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Approaches to Demonstrating the Cumulative Effects of Large-Scale Ecosystem Restoration

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U.S. DEPARTMENT OF ENERGY

PUGETSOUND PARTNERSHIP

US Army Corps of Engineers®

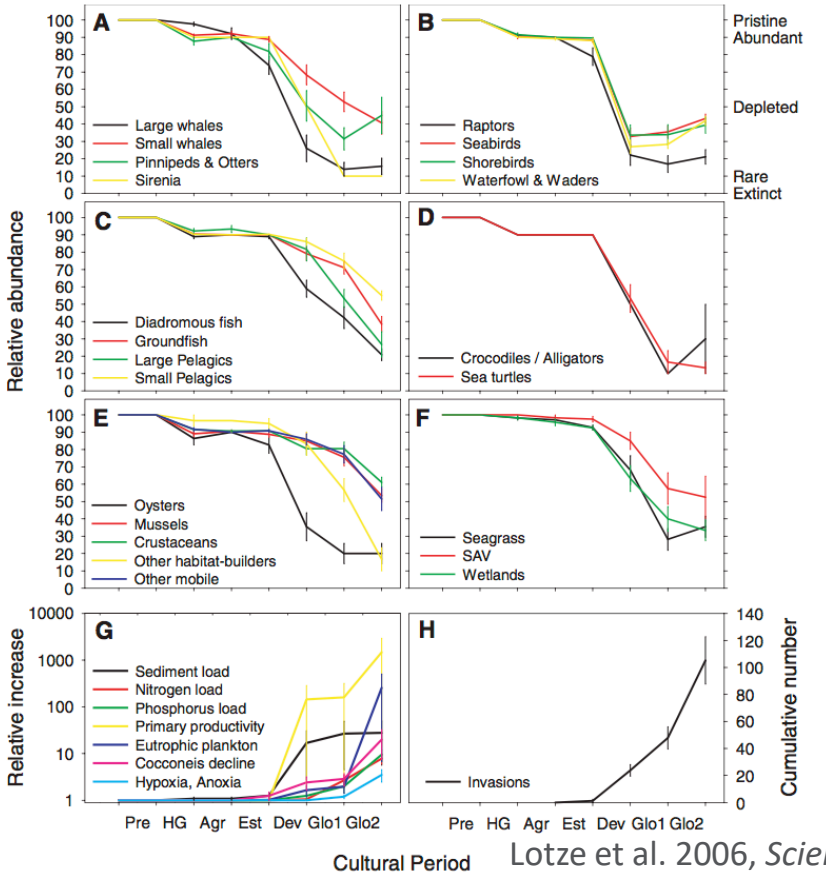
USGS

Overview

- 10:30-10:40 Introduction
- 10:40-11:00 Programs
- 11:00-11:30 Key Questions
- 11:30-11:50 Audience Q&A
- 11:50-12:00 Wrap Up

Introduction: Why We Need Diverse Approaches to Assess Cumulative Effects

Degradation of Coasts is a Cumulative Impacts Problem. Restoration of Coasts is a Cumulative Effects Challenge.

