NORTHWEST TERRITORIES ENVIRONMENTAL STUDIES RESEARCH FUND

ANNUAL REPORT AND BUDGET 2022-2023

NWT ESRF | Powering Northern Energy Research

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ESRF
POWERING NORTHERN ENERGY RESEARCH

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Andrew Applejohn
Chair, NWT Environmental Studies Research Fund

Message from the Chair

I am very pleased to present the 2022-2023 annual report for the Northwest Territories Environmental Studies Research Fund (ESRF). With Covid restrictions ending, multi-year research programs were granted a cost-free extension, which is reflected in reduced spending for the current fiscal year. These projects are now concluding as planned. The NWT ESRF provided support to two new projects, one led by the Northern Alberta Institute of Technology to build on a proof of concept project from 2021-2022, and another project led by Concordia University. I would like to take the opportunity to welcome Chad Grummett, Imperial Oil to the Management Board as the second industry member.

Introduction

The Northwest Territories Environmental Studies Research Fund (ESRF) is a research program established to finance environmental and social studies relating to oil and gas activity in the NWT that will help inform decision making. The fund is supported through the collection of levies from all interest holders of petroleum lands in the onshore areas of the NWT – Exploration Licences, Production Licences, and Significant Discovery Licences alike. Levy rates are determined by the ESRF Management Board on an annual basis, and interest holders are invoiced based upon their total land holdings (total number of hectares under licence) within the onshore NWT. The Management Board is composed of representatives from government (2), industry (2) and public (2) of the NWT.

Management Board Membership

Chair: Andrew Applejohn, Environment and Climate Change
– GNWT Member

Vice-Chair: Ken Hansen
– Industry Member

Viktor Terlaky, Industry, Tourism, and Investment
– GNWT Member

Chad Grummett
– Industry Member

Ray Case
– Public Member

Richard Binder
– Public Member

Summary of Activities 2022-2023

Communications

Project Reports added in 2022-2023 are available at **https://www.nwt-esrf.org/publications**:

- University of Waterloo, Regional hydrologic and ecologic characterization, and baseline assessment 2022-2023 report.
- Wilfrid Laurier University, University of Colorado Boulder, Assessing terrain sensitivity to permafrost thaw and fire to understand and predict boreal caribou 2022-2023 report.
- Wilfrid Laurier University, Accelerating recovery of boreal caribou habitat via lichen seeding for oil and gas related remediation – Project Progress Report.
- Northern Alberta Institute of Technology, The Northern Landscapes Sensitivity Atlas and Net Environmental Benefit Analysis (NEBA) Tool Plain Language Report.
- The Northern Landscapes Sensitivity Atlas, and Net Environmental Benefit Analysis (NEBA) Tool Preliminary Project Discovery Report.
- Concordia University, Penetration of spilled oil into thawing frozen soil, 2023 Report.

Management Board Meetings

For the first time since Covid restrictions were introduced, the Management Board was able to meet in person on June 29, 2022, in Yellowknife and again on February 28, 2023, in Calgary.

On February 27, the Management Board also met specifically with Cenovus representatives and Dave Rudolph, University of Waterloo who leads a multi-year groundwater research program within the Cenovus lease, to discuss next steps moving forward.

Key program direction for the 2022/2023 fiscal year included:

1. Levy rate for industry would remain the same.
2. Two new proposals approved for single year funding: Concordia University - Penetration of Spilled Oil in Thawing Frozen Soil and Northern Alberta Institute of Technology - The Northern Landscapes Sensitivity Atlas and NEBA Tool.

2022-2023 Funded Projects

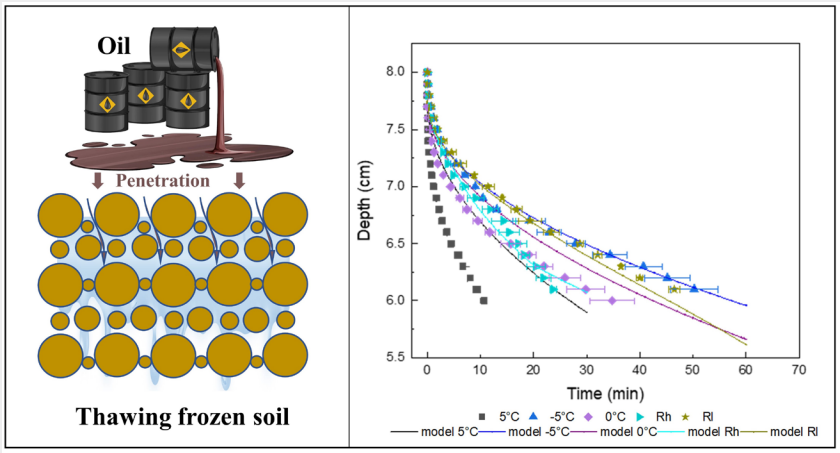
Penetration of Spilled Oil in Thawing Frozen Soil

