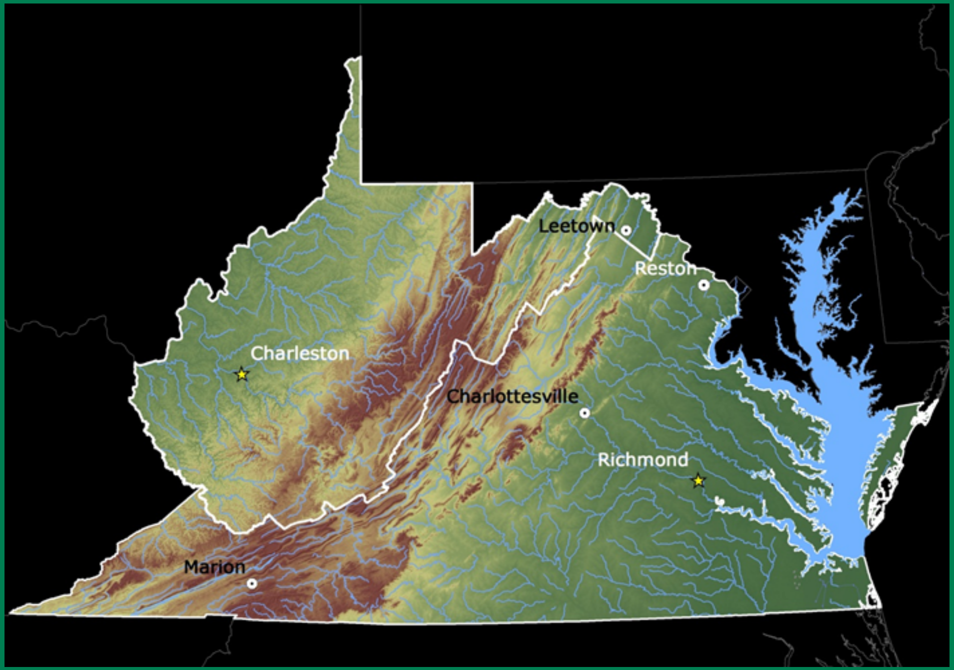
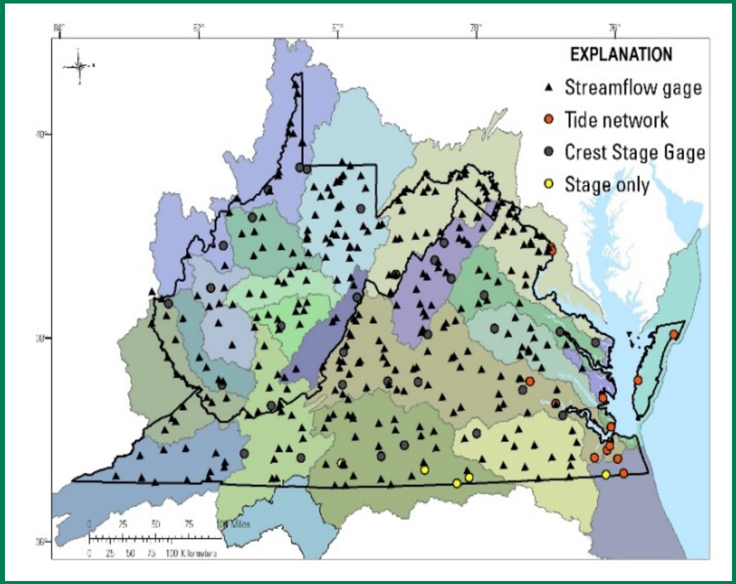
Advances in Earth Science

Data for Decision Making

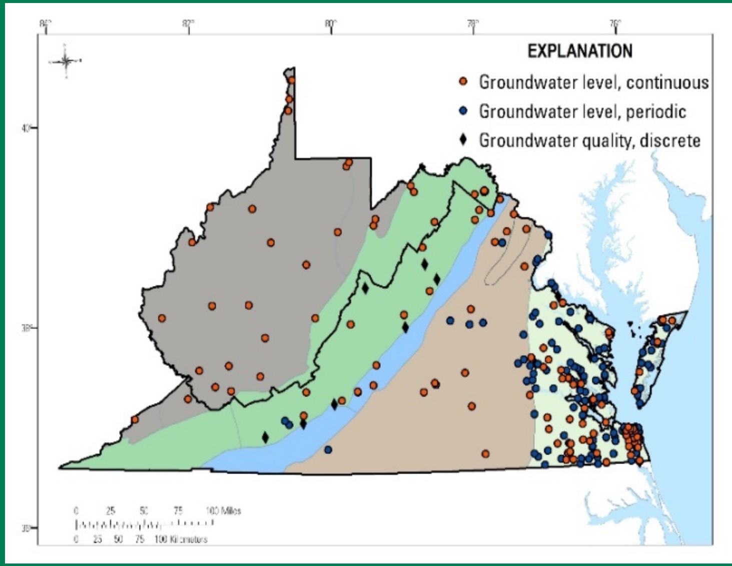


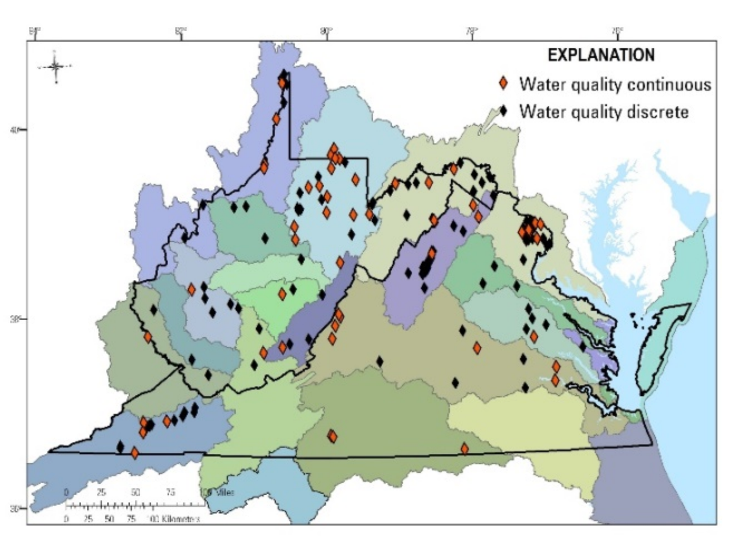
Mark Bennett

USGS Virginia and West Virginia
Water Science Center



Consistent, long-term data is the foundation for our science and provides the basis for decision making by water resource managers.





