Salt Marsh Monitoring by the U.S. Fish & Wildlife Service's Northeast Region

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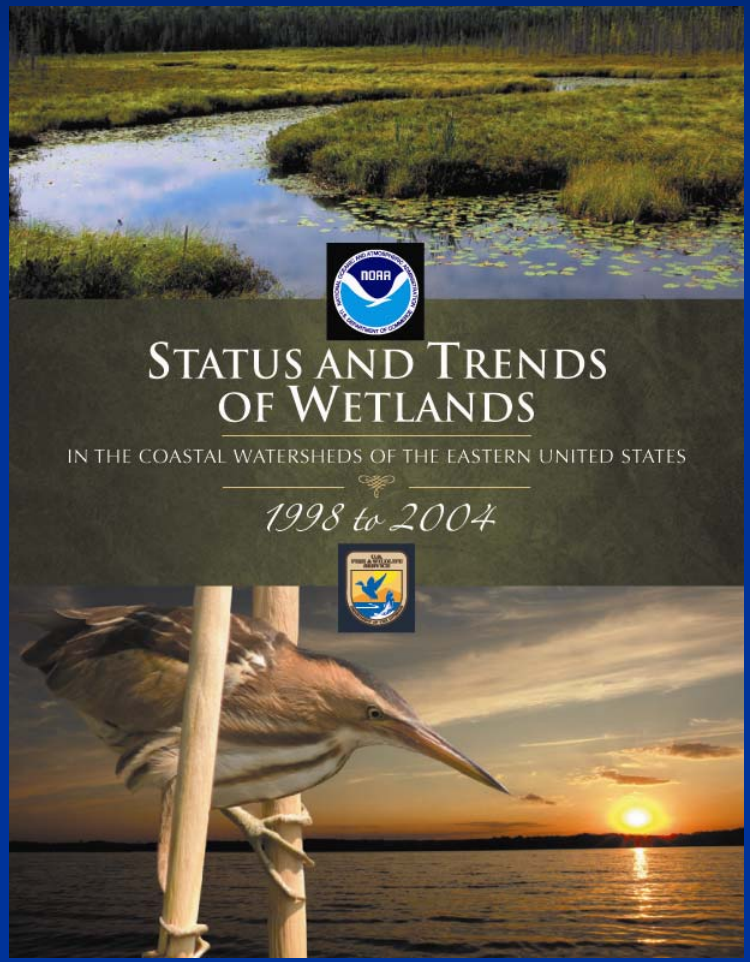
Types of Monitoring

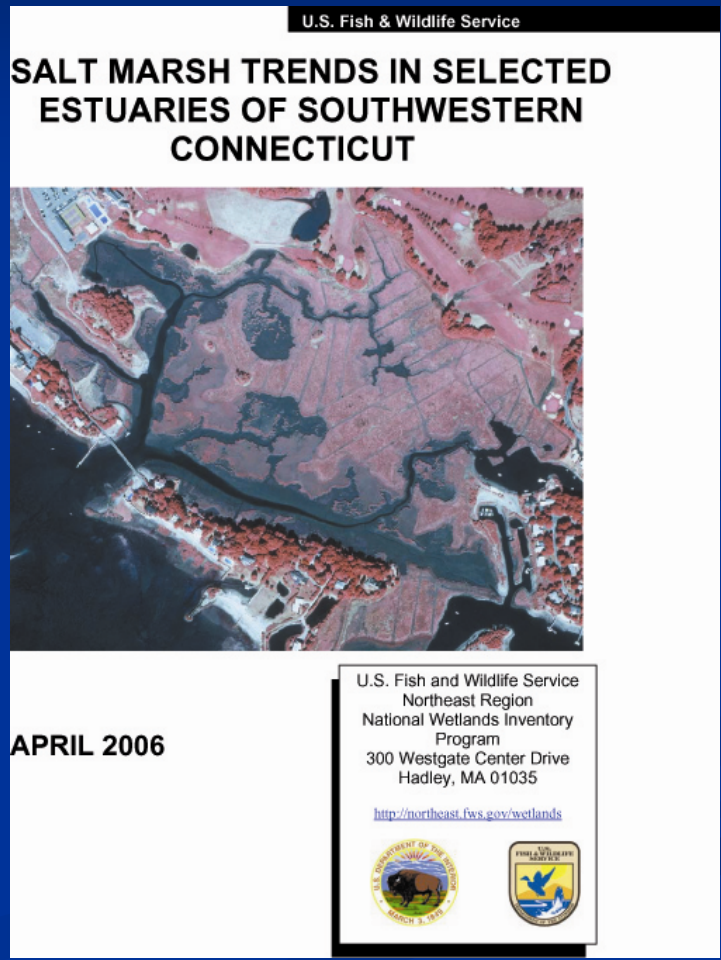
- Remotely sensed Monitoring
  - Area and type changes (e.g., trends analysis)
  - Can cover large or small areas
- On-the-ground Monitoring
  - Addressing processes (accretion, erosion, subsidence, salt balance, etc.)
  - Analyzing vegetation and soil changes
    - Plot analysis
    - Reference wetlands
  - Evaluating wildlife habitat

