

Research Bulletin

NWT Cumulative Impact Monitoring Program

NWT Thermokarst Mapping Collective

Summary

Permafrost thaw is a primary cause of climate-driven landscape change in the north and has a major effect on ecosystems and infrastructure. The NWT Thermokarst Mapping Collective project developed a methodology to generate NWT-wide thermokarst and permafrost feature inventory maps. Understanding the distribution of thaw-sensitive terrain is critical to predicting the future state of the environment and water resources. It is also needed for planning community and infrastructure adaptation to climate change.

Why is This Important?

To make informed decisions and recommendations on barren-ground caribou, This project addresses an important knowledge gap on the distribution of thaw-sensitive permafrost terrain across the NWT. This is required to understand the environmental and societal consequences of permafrost thaw and is the first permafrost mapping project of this scope.

What Did We Do?

- We developed mapping methods to create an inventory of landslides such as thaw slumps, lake and pond degradation, and permafrost landforms such as ice wedges. These features are indicators of sensitive terrain.
- Satellite images were used to identify and characterize permafrost features.
- The NWT high-resolution satellite imagery (Sentinel, 10 m resolution) was inspected by the mappers. Indicators of sensitive permafrost terrain were recorded within a standardized 7.5 x 7.5 km² grid for the entire NWT.
- Researchers and Indigenous partners in the Inuvialuit, Gwich'in, Sahtu and Dehcho regions observed areas from the air to validate the mapping efforts.



Example of a retrogressive thaw slump (abrupt thawing of ice-rich permafrost).

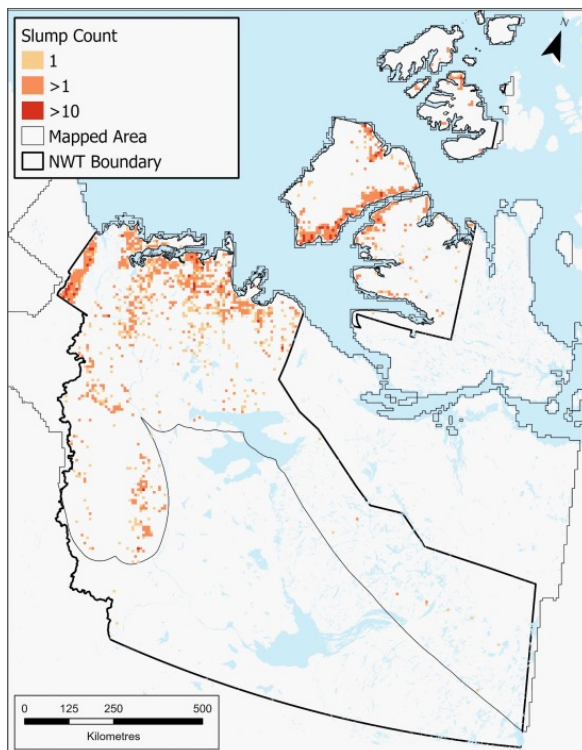


What Did We Find?

- The inventory identifies major differences in permafrost and terrain conditions across the NWT.
- It replicates independent datasets and was corroborated by aerial surveys in some key areas across the territory. This gives us confidence that the results depict the permafrost sensitivity of landscapes across the NWT.
- The mapping results are a significant improvement over modeled depictions of thaw-sensitive terrain.

What Does This Mean?

- The maps provide information on sensitive permafrost terrain, including hotspots of landscape and ecosystem change.
- Permafrost characteristics vary from place to place, and this means that thawing will affect different landscapes, ecosystems, and communities in different ways.
- Results can guide regional and local research to better understand the impacts of permafrost thaw on water quality and habitat.



The distribution of retrogressive thaw slumps impacted inventoried by the NWT Thermokarst Mapping Collective. Thaw slumps were mapped within the entire continuous permafrost zone and within a 50 km buffer extending into the discontinuous permafrost zone (indicated by the black line cutting across the territory)

What's Next?

- The mapping results are being used to design a study characterizing permafrost-affected lakes and determining their sensitivity to climate change.
- The preliminary mapping outputs have fostered discussions with Indigenous governments and organizations about designing permafrost monitoring programs. Spatial datasets are supporting land use planning, being conducted by the Gwich'in Land Use Planning Board.
- Additional permafrost mapping following similar methods but at finer scales is being implemented around communities and areas of ecological or development interest.

What are permafrost and thermokarst?

Permafrost refers to ground that remains below 0°C throughout the year. Above the permafrost is an active layer that thaws each summer. The active layer can increase during warm summers or with disturbance. This may lead to the thaw of permafrost and to thermokarst development in ice-rich areas. Thermokarst is settling of the ground surface caused by thawing of ice-rich permafrost

For More Information

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NWT Cumulative Impact Monitoring Program
(CIMP186)

NWT CIMP is a source of environmental monitoring and research. The program coordinates, conducts and funds the collection, analysis and reporting of information related to NWT environmental conditions. If you're conducting environmental monitoring and research, consider sharing your information with northern residents and decision-makers in a Bulletin.