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INTERNATIONAL TECHNICAL ASSISTANCE PROGRAM





Connecting Ecosystem Services Values to Decision-Making

Regional Flyway Initiative:
Understanding Wetland Ecosystem Services and How to Assess Them

Training Series at the EAAFP Meeting of Partners (MOP11)
in partnership with the US Department of the Interior

14 & 15 Mar 2023

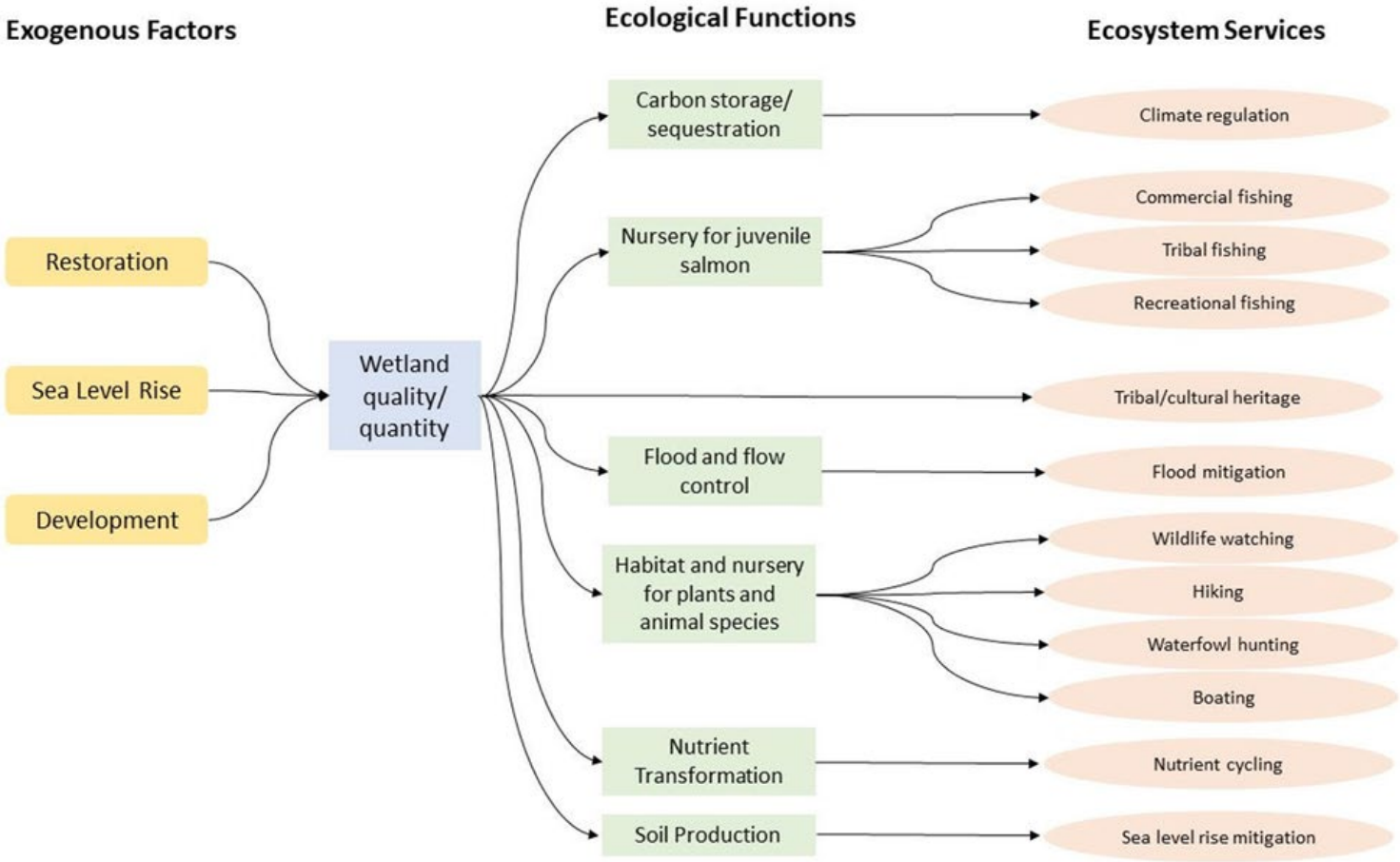
"A priority when making decisions that directly or indirectly influence wetlands is to ensure that information about the full range of benefits and values provided by different wetland ecosystem services is considered."

- Millennium Ecosystem Assessment 2005

NISQUALLY NATIONAL WILDLIFE REFUGE, WASHINGTON STATE, USA

- The Nisqually River Delta is at the confluence of the freshwater river and the saltwater Puget Sound connecting to the Pacific Ocean
- A tidally influenced coastal wetland, dominant habitats include tidal marshes, mudflats, and marine waters
- It supports a rich diversity of resident and migratory birds, fish and many other species
- The land is protected and co-managed by the US Fish and Wildlife Service and the Nisqually Indian Tribe

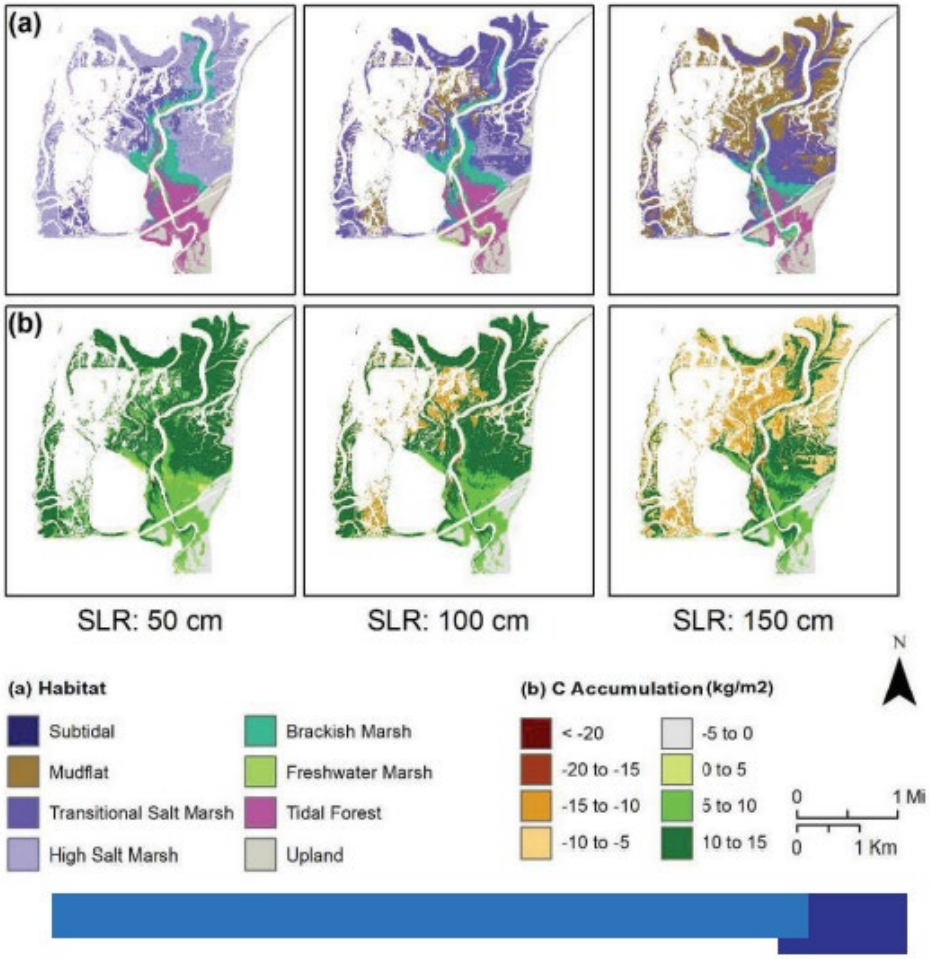
ECOSYSTEM SERVICES FLOW DIAGRAM



For project information and publications, visit: https://www.usgs.gov/centers/western-geographic-science-center/science/ecosystem-services-assessment-nisqually-river?qt-science_center_objects=0#overview

