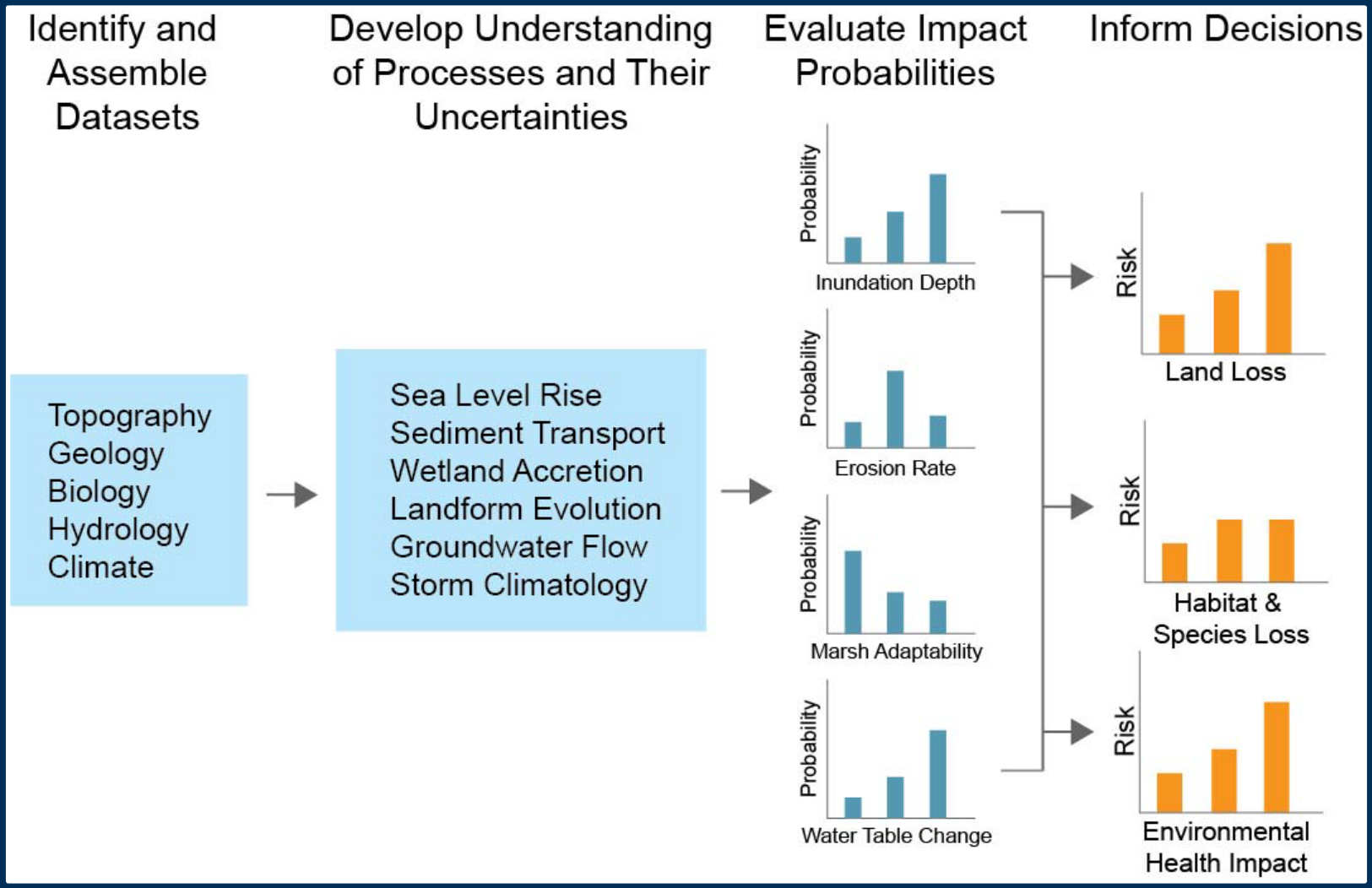
Forecast effects of accelerating sea-level rise (SLR) on the habitat of Atlantic Coast piping plovers and identify responsive conservation strategies