Remotely Sensed Monitoring

- NWI uses aerial imagery to track wetland changes in wetland type
  - Wetland Status & Trends Studies = a type of monitoring
    - For large geographic areas
      - Statistical Sampling – analyze changes in 4-square mile plots; generate estimates
    - For small areas
      - Area-based Analysis –analyze complete area for changes over time

Region vs Local Reports



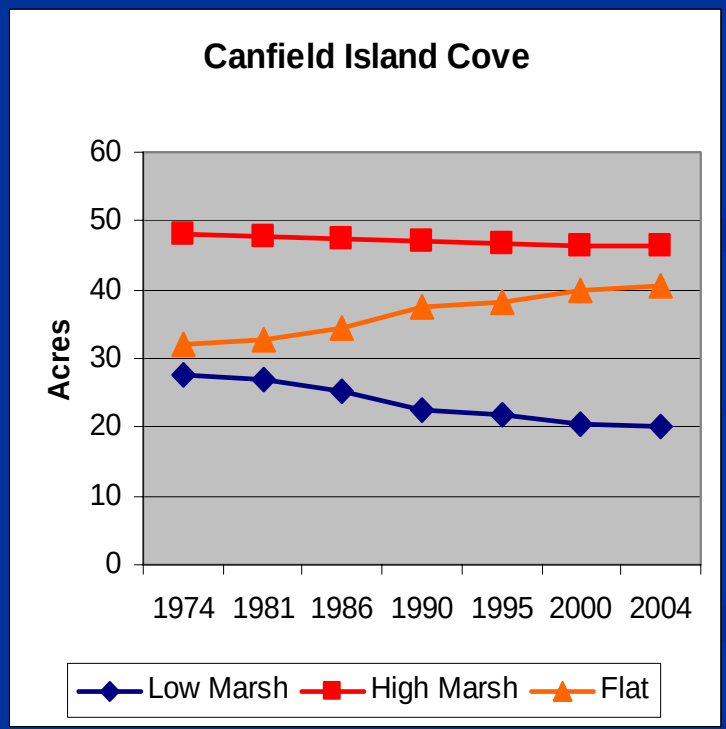


Canfield Cove, CT

1974

2004

Salt Marsh System	Marsh Zone	Acreage 1974	1981	1986	1990	1995	2000	2004	Overall Acreage Change (% Change)
Canfield Island Cove	Tidal Flat	32.15	32.72	34.58	37.58	38.16	39.87	40.51	+8.36 (26.0)
	Low Marsh	27.61	27.08	25.36	22.53	21.90	20.62	20.06	-7.55 (27.3)
	High Marsh	48.13	47.71	47.25	47.07	46.71	46.36	46.42	-1.71 (3.5)
	Open Water	14.95	14.95	14.95	14.87	14.89	14.95	15.17	+0.22 (1.5)
	Aquatic Bed	0.80	0.75	0.78	0.78	0.78	0.81	0.49	-0.31 (38.8)
	Beaches	0.50	0.41	0.45	0.43	0.47	0.47	0.47	-0.03 (6.0)
	Palustrine Tidal	0.00	0.00	0.45	0.53	0.84	0.31	0.31	+0.31 (na)

