ABSTRACT for 2010 ESRP Meeting Poster

Title: Nitrogen over-enrichment effects on belowground structure in coastal wetlands and implications for delivery of ecosystem services

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Salt marshes supply many ecosystem services, such as fish, crab and bird habitat, flood abatement and carbon sequestration. Since salt marshes function as a moderating buffer between ocean and land, they are one of the first lines of defense to absorb the effects of sea level rise. Additionally, marshes are the final moderating buffer from land-based anthropogenic inputs flowing into the coastal waters. Thus marshes can have an influence on stressors from both land and sea.

This research investigated two geographically separated sets of marshes with different soil matrices: one location, on Jamaica Bay in Long Island, NY and the other in the North Inlet Estuary of Winyah Bay, SC. Sediment cores were taken in 2008 and 2009 from the organic-rich soils in marshes of Jamaica Bay NY, which is under the purview of the National Park Service, at the end of the JFK Airport runway, JoCo Marsh, and from a disappearing marsh on Black Bank Island. We recently took cores from the Mashomack Preserve (NY), a less anthropogenically impacted marsh area; however, the data has not yet been analyzed. The Jamaica Bay site has been exposed to significant nutrient loads (sewage effluent) for decades. The SC samples were taken from the mineral marsh soils associated with an ongoing project run by the Baruch Marine Field Laboratory of the University of South Carolina. Some plots were controls and others were treated over a 12 year period with constant elevated levels of nitrogen and/or phosphate.

This study determined the effect of increased nutrient load on the biomass, abundance and diameter of roots and rhizomes in both the NY and SC marshes. In addition to determining the mass of roots and rhizomes using hand-sieving methods, we also used a new Computer Aided Tomography (CT) tool on the same samples to determine abundance and diameter of roots and rhizomes.

Our findings demonstrate that an elevated nutrient load alters the biomass, abundance and diameter of roots and rhizomes. In the organic-rich Jamaica Bay salt marsh soils, the results suggest that elevated nutrient loads can weaken below ground structure, despite a healthy appearance aboveground, by reducing the abundance and mass of roots and rhizomes. Surprisingly, the diameter of rhizomes in the disappearing salt marshes of Jamaica Bay were significantly greater than in the stable marshes, perhaps to assist the plants in adapting to nutrient-enriched and low redox conditions. In the mineral-rich soils of South Carolina there was a positive and significant nitrogen effect on the abundance of rhizomes and coarse roots, and a significantly adverse effect on the mass of the fine roots. As in the disappearing marsh of Jamaica Bay, the diameters of the rhizomes in the nitrogen treated plots in SC were significantly larger than the controls. Additionally, the nitrogen enrichment appears to have a positive effect on the overall belowground biomass, but long term effects of nutrients on belowground marsh in mineral-rich soils are unclear since fine roots were adversely affected. It is unclear if there is a threshold

where the build-up of organic matter in mineral soils will alter the biogeochemical response of the plants to fertilization and affect root and rhizome production. Especially in organic-rich soils, alterations in the belowground structure will likely have an adverse effect on the provision of many ecosystem services, directly or indirectly, as a result marsh area loss.