Salt Marsh Retreat Based on Sea Level Rise in Cape May County New Jersey

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Introduction

The following is a sub-analysis of a larger project conducted by the Advanced Environmental Geomatics class of 2009 at Rutgers University. The main focus of the project was use of lidar data in studying the effects of sea level rise on New Jersey's Cape May County. The class identified two major dimensions of sea level rise. One section focused on the impacts on human activity, while the other put its attention on ecological implications. This analysis is focused on the effects on salt marshes in Cape May.

Salt marshes are areas of terrestrial or peat deposition colonized by herbaceous and small shrubby terrestrial vascular plants, almost permanently wet and frequently inundated with salt water (Long and Mason, 1983). Salt marshes are dynamic coastal features, shaped by the interaction of water, sediment, and vegetation (Wiegert et al., 1981). A variety of studies (Titus, J.G. 1988; Morris, J.T. et al. 2002; Cooper, M.J.P, M.D. Beever, and M. Oppenheimer. 2005) have researched and gathered data about sea level rise and its effect on coastal wetlands. The general consensus is that the wetlands are in danger of being lost to rising waters. Historically, New Jersey's salt marshes have been able to keep pace with sea level rise by retreating upland or vertical accretion. The studies mentioned above have shown that due to faster rates of sea level rise and loss of upland areas due to human development, the wetlands can no longer sustain themselves.

The importance of these territories can be found in their ecological, and commercial value. Wetlands support a wide biodiversity of organisms, as well as serve

as flood buffers and natural water filtration systems. Salt marshes are areas of recreational activities such as fishing, crabbing, hiking, and bird watching. Saving the wetlands means saving a part of New Jersey.

Background

To achieve the best results and better understand the processes involving both sea level rise and its effects on salt marsh dynamics, some general preliminary research was required before beginning this analysis. Studies conducted by the EPA, Titus, Cooper, Beevers, and Oppenheimer provided information on the greenhouse effect and its consequences on salt marshes. Research undertaken by Khalequzzaman and Morris, as well as Titus and Reed, was functional to better comprehending salt marsh ecology, in particular the processes of accretion and retreat. The work of Psuty and Ofiara provided the statistics and actual measures of sea level rise utilized in this analysis. The methodology for this project was inspired by studies conducted by CRSSA and the American Littoral Society. See *Literature Cited* for specific reports.

Objective

This study's main objective is to determine which areas of Cape May County are available for salt marsh retreat in the event of two sea level rise scenarios, specifically the low-end 0.6 meter scenario and the high-end 1.2 meter scenario based off mean sea level. Furthermore, the study seeks to identify which potential retreat areas would be lost to sea level rise and where new areas could become available.

The results of the analysis pertain to the larger study as a whole from two perspectives. On the human scale, as motioned above, salt marshes play an important role in recreational activities. Cape May County generates a significant amount of revenue from "eco-tours" of its wetlands. Furthermore, their function as flood buffers

could save potential upland development from inundation. On the ecological side, salt marshes serve as natural water filters, migratory rest stops for birds, as well a feeding, spawning, and nesting grounds for them and many other species.

Methods

The data utilized in the analysis had been collected and made available by CRSSA for the Coast Habitat Vulnerability to Sea Level Rise project. The sea level rise scenarios were created utilizing lidar based DEMs generated by NOAA[1].

The first step in identifying areas available for salt marsh retreat consisted of determining land cover in Cape May. Data on land cover was available at CRSSA. The next step involved defining the upper wetland boundary, which was also available at CRSSA. Third, a retreat area was determined from the upper wetland boundary by running a 500-meter buffer into the upland. Fourth, areas classified as urban, thus developed, were removed from the designated retreat area as they block salt marsh retreat. Finally, the two sea level rise scenarios were applied and the change in marsh size and retreat area size were measured.

