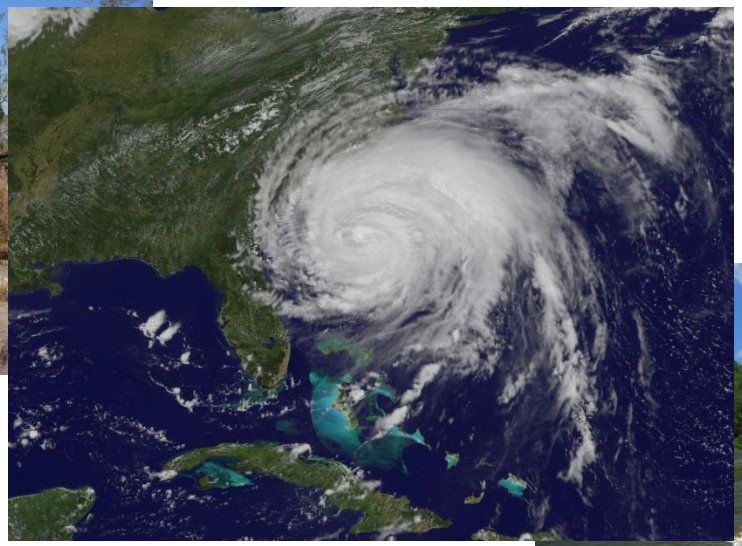
USGS
science for a changing world

Actionable Science @ DOI SE Climate Science Ctr. Implementing a decision-oriented project portfolio



Jerry McMahon
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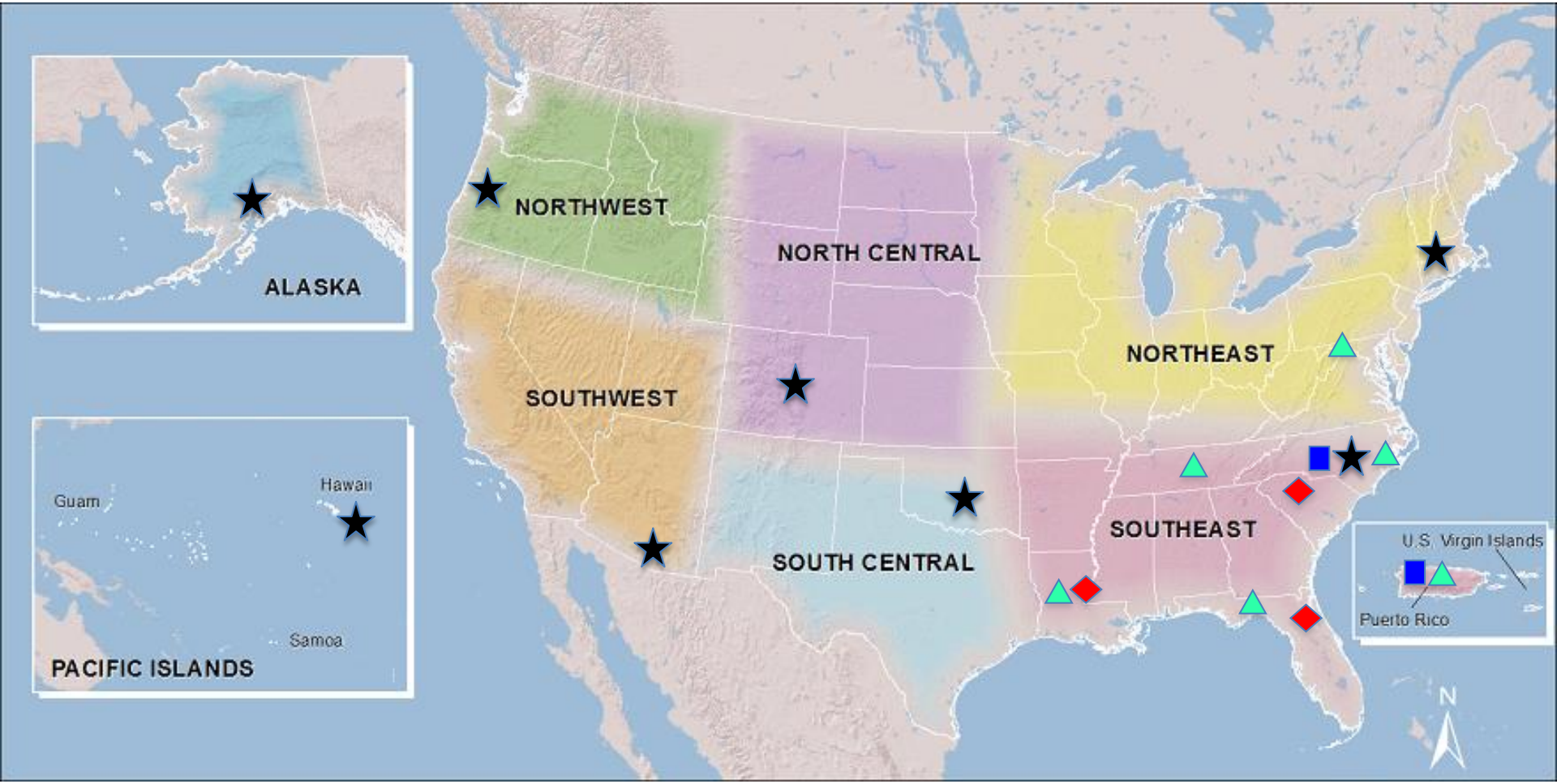
Carolinas Climate Resilience Conference
April 29, 2014
U.S. Department of the Interior
U.S. Geological Survey

