NAME: Janet Jansson
ORGANIZATION: LBNL
PROGRAM AFFILIATION: TES
ABSTRACT TITLE: Impact of fire and natural thaw on permafrost microbial communities and functions

ABSTRACT: Permafrost currently sequesters a large fraction of the terrestrial carbon that is susceptible to microbial enzymatic processes as the permafrost thaws. We aimed to determine the impact of natural thaw as well as increased soil temperatures due to fire on permafrost microbes and functions using a variety of omics approaches. The sampling sites were in central Alaska: 1. Nome Creek, the site of the Boundary fire in 2004; and 2. Tanana Valley, a boreal forest region where natural thaw has resulted in thermokarst bog formation. Replicated samples were taken from surface, active layer samples, as well as from permafrost in the different depths and DNA was extracted and sequenced. In addition, RNA and proteins were extracted from the Tanana Valley samples to provide information of gene expression and activity. We found that both natural thaw and fire had a dramatic impact on the composition and function of the permafrost microbial communities. The results indicated that there were specific microbes that were more abundant in permafrost compared to thawed soil at the same depth. The types of functions that were detected in permafrost included those for nitrogen assimilation and stress tolerance. The microbial activity was much lower in the permafrost compared to thawed samples, based on the lower gene expression in permafrost. By contrast, there were many shared functional genes that were expressed in seasonally thawed active layer and bog samples, including transporters. After thaw there was an increase in genes and proteins for methanogenesis in the bog, but due to the decrease in carbon content after fire this was not the case at Nome Creek. These findings suggest that rapid thaw due to fire has different consequences on carbon cycling processes compared to more gradual thaw, something that should be taken into account in future climate models.