Tools for Protecting Coastal Wetlands

A Watershed Academy Webcast
Celebrating American Wetlands Month

Tuesday, May 4, 2010
1:00pm – 3:00pm Eastern

Dr. Bill O. Wilen, U.S. Fish and Wildlife Service

Danielle Bamford, The Baldwin Group/NOAA Coastal Services Center

Marcia Berman, Virginia Institute of Marine Science, Center for Coastal Resources Management

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Tools for Protecting Coastal Wetlands

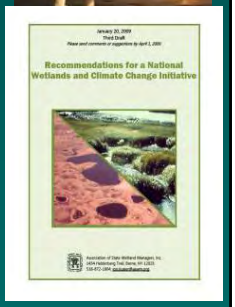
Photo courtesy of Ed Lewandowski; Director, Delaware Inland Bays NEP

Clay Miller
Environmental Protection Specialist
Wetlands Division, U.S. EPA

Importance of Emphasizing Coastal Wetlands

- From 1998-2004, coastal wetlands in Eastern U.S. *lost an average of 59,000 acres annually* (NOAA, FWS Status and Trends Report)
- Coastal wetlands provide *economic benefits* and their destruction can result in economic losses
- Increasing evidence of the threats posed by *sea level rise and climate change* and the benefits of coastal wetland protection

  (ASWM National Wetlands and Climate Change Initiative)



Definitions of Coastal Wetlands and Loss

Coastal Wetlands =

Those wetlands (tidal and fresh) within a HUC 8 watershed that are adjacent to and drain to the Atlantic, Pacific, or Gulf of Mexico

Coastal Wetland Loss =

A decline in the areal extent or ecological integrity of wetlands in the HUC 8 watershed

Photo courtesy of Nancy Laurson, U.S. EPA Oceans and Coastal Protection Division

Coastal Wetlands Initiative

- Formed by EPA in recognition of importance of coastal wetlands
- 2 Pronged Approach
  - Federal Inter-Agency Workgroup
  - EPA Coastal Wetland Review Team
    - Examining loss in selected watersheds by gathering available data and direct input from on-the-ground stakeholders
- Goals of the Coastal Wetland Initiative:
  - Improve understanding of:
    - Functions and values of coastal wetlands
    - Factors contributing to loss in specific geographic areas
  - Identify and disseminate tools, strategies, policies and information to protect and restore coastal wetland resources

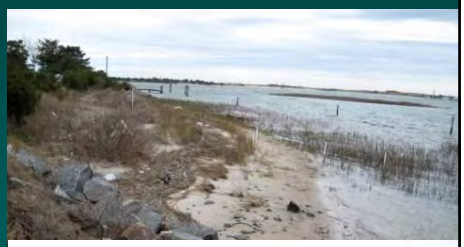
Coastal Wetland Initiative Key Findings To Date: Stressors on Coastal Wetlands

- Direct and indirect impacts contributing to loss and degradation
- Immediate impacts
  - Development
    - Residential and commercial
  - Agriculture and forestry
  - Coastal erosion
  - Hydrologic alterations
- Future impacts
  - Climate change and sea level rise

Photo courtesy of Amie Howell, U.S. EPA Region 3

Tools and Strategies for Coastal Wetland Protection

- Important considerations:
  - Planning with understanding of both near-term and long-term stressors
  - Collaboration and partnerships
- Webcast will provide examples of web-based tools that can help decision-makers plan for better coastal wetland protection



Photos courtesy of Arleen O'Donnell, Eastern Research Group

Webcast Speakers

- Dr. Bill O. Wilen (U.S. Fish and Wildlife Service)
  - Sea Level Affecting Marshes Model (SLAMM)
- Danielle Bamford (NOAA's Coastal Services Center)
  - Habitat Priority Planner
- Marcia Berman (VIMS Center for Coastal Resources Management)
  - Geospatial Management Tools for Local Governments

What I am not going to talk about

- **Sea-level Rise**
- **IPCC reports**
- **How active tectonics and melting glaciers will impact sea levels.**
- **How eustatic sea levels are adjusted to local conditions.**
- **The science behind tide data and datums**
- **and a lot of other things**

I will tell you

- **About SLAMM (Sea level Affecting Marshes Model)**
- **How SLAMM is geoenabled through the Internet**
- **How to get your hands on the SLAMM model**
- **The basics of how it works**
- **How the SLAMM outputs are viewable over the Internet using SLAMM View**
- **Live demo of SLAMM View**

My Goal

- **Peak your interest in SLAMM so you :**

  Download the technical documentation.

  Download the model and sample data. Change the inputs and see what happens.

  Post your questions and feedback to the SLAMM Forum.

  HELP us move SLAMM to the next level

Sea Level Affecting Marsh Model (SLAMM)

- **Developed in mid-1980s by**
  Dr. Dick Park, Eco Modeling
- **Next generation developer**
  Mr. Jonathon Clough, Warren Pinnacle
- **Coastal Marsh Ecologist**
  Dr. Chris Craft, Indiana University
- **Developer of SLAMM-View**
  Dr. Jeff Ehman, Image Matters

National Wetlands Inventory

Google: FWS Wetlands

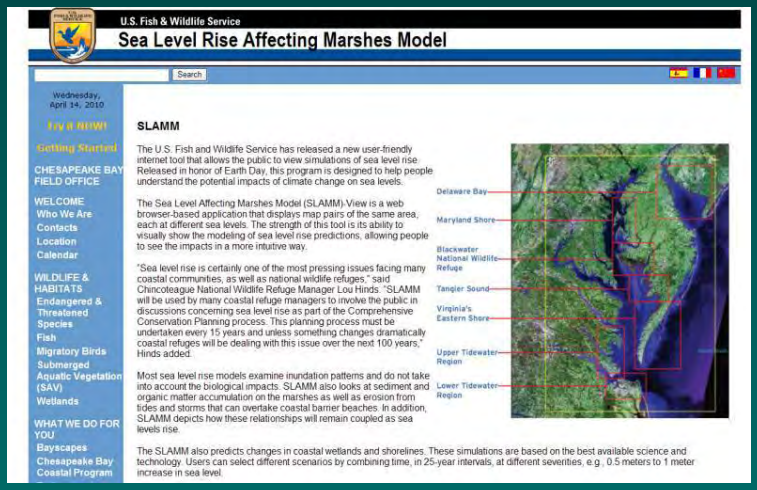
For access to: Wetlands Mapper, data downloads, Web Mapping Service, Google Earth application to view wetlands

SLAMM-View Portal

Google: FWS SLAMM

For access to the portal hosted by the FWS, Chesapeake Bay Field Office

FWS, Chesapeake Bay Field Office



SLAMM

Google: SLAMM

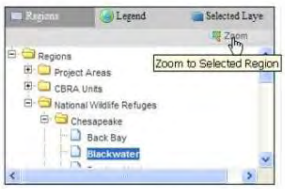
For access to: SLAMM Model, Technical Documentation, Overview, PowerPoint, User Forum, Bibliography, and more.

SLAMM View

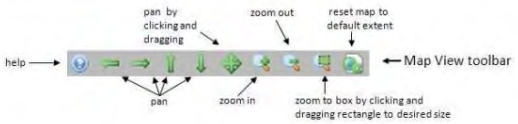
Tutorial

2) Zoom to your area of interest using the Regions View, and then Pan and Zoom using the Map Tools in the Map View header.

1. Click to highlight a Project Area, Coastal Barrier Resources Act (CBRA) Unit, or National Wildlife Refuge.
2. Zoom to the selected region of interest by clicking on the Zoom button, as shown below:

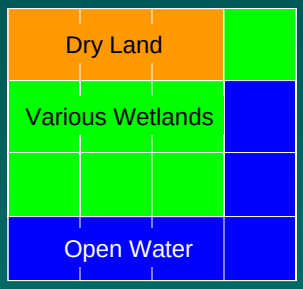


3. Then Pan and Zoom by clicking to "depress" the tool button of choice to activate the tool, then use the tool. Note that a tool stays active until you deactivate it or activate another tool.

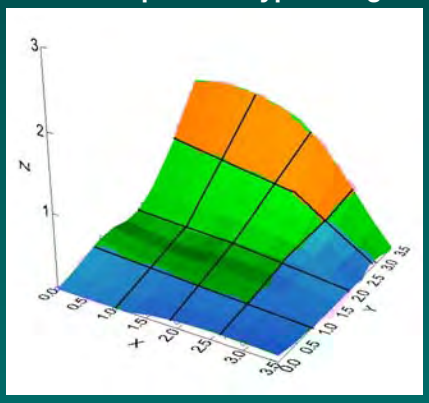


Conceptual Model

- **30m x 30m cells with elevation, slope, aspect, wetland type**
- **Cell size can be variable but many DEMs have 30 m resolution**
  - **Cells will track movement of multiple land-type categories**



2D Representation



3D Representation

Five Primary Processes Modeled

- Inundation
- Accretion
- Erosion
- Overwash
- Saturation

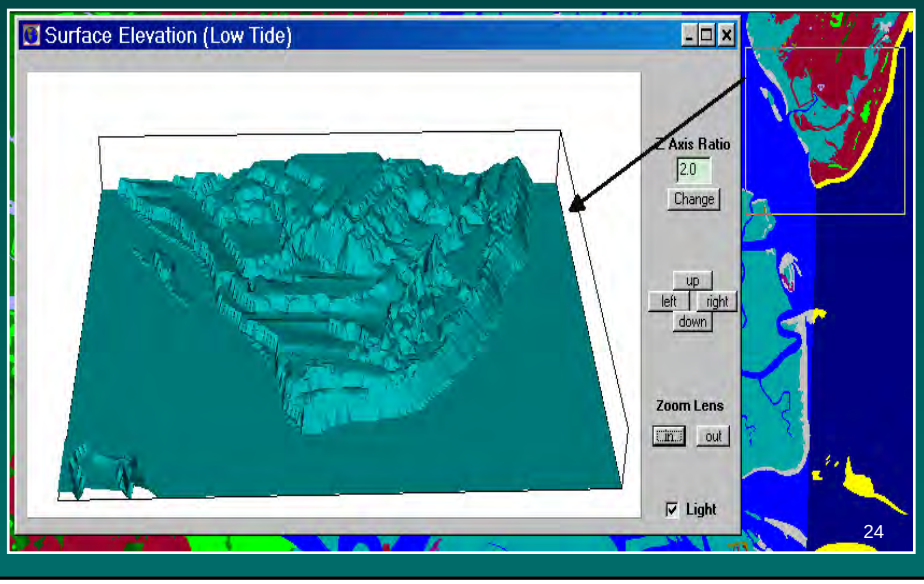
SLAMM 6 added

Salinity Module

How SLAMM processes wetlands elevations

- **The front edge of each wetland type is assigned a minimum elevation, specific to the wetland category that it falls into.**
- **The back edge of each wetland type is given the maximum elevation for that category.**
- **The slope and elevations of the intermediate cells are interpolated between these two points.**
- **The real life wetlands integrate the tides, accretion, salinity, freshwater inflows, and factors we don't understand.**

