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Soil Viral Impacts on Microbial Ecology and Carbon Cycling in Natural and Agricultural Ecosystems

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ABSTRACT

Soil and rhizosphere microorganisms are key contributors to carbon and nutrient cycling and plant productivity, and recent work suggests that viruses also have significant impacts on terrestrial ecosystems. Our group uses metagenomic approaches to characterize viral communities and their contributions to microbial ecology and biogeochemistry in natural and agricultural soils. Results from a thawing permafrost peatland in Northern Sweden and from agricultural soils in California will be presented to highlight soil viral diversity and predicted viral impacts on microbial ecology and carbon cycling. Differences in viral community composition and virus-host dynamics along a permafrost thaw gradient, along with the recovery of viral genes implicated in complex carbon degradation, suggest that viruses contribute to carbon cycling and ecosystem function in terrestrial habitats vulnerable to climate change. In tomato fields, a significant shift in soil viral community composition between pre-planting and harvest samples suggests the potential for recruitment of a distinct virome to rhizosphere soils. Taken together, these findings highlight the need for further investigations into feedbacks among viral community composition, microbial ecology, carbon and nutrient cycling, and plant productivity across diverse terrestrial habitats.