ECOSYSTEM SERVICES RESEARCH PROJECTS

- Marsh equilibrium modeling to assess habitat change under Sea Level Rise
  (https://doi.org/10.1007/s12237-022-01087-5)
- Carbon measurement and valuation of carbon ecosystem service
  (https://doi.org/10.1007/s12237-022-01087-5)
- Bioeconomic model of salmon under Sea Level Rise (results unavailable)
- Hedonic analysis of restoration project
  (https://www.mdpi.com/2073-445X/11/9/1432)
- Assessed habitat-birder preferences using eBird (in prep)



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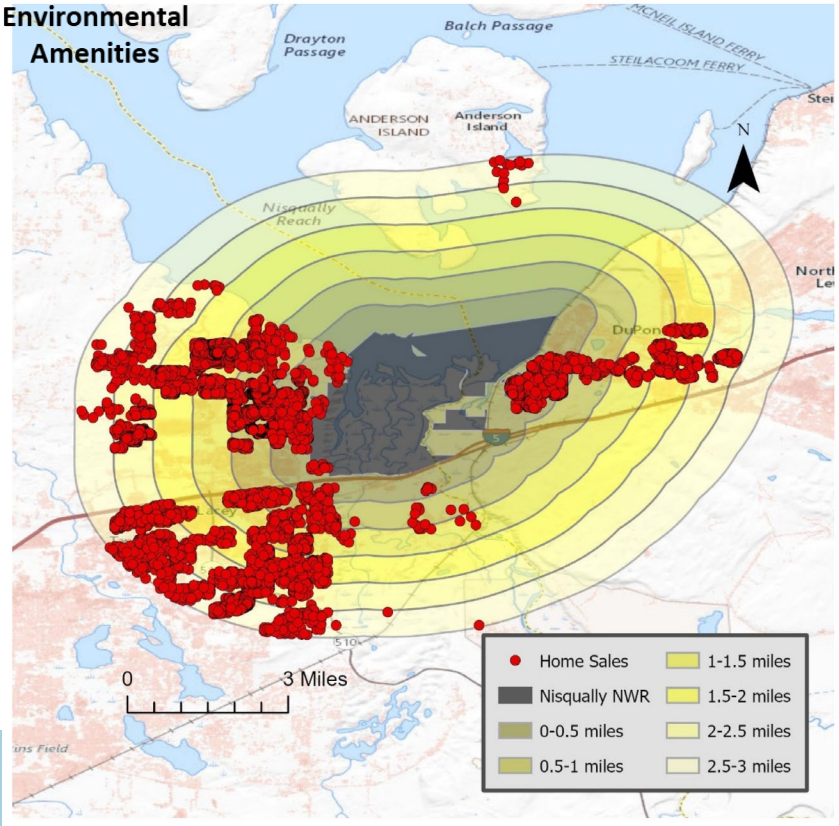
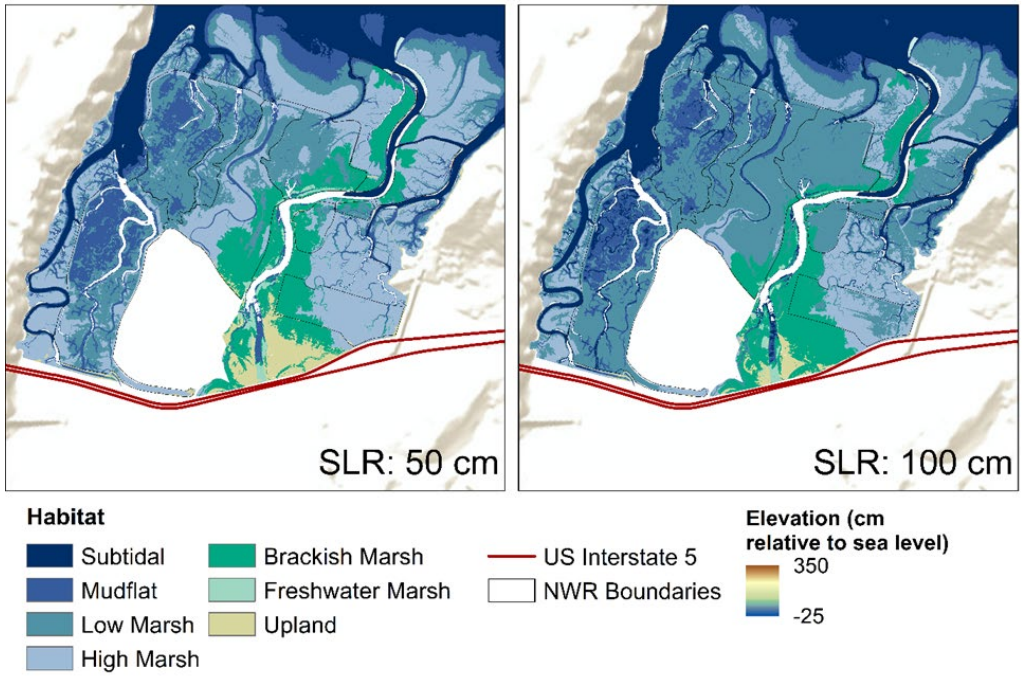
A PRE- AND POST- RESTORATION ANALYSIS

- Hedonics pricing method to consider pre- and post-restoration environmental amenity value
- Findings:
  - Average home value = $335,443
  - Homes within 0.5 mile increased by $37,631
  - Homes 0.5 to 1 mile increased by $10,489
  - Homes 1 to 1.5 miles increased by $31,186