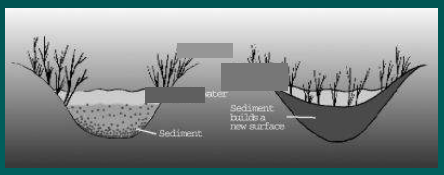
SLAMM 3-D Graphing Tool



Critical Local Influences

- **Accretion is the buildup of organic and inorganic matter on the marsh surface**

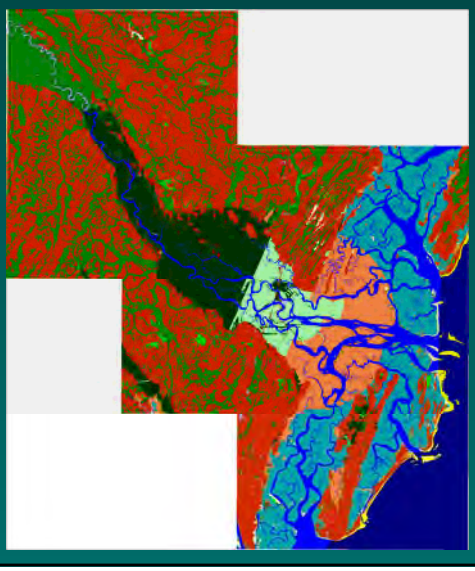
Sediment and Organic Deposition



Substrate Buildup

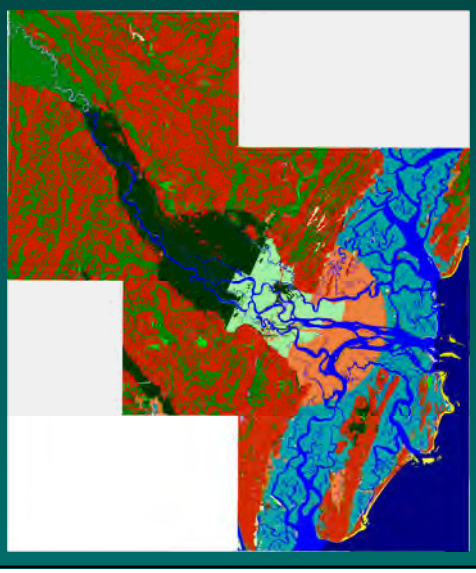
- **Response of vegetation to sea-level rise**
- **Freshwater inflow**
- **Movement of the salt wedge**

Altamaha River GA



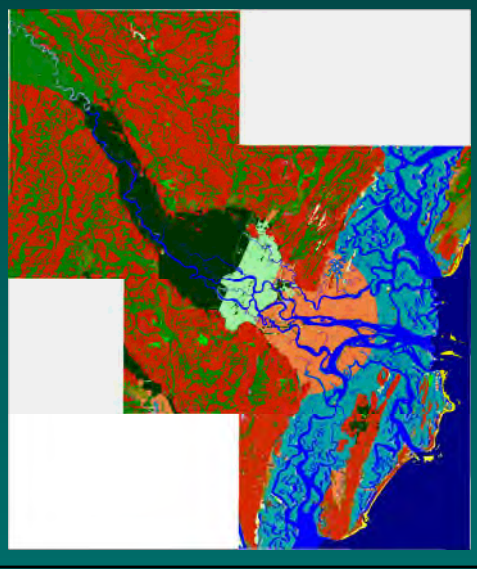
Year 1983

Altamaha River GA



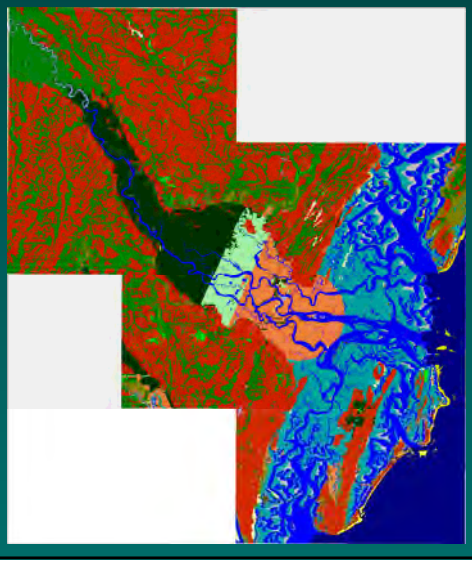
Year 2025

Altamaha River GA



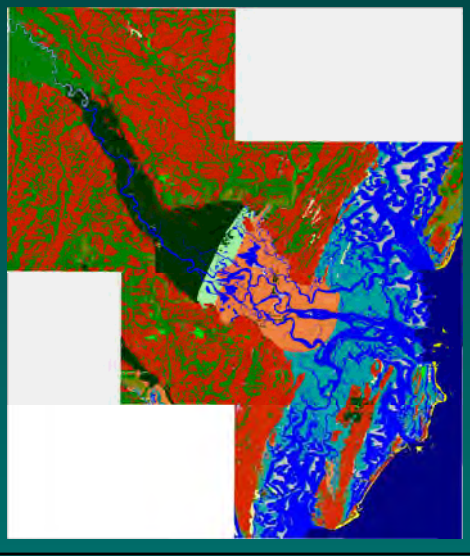
Year 2050

Altamaha River GA



Year 2075

Altamaha River GA



Year 2100

Why is FWS involved?
174 Coastal Refuges

- **It allows us to be in compliance with DOI Secretarial Order 3289: *"consider and analyze potential climate change impacts… when developing multi-year management plans."***
- **The results of SLAMM simulations are being included in Refuge (CCPs) Comprehensive Conservation Plans.**

Relative Vulnerability

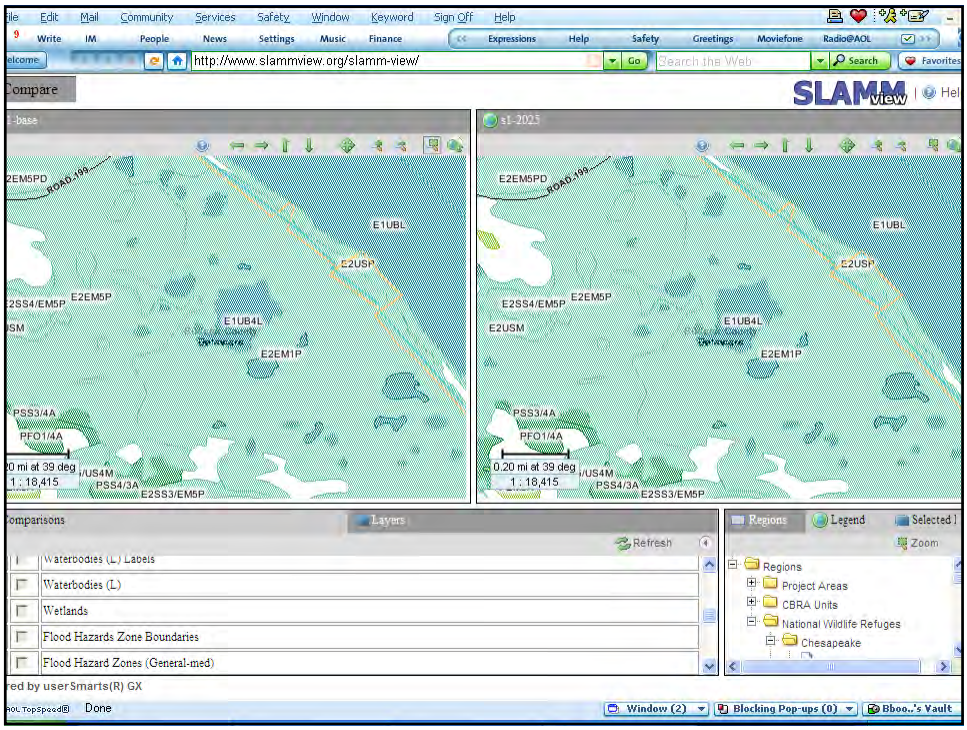
SLAMM provides policymakers with valuable information as to which sites are more vulnerable than others to sea-level rise and is a useful tool in assessing priorities when finances are limited.

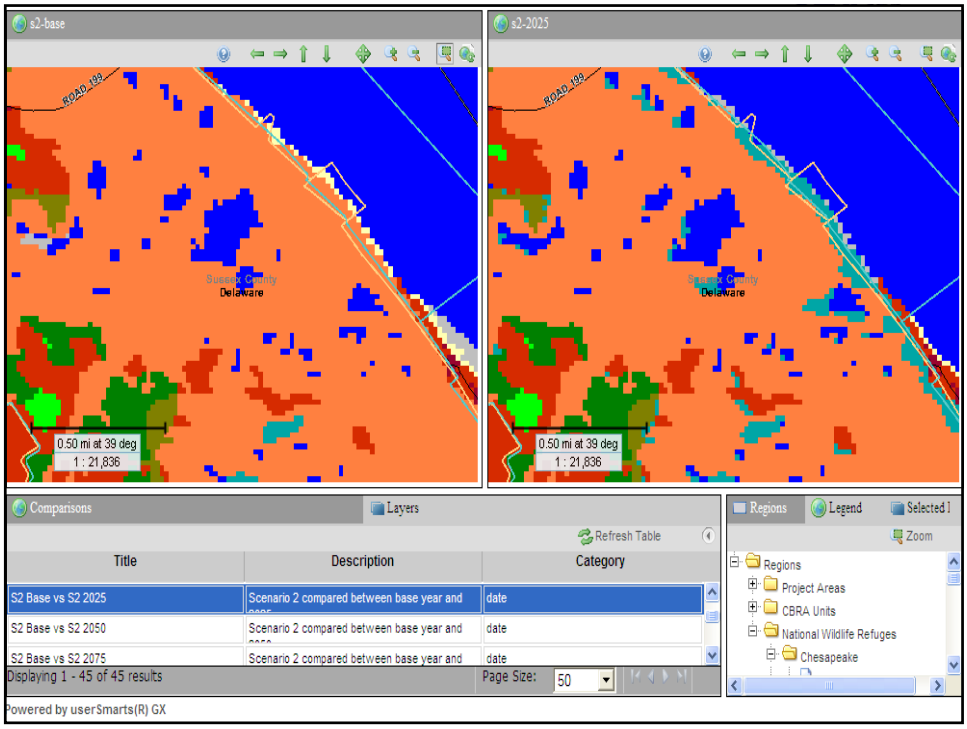
For:

- Land acquisition
- Wetland restoration projects
- Species management

Why SLAMM?