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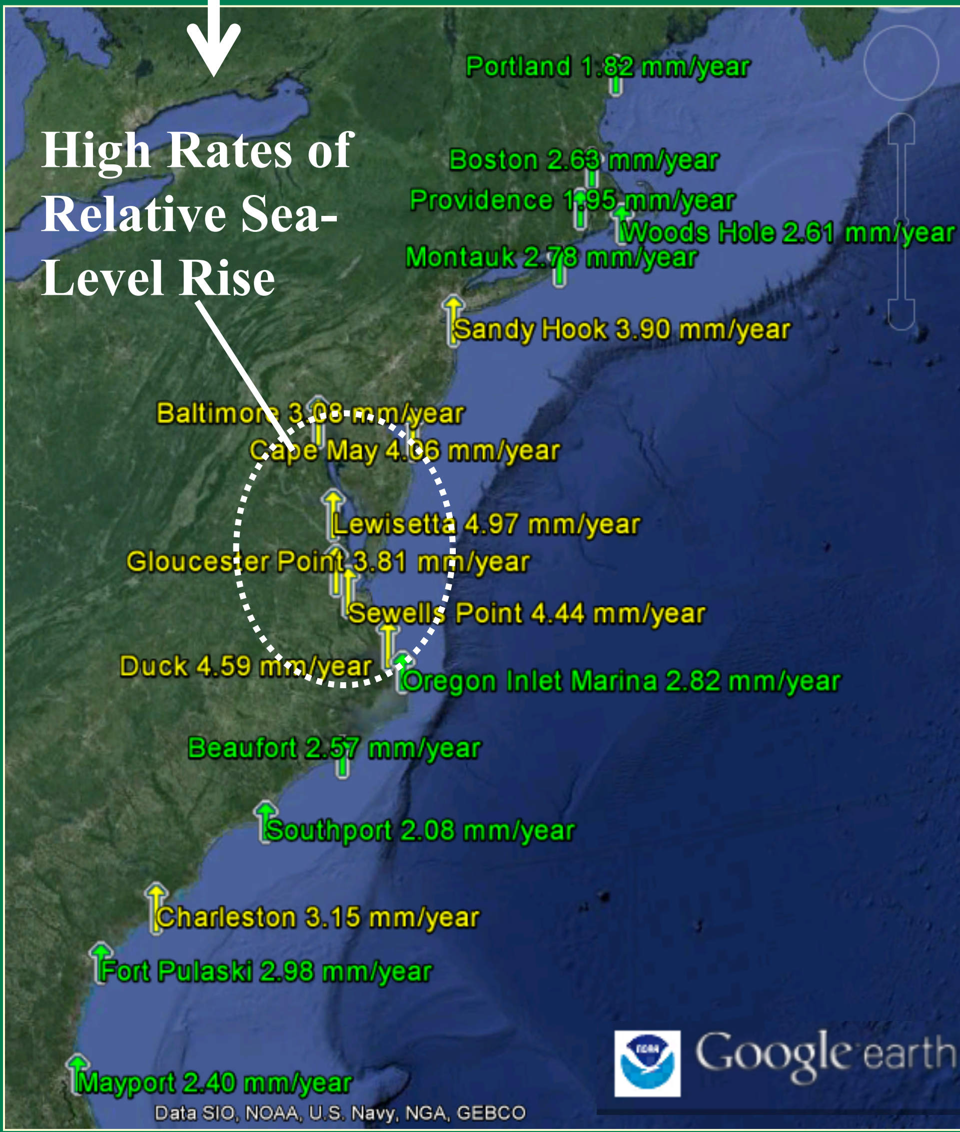
- **Understanding ecosystems and predicting ecosystem change**
- **Understanding climate variability and change**
- **Water availability and water use**
- **National hazards, risk, and resilience assessments**

