Tidal Wetland Indicators for the 2011 State of the Delaware Estuary and Basin Technical Report

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Abstract

Tidal wetlands are one of the focal natural resources in the planned 2011 Technical Report for the Estuary and Basin, which will lead to State of the Estuary and Basin Reports in 2012-2013. Status and trends in the extent and health of tidal wetlands will be interpreted as environmental indicators of the health of the watershed.

In past watershed assessments, wetland indicators have been difficult to develop because of insufficient and inconsistent data for the entire Delaware Estuary. Updated acreage assessments based on the National Wetlands Inventory are being examined. Several new state and academic programs are underway to examine the condition of tidal wetlands in the Delaware Estuary. In addition, land use patterns in the buffer zone around tidal wetlands and shoreline condition are being quantified as a potential indicator of future wetland resilience.

Despite the fact that coastal wetlands are a hallmark feature of the Delaware Estuary landscape, efforts to track their status continue to be hampered by incomplete or incompatible past and recent data. In Pennsylvania, National Wetland Inventory (NWI) data has not been collected for some areas since the 1970's. Use of land cover data, while comprehensive for the estuary, does not have the same level of resolution as NWI and only extends back to the early 1990's.

We intend to "ground truth" land cover data with NWI for areas of greatest overlap in time and space, and then show recent trends in acreage changes by comparing 1993 and 2007-2008 land cover datasets. Longer term trends analysis will be attempted using NWI for areas where we have the data as example scenarios of change. Any input on this important indicator, as well as on shoreline condition data and wetland buffers, would be warmly received by the authors.

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Partnership for the Delaware Estuary, 2006. Guide to the Natural Communities of the Delaware Estuary: Version 1. 2006. Westervelt, K., E. Largay, R. Coxe, W. McAvoy, S. Perles, G. Podniesinski, L. Sneddon, and K. Strakosch Walz. NatureServe, Arlington, Virginia. PDE Report No. 06-02. 338 p.

Introduction

Tidal wetlands serve as an excellent habitat indicator, especially for the wetland-rich Delaware Estuary. They exist at the land-sea interface and are our first line of defense against sea level rise and storm surge. Coastal marshes help sustain fisheries and shellfisheries, provide breeding and foraging habitat for diverse fish and wildlife., and sustain jobs in eco-tourism and fisheries. They are also underappreciated for their essential ecosystem services such as helping sustain good water quality, sequestering carbon, and buffering other habitats (Fig. 1).

In the last five years, the Partnership for the Delaware Estuary has been leading a multistate, interdisciplinary effort to assess the current extent and health of our vast tracts of coastal wetlands (see other presentations on the Mid-Atlantic Coastal Wetland Assessment.) Information from that effort and other wetland assessments is not yet available for use in the 2011 Technical Report for the Estuary and Basin (TREB), and so we will need to rely on a patchwork of acreage datasets that is incomplete and somewhat incompatible in time and space. This poster describes our approach and current progress in assessing tidal wetland status and trends in the Delaware Estuary. Final results will be reported as a core indicator in the Intertidal Habitats section of the TREB.