- Because SLAMM runs on existing data available over the Internet and the model is available to the public.
- It is possible to produce comparative analysis over large areas relatively inexpensively.
- Areas like Chesapeake Bay, Puget Sound, the combined coasts of South Carolina and Georgia cost **tens** of thousands, not **hundreds** of thousand of dollars.

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s2-2025
ROAD_199
Sussex County
Delaware
0.50 mi at 39 deg
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Comparisons
Layers
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S2 Base vs S2 2025
Scenario 2 compared between base year and
date
S2 Base vs S2 2050
Scenario 2 compared between base year and
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S2 Base vs S2 2075
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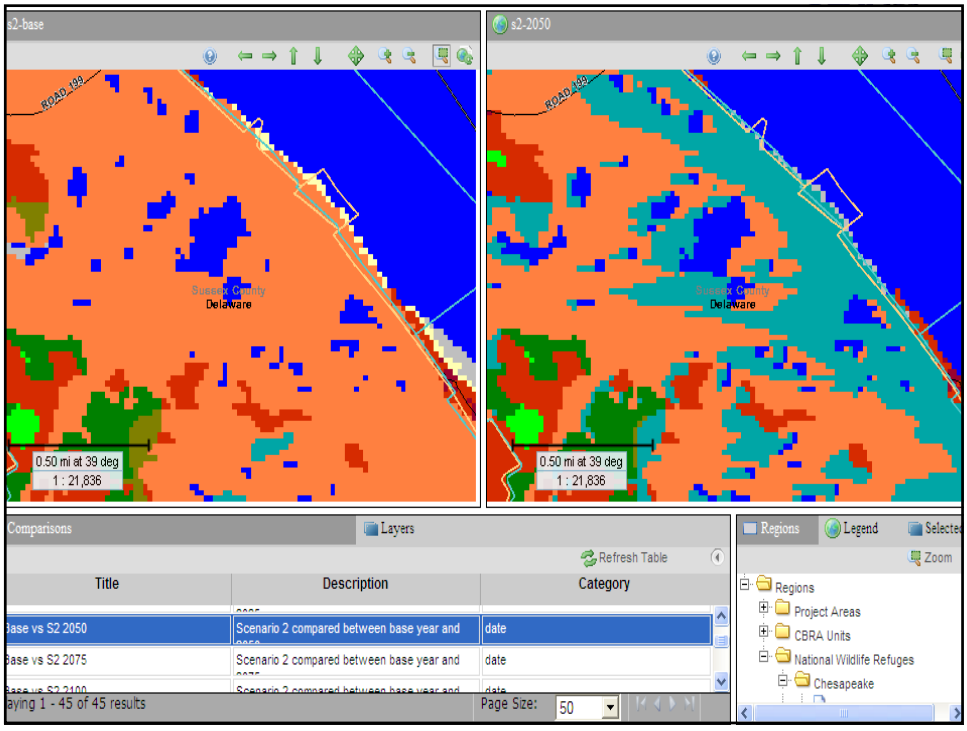
CBRA Units
National Wildlife Refuges
Chesapeake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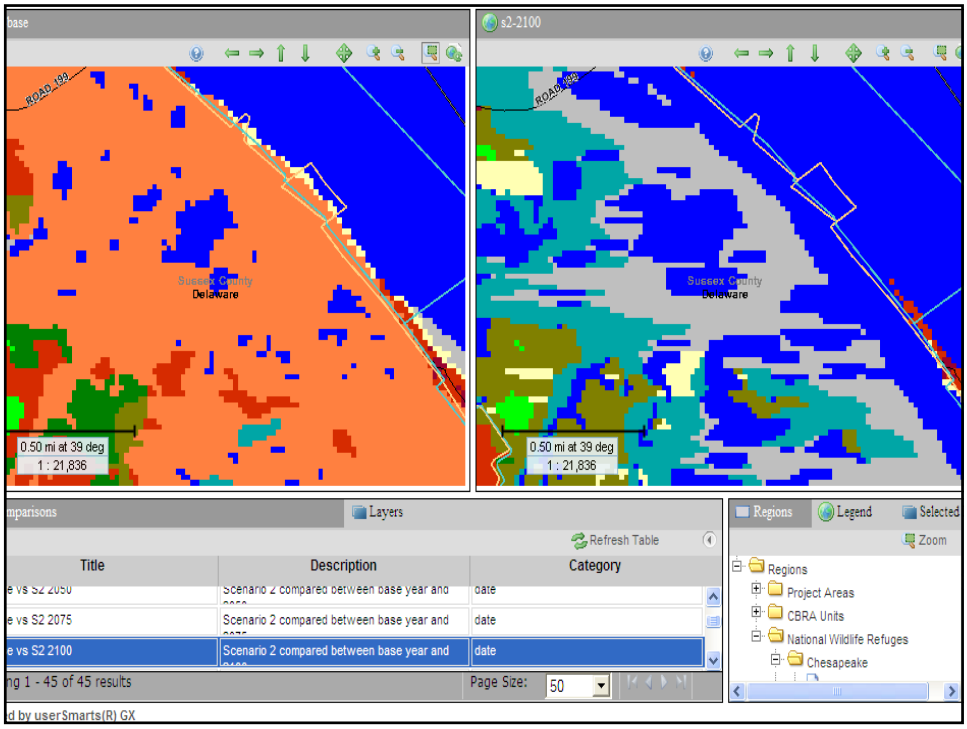
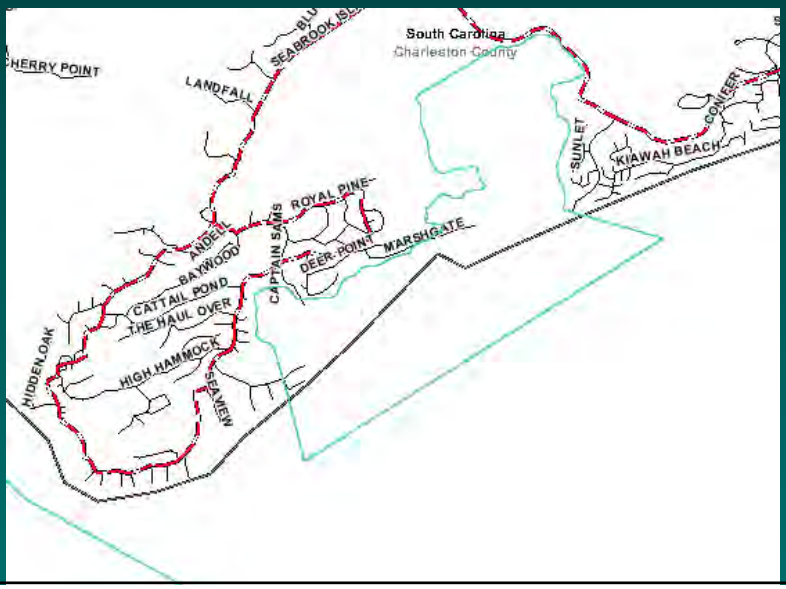


Nooksack Delta, Lummi Bay, and Bellingham Bay

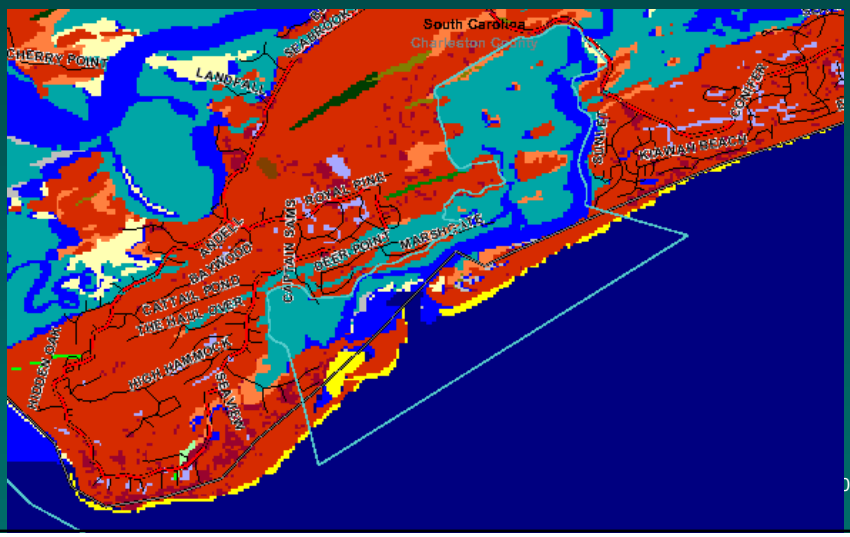
Importance of Dikes (White)

