Evaluation of Microbial Respiration and Enzyme Activity Downstream in the North East Shark River Slough (NESRS)

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Introduction

The Everglades is a large ecosystem in which freshwater flows from north to south. Freshwater is delivered to the southern Everglades mainly through the North East Shark River Slough(NESRS). The construction of canals and levees has altered the flow of freshwater, cutting off flow to NESRS and causing loss of hydrological and ecological connectivity. Restoration projects are in place to restore the flow of freshwater, which may affect nutrient dynamics in the southern Everglades.

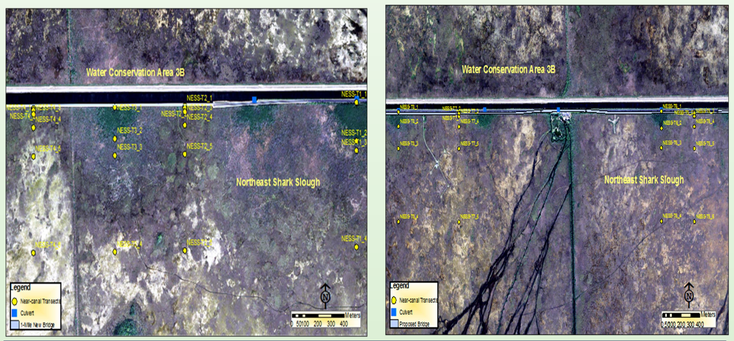


Figure 1: Location of the near-field monitoring transect sites in Northeast Shark River Slough, Everglades National park

Objective

Determine the effects of flow on nutrient dynamics in soils of the Northeast Shark River Slough

Methods

Soil (0-2 cm) from NESRS transect sites were slurried with DDIH_2O and amended with: 0.4 mmole P (as KH_2PO_4, +P), 1.2 mmole C (as glucose, +C), and the combination (+P +G). Unamended slurries were used as controls (C). Known mass slurries were incubated for 96 h (dark) in 20 ml gas chromatograph vials with CO_2-free air purged headspace. After incubation the headspace was analyzed for CO_2 after conversion to CH_4 by flame ionization detection. Subsamples of slurries were diluted (x1000) and incubated with methylumbelliferyl substrates for enzymatic analysis of phopsphatase and glucosidase on a microplate reader. Univariate ANOVA (SPSS 23) was used to compare treatments within a distance (small letters) and between treatments across distances (capital letters).