- Partnership between USFWS, USGS, Virginia Tech, and others
- PIPL habitat virtually certain to be impacted by accelerating SLR
  - Potential impacts are rangewide
  - Natural and human responses to coastal change are poorly quantified
- Research group using common Bayesian approach to integrate geologic, biologic and other relevant data
  - Convey what we know and what we know we don't know
  - Synthesize data and models for habitat evolution and plover behavior
  - Provide basis to focus research resources
- Develop science-based decision tools for managers to inform conservation recommendations to land managers and regulators

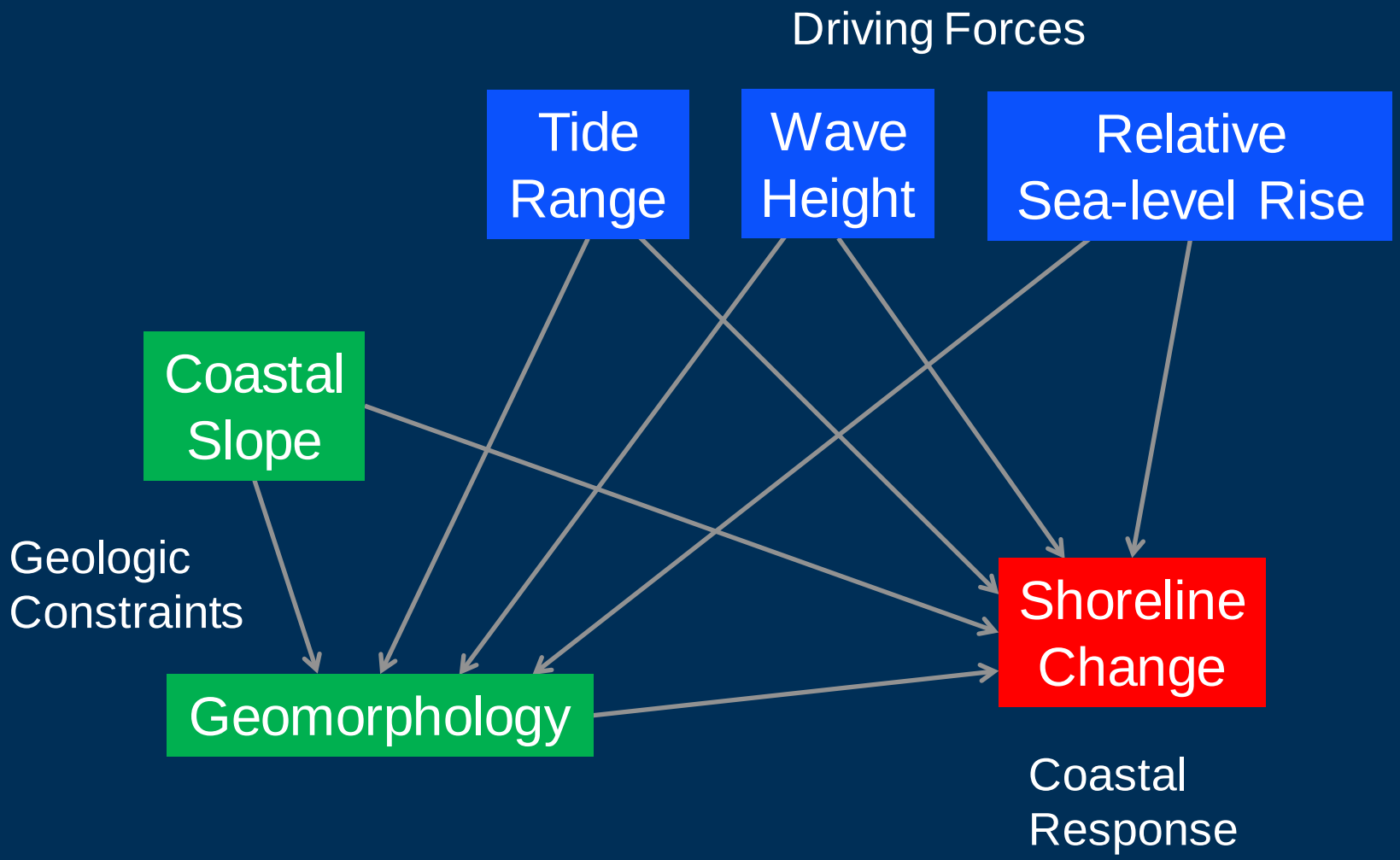
A conceptual approach to the multivariate, uncertainty problem for coastal change (and plovers)



