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Microbial community composition and functional potential of soil and water microorganisms in the Yukon-Kuskokwim Delta, Alaska

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INTRODUCTION

- Climate change is increasing both fire frequency and fire intensity in arctic and boreal regions.
- Environmental factors that are altered by fire will impact post-fire microbial degradation of soil carbon.
- A major challenge exists in identifying how environmental factors govern ecosystem function of microbial communities, and how these are associated with greenhouse gas emissions (GHG).

RATIONALE and APPROACH

- We investigated the microbial community composition of surface water and soils in the Yukon Kuskokwim Delta (Fig. 1) from areas with contrasting burn histories and thaw (Fig. 2).
- CH_4 fluxes were significantly higher in burned channel fens relative to unburned fens in 2017 (Fig. 3a).
- We hypothesize that burned soils and waters within burned areas will contain significantly different microbial communities with varying metabolic potentials that can greatly impact GHG emission.
- A 2016 study from water bodies across the Yukon-Kuskokwim Delta indicated distinct bacterial communities in burned and unburned sites (Fig. 3b).
- We aim to expand this dataset to examine spatial patterns in microbial diversity and metabolic potential.

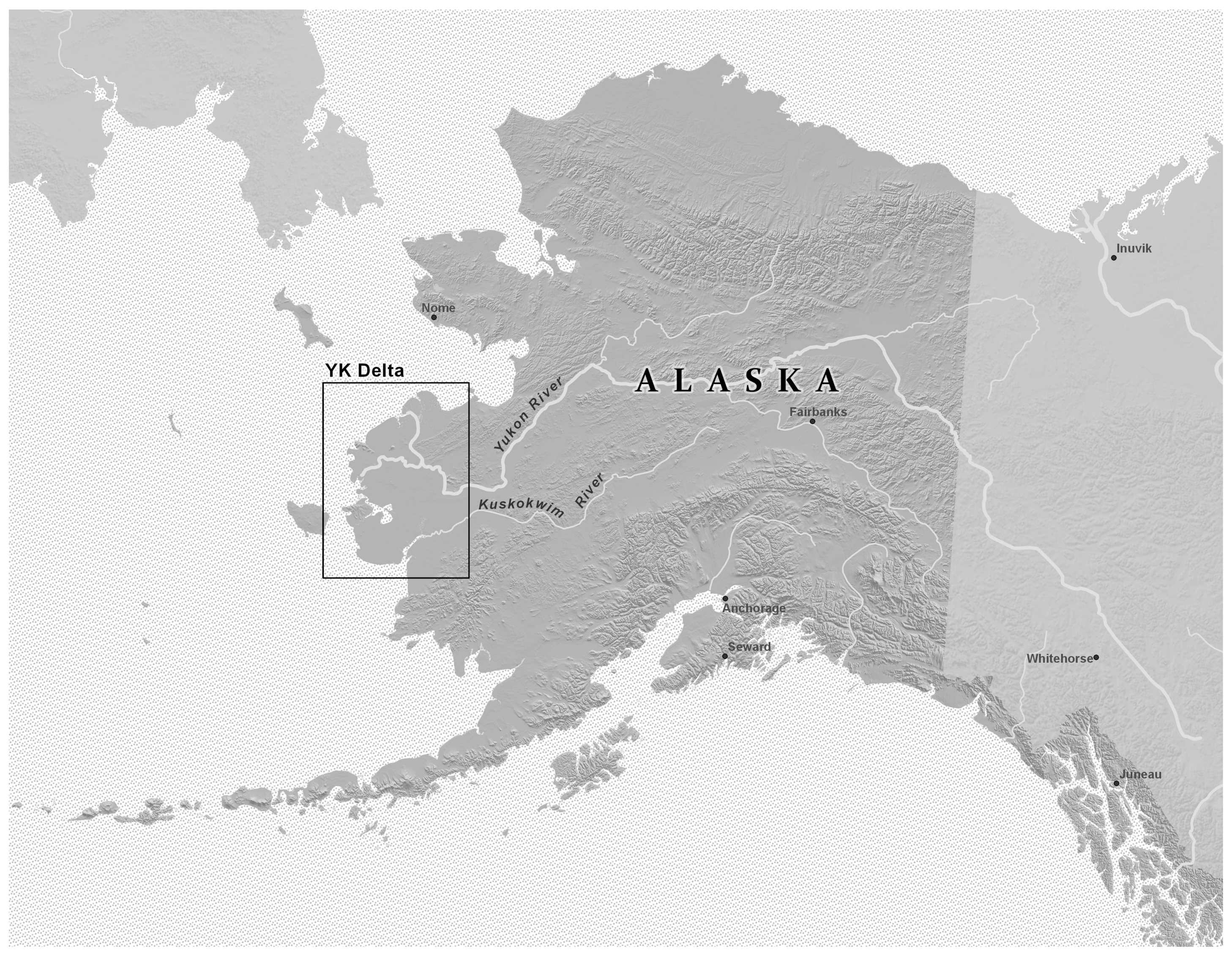

Fig. 1. Field site location.