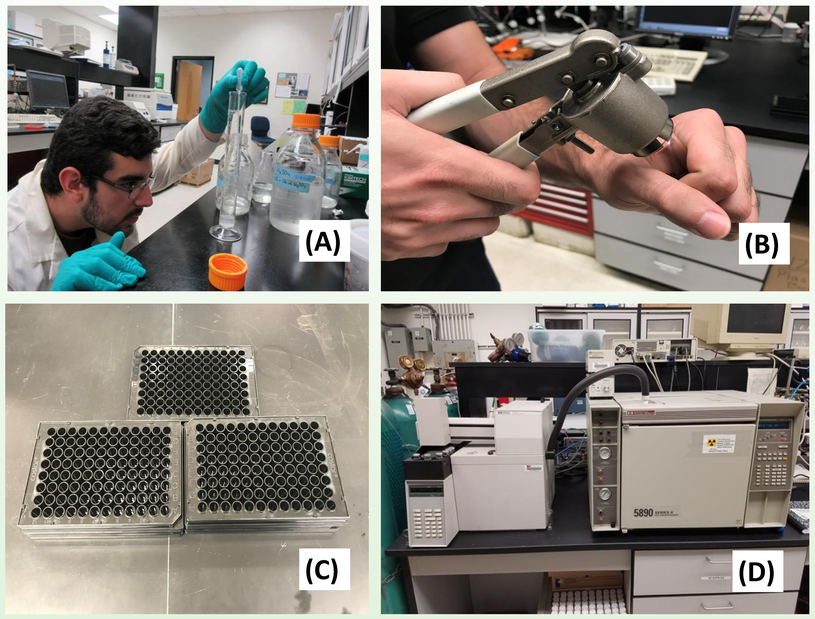
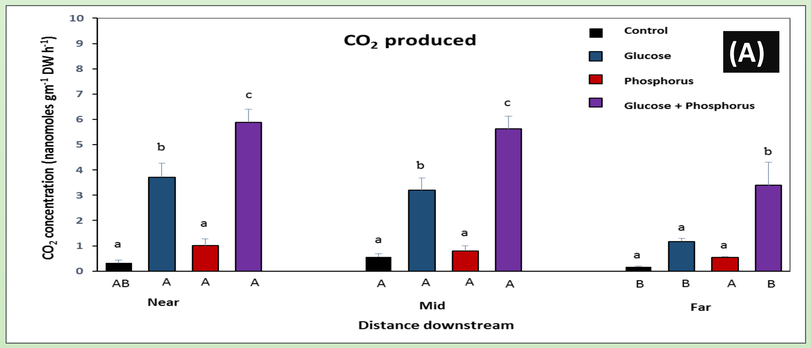
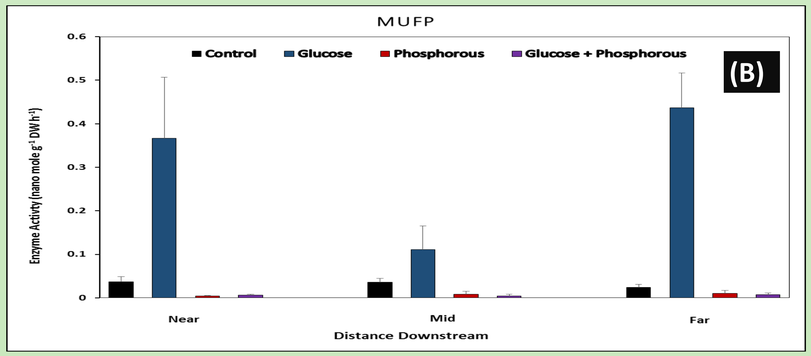


Figure 2: (A) Preparing solutions for EA analysis (B) Preparation of glass vials for CO_2 analysis (C) Microplate reader trays and (D) Gas Chromatography for CO_2 analysis

Results





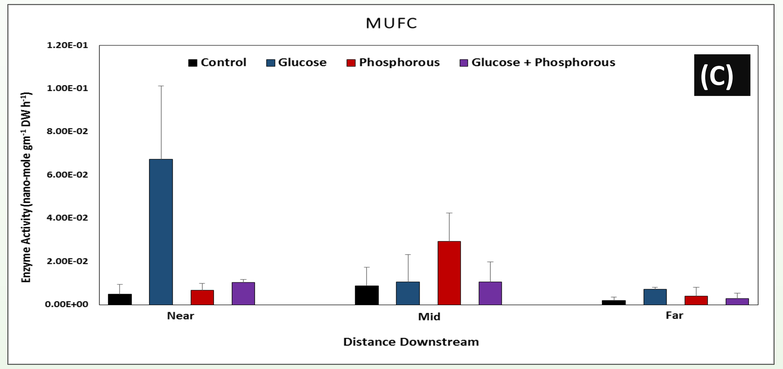


Figure 3: (A) CO_2 produced by soils (B) MUFP and (C)) MUFC analyses for NESRS surface soils

Conclusion

There was not a significant increase in respiration with the addition of P at any distance downstream of the canals. The addition of glucose significantly increased respiration near the canal and mid-way along the transects suggesting that respiration, at least in proximity to inflow, in the NESRS is not limited by phosphorous, but by availability of ready-to-use, or labile C. In addition, our results indicate that when amended with labile C the microbes increase the production of phosphatase (MUFP) suggesting an inducible mechanism to more efficiently consume organic matter. As expected, +P reduced the MUFP activity.

Take Home Note

Respiration in the soil of NESRS is not limited by phosphorous but by availability of labile carbon in the environment. Further studies are needed to fully understand that effect of restored flow on the nutrient dynamics and microbial community of the southern Everglades.

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