



Northwest Territories Environmental Studies Research Fund

2016-2017 Annual Report
and Budget Proposal



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Environmental Studies Research Funds (ESRF)

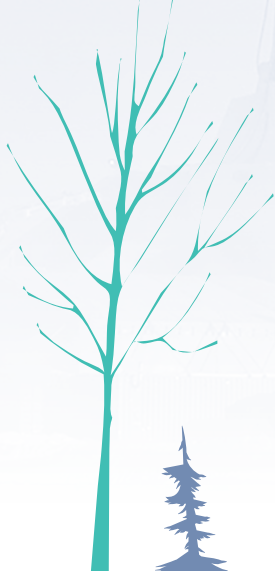
Message from the Chair

I am very pleased to present the second annual report for the Northwest Territories Environmental Studies Research Fund (ESRF). Despite the decrease in upstream oil and gas activity in the Northwest Territories over the past year, continuing to support high caliber research related to the energy industry remains a priority of the Management Board. This fund will continue with a strong focus on developing cost-effective strategies for maintaining baseline monitoring programs across those areas of the territory likely to see development in the future. Maintaining research programs that support fact-based decision-making related to energy development is an excellent investment in the future of the NWT.

Andrew Applejohn

Chair

NWT Environmental Studies Research Fund



Introduction

The Northwest Territories Environmental Studies Research Fund (ESRF) is a research program supporting environmental and social studies to inform decision-making related to oil and natural gas exploration and development on lands within the NWT. The ESRF program replaces the federal ESRF established in 1987 and is a collaborative effort between the Government of the Northwest Territories (GNWT), industry and the public. Funding for the ESRF is collected through levies paid by all oil and natural gas related interest holders of lands in the onshore regions of the NWT – Exploration Licence holders, Production Licence holders and Significant Discovery Licence holders alike. Levy rates are determined on an annual basis by the ESRF Management Board and all interest holders are invoiced based upon their land holdings (total number of hectares) within a particular region.

The purpose of the ESRF is to finance environmental and social studies pertaining to the manner in which and to the terms and conditions under which petroleum exploration, development and production activities should be conducted on lands administered by the GNWT. Environment is interpreted in the broadest possible sense and extends from the physical environment and biological environment issues to socio-economic issues.

The Management Board is composed of representatives from government, industry and the public of the NWT, and brings a wide range of perspectives on what research is needed to support decision making related to sustainable energy resource development in our territory.

Management Board Membership

(Current term expires June 2018)

Chair: Andrew Applejohn – ENR, GNWT member

Vice-Chair: Ken Hansen – industry member

Menzie McEachern – ITI, GNWT member

Scott Gedak – industry member

Ray Case – public member

Summary of Activities in 2016-2017

Communications

NWT ESRF website approved by Management Board and now live: <https://www.nwt-esrf.org/>

Publication from NWT ESRF supported research projects:

- Polfus, J. L., M. Manseau, D. Simmons, M. Neyelle, W. Bayha, F. Andrew, L. Andrew, C. F. C. Klütsch, K. Rice, and P. Wilson. 2016. *Łeghágots'enetę (learning together): the importance of indigenous perspectives in the identification of biological variation*. Ecology and Society 21(2):18. <http://dx.doi.org/10.5751/ES-08284-210218>

Project reports available at <https://www.nwt-esrf.org/publications>:

- *Human footprint, habitat, wolves and boreal caribou population growth rates*
- *Baseline Hydrogeological Evaluation of Central Mackenzie Valley Oil and Gas Exploration Areas Sahtu Region, Northwest Territories*
- *Landscape Projections on Boreal Caribou Habitat in NWT – Summary Report*

Management Board Meetings

Two face-to-face meetings of the ESRF Management Board took place in 2016-2017, both in Yellowknife, NWT, on June 7 and September 28, 2016. Key program direction for the 2017-2018 fiscal year included:

1. Wildlife and water to be retained as the two priority research areas for the NWT ESRF, with a commitment to explore the socio-economic theme further; however, not as a call or proposal this fiscal.
2. Wildlife (Boreal caribou) and groundwater confirmed as priority areas for 2017-2018. Solicited call to be made to the Canol Shale Technical Working Group to further groundwater/permafrost work in Central Mackenzie Valley. Focused open call for development and validation of new techniques and integrated systems related to acquisition of baseline conditions related to wildlife and wildlife habitat. Focus on Boreal caribou. Boreal caribou call will have a total of \$100K, with maximum funding of \$50K per project.
3. Board appointments to be staggered, renewed in offset fashion, with an increased flexibility of board appointments by changing existing length of term wording of three years to “up to three years”.
4. Consensus to work towards adding a second public member, with relevant expertise to Management Board.
5. Marginal budget increase to \$300K total: \$100K for water, \$100K for wildlife, \$100K for administration.
6. NWT ESRF timeline to be on a fiscal rather than calendar year reporting basis.



Photo: Jean Polfus

NWT ESRF Supported Research

On December 14, 2016, a conference call was held for the Management Board to review the solicited research proposals submitted through the focused open call.

The solicited groundwater proposal led by the University of Waterloo was approved for funding at the requested \$100K funding level. This level of funding is anticipated on a yearly basis for a five-year term, contingent on an annual review and approval by the Board.

Boreal caribou proposals from the focused open call were reviewed based on a number of criteria, including:

- Need demonstration as it relates to decision-making
- Transferability of work within the NWT and to other species
- Demonstration of innovation and leveraging
- Relationship with communities
- Feasibility
- Intent for communication of results

Projects were rejected at the outset if these were deemed not applicable to the oil and gas industry.

Seven proposals were received, of which two were selected for funding at the full \$50K per year over four years:

1. Multi-species monitoring using winter track surveys in the Sahtú Settlement Region; and
2. Assessing terrain sensitivity to permafrost thaw and fire to understand and predict Boreal caribou habitat and forage quality in the Sahtú.

As per the groundwater project, funding after this fiscal is subject to review and approval by the Management Board on an annual basis.

On March 15, 2017, a conference call was held to determine if some limited further funding should be allocated based on proposals already submitted.

It was determined that \$10K could be provided to support *Trajectory surveillance tools for Boreal caribou conservation and management*.

The Management Board also determined that some funding may be available to support components of the proposal entitled *Conveying caribou: developing effective community-based communication tools to support sustainable caribou stewardship*. However, a final decision was deferred until a face-to-face meeting scheduled for June 14 to 16, 2017, in Inuvik.



Summaries of Funded Science Program Proposals

The following are summaries of the four science program proposals selected for funding in 2016-2017.

1. Assessing terrain sensitivity to permafrost thaw and fire to understand and predict Boreal caribou habitat and forage quality in the Sahtú

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

Project Description

The 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. Specific project objectives include:

1. Perform field surveys of permafrost, soil and vegetation characteristics to quantify caribou habitat condition.
2. Link field data to land cover and fire maps to measure spatial patterns of habitat condition and availability for Boreal caribou and model their dynamics with time-following-fire.
3. Analyze high resolution imagery to quantify historical land cover change associated with human activity, fire, thermokarst and interactions among these disturbance types.
4. Use field and land cover change data within an existing thermokarst modelling framework to create predictive maps of where and how permafrost is most likely to change with warming or disturbance.
5. Develop a collaborative decision support system for improved Boreal caribou habitat management in the Sahtú region fed by spatially-explicit permafrost and vegetation data, and available data on caribou habitat use (from collar data and harvester information).

Relevance for NWT

The Sahtú region is a resource rich region where substantial resource extraction has occurred in the past and much more is anticipated in the future. Developing a solid understanding of the interaction between permafrost thaw and Boreal wildfire and what this means for caribou habitat regionally will provide critical insights into the rates of change that we can anticipate in the face of ongoing environmental change. When combined with projected rates of habitat degradation or loss due to resource development activities, we will have the capacity to understand the cumulative impacts of these environmental and anthropogenic drivers on the extent and quality of caribou habitat.

