# Northwest Territories Environmental Studies Research Fund

## Annual Report and Budget 2024-2025

P.O. Box 1320, Yellowknife, NT X1A 2L9 • www.nwt-esrf.org

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# Message from the Board

We are very pleased to present the 2024-2025 annual report for the Northwest Territories Environmental Studies Research Fund (ESRF).

The NWT ESRF continued to provide support to the University of Alberta project titled "**Numerical Modelling of the Permafrost Thawing and its Repercussions in the NWT"** and the University of Waterloo project titled "**Regional hydrologic and ecologic characterization and baseline assessment of remote northern Canadian terrain in advance of shale oil and gas development".**

# Management Board Membership

**Chair: Andrew Applejohn** – GNWT member

**Vice-Chair: Ken Hansen** – Industry member

**Viktor Terlaky** – GNWT member

**Chad Grummett** – Industry member

**Vacant** – IGO member

**Ray Case** – Public 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 (1) of the NWT.

# Summary of Activities in 2024-2025

## Management Board Meetings

The Management Board met in person in Yellowknife, NT on November 21, 2024.

Key program direction for the 2024/2025 fiscal year included:

1. Levy rate for industry would remain the same.
2. ESRF would continue to collect levies and not make any significant funding decisions apart from the projects and research areas previously identified

# 2024-2025 Funded Projects

## Numerical Modelling of the Permafrost Thawing and its Repercussions in the NWT

**Project Lead:** Dr. Vadim Kravchinsky
**Organization:** University of Alberta

**Project Summary:**

Over the past few years, significant advancements in machine learning (ML) techniques have enabled us to analyze complex environmental data with unprecedented efficiency and precision. ML models excel at uncovering relationships between dependent variables and various explanatory factors. Unlike traditional physics-based models, ML models provide a flexible framework for exploring environmental conditions related to topography and land cover, aspects that are often challenging to capture using only physical parameters. This report presents our first-year results on numerical modelling of permafrost thawing based on various parameter records from the Northwest Territories. We tested the capabilities of ML algorithms in analyzing permafrost thaw dynamics in the study area and implemented the ML techniques Random Forest and Neural Networks using the Matlab programming language for numeric computing. Our regression analysis of the selected data demonstrated the ML techniques' capability to construct temperature change predictions from training with actual observational data. The Neural Networks algorithm exhibited rapid learning and optimization capabilities, effectively capturing the complex relationships governing permafrost thaw rates. Mean Squared Error and error distribution analyses further confirmed the precision and reliability of the preliminary ML models in predicting temperature variations. The application of the Random Forest algorithm for predicting Mean Annual Ground Temperature revealed satisfactory predictive power and suggested directions for improvement and refinement in the next reporting year. Our study lays the groundwork for more detailed future analyses and enhancing predictive model accuracy for permafrost thaw dynamics using ML techniques.

**NWT ESRF Funding**: $215,625 over five years.

Full 2024-2025 project report available at https://www.nwt-esrf.org/publications

# 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 Summary:**

Building on the field activities and results of the previous ESRF project, the Year 1 (2024-2025) work of the current project focused on three main areas of study. The first component involved targeted applications of several advanced terrestrial geophysical instruments (EM and ERT) deployed at specific locations of interest to better characterize the occurrence and continuity of permafrost beneath various surface water features (streams and wetlands) and clearings (drill pads and seismic lines). The second major field activity involved soil gas sampling combined with groundwater and surface water sampling to specifically characterize the geologic conditions and the nature of carbon within the subsurface (including within the shallow permafrost) that is being released to the atmosphere. The combined data sets were then used to inform the continued development of the numerical modeling tools designed to simulate critical future scenarios of interest within the context of a warming climate. Initial scenario modeling work was conducted during the Year 1 program. The work remains focused within the Bogg Creek watershed, near Norman Wells in the Central Mackenzie Valley (CMV), NWT.

**NWT ESRF Funding**: $100,000/year for five years (time frame extended due to Covid delays)

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

## Financial Statement of the NWT ESRF for the Fiscal Year 2024-25

| | | |
|---|---|---|
| **Revenues** | | |
| Industry Levies | $ | 200,000 |
| **Total Revenues** | **$** | **200,000** |
| | | |
| **Expenses** | | |
| **Administration** | | |
| Compensation & Benefits | $ | - |
| Travel | $ | (4,269) |
| Communications & Promotions | $ | - |
| Publications | $ | - |
| Other | $ | (2,326) |
| **Total Administration Expenses** | **$** | **(6,595)** |
| | | |
| **Science Program** | | |
| Winter Track Surveys | $ | (100,000) |
| Permafrost Numerical Modelling | $ | (52,875) |
| | | |
| | | |
| **Total Science Program Expenses** | **$** | **(152,875)** |
| **Total Expenses** | **$** | **(159,470)** |
| **Total 2024-2025 Surplus (Deficit)** | **$** | **40,530** |
| | | |
| **Summary** | | |
| | | |
| Opening Balance (April 1, 2024) | $ | 340,893 |
| Revenue | $ | 200,000 |
| Expenses | $ | (159,470) |
| **Closing Balance (March 31, 2025)** | **$** | **381,423** |

## Proposed Budget of the NWT ESRF for the Fiscal Year 2025-26

| | | |
|---|---|---|
| **Revenues** | | |
| Industry Levies | $ | 200,000 |
| **Total Revenues** | **$** | **200,000** |
| | | |
| **Expenses** | | |
| **Administration** | | |
| Compensation & Benefits | $ | (75,000) |
| Travel | $ | - |
| Communications & Promotions | $ | - |
| Publications | $ | - |
| | | |
| **Total Administration Expenses** | **$** | **(75,000)** |
| | | |
| **Science Program** | | |
| Groundwater | $ | (100,000) |
| Permafrost Numerical Modelling | $ | (100,000) |
| | | |
| | | |
| **Total Science Program Expenses** | **$** | **(200,000)** |
| **Total Expenses** | **$** | **(275,000)** |
| **Total 2024-2025 Surplus (Deficit)** | **$** | **(75,000)** |
| | | |
| **Summary** | | |
| | | |
| Opening Balance (April 1, 2025) | $ | 381,423 |
| Revenue | $ | 200,000 |
| Expenses | $ | (275,000) |
| **Closing Balance (March 31, 2025)** | **$** | **306,423** |

# Levy Breakdown 2024-2025

The levy rate is $0.323 per hectare

| Description | Hectares | Amount |
|---|---|---|
| Significant Discovery Licenses | 607,202 | $196,126.25 |
| Production Licenses | 11,711 | $3,782.65 |
| Pioneer Production Licenses | 321 | $103.68 |
| **Total** | **619,234** | **$200,012.58** |

| Location | Hectares | Amount |
|---|---|---|
| Mackenzie Delta / Arctic Islands | 130,173 | $42,045.88 |
| Central Mackenzie Valley | 434,012 | $140,185.88 |
| Southern NWT | 55,049 | $17,780.83 |
| **Total** | **619,234** | **$ 200,012.58** |