Year 2100 (IPCC A1B Mean), No Dikes

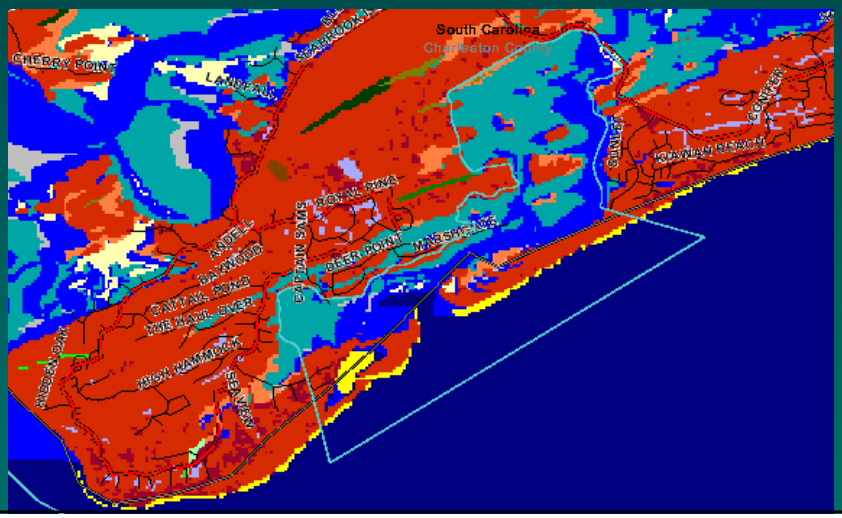
Captain Sam's Inlet, SC



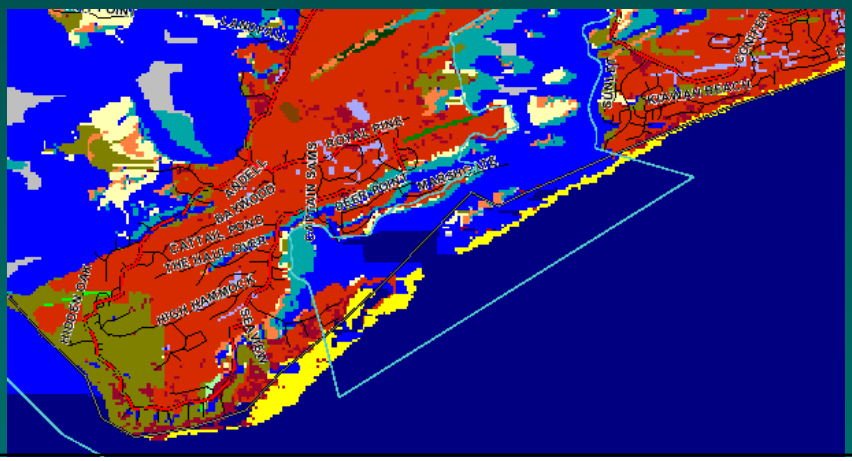
Captain Sam's Inlet, SC 2025



Captain Sam's Inlet, SC 2050



Captain Sam's Inlet, SC 2100

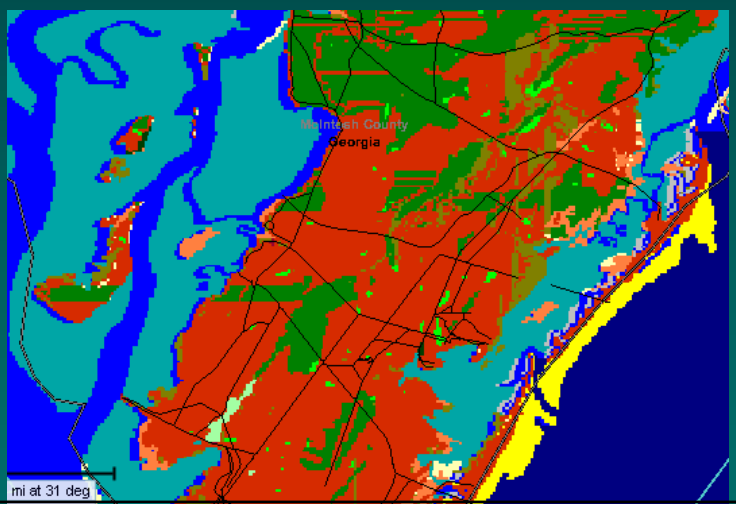


Saturation

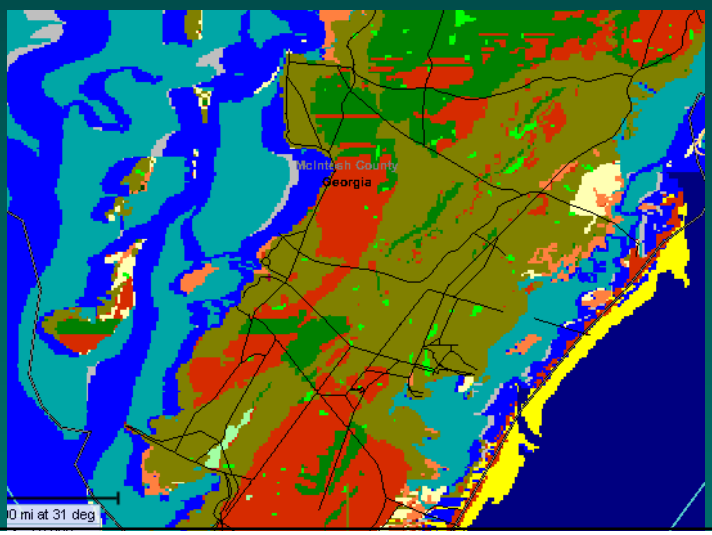
- ***Migration*** of coastal wetlands onto adjacent uplands as a response to rising groundwater tables.

- Existing fresh groundwater floats on deeper brackish groundwater. As sea level rises, the level of brackish groundwater rises, pushing fresh groundwater to the surface of the soil -- creating favorable conditions for wetlands ***migration (colonization).***

Blackbeard Island NWR, GA 2025



Blackbeard Island NWR, GA 2050



Contributors

Too numerous to mention

- Everyone who makes their SLAMM related data available to others.
- Everyone who comments on the SLAMM Forum.
- Everyone who has provided constructive criticism.

Upgrades within SLAMM 6

- Funded through a grant administered by (and with the assistance of) The Nature Conservancy.
- Command line addition funded by the University of Florida.
- Additional refinements were funded by Industrial Economics under contract to the US Environmental Protection agency.
- Bill Wilen of the National Wetlands Inventory (NWI) who carefully examined all of the NWI to SLAMM code linkages.

How can you help?

- Get your accretion data and your SLAMM simulations posted on the Internet.
- Help build the scientific foundation upon which SLAMM 7, 8, or 9 will be built.
- After you have reduced your carbon footprint, apply your talents to move SLAMM down the road.

Questions?

Post your questions and feedback to the SLAMM Forum
To
http://warrenpinnacle.com/SLAMMFORUM/

OR

Google: SLAMM

Danielle Bamford
www.csc.noaa.gov/digitalcoast/tools/hpp/index.html

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Habitat Priority Planner
At a Glance

- Decision support tool guiding management action for the following purposes:
  - Conservation
  - Land use
  - Restoration
- Wizard design
- Intermediate GIS users
- Designed for interactive use with stakeholders

NOAA Coastal Services Center
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Tool Requirements

Software Requirements

- ArcGIS 9.3 or 9.2 (with current Service Pack)
- Spatial Analyst

Data Requirements

- Landcover layer (Raster or Vector)
  http://csc.noaa.gov/digitalcoast/data/index.html
- Site - specific data sets (optional)

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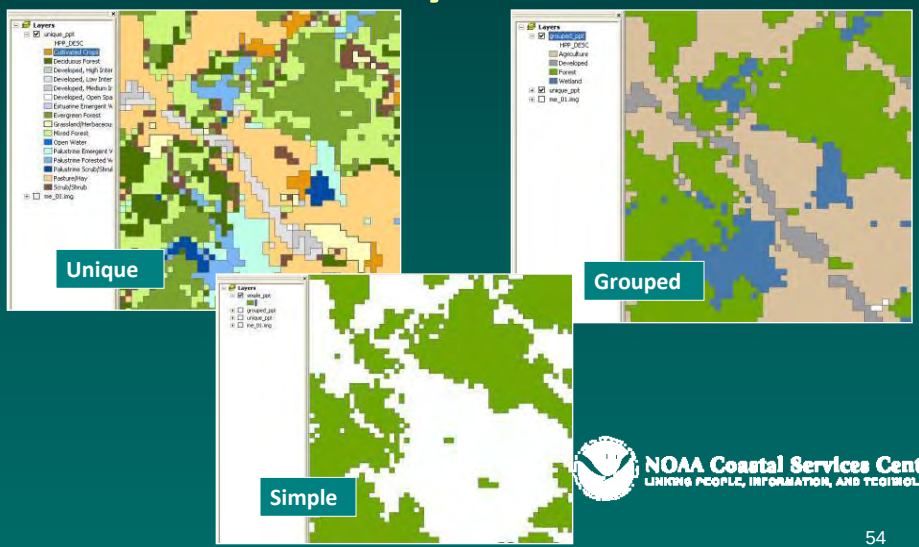
Habitat Priority Planner

- Step 1: Classify habitats
- Step 2: Analyze habitats
- Step 3: Explore data

NOAA Coastal Services Center
LINKING PEOPLE, INFORMATION, AND TECHNOLOGY

Step 1 - Classify Your Habitats customize your landcover



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Step 2 - Habitat Analysis Optional Analyses

Landscape Analyses

Habitat Quality

- Size
- Perimeter-area ratio
- Core area

Habitat Connectivity

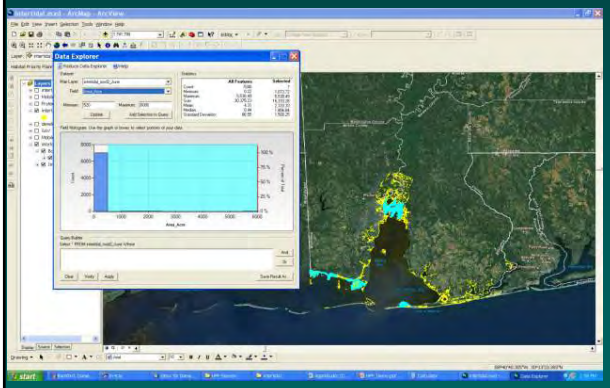
- Proximity
- Nearest neighbor

Custom Analyses

Relational Analyses

- Count
- Distance to
- Presence or absence
- Polygon overlay
- Linear distance within

Step 3 – Data Explorer intuitive data exploration



- **Graph-based selections**
- **Easy query building**
- **Quick analysis**
- **Transparent decision-making**

Step 3 – Data Explorer Example

Goal: Identify and conserve large patches of freshwater wetlands that impact drinking water wells and can be linked with protected lands

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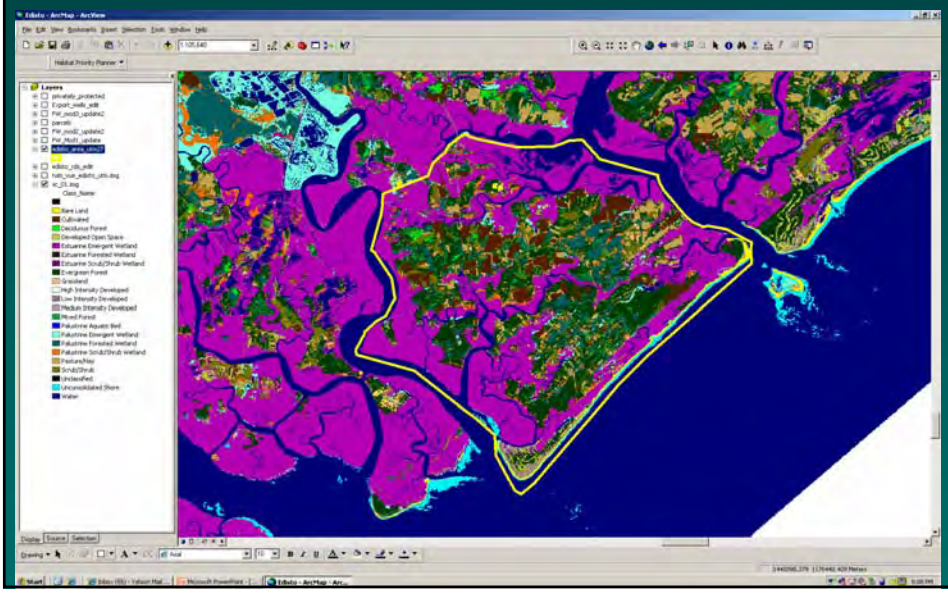

