The Mid-Atlantic Coastal Wetland Assessment (MACWA): Introduction and Progress

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Figure 1: Taking Sediment Elevation Table (SET) measurements in Delaware's inland bays.

Figure 2: Field training on use of the Mid-Atlantic Tidal Rapid Assessment Method by staff from the Delaware Department of Natural Resources and Environmental Control.

Abstract: Coastal wetlands are a hallmark feature of the mid-Atlantic, particularly in the Delaware Estuary and coastal New Jersey and Delaware where extensive fringing tidal marshes provide critical ecosystem services such as flood protection, carbon sequestration, food and habitat for fish and wildlife, and water quality enhancement (Figure 4). A scarcity of monitoring and assessment data, however, hampers efforts to regulate and preserve these wetlands even as many areas appear to be suffering rapid loss and degradation.

The National Estuary Programs are working with EPA and the states to fill vital data gaps with a multi-tier, sustained monitoring program for coastal wetlands that can be linked to water quality monitoring, flow and sediment management, regional restoration planning, and climate adaptation planning. A Mid-Atlantic Coastal Wetland Assessment (MACWA) is conceptualized as a network of fixed stations and shared rapid assessment datasets that provide a regional monitoring framework from the NJ to DE/MD coasts. Information from MACWA will help us differentiate between local and regional causes of continued coastal wetland loss and degradation, aid in regulatory decision making, manage for ecosystem services, strengthen climate adaptation priority-setting, and more fully understand how coastal wetlands affect and are affected by water quality.

Fixed station efforts will consist of intensive monitoring of physical, chemical and biological metrics over time at sites stratified by salinity and watershed to ensure that diverse wetland types (freshwater tidal, brackish, salt marshes) and stressor gradients (nutrients, sediments, contaminants) are represented (Figure 5). Rapid assessments will build on the Mid-Atlantic Rapid Assessment Method (MidTRAM), following a stratified random, probabilistic approach. Following EPA guidance, "core" metrics will be chosen that can be used consistently across strata, while also acknowledging that "supplemental" metrics will be needed to address local differences in wetland types and stressors.

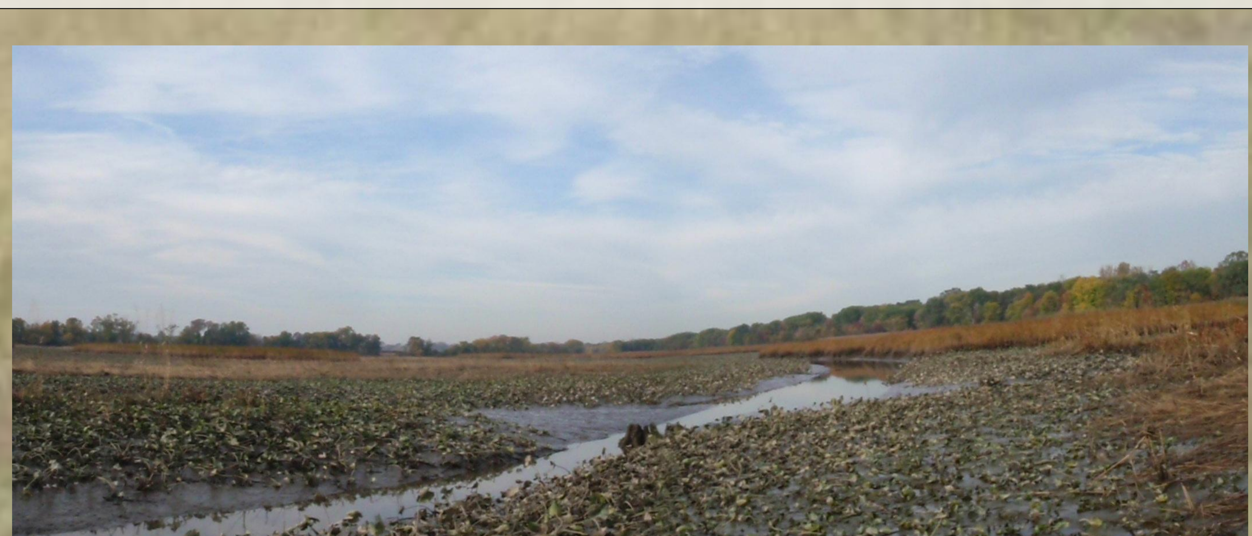

Figure 3: Tidal freshwater wetland at the John Heinz National Wildlife Refuge at Tinicum, PA

Introduction: Extensive and diverse tidal wetlands exist in the mid-Atlantic. For example, in the Delaware Estuary, tidal wetlands form a marshy fringe surrounding most of the system (Figure 4), ranging from expansive salt marshes around Delaware Bay to nationally rare freshwater tidal marshes in the upper Estuary. Together, these wetlands represent perhaps the most critically important habitat in this watershed for both ecosystem and human health.

Unfortunately, many tidal wetlands in the region appear to be losing acreage, and in areas where marshes remain, they appear to be declining in health. This decline makes them more vulnerable to sea-level rise and reduces the natural services they provide; they produce fewer sport fish and shellfish, provide less habitat for migratory waterfowl and nesting birds, filter less water, sequester less carbon, and provide less flood protection.

Despite their importance to the region, there has never been a coordinated and consistent assessment of the status and trends in the health of coastal wetlands across the Delaware Estuary or the region. The National Wetland Inventory and land use datasets have helped us track acreage changes, but these datasets are either too infrequent or poor in resolution.

In 2008, the Partnership for the Delaware Estuary (PDE) worked with state partners and academics to design an integrated Delaware Estuary Wetland Monitoring and Assessment Program (DEWMAP) with start-up funding from the U.S. Environmental Protection Agency. DEWMAP will use information gathered from new fixed monitoring stations, remote sensing, and rapid assessments of wetland areas to determine and contrast conditions around the Estuary (Table 1). In addition to local and state-specific factors, it will consider watershed factors such as freshwater and sediment inflows that help regulate salinity and marsh-surface elevation for a more holistic look at how the ecosystem is functioning across the watershed.

Recently, PDE joined with the Barnegat Bay National Estuary Program to broaden DEWMAP, together raising more than $850,000 in direct support and about $500,000 in additional matching funds. We are now hoping to link this effort to wetland monitoring initiatives by the state of Delaware and the Center for the Inland Bays of Rehoboth Beach, Delaware (Figure 6). Together, efforts in the Delaware Estuary, Barnegat Bay, and Inland Bays will begin to establish a mid-Atlantic network of stations to monitor changes in tidal wetlands at key locations, supported by rapid assessments of marsh conditions and remote-sensing data.

Proactive management of our coastal wetlands in the face of changing land use and climate will require a firm knowledge base. Only by tracking coastal wetland status and trends at local and regional scales will environmental managers be equipped with the necessary knowledge to sustain these critical habitats.

For more information on these efforts, please visit www.DelawareEstuary.org/Science_Projects_Wetland_Assessment.asp.