Project Lead: Chunjiang An
Organization: Concordia University

PROJECT DESCRIPTION:

Oil pollution is one of the major environmental concerns in the petroleum industry. Thousands of oil spills have been recorded across Canada, primarily from natural seeps, oil drilling and production, and transportation losses. The leakage of oil into the soil causes changes in soil physical and chemical properties and affects the composition and structure of soil microbial communities, leading to the deterioration of soil environmental quality. At the same time, the migration and diffusion of oil pollutants into the underground aquifer poses a serious threat to the groundwater environment. Rapid oil spill response is crucial for reducing oil contamination. Therefore, it is necessary to analyze the behavior, distribution, and penetration of oil in soil after spills, which can help determine appropriate and timely response measures.

Frozen soil exists widely in Canada especially in the Northwest Territories (NWT). 58% of the land in the Northern Hemisphere, which makes up about 55 million square kilometers, freezes seasonally. With increasing temperature under climate change, more permafrost soil would become seasonally frozen soil and start to thaw. It is required to consider the oil penetration patterns in such thawing frozen soil. There were some previous studies regarding the oil or other liquids penetrating frozen or unfrozen soil, while oil penetration in soil during the thawing process is still unknown. Therefore, the proposed research project will explore the penetration process of spilled oil in thawing frozen soil.



Penetration depth of spilled oil into thawing frozen soil under different conditions.

NWT ESRF Funding:
$60,000
Project report available at **https://www.nwt-esrf.org/publications**

The Northern Landscapes Sensitivity Atlas and NEBA Tool

Project Lead: Kevin Kemball
Organization: Northern Alberta Institute of Technology

PROJECT DESCRIPTION:

Following the completion of its Northern Landscapes Sensitivity Atlas proof-of-concept project (January through March, 2022) with the support of the Northwest Territories Environmental Studies Research Fund (ESRF), NAIT has proposed to redirect a previously allocated grant from the Natural Sciences and Engineering Research Council (NSERC), Canada's College and Community Social Innovation Fund (CCSIF) to continue the tool's development at the community and regional level within the Sahtú Settlement Area of the Northwest Territories (NWT).

The tool was initially developed as a municipal hazard and risk identification and mitigation web mapping application, in partnership with an Alberta-based insurance provider, with a focus on emergency management. NAIT proposes to reorient the project to support community and regional environmental planning and management in the Sahtú Settlement Area of the NWT.

The Northern Landscapes Sensitivity Atlas proof-of-concept constituted the first stage of development of a net environmental benefit analysis (NEBA)-oriented sensitivity mapping tool. This project expands the proof-of-concept

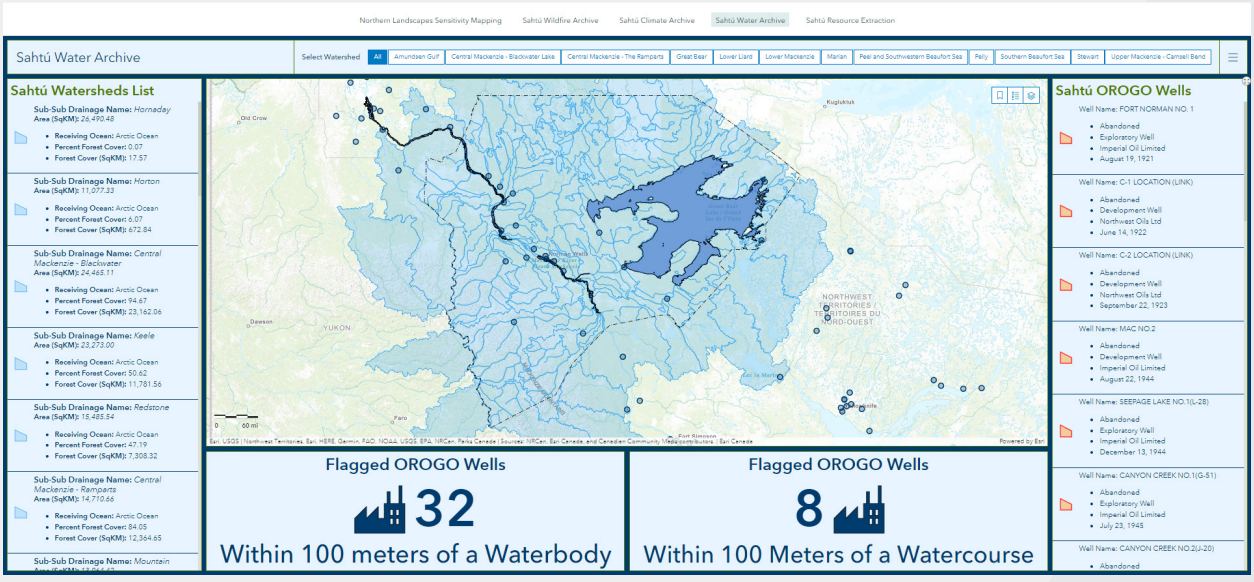
Old Fort Norman Hudson Bay Company structures in Tulit'a. Photo by D. Blaine

