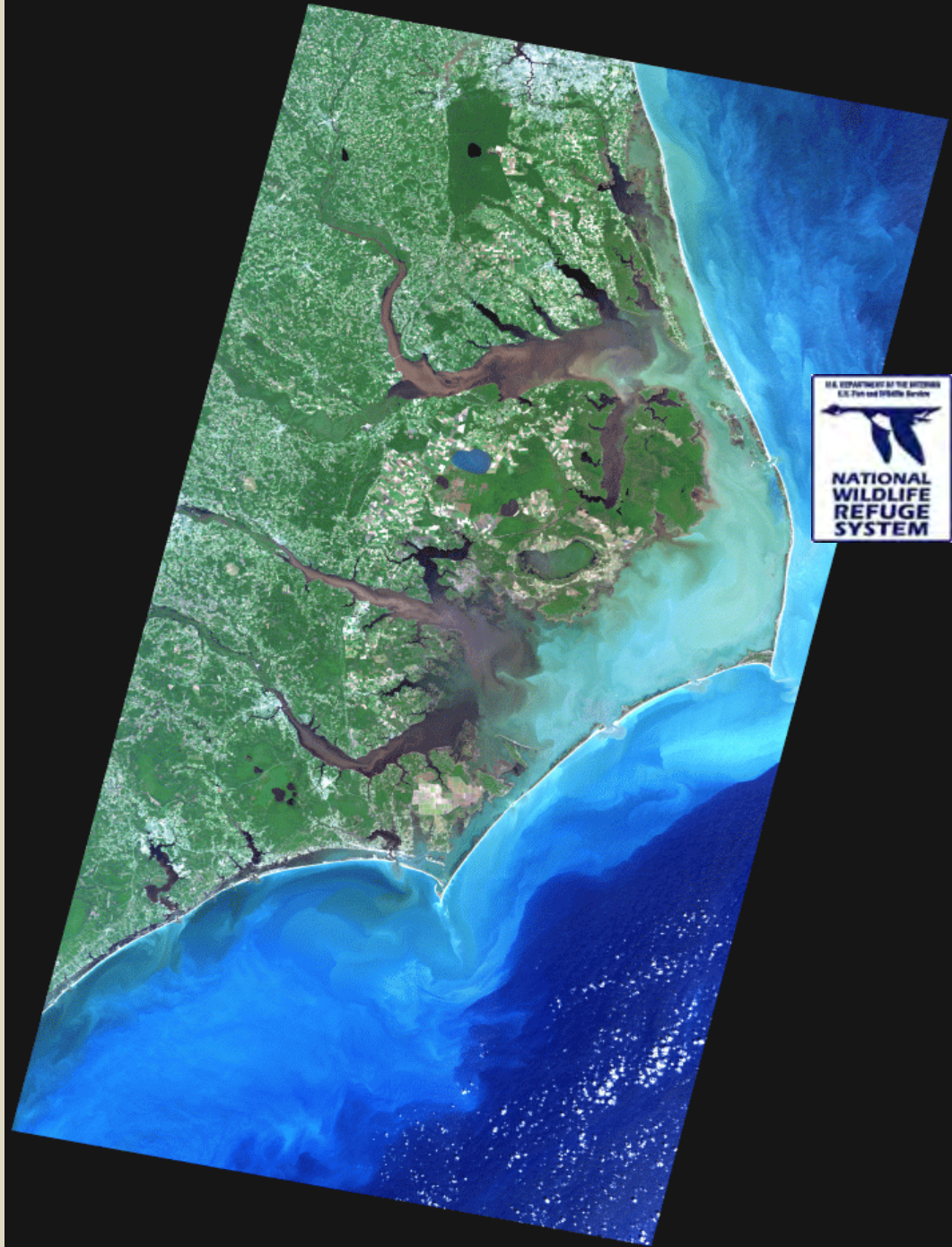




North Carolina Coastal National Wildlife Refuges Complex

Concerns & Priorities for Wildlife and Habitat Management in Coastal Wetlands

Dennis Stewart, Refuge Biologist



Conservation Sites in the Mid-Atlantic Coastal Plain



Eleven National Wildlife Refuges

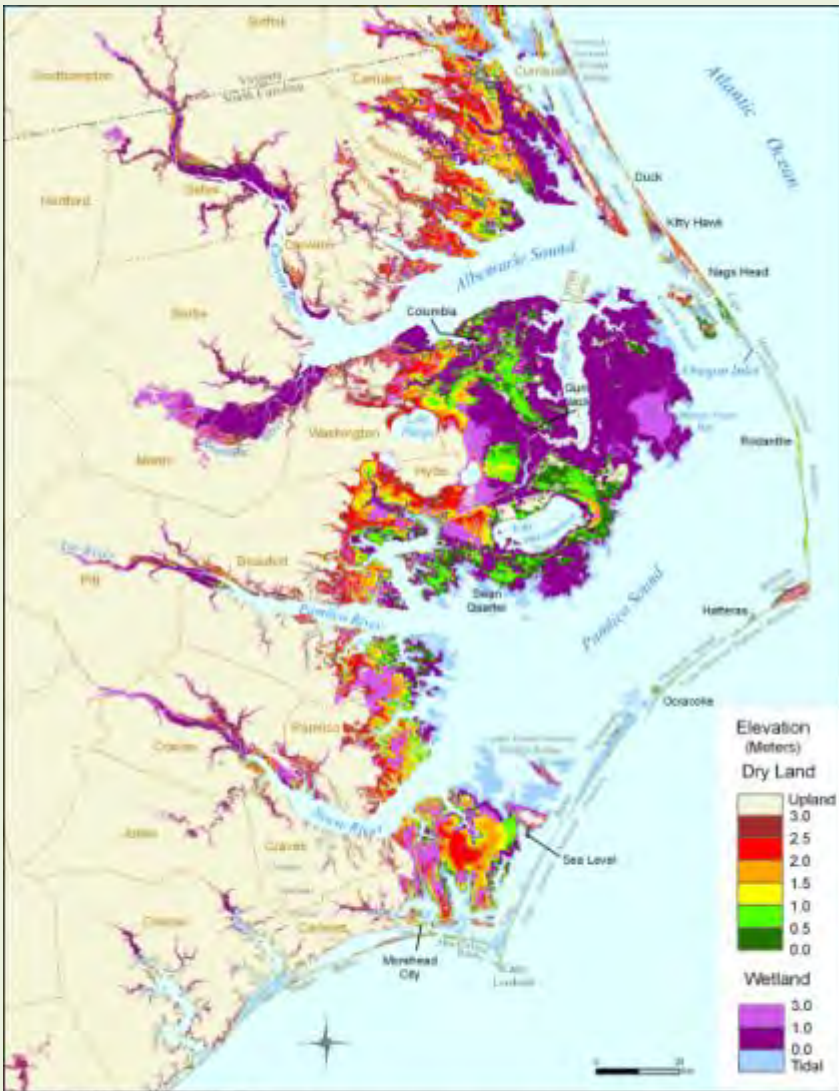
Southeast
Virginia/
Northeast
North Carolina
Coastal Plain