PREDICTING ECOSYSTEM SERVICES CHANGES



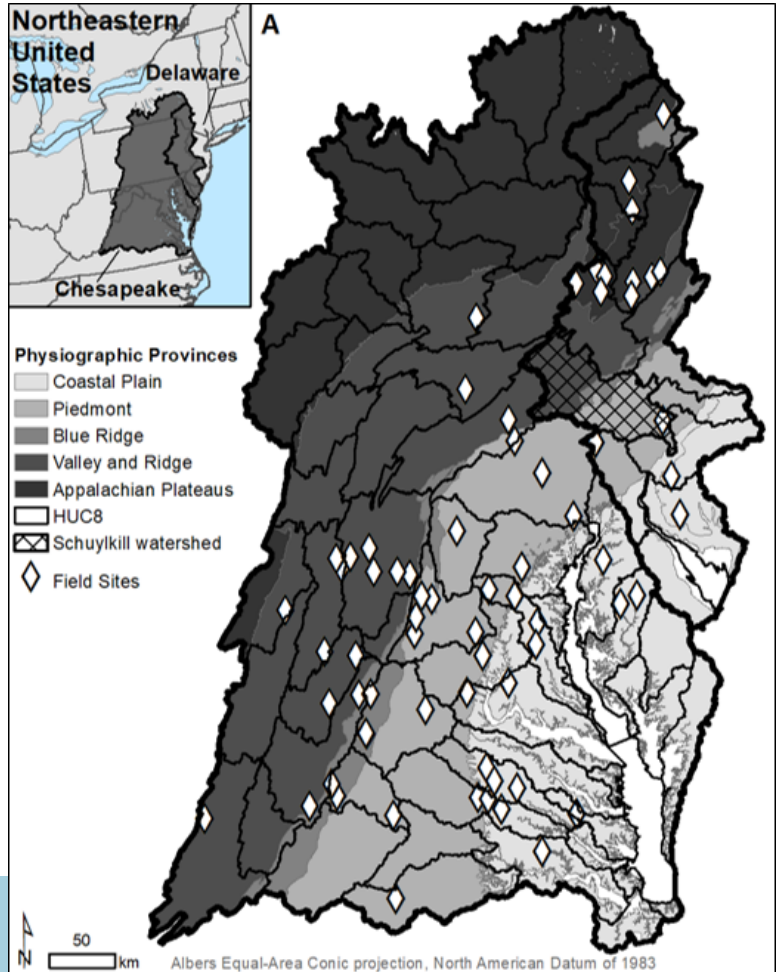
- Used eBird to correlate recreation visitation incidence and habitat type
- Allowed for projecting recreation under different SLR scenarios (as habitat changes)

CHESAPEAKE BAY AND DELAWARE RIVER WATERSHEDS, USA

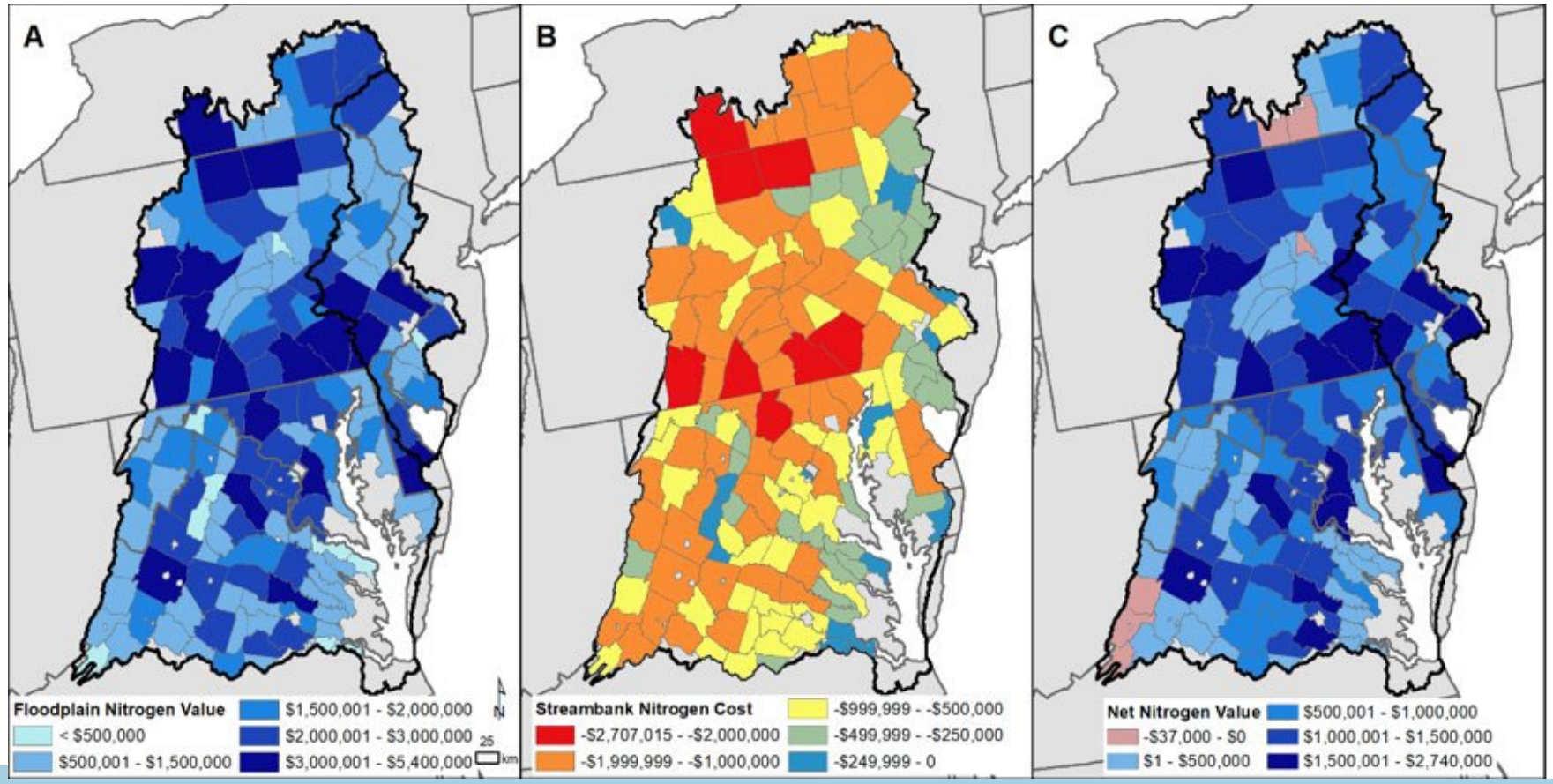
Diverse watershed area with urban areas, forests, and agriculture in inland and coastal zones

Floodplain sediment and nutrient retention
Non-tidal wadable streams in the Chesapeake and Delaware River watersheds

Floodplain flood attenuation
3-6th order streams in the Schuylkill River watershed in Pennsylvania