Explicitly include uncertainties, as well as management application

Simple Bayesian Network for Coastal Vulnerability

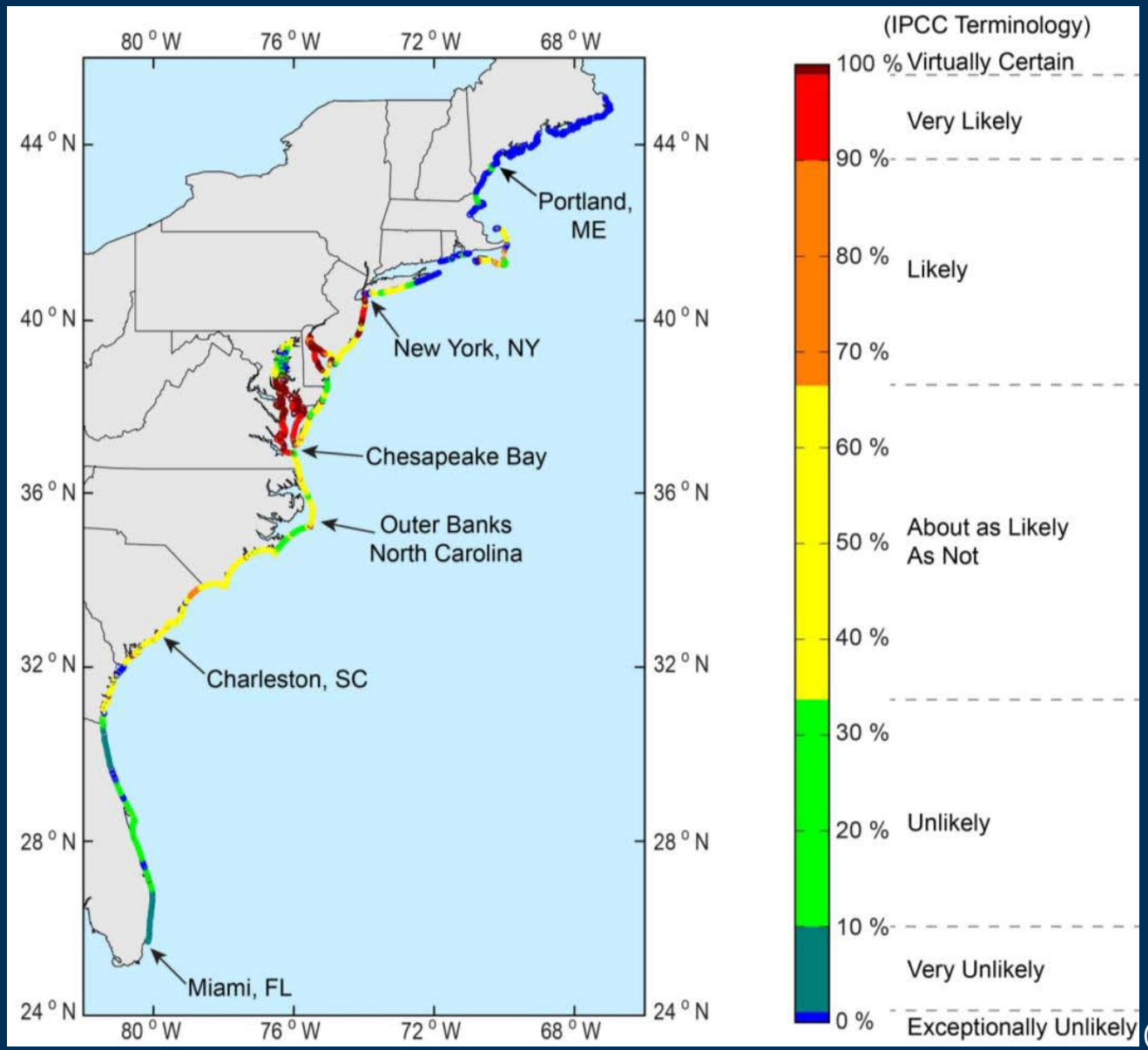
(uses existing USGS data from Thieler and Hammar-Klose, 1999)