154 miles

120 miles



Vulnerability in NE North Carolina



- Extremely low elevation
 - Third most vulnerable region to impacts of sea-level rise in North America¹
 - RSLR 3.0-3.3 mm/y²
- Susceptible to hurricanes and nor'easters
- Extensive ditching and draining of wetlands
- Regional impacts
 - Shoreline erosion; inundation; saltwater intrusion; species invasions; rapid habitat transition; catastrophic wildfires

• ¹US CCSP 2009, ²Kemp et al. 2009

Elevations of Land Close to Sea Level
Elevations are above spring high water, which is the average high tide during new and full moons, and approximately the inland boundary of tidal wetlands. This map is a general graphical representation of elevations in the area depicted, not designed to estimate the precise elevations at specific locations. Actual elevations at specific locations may be 30 cm above or below the elevation shown.
Source: J.G. Titus and J. Wang. 2008. "Maps of Lands Close to Sea Level along the Mid-Atlantic Coast".
US Environmental Protection Agency

Accretion, Subsidence, & Sea Level Rise in Organic Soils

Management Actions Effects on Organic Soils								
		SUBSIDENCE (S)					Sea-level Rise	
		Accretion (1.9 mm/yr)	Drainage (11.6 mm/yr)	Drainage and Fire (24 mm/yr)	Drainage, Fire, Farming (35.6 mm/yr)	Minimum subsidence estimate (20 mm/yr)	Minimum Sea level Rise (2.82 mm/yr)	Maximum Sea level Rise (3.2 mm/yr)
Year	Base (mm)	A_{nat}	S_d	S_{df}	S_{dff}	S_{min}	SLR_{min}	SLR_{max}
0	100	100	100	100	100	100	0	0
1	100	101.9	88.4	76	64.4	80	2.82	3.2
2	100	103.8	76.8	52	28.8	60	5.64	6.4
3	100	105.7	65.2	28	-6.8	40	8.46	9.6
4	100	107.6	53.6	4	-42.4	20	11.28	12.8
5	100	109.5	42	-20	-78	0	14.1	16
6	100	111.4	30.4	-44	-113.6	-20	16.92	19.2
7	100	113.3	18.8	-68	-149.2	-40	19.74	22.4
8	100	115.2	7.2	-92	-184.8	-60	22.56	25.6
9	100	117.1	-4.4	-116	-220.4	-80	25.38	28.8
10	100	119	-16	-140	-256	-100	28.2	32
11	100	120.9	-27.6	-164	-291.6	-120	31.02	35.2
12	100	122.8	-39.2	-188	-327.2	-140	33.84	38.4
13	100	124.7	-50.8	-212	-362.8	-160	36.66	41.6
14	100	126.6	-62.4	-236	-398.4	-180	39.48	44.8
15	100	128.5	-74	-260	-434	-200	42.3	48
16	100	130.4	-85.6	-284	-469.6	-220	45.12	51.2
17	100	132.3	-97.2	-308	-505.2	-240	47.94	54.4
18	100	134.2	-108.8	-332	-540.8	-260	50.76	57.6
19	100	136.1	-120.4	-356	-576.4	-280	53.58	60.8
20	100	138	-132	-380	-612	-300	56.4	64

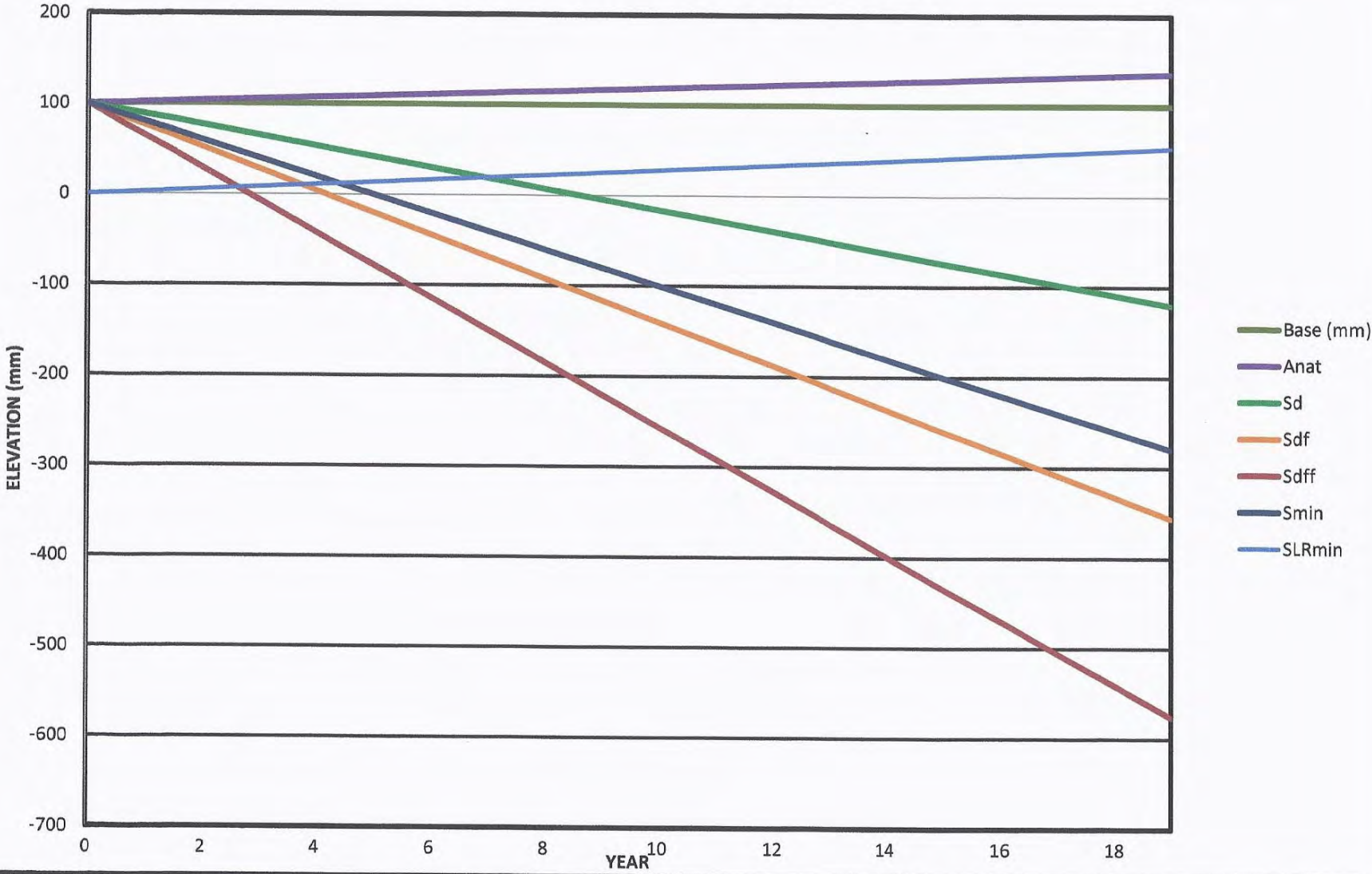
Data from:

Richardson, C. J. 1981. Pocosins: Ecosystem Processes and the Influence of Man on System Response in Pocosin Wetlands, 1981. Proceedings of POCOSINS: A Conference on Alternative Uses of the Coastal Plain Freshwater Wetlands of North Carolina

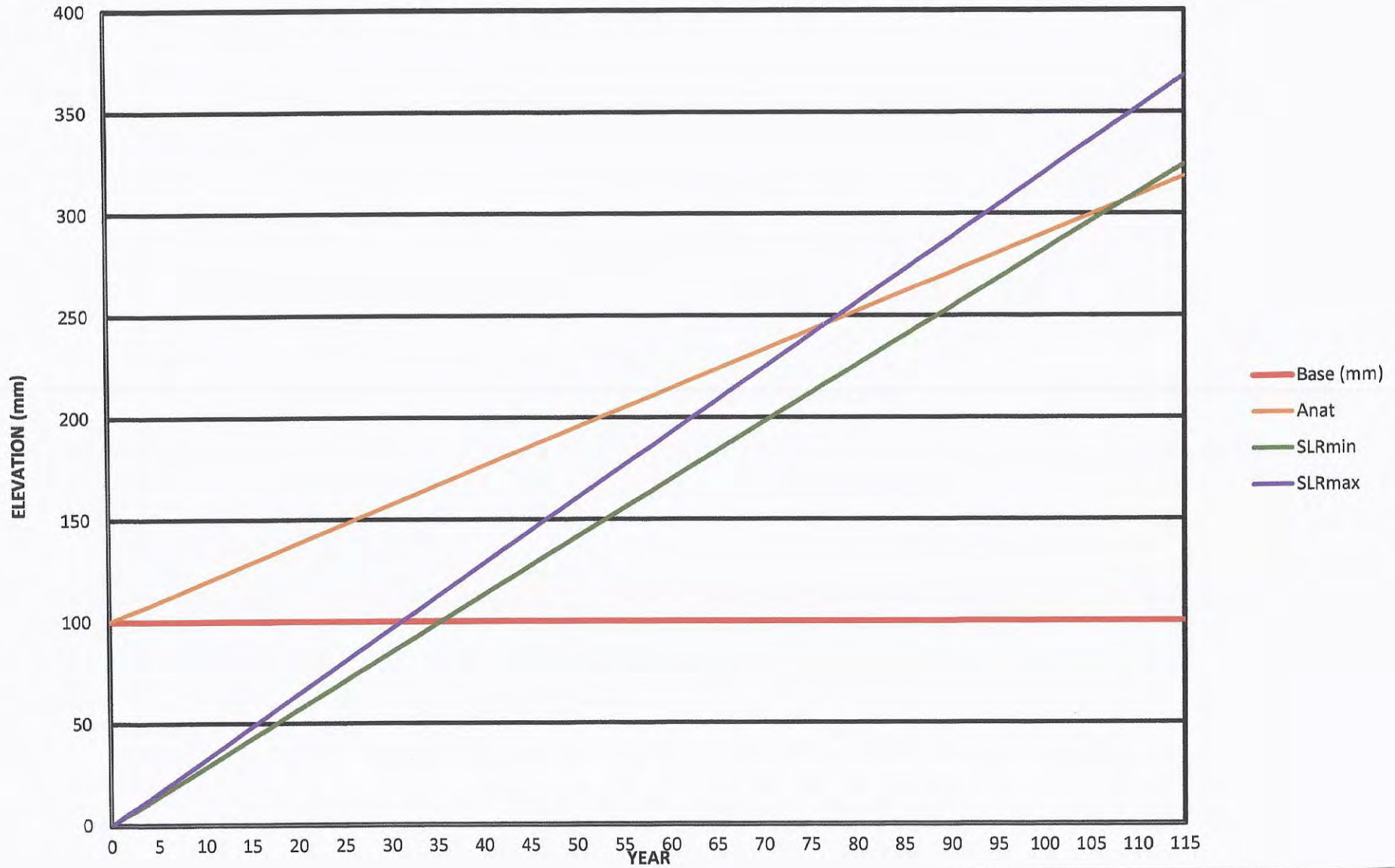
Dolman, J. D. and S. W. Buol. 1967. A study of organic soils (Histosols) in the tidewater region of North Carolina. Tech. Bul. 181. North Carolina Agricultural Experiment Station, Raleigh, NC. 52 pp.

Farnham, R. S. and H. R. Finney. 1965. Classification and properties of organic soils. Advances in Agron. 17:115-162. (Appox. 30% loss in thickness with drainage.)