Due to the heavey loss in retreat area, in the case of the 1.2-meter sea level rise, an additional 500-meter buff was applied going upland from the original retreat zone. The additional step was taken to identify any further areas that would be available for retreat.

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[1] Financial assistance for the acquisition of lidar data was provided by the New Jersey Coastal Management Program through CZM Grant Awards #NA06NOS4190228 and NA07NOS4190186 awarded through the Coastal Zone Management Act of 1972, as amended, administered by the Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration. Additional funding was provided by the New Jersey State Police through the FY2007 EMPG Program, the Natural Resource Conservation Service of the U.S. Department of Agriculture, the U.S. Army Corps of Engineers, Philadelphia, PA, the United States Geologic Survey, and the New Jersey Department of Environmental Protection, Office of Information Resources Management.

Results

With respect to the low-end (0.6m) scenario: 47% of the 110349.29 acres of Cape May salt marsh were lost, leaving 58485.13 acres. Only 2% of the 42834.14 acres of retreat area were lost. The main reason for this outcome is that the retreat areas lay in the uplands outside the marsh. Because this sea level rise scenario was not extensive enough to inundate large areas of uplands, the retreat area remained fairly safe.

In the case of the high-end (1.2m) scenario: the salt marsh is completely inundated. 32% of the retreat area also disappears leaving only 29127.22 acres for retreat. If the additional 500-meter buffer is added, the retreat area jumps to 57747.24 acres. These results have been represented visually in figures 1 and 2 on the following page.

Though the analysis does answer the question stated in the objective, it remains somewhat simple and limited. This analysis does not consider accretion (i.e. marsh growing by vertically through sediment deposition). Although the literature examined states that accretion cannot keep up with an accelerated sea level rise, it surely plays some role in preserving the marsh that was not be addressed in this instance. Increase in developed areas is also not a factor in this study. This is particularly true for the additional buffer in 1.2m scenario. In the event the county builds any new type of infrastructure in the buffer area, the acreage available for retreat would be thrown off. Finally, this study presumes that the effects of sea level rise are immediate. The water will not rise over night. This means the marsh will retreat gradually to new areas making more of less new retreat areas upland. This study would surely be improved if the gradual retreat of salt marsh could be predicted and incorporated in the analysis.

Impacts of Sea Level Rise on Salt marsh Retreat in Cape May County, NJ - 0.6 m Scenario