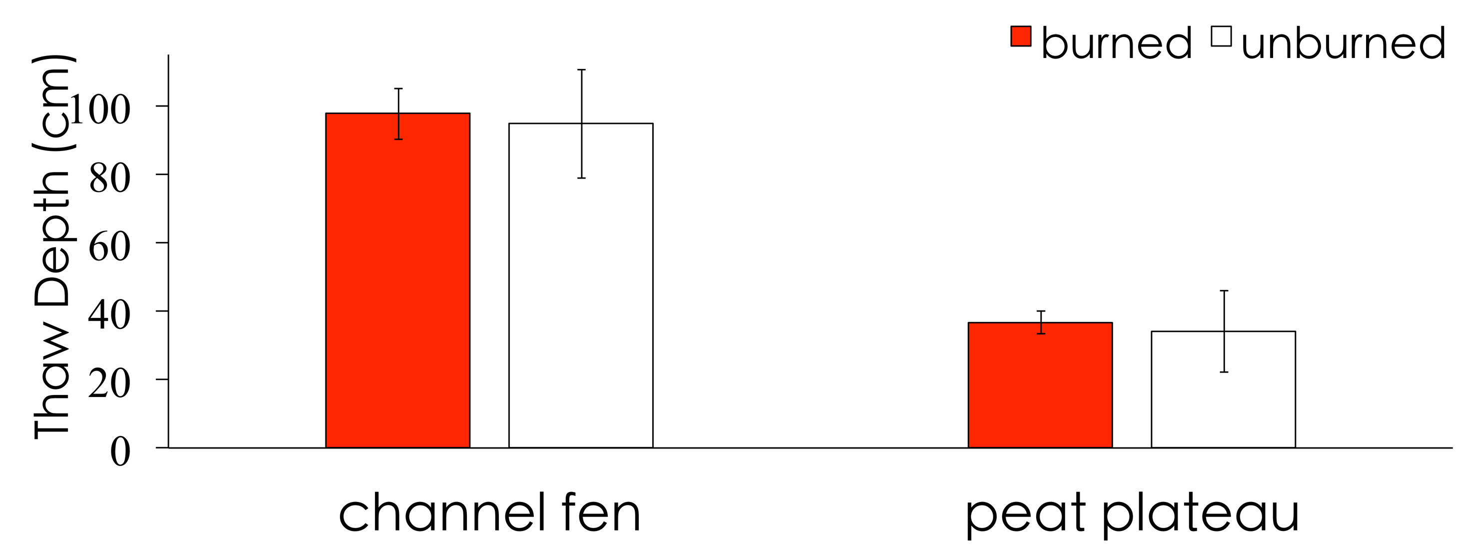

Fig. 2. Thaw depth measured in July 2018

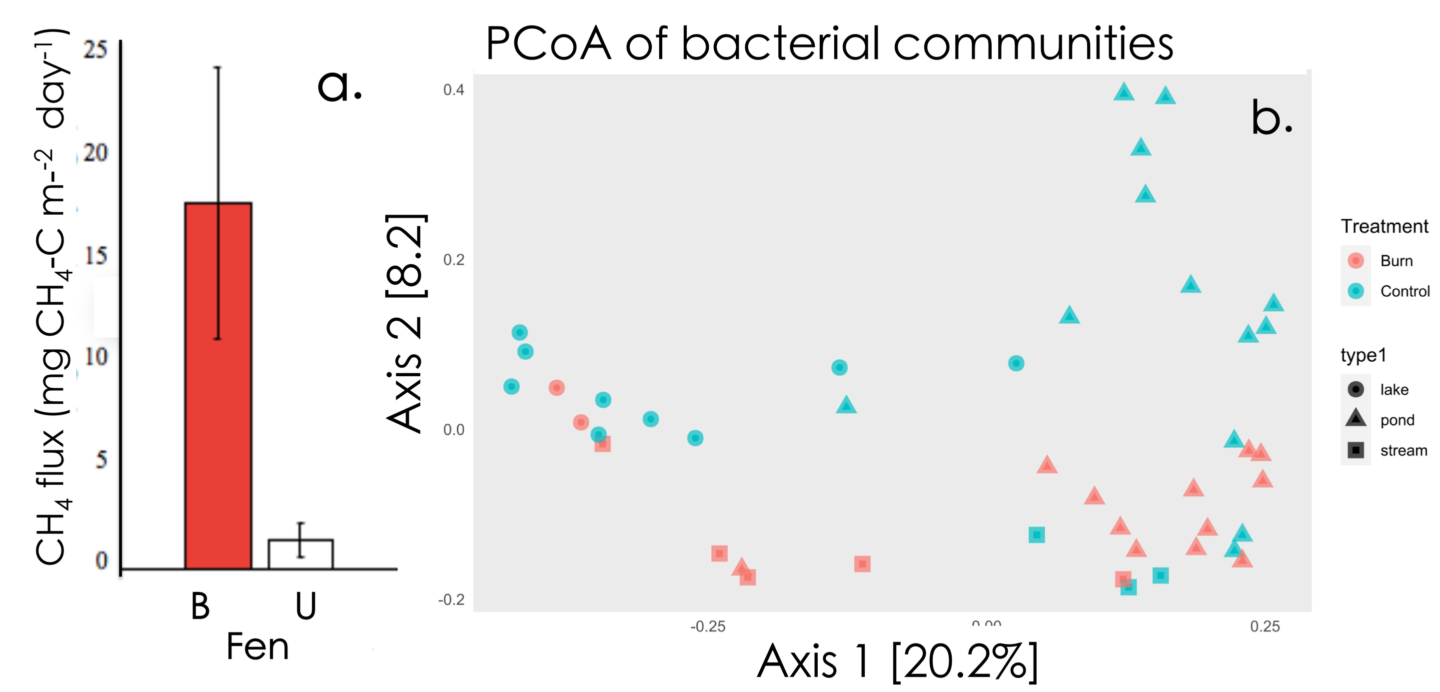

Fig. 3a. Channel fen CH_4 flux (2017) 3b. Principle coordinates analysis (PCoA) contrasting microbial communities