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NWT Cumulative Impact Monitoring Program

How does long term exposure to permafrost thaw slumps affect stream health?

Summary

Permafrost thaw slumps in streams produce a continuous disturbance that impacts stream health. From 2010-2014, we sampled the physical habitat and benthic invertebrates (bugs) in the Peel Plateau to assess how permafrost thaw slumps impact stream health. During 2021, in collaboration with the Tetlit Gwich'in Renewable Resource Council, we revisited the same sites to compare samples and to understand how biotic stream health is affected by continual, long-term exposure to thaw slumps. We found that while water quality trends remained similar, overall invertebrate abundance did not differ across years, however invertebrate diversity and richness increased in slump-impacted streams.

Retrogressive thaw slumps demonstrating debris input into a river system. (Credit: M. Dolan)

Why is This Important?

Community members have expressed concerns about the long-term impact of permafrost thaw slumps on stream health. Project results can inform cumulative impact monitoring, support climate change adaptation strategies and provide capacity/toolkits for standardized environmental monitoring of freshwater systems.

What Did We Do?

- In 2021, we returned to 24 stream sites across the Stony Creek watershed previously sampled in 2010-2014.
- We measured water quality variables and collected benthic invertebrate samples.
- Information collected in 2021 was then compared to the information collected between 2010-2014.

What Did We Find?

- We found that turbidity, suspended solids, and concentration of both phosphorus and nitrogen remained high at all sites.
- Although sites remained highly disturbed in 2021, invertebrate diversity and richness were higher in 2021 than 2010-2014.
- Benthic invertebrate diversity and richness is most impacted by the concentration of suspended solids and phosphorous, which both increase in response to a thaw slump.

A thaw slump confluence. Thawed slump debris enters a stream, creating a division between a clear, unimpacted upstream, and a turbid downstream. (Credit: M. Dolan)

What Does This Mean?

From this study we have a better understanding of how permafrost thaw slumps influence ecological health metrics in northern streams. The study results suggest that the number of intolerant species has not changed but the richness of sediment tolerant species have increased over time as disturbed habitats were recolonized. Future biomonitoring of streams in the Peel Plateau is vital to understanding biotic responses to permafrost slumping and overall ecosystem health. Continued monitoring by trained northerners is needed as climate-driven disturbances (e.g., wildfire, permafrost thaw) become common throughout the north.

For More Information

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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.