

## THE VALUE OF PROTECTIVE SERVICES FROM COASTAL NATURAL AREAS

*Margaret Walls, Resources for the Future*

*Celso Ferreira, Department of Civil, Environmental, and Infrastructure Engineering, George Mason University*

Wetlands and other natural lands in coastal areas can provide a wide range of ecosystem services. One of the most important may be protection from storm surge-related flooding. Estimating the value of those services is difficult, yet having this economic information, in dollar terms, can help local and state governments make important land use decisions in coastal areas. In this study, we develop and implement an analytical framework that integrates state-of-the-art mathematical modeling of storm surge and waves with a careful economic valuation exercise in order to calculate the value of coastal protective services from wetlands and other natural lands. Our study region is the Maryland counties on the Atlantic coast and bordering the Chesapeake Bay and its tidal waters. Our approach is fully interdisciplinary. We combine results from surge and wave simulations using the ADCIRC+SWAN hydrodynamic and wave models, calibrated to the Chesapeake Bay, with detailed information on property values (from Maryland's MdProperty View database) and land cover (using NOAA's C-CAP land cover data). The coastal flooding is simulated for historical hurricanes that made landfall in the Chesapeake Bay region (Irene [2011], Floyd [1999] and Isabel [2003]) and hypothetical storms derived from historical tracks. We analyze future scenarios for population growth in Maryland counties, calculating economic losses due to property damages from hurricane flooding under alternative scenarios for land use change. Those scenarios capture land conservation-i.e., permanently protecting some lands from development-and locations for new households. The land cover changes are incorporated into the hydrodynamic model by its geospatial impact on the hydrodynamic bottom friction and its impact on the momentum transfer from the wind to the water column. We compare scenarios in which, for example, new households locate in and outside of areas prone to hurricane flooding, as well as nearby or far away from wetlands and other natural areas that provide protection in a hurricane (which we measure from our surge modeling). We compare the benefits of land conservation in particular areas to the costs-i.e., how will the additional protective services obtained from conservation compare with the opportunity cost of setting those lands aside. The research highlights how the value of ecosystems service is highly dependent on all of these factors and what this means for state and local decision makers managing land use and population growth.