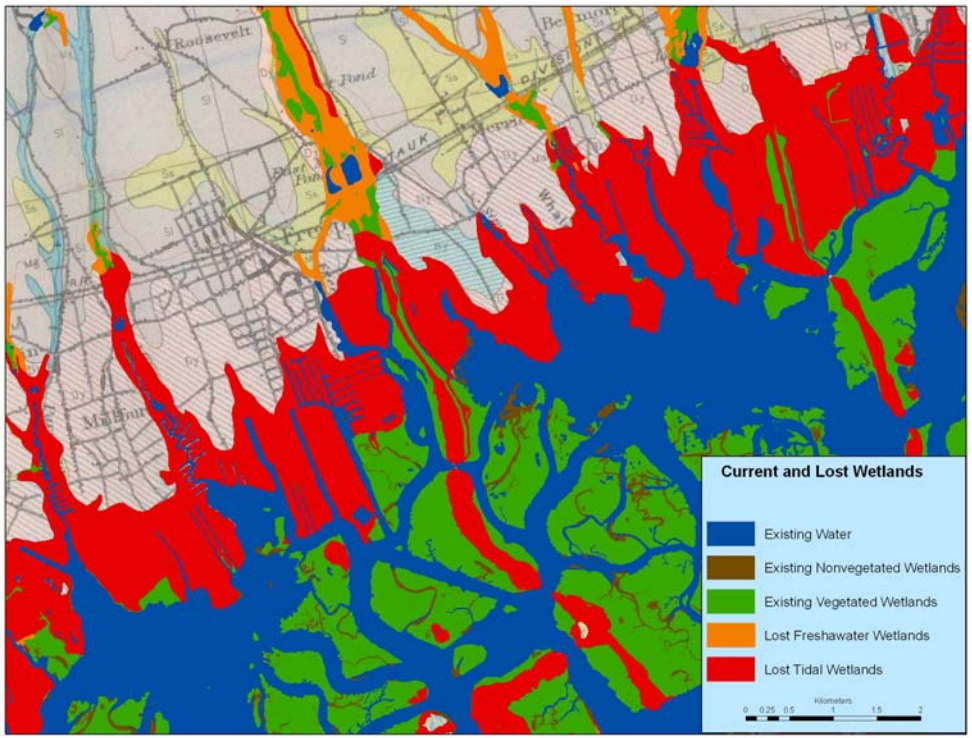


Considerations for Site-specific Monitoring

- Special aerial imagery
  - Low tide
  - Peak of growing season
  - Normal issues re: quality (e.g., cloud-free)
  - Large-scale or high resolution
  - CIR

Integrating Trends with NWI Updates

- Region 5 Standard Practice; Optional elsewhere
  - Delaware
    - Recent
  - Long Island
    - Historic
    - Recent



Monitoring Salt Marsh Migration: Northeast Region Pilot Study

- As sea level rises, marshes tend to advance landward converting forests to marshland
  - This has happened since the sea level rates slowed about 6,000 years ago, after rising at great rates right after the most recent glacial epoch
- These lowland forests need to be kept available for salt marsh migration
- Neighboring lands are vital to future of East Coast tidal marshes and preserving the benefits they provide for fish and wildlife
- There are many examples of dead trees or stumps in today's salt marshes

Downeast Maine

Cape Lookout Marshes, MD

My Interest

- Raising awareness of the need to keep forests as lands suitable for marsh migration
- Document the long-term changes in vegetation and soils from forest to marsh

Study Objective

- Establish permanent plots to document changes in coastal plant communities over time
  - Vegetation patterns
  - Soil properties
- Gain information on how long it takes for significant changes to occur
  - Salt marsh to tidal flat or open water
  - Forested wetland to marsh
  - Upland forest to forested wetland or marsh
  - Changes in soil properties – mineral soil to organic soil; nonhydric soil to hydric soil

Methods

- Analyze aerial photos and get input from refuge biologists on possible study sites
- Review sites in field
- Lay out transects along gradient from salt marsh to forested wetland to lowland upland forest
- Establish permanent plots
  - 30'-radius circular plots for Forests
  - 15'-radius circular plots for Shrub Thickets (or shrub stratum)
  - 5'-radius circular plot for Marshes (or herb stratum)
- Mark center point with wooden stake or blaze tree
- Record GPS location
- Sample plant communities and soils

Vegetation Sampling

- Strata - Metric
  - Tree – areal cover; dbh/basal area; density
  - Shrub - cover
  - Herb - cover
  - Woody Vine – qualitative
- Stress indicators
  - Chlorosis
  - Dieback/Death

Soil Sampling

- Soil profile description to 50cm
- Texture analysis
  - In-the-field by feel
  - Confirmed or corrected by lab analysis
- Carbon content

Pilot Refuge

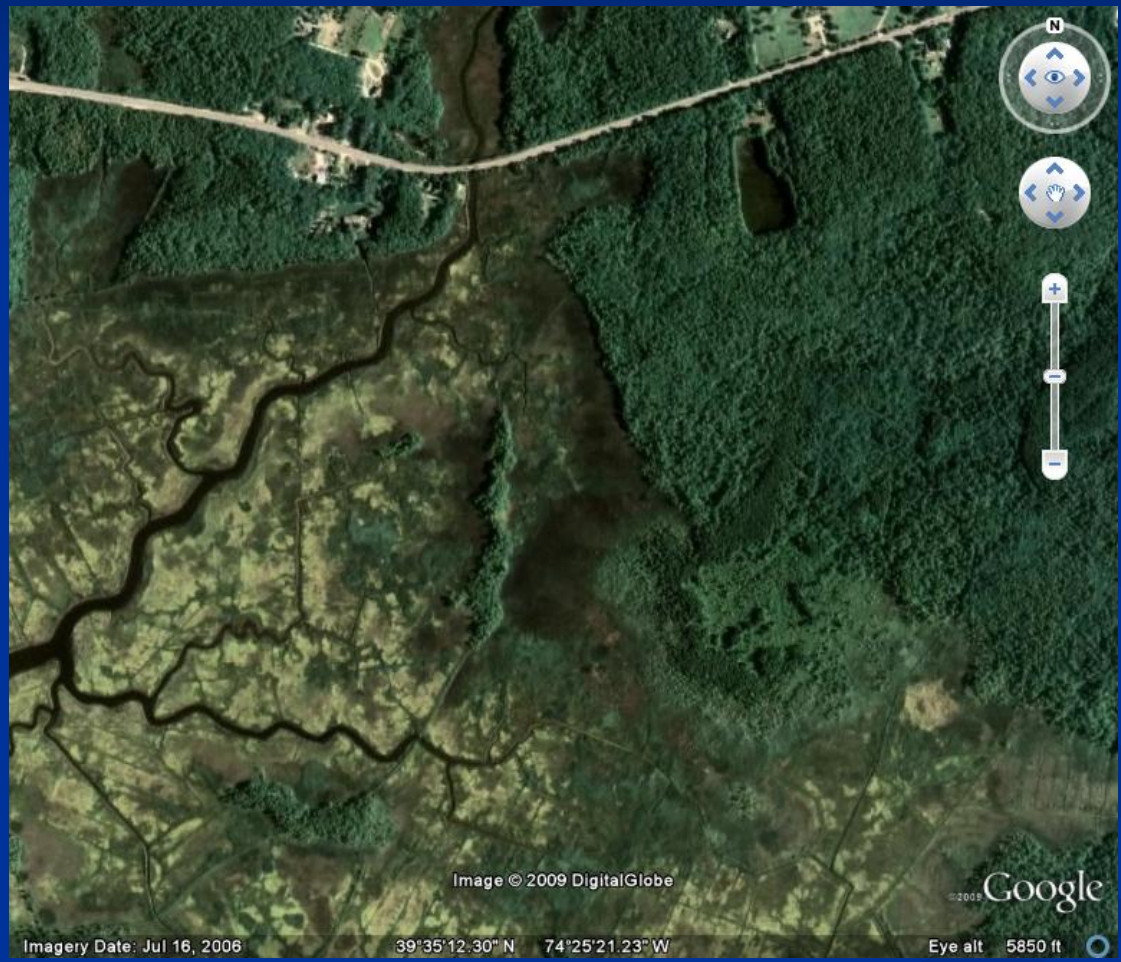
Forsythe National Wildlife Refuge

- 44,000+ acre refuge in southern NJ
- 78% salt marsh
- 4% forested wetland
- 13% upland forest
- 3% grassland
- 2% beaches and dunes
- areas of known salt/brackish marsh migration (former Atlantic white cedar swamp)

Forsythe NWR Study

- Three "transects"
  - Leeds Point
    - 1 marsh plot, 1 marsh-forest edge plot, 2 forested wetland plots; 1 upland forest plot
  - Jobs Creek
    - Several marsh plots, one mixed EM/dead-dying trees plots; 2 forested wetland plots; 1 upland forest plots
  - AT&T Site (OMWM site; research ongoing)
    - Several marsh plots, 1 marsh-PFO edge plot; 2 forested wetland plots; 1 upland forest plot