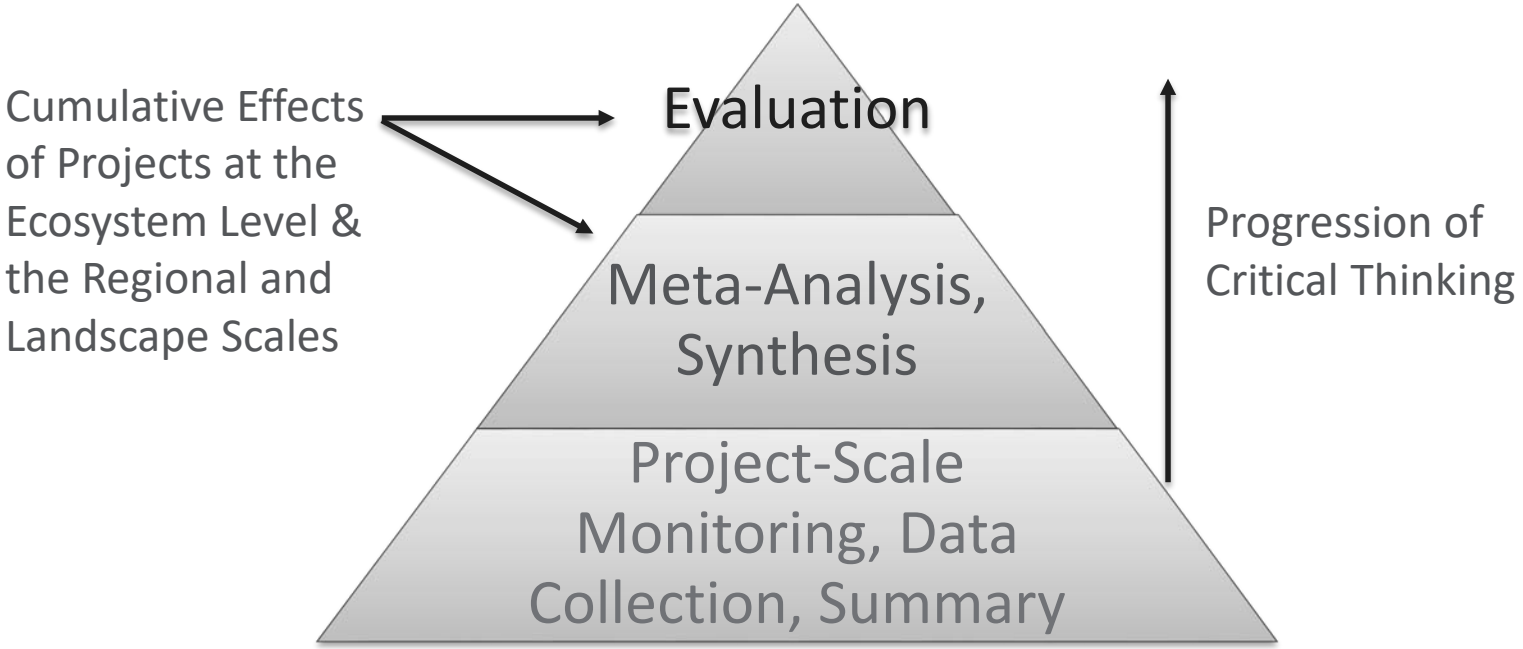


Lotze et al. 2006, *Science*

Definition: The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions" (40 CFR § 1508.7)

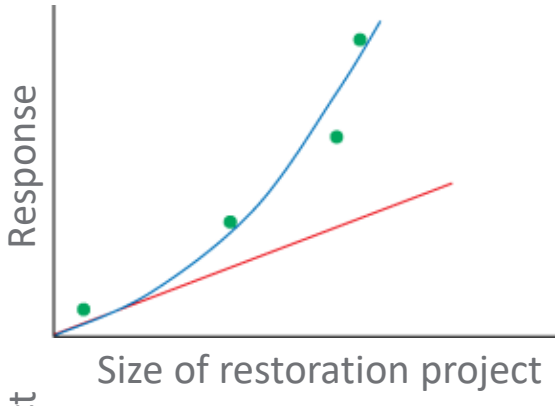
- Complexity of interactions in ecosystems, restoration actions, and responses.
- Support adaptive management, decision-making and accountability to stakeholders and taxpayers.