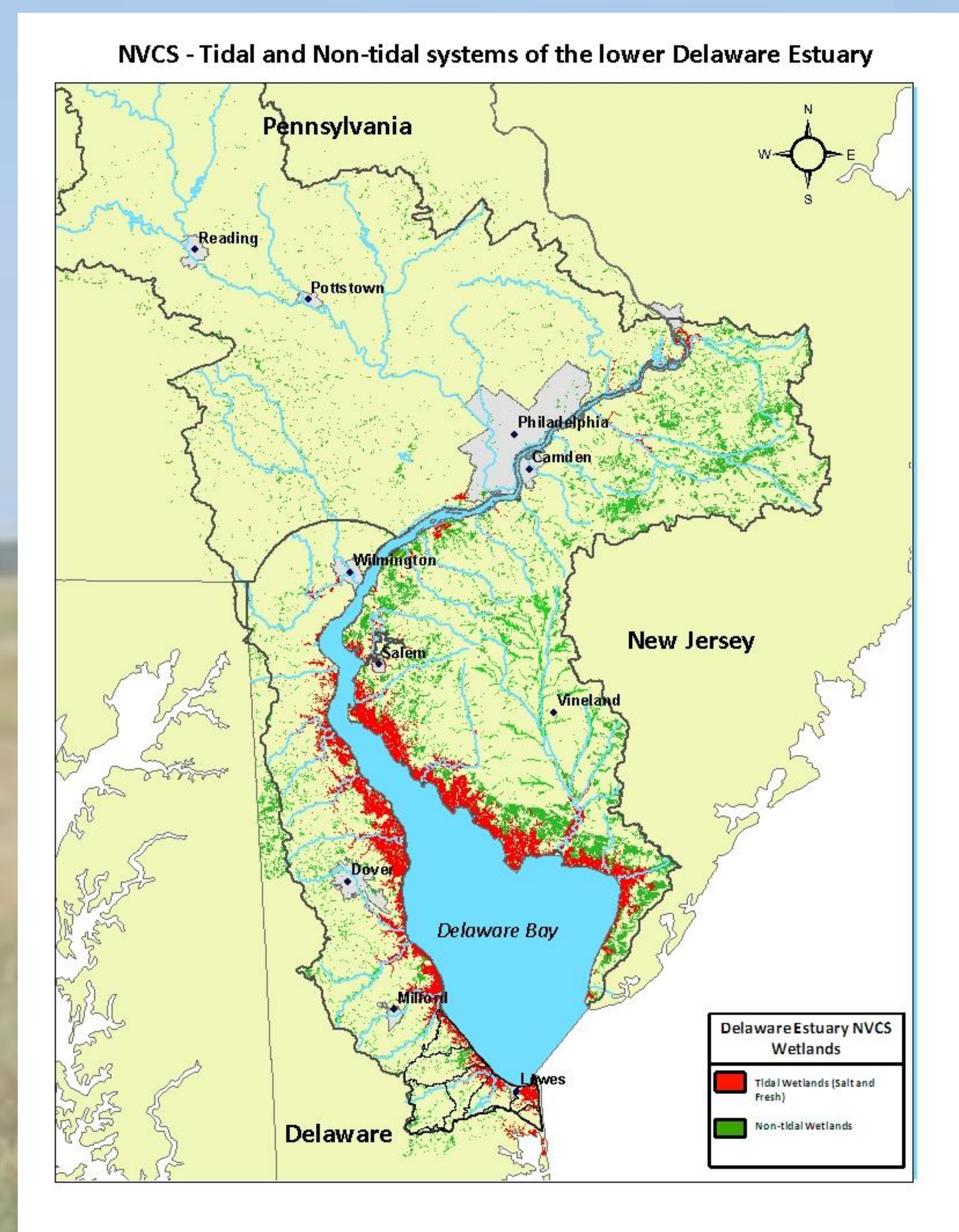

Figure 4: Tidal and non-tidal ecological systems of the Delaware Estuary determined with the National Vegetation Classification System (PDE, Report #06-02).

Table 1. Candidate indicators and metrics under consideration for the prospective Mid-Atlantic Coastal Wetland Assessment organized by tiers proposed by EPA.

EPA Design Component	Example Indicators	Example Metric
Tier 1 (Landscape Census Data)	Wetland Extent	*wetland acreage*
	Wetland Buffer Condition	*adjacent land use*
	Wetland Contiguousness	*connectivity (inter/intra*
	Historic Change	*loss or gain in acreage*
	Wetland Morphology	*percent open water*
	Plant Community Integrity	*vegetation community/type*
	Shoreline Condition	*edge status*
	Anthropogenic Alterations	*ditching*
Tier 2 (Rapid Assessment Data)	Plant Community Integrity	*vegetation community type*
		invasive species
		species list
		vegetation structure board
	Primary Production	*below and above ground biomass*
	Wetland Morphology	*percent open water*
	Invertebrate Community Integrity (sessile species)	*presence and relative abundance of functional dominant and bioindicator species*
	Wildlife Habitat Integrity (mobile species)	*evidence of fish and mobile shellfish*
	Hydrological and Shoreline Integrity	*evidence of hydrological alterations or impairment*
	Substrate Integrity	*percent organic matter and sediment description*
	Elevation and Sediment Budget	*relative elevation*
Tier 3 (Intensive Studies)	Water Quality	*specific conductivity*
		dissolved nutrients
	Biogeochemical Cycling	*sediment porewater nutrient concentrations*
	Carbon Storage	*carbon sequestration in belowground biomass*
	Elevation and Sediment Budget	*Sediment Elevation Table*
	Plant Community Integrity	*vegetation robustness*
	Functional Dominant Fauna Integrity	*biofiltration capacity of bivalves*

Figure 7: Measuring bearing capacity in wetlands.

