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FUNCTIONAL ASSESSMENT OF ALASKA PEATLANDS IN COOK INLET BASIN REGION 10 REGIONAL APPLIED RESEARCH EFFORT (RARE)

Background

Peatlands are organic soil wetlands that are underlain by peat, which is partially decomposed vegetation. Peat develops when the rate of plant growth exceeds decay and commonly accumulates 1 mm annually. The Cook Inlet Basin ecoregion of south central Alaska contains many wetlands. Most of these wetlands are peatlands and nearly all are still pristine. Some are extensive as shown in the picture below taken in the Kalifornski Flats on the Kenai Peninsula.

The majority of Alaska's population lives within this ecoregion, in Anchorage and the Matanuska-Susitna Borough (MSB) to the north and in the Kenai Peninsula Borough to the south. All three areas are experiencing population growth, with the MSB the most rapidly developing. Our aim has been to help environmental managers in this ecoregion to look at the classification of their wetlands, understand functions of the peatlands, and have measures to determine the impact of human activities.

Approach

Specific goals of this project included quantifying wetland hydrologic functions, comparing different classification systems of wetlands, measuring arsenic concentrations in wetland pore waters, and determining nutrient demands in peat using rates of microbial extracellular enzyme activity (EEA).

Results

Peatlands were found to contribute 55 % of the water for summer dry-season baseflow to a tributary of the Anchor River, an important anadromous fishery. Many of the peatlands in this watershed are fens with respect to vegetation and pH but are ombrotrophic hydrologically. Like the small watershed measured and modeled here, most peatlands in this ecoregion probably provide discharge to adjacent streams.

The Cook Inlet Classification (CIC), a wetland classification system developed for this region (Gracz 2012), was found to perform better at grouping biological and physical variables than a hydrogeomorphic wetland classification developed in another region. The CIC uses hydrologic and geomorphologic features as well as vegetation to type wetlands.

Arsenic was found in measurable (>1.3 µg/L) quantities in 60 % of pore water samples from intact peat. Indeed, 30 % of the 27 wetlands sampled had >10 µg/L which is the EPA standard for arsenic in drinking water. The source of the arsenic is presumed to be natural, not anthropogenic.

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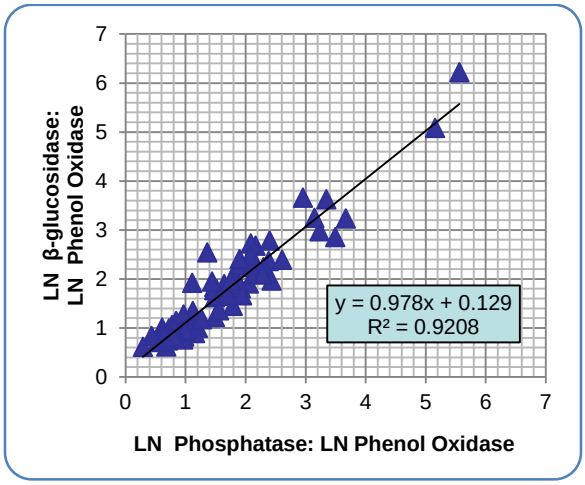
The microbial EEA methods tested various substrates including simple sugars, amino acids, a phospho-monoester, and polycyclic phenols. EEA rates in peat samples demonstrated nitrogen and phosphorus limitations within the peat along vertical profiles in the wetlands; P-limitation was present mostly in the upper peat layers. Chemical ratios of C, N and P in the peat were not as reliable measures of resource constraints in these peatland soils as were EEA. The EEA rates also demonstrated the tight coupling of microbial N and P acquisition to recalcitrant organic carbon breakdown, i.e., C compounds that are more resistant to decomposition, as seen in data of the following graphic figure.

In this figure phenol oxidase enzyme activity (EA), which represents the potential rate of utilization of a recalcitrant organic C compound, normalizes the significant relationship between an organic C breakdown (by β-glucosidase EA) and phosphorus acquisition (by phosphatase EA).



Impact

This project incorporated novel tools to examine and measure the functional character of wetlands, and in particular, peatlands. These functional attributes reveal how the peatlands support ecological services such as providing source water for fishable streams, drinking water, habitat for wildlife, and C storage and C accumulation in the peat. The qualitative and quantitative methods help environmental managers know what to expect of natural peatlands in this region. With this information, we can better achieve goals to protect wetlands from disturbance or loss of ecological services.

Citations

Gracz, Michael B. (2012) Wetland Classification and Mapping of the Cook Inlet Basin, Alaska. Kenai Watershed Forum http://cookinletwetlands.info/

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