Mapping Shoreline Change in Maurice River

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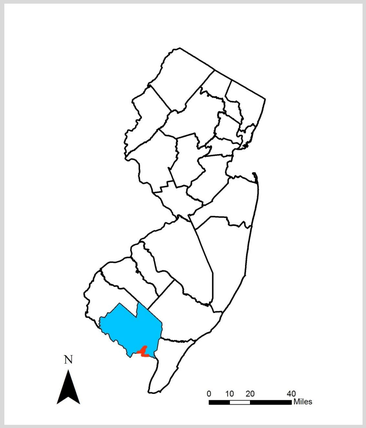
Purpose:

Identify eroding shorelines around the mouth of the Maurice River to target coastal restoration efforts.

Introduction:

This shoreline change review was performed at the mouth of the Maurice River in Maurice River Township and Commercial Township in Cumberland County. It identified those shoreline areas with high erosion rates and may require restoration efforts. The review also split the study area into distinct shoreline types to determine which types, if any, experience significantly different rates of change.



Background: Maurice River

The Maurice River is an environmentally and economically important Atlantic Coastal river that serves as a critical link between the Pinelands National Reserve and the Delaware Estuary. Historically, the river and its surrounding cities and townships, including the cities of Vineland and Millville, and the Townships of Maurice River, Commercial and Buena Vista, have been home to rich fishing, boating and oyster harvesting industries. The salt marshes also support 53 percent of New Jersey's endangered non-aquatic animal species and countless species of fish. In 1993, the Maurice River and several tributaries—including Menantico and Muskee Creeks and the Manumuskin River—were added to the National Wild and Scenic River System. (2)

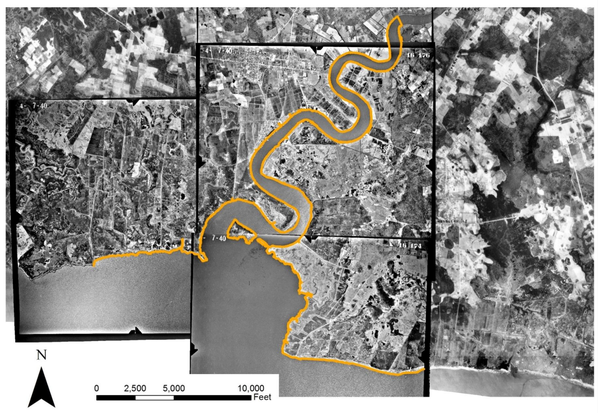
This area was also historically used for *Spartina* or "salt hay" farming. The photograph to the right is an image from the 1932 aerials showing one of the most significant areas of salt hay farming in the region. This old practice involved diking off wetlands from the surrounding river and cultivating the vegetation to be used in everything from cow feed to coffin bed lining. Because the farming plots were cut off from the diurnal tidal cycle, they no longer received sedimentation and were unable to keep pace with sea level. When this farming practice was ended and the plots were abandoned, the dikes blew out and the compacted land was quickly converted to mudflat (see historical shorelines below). The loss of vital wetlands from salt hay farming has left Matt's Landing and the surrounding area more exposed to hazards and could threaten local crab fisheries and wildlife. (5)

Tidal range in this area is between approximately 5 and 7 feet depending on the time of year. (4) Tides were not considered in this review and could be a source of error in the results.

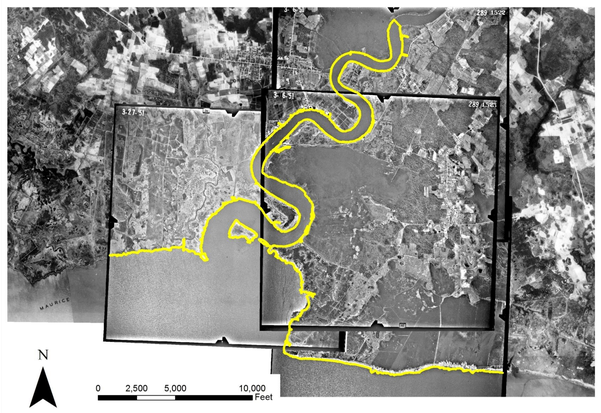
Step 1: Historic Shorelines:

Six historic shoreline vectors were created from georeferenced aerial photos (1940- 1961) and existing NJDEP data layers (1977 – 2012). Shorelines were digitized to the "wet/dry line", characterized by a change in tone along the shore from dark to light.