(Gutierrez et al., 2011)

Mapping Erosion Risk Using Bayesian Networks

Probability of shoreline erosion >2 m/yr

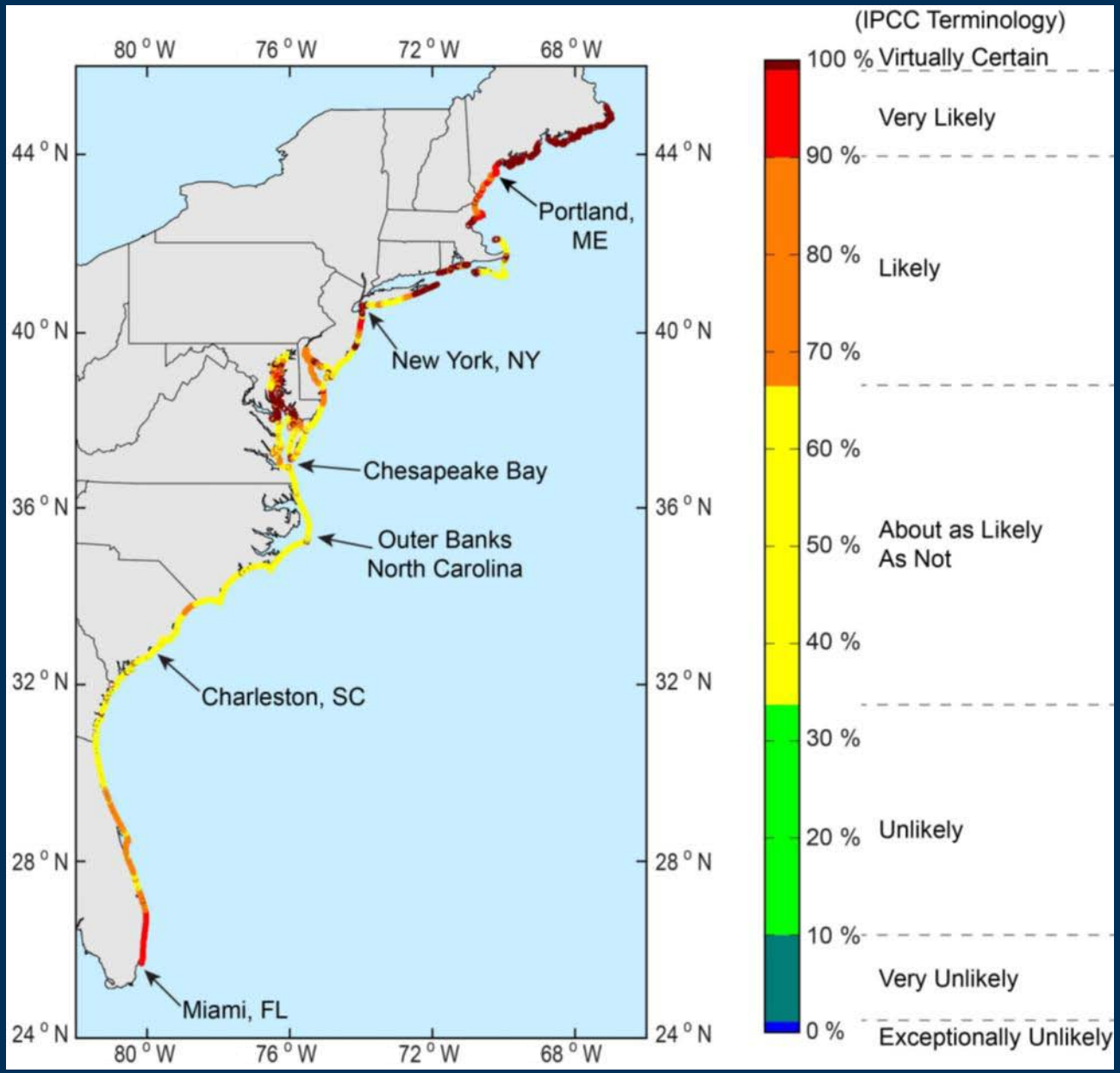


(Gutierrez et al., 2011)

