

Project acronym: VPthaw

Project title: Vegetation - permafrost interactions in a lowland tundra ecosystem: shrub decline due to abrupt thaw triggered by wet summers?

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Discipline: Earth Sciences & Environment

Station(s): Chokurdakh Scientific Tundra Station (Russia)

The lowland tundra at the Chokurdakh Scientific Tundra Station appears to become wetter and wetter with shrub drowning as a consequence. The increasing wetness contrasts with the generally expected drying of the tundra due to increased evapotranspiration and gradual deepening of the active layer in a warming climate. Over the past decade, we have observed an increasing number of thaw ponds and other thermokarst features related to small-scale collapse of ice-rich permafrost. In these new open water features the pre-existing shrub vegetation drowns, suggesting an alternative to the widely assumed shrub expansion in Arctic ecosystems for ice-rich poorly drained lowland tundra.

We hypothesize that the abrupt permafrost thaw responsible for the wetter conditions can be triggered by extreme wet and warm summers. We propose to assess the dynamics and drivers of potential shrub decline by combining landscape and local-scale monitoring with experimentation.

In the field we will 1) monitor changes in vegetation composition, thaw depth, and moisture conditions in transects over thaw ponds differing in age; and 2) experimentally test if we can trigger permafrost collapse in a novel precipitation experiment. A better understanding of what determines shrub expansion and shrub decline is important as the climate-induced shifts in permafrost degradation and vegetation succession have important consequences for the climate and greenhouse gas balance.

This project at an understudied Arctic region is expected to provide a novel perspective on Arctic landscape changes, which is required to improve predictions of the future of Arctic permafrost and its carbon storage.