



Framework for Implementing Sustainable Shorelines

Summary of Social Science Investigations: Shoreline Decision Modeling

Project Activity: Shoreline Management Decision Outcome Model

Development of a spreadsheet-based simulation of the probability that tidal marshes will persist along coastal shorelines in Gloucester County, Virginia considering sea level rise and the social network interactions that inform shoreline property owner management decisions.

Objective: To simulate the potential consequences of rising sea level on tidal marshes over the next 30 and 70 years (2050 and 2100) and to support evaluation of the influences of agents in the social network informing shoreline property owner decisions regarding management of eroding shorelines.

To investigate the potential for directed outreach and/or altered regulation of private shoreline management to affect the trajectory of tidal marsh inventories under anticipated sea level rise.

Methods: A spatially explicit inventory of the tidal shoreline conditions in Gloucester County was used to identify the location of all existing tidal marshes, adjacent land use, shoreline structures, bank height, and exposure. These factors were used to estimate the potential for suitable marsh habitat to persist on the site given a sea level rise rate specified by the model user.

Shoreline property owner effects on marsh persistence were simulated based on the probability of selecting various management options (e.g. hard structures, living shorelines, no defensive practice). The probability of a particular choice was assessed in a calculation that allows the model user to adjust the relative level of influence of four factors: the property owner's perception of risk; technical advice from regulators and scientists; neighbors' management choices; and contractor recommendations. (These are the primary considerations for property owners identified in the social network analyses conducted in other parts of this project.) A review of shoreline projects over the past several decades was used to assign the initial probabilities for the management options coming from technical advisors, neighbors, and contractors. By combining these probabilities with the assigned level of influence for each group, the distribution of potential decisions can be assessed over a specified forecast interval.

Varying the relative influences of the factors influencing decisions makes it possible to assess the potential value of targeted outreach to property owners, contractors, and/or regulators under a variety of sea level rise scenarios.

Initial Findings: For Gloucester County, the survey and interview work done to describe the information flows through the social network affecting shoreline management suggested the importance of contractors in cumulative outcomes for marsh resources. The model simulation demonstrated the potential for outreach designed to increase contractor preference for living shoreline structures to have a modest impact on marsh persistence probabilities.

Similarly, the model made it clear that a regulatory change to require the use of management options designed to sustain marshes could produce a modest impact on marsh persistence

probabilities. As it turned out this particular action had been a pending recommendation in Virginia during the course of this project and was finally enacted in 2020.

Simulations also made it clear that at the historic rate of shoreline management decisions (number of permitted projects per year), the potential for altering the trajectory of marsh resources is similarly modest. At the current and forecast rates of sea level change, there would need to be a significant increase in the proportion of shoreline being actively managed to make an appreciable difference in outcomes.

Ongoing Work: A graphical interface is being developed, along with further refinement of the underlying model, to allow for interactive manipulation of decision influence factors. A more spatially explicit consideration of factors is being considered to better reflect community characteristics, contractor service areas, and extension coverage. Additional analyses of scenario outcomes to support ecological consequence assessments is under development. These will include things like the changes in length of contiguous marsh reach distributions, and changes in distributions of shorescape community types.