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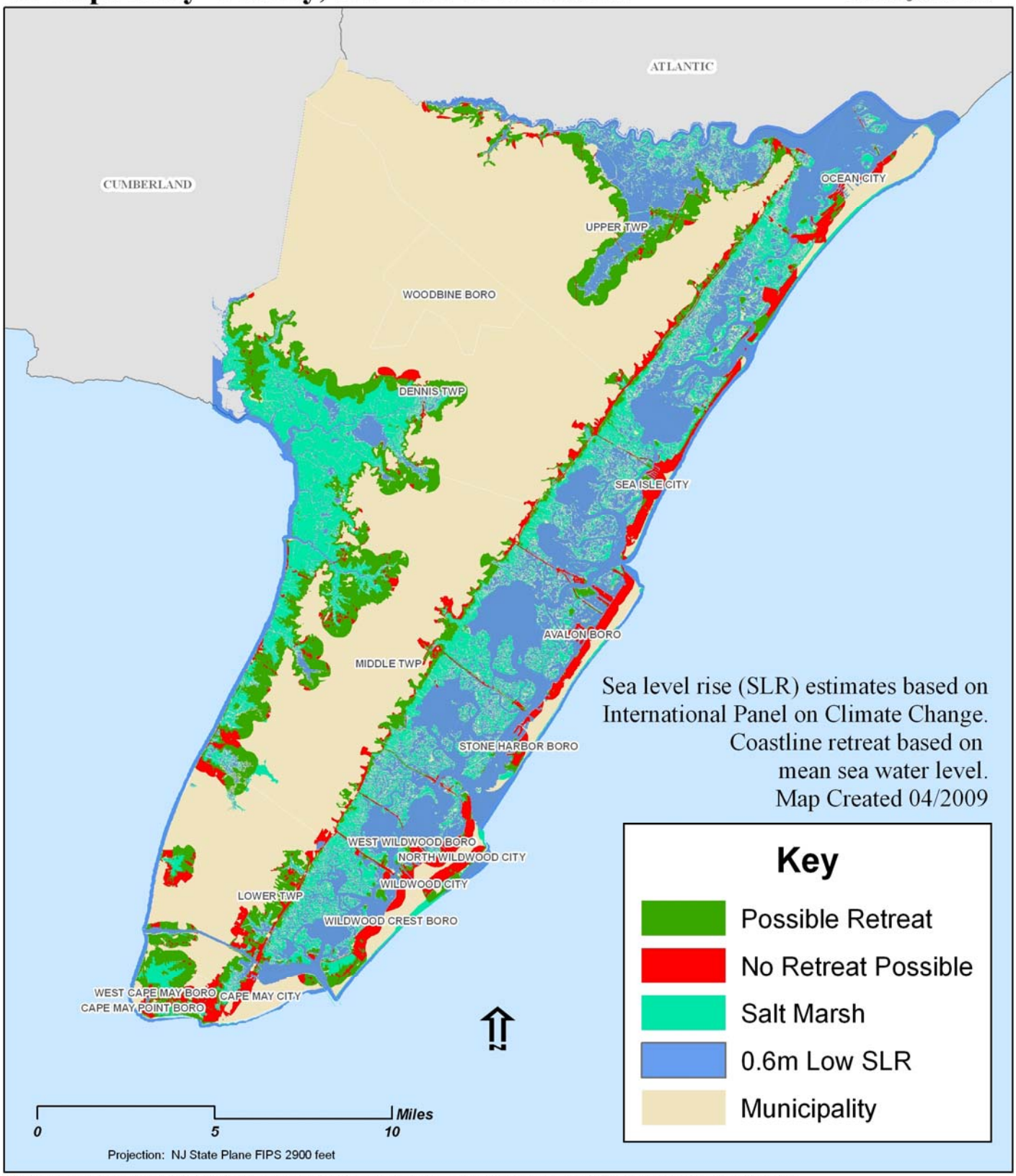

Financial assistance for the acquisition of Lidar data was provided by the New Jersey Coastal Management Program through CZM Grant Awards #NA06NOS4190228 and NA07NOS4190186 awarded through the Coastal Zone Management Act of 1972, as amended, administered by the Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration. Additional funding was provided by the New Jersey State Police through the FY2007 EMPG Program, the Natural Resource Conservation Service of the U.S. Department of Agriculture, the U.S. Army Corps of Engineers, Philadelphia, PA, the United States Geologic Survey, and the New Jersey Department of Environmental Protection, Office of Information Resources Management.

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Fig. 1

Impacts of Sea Level Rise on Salt marsh Retreat in Cape May County, NJ - 1.2 m Scenario