to a pilot landscape scale encompassing the Sahtú area. This web-based platform incorporates a host of local, regional, national, and international datasets where intersections of the natural, social, and built environments can be visualized, overlaid, and compared. Observations made with this tool – which will be expandable to include new data and analysis functions – will inform environmental policymaking, planning, response, and management decisions, specifically within the unique ecological, social, and cultural context of the communities that need it.

This web-based geographic information system (GIS) decision support application serves as a powerful, cost-effective tool for integrating local, regional, and territorial data into a centralized platform. Built using Esri's suite of desktop and online software applications, the Atlas can be seamlessly incorporated into the NWT's established Enterprise GIS.

NWT ESRF Funding: $20,000

Plain language and technical reports available at **https://www.nwt-esrf.org/publications**



Dashboard view showing intersection of publicly available data for Sahtú OROGO wells and watersheds in the Sahtú Settlement Area of the NWT.

Multi-year Funded Projects UPDATES

Accelerating Recovery of Boreal Caribou Habitat via Lichen Seeding for Oil and Gas Related Remediation

Project Lead: Dr. Jennifer Baltzer
Organization: Wilfrid Laurier University

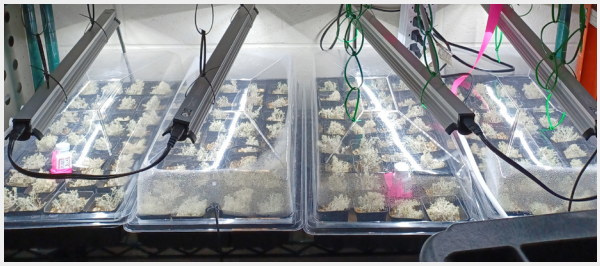
PROJECT DESCRIPTION:
Boreal caribou represent a culturally imperative food source for Indigenous populations throughout much of the Northwest Territories (NWT); however, habitat degradation, predation, and cascading impacts from climate change have reduced boreal caribou populations across Canada by over 30% in the past 20 years – resulting in their current designation as a Schedule 1 "threatened" species under the *Canadian Federal Species At Risk Act*. In the NWT there is concern over the cumulative effects of climate warming-related acceleration of disturbances (wildfire and permafrost thaw) coupled with development activities on boreal caribou populations. Successful remediation of sites that have been naturally disturbed by wildfire or associated permafrost decay could, in part, mitigate modern habitat loss, reducing stress on targeted boreal caribou populations. Lichen seeding techniques represent a novel remediation strategy, however, we have limited knowledge of the environmental conditions (i.e., permafrost presence, fire severity, stand age, etc.) that best promote seeded lichen establishment, particularly in discontinuous permafrost systems common to the Northwest Territories.

OBJECTIVE:
The project will address this knowledge gap by determining under what landscape conditions caribou habitat recovery can be accelerated by lichen seeding.

NWT ESRF Funding: $50,000 over two years (timeframe for project was extended due to Covid restrictions).

