ROBARTS CENTRE FOR CANADIAN STUDIES

REFLECTIONS ON RESEARCH
ISSUE 13
SEPTEMBER 2024

INVESTIGATING THE IMPACT OF CRYOGENIC LANDSLIDES ON LAKES IN THE EASTERN MACKENZIE DELTA (NT, CANADA) USING A PALEOLIMNOLOGICAL FRAMEWORK

VICTORIA CARROLL, PHD IN GEOGRAPHY

Victoria is a PhD student in the Department of Geography at York University. She is a recipient of a Borealis Training Award, adjudicated by the Robarts Centre, to support students involved in northern fieldwork. She also received the Northern Studies Training Award from Polar Knowledge Canada in 2023.

Tell us about your research and how it relates to the study of Canada.

My master's research analyzes how permafrost thaw drives grand-scale mass movement events in the Mackenzie Delta, impacting the biogeochemistry of Arctic lakes in the Northwest Territories. One of my significant findings has been the potential for these landslides to rapidly transport prominent levels of mercury into lakes, which, in high quantities is toxic and can biomagnify up the food chain. This contamination concerns northerners, who use the region for hunting and fishing.

My PhD will expand this research on permafrost thaw by adding a central focus on human health. Many northern communities rely on drinking water sourced from local lakes and in many cases, these sources were chosen to supply drinking water before any environmental monitoring or assessment programs were established. Since treatment plants in remote areas are often limited in resources, additional monitoring of new environmental and human health risks posed by permafrost thaw is paramount.

In June 2024, I visited Iqaluktuutiaq (Cambridge Bay), Nunavut, to assist in a water operator training program for grade 11 students. Over the course of a week, our team worked with students one-on-one, leading lessons and lab sessions on water treatment. My sessions focused on the impacts of permafrost thaw on Arctic and northern lakes and the water cycle. I have also supported research expeditions in and around Yellowknife investigating arsenic contamination in lakes where arsenic was introduced into the environment during diamond exploration and extraction. Ultimately, this research will help to understand the ability of plants and microbes to bioremediate contamination at various concentrations.

Tell us about your field and your professional experiences before starting your current studies.

Throughout my academic journey, I participated frequently in environmental and geographical research, particularly relating to Canada, even though this was not my initial focus. In the final year of my undergraduate studies, I joined a research opportunity program where three other students and I investigated river discharge trends related to various solute concentrations across four southern Ontario rivers. This research provided context to underlying hydrological processes including solute source, transport, and storage.

The blend of hands-on experience and working directly with an expert professor on the topic intrigued me to further pursue research by beginning my Master's. I started my Master of

Science in the Geography Department at York in 2022. I joined the Limnology and Paleoenvironmental Research Group with my particular focus on paleolimnology which is the historical study of lakes and surrounding environments using sediment.

How did you come to choose this topic?

When choosing York for my graduate studies, I had the opportunity to join the liminology and paleoenvironmental lab run by Dr. Jennifer Korosi and Dr. Joshua Thienpont, who are also Robarts Faculty Associates. While working with them, I increased my lab experience and learned about Northern Canada firsthand. In the field, I saw the impacts of permafrost thaw and was inspired to continue studying the effects of this thaw on lake systems and drinking water treatment methods.

Tell us about the challenges that you as a researcher are experiencing or had to overcome to do this work.

The first time doing anything can be intimidating, so it is necessary to understand that you have to start somewhere. Fieldwork was initially quite daunting for me, having Type One Diabetes, since it meant being in very remote areas and needing to be prepared for any and all circumstances. Despite those same stresses still existing, fieldwork quickly became my favourite part of research with the help of organizational techniques and a supportive team.

Communicating what you need so that those around you are prepared to support you benefits everyone and helps to make science more accessible to all. I am incredibly lucky to have exceptionally supportive lab mates, supervisors, and a graduate cohort; however, research can feel isolating for many, so finding methods that work best for you is crucial.

Tell us about what you enjoy the most about the work you do.

I enjoy hands-on work, so lab and fieldwork are the most rewarding for me. Seeing your results come together after long days in the lab or field is one of the best feelings!

What advice/lessons/tips do you have for those starting their academic journey?

Maintain as much balance in your life as possible! Your academic projects are important, but they are not everything. Take time to prioritize the people, places and things that make you happy.

What are key takeaways you want others to come away with?

1. *It is okay to pivot your research goals!*
Pivoting and remaining flexible are necessary when pursuing research. There will be instances throughout the process where you need to make a change or feel pulled in a more stimulating direction.

2. *Hands-on experience is incredibly important.*
Working directly with the people, places, or things your research impacts is valuable for gaining fresh perspectives.

3. *Communicate your needs so that your team can best support you.*
Communicating with those around you, whether your research team or friends, can help you avoid feeling isolated. Joining clubs or organizations can also build this support system.

What are the next steps in your research?

My goal is to work with Arctic and sub-Arctic communities and the Canadian government to create feasible, practical, and effective plans for mitigating risks associated with permafrost thaw's impact on lake biogeochemistry and drinking water systems. By understanding what contaminants are stored in frozen ground, we can minimize the human risk associated with consuming locally sourced drinking water or fish.

Safe and accessible drinking water should be guaranteed to all Canadians, and unfortunately, this is not yet a reality. My research will highlight and bring attention to remote communities where safe drinking water is precarious due to limited infrastructure, funding, or resources. With increasing temperatures, contaminants released from permafrost poses a serious threat and I hope to be able to use the opportunities provided by York to explore this topic.