in waters within burned (red) and unburned (blue) sites *(2016).*

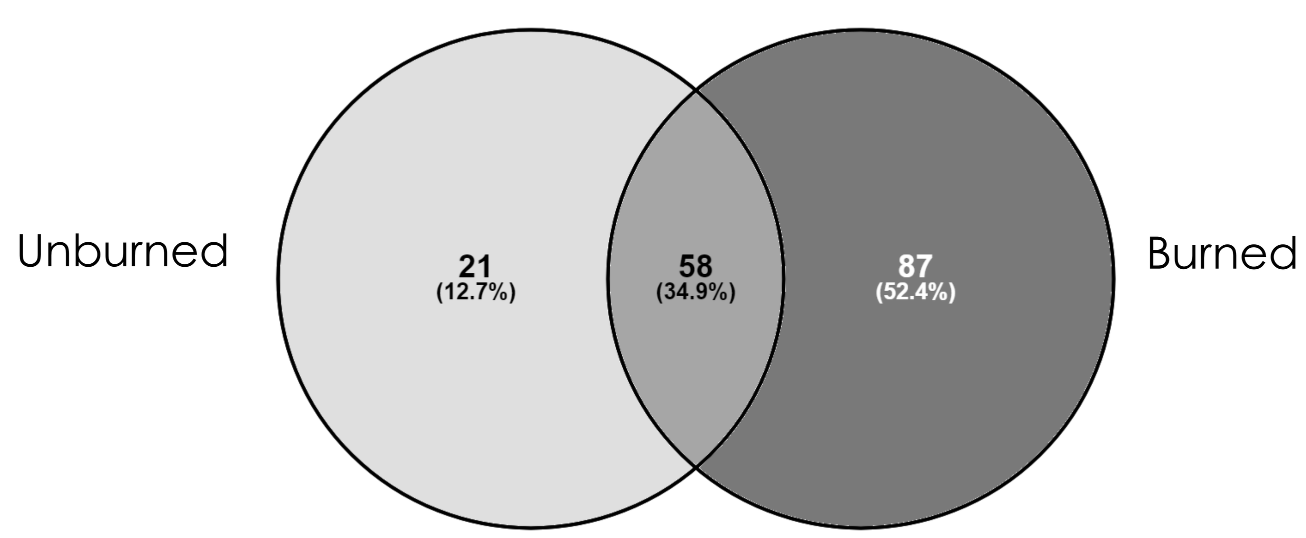

Fig. 4. A greater number of specialist microbial communities identified in burned (right) relative to unburned (left) waters (2016).