Project 2023 update report available at **https://www.nwt-esrf.org/publications**

Transplanted caribou lichen fragments at a typical transplantation site. Photo credit: Elise Brown-Dussault



Testing the light and moisture preferences of Cladonia mitis in a lab experiment. Photo credit: Elise Brown-Dussault

Assessing Terrain Sensitivity to Permafrost Thaw and Fire to Understand and Predict Boreal Caribou Habitat and Forage Quality in the Sahtú

Project Leaders: Dr. Jennifer Baltzer; Merritt Turetsky
Organization: Wilfrid Laurier University and University of Colorado Boulder

PROJECT DESCRIPTION:
The proposed research will address how fire and permafrost conditions interact to determine caribou habitat responses to climate change and human activity in the Sahtú, a resource-rich region poised for substantial oil and gas development. Using a combination of field measurements and remotely sensed land cover change, we will improve predictions about the sensitivity of permafrost to fire and human activity in the Sahtú and how this relates to caribou forage availability and quality and caribou habitat use. This will be accomplished by quantifying key metrics of land cover change, terrain stability, and vegetation across a range of permafrost conditions and disturbance gradients.

NWT ESRF Funding: $50,000 a year for four years. An additional $73,700 awarded for 2021-2022. Timeframe for project was extended due to Covid restrictions.

Full project update available at **https://www.nwt-esrf.org/publications**

Permafrost monitoring site sampling team members standing by one of the long-term monitoring boreholes. Photo credit: Emily Ogden

Regional Hydrologic and Ecologic Characterization and Baseline Assessment of Remote Northern Canadian Terrain in Advance of Shale Oil and Gas Development

Project Leader: Dr. David Rudolph
Organization: University of Waterloo

PROJECT DESCRIPTION:

Research activities completed during the past year of the project have been conducted through an extension to the initial 5-year project. Anticipated project timelines and deliverables were extended due to the limitations on field access related to the Covid-19 pandemic. The focus from the extended Year 6 has been in two main areas.

The first involved the design, implementation, and detailed interpretation of the airborne electromagnetic geophysical survey (AEM), which was flown in April 2021. Very preliminary, raw data were presented in the Year 5 annual report. The second major area of work has been on the further development and application of numerical modeling tools designed to simulate the influence of transient groundwater flow phenomena on surface water systems, land form change and ecology within discontinuous permafrost terrain. The modeling tools have been applied to explore various scenarios of interest related to long term permafrost thaw characteristics, land subsidence and the formation of thermokarst features, and solute fate and transport influenced by the thawing processes.

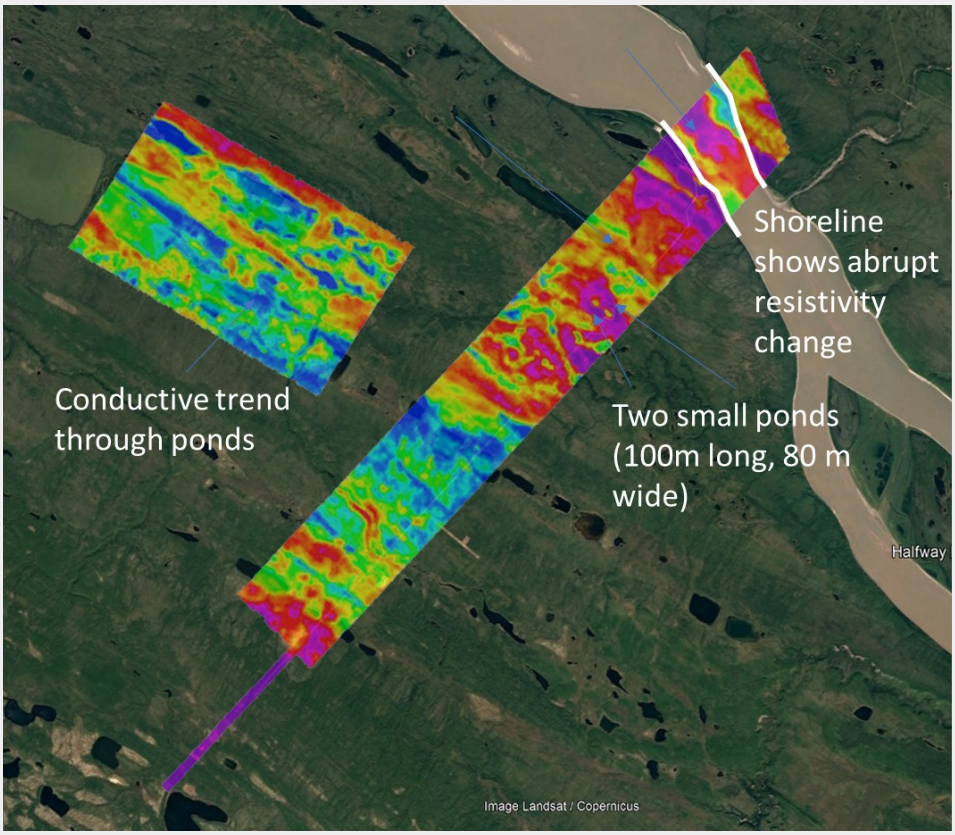
The work remains focused within the Bogg Creek watershed, near Norman Wells in the Central Mackenzie Valley (CMV), NWT. Two students, Ms. Jiaqi Weng (PhD) and Ms. Rebecca Zhao (BSc) have been working on the main components of the project and their work over the course of the past year forms a considerable part of the Year 6 annual report. Support for the research is continuing to be provided by Cenovus, who manage the Slater River hydrocarbon lease area near Norman Wells. Mr. Chris Salewich, who has been our main collaborator from Cenvovus/Husky over the entire course of the project, remains our main point of contact moving forward. Through Mr. Salewich's support, the research team met with Cenovus officials and members of the ESRF Management Board in February, 2023 to discuss results of the