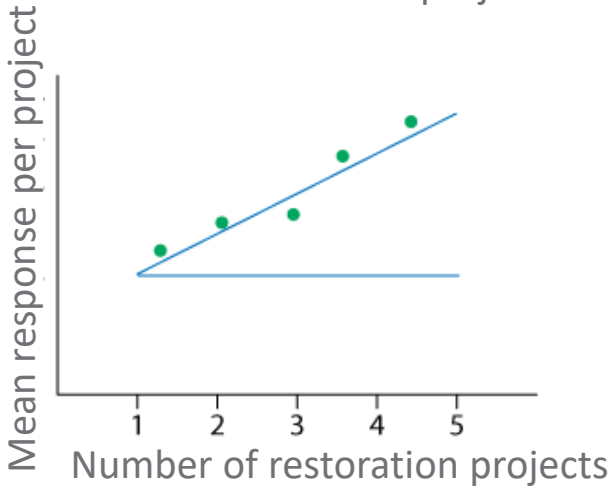
Effects Pyramid

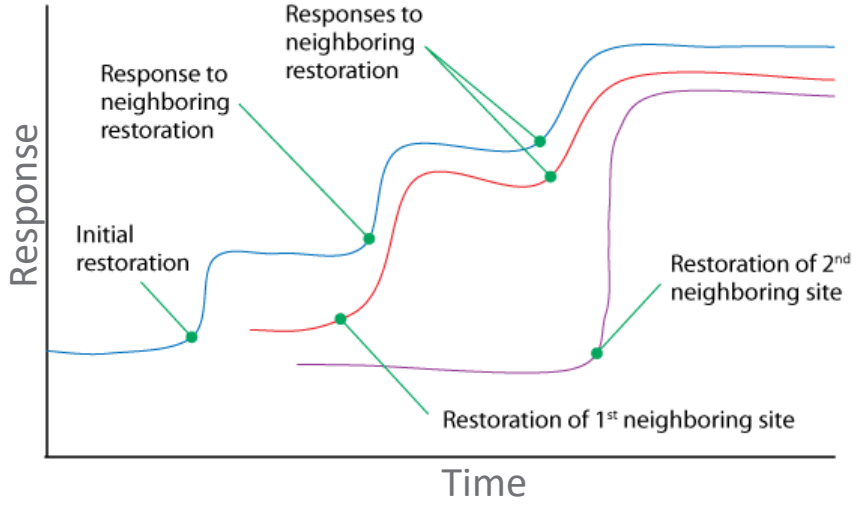


Diefenderfer et al. 2016, Ecosphere

How Do Cumulative Effects Look?







Hypothetical ecosystem responses:

- a nonlinear response to project size
- a linear response to the density of projects
- responses of a restoration site to the later restoration of neighboring sites (sequencing)

Diefenderfer et al. 2011, *Ecological Restoration*

Modes for the Accumulation of Effects

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- Frequent and repetitive effects *(time crowding)*
- Delayed effects *(time lags)*
- Effects occur away from the source *(cross-boundary)**
