Microbial Community Responses to Elevated Temperature and CO_2 in Peat Decomposition Ladders

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Peatlands are ecosystems in which plant primary production has historically outpaced microbial decomposition and, as a result, peatlands store approximately one-third of the global terrestrial organic matter. As climate change accelerates, increased temperature and atmospheric CO_2 have the potential to alter the processes involved in organic matter accumulation and degradation. Specifically, warming may influence microbial communities involved in organic matter decomposition, leading to increased decomposition and further production of the greenhouse gases CO_2 and CH_4. To investigate how increased temperature and elevated CO_2 may impact microbial communities associated with organic matter decomposition, we utilized the Spruce and Peatland Responses Under Changing Environments (SPRUCE) experiment in northern Minnesota. Peat decomposition ladders consisting of known quantities of peat in discrete mesh bags were placed into the SPRUCE treatment chambers at four depths below the surface of the peat in 10 cm increments (between 0-40 cm) allowing them to decompose *in situ* and were collected after three years. Peat mass loss and carbon:nitrogen (C:N) changes were quantified, and characterization of the microbial communities were accomplished through 16S rRNA (bacterial/archaeal) and ITS (fungal) amplicon sequencing. Our results show that microbial community composition is significantly impacted by depth, temperature, and CO_2 treatment. We found that bacterial/archaeal and fungal alpha-diversity were highest near the surface (0-10 cm) and in the plots with the highest warming treatment (+9° C). Numerous microbial phyla were significantly differentially abundant between temperature treatments, indicating selection of specific microbes with warming. We did not find a significant correlation between microbial community composition and peat mass loss or C:N. This may be due to a lag between community shift and decomposition process responses to warming and our planned outyear collections of peat decomposition ladders will be used to test this hypothesis. Collectively, our results indicate that increased temperature and CO_2 as a result of climate change can alter microbial communities in peatlands, potentially contributing to increased decomposition rates and greenhouse gas emissions.