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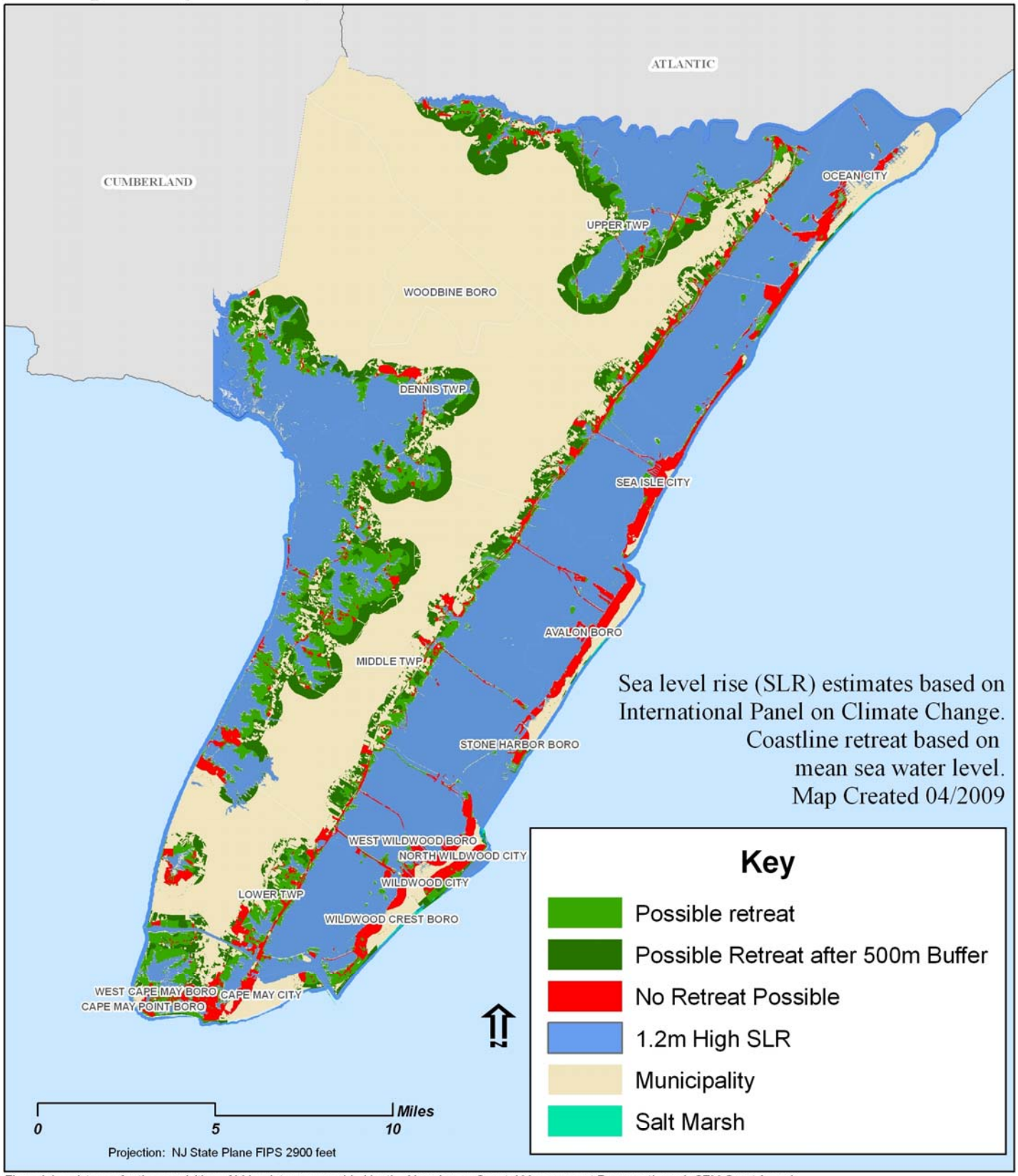

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Fig.2

Summary & Conclusion

Overall, the study has shown that a 1.2 meter sea level rise could be devastating to salt marshes in Cape May. Even with an additional 500 meters of land available for retreat, the area that could become salt marsh is still inferior to the remaining salt marsh in a 0.6 meter scenario. In the end sea level rise will eliminate at least half the salt marsh in the county.

The study is limited due to insufficient studies on salt marsh accretion, lack of consideration for new developed areas, and lack of prediction of salt marsh retreat dynamics. Even so, it represents a step toward addressing the issue incorporating these variables and considering action to create no development zones to protect the marsh and the existing uplands.

If the natural encroachment of marshes onto upland area is not prevented by development, and if the coastal erosion rates can be reduced, then the present size of the marshes can be maintained in the future (Khalequzzaman, 1989).

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