USGS

The Problem

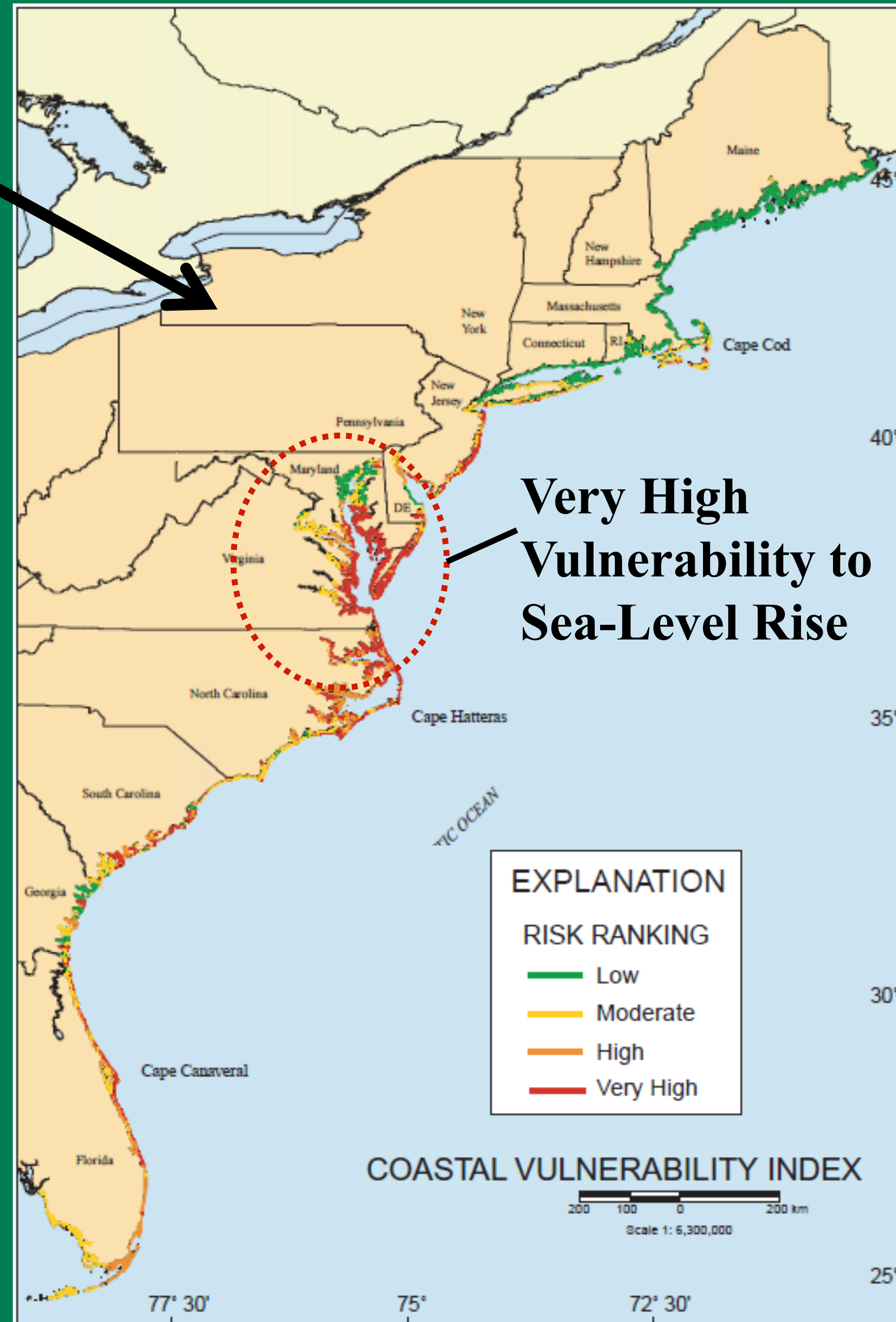
Why it is Important

High Rates of Relative Sea-Level Rise



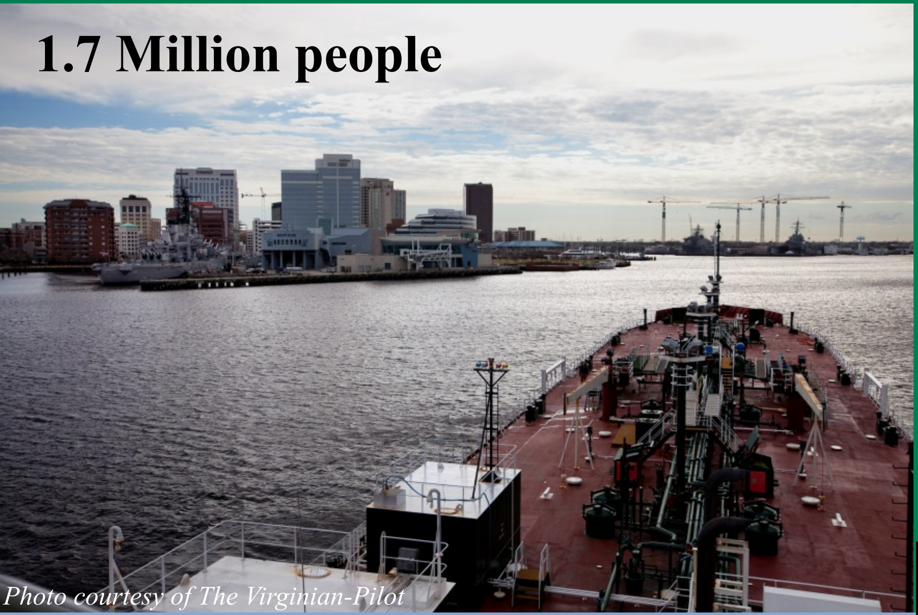
NOAA Sea-Level Trend Data (Zervas, 2009)