Management Actions & Organic Soils



"Natural Processes" & Sea level Rise on Organic Soils

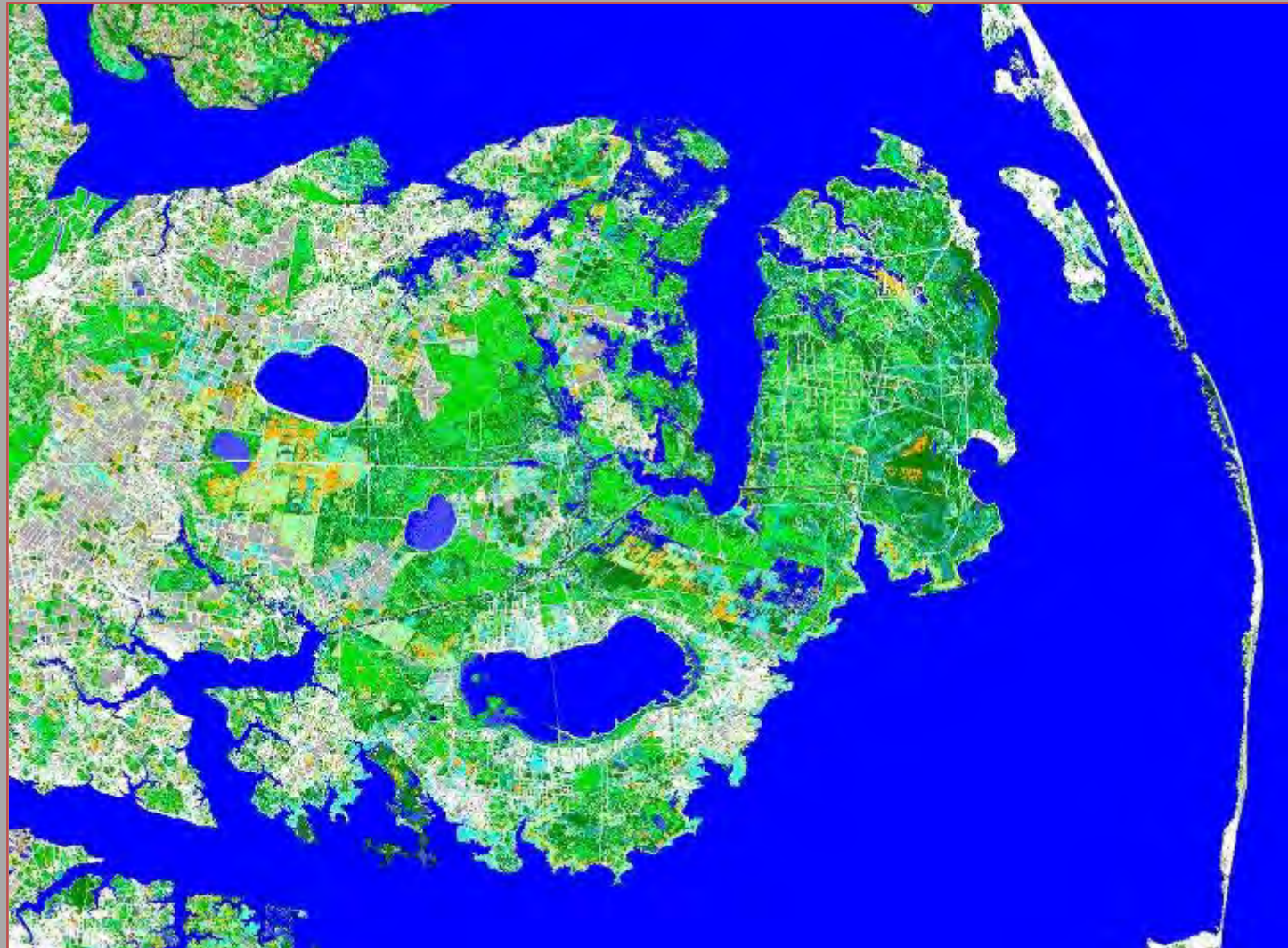


*Over 1 million acres will be inundated as sea-level rises
over the next few centuries*