Department of Interior Climate Science Center Network

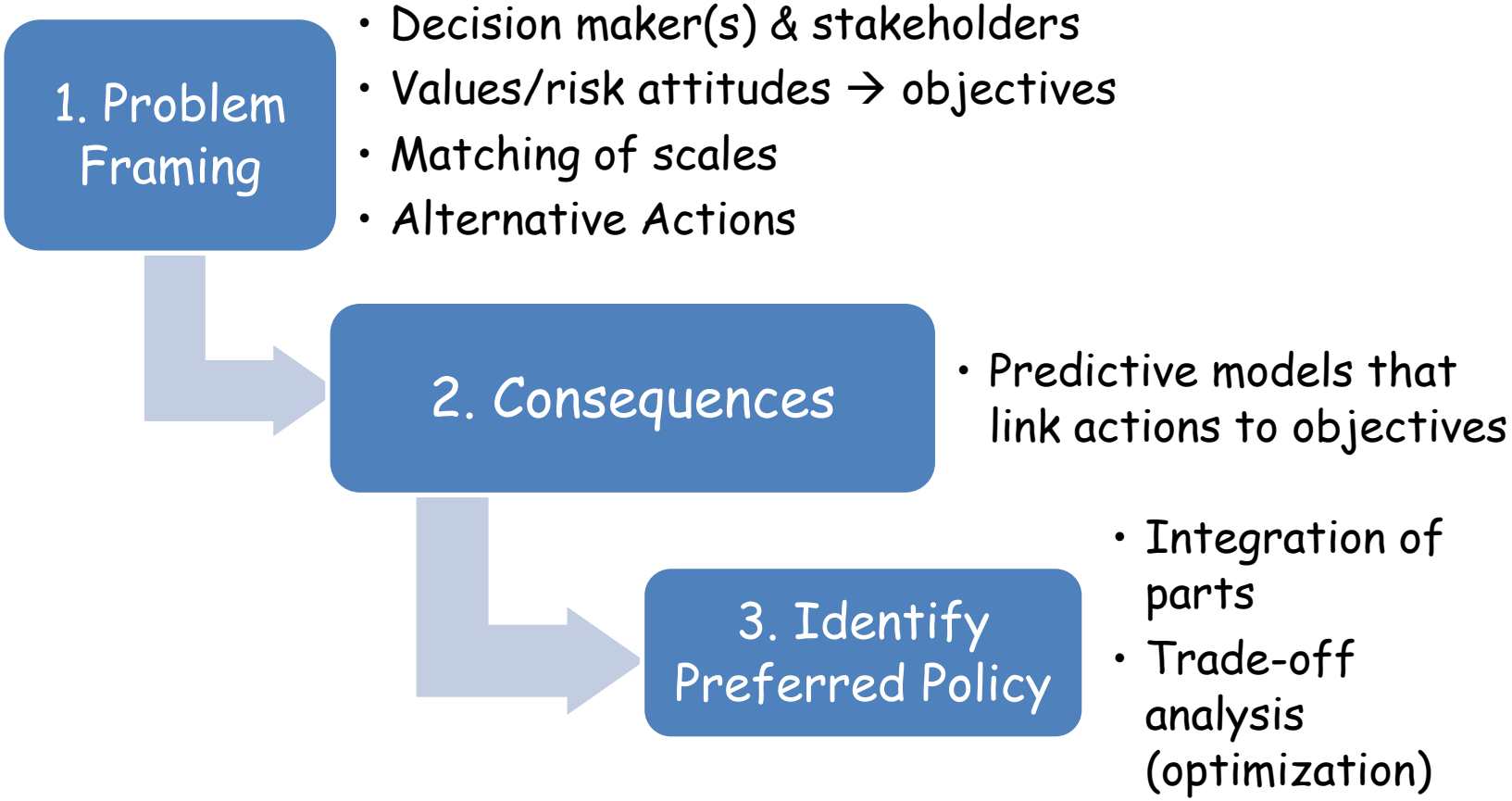


DOI Secretarial Order 3289: Producing actionable science that helps individuals and organizations understand and adapt to global change.

SECSC vision for science that "adds up"

- In general: Actionable science provides data, analyses, projections, tools, or approaches that can support decisions regarding assessment or management of the risks and impacts of climate change.
    - It is ideally co-produced by scientists and decision-makers, and creates rigorous, understandable, accessible, and usable products to meet the needs of stakeholders.