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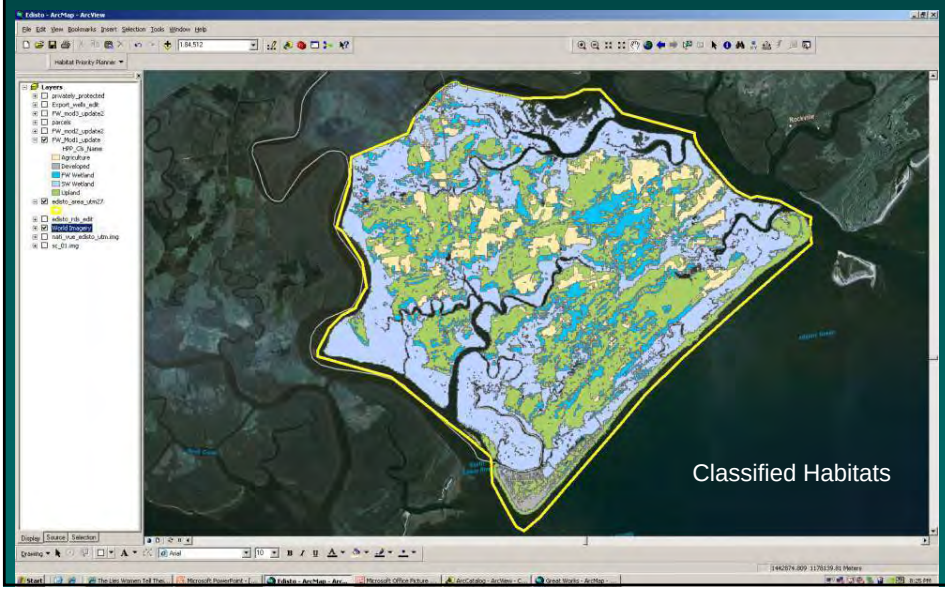

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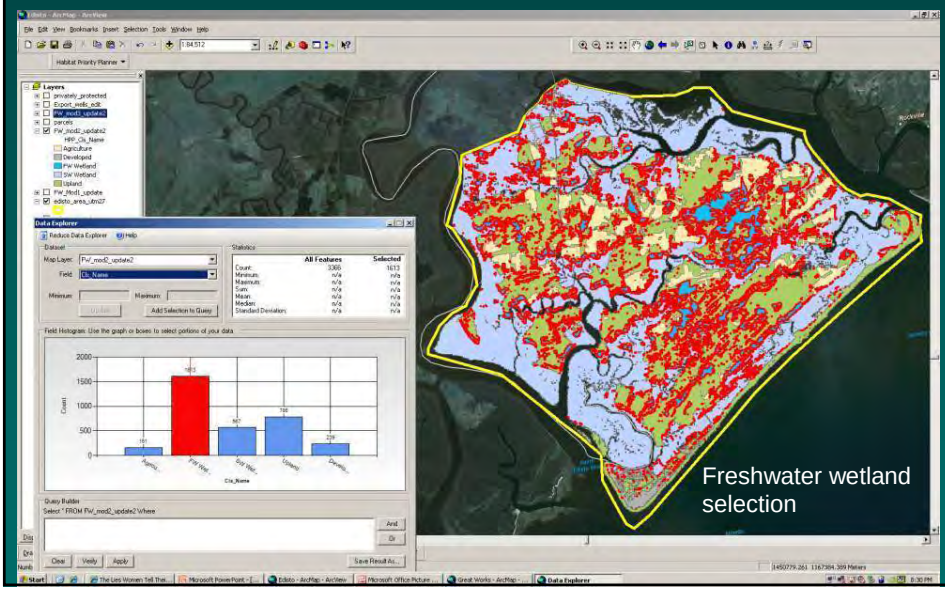

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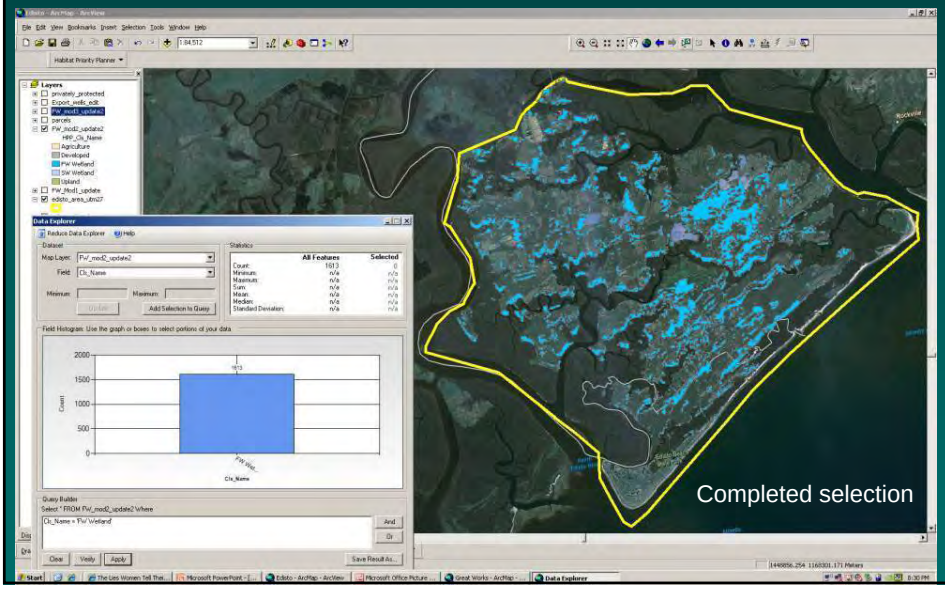
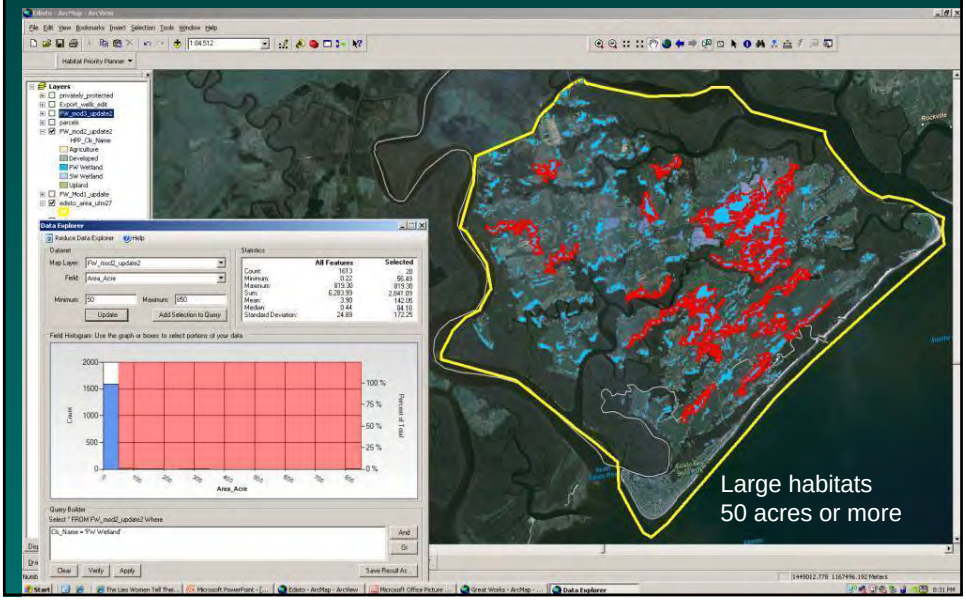


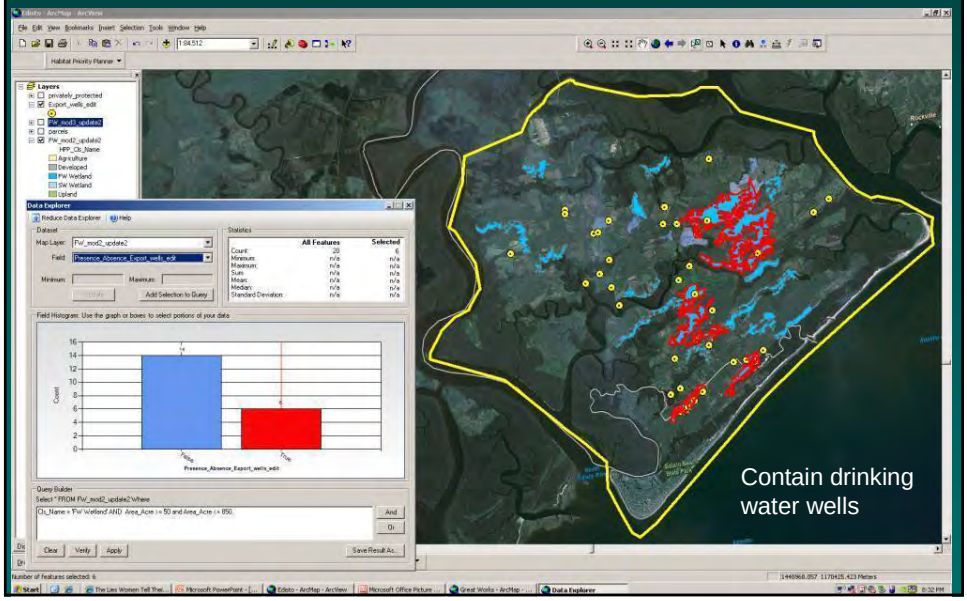
Step 3 – Data Explorer Example

Goal: Identify and conserve large patches of freshwater wetlands that impact drinking water wells and can be linked with protected lands



Step 3 – Data Explorer Example

Goal: Identify and conserve large patches of freshwater wetlands that impact drinking water wells and can be linked with protected lands