Spatial variability in the value of floodplain sediment and nutrient retention*



*Preliminary findings subject to revision

Floodplains provide substantial benefits by trapping sediments and nutrients*

Net Nitrogen Retention = $125 million USD per year
Chesapeake and Delaware

*Preliminary findings subject to revision

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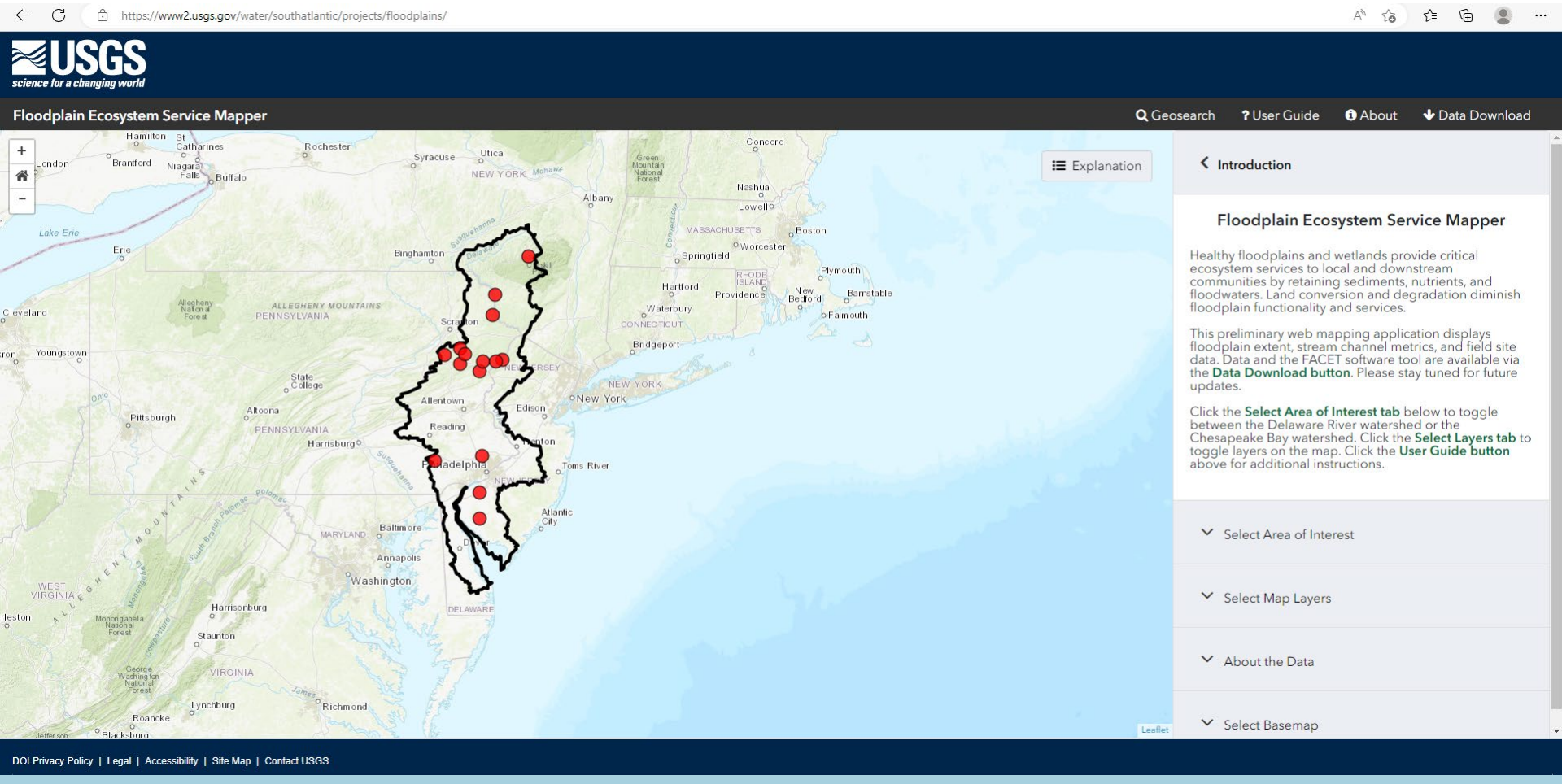
FLOODPLAIN ECOSYSTEM SERVICES MAPPER



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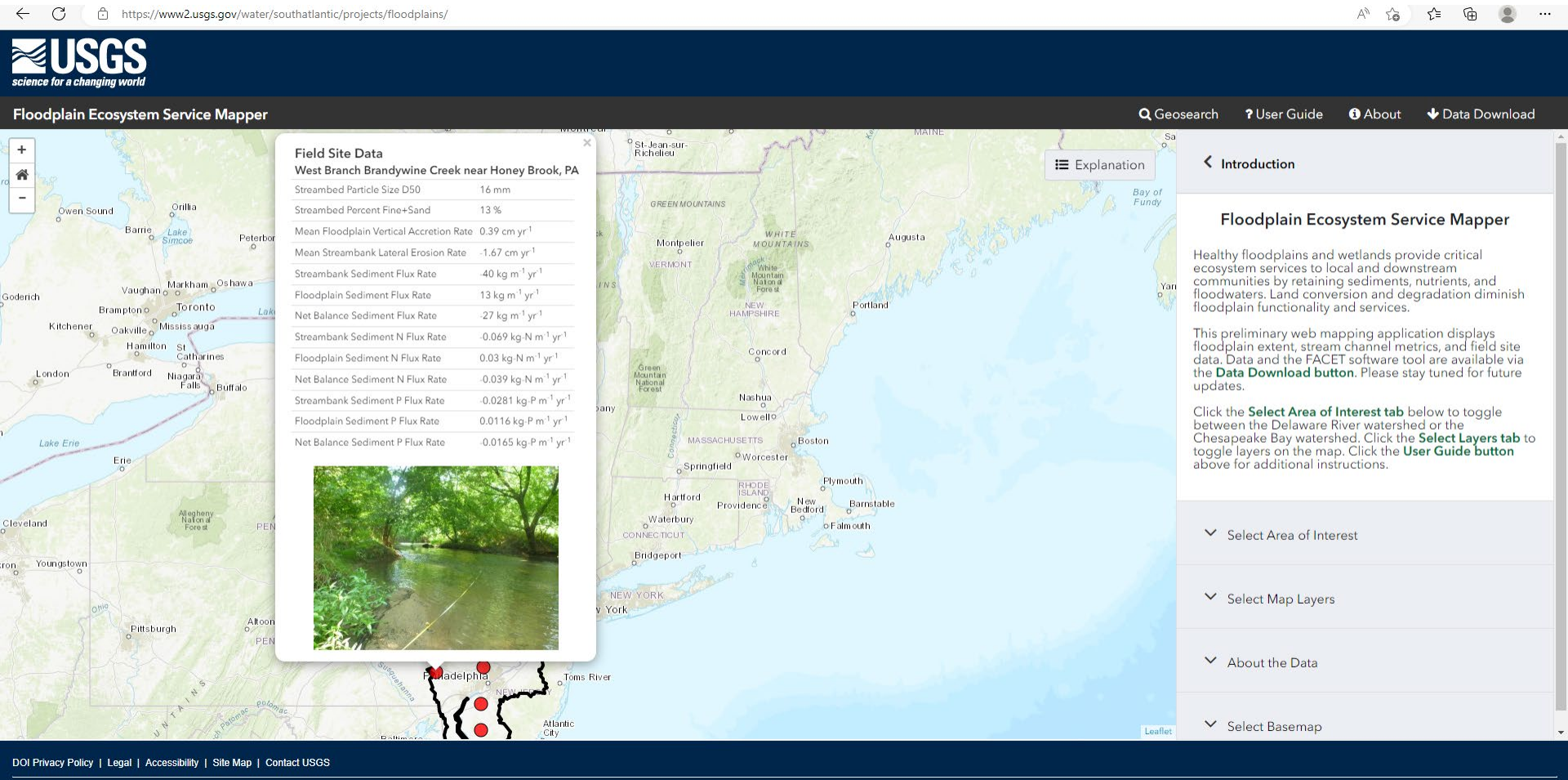
FLOODPLAIN ECOSYSTEM SERVICES MAPPER