Very High Vulnerability to Sea-Level Rise

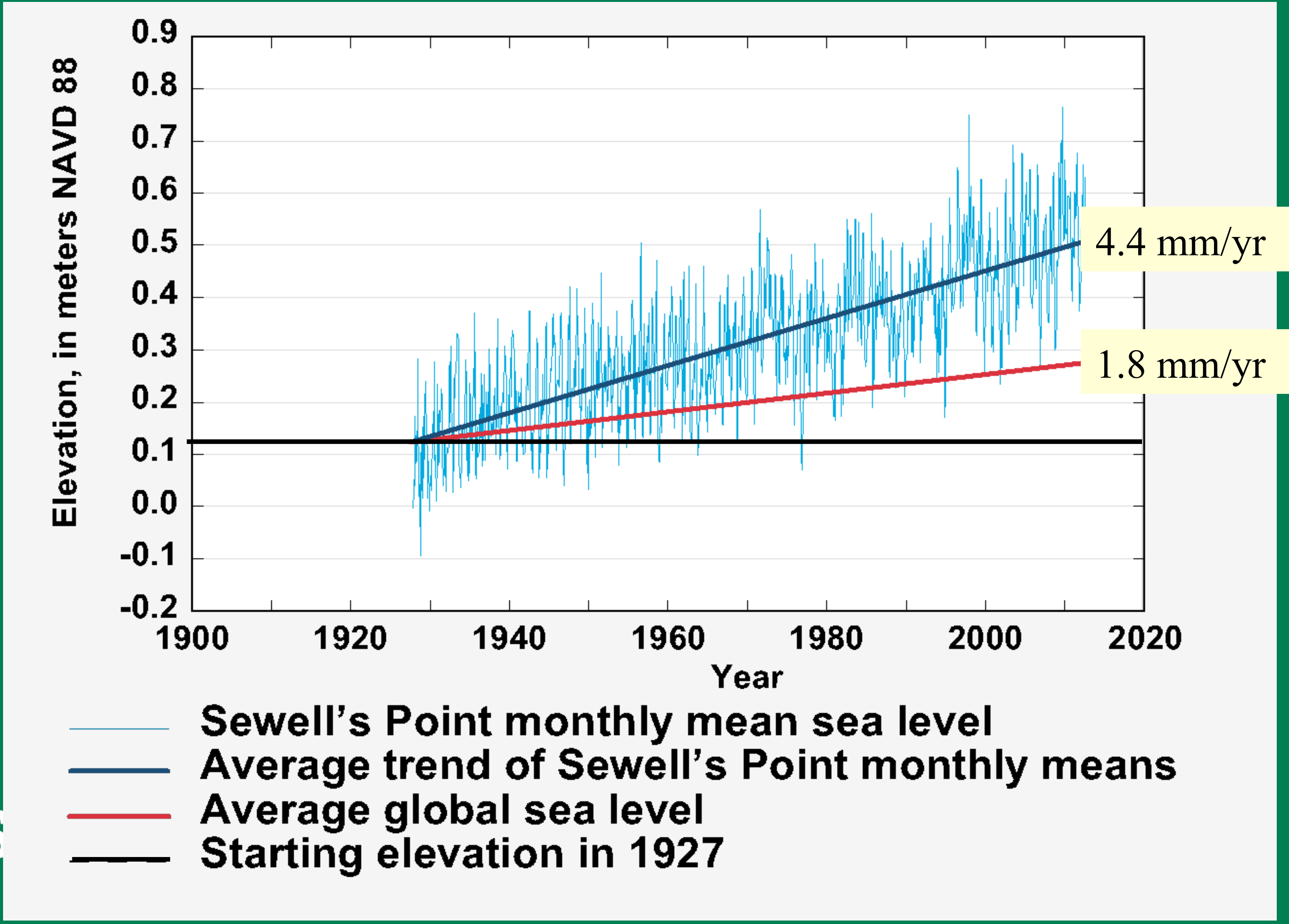


Thieler and Hammar-Klose, 1999, USGS , OFR 99-593

Infrastructure, Historic Sites, and Ecosystems Affected by Sea-Level Rise



Sea-Levels at Sewells Pt., Norfolk NOAA# 8638610



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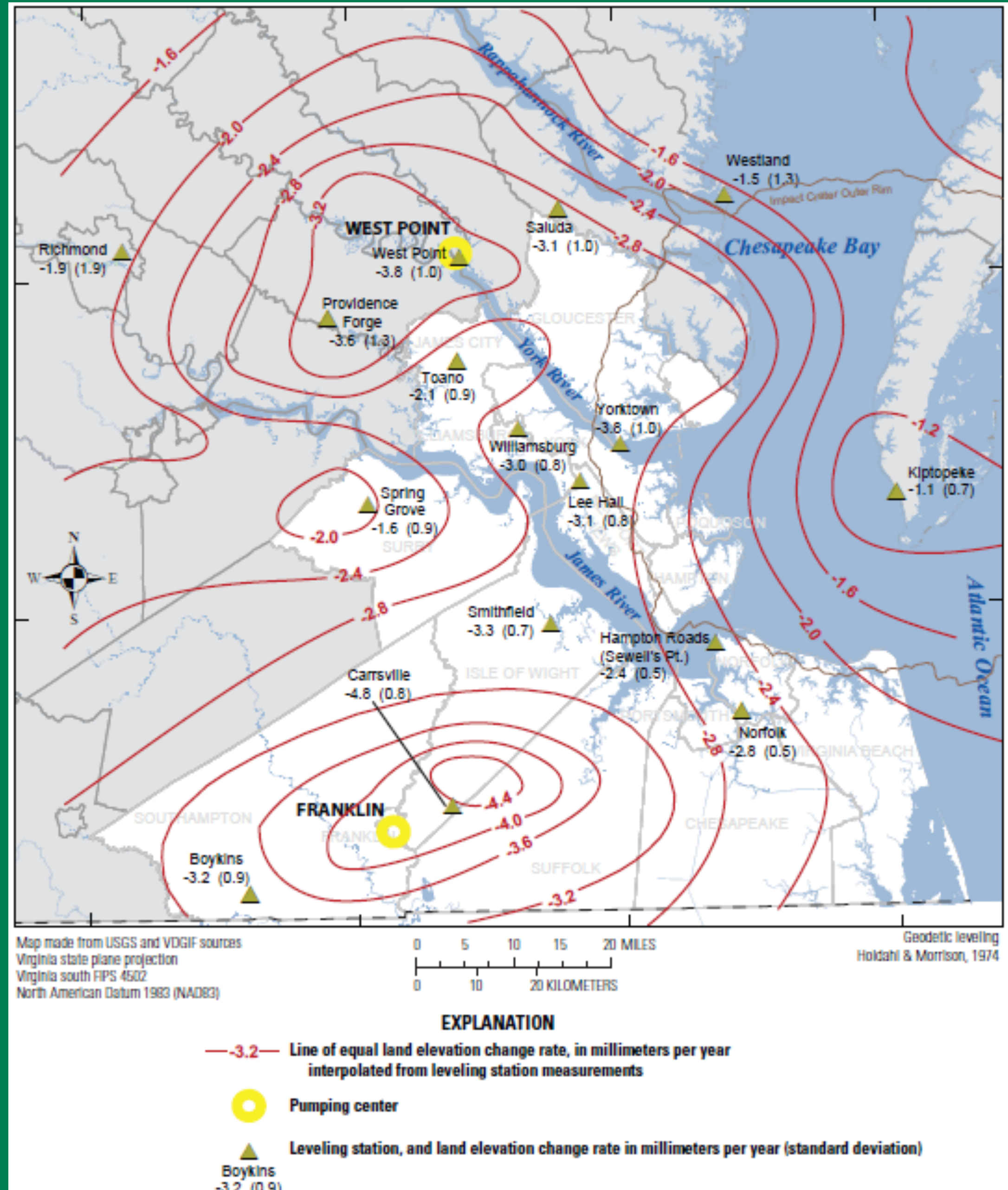
Land Subsidence 1940-1970 (mm/yr)

Published by National Geodetic Survey

Holdahl and Morrison, 1974, Tectonophysics, 23(4), p. 373–390



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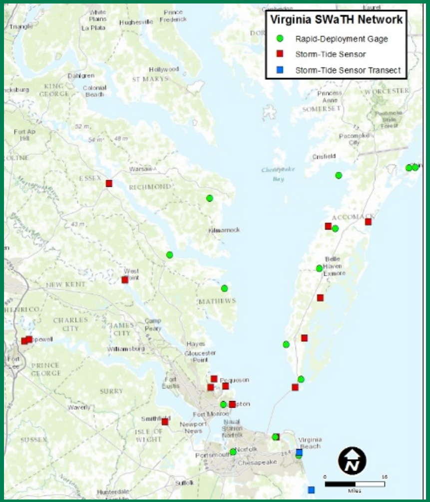
Coastal Virginia Tide and Storm Monitoring

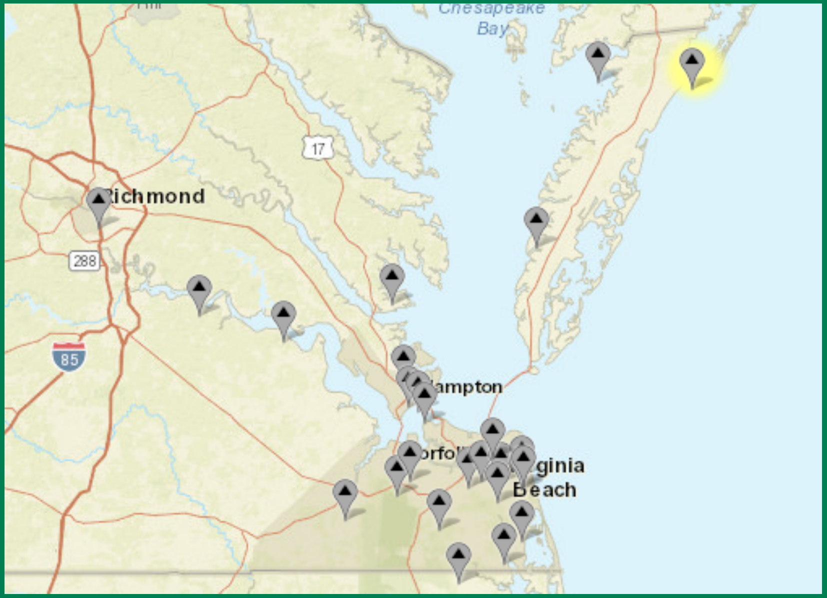
- USGS Surge-Wave-and-Tidal-Hydrodynamics
- Continuous sites expansion started as a result of USGS Hurricane Sandy Funding and local contacts
- 26 continuous sites (25 new)
- 13 Rapid deployment gages
- 14 storm-tide locations
- 2 wave trans-sects

Coordination and Funding

- Localities (10)
- NWS & NOAA CO-OPS
- NASA and COE
- USGS



Surge-Wave-and-Tidal-Hydrodynamics sites



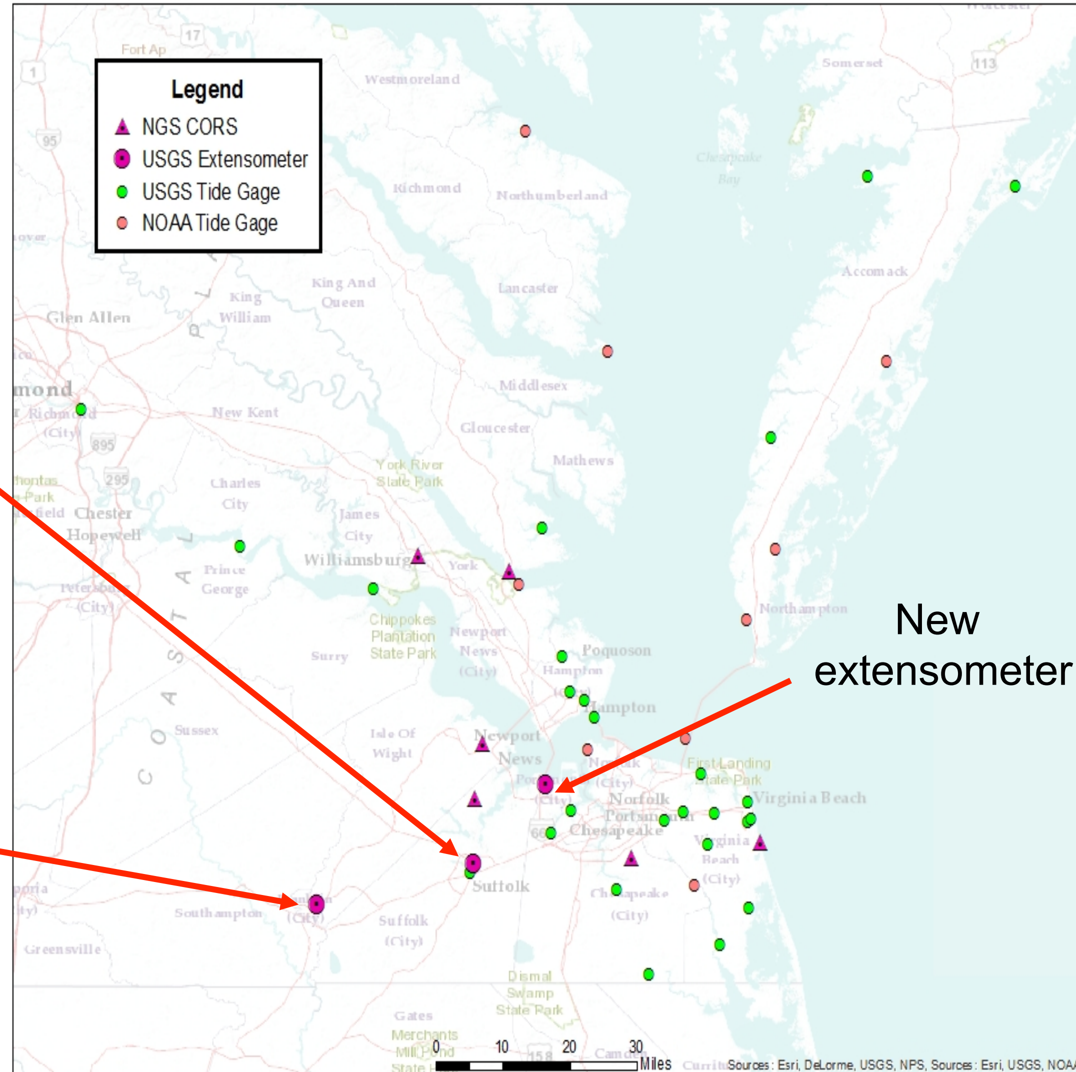
Continuous Cooperatively Funded Monitoring sites

USGS

Subsidence Monitoring Network (Re)-Establishment

Suffolk
58C 52

Franklin
55B 60



New extensometer

Total Nitrogen per Acre Loads and Trends: 2005-2014

Improving Trends = 44 of 81 (54%)
Degrading Trends = 22 of 81 (27%)
No Trend = 15 of 81 (19%)

Of the 14 stations with the highest per acre loads for Total Nitrogen:

- 6 have improving trends
- 3 have degrading trends
- 4 have no trends
- 1 has insufficient data for trends

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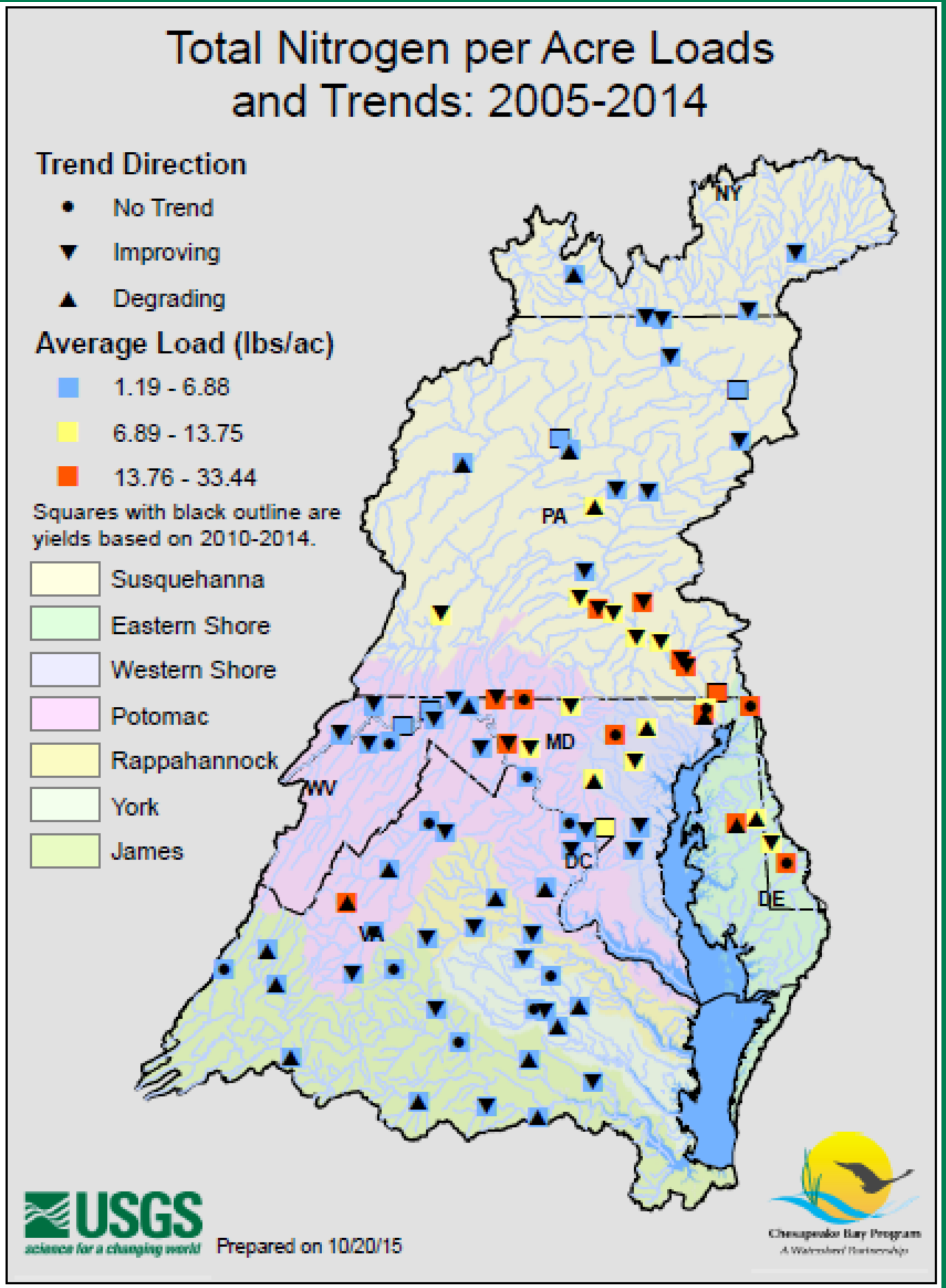

