Dune-System Assessment: Borough of Mantoloking Ocean County New Jersey

Dr. Stewart C. Farrell
Center Director & Founder

COASTAL RESEARCH CENTER
RICHARD STOCKTON COLLEGE
POMONA, NEW JERSEY

Dr. Mark J. Mihalasky
Center Director of Research

Overview & Context:

The Borough of Mantoloking is located on a low-lying barrier beach in northern Ocean County, New Jersey. Coastal communities and economies are important to New Jersey's prosperity and quality of life, but they are vulnerable to devastating affects from northeast storms and hurricanes. The 2004 storm season was unusually active and it is anticipated that the 2005 season will be similar, continuing a 20-25 year long trend of enhanced activity in the Atlantic basin that began in 1995. This *increasing trend* in storm activity coincides with a *decreasing trend* in Federal funding for shore protection and beach nourishment. Since about 2002, responsibility for protecting and maintaining the coast has been incrementally shifting to the State and municipal governments. During 2003-2004, an assessment was carried out at the lot-and-block level to determine the ability of the Borough's dune-system to withstand 2-year, 5-year, 10-year, 20-year, 50-year, and 100-year storm events. The assessment represents the condition of the dune system as of Fall 2000 (the most recent date for which key data are available).

Purpose & Benefits:

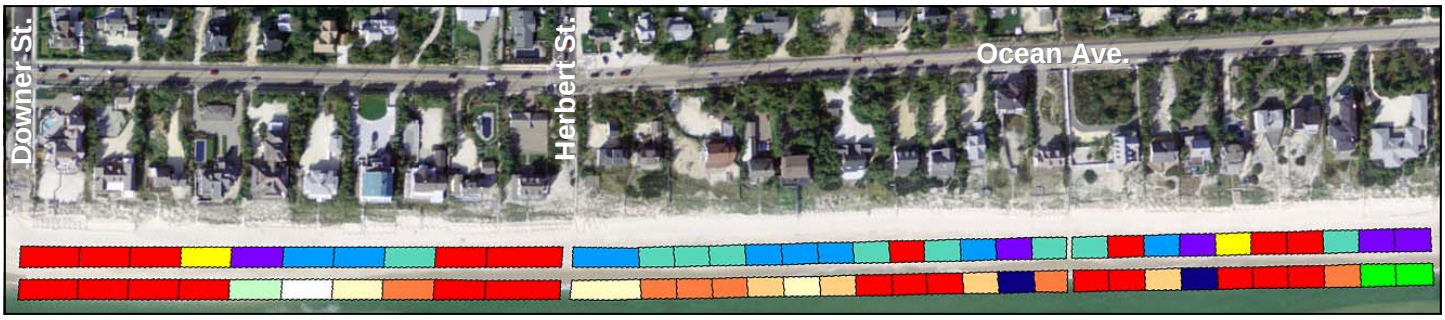
The dune system in Mantoloking is a vital natural resource that protects the Borough against storm damage. Dune system assessment is important for effective management and sustainability of this resource. An assessment will facilitate more efficient use of limited State and municipal resources by optimizing storm hazard mitigation activities.

Methodology:

The assessment is a Geographic Information System-based, knowledge-driven modeling methodology that identifies weaknesses in the dune system and highlights areas that may be vulnerable to storm damage (such as erosion, overwash, or breach). Several variables relating to dune, beach, and nearshore morphology were collected, compiled, and evaluated in order to determine the susceptibility of the dune system to potential damage from storm activity. These variables were quantified, then, using expert knowledge, assigned a "weight" of influence with respect to their ability to withstand or counteract storm erosion. Elevation and bathymetry profile data were used in a wave run-up erosion simulation to determine the failure point of the dune system for each oceanfront property (the point of failure is defined as dune crest breach in response to landward erosional recession of the foredune). Simulations were run for 2-year, 5-year, 10-year, 20-year, 50-year, and 100-year storm events using parameters developed by FEMA. A map of "dune susceptibility" was generated by using fuzzy-set theory to combine the variables. The results of the erosion simulations were used to control the degree of variable combination, and to classify the susceptibility values into intervals.

Results & Interpretations:

The results of the assessment are conveyed as a map that consists of an aerial photograph on which two spectrum-colored strips are overlain along the extent of the beachfront (see figure below). The strips are subdivided into segments that correspond to the width of each beachfront property. The susceptibility maps indicate that the Borough's dune system is an effective barrier for 2-, 5-, 10-, and 20-year storm events. For a 50-year storm event, there are 16 failure and near-failure points. Based on 2004 property tax assessment values, a 50-year storm could result in combined public and private storm damage of up to $43.8 million dollars. For a 100-year storm event, the estimates of failure are less meaningful or reliable at the lot-and-block level. The power of a storm increases dramatically from a 50- to 100-year event, and it is likely that long sections of the dune system would be breached, overwashed, and even reduced to the elevation of the beach.



Part of the Mantoloking dune-system assessment for a 50-year storm event, showing the oceanfront area in most need of storm hazard mitigation. The landward (upper) strip represents an absolute measure of susceptibility that the dune system will fail during a storm of given intensity. The seaward (lower) strip represents a relative measure of each property's dune system performance (as compared to all others along the oceanfront) for a given intensity storm event. Warmer colors (reds) represent higher susceptibilities to storm erosion, whereas cooler colors (blues) represent lower susceptibilities.