The Effect of Prescribed Burning on Nitrification-Coupled Denitrification in a Restored Chesapeake Bay Tidal Marsh

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Prescribed burning is a management practice commonly used in tidal marshes of the Southeastern and Mid-Atlantic United States to improve habitat for target species. It can stimulate biomass production of desired plants, remove invasive species, and prevent larger, more destructive burns. Tidal marshes are ecosystems of interest because they possess dynamic redox conditions that promote nitrogen cycling and therefore nutrient removal. The impact of prescribed burning on tidal marsh biogeochemical processes, especially nitrification-coupled denitrification, is understudied. The objective of this study is to investigate the effect of a prescribed burn on nitrification coupled denitrification in a restored Chesapeake Bay tidal marsh on Poplar Island, Maryland, United States. A prescribed burn was completed in March 2024 as part of an effort to combat marsh dieback by removing overwintering habitat for stem-boring insects and pathogenic organisms. The work presented here builds on a study of the response of vegetation, microbial, and insect communities to the prescribed burn. To measure sediment-water exchange of nutrients like ammonium and nitrate/nitrite, as well as dissolved nitrogen and oxygen gas, intact cores were collected from both burned and control plots. The cores were incubated under dark followed by light conditions. Soil porewater equilibrators were deployed in the same sites to measure concentrations of pore water nutrients such as ammonium, nitrate/nitrite, and sulfides within the rhizosphere. Two sites in each burn and control plot were established in three marshes ranging in age from 9 – 15 years, for a total of twelve study sites. These measurements were taken at two time-points in the growing season before the prescribed burn (July 2023 and October 2023) and two time-points in the post-burn growing season (July 2024 and October 2024). Pre-burn and post-burn sediment-water exchange rates and porewater nutrients were compared to investigate the impact of the prescribed burn on sediment biogeochemistry. To further understand environmental controls on the results, climate data like soil, water, and air temperature, as well as water level were also analyzed for both the pre-burn and post-burn growing seasons. The impact of marsh age was also investigated by comparing results between the three different marsh cells. Results from these analyses will be highlighted in detail in this presentation.