NWT ESRF Funding: \$50,000/year for four years



Photo: Husky Energy

2. Multi-species monitoring using winter track surveys in the Sahtú Settlement Region

Project Leader: James Hodson

Organization: GNWT Environment and Natural Resources

Project Description

This project aims to establish a collaborative (communities, industry and government), regionally-based, long-term wildlife snow track monitoring program in the Sahtú Settlement Area to measure cumulative impacts of industrial development and other land use activities by assessing the link between patterns of abundance and occupancy of Boreal woodland caribou, caribou predators, alternate prey and other furbearers to changes in disturbance footprint and landcover over space and time. This project specifically addresses “the development and validation of new techniques and integrated systems for the acquisition of baseline information related to Boreal caribou”. It will build off of experience gained through a three-year pilot project with the community of Tulita (2015-2017; CIMP162)

to develop snow track survey protocols and develop community-based monitoring capacity. Power analyses undertaken in the pilot project have helped to determine sampling effort required to detect temporal changes in species occupancy. To achieve the necessary level of sampling effort to detect changes, the next phase of this project will focus on expanding the program to other Sahtú communities adjacent to active oil and gas exploration licences (Norman Wells and Fort Good Hope), and on continuing the program in Tulita. If oil and gas companies become active in the region again, they will be invited to participate in the program to increase the spatial coverage of the monitoring program.

Oil and gas exploration licences currently cover ~1.35 million hectares of the Sahtú Settlement Area and overlap the western limit of the NWT Boreal caribou range. Exploration activity will increase habitat and sensory disturbance to wildlife and provide new access to remote areas. Communities, government and industry have expressed interest in monitoring cumulative impacts of this activity on wildlife. There is currently a lack of data on distribution and population trends for many wildlife species within the areas of current shale oil exploration.



Photo: Harry van Oort

A standardized monitoring program that can involve community members and be applied at a regional scale by communities, industry and government is needed to describe baseline conditions prior to development and to detect changes should further development occur.

This project will use winter wildlife track surveys conducted along existing linear features to measure changes in occupancy and relative abundance of multiple species, including Boreal caribou, within and outside of areas of potential oil and gas exploration and development. The program design and approach to estimating species occupancy is based on a similar winter track survey program conducted in Banff National Park (Whittington et al. 2015). Track surveys are conducted by snowmobile along selected survey routes. A standardized data collection application (currently Trailmark™) is run on handheld rugged field computers or tablets to record wildlife tracks and take geo-referenced photos and audio recordings. At the end of each survey day, data is backed up on computers and uploaded through a wi-fi connection to a central database, which can be accessed by all program participants. The use of a data collection “app” on mobile devices standardizes the way in which data is collected and eliminates the need for recording data on paper, which then must be manually entered. The Tulita pilot project has demonstrated that the use of the “app” is easily learned by community members. Working with harvesters and youth from the community capitalizes on their existing expertise in wildlife track identification and promotes the transfer of knowledge about wildlife tracks and interpretation from elders to youth. The methods and technology used in the Tulita pilot project can be easily adopted by companies operating in the region. If communities, industry and government all follow the same methodology, the data can be pooled to provide coverage at a scale that is necessary to detect cumulative effects due to landscape level changes to wildlife habitat.

For the next phase of the project we are proposing to hire two survey teams (each with two people) in Tulita, Norman Wells and Fort Good Hope through the local Renewable Resources Councils. Each survey team would be responsible for surveying four routes at least four times each winter, for four consecutive winters. The funds requested will be used to support salaries of community-based monitors, equipment rentals and purchase, gas/oil, travel to communities to plan field work and present results, statistical analysis and presentations at workshops and conferences.

Relevance for the NWT

This project will provide important lessons in the coordination, logistics and implementation of community-based monitoring programs. It will provide baseline data on wildlife distribution and relative abundance within the Canol Shale Formation prior to further exploration or development, and if the program continues on an annual basis, it will provide temporal trends in wildlife occupancy and relative abundance. The data collected in this project can help to inform future environmental assessment processes and land use planning. It will provide a standardized data collection protocol that can be adopted by proponents of oil and gas development within the Sahtú region, which will expand the scope of the monitoring program and allow for evaluation of cumulative effects. Specifically, it will contribute to monitoring of Boreal caribou distribution in the Sahtú region, for which no other current programs are in place.

NWT ESRF Funding: \$50,000/year for four years

3. Regional hydrologic and ecologic characterization and baseline assessment of remote northern Canadian terrain in advance of shale oil and gas development

Project Leader: David Rