REMEDIATING IMPACTS OF GLOBAL CLIMATE CHANGE-INDUCED SUBMERGENCE ON SALT MARSH ECOSYSTEM FUNCTIONS

A Dissertation

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by
Camille LaFosse Stagg
B.S., Christian Brothers University, 2002
M.S., Clemson University, 2004
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ABSTRACT

Impacts of global climate change, such as sea level rise and severe drought, have altered the hydrology of coastal salt marshes resulting in submergence and subsequent degradation of ecosystem function. A potential method of rehabilitating these systems is the addition of sediment-slurries to increase the elevation of the marsh surface, thus ameliorating the effects of excessive inundation. Although this technique is growing in popularity, the successful restoration of ecological function after sediment addition has received little attention. The purpose of this research was to determine if sediment subsidized salt marshes are functionally equivalent to natural marshes and whether salt marshes restored with this technique are sustainable over time. This research addressed the following questions: 1) Does sediment-slurry addition restore important ecological functions such as primary production, organic matter decomposition and secondary production?, 2) If so, what level of sediment addition results in optimal function?, 3) What soil physico-chemical parameters associated with sediment addition influence these ecological functions? and 4) How does vegetation resilience in sediment subsidized marshes change over time?

Moderate intensities of sediment-slurry addition, resulting in elevations at the mid to high intertidal zone (42-53 cm NAVD 88), successfully restored ecological function to degraded salt marshes. Additionally, salt marshes that received intermediate levels of sediment addition were more resilient than natural marshes, and maintained their resilience over time. However, all ecological functions showed a sediment addition threshold that was characterized by a decline in production and resilience and accelerated decomposition in areas of intense sediment addition, or high elevation (> 53 cm NAVD 88). The primary regulator of enhanced ecological function in the restored marshes was the alleviation of flooding stress observed in the degraded marsh.
Declines in ecological function above the sediment addition threshold were principally influenced by dry conditions that resulted from insufficient and infrequent flooding at high elevations. Therefore, the addition of intermediate levels of sediment to submerging salt marshes increases marsh surface elevation, ameliorates impacts of prolonged inundation and increases production and resilience. However, too much addition of sediment results in diminished ecological function that is equivalent to the submerged or degraded system.