Effect of fertilization on soil respiration and belowground macro-organic matter in *Spartina alterniflora* marsh soils

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Human activities and rising populations increase watershed nutrient loads, which may alter the structure and function of coastal wetlands. In a long-term fertilization experiment in the North Inlet-Winyah Bay Reserve (NI-WB, NERR) (SC) *Spartina* marsh system, we used a 2 X 2 factorial design with nitrogen (N) and phosphorus (P) treatments to examine effects on soil respiration and belowground macro-organic matter (organic material retained on a 1 mm sieve). Nitrogen fertilization caused elevated soil respiration rates, with a significant ($P < 0.05$) main effect of N, no significant effect of P, and a significant N X P interaction. Total belowground macro-organic matter was variable between replicates. In general, the control plots had greater differentials between shallow (0 – 10 cm depth) and deeper (10 – 20 cm) macro-organic matter stores. There was a significant inverse relationship ($R^2 = 0.62$, $P = 0.002$) between the macro-organic matter differential and the soil respiration rates, as well as a significant inverse relationship between the shallow macro-organic matter and the soil respiration rates ($R^2 = 0.38$, $P = 0.03$). In addition, we measured elevated soil respiration rates in NI-WB soils collected near a confluence draining a residential development compared with control areas. Similarly, increasing soil respiration rates and decreasing carbon stores in surface soils were found in marshes along a gradient of low to high watershed nitrogen loads in Narragansett Bay (RI). Further, in deteriorating marshes of Jamaica Bay (NY), which have been exposed to large sewage loads for over six decades, we measured elevated soil respiration rates and significant losses in belowground roots and rhizomes compared to stable marshes in this system. These results suggest that long-term eutrophication reduces marsh stability in part due to elevated soil respiration rates and losses in belowground macro-organic matter.

Key words: soil respiration; *Spartina*; macro-organic matter; roots; rhizomes; eutrophication