- In particular, for the SECSC:
    - Characterize and understand the effects of climate change on fish, wildlife, and habitat
    - Provide research-based information to support landscape scale adaptive management decisions

Decision Analytic Approach



Actionable science challenges

All aspects of this process for doing landscape-scale, actionable science are complicated by "wicked decision context"

- No definitive problem formulation; no clear right or wrong answer; no clear stopping rule.

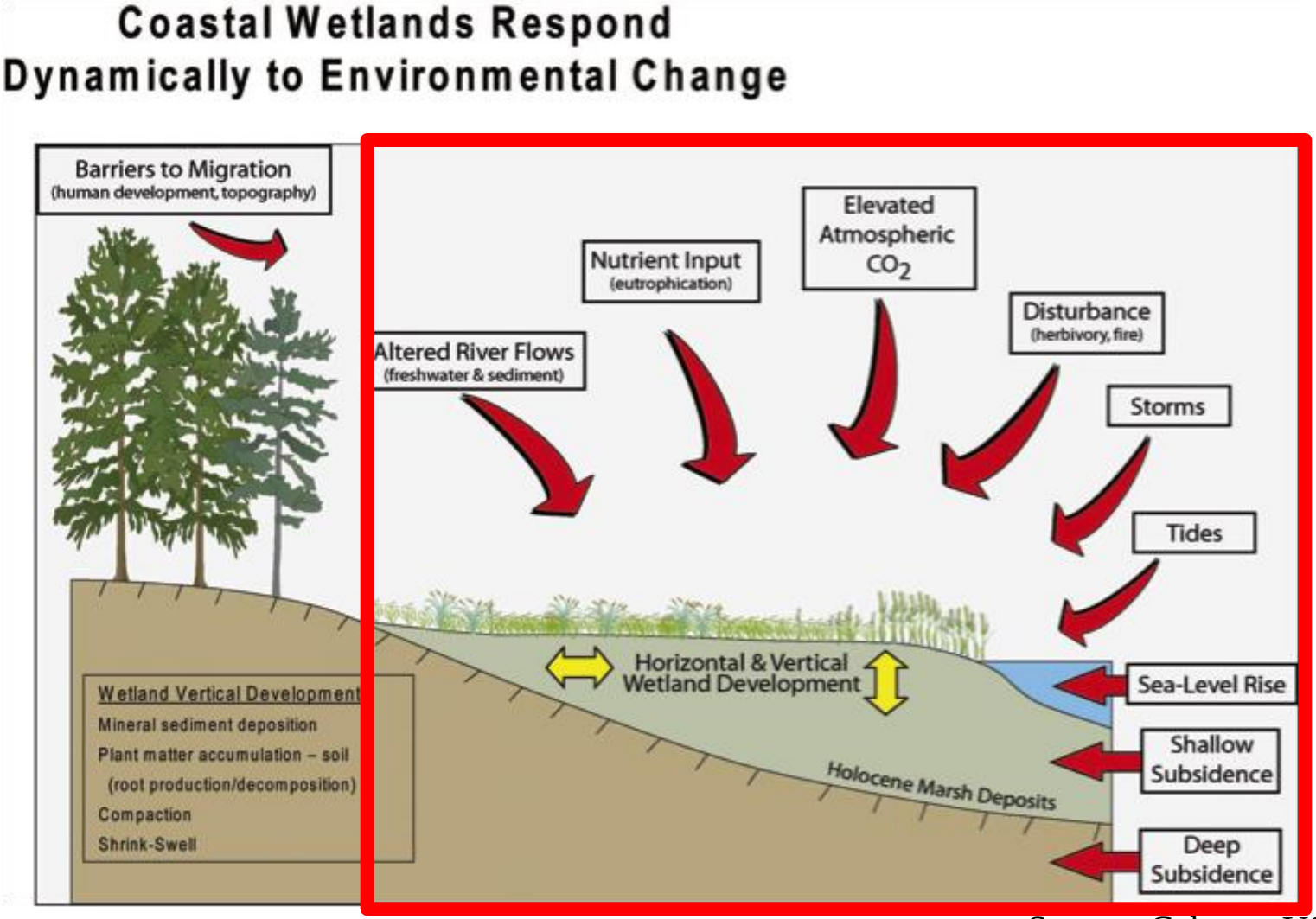
- Complex, coupled human-natural systems