Changes in Nitrogen per Acre Loads: 2005-2014

Trend in load network is the first of its kind

Improving Trends = 44 of 81 (54%)
Degrading Trends = 22 of 81 (27%)
No Trend = 15 of 81 (19%)

Improving Stations

Range = -0.10 to -5.07 lbs/ac

Median = -0.68 lbs/ac (-10.0%)

Degrading Stations

Range = 0.04 to 1.21 lbs/ac

Median = 0.33 lbs/ac (7.84%)

Download figure:
http://cbrim.er.usgs.gov/maps.html

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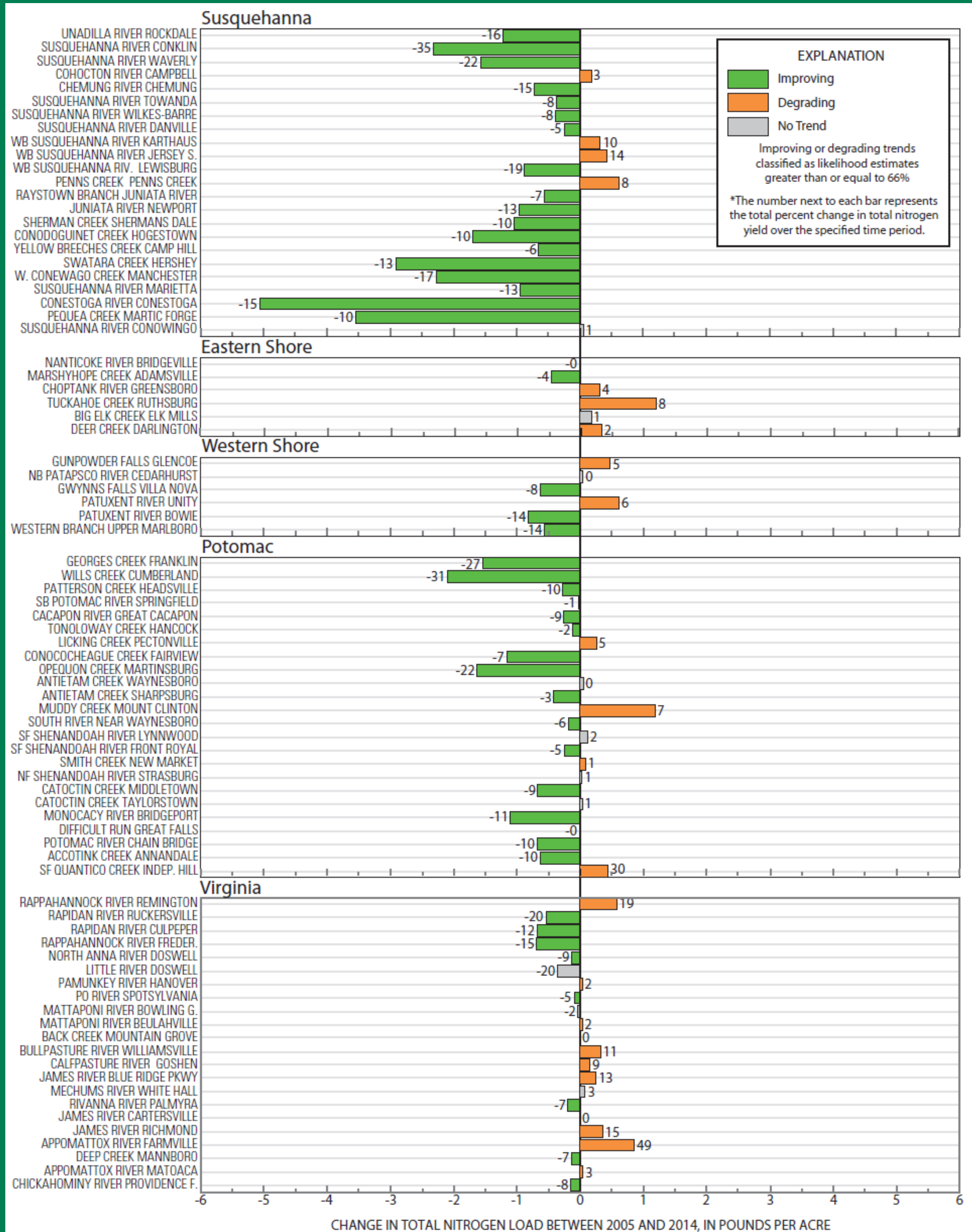

Assessing Watershed Scale Responses to BMP Implementation in Fairfax County

1. Generate long-term monitoring data to describe:
   - Current water-quality conditions,
   - Trends in water-quality, nutrient and sediment loads and yields.

