Sea-Level Rise Impacts on Hudson River Marshes

Allison Hooks[1], Frank Nitsche[2]

[1]Department of Earth and Environmental Sciences, Columbia University, New York, NY, [2]Lamont-Doherty Earth Observatory, Palisades, NY

The response of tidal marshes to increasing sea-level rise is uncertain. Tidal marshes can adapt to rising sea levels through vertical accretion and inland migration. Yet tidal marshes are vulnerable to submergence if the rate of sea-level rise exceeds the rate of accretion and if inland migration is limited by natural features or development. We studied how Piermont and Iona Island Marsh, two tidal marshes on the Hudson River, New York, would be affected by sea-level rise of 0.5m, 1m, and 1.5m by 2100. This study was based on the 2011-2012 Coastal New York LiDAR survey. Using GIS we mapped sea-level rise projections accounting for accretion rates and calculated the submerged area of the marsh. Based on the Hudson River National Estuarine Research Reserve Vegetation 2005 dataset, we studied how elevation zones based on vegetation distributions would change. To evaluate the potential for inland migration, we assessed land cover around each marsh using the National Land Cover Database 2011 Land Cover dataset and examined the slope beyond the marsh boundaries. With an accretion rate of 0.29cm/year and 0.5m of sea-level rise by 2100, Piermont Marsh would be mostly unchanged. With 1.5m of sea-level rise, 86% of Piermont Marsh would be flooded. For Iona Island Marsh with an accretion rate of 0.78cm/year, sea-level rise of 0.5m by 2100 would result in a 4% expansion while 1.5m sea-level rise would cause inundation of 17% of the marsh. The results indicate that Piermont and Iona Island Marsh may be able to survive rates of sea-level rise such as 0.5m by 2100 through vertical accretion. At rates of sea-level rise like 1.5m by 2100, vertical accretion cannot match sea-level rise, submerging parts of the marshes. High elevations and steep slopes limit Piermont and Iona Island Marsh's ability to migrate inland. Understanding the impacts of sea-level rise on Piermont and Iona Island Marsh allows for long-term planning and could motivate marsh conservation programs.