- Scale mismatch

- Adaptation response: a moving target

- Managers, scientists, and public are not experienced with handling these challenges

Coupled human-natural systems are influenced by processes occurring at multiple spatial, temporal, and governance scales



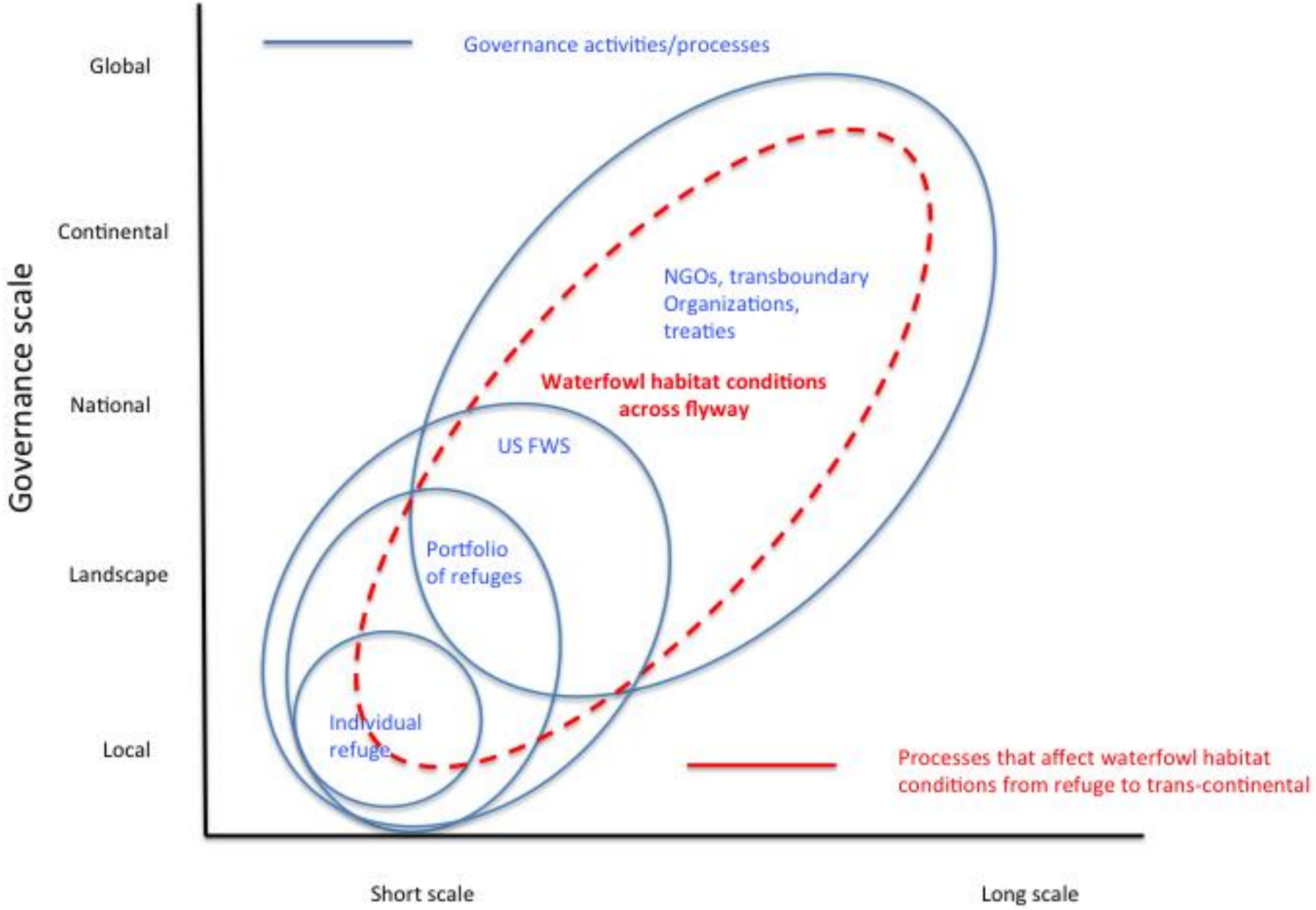
Source: Cahoon, USGS

Management of these coupled systems must deal with a "scale mismatch" phenomenon…