Jobs Creek Study Area



Soil Map

Map Unit Legend

Burlington County, New Jersey (NJ005)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BesAs	Berryland mucky sand, 0 to 2 percent slopes, occasionally flooded	56.5	16.1%
DocB	Downer loamy sand, 0 to 5 percent slopes	0.0	0.0%
GahB	Galloway sand, 0 to 5 percent slopes	12.1	3.5%
GakB	Galloway fine sand, 0 to 5 percent slopes	24.0	6.8%
LakB	Lakehurst sand, 0 to 5 percent slopes	11.7	3.3%
MakAt	Manahawkin muck, 0 to 2 percent slopes, frequently flooded	29.3	8.3%
PHG	Pits, sand and gravel	4.5	1.3%
TrkAv	Transquaking mucky peat, 0 to 1 percent slopes, very frequently flooded	152.3	43.3%
WATER	Water	0.9	0.2%
WodB	Woodstown loamy sand, 0 to 5 percent slopes	60.2	17.1%
Totals for Area of Interest		351.5	100.0%

NWI Info


E2EM1P6
PFO1/4R
PFO4R
E1UBL6
E2EM1
PFO1R
PSS4/1R
PFO1/3E
PFO1E
PFO1/4E
PSS1/4R
E1UBL
E2EM1/SS4P
PFO1/4Eg
PFO4Rg
PSS1R
PFO4B
PSS1/FO1R
E2EM5P
E2EM1Pd
E2SS1P
Image © 2009 DigitalGlobe
Google
39°35'12.30" N
74°25'21.23" W
Eye alt 5851 ft

Brackish Marsh (Three-square)

"Ghost Forest" (Phragmites)

Dying Forest (Nearly Dead)

Atlantic White Cedar Swamp

Frequency of Sampling

- Year 1 – establish initial conditions
- Every 5 years thereafter
- And when the Refuge's Comprehensive Conservation Plan (CCP) is updated
- Forsythe NWR
  - CCP in 2004 for Forsythe NWR
  - 2009 (initial salt marsh migration study)
  - 2014
  - 2019 (CCP update)
  - 2024
  - 2029, etc. (ideally, but at least when CCP is updated – 15-year cycle)

Future Plans

- Do a few more coastal refuges in Northeast
- See if interest in other coastal refuges (secure funds)
- Gain interest by other agencies to do same on their lands
- Coordinate studies with universities so that work can be passed on for graduate studies (MS theses)
- Separate Initiative: Possibly create coastwide maps showing locations suitable for salt marsh migration

Region 5 Refuge Program – Salt Marsh Monitoring

- Salt Marsh Index of Ecological Integrity
  - Coordinated study with USGS
  - One measure of biological integrity of the NWRs
  - Developing this index; USGS analyzing data
  - At conclusion of study, recommendations will be made re: indicators to monitor
  - Contact: Susan_Adamowicz@fws.gov

Metrics Being Evaluated

- Vegetation Community
- Wildlife Community
- Tidal Restrictions
- Invasive Species
- Mosquito Control Activities
- Degree of Physical Alteration (e.g., ditching, pond creation)
- Adjoining Habitat
- Degree of Human Activity
- Others (some local interest)

Uses of Index

- Identify reference salt marshes to be used as restoration targets
- Use to rank the ecological integrity of salt marsh units and provide for long-term monitoring of salt marsh health
- Identify and prioritize restoration activities
- Evaluate the effectiveness of restoration practices
- Evaluate salt marsh objectives within CCPs and Habitat Management Plans
- Identify thresholds for maintaining intrinsic value of marshes
- Provide measurable objective to evaluate and guide management activities (use in annual performance reporting)
- Satisfy legal mandate to monitor biological integrity of refuges (Refuge Improvement Act)

Refuges Where Salt Marsh Monitoring is Underway

- Selected Refuges
  - Rachel Carson (ME)
  - Parker River (MA)
  - RI Complex
  - McKinney (CT)
  - Wertheim (NY)
  - Forsythe (NJ)
  - Bombay Hook and Prime Hook (DE)
  - Eastern Shore (VA)

FWS Monitoring – Salt Marshes

- Not systemwide
- Pilot projects
  - Salt Marsh Migration Monitoring (Tiner)
  - Salt Marsh Integrity Index (Adamowicz)
- Wetland Trend Studies
  - Integrating with updates of NWI in Region 5 and select areas elsewhere (Tiner)

For further information, contact:

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