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Effect of water level drawdown on decomposition in boreal peatlands

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Plant litter production and decomposition are key processes in element cycling in most ecosystems. In peatlands, there has been a long-term imbalance between litter production and decay caused by high water levels (WL) and consequent anoxia. This has resulted in peatlands being a significant sink of carbon (C) from the atmosphere. However, peatlands are experiencing both "natural" (global climate change) and anthropogenic (ditching) changes that threaten their ability to retain this ecosystem identity and function. Many of these alterations can be traced back to WL drawdown, which can cause increased aeration, higher acidity, falling temperatures, and a greater probability of drought. Such changes are also associated with an increasing decomposition rate, and therefore a greater amount of C released back to the atmosphere. Yet studies about how the overall C balance of peatlands will be affected have come up with conflicting conclusions, demonstrating that the C store could increase, decrease, or remain static. A factor that has been largely overlooked is the change in litter type composition following persistent WL drawdown. It is the aim of our study, then, to help to resolve this issue.

We studied the effects of short-term (ca. 4 years) and long-term (ca. 40 years) persistent WL drawdown on the decomposition of numerous types of above-ground and below-ground plant litters at three boreal peatland sites: bog, oligotrophic fen and mesotrophic fen. We thus believe that enough permutations have been created to obtain a good assessment of how each factor, site nutrient level, WL regime, and litter type composition, influences decomposition. We used the litter bag method to measure the decomposition rates: placed measured amounts of plant litter, or cellulose strips as a control, into closed mesh bags, and installed the bags in the natural environment for decomposition for each litter type for varying amounts of time. Following litter bag recovery, the litter was cleaned of excess debris and analyzed for changes in mass, enzyme activity, mesofauna presence, and microbial community composition, among other things. The experiment has a run-time of ten years, the results from the first two years are presented in the poster.