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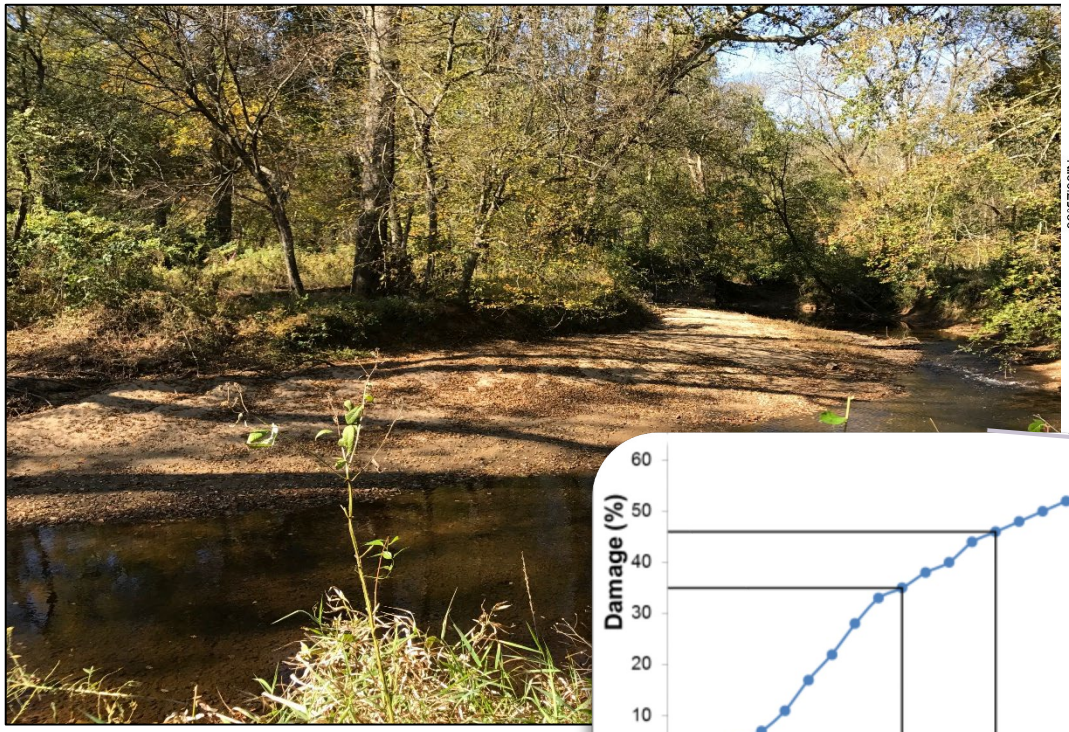
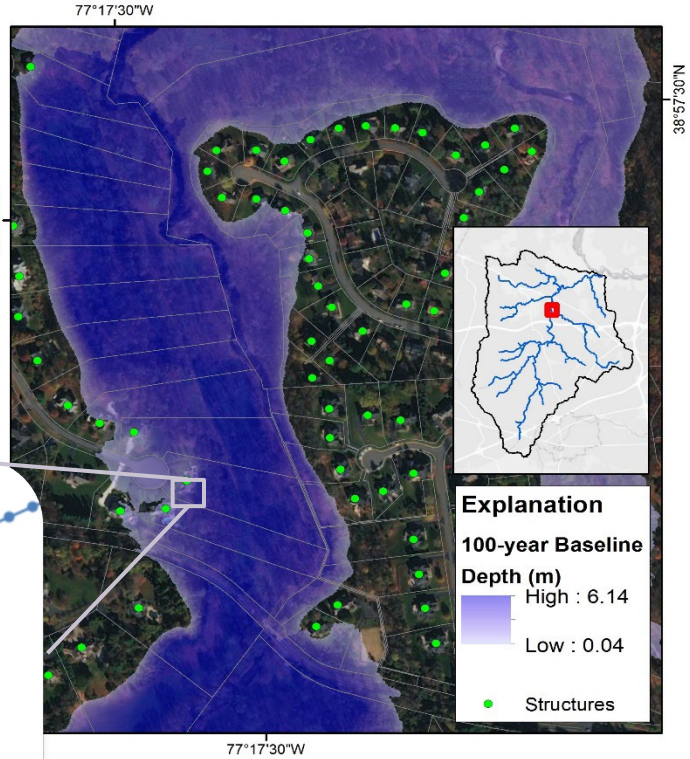
FLOOD ATTENUATION ANALYSIS





FLOOD ATTENUATION RESULTS

Results suggest an annual value of $73,412 for flood mitigation in Difficult Run (damages in baseline: $115,596 damages in counterfactual: $42,184)

https://doi.org/10.1016/j.jenvman.2018.10.023

Similar methods being applied in Delaware River Watershed, USA

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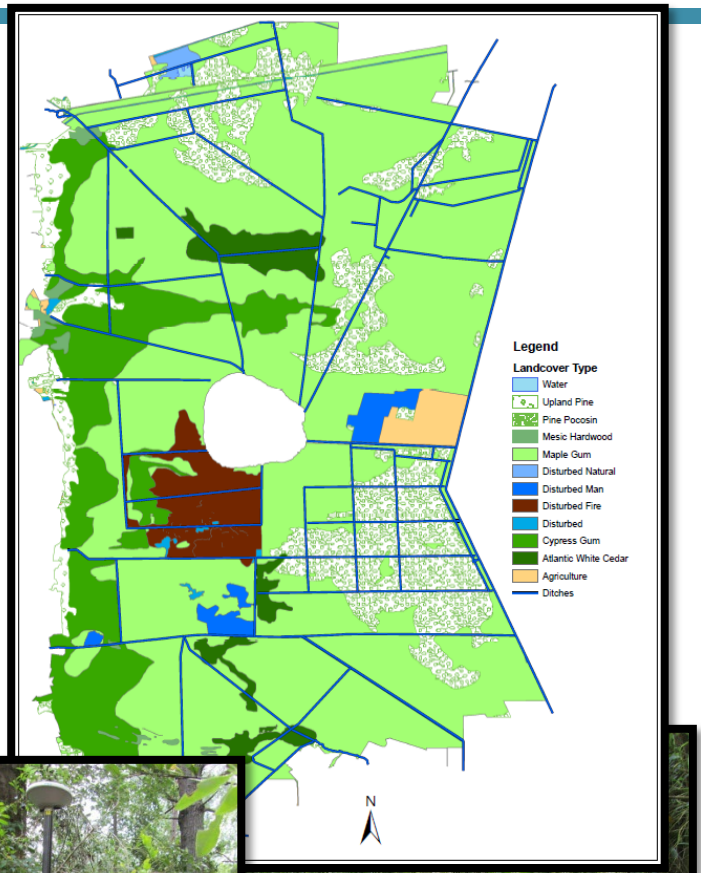
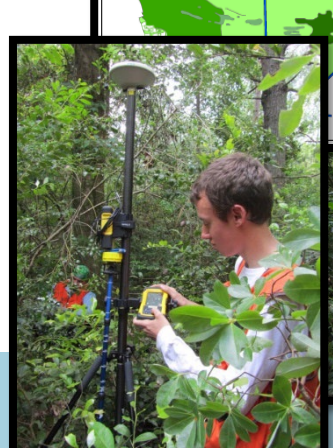
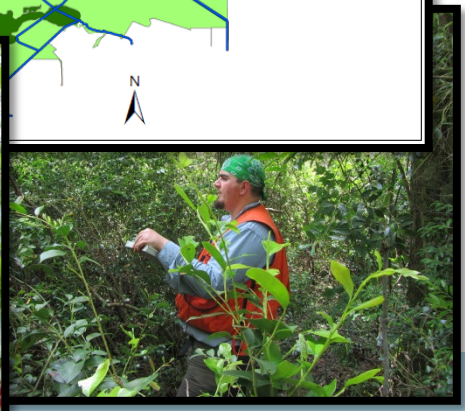
GREAT DISMAL SWAMP NATIONAL WILDLIFE REFUGE, USA

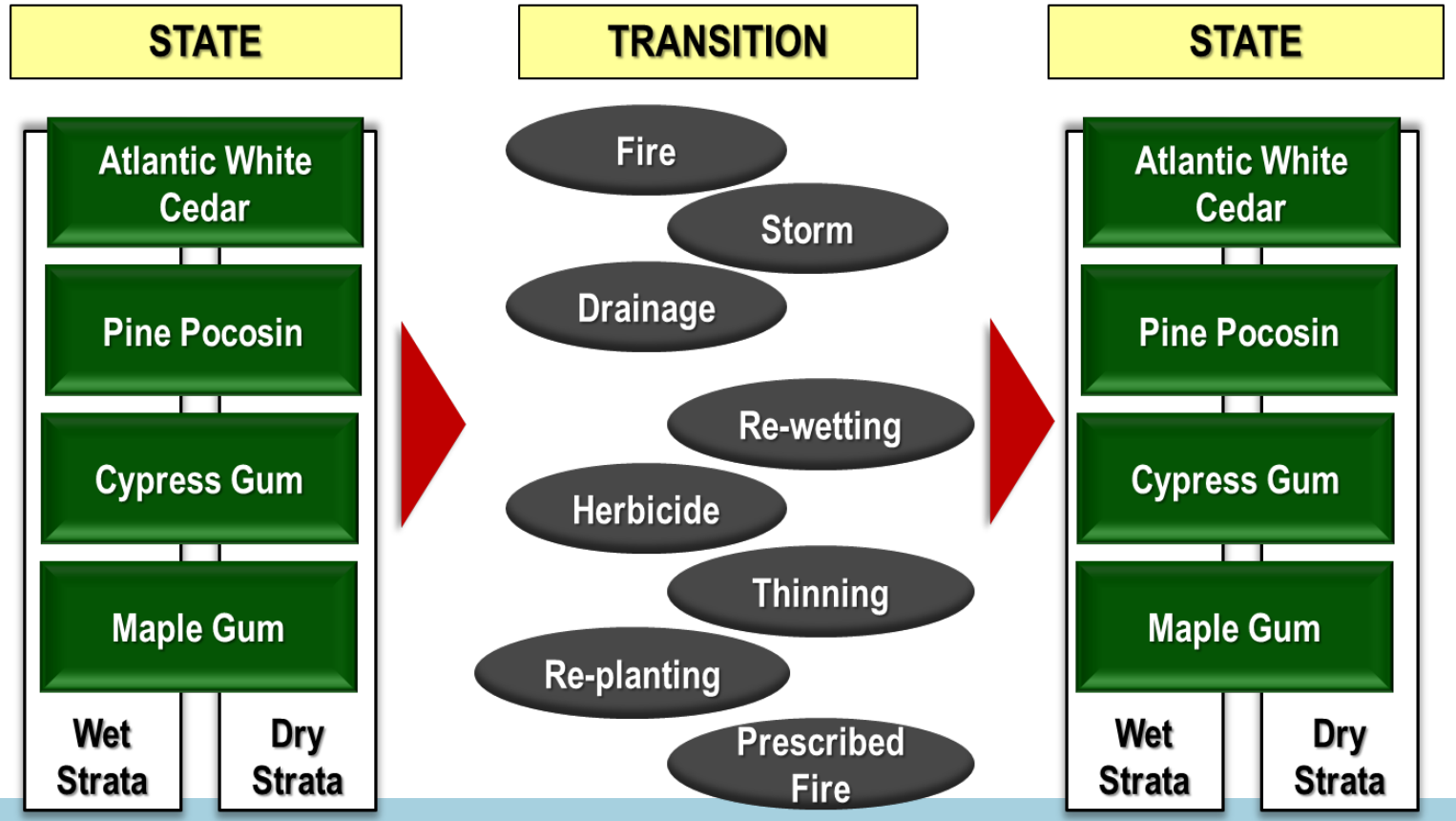
- A forested peatland in southeastern Virginia and northeastern North Carolina, USA
- Estimate local-scale carbon storage and flux
- Hydrologic research
- Remote sensing: aboveground biomass (field verification), properties such as soil moisture and peat depth, and wildfire burn severity
- Assess ecosystem services in relation to selected management actions
- See https://doi.org/10.1016/j.ecolecon.2018.08.002 for details on carbon sequestration analysis





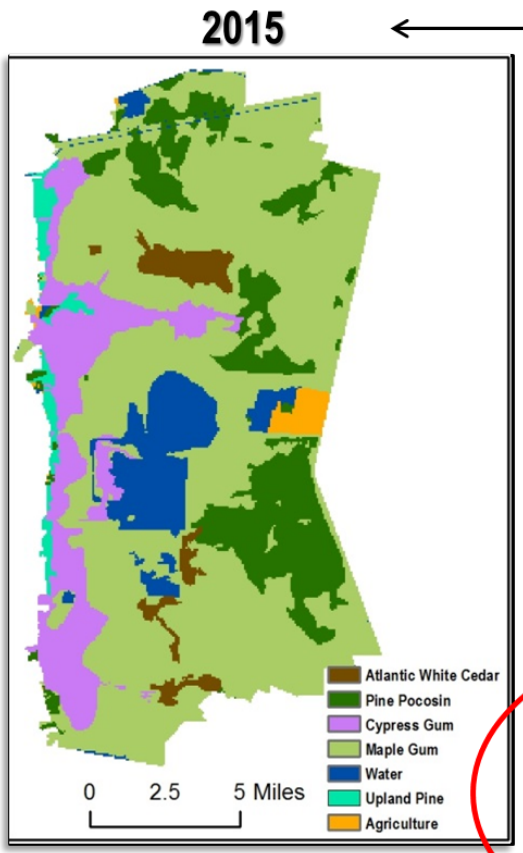


Predicting carbon sequestration under management scenarios

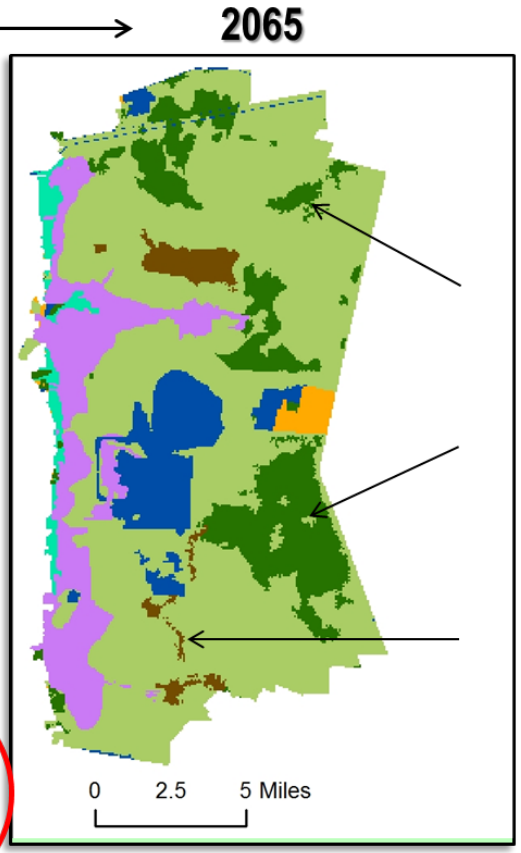


*Model developer – Rachel Sleeter, USGS

SCENARIO 1: REFERENCE CONDITIONS



50 YEARS



SCENARIO ASSUMPTIONS:

CURRENT VEGETATION AND CARBON BIOMASS

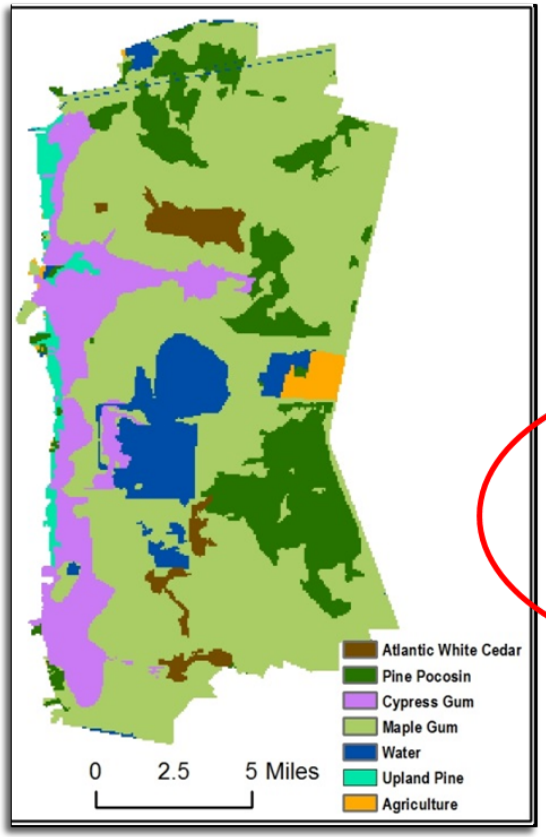
SOIL MOISTURE:
- ~ 65% DRIER; ~35% WETTER (RELATIVE)

NATURAL DISTURBANCE:
- WIND/STRESS
- FIRE (Probability of 1 Extreme Fire Event within 100 YRS)
- INVASION OF UNDESIRED SPECIES (MAPLE GUM)

NO MANAGEMENT
- NO FIRE SUPPRESSION (PRESCRIBED FIRES OR THINNING)
- NO REWETTING
- NO FOREST RESTORATION (THINNING, REPLANTING, HERBICIDE)

SCENARIO 2: EXTREME FIRE

2015 ← 50 YEARS → 2065



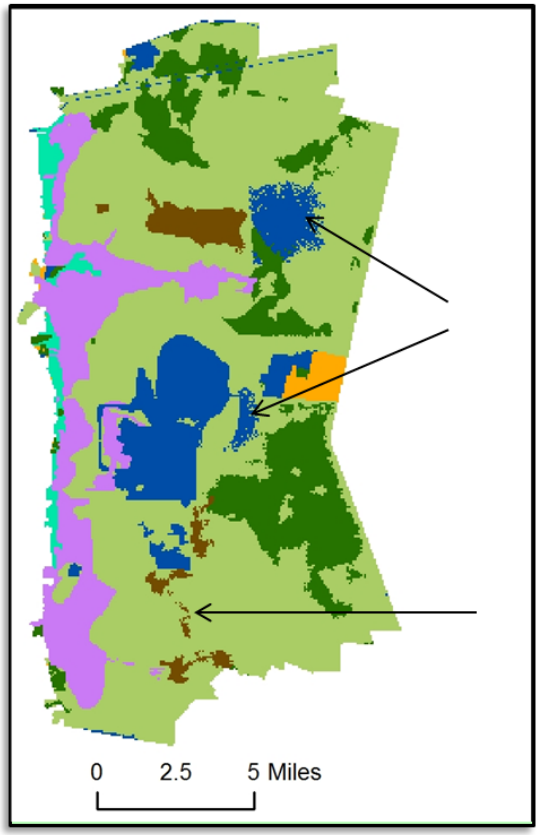
SCENARIO ASSUMPTIONS:

CURRENT VEGETATION AND CARBON BIOMASS

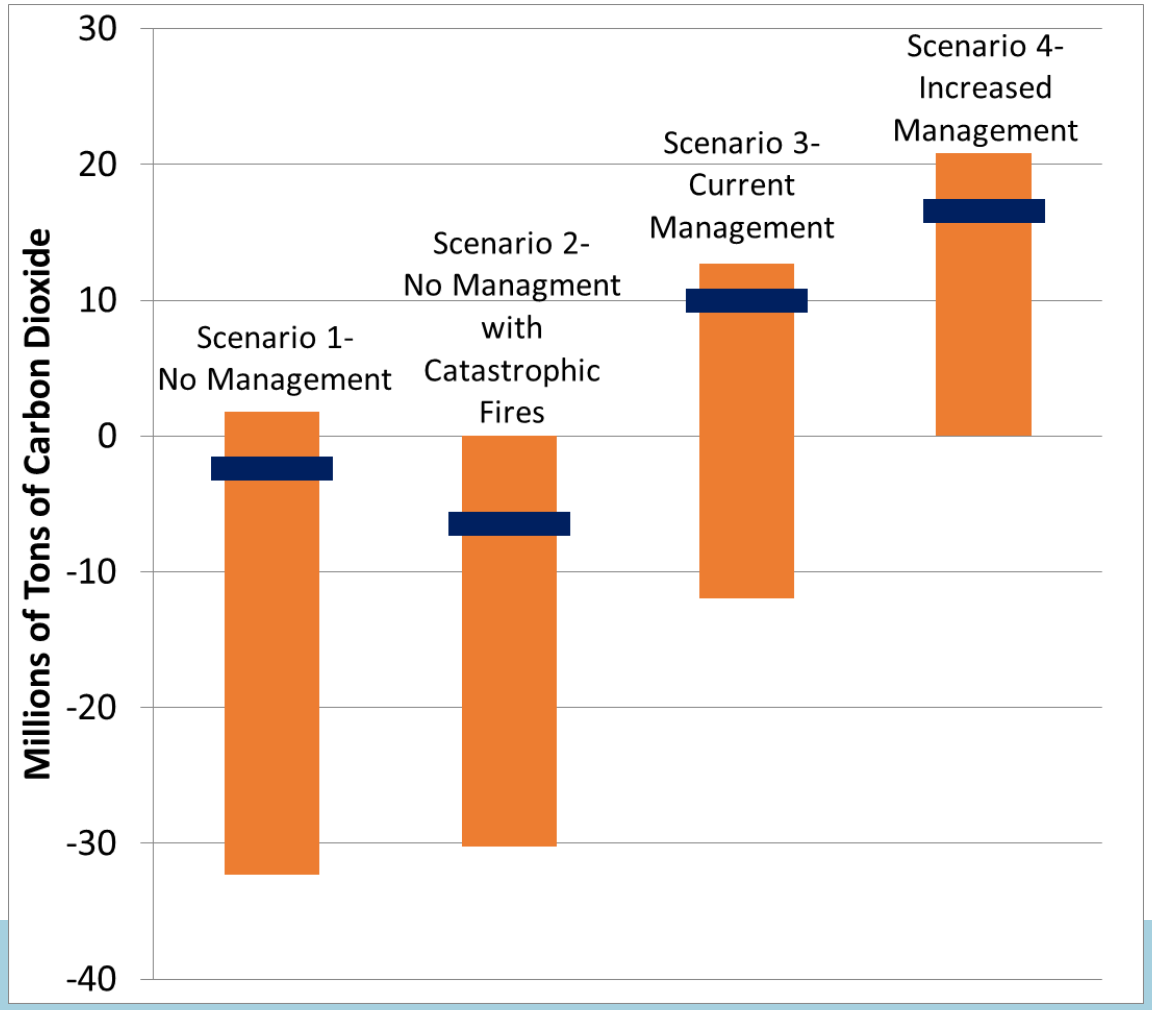
SOIL MOISTURE:
- ~ 65% DRIER; ~35% WETTER (RELATIVE)

NATURAL DISTURBANCE:
- WIND/STRESS
- **FIRE – 2 LARGE FIRES OCCUR ON SAME PATCH WITHIN 5 YRS**
- INVASION OF UNDESIRED SPECIES (MAPLE GUM)

NO MANAGEMENT
- **NO** FIRE SUPPRESSION (PRESCRIBED FIRES OR THINNING)
- **NO** REWETTING
- **NO** FOREST RESTORATION (THINNING, REPLANTING, HERBICIDE)



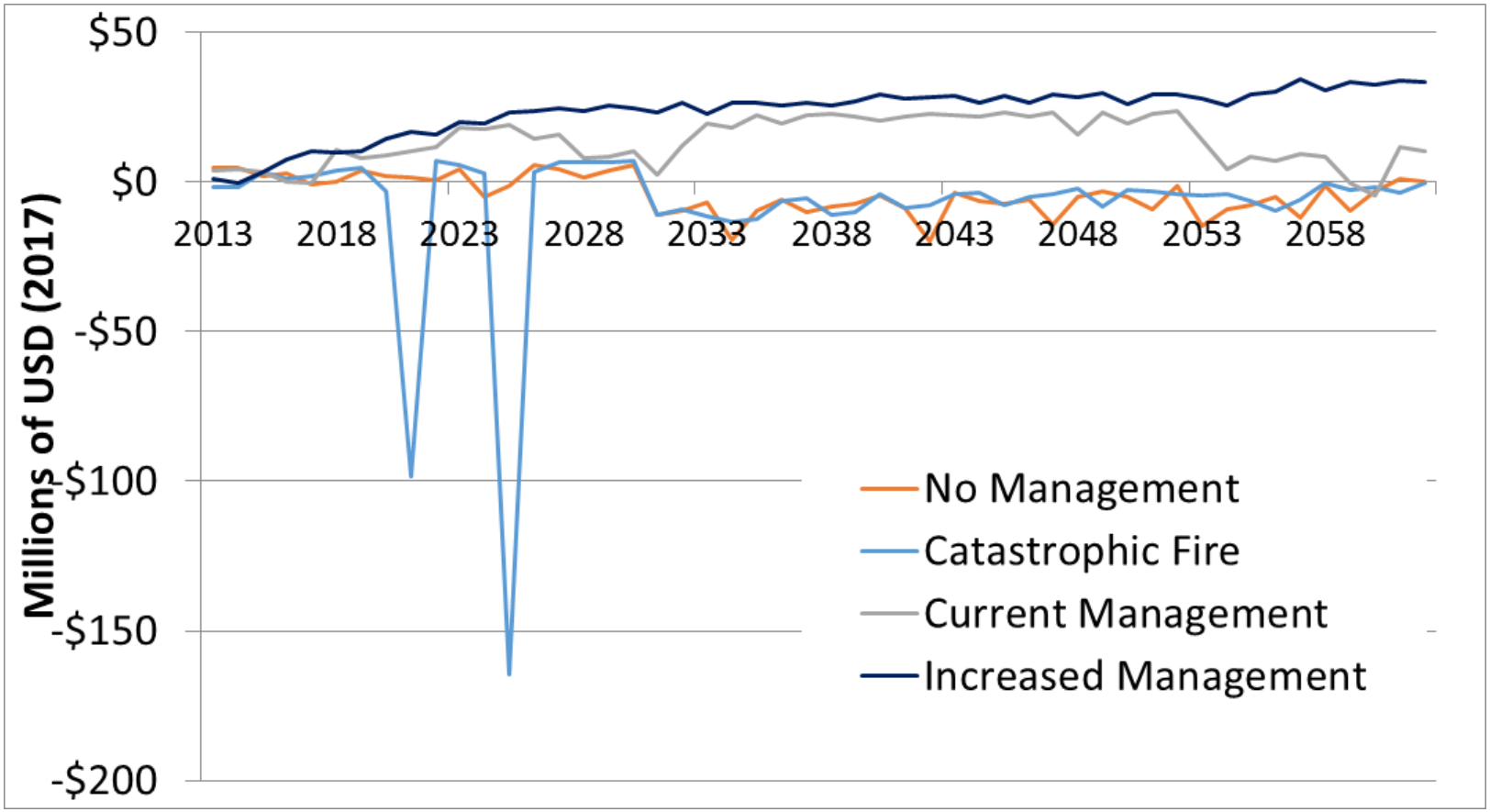
RESULTS: TOTAL CO2 SEQUESTERED



Range and Mean Total Carbon Sequestered (positive) or Emitted (negative) from 2013-2062.

The range of total CO2 emissions for the entire simulation period is shown in orange with the mean represented in blue

RESULTS: ANNUAL VALUE OF CO2 SEQUESTERED



Annual Value of Carbon Sequestration for Four Scenarios in GDS (at the 3% discount rate); note that values differ in the first year due to the incorporation of uncertainty in the model

ACKNOWLEDGEMENTS

This work represents multi-disciplinary, multi-agency partnerships. The following individuals provide substantial contributions to the projects and materials herein:

Nisqually: Anthony Good, Kristin Byrd, Isa Woo, Glynnis Nakai, Monica Moritsch, Travis Poitras, Melanie Davis, Susan De La Cruz, Lisamarie Windham-Myers, James Morris, Ken Krauss, Judith Drexler, Eric Grossman, Dan Nowacki, James Losee

Chesapeake and Delaware: Kristina Hopkins, Jacqueline Welles, Gregory Noe, Peter Claggett, Labeeb Ahmed, Marina Metes, Fabiano Franco, Collin Lawrence, Dianna Hogan

Great Dismal Swamp: Dianna Hogan, Zhiliang Zhu, Brad Reed, John Schmerfeld, Sara Ward, Chris Lowie, Fred Wurster, Christine Pickens, Chuck Peoples, Brian van Eerden, Ken Krauss, Nicole Cormier, Rebecca Moss, Courtney Lee, Jamie Duberstein, Josh Salter, Laurel Gutenberg, Chris Wright, Judy Drexler, Gary Speiran, Todd Hawbaker, Zhong Lu, John Qu, Laurel Gutenberg, Bryan Parthum, Rachel Sleeter, Kim Angeli, and Gary Fisher

CONTACT INFORMATION

Dr. Emily Pindilli, US DOI ITAP, US Geological Survey Science and Decisions Center Director, US Geological Survey Chief Economist

Webpage: https://www.usgs.gov/staff-profiles/emily-j-pindilli
Email: epdindilli@usgs.gov