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

- Protected Lands
- The Nature Conservancy's Ecoregional Priorities

Legend:
- Green: Protected Lands
- Light Green: The Nature Conservancy's Ecoregional Priorities

Scale:
- 0 5 10 20 30 40 Miles

Locations:
- Chowan River
- Roanoke River
- Tar River
- Alligator River
- Pocosin Lakes NWR
- Albemarle Sound
- Pamlico Sound
- Virginia Beach
- Nags Head

Counties:
- Greenville
- Pitt County
- Beaufort County
- Washington County
- Hyde County
- Gates County
- Hertford County
- Northampton County
- Southampton County
- Suffolk
- Cape Fear
- Beaufort
Eleven National Wildlife Refuges

Southeast Virginia/
Northeast North Carolina
Coastal Plain

120 miles

154 miles

Atlantic Ocean

Outer Banks Region

National Wildlife Refuges
Vulnerability in NE North Carolina

- Extremely low elevation
- Third most vulnerable region to impacts of sea-level rise in North America\(^1\)
- RSLR 3.0-3.3 mm/y\(^2\)
- 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

\(^1\)US CCSP 2009, \(^2\)Kemp et al. 2009
### Accretion, Subsidence, & Sea Level Rise in Organic Soils

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

Data from:


"Natural Processes" & Sea level Rise on Organic Soils

- Base (mm)
- Anat
- SLRmin
- SLRmax

Elevation (mm) vs. Year
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
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
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
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
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
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)
WHAT ABOUT OTHER COASTAL REFUGES ??

Conservation concerns

Establishing Priorities

Integrating Other Initiatives

Adaptive management

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

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.
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
**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 239 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, retrorsa 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**

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Alt 1 Current</th>
<th>Alt 2 Preferred</th>
<th>Alt 3</th>
<th>Alt 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allow natural succession via native willow/cottonwood seed fall.</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pump water to mimic floodplain processes in units with water management capabilities to control invasive plants and promote native seed germination.</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

**Rationale:** In presettlement times, Pacific willow (Salix lucida esp. lasiandra) 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 folea), wooly sedge (Carex peliata), retrorsa 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.

**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, retrorsa 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**

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Alt 1 Current</th>
<th>Alt 2 Preferred</th>
<th>Alt 3</th>
<th>Alt 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allow natural succession via native willow/cottonwood seed fall.</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pump water to mimic floodplain processes in units with water management capabilities to control invasive plants and promote native seed germination and survival.</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

**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.
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
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???
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

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

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

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

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

THANK YOU!

Q U E S T I O N S ??