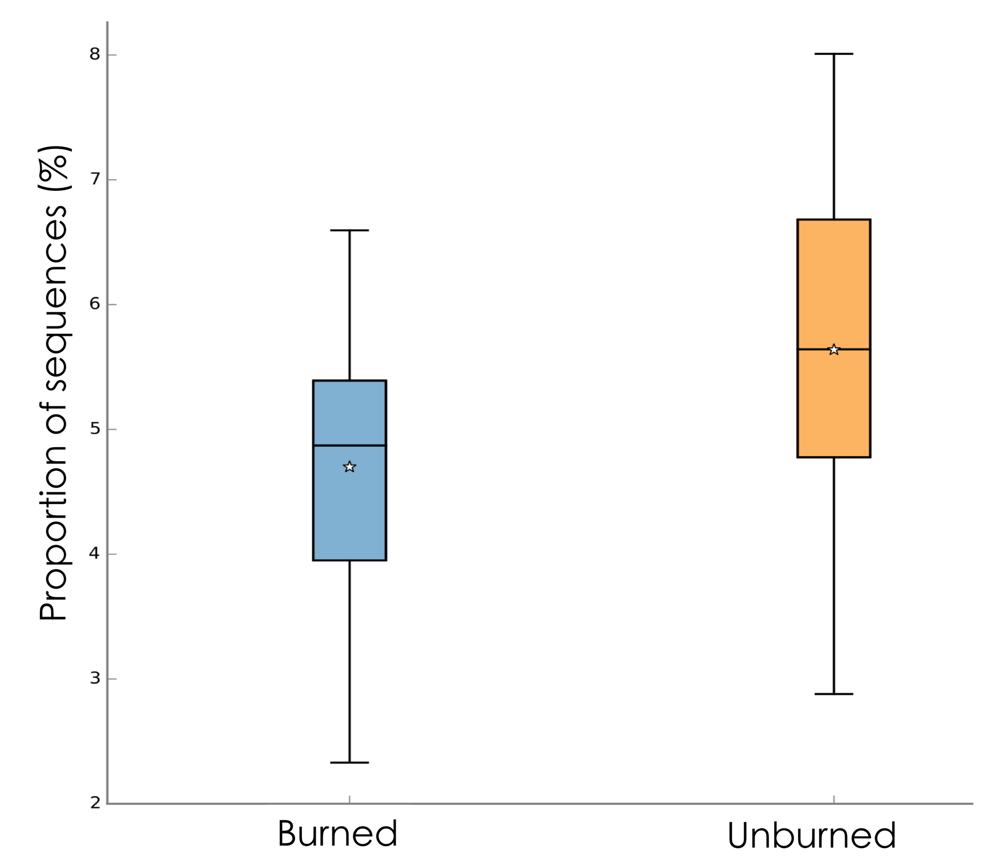

Fig. 5. Proportion of total sequences that code for denitrification genes in burned (blue) and unburned (orange) freshwater sites (2016). $p < 0.05$

CONCLUSIONS

- Microbial communities in surface water in burned areas were significantly different than unburned areas(Fig. 3b).
- Greater number of specialist microbial communities in waters in catchments affected by fire (Fig. 4).
- Fire influenced microbial function in freshwaters, such as patterns of denitrification (Fig. 5).

FUTURE RESEARCH

- The microbial community composition of channel fen and peat plateau soils in burned and unburned regions will be compared using PCoA and proportion of unique taxa (e.g. figures 3b & 4).
- Similarly, waters from contrasting sites (e.g. lake, pond and pore waters) will be synthesized with the existing 2016 dataset and compared as above.
- Community function will be assessed in both soils and waters to contrast microbial potentials in nutrient and carbon degradation pathways as well as GHG production.
- Environmental data and 2018 GHG fluxes will be analyzed and run compared to the above to assess ecosystem response to microbial community changes.
- Examine differences in Archaea to better understand the increase in CH_4 production and methanogens in burned areas.

ACKNOWLEDGEMENTS

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