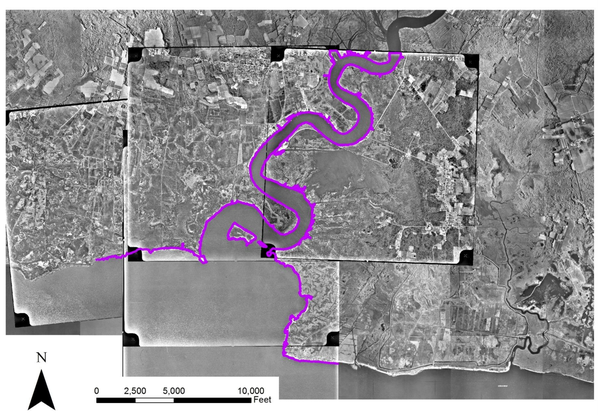
Maurice River Shoreline 1940



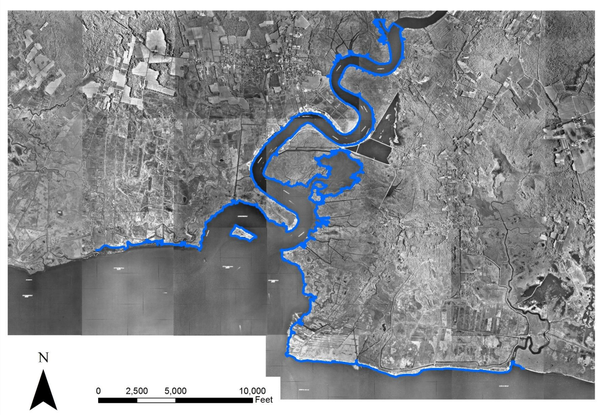
Maurice River Shoreline 1951



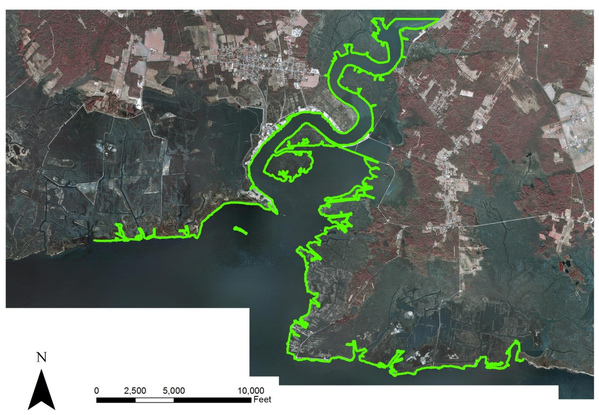
Maurice River Shoreline 1961



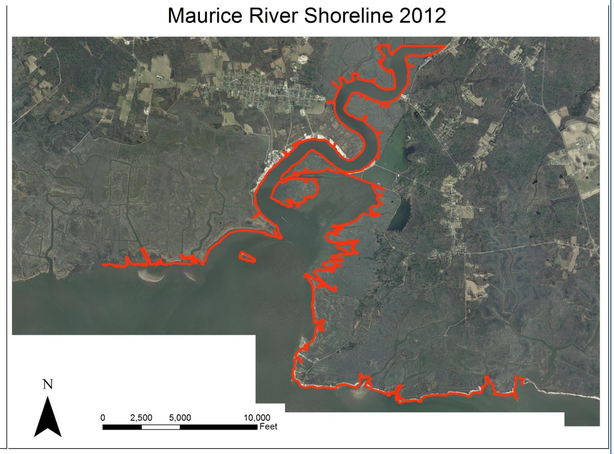
Maurice River Shoreline 1977



Maurice River Shoreline 2002



Maurice River Shoreline 2012

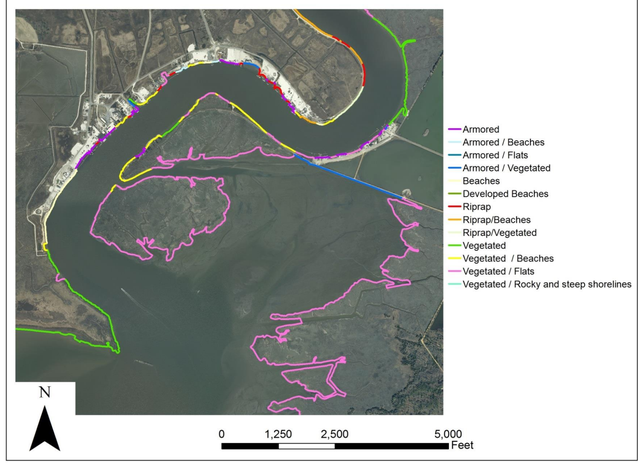


Step 2: Shoreline Inventory:

To map the shoreline types along the study area, NOAA's Environmental Sensitivity Index (ESI) layer was used. ESI provides shoreline type descriptions for the entire coast of the USA and is used for prioritizing oil spill cleanup response. The New Jersey ESI layer was added to GIS and edited for Maurice River. In the study area, 13 distinct shoreline types were identified. Along this river, 85% of the shoreline is vegetated, 10% is armored (bulkhead or riprap), and 5% are beaches.

North facing view, top, and south facing view, bottom, of the mouth of the Maurice River. (Photos by Steve Jacobus.)