- Effects arising from multiple sources or pathways *(compounding)*
- Secondary effects *(indirect effects)*
- Fundamental changes in system behavior or structure *(triggers, thresholds)*
- Change in landscape pattern *(fragmentation / aggregation)**
- High spatial density of effects *(space crowding)**

Council on Environmental Quality, Executive Office of the President, 1997

*Examples next slide

Emergent Properties at the Landscape Scale

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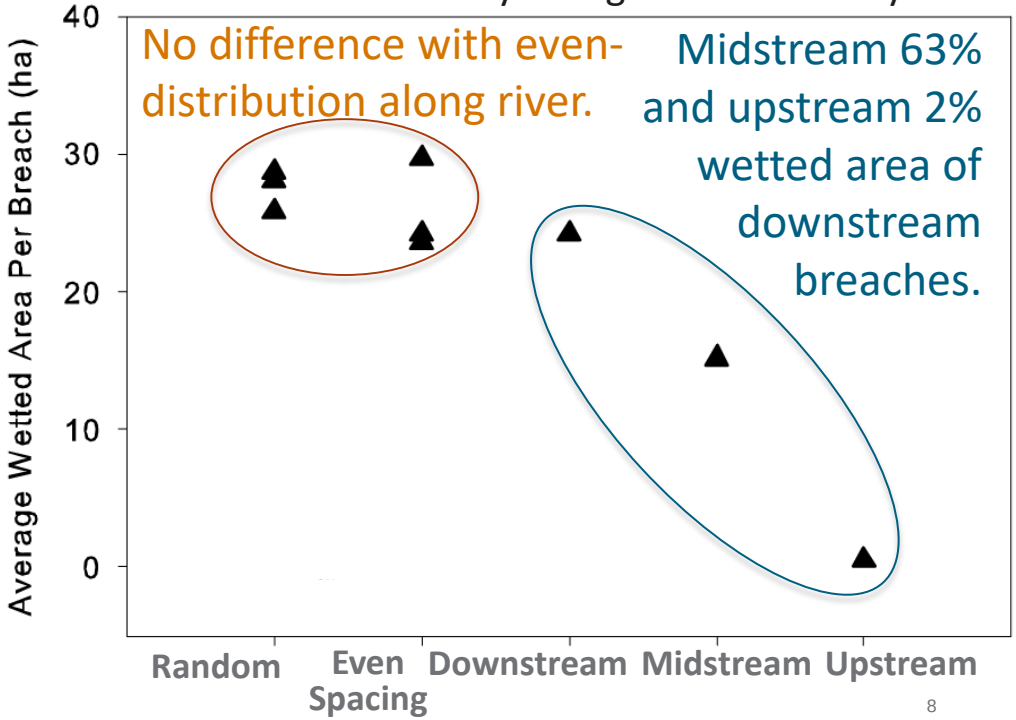
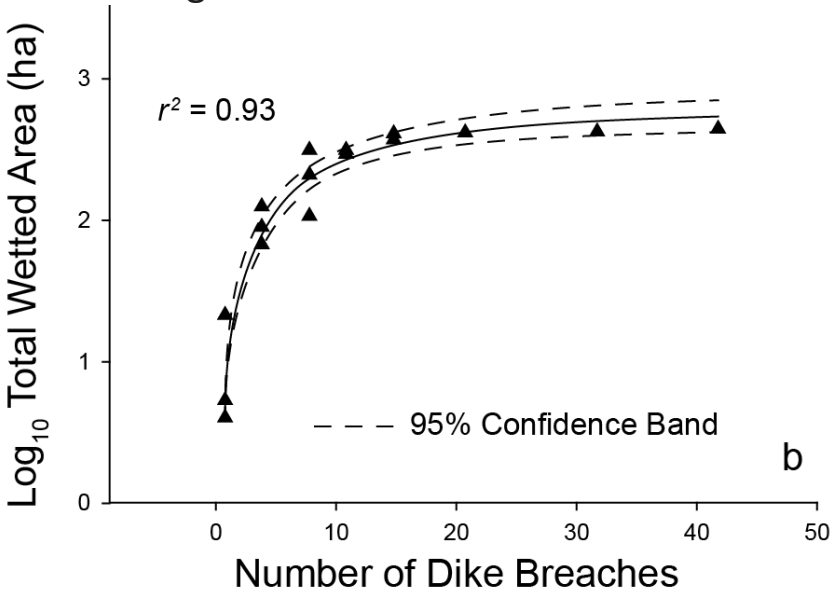
Landscape Pattern: Spatial configuration of dike breaches to restore hydrological connectivity

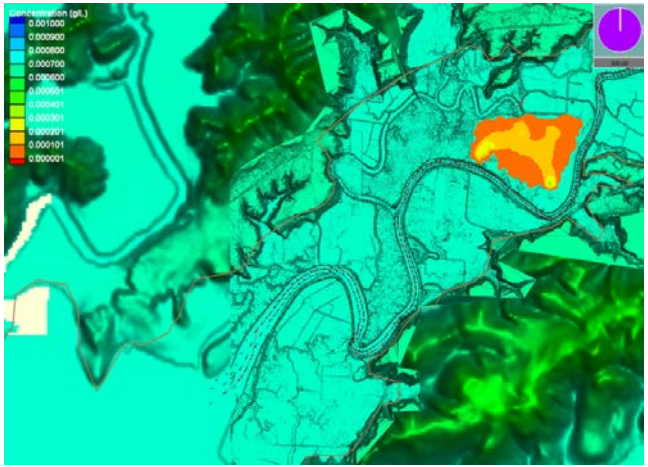


Space Crowding: Synergistic effect and diminishing returns of additional dike breaches



Diefenderfer et al. 2012, *Landscape Ecology*

Cumulative Effects Have Species and Ecosystem Outcomes

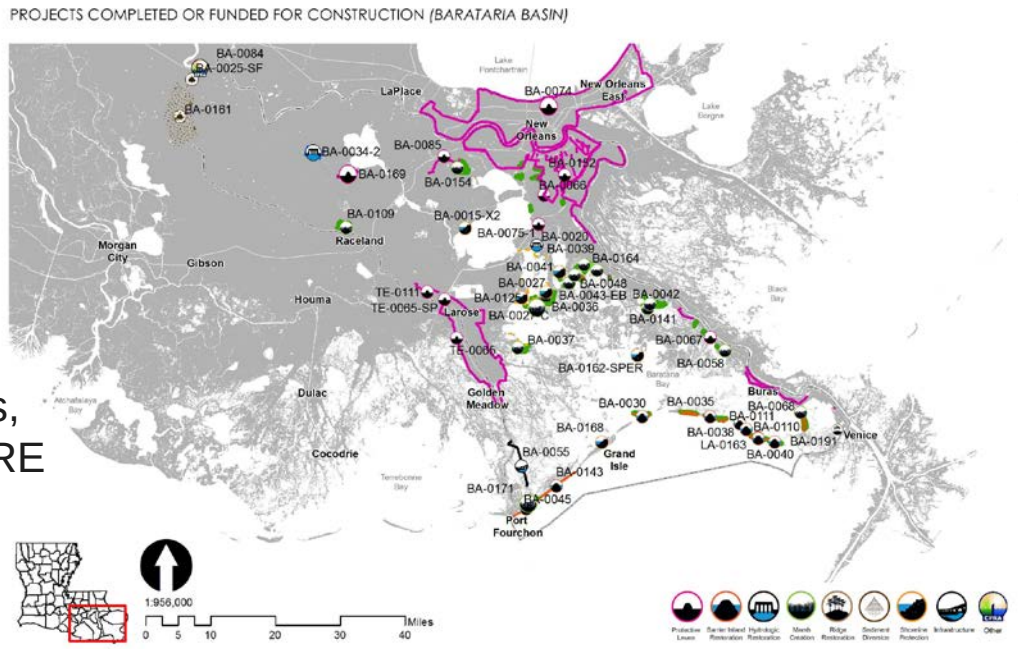


- Particulate organic matter from tidal marshes is exchanged among restoration projects and exported at least 7 kilometers to the mainstem Columbia R.
  (Thom et al. 2018, *Ecological Applications*)
- Stable isotopes show marsh microdetritus in Columbia R. juvenile salmon food web
  (Meier & Simenstad 2009, *Estuaries and Coasts*)

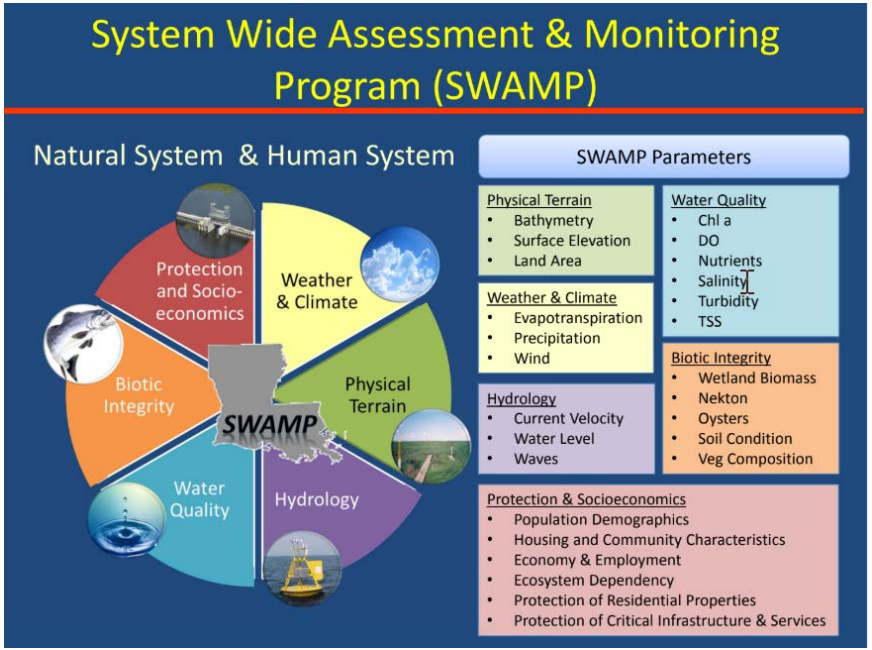
Programs:
Overview and Role of Integrated Assessment of Restoration Projects

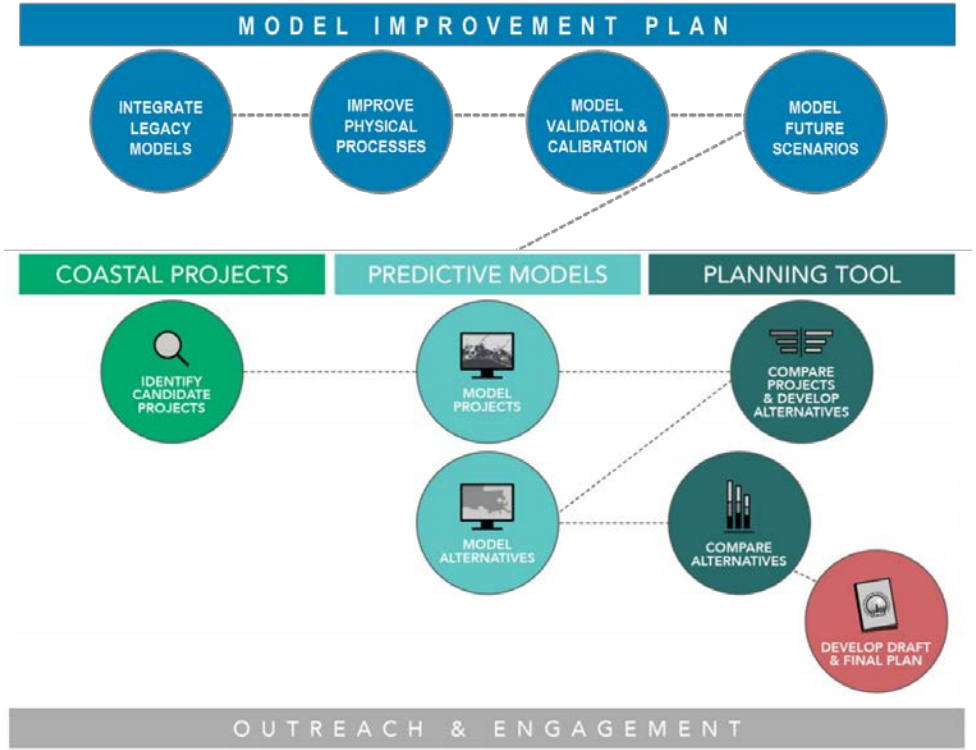
Gulf of Mexico – Louisiana Protection & Restoration

- Goals:
  - Risk Reduction
  - Land Loss Reduction
- Program background:
  - Geographic extent: Coastal Louisiana
  - Governance: LA CPRA, Boards & Councils
  - Source of restoration funding:
    - CWPPRA, State Mineral Revenues, GOMESA, NRDA, NFWF, RESTORE
- Integrated monitoring & modeling to support cumulative effects assessments



Gulf of Mexico – Louisiana Protection & Restoration

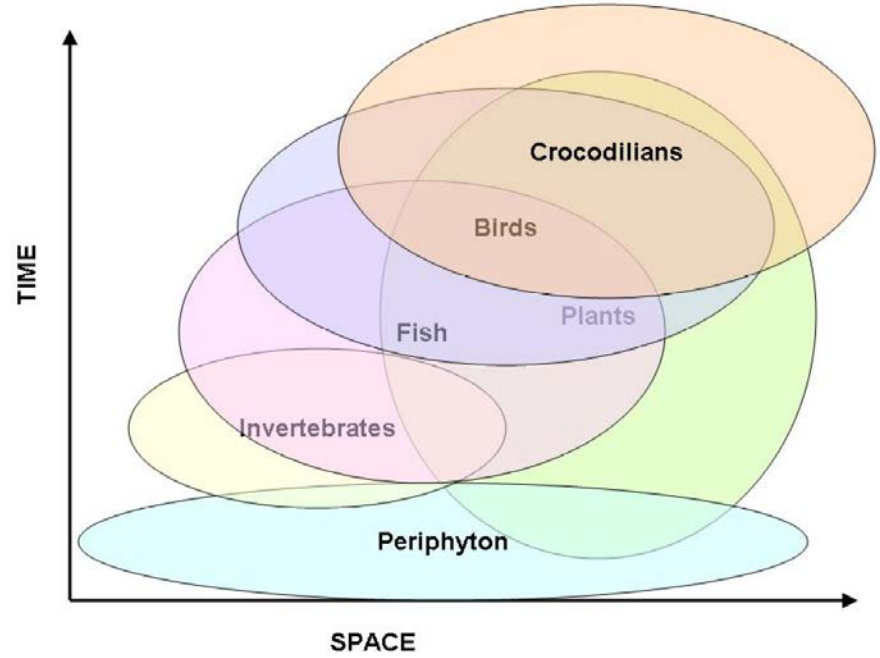




South Florida Ecosystem Restoration Program – The Everglades

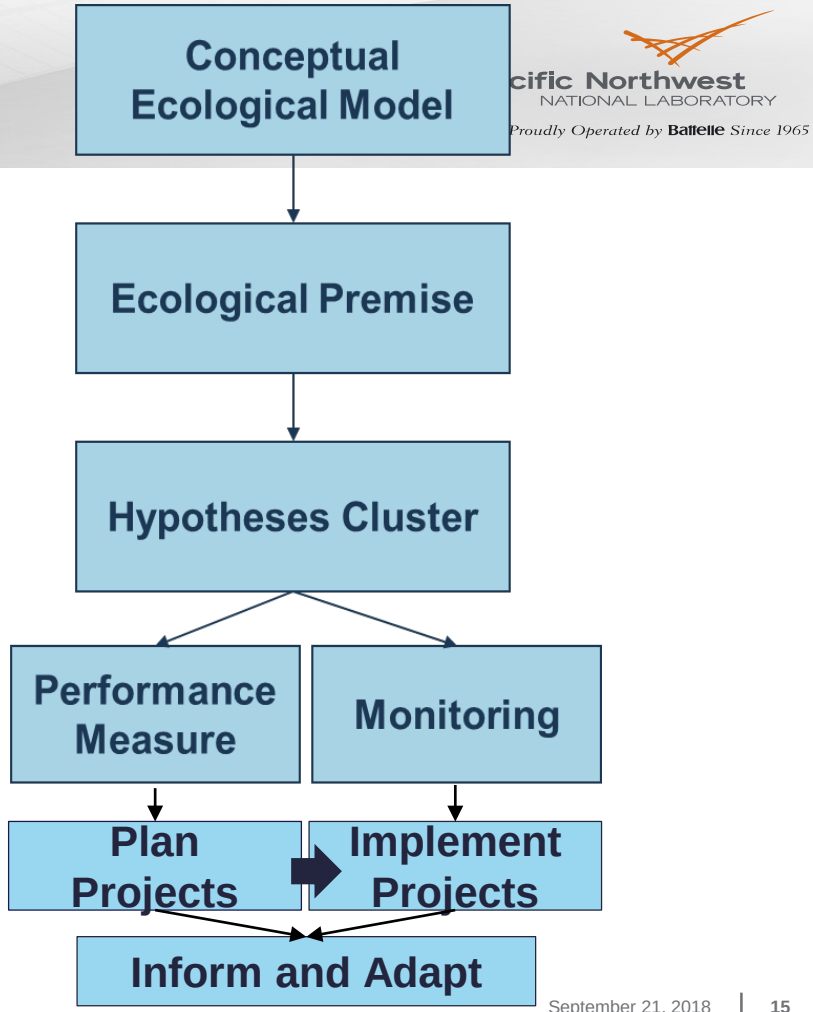
- Objectives:
  - Improve the health of over 2.4 million acres of the south Florida ecosystem, including Everglades National Park and Lake Okeechobee.
  - Significantly reduce damaging freshwater releases to the estuaries while improving water deliveries to Florida Bay and Biscayne Bay.
  - Improve water quality, enhance water supply, and maintain flood risk mitigation.
- Program background:
  - Key stakeholders and governance: State of Florida, U.S. Army Corps of Engineers, Department of Interior, Native American Tribes, Agriculture, Local Gov.
  - Source of restoration funding: Congressional appropriations through Water Resource and Development Acts