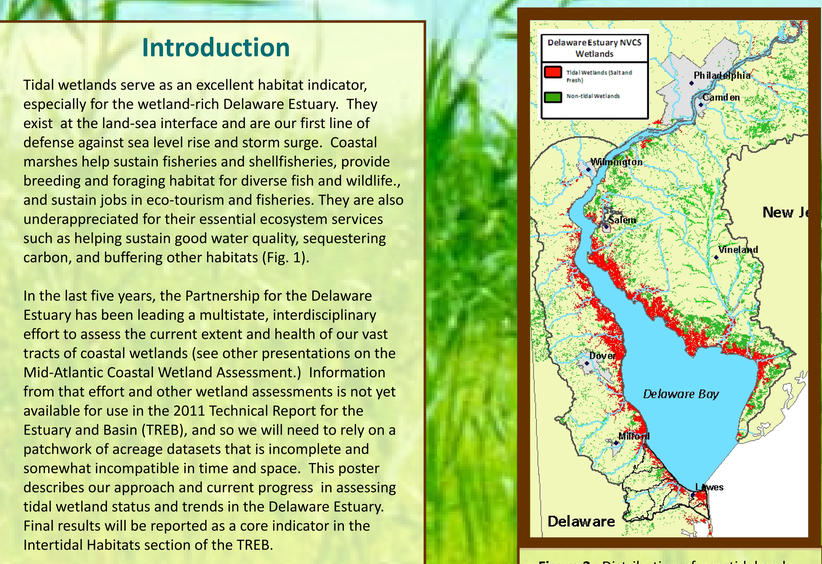


Figure 2. Distribution of non-tidal and tidal wetlands in the Delaware Estuary as determined using the Natural Vegetation Classification System (PDE 2006).

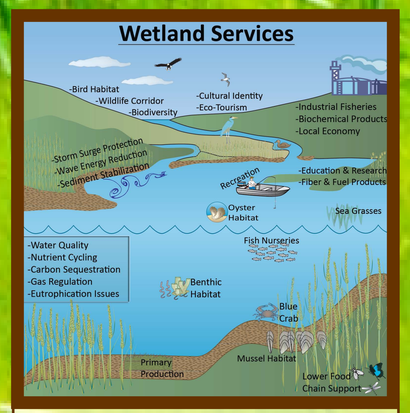


Figure 1. Example ecosystem services provided by coastal wetlands (compiled by PDE).

Why Tidal Wetlands?

Tidal wetlands are arguably the Delaware Estuary's most important and characteristic habitat. There are two traits that distinguish this system from others. First, there is a near contiguous border of more than 150,000 acres of tidal wetlands that fringe Delaware Bay and the lower estuary region (Fig. 2).

Second, the system has the largest freshwater tidal prism in the world, and the extended salinity gradient leads to a rich diversity of marsh types. Some are flooded regularly by tides and others are irregularly flooded on spring tides or during storms. The most extensive types are marshes dominated by perennial vascular plants. The different marsh communities are mainly delineated by the salinity gradient.

Indicator Approach

The most important tidal wetland indicator is their sheer extent, principally the acreage of emergent vegetated tidal marsh. Due to inconsistencies among datasets and/or the small amount of acreage associated with them, acreage for some classes of wetlands could not be tabulated. These included subtidal habitats, aquatic plant habitats, and shrub and tree-dominated habitats.

Our efforts to date have focused on comparing recent data from the National Wetlands Inventory to recent data from the NOAA Coastal Services Center, in areas where both exist (Fig. 3). We hope to use both datasets to demarcate wetland acreage changes from the time of the earliest NWI (1970's) to present. By focusing on only emergent vegetated wetlands (not shrub-scrub, forests, aquatic plants), we have found reasonable agreement between these two data layers (Fig. 4). Analysis of earlier NWI data might necessitate digitization of old aerial photographs or maps, which might not be possible for this report.

Exploratory work is also underway to develop indicators of tidal wetland condition (health) for representative areas of the estuary where rapid assessments have been completed. Ideally, we also would like to develop intertidal habitat indicators associated with tidal wetland buffer extent and shoreline condition to assess the status of the landward and seaward margins of tidal wetlands, respectively.