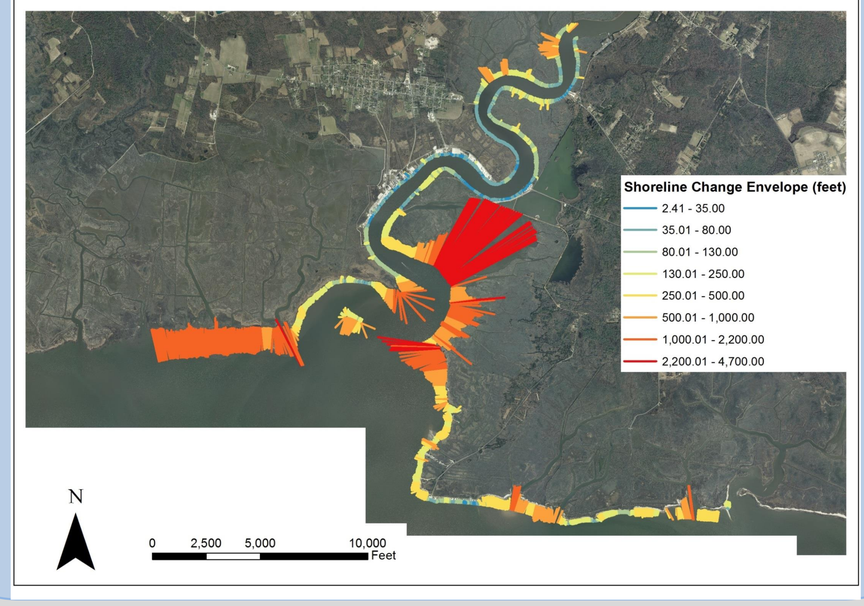
Maurice River Shoreline Inventory



Step 3: Digital Shoreline Analysis System

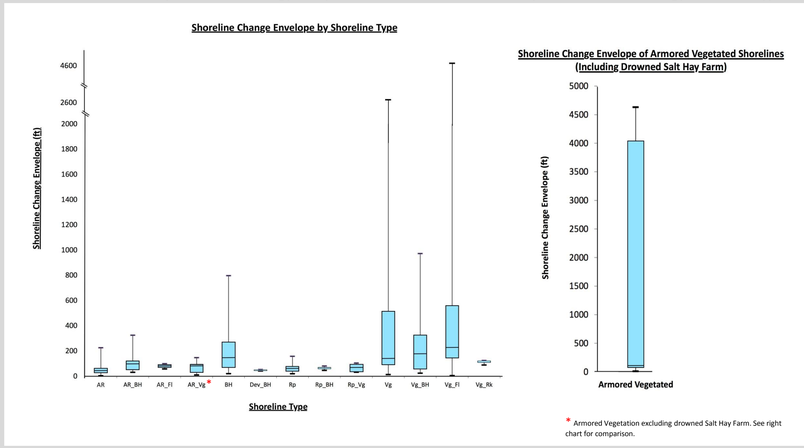
The erosion between historic shoreline was analyzed using the Digital Shoreline System (DSAS) program developed by USGS. First, all of the digitized shorelines were merged and dissolved. They were then clipped based on shoreline type. This creates shapefiles for each shoreline type consisting of the digitized shoreline at each year chosen for the study. Then, a buffer of 10 feet was created around each shapefile. The buffer was converted into a polyline and cut so that only the most landward or seaward line remained. As the DSAS tool is run, it casts transects at user defined intervals from the baseline covering the extent of the erosion. DSAS also provides shoreline change rates and distances so statistics can be calculated.

Maurice River Shoreline Change



Step 4: Results

All statistics were performed using R statistical software (version 3.2.3) with the assistance of Evan Sherer. The shoreline change envelope (SCE) for each shoreline type were compared using a Kruskal-Wallis test, followed by a Dunn's test for multiple comparisons (using the Holm method to adjust p-values).
The results suggest that Armored Vegetation, Vegetated, and Vegetated Flat areas experience the highest level of erosion at the mouth of the Maurice River, with maximum values in excess of 4500 ft. The area with the largest change, the east side of the river on the second meander, was most likely the result of the blowout of the dikes surrounding *Spartina* farms. To account for this, statistics were run separately on Armored Vegetation when excluding this area. As seen on the charts below, without this large blowout erosion on the armored vegetation shorelines were significantly lower. The submersion of the *Spartina* farms caused a dramatic increase in erosion levels in this region.