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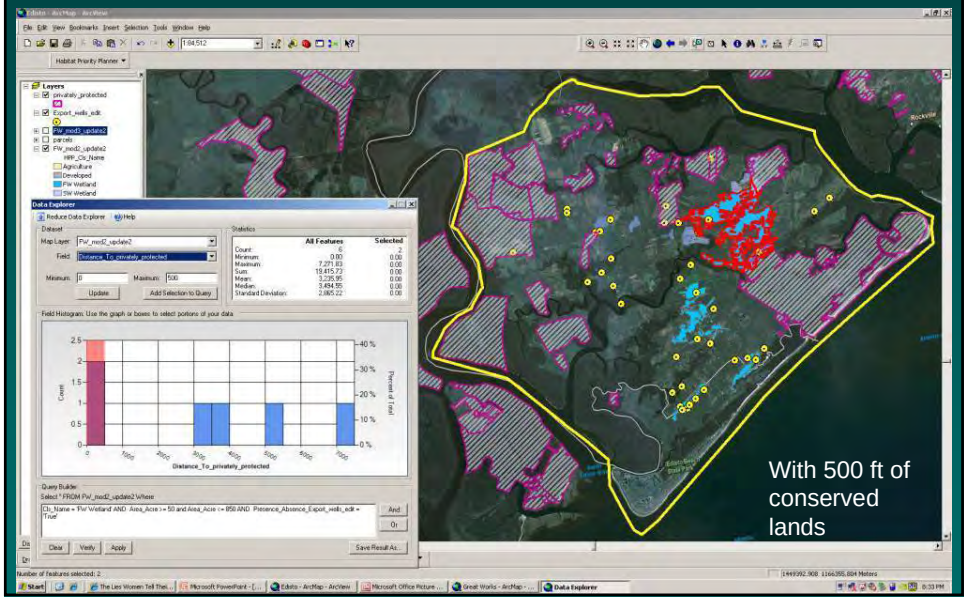
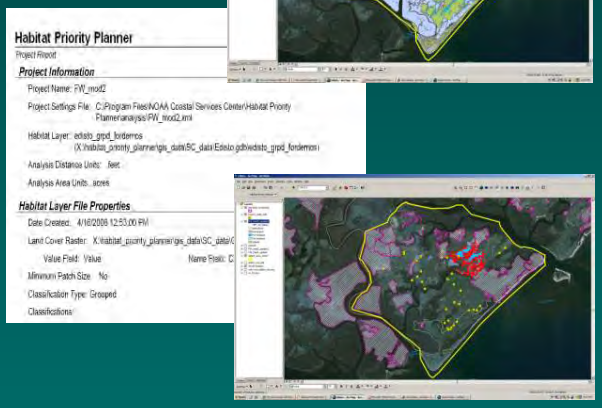


Habitat Priority Planner Outputs

Step 1:
Classified habitats

Step 2:
Habitat analysis results and report

Step 3:
Habitats meeting selection criteria



Building the User Community

- **Climate change adaptation**
  South Carolina
- **Strategic conservation planning**
  Maine, South Carolina, Alabama, Great Lakes
- **Restoration**
  Maine, Great Lakes, Washington
- **Land-use planning**
  Commonwealth of Northern Mariana Islands (CNMI), Hawaii and South Carolina
- **Water quality management**
  Pacific Islands (CNMI), South Carolina

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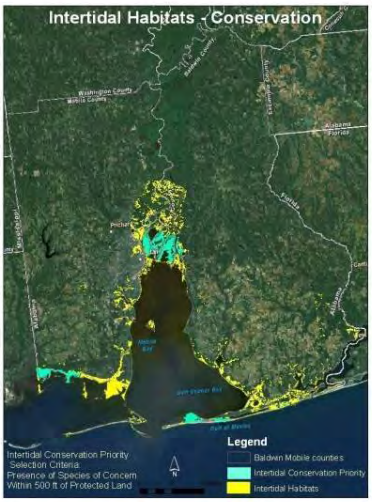
LINKING PEOPLE, INFORMATION, AND TECHNOLOGY

Large-Scale Conservation Planning

Mobile Bay, Alabama



Resource Management:

- **National Estuaries Program (NEP) led effort**
- **Add spatial context**
- **Land to sea application**
- **Data gap identification**

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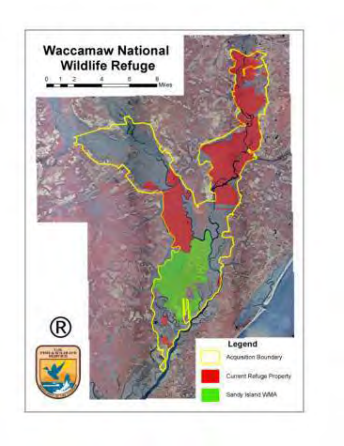
Large-Scale Conservation Planning

Mobile Bay, Alabama

U.S. Fish and Wildlife Service (FWS) Waccamaw, South Carolina

22,869 acres



- FWS national mandate to use Sea Level Affecting Marshes Model (SLAMM)
- Managers want site-specific analyses and guidance
- CSC interest in interoperability of HPP and other tool/model outputs

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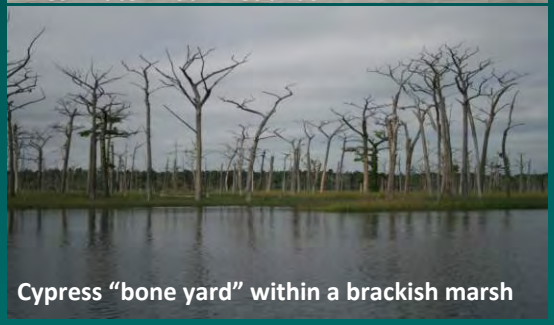
Climate Change Analyses and HPP

Use climate change data as primary input

Relate other important local data to scenarios

View "before" and "after"—visualize change and loss

Freshwater Tidal Wetlands



Cypress "bone yard" within a brackish marsh

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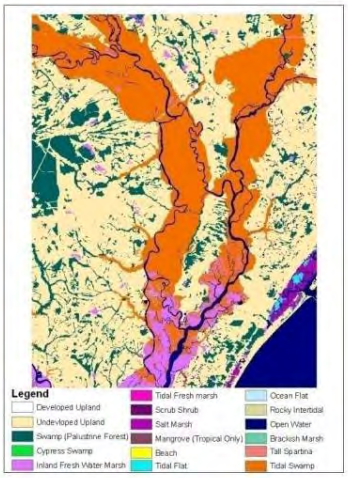
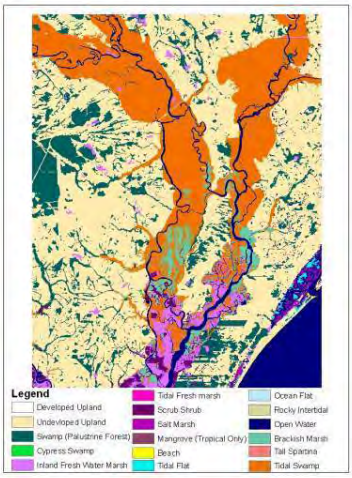
SLAMM Output for 2025

Initial Condition

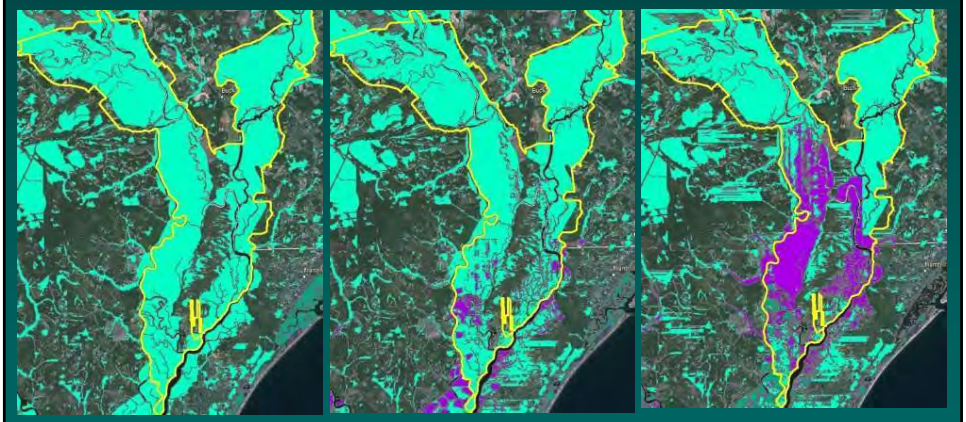


Site Specific analysis SLAMM



HPP Wetland Groups

Initial Condition **2025** **2050**



Brackish Marsh
Freshwater Habitats
Saltwater Habitats
Waccamaw NWR boundary

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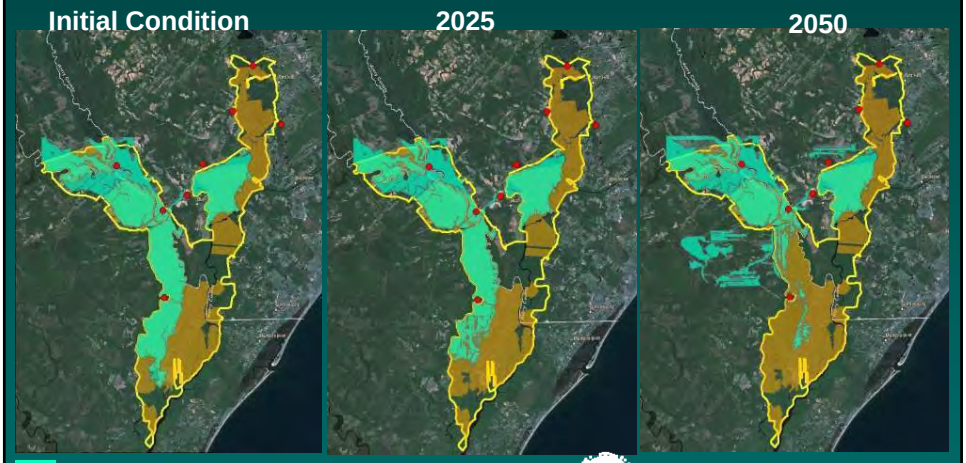
Freshwater Habitat Prioritization

- Freshwater habitats that are protected
- Within one mile of Swallow Tail Kite (SWTK) nest



Freshwater Marsh
Waccamaw NWR boundary
SWTK Nesting Sites
Conserved Lands

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From the
Habitat Priority Planner Development Team

For More Information:
Download the tool and instructions from

www.csc.noaa.gov/digitalcoast/tools/hpp/index.html

Or contact Danielle.Bamford@noaa.gov

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Comprehensive Coastal Resource Management Plan
A Geospatial Toolbox for Local Governments

Marcia Berman
Center for Coastal Resources Management
Virginia Institute of Marine Science

http://ccrm.vims.edu

WHAT IS A COMPREHENSIVE COASTAL RESOURCE MANAGEMENT PLAN (CCRMP)?