Figure 8: Cutting a soil coir to determine below ground biomass.

Goals:

- Facilitate coordination, use of similar methodologies, and data comparability across region states, EPA Regions 2 and 3, and four NEPs between the NJ and MD coasts (Figure 6), following the multi-tier EPA framework (Table 1.)
- Establish a network of fixed monitoring stations and begin to contrast condition, structure and function among these sites. These will include *reference* sites for best possible conditions, *representative* sites for prevailing conditions, and *indicator* sites for stressor conditions. Sites will be stratified by salinity, watershed, and state (Figure 5.) Best possible sampling designs will be used in intensive monitoring, including geomorphic, biotic and water quality data collection.
- Develop and test rapid assessment methods (RAM) to assess condition of tidal wetlands across the region based on the DNREC Mid-Atlantic Tidal Wetland Rapid Assessment Method (MidTRAM). The RAM will retain full MidTRAM metrics as "core" measurements, augmented with "supplemental" metrics needed for specific marsh types (*e.g.*, freshwater tidal marshes) and/or to capture seaward edge erosion. Development and application of this RAM should be consistent with many core elements of the 2011 National Wetlands Conditions Assessment planned (Figures 5, 7 and 8).
- Collect new RAM condition data on tidal wetlands in up to eight study areas in Barnegat Bay and Delaware Estuary watersheds during 2010-2011.
- Relate findings from rapid assessments and fixed stations, enabling extrapolation of results from intensive studies to broader areas, including potential ground-truthing of remote sensing data (Tier 1, Table 1).
- Interpret findings from rapid assessments and fixed stations in the context of ecosystem services flowing from tidal wetlands in various states of condition. Characterize the consequences of tidal wetland impairment in natural capital terms associated with goods and services furnished by different types of tidal wetlands.
- Identify stressors causing the greatest marsh deterioration, helping managers prioritize actions that will maximize net long-term conservation and restoration outcomes.
- Assess how climate change (e.g., sea level rise) is impacting tidal wetland condition.
- Strengthen criteria to assess restoration outcomes. Wetland mitigation is important in the region, however there insufficient baseline information on reference conditions and relative values for different types of tidal wetlands. This limits our ability to set meaningful success criteria and quantify compliance for restoration projects.
- Prepare training materials for future Tier 2 and 3 sampling (Figure 2, Table 1).
- Develop and disseminate decision-making materials to assist local and regional managers in integrating wetland protection and enhancement into watershed planning and restoration.
- Convene conference sessions or workshops to share outcomes with scientists, managers and restoration practitioners.

Figure 5: Examples of recent and planned tidal wetland monitoring and assessment activities in the Delaware Estuary and vicinity.

Figure 6: Mid-Atlantic region showing the four National Estuary Programs that might become involved in MACWA.

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Lead Participants:

Partnership for the Delaware Estuary
Barnegat Bay National Estuary Program
Center for Inland Bays
Academy of Natural Sciences
Rutgers University
Environmental Protection Agency- Regions 2 & 3, Headquarters
State of Delaware
State of New Jersey
Commonwealth of Pennsylvania
Wetlands Research Services
Villanova University

RAM- Rapid Assessment Method
ANSP- Academy of Natural Science Philadelphia
PDE- Partnership for the Delaware Estuary

Guide to the Natural Communities of the Delaware Estuary. 2006. Westervelt, K., E. Largay, R. Coxe, W. McAvoy, S. Perles, G. Podniesinski, L. Sneddon, and K. Strakosch Walz. Copyright © 2006 NatureServe, Arlington, Virginia. Partnership for the Delaware Estuary, Report #06-02. 338 pp.