- …that is, scales at which an environmental systems varies and the scales at which governance occurs are not well matched.

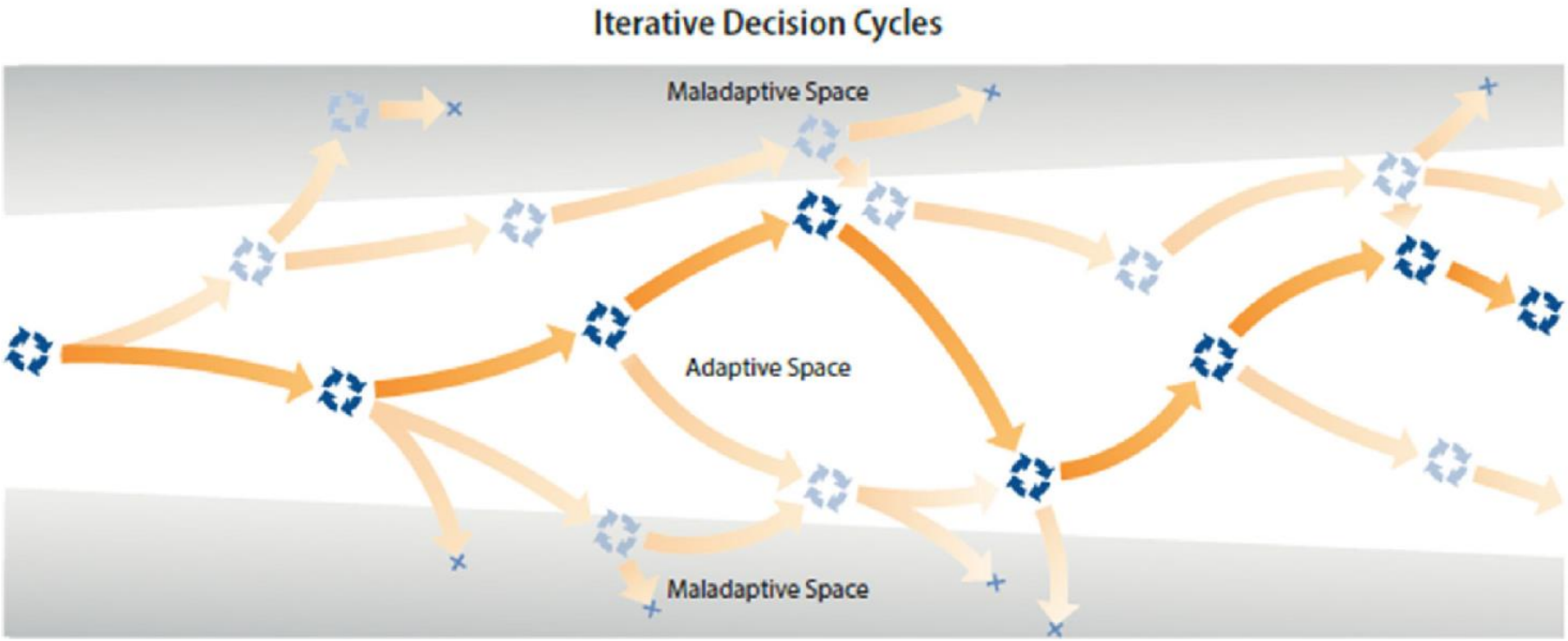
  - For example, is an individual refuge the right scale to think about and make resource allocation decisions that address a mix of local and broad-scale conservation objectives?