- **ecosystem based strategy to sustain ecosystem services;**
- **provides guidance for local governments;**
- **focused on:**
  - **riparian lands management**
  - **tidal lands: wetlands, beaches, and dunes**
  - **subaqueous lands: SAV, oyster reefs**
  - **non-tidal wetlands**

COMPONENTS OF A CCRMP

Comprehensive Shoreline Inventory
Wetlands Inventory
Geospatial Shoreline Management Model
Nontidal Wetlands Condition Assessment
Wetlands Mitigation/Restoration Targeting Tool
Climate Change Vulnerability models
Conservation Targeting Tool
Shallow Water Use Conflict Assessment

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COMPREHENSIVE SHORELINE INVENTORY

- Riparian land use classification
- Bank assessment
- Shoreline characterization

http://ccrm.vims.edu/gis_data_maps/shoreline_inventory

Shoreline Inventory Reports Wicomico County, MD

Riparian Land Use

Shoreline Characterization

Geospatial Shoreline Management Model

- Automated science-based decision support tool
- Integrates management across coastal profile
- Returns 11 different options for erosion control

do nothing ⟶ living shoreline ⟶ traditional

Mathews County, VA
Shoreline Management Model

Legend

- Currently defended
- No action needed
- No action needed &/or bank mod. &/or veg. man.
- No action needed &/or upland mod.
- No action needed &/or veg. man.
- Bank mod.
- Bank mod. &/or breakwaters
- Bank mod. &/or breakwaters &/or revetment
- Bank mod. &/or planting w/ biologs
- Bank mod. &/or planting w/ sill
- Bank mod. &/or planting w/ sill &/or upland mod.
- Bank mod. &/or upland mod.
- Beach nourishment.
- Planting w/ biologs
- Planting w/ sill
- Breakwaters
- Revetment
- Upland mod. &/or planting w/ sill
- Veg. man. &/or planting w/ biologs
- Veg. man. &/or planting w/ sill

Mathews County, VA
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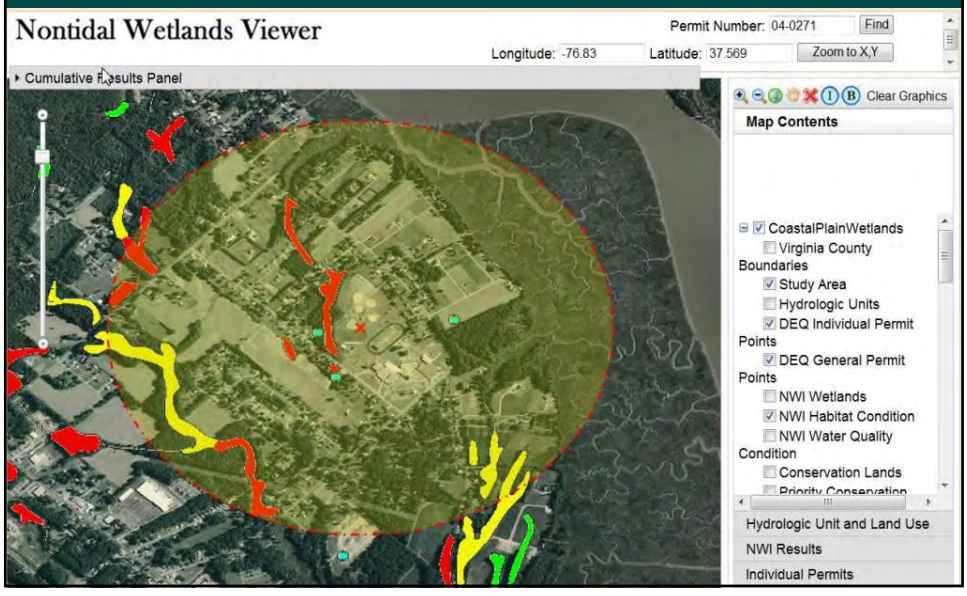
- Revetment
- Upland mod. &/or planting w/ sill
- Veg. man. &/or planting w/ biologs
- Veg. man. &/or planting w/ sill

Non-tidal Wetlands
Condition Assessment

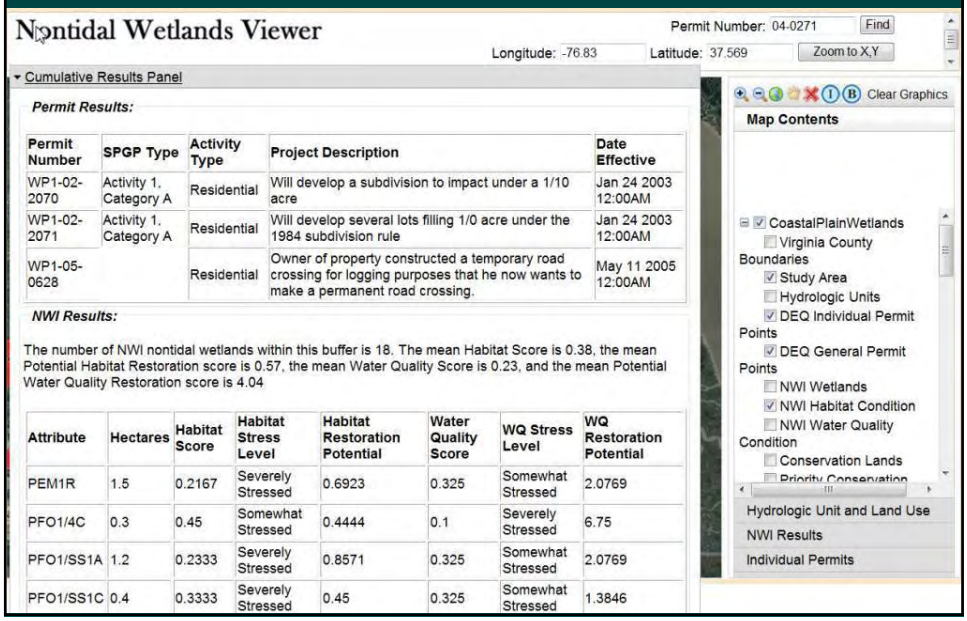
- **Multi-level condition assessment**
- **Landscape emphasis**
- **Focused on ecosystem service impacts**

Non-tidal Wetlands
Condition Assessment

Non-tidal Wetlands
Condition Assessment



Non-tidal Wetlands Condition Assessment



Permit Results:

Permit Number	SPGP Type	Activity Type	Project Description	Date Effective
WP1-02-2070	Activity 1, Category A	Residential	Will develop a subdivision to impact under a 1/10 acre	Jan 24 2003 12:00AM
WP1-02-2071	Activity 1, Category A	Residential	Will develop several lots filling 1/0 acre under the 1984 subdivision rule	Jan 24 2003 12:00AM
WP1-05-0628		Residential	Owner of property constructed a temporary road crossing for logging purposes that he now wants to make a permanent road crossing.	May 11 2005 12:00AM

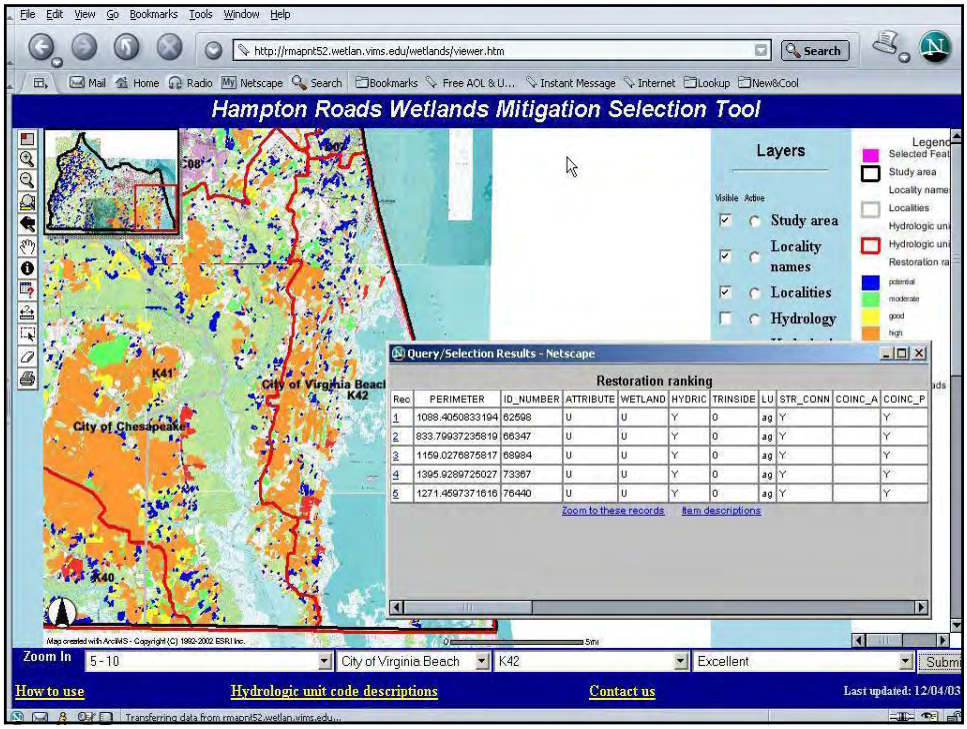
NWI Results:

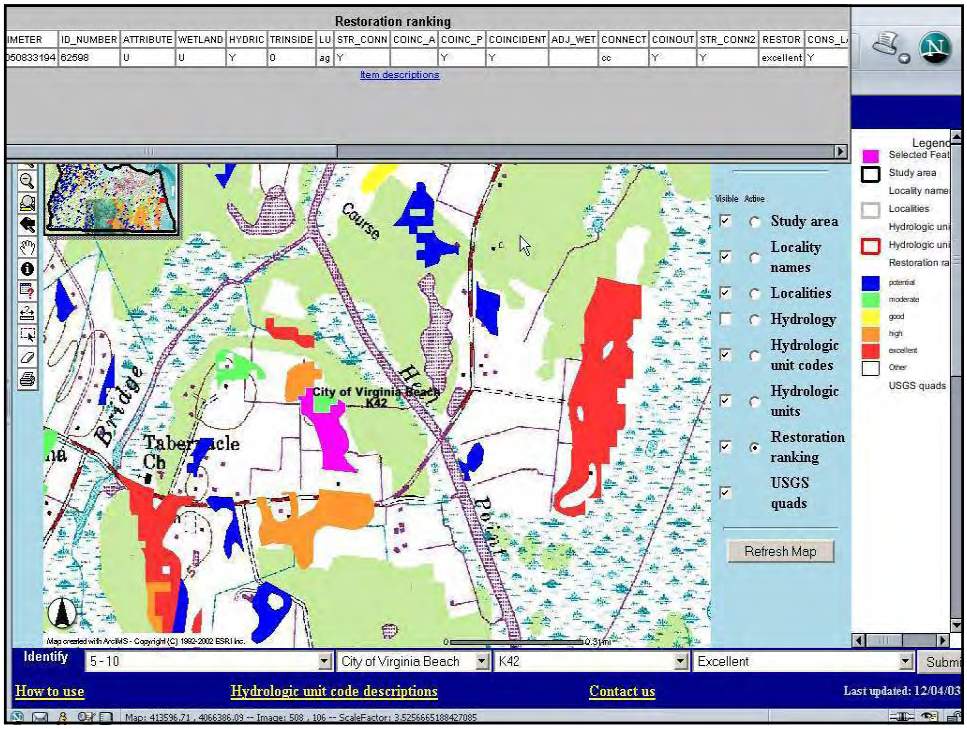
The number of NWI nontidal wetlands within this buffer is 18. The mean Habitat Score is 0.38, the mean Potential Habitat Restoration score is 0.57, the mean Water Quality Score is 0.23, and the mean Potential Water Quality Restoration score is 4.04