**SLR Simulation:
4 in increments
up to 32 in**

**Current rate =
200 years**

**Best case =
150 years**

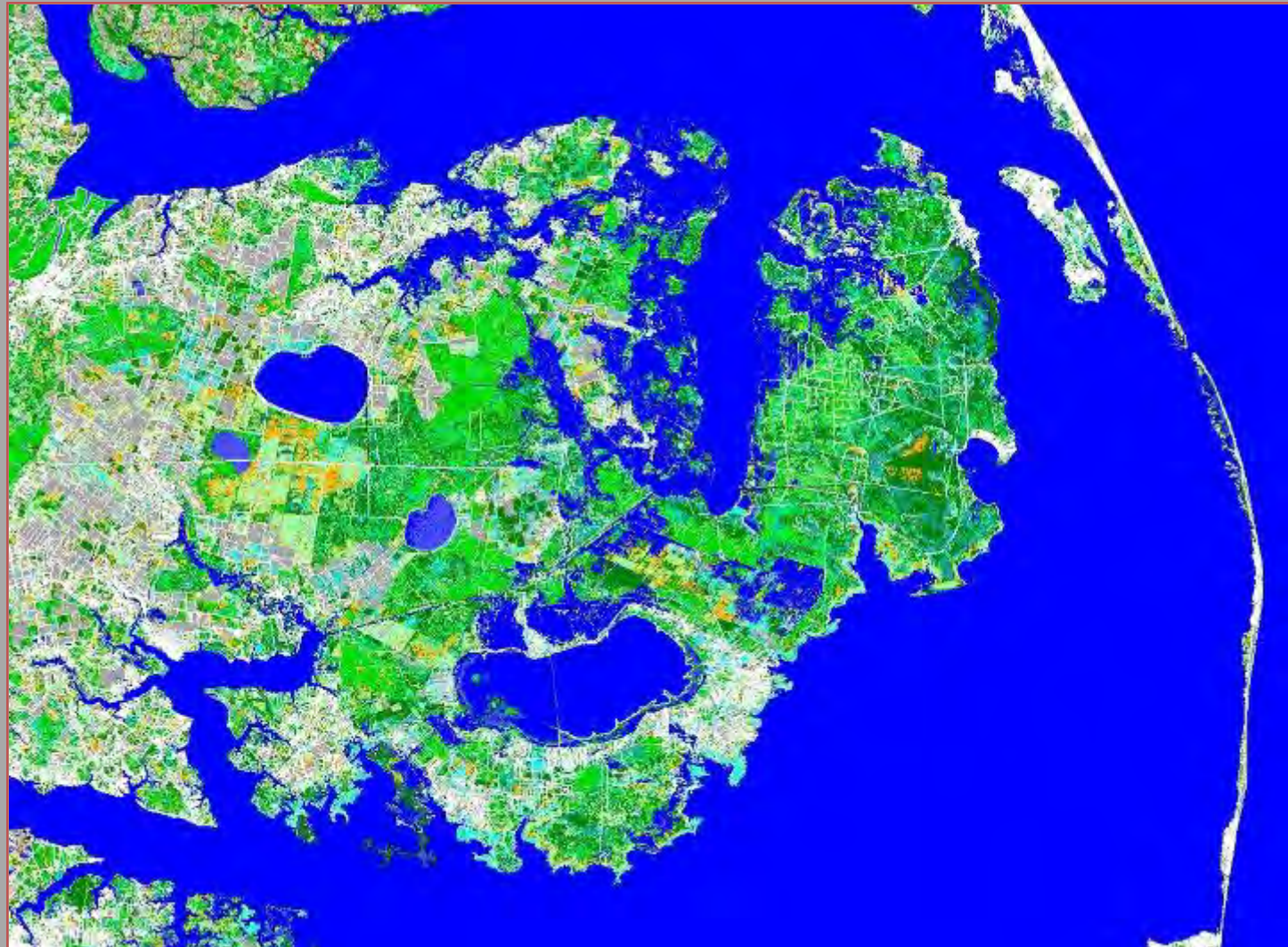


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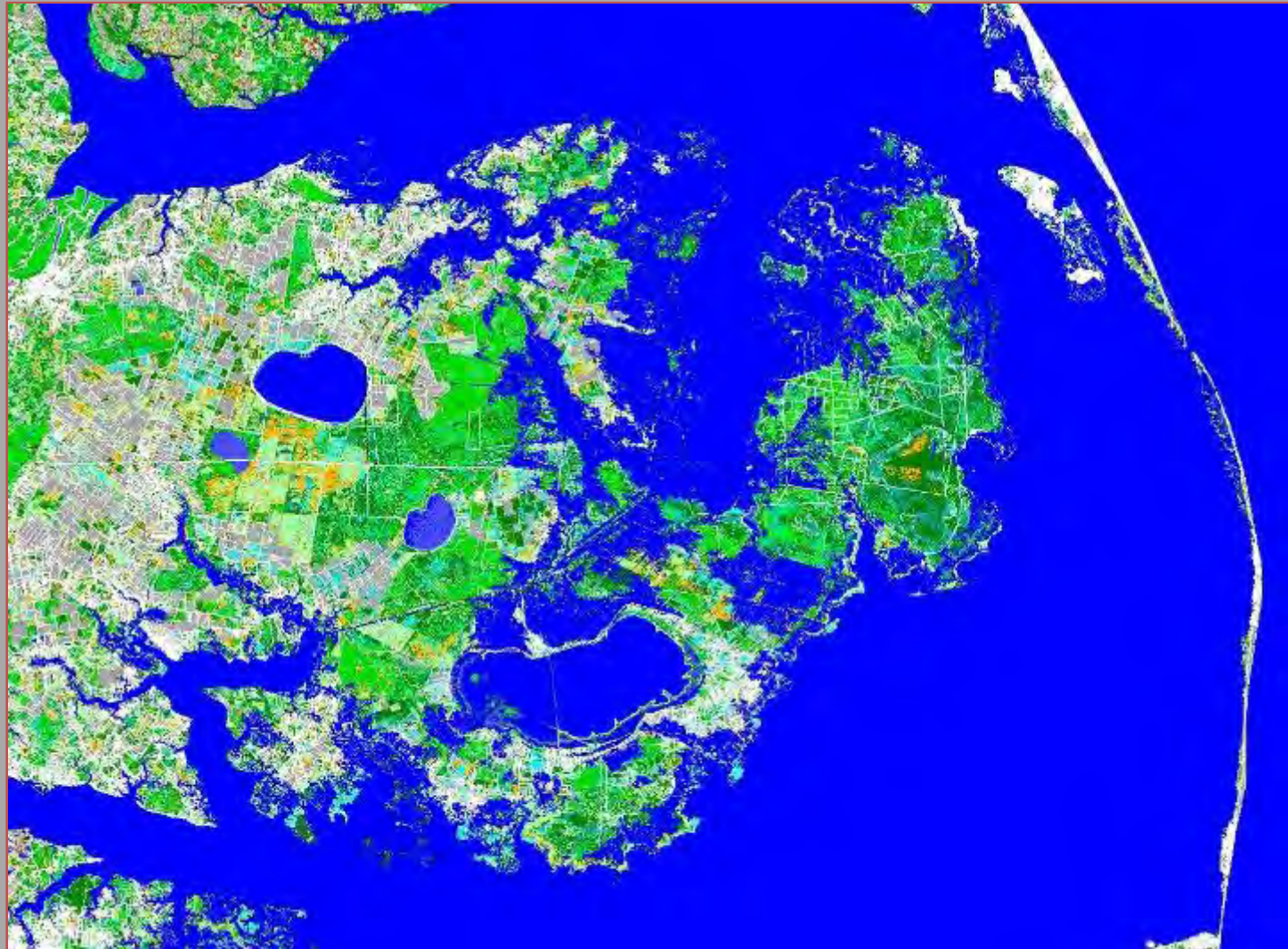


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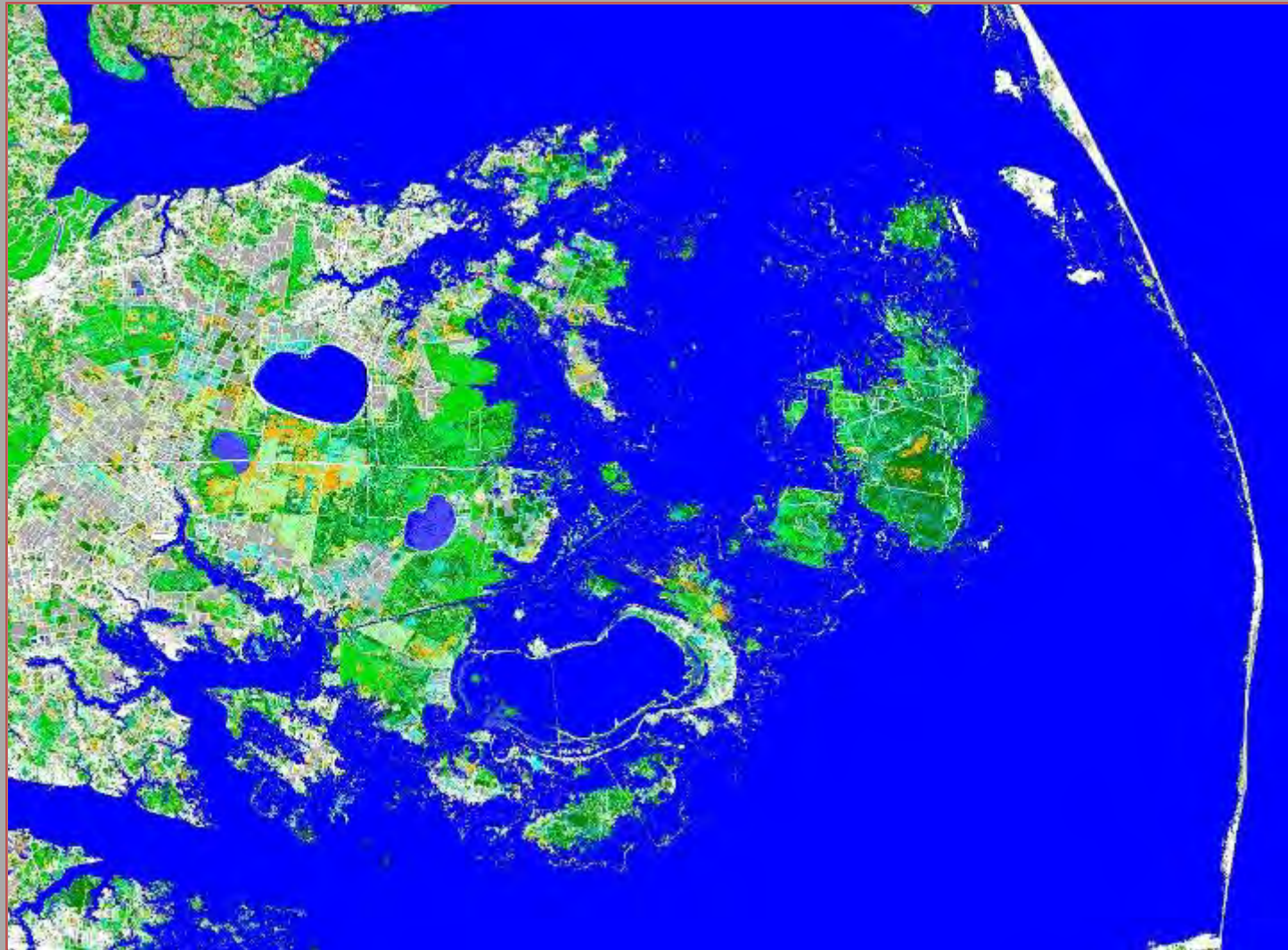


