Effects of Disturbances on Vegetation Composition and Permafrost Thaw in Boreal Forests and Tundra Ecosystems of the Siberian Arctic

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Background

- Climate-driven changes to the thermal regime of permafrost soils have the potential to create surface disturbances that influence vegetation dynamics and underlying soil properties.
- These changes are particularly important in *yedoma,* ice-rich permafrost which is common across large areas of the Siberian Arctic.
- Vegetation and the accumulation of soil organic matter drive ecosystem carbon (C) dynamics and contribute to the insulation of soils and protection of permafrost from thaw.

Objective

- Examine the effects of two disturbance types—thermokarst and frost boils—to determine disturbance effects on the vegetation community and soil properties.

Disturbances

Thermokarst

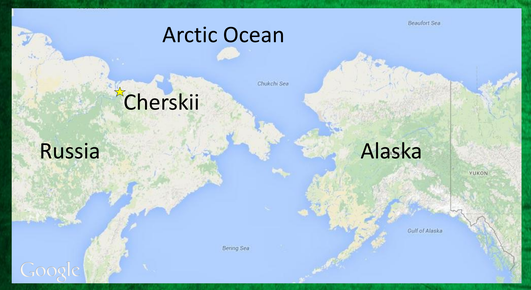
- As soil thaws it starts to subside causing it to cave in on itself.

- Upwellings of soil due to cryoturbation.

Frost Boils

- I sampled disturbed and undisturbed areas in two thermokarst locations in boreal forests and two frost boil locations in tundra

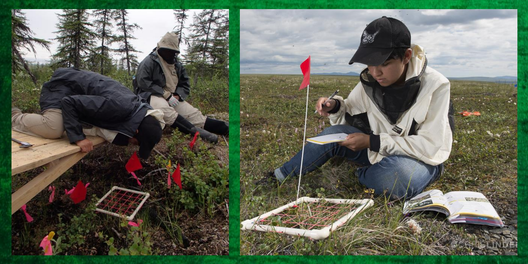
Study Sites



- The sites were located near the Northeast Science Station (NESS) in Cherskii, Russia.

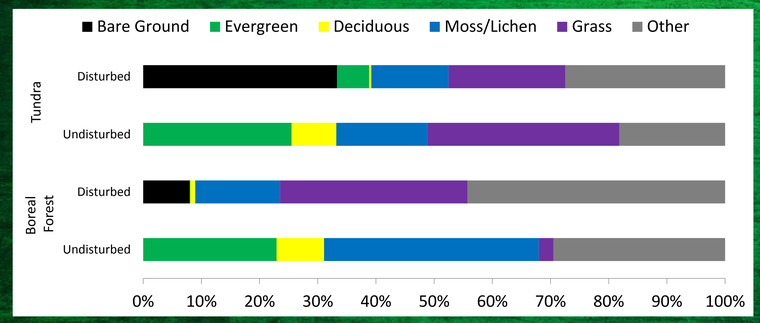
Methods

- Grid point vegetation measurements in both disturbed and undisturbed sites.



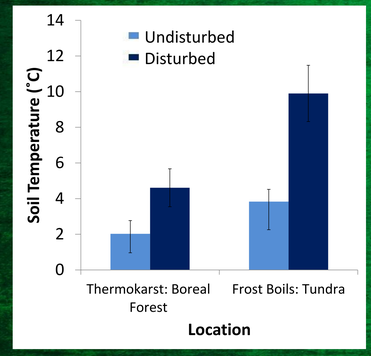
- Soil temperature, moisture and thaw depth were measured in disturbed as well as adjacent undisturbed sites.

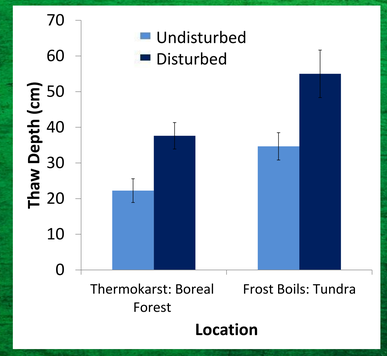
Vegetation Cover



- Both thermokarst and frost boils resulted in decreased vegetation cover and greater exposure of mineral soils.
- Disturbed locations showed a significant decrease in shrub cover and an increase in bare ground.

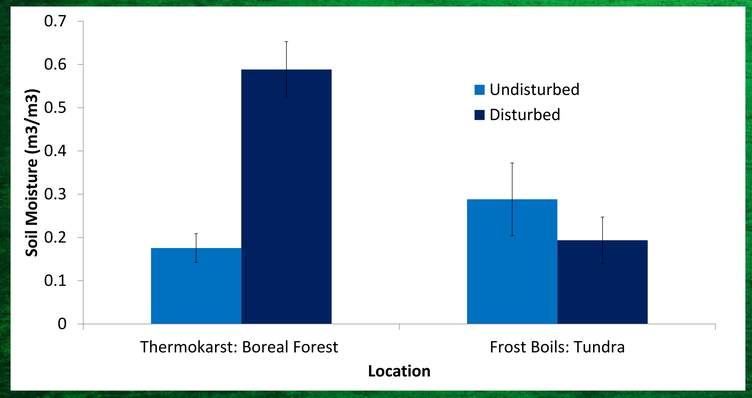
Soil Temperature & Thaw Depth





- 2-3 times higher soil temperature and deeper thaw depth in disturbed vs undisturbed sites.

Soil Moisture



- Soil moisture was 3-4 times higher in thermokarst areas but 1.2-2 times lower in frost boil areas.

Conclusion

- These results highlight important linkages between disturbances, vegetation communities, and permafrost soils, and contribute to our understanding of how changes in Arctic vegetation dynamics as direct and/or indirect consequences of climate change have the potential to impact permafrost C pools.

Future Work

- Observe and measure the effects of fire as a disturbance on boreal forest larch stands.

Acknowledgements

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