Attribute	Hectares	Habitat Score	Habitat Stress Level	Habitat Restoration Potential	Water Quality Score	WQ Stress Level	WQ Restoration Potential
PEM1R	1.5	0.2167	Severely Stressed	0.6923	0.325	Somewhat Stressed	2.0769
PFO1/4C	0.3	0.45	Somewhat Stressed	0.4444	0.1	Severely Stressed	6.75
PFO1/SS1A	1.2	0.2333	Severely Stressed	0.8571	0.325	Somewhat Stressed	2.0769
PFO1/SS1C	0.4	0.3333	Severely Stressed	0.45	0.325	Somewhat Stressed	1.3846

WETLAND MITIGATION/RESTORATION TARGETING TOOL

- Automated decision support query tool
- Landscape approach to site selection for mitigation
- Model drivers:
  - location of existing wetlands
  - hydrology
  - soils
  - land use


Hampton Roads Wetlands Mitigation Selection Tool
Layers
Study area
Locality names
Localities
Hydrology
Query/Selection Results - Netscape
Restoration ranking
Zoom to these records
Item descriptions
City of Chesapeake
City of Virginia Beach
K41
K42
K40
Zoom In
5 - 10
City of Virginia Beach
K42
Excellent
How to use
Hydrologic unit code descriptions
Contact us
Last updated: 12/04/03


Restoration ranking
Item descriptions
Study area
Locality names
Localities
Hydrology
Hydrologic unit codes
Hydrologic units
Restoration ranking
USGS quads
Refresh Map
City of Virginia Beach
K42
Identify
5 - 10
City of Virginia Beach
K42
Excellent
How to use
Hydrologic unit code descriptions
Contact us
Last updated: 12/04/03

CLIMATE CHANGE VULNERABILITY

… PREDICTING SHIFTS IN KEY COASTAL HABITATS

… THROUGH MAPS, MODELS, AND INTERACTIVE TOOLS

Climate Change Vulnerability Models

Shallow-Water and Tidal Wetlands – projected shifts due to sea level rise

Tidal Marsh Vulnerability – risk based on geomorphology and development patterns

Estuarine Beach Vulnerability – risk based on geomorphology and development patterns

Submerged Aquatic Vegetation – projected shifts due to sea level rise and elevated temperatures

Vulnerable Developed Lands – vulnerability to inundation

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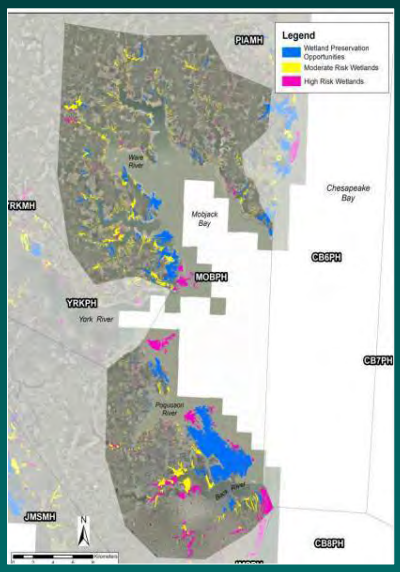
Tidal Marsh Vulnerability



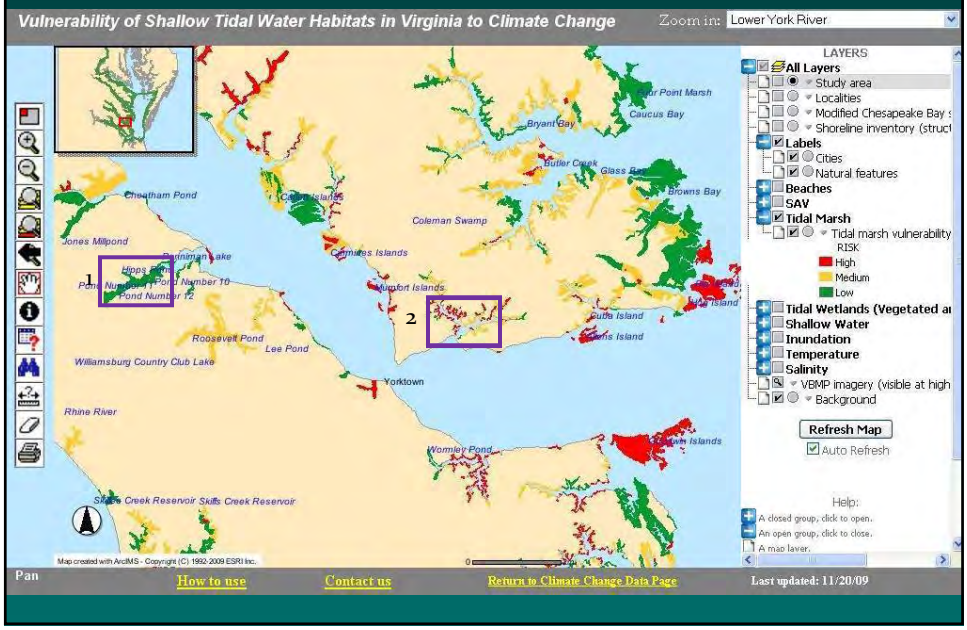
<u>High risk marshes</u> = entirely adjacent to hardened shoreline, riparian land development &/or banks > 5 ft

<u>Moderate risk marshes</u> = adjacent to mixed land use conditions (e.g. partial association with shoreline hardening or riparian development)

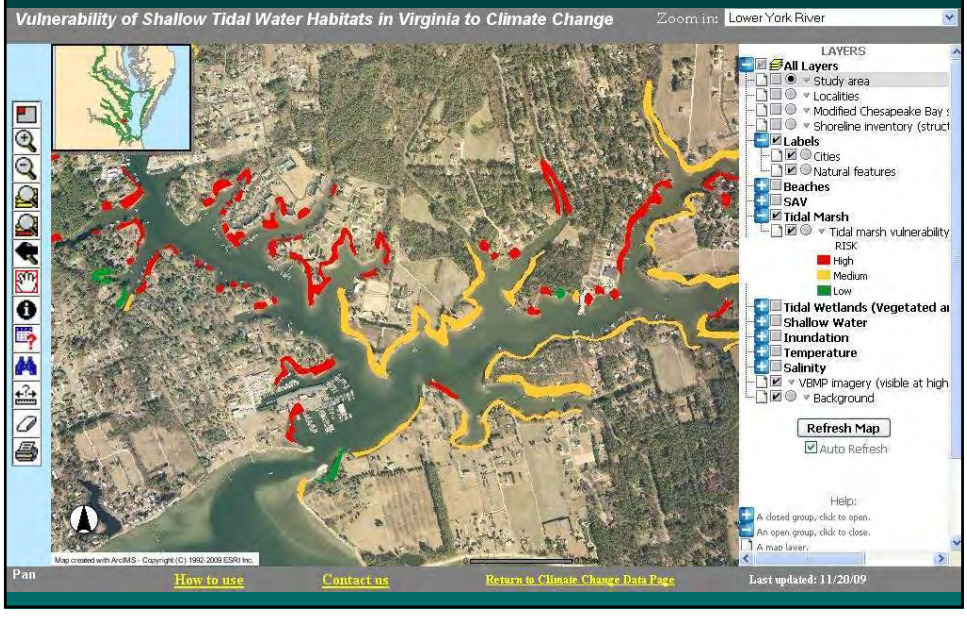
<u>Low risk marshes</u>* = entirely adjacent to natural lands, a shoreline without structures, & banks < 5ft
Represent preservation opportunities

Based on Tidal Marsh Inventory (1972 -1988; site visits to all tidal marshes)

Interactive Tool: Tidal Marsh Vulnerability



Interactive Tool: Tidal Marsh Vulnerability



PUTTING IT ALL TOGETHER
YORK RIVER WATERSHED
CCRMP

Comprehensive Shoreline Inventory
Wetlands Inventory
Geospatial Shoreline Management Model
Nontidal Wetlands Condition Assessment
Wetlands Mitigation/Restoration Targeting Tool
Climate Change Vulnerability models
Conservation Targeting Tool
Shallow Water Use Conflict Assessment

Questions?

http://ccrm.vims.edu

May is American Wetlands Month!

This May will mark the 20th anniversary of American Wetlands Month, a time when EPA and its partners celebrate the vital importance of wetlands to the Nation.

This year, EPA is focusing on coastal wetlands throughout the month. Visit EPA's AWM Web site to find events in your area.

www.epa.gov/wetlands/awm

Speaker Contact Information

Dr. Bill O. Wilen, Chair, Wetlands Subcommittee, Federal Geographic Data Committee, National Wetlands Inventory, U.S. Fish and Wildlife Service
bill_wilen@fws.gov

Danielle Bamford, Environmental Scientist, The Baldwin Group, on contract to Coastal Services Center, National Oceanic and Atmospheric Administration
danielle.bamford@noaa.gov

Marcia Berman, Coastal Geologist and Director, Comprehensive Coastal Inventory Program, Center for Coastal Resources Management, Virginia Institute of Marine Science, College of William and Mary
marcia@vims.edu

Participation Certificate

If you would like to obtain participation certificates for multiple attendees, click the link below:

www.epa.gov/owow/watershed/wacademy/webcasts/pdf/2010_5_4_certificate.pdf

You can type each of the attendees names in and print the certificates