Mapping Prediction Uncertainty

Higher probability = higher certainty of outcome

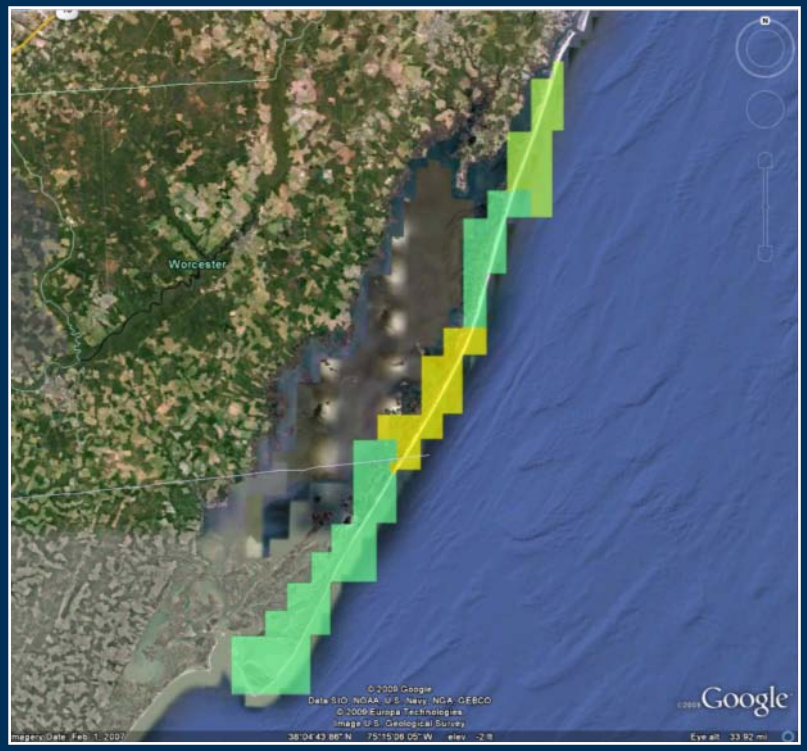
- Uncertainty map can be used to identify where better information is needed
- Areas of low confidence require
  - better input data
  - better understanding of processes
- Can use this map to focus research resources



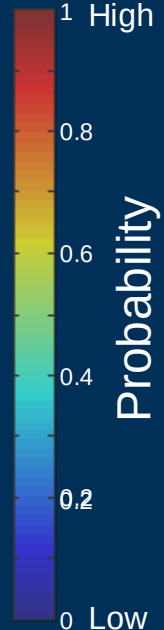
(Gutierrez et al., 2011)

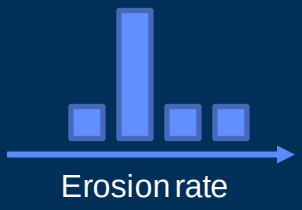
Application of a Bayesian network to an uncertain future: Probability of shoreline erosion >1 m/yr at Assateague Island National Seashore

Current conditions



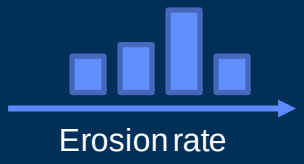
SLR +1 mm/yr, Wave ht. +10%





Narrow probability distributions

Relatively low uncertainty



Higher likelihood of erosion

Broader distributions

Increased uncertainty

Decision Support for DOI Agencies

Piping plover, *C. melodus*

- Listed species
- DOI management responsibility
- Lifecycle includes substantial time on NPS lands for breeding, migrating, wintering
- Have interesting and specific habitat requirements that we can predict
  - Rangewide habitat availability
  - Attributes and distribution of breeding, foraging areas
  - Wave run-up and inundation sensitivity (morphologic and hydrodynamic detail)
- Can feed predictions back into population dynamics models

Plovers in a Bayesian Network