project to date and to review plans for the subsequent phase of the work.

The project continues to receive technical, financial, and in-kind support from research colleagues at Wilfrid Laurier University (WLU) and Cenovus. Leveraged financial and in-kind support continues to be provided through our on-going participation in the Global Water Futures (GWF) program and specifically the Northern Water Futures project headed by Dr. Jenn Baltzer at WLU.

NWT ESRF Funding: $100,000 a year for five years (time frame extended due to Covid restrictions).

Full project update available at **https://www.nwt-esrf.org/publications**



Actual resistivity as measured at a depth of approximately 26 m below ground surface with the Resolve6 AEM system. Blue areas are more conductive (less resistive) and may represent areas of discontinuous permafrost.

Financial Statement of the NWT ESRF for the Fiscal Year 2022-2023

Revenue *		
Industry Levies	**$**	**214,174**
Expenses		
Administration		
Compensation & Benefits	$	-
Travel	$	(9,106)
Communications & Promotions	$	(4,342)
Publications	$	(3,884)
Other	$	(1,970)
Total Administration Expenses	**$**	**(19,302)**
Science Program		
Penetration of Spilled Oil in Thawing Frozen Soil	$	(60,000)
The Northern Sensitivity Landscapes Atlas and NEBA Tool	$	(20,000)
Total Science Program Expenses	**$**	**(80,000)**
Total Expenses	**$**	**(99,302)**
Total 2021-2022 Surplus (Deficit)	**$**	**114,872**

Proposed Budget of the NWT ESRF for the Fiscal Year 2023-2024

Revenue *		
Industry Levies	**$**	**215,000**
Expenses		
Administration		
Compensation & Benefits	$	(50,000)
Travel	$	(15,000)
Communications & Promotions	$	(2,000)
Publications	$	(3,000)
Total Administration Expenses	**$**	**(70,000)**
Science Program		
Groundwater	$	(100,000)
Caribou Habitat	$	(25,000)
Remediation	$	(20,000)
Total Science Program Expenses	**$**	**(145,000)**
Total Expenses	**$**	**(215,000)**
Total 2021-2022 Surplus (Deficit)	**$**	**–**

* Industry levies are shown in the GNWT Main Estimates in the year they are invoiced and these amounts are to fund the projects for the following fiscal year.

Summary		
Opening Balance (April 1, 2022)	$	103,255
Revenue **	$	214,174
Expenses	$	(99,302)
Closing Balance (March 31, 2023)	**$**	**218,127**

Summary		
Opening Balance (April 1, 2023)	$	218,127
Revenue **	$	215,000
Expenses	$	(215,000)
Closing Balance (March 31, 2024)	**$**	**218,127**

** The ESRF budget and actuals are provided each year in the GNWT main estimates as information. As 2023-24 progresses and information on the current budget is updated, the revised GNWT main estimates for 2023-24 will be reflected in the 2023-24 GNWT main estimates.

Levy Breakdown 2022-2023

Description	Hectares		Amount
Significant Discovery Licences	622,951	$	201,213.17
Production Licences	30,451	$	9,835.67
Pioneer Production Licences	321	$	103.68
Total	**653,723**	**$**	**211,152.53**
Location	**Hectares**		**Amount**
Mackenzie Delta / Arctic Islands	130,173	$	42,045.88
Central Mackenzie Valley	434,012	$	140,185.88
Southern NWT	89,538	$	28,920.77
Total	**653,723**	**$**	**211,152.53**

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