Other areas of particularly high erosion include the Delaware Bay shore immediately to the west of the river and the first few meanders of the river, presumably due to higher wave energy. Costal restoration efforts should be focused on these shoreline types and locations.
Future studies will incorporate wave energy analysis to determine the relationship between wave energy, shoreline type and shoreline change.



* Armored Vegetation excluding drowned Salt Hay Farm. See right chart for comparison.

This plot depicts the shoreline change envelope by shoreline type. The area within each blue box represents the interquartile range (middle 50 % of the data). The line in the middle of each box is the median and the ends of the whiskers represent the maximum and minimum shoreline change rates for each shoreline type. AR – Armored; AR_BH -Armored Beach; AR_FL – Armored Mud Flat; AR_Vg – Armored Vegetation; BH – Beach; Dev_BH – Developed Beach; Rp – Riprap; Rp_BH – Riprap Beach; Rp_Vg – Riprap Vegetation; Vg- Vegetation; Vg_BH – Vegetated Beach; Vg_Fl – Vegetated Mud Flat; Vg_Rk – Vegetated/ Rocky and Steep Shoreline.

Citations:

1. Evan Sherer
2. *Maurice River, New Jersey*. https://www.rivers.gov/rivers/maurice.php
3. Steve Jacobus- Photo credit
4. *Tides and Currents*. http://www.tidesandcurrents.noaa.gov/noaatidepredictions/
5. Weinstein Et al. *Catastrophies, Near Catastrophies and the Bounds of Expectation: Success Criteria for Macroscale Marsh Restoration.*

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