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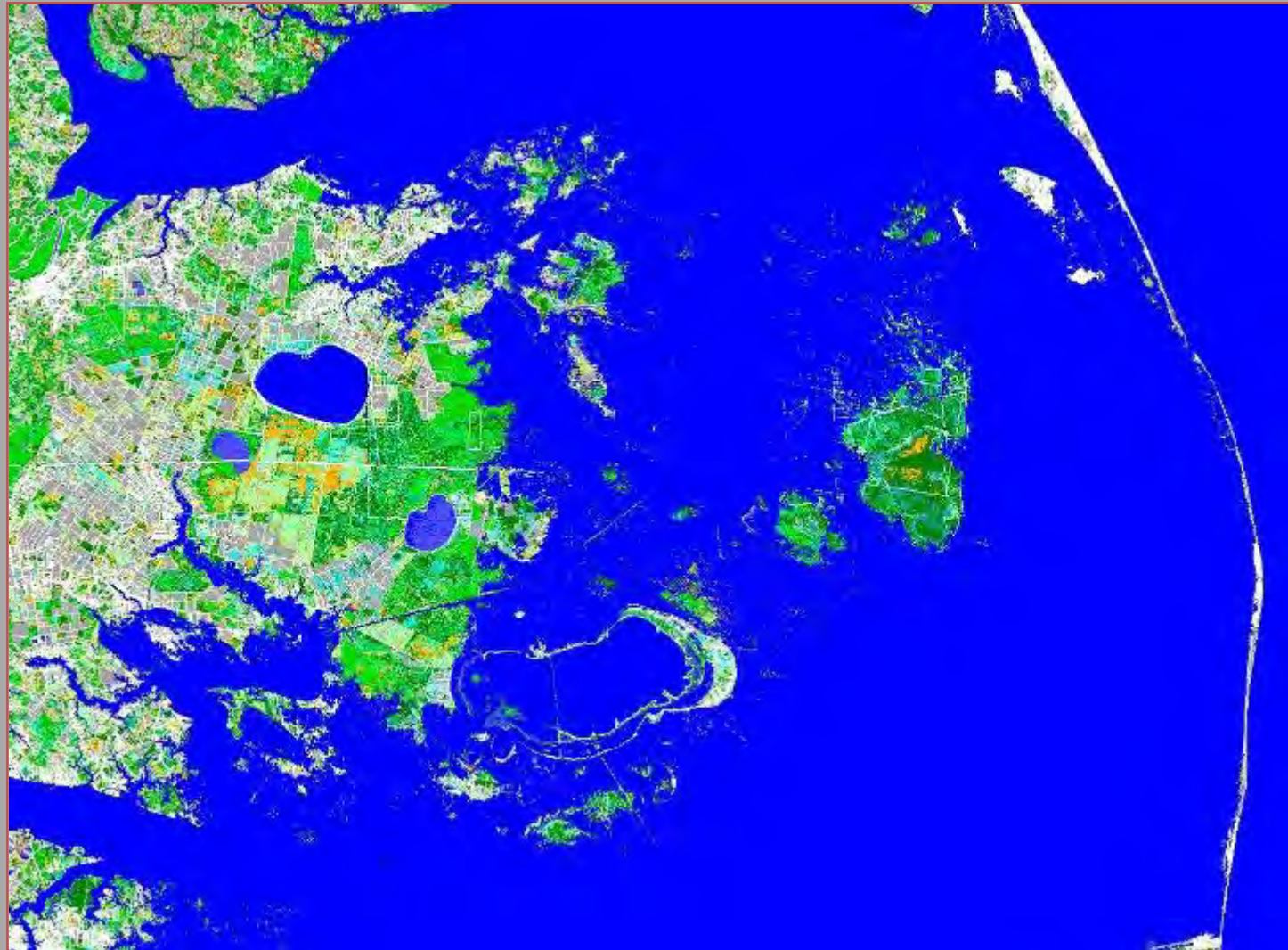



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An aerial photograph of a wetland landscape. The foreground and middle ground are dominated by a dense forest of tall, thin, light-colored trees, likely cypresses, growing in a shallow, dark water body. The background shows a more lush, green forest of shorter trees. The water is dark and reflects the sky. The overall scene is a mix of natural beauty and potential environmental concern.

***It would be easy to just throw up
our hands and say “Why bother?”
As professionals - Not an option***

Management actions can happen in these wetlands

BUT

***Must be more cognizant of our effects
on these landscapes***

Pea Island National Wildlife Refuge

**NATIONAL WILDLIFE REFUGE SYSTEM IMPROVEMENT ACT OF
1997**



EMPHASIS ON MISSION and PURPOSE

MISSION: “. . .to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.”

PURPOSE (Refuge specific): “. . .as a refuge and breeding ground for migratory birds and other wildlife.” (EO 7864, 4/8/1938)

“. . .for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.” (Migratory Bird Conservation Act)







E

0 0.05 0.1 0.2 Miles

WHAT ABOUT OTHER COASTAL REFUGES ??

Conservation concerns

Establishing Priorities

Integrating Other Initiatives

Adaptive management

etc

NE NC COASTAL NWRs

- Mackay Island
 - Currituck ??
- Alligator River
- Pocosin Lakes
- Roanoke River
- Mattamuskeet
 - Swanquarter
 - Cedar Island

SE VA COASTAL NWRs

- Back Bay ??
- Great Dismal Swamp

**Scale – Local, Landscape,
Regional, etc**



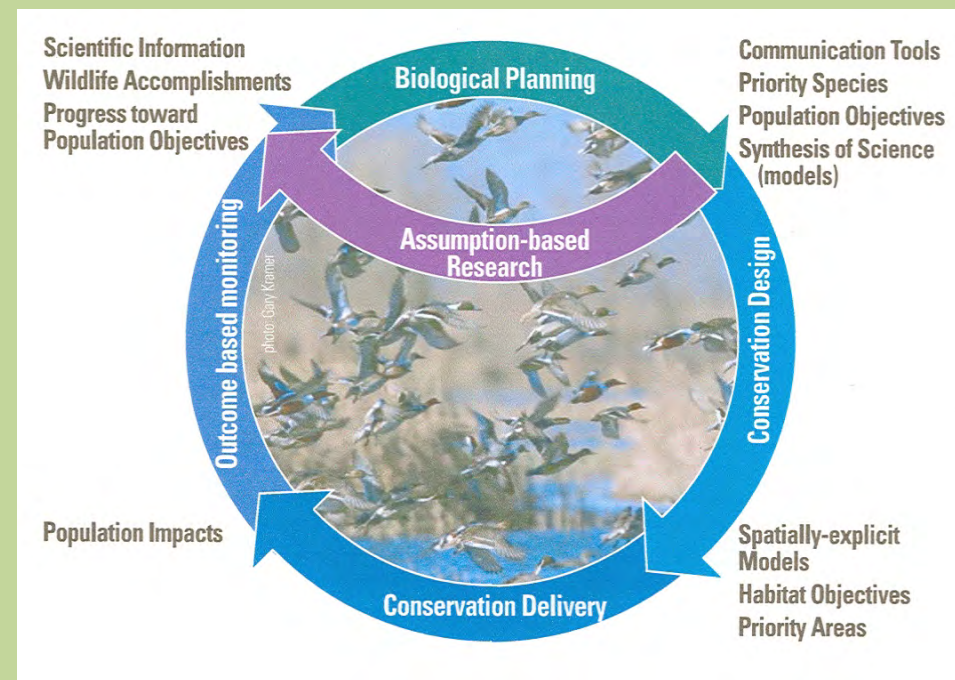
Strategic Habitat Conservation

“the new conservation strategy”

RD ESTABLISHED PRIORITIES FOR SE REGION

Highest priorities are:

- ✓ **National Wildlife Refuge System**
- ✓ **Landscape Conservation**
- ✓ **Migratory Birds**
- ✓ **Threatened & Endangered Species**
- ✓ **Aquatic Species**
- ✓ **Connecting People With Nature**



Guidance – many sources - - -

- Refuge Resources Of Concern
- Surrogate Species
- LCC - Priority Species
- Birds of Management Concern
- Migratory Birds - Focal Species

Focal Species = a subset of the Birds of Management Concern that also demonstrate other characteristics, including:

- high conservation needs
- represent a broader group of species
- partnerships
- etc.