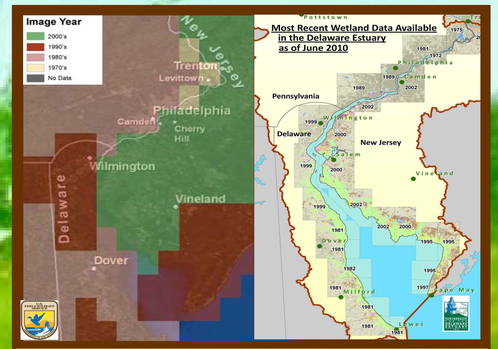
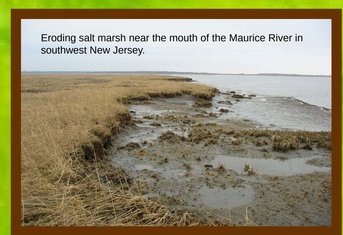


Figure 3. Most recent available NWI data for wetlands of the Delaware Estuary and vicinity.



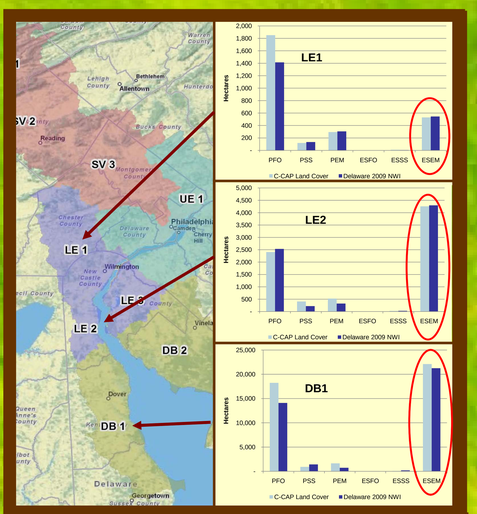


Figure 4. Comparison of 2006 land use data and 2009 NWI data for tidal wetland extent in selected watershed areas of Delaware. Estuarine emergent wetlands are circled in red.

Preliminary Findings

More than 2% (>1300 hectares) of emergent estuarine wetlands (salt and brackish marshes) were lost in the Delaware Estuary between 1996 and 2006 based on land cover data.

Region	1996	2001	2006
UE1	259	256	240
UE2	1579	1541	1445
LE1	554	554	525
LE2	4338	4280	4237
LE3	7864	7871	7839
DB1	22252	22198	22074
DB2	25266	24537	24412
Total ha	62113	61238	60771

These losses occurred disproportionately across the seven watershed regions containing emergent estuarine marshes with greatest rates of loss occurring in the upper estuary (Fig. 5).

Most losses around Delaware Bay occurred in New Jersey during this period. But a separate analysis of earlier land cover data showed that Delaware lost more than 15% if its emergent tidal marsh between 1992 and 1996.

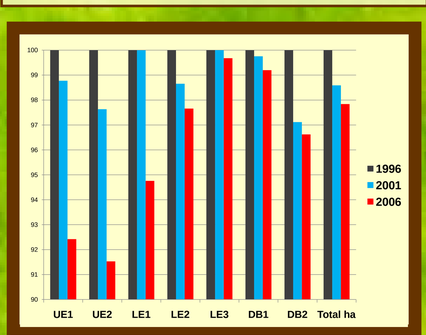


Figure 5. Relative percentage of emergent tidal marsh acres remaining from 1996 in different watershed regions of the Delaware Estuary based on land cover data.

Next Steps

- Resolve attribute discrepancies between NWI and CSC datasets to more accurately inventory current and past acreages for all tidal wetland types.
- Develop indicators for tidal wetland buffers (landward migration) and shoreline condition (seaward erosion)
- Investigate whether new data on tidal wetland condition can be used as an environmental indicator.
- Discuss status and trends in relation to projected future losses of tidal wetlands from sea level rise and other factors (Fig. 6).

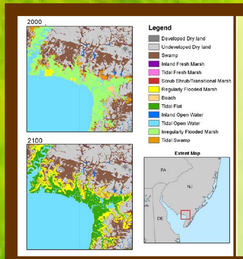


Figure 6. Total acreage of tidal wetlands in the Delaware Estuary is predicted to decline by >25% by 2100 due to sea level rise and other factors (PDE 2010), with conversion to open water far exceeding gains due to landward migration.