2018 Geodynamics Seminar

Microbial and Biogeochemical Responses to 15 years of Nutrient Enrichment in a New England Salt Marsh

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Abstract

Nitrate concentrations in coastal and estuarine waters are increasing around the globe and much research has been done to understand the effects of nutrient enrichment on coastal communities. Nitrate is unique, however, in that it can be used both as a nutrient to increase primary production in nitrogen limited coastal waters and, in the absence of oxygen, as an electron acceptor to fuel microbial heterotrophic metabolisms. Determining which of these processes dominates is essential, as the former promotes carbon fixation and storage and the latter may decrease the carbon sink capacity of marshes. We have been experimentally enriching entire salt marsh creeks with dissolved nitrate for fifteen years and examining ecosystem scale effects of this nutrient enrichment. Our results indicate only a modest response of marsh plant growth as a result of nitrate enrichment, but a dramatic shift in both the fungal and active bacterial communities, including dramatic increases in fungal taxa that are known to denitrify. Further, controlled flow through experiments, where marsh sediment was exposed to dissolved nitrate under anaerobic conditions, demonstrated greater DIC production than when under nitrate limiting conditions. Taken together, our research suggests that the dissolved nitrate that continues to enrich our coastal waters may play an important role as an electron acceptor to fuel microbial decomposition of marsh carbon, which could ultimately affect the carbon storage capacity of these critical blue carbon habitats.