IDENTIFYING REFUGE RESOURCES OF CONCERN AND MANAGEMENT PRIORITIES: *A Handbook*



King Rail Conservation Action Plan and Status Assessment





FROM SHC AND R4 PRIORITIES TO A PRESCRIBED BURN - - - - -

ALLIGATOR RIVER NATIONAL WILDLIFE REFUGE AS AN EXAMPLE

POCOSIN = SWAMP ON A HILL = PEAT DOME

Peat accretion rate (1.6 – 3.2 mm/yr)

Peat subsidence rate (Disturbance >20 mm/yr) (interactions - peat & salt water??)

Global climate change – rising sea level (2.8 -3.2 mm /yr) & salt water intrusion

Carbon sequestration vs carbon released (drainage, smoke, etc.)

Pond pine pocosin - What is suitable red-cockaded woodpecker habitat?

What is suitable Swainson's warbler habitat?

Now? In 25 years? In 50 years? In 100 years?

SO – Where are we headed with regards to habitat management?



CCP's establish framework for Refuge management GOALS & OBJECTIVES

MUST HAVE MORE DETAILED OBJECTIVES

If I ask – most fire objectives can be summed into 2 words

FUEL REDUCTION

(and that's OK – nice, emotional concept – politicians fund!)

To achieve R4 priorities and objectives - go beyond fuel reduction

Soil type & habitat parameters must be primary considerations to fulfill mission and purpose over the long term



AND we must integrate these SHC/R4 priorities and objectives as they are shaping management well into the future

The train is on the track!

Future success will depend on:

Habitat based objectives – not just fuel reduction

AND we have to write *SMART*, habitat based objectives

***SMART* =**

- ***Specific***
- ***Measurable***
- ***Attainable***
- ***Relevant***
- ***Timely***

Example of Goal and Objectives from the Handbook

Goal 4: Protect, manage, and restore a natural diversity of native floodplain forests representative of the historic lower Columbia River ecosystem.

Objective 4.1 Early Successional Floodplain Forest

Protect and maintain at least **330 acres** of early successional floodplain forest benefiting migratory and resident landbirds, native reptiles, and native amphibians. Early successional floodplain forest is characterized by the following attributes:

- Understory with 30-80% cover of native shrubs (3-12 feet tall) such as red-osier dogwood, willow, snowberry, Douglas' spirea, serviceberry, red elderberry, Indian-plum, cascara, rose with scattered openings containing native herbaceous species (e.g., Columbia sedge, green-sheathed sedge, wooly sedge, retrorse sedge, and stinging nettle).
- < 30% cover of invasive plants (e.g., reed canarygrass, false indigo, and blackberry) in understory/herbaceous layer:
- < 20% canopy cover of native trees (> 12 feet tall) such as Pacific willow, cottonwood, and red-osier dogwood.

Strategies Applied to Achieve Objective <i>Strategy applies to alternatives (✓) or is modified by replacing text in italics with the text in this row</i>	Alt 1 Current	Alt 2 Preferred	Alt 3	Alt 4
Monitor and treat up to 10% of early successional forest annually for invasive plants. Use IPM strategies including mechanical, physical, biological, and chemical means to eradicate, control, or contain invasive and undesirable plants.	up to 5%	✓	✓	✓
Allow natural succession via natural willow/cottonwood seedfall.	✓	✓	✓	✓
Pump water to mimic floodplain processes in units with water management capabilities to control invasive plants and promote native seed germination.		✓	✓	✓

Rationale: In presettlement times, Pacific willow (*Salix lucida* ssp. *lasianдра*) swamps were a widespread plant community along the lower Willamette and Columbia rivers. Presettlement components of this plant community probably included Columbia sedge (*Carex aperta*), green-sheathed sedge (*Carex feta*), wooly sedge (*Carex pellita*), retrorse sedge (*Carex retrorsa*), and

stinging nettle (*Urtica dioica*) (Guard 1995). Since the arrival of settlers in the early 1800s, between 50% and 90% of riparian habitat in Washington has been lost or extensively modified (Knutson and Naef 1997). This was once a common habitat type on the refuge and contributes to the species diversity. Much of the native understory has been lost or highly degraded by livestock grazing and alterations

to natural hydrology (levees, dams). Today Pacific willow and reed canarygrass form a common community type.

including temperature, water quality, water chemistry, cover, and nutrients.

Intact riparian areas are important to the conservation of Washington's vertebrate species. Of the 118 species of landbird migrants occurring in Washington, 67 (57%) use riparian habitat (Andelman and Stock 1994). Avian densities in riparian forests along the Columbia River can be as high as 1,500 birds per 100 acres (Tabor 1976). Approximately 85% of Washington's terrestrial vertebrate species use riparian habitat for essential life activities (Knutson and Naef 1997). Riparian habitat is additionally important to supporting healthy native fish populations by benefiting instream characteristics

The refuge contains approximately 1,100 acres of riparian and/or floodplain forest habitat in various seral stages or conditions. Most of this habitat on the refuge is vulnerable and/or remains in a degraded condition due to invasive plants, past grazing practices, alteration of hydrologic regimes, altered river levels, and poor native plant recruitment/ recovery. The refuge can contribute toward providing habitat or habitat connectivity for species that are dependent on riparian and floodplain forests by enhancing or restoring a mix of early, mid, and late successional floodplain forests on the refuge.

Objective 4.1a Restore Early Successional Floodplain Forest

Within the lifetime of the CCP, restore up to **160 acres** of selected old fields, pasture, and non-managed wetlands to early successional floodplain forest. Restored early successional floodplain forest is characterized by the following attributes:

- Understory with 30-80% cover of native shrubs (3-12 feet tall) such as red-osier dogwood, willow, snowberry, Douglas' spirea, serviceberry, red elderberry, Indian-plum, cascara, and rose with scattered openings containing native herbaceous species (e.g., Columbia sedge, green-sheathed sedge, wooly sedge, retrorse sedge, and stinging nettle).
- < 30% cover of invasive plants (e.g., reed canarygrass, false indigo, and blackberry) in understory/herbaceous layer.
- < 20% canopy cover of native trees (> 12 feet tall) such as Pacific willow, cottonwood, and red-osier dogwood.