2. Evaluate relations between observed conditions/trends and BMP implementation.

3. Transfer the understanding gained to other less-intensively monitored watersheds.

USGS

Network

- Site selection optimized using statistical analyses and local knowledge
- All watersheds < 5 mi^2

THE GREAT DISMAL SWAMP

Hydrologic Response to Increased Water Management Capability at the Great Dismal Swamp National Wildlife Refuge: Enhancing Resiliency for Wildlife and People

Collaborative effort among:

- U.S. Fish and Wildlife Service
- USGS Virginia Water Science Center
- The Nature Conservancy
- The City of Chesapeake
- Virginia Department of Conservation and Recreation, Division of Game and Inland Fisheries
- U.S. Army Corps of Engineers

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THE GREAT DISMAL SWAMP

Hydrologic Response to Increased Water Management Capability at the Great Dismal Swamp National Wildlife Refuge: Enhancing Resiliency for Wildlife and People

Objective:

To assess the hydrologic response to increased water management and use the assessment to help design improved management strategies that (1) improve habitats by increasing the wetness and peat formation in the swamp, (2) reduce downstream flooding, and (3) reduce the risk of catastrophic fires

Roots Exposed by Decomposing Peat

Burned Peat and Atlantic White Cedar Stumps– South One Fire, June 9-October 11, 2008

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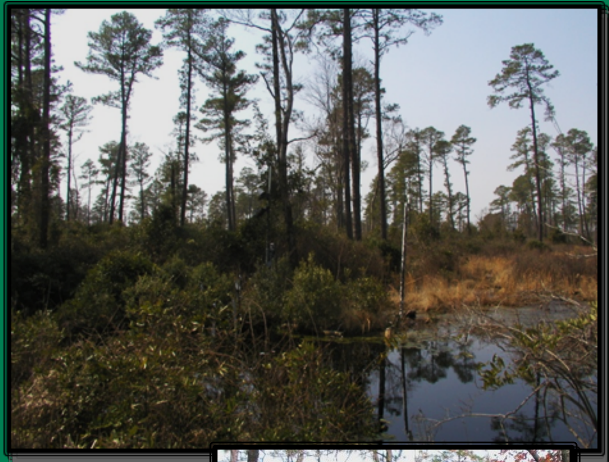
Hydrologic Response to Increased Water Management Capability at the Great Dismal Swamp National Wildlife Refuge: Enhancing Resiliency for Wildlife and People



Approach:

- Water-control structures are being installed and repaired on ditches to better manage the discharge of water from the peat.
- Water will be managed to enhance habitats, reduce downstream flooding, reduce the risk of catastrophic fire, and improve water quality.
- Groundwater and ditch levels, precipitation, soil-moisture, and water-quality will be monitored before structure installation.
- Developing model to simulate the impact of opening and closing water control structures

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THE GREAT DISMAL SWAMP (CARBON SEQUESTRATION)

Ecosystem Services Assessment and Carbon Monitoring in Support of Land Management at Great Dismal Swamp, Pocosin Lakes, and Alligator River National Wildlife Refuges

Objective:

To (1) characterize changes in potential carbon sequestration through the effects of groundwater levels and soil moisture on aboveground biomass, and peat thickness; (2) estimate the effects of refuge hydrologic management and restoration on carbon sequestration and maintaining resilient, target, plant communities; and (3) provide an assessment and valuation of select ecosystem services deemed important to FWS and other stakeholders.

Roots Exposed by Decomposing Peat

Burned Peat and Atlantic White Cedar Stumps– South One Fire, June 9-October 11, 2008

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Characterizing the response of stream low-flows to precipitation and climate.

A cooperative project with

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

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Purpose.

- Build upon our low-flow analyses from 2010 to...
  - Extend the lead time for drought response.
  - Improve and extend DEQ's drought response information and services throughout Virginia.
  - Deepen our understandings of interactions among precipitation, low-flow, and other basin variables.

Concept: Effective recharge window.

We began to appreciate the idea that ...

- Rainfall during the N-D-J-F "recharge months" (before "leaf-out"), is linked to summer stream flow.

- Recharge during this critical time may *drive* water availability during summer low-flow months.

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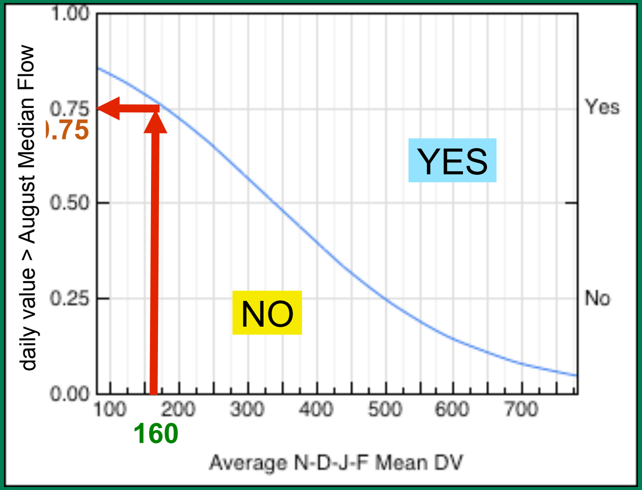
Drought probability using:
Maximum likelihood logistic regressions.

- Example maximum likelihood probability plots describing the chance that average monthly flow will exceed median August POR return flow as a function of the average of combined N-D-J-F mean monthly flows for station number 02039500, Appomattox River near Farmville, Virginia.

August as F(Ave. Combined N-D-J-F) Probability Plot



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