

Soil Characteristics at Marsh Dieback Areas Along the Georgia Coast

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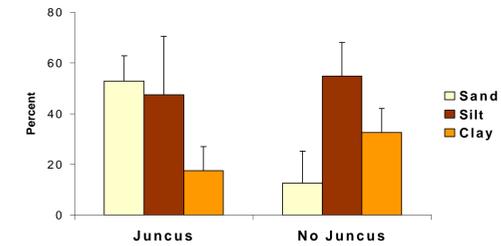
Abstract

In winter, 2002, salt marsh dieback was reported in coastal Georgia. These are areas of marsh with little or no above-ground vegetation. The cause of the dieback is unknown, but one suggestion is that it is the result of a change in soil chemistry. We were interested in determining whether dieback is associated with particular soil types. In summer 2003, soil samples were taken from 16 sites along the Georgia coast in an attempt to assess any differences in percent sand, silt, and clay composition, as well as percent organic matter. At each site, samples were taken at both dieback and nearby reference areas. Sites were also classified in terms of location (inland vs. barrier island), the presence of *Juncus roemerianus* within the study site, and other characteristics. Our results did not reveal any overall differences between reference and dieback sites, but we did see significant differences in % sand at 3 sites ($p < 0.05$). We also found a greater percentage of sand in sites with *Juncus roemerianus* present, and at sites that are a part of barrier islands ($p < 0.01$). These results suggest that dieback is not associated with a particular soil type. Percent organic content analysis is ongoing.

Examples of marsh dieback in Georgia



Differences Based on Plant Species



- > Sites with *Juncus roemerianus* had significantly higher % sand and lower % clay than sites where *J. roemerianus* was not present.
- > This is not surprising, because *J. roemerianus* is often found in higher areas, which generally have sandier soils.

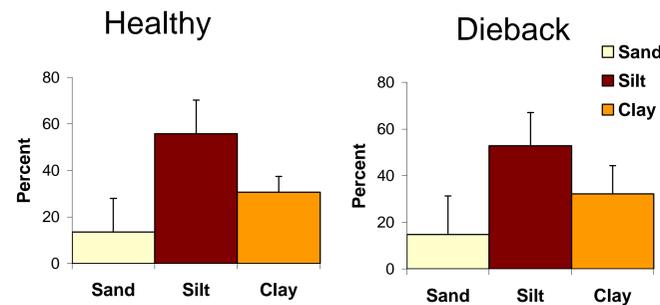
Introduction

- > In winter 2002, salt marshes along the coast of Georgia experienced extensive dieback, resulting in areas of bare mud. The two major plants in Georgia marshes, salt marsh cordgrass (*Spartina alterniflora*) and black needle rush (*Juncus roemerianus*), were both affected.
- > Although a variety of hypotheses have been proposed (including pollution, fungal pathogens and snail herbivory), changes in soil chemistry have been identified as the most likely causes of dieback. Concurrent to the dieback, Georgia experienced one of the worst droughts in its history. Increased evapotranspiration and decreased flushing rates may have contributed to soil desiccation and subsequent changes in soil chemistry.
- > This survey was conducted in order to identify patterns associated with the soil composition of salt marsh dieback areas in coastal Georgia. I was interested in determining differences in soil composition (% sand, % silt and % clay) between healthy and dieback areas. I was also interested in investigating relationships between soil composition and plant species, proximity to the ocean, the area affected, the portion of the marsh affected (the dieback pattern), and the presence of man-made structures at each site.



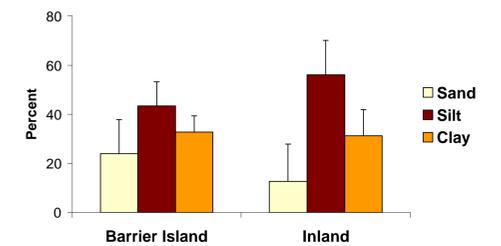
Map of the Georgia coast, showing areas sampled in this study.

Soil Composition



- > There were no overall differences in soil composition between healthy and dieback areas.
- > When taken together, samples averaged $14.3 \pm 15.5\%$ sand, $54.3 \pm 14.2\%$ silt, and $31.5 \pm 10.0\%$ clay. However, the large standard deviations associated with these observations indicate that soil composition is highly variable.

Differences Based on Proximity to the Ocean



- > Soil composition differed between barrier island and inland sites.
- > % sand was significantly higher and % silt significantly lower at barrier island sites.
- > This observation is likely because of the higher wave energy (and hence larger particles) at barrier island as compared to inland sites.

Other Observations

- > No differences were detected with respect to the area affected, the portion of the marsh affected (the dieback pattern) or the presence of man-made structures (data not shown)

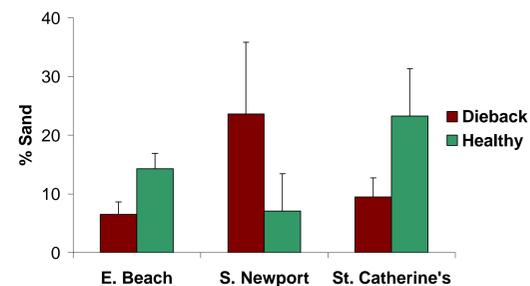
Conclusions

- > Soil composition was highly variable. This type of patchiness has been observed elsewhere, and is typical of marsh sediment.
- > Overall, soil composition was similar between healthy and dieback areas, although differences were observed at a few sites. Other observed differences (i.e. increased % sand at sites containing *J. roemerianus*, those on barrier islands) were consistent with published observations of marsh sediment.
- > These results suggest that the composition of marsh soil may have had little to do with determining the location of dieback sites. Other factors such as soil organic content (studies ongoing), soil desiccation, metal toxicity, pathogens or other factors may have been more important in causing dieback.

Acknowledgements

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Site Differences between Dieback and Healthy Areas



- > 3 out of the 16 individual sites showed significant differences in soil composition ($p < 0.05$) between healthy and dieback areas, but these were not consistent. Sand content was lower in the dieback area than in the healthy area at 2 of the sites, and higher at the other site.



Methods

- > A total of 16 sites were surveyed in this study (see map)
- > Sites were chosen so that they were distributed throughout the coastal zone and contained both species affected. Dieback sites were classified by plant species (*Juncus* vs. no *Juncus*), proximity to the ocean (inland vs. barrier island), the area affected, the portion of the marsh affected (the dieback pattern) and the presence of man-made structures. (Classifications were determined by Matt Ogburn)
- > At each dieback site, 4 to 8 samples were collected in both the dieback area and a nearby healthy area.
- > Plugs of soil weighing approximately 500 g (wet weight) were collected from a depth of 10 cm, placed in plastic bags and frozen for later analysis.
- > 40-70 g of each sample were thawed at room temperature, mixed with a dispersant solution of 5 ml of NaPO_3 and 150 ml of DI water and placed on a table shaker for 24 hours. Sand, silt and clay components were separated using a method adapted from Carver (1971) and Folk (1971) by Clark Alexander (Skidaway Institute of Oceanography). Each fraction was dried at 60°C and weighed and percentages were calculated by dividing the weight of each fraction by the total weight of all 3 fractions.
- > T-tests were used to examine differences between % sand, silt and clay in different site classifications. (All data were square-root transformed prior to analysis.)