Alternatives <i>Objective as written above is modified by replacing acres in italics with the text in this row.</i>	Alt 1 Current	Alt 2 Preferred	Alt 3	Alt 4
<i>Acres of early successional floodplain forest restored over lifetime of CCP:</i>	0 acres	160 acres	170 acres	185 acres
Strategies Applied to Achieve Objective	Alt 1	Alt 2	Alt 3	Alt 4
Seed or plant willow and red-osier dogwood in wetlands, wetland edges, or other appropriate hydric areas. Incorporate techniques to remove competing vegetation such as reed canarygrass by mechanical or chemical methods and use fencing or mats to reduce rodent damage to new plantings. New plantings will focus on connecting or expanding existing riparian stands in areas that are unlikely to be used by focus species such as dusky Canada goose or cranes.		✓	✓	✓
Use IPM strategies including mechanical, cultural, biological, and chemical means to eradicate, control, or contain invasive and undesirable plants (see Appendix K).		✓	✓	✓
Allow natural succession via natural willow/cottonwood seedfall.	✓	✓	✓	✓
Pump water to mimic floodplain processes in units with water management capabilities to control invasive plants and promote native seed germination and survival.		✓	✓	✓

Rationale: The refuge has an opportunity to restore early successional floodplain (bottomland) forest in selected old fields, pastures with low productivity, and wetland basins with poor water holding capabilities. Restored early successional floodplain forest benefits migratory and resident landbirds, native reptiles, and native amphibians. Planting willow and red osier dogwood would accelerate regeneration, enhance habitat quality, and provide habitat connectivity with existing floodplain forest. Highest priority areas for restoration would be based on their size and connectivity on and off the refuge.

Though these acreages are relatively small, restoration efforts may provide valuable habitat or habitat connectivity for some species that are dependent on riparian and bottomland forests. New plantings will focus on connecting or expanding existing riparian stands in areas that are unlikely to be used by focus species such as dusky Canada geese or cranes. One seasonal wetland on River 'S' Point (16 acres) is undergoing succession to native trees. Under all alternatives this succession would continue; therefore, this wetland is now included under the early successional floodplain forest habitat type.



Alligator River National Wildlife Refuge . . .

Established in 1984 as a refuge for managing, protecting, and enhancing the area's unique wetland habitats and their associated species





Alligator River National Wildlife Refuge

WILDLIFE SPECIES OF MANAGEMENT CONCERN

Migratory land birds of national or regional concern

Red-cockaded woodpecker

Black throated green warbler

Neotropical migrants

Waterfowl, Marsh birds

Wading birds

Red wolf

Black bear

Anadromous fish

American alligator

State-listed reptiles and amphibians

White-tailed deer



Possibilities in the face of rising sea level and salt water intrusion????

*Accept the situation
Manage accordingly*

FRONTLINE COMMUNITIES

INTERIOR COMMUNITIES

FRONTLINE COMMUNITIES

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat
© 2013 Google

Google earth

Room for lots of discussion on management strategies for each

FRONTLINE Habitat

- Natural Processes
- Restoration vs "pre-storation"
- Spending scarce management \$\$
- RCW mgt??????
- etc

INTERIOR Habitat

- The Last "Stand"??
- Higher priority for management \$\$
- Enough time
 - with canals
 - w/out canals
- etc



Use fire to increase rate of transition from forest to shrub to marsh???

Habitat Management Plans



Alligator River National Wildlife Refuge

U.S. Fish and Wildlife Service

HABITAT MANAGEMENT PLAN



Photo: USFWS-Dennis Stewart

JULY 2013

DRAFT

DRAFT

DRAFT

TWELVE MANAGEMENT UNITS

- Each unit characterized by habitat types and acreage of each
- Refuge/surrogate/priority species will be identified for habitat types
- Objectives set for habitat types
- Strategies developed for achieving the objectives

4.0 Habitat Management Units

Management Unit	Size (ac)	Soil Type	Habitat Types	Current Condition	Refuge Treatment History
Brier Hall	7110				
Cropland	5750				
North 64	14720				
Mashoes	3854				
South 64	2947				
Northwest Swamp	24157				
Southwest Swamp	23321				
South Frontline Pocosin	16809				
Low Pocosin	11225				
North Frontline Pocosin	18361				
Long Curve	5662				
Upper Milltail	14252				

***SMART* OBJECTIVES**

(But they will need to become smarter as the HMP is finalized!)

- **2.2.1 Brier Hall Unit:**
- **Goal:** Inventory and manage to provide diverse, high quality mid-Atlantic forested wetlands, transitional wetlands, marsh, and aquatic habitat types for wildlife.
(CCP)

- **2.2.1.7 Pond pine shrub pocosin**
- **Objective 1:** Protect and manage **211.4** acres of pond pine/shrub pocosin habitat continuously for red-cockaded woodpecker and Swainson's warbler to the following standards:

- ✓ **50-70% overstory pond pine canopy cover over 75% of the total habitat type acreage in this unit**
- ✓ **Maintain 70-80% of unit acreage for a shrub understory with a height range of 6-25 feet.**

Strategies:

- **Monitor forest health annually.**
- **Treat infestations of pests and diseases as needed.**
- **Monitor and inventory habitat annually to determine value for surrogate and refuge wildlife species.**
- **Through the use of current aerial photography and GIS digitize habitat types and evaluate habitat change at 5-year intervals.**
- **Prescribed fire with a return interval of 15-20 years**
- **Allow and assist other agencies, organizations, and universities to conduct studies and investigations.**

2.2.1.8 Pond pine cane pocosin

Objective: Protect and manage 159.4 acres of pond pine/cane pocosin habitat continuously for red-cockaded woodpeckers and Swainson's warbler to the following standards:

- ✓ 50-70% overstory pond pine canopy cover over 75% of the total habitat type acreage in this unit**
- ✓ Maintain 60-90% of unit acreage for cane understory with a height of 4-12 feet and less than 25% shrub**

Strategies:

- Monitor forest health annually**
- Treat infestations of pests and diseases as needed**
- Monitor and inventory the habitat annually for its value for the wildlife species present**
- Restore areas killed by the southern pine beetle & not affected by salt water intrusion**
- Prescribed fire with a return interval of 10-15 years**
- Allow and assist other agencies, organizations, and universities to conduct studies and investigations.**

Rationale: This plan is an improvement on the current management as it provides for monitoring unit habitat value for surrogate and refuge wildlife species. Monitoring will also help evaluate the rate of habitat change due to climatic factors and the effectiveness of refuge management on pond pine pocosin with a shrub and with a cane understory in this management unit

If done correctly HMP should:

- Provide sound, professional wildlife/habitat based guidance for management actions***
- Provide wildlife based guidance to fire program for scheduling & prescriptions for prescribed fire***

BUT will require close coordination between program areas, flexibility, and monitoring.

MONITORING – CRITICAL TO DETERMINE SUCCESS

Various levels of monitoring: –

❖ ***“Windshield survey”***

- Observations are anecdotal
- Anecdotal observations = opinion (everybody has one)

❖ ***“Bare bones” monitoring***

- Requires staff time, funding, sample design, & data analysis
- Results provide more defensible data base, but not rigorous

❖ ***Monitoring for publication***

- Requires more staff time & more funding
- Requires more robust sample design & data analysis
- Results provide a defensible data base for decision making

❖ ***University level research***

- Encourage universities to implement research projects
- Pure or applied science
- Assist to the extent possible

Bottom line = you get what you pay for



Some portion of today's fuel is tomorrow's soil in peat systems!



Must think in terms of what this area will be – not what it was!

BUT managing to historic conditions - - - - - ??????

- ❖ Last medieval warming period ≈(1100 AD)
- ❖ Pre -settlement



THANK YOU!

**Q
U
E
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??**