Everglades Indicators



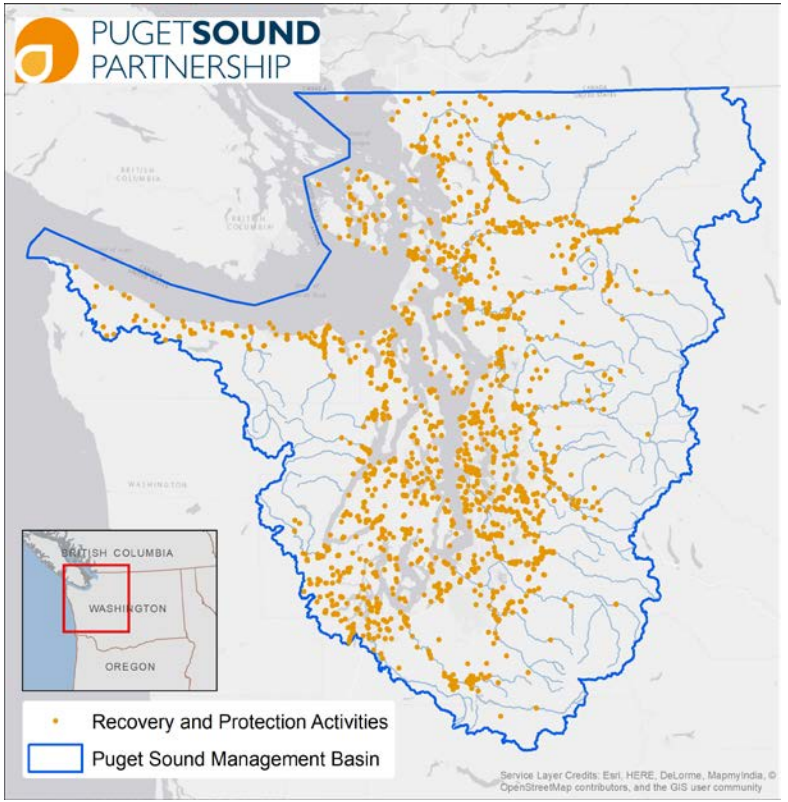
Everglades Science Framework

- Everglades Restoration: https://evergladesrestoration.gov
- RECOVER http://141.232.10.32/pm/recover/recover.aspx



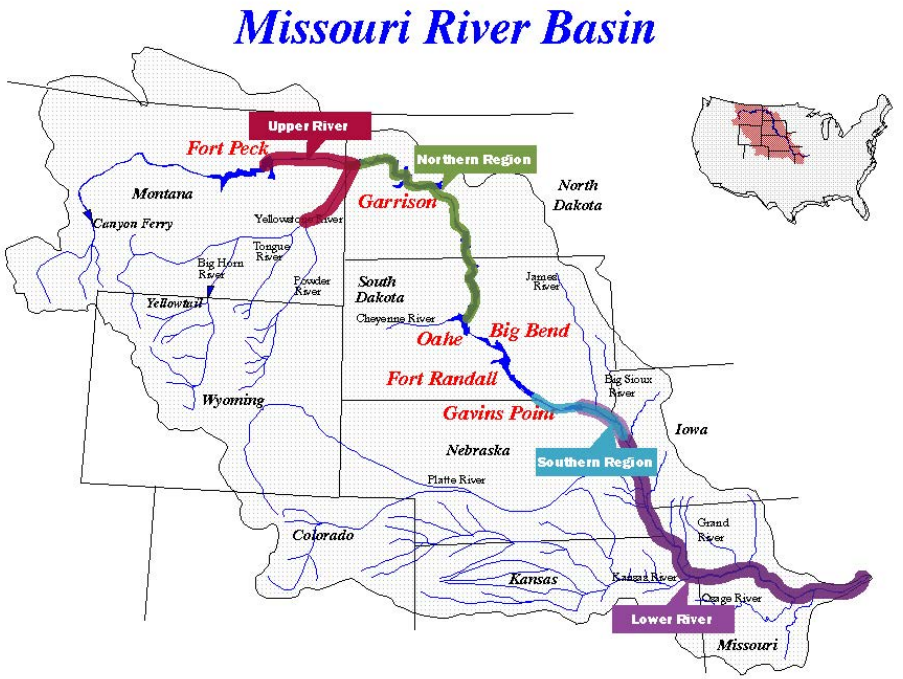
Puget Sound Partnership

- Ecosystem recovery goals:
  - Healthy human population
  - Quality of life
  - Thriving species and food web
  - Protect and restore habitat
  - Water quality and quantity
- Program background:
  - Geographic extent: Puget Sound Basin
  - Key partners: agencies, tribes, public and private sectors
  - Governance: Boards and advisory groups
  - Restoration funding: National Estuary Program, EPA, Washington State, NOAA
- Currently examining approaches to cumulative effects



Missouri River Recovery Program

- Goal: Replace lost habitat and avoid a finding of jeopardy to threatened and endangered species (pallid sturgeon, least tern and piping plover) resulting from USACE reservoir operation and bank stabilization on the Missouri R.
- Program background:
  - Key stakeholders and governance: USACE and USFWS; also involved are stakeholder committee of states, tribes, and interest groups
  - Source of restoration funding: Congressional appropriations
- Experience with application of cumulative effects methodologies: the effects analysis, integrated modeling, development of sturgeon science plan.



Key Questions

1. What has your program done to address the challenges of evaluating cumulative effects at an integrative regional level across multiple sites, projects, programs, and watersheds?
2. What emerging methods and advances in tools has your program used to analyze and assess cumulative effects?
3. Which ones have worked well, which have not, and why?
4. What is your program planning for future evaluations of cumulative effects and why?
5. What recommendations or parting thoughts do you have?


Audience Q&A

Thank You