  - Should the refuges (as they exist now and after the realization of a variety of global change scenarios) be thought of as a portfolio of assets that can be managed together, at least to accomplish some broader scale conservation outcomes?

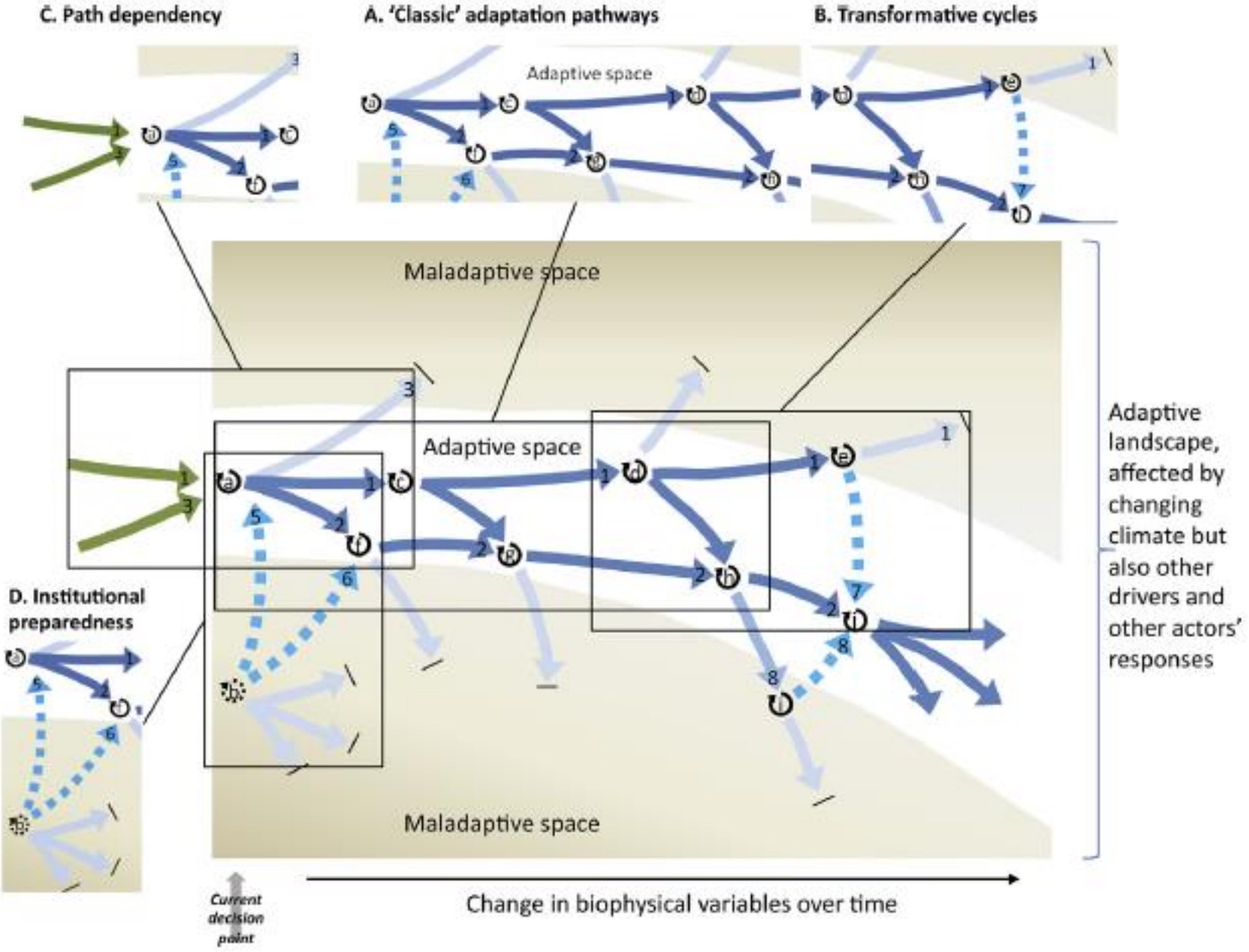

Governance activities/processes
Global
Continental
National
Landscape
Local
Governance scale
NGOs, transboundary
Organizations,
treaties
Waterfowl habitat conditions
across flyway
US FWS
Portfolio
of refuges
Individual
refuge
Processes that affect waterfowl habitat
conditions from refuge to trans-continental
Short scale
Long scale
Spatial and temporal scale
After Cash et al, 2006

Making smart refuge-scale adaptation decisions: rear guard action and linked decisions

- What is the basis for deciding it is time to start transitioning from the current mission (or refuge "footprint") to a new mission, given uncertainty about
  - the trajectory of some of the large-scale drivers (e.g., drought, sea-level rise, saltwater intrusion)
  - what future objectives can be achieved at or near a refuge?
  - What the future objectives even are? And who will define them?



(Wise et al., 2014, GEC)


C. Path dependency
A. 'Classic' adaptation pathways
B. Transformative cycles
Adaptive space
Maladaptive space
Adaptive space
Maladaptive space
D. Institutional preparedness
Adaptive landscape, affected by changing climate but also other drivers and other actors' responses
Current decision point
Change in biophysical variables over time

General lack of preparation on part of decision makers, scientists, and public for making wise decisions in the face of these challenges

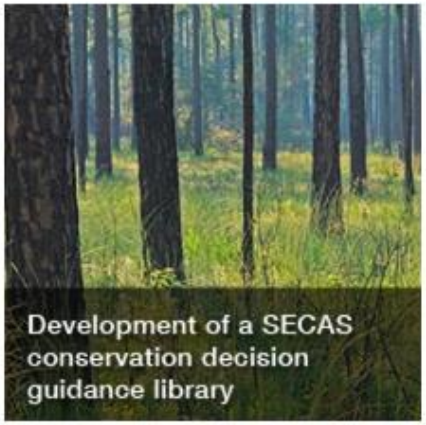
- Mental maps don't account for multi-scale complexity
  - Dealing with broad scale change (space and time) that is noisy at the scale we experience it.
    - E.g., weather versus climate
  - Impressions of change based on recent experience (availability bias)
- Thinking fast-thinking slow
  - Thinking fast: short term recognition of risks and rewards
  - Thinking slow: longer term recognition of risks and rewards
- General scientific literacy
  - Short term (time and space) relations between stressors and response
  - Longer term (time and space) ; see Mental Maps

SECSC "actionable science" niche (activities that wouldn't happen without the NCSU-USGS collaboration)

- Our understanding of this niche is evolving…
- From primarily "standard" climate science…
  - impacts of climate/land use stressors on endpoints (FY11/12 projects); state of science syntheses
- …toward a "conversation and listening"-directed science model…science focused by what people care about in the context of decisions they have to make.
  - Continue to discuss and understand the challenges above
  - Decision focused research projects
  - Broader public conversations and education
  - Training the next generation of scientists: GCF program

2013 Projects

Dynamic reserve design in the face of climate change and urbanization



Development of a SECAS conservation decision guidance library

Evaluation and downscaling of CMIP5 climate simulations for the Southeast US

An adaptive landscape planning and decision framework for gopher tortoise (*Gopherus polyphemus*) conservation

Understanding conservation management decisions in the face of sea-level rise along the U.S. Atlantic coast

Tree Eaters: Predicting the response of herbivores to the integrated effects of urban and global change

Developing multi-model ensemble projections of ecologically relevant climate variables for Puerto Rico and the US Caribbean

Application of structured decision making for delivery of instream flow ecology for water governance decisions in the Southeastern U.S.

Structured decision-making to facilitate multi-stakeholder coastal conservation and restoration under climate change uncertainties: case study on barrier islands of the northern Gulf of Mexico

Actionable science: decision analysis and science communication

Thank you!

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Vulnerability Assessment

- Vulnerability = f (exposure, sensitivity, adaptive capacity)
- Vulnerability is context specific
- We measure the vulnerability:
  - **OF** a measureable characteristic of something we care about
  - **TO** a specific stressor

- Examples:
  - Vulnerability of corn prices to drought
  - Vulnerability of coastal highways to sea-level rise
  - Vulnerability of a species in the face of habitat loss

Housing prices

Cost of borrowing money

Ecosystems Goods and Services

Land Development costs

Critical Facilities & Infrastructure