The effects of wildfires on permafrost thaw and soil nutrients in an Arctic tundra ecosystem

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ATMOSBIOS
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INTRODUCTION

The Arctic has already warmed over 2˚C above pre-industrial levels, almost four times faster than the planet [1]. This rapid warming is causing a shift in Arctic ecosystem function and natural disturbance regimes. In facts, the frequency, severity and extent of wildfires in the Arctic biome continue to increase [2]. The influence of fires on the distribution, availability and cycling of soil nutrients in permafrost regions remains poorly understood. The disruption of these mechanisms could have considerable consequences for plant growth, plant succession, population dynamics, ecosystem structure and overall biodiversity, all of which could have repercussions on the food systems of indigenous communities, greenhouse gas emissions and more.

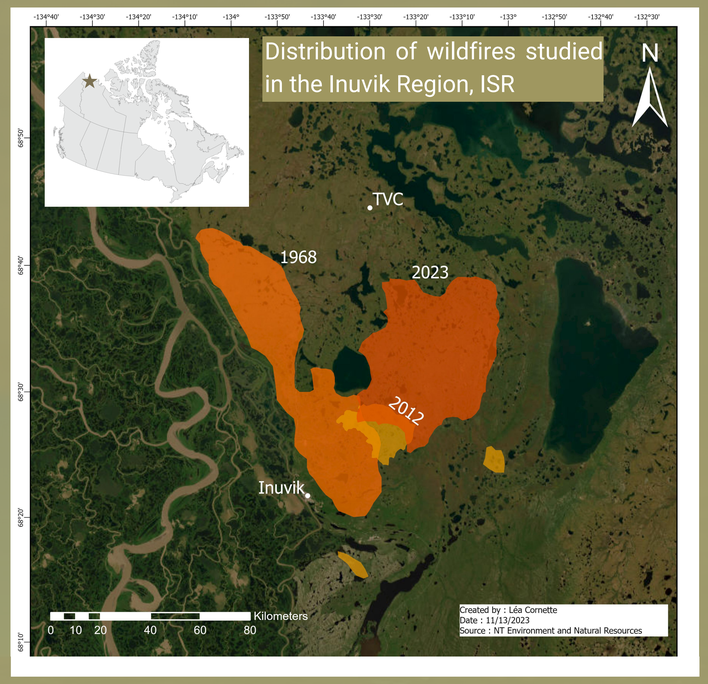
GOAL AND OBJECTIVES

The goal of this project is to **shed light on how permafrost thaw accelerated by wildfires in the Inuvialuit Settlement Region (ISR) affects soil nutrient dynamics along an Arctic tundra fire chronosequence.**

1. Understand the dynamics and evolution of soil nutrients (phosphorus and nitrogen) as a function of permafrost thaw

2. Assess the availability of these nutrients throughout the short Arctic growing season and thus the deepening of the seasonally-thawed active layer (June to September)

3. Determine the extent to which those nutrients might be limiting factors in the microbial decomposition of soil organic matter and primary productivity.



576 soil samples

- x4 Sites: Unburned at TVC; 1968 fire; 2012 fire; 2023 fire
- x3 Cover types: Bare soil/Lichen; Tussocks; Schrubs
- x6 Replicates
- x2 Depths
- x4 Field campaigns: June; July; August; September

METHODS

At each study site, we will collect soil samples from the same ecosystem type (i.e. upland mineral tundra), for a total of **576 samples.**

- **Auxiliary measurements** : soil temperature and moisture, frost table position and vegetation characteristics (e.g., percent cover).
- **Hedley sequential fractionation + oxygen isotope composition** : to determine the size and bioavailability of different soil nitrogen and phosphorus pools.
- **Fertilization experiments** : to assess whether the supply of nitrogen and phosphorus limits microbial decomposition of soil organic matter and primary productivity.

Trail Valley Creek Research Station (TVC), ISR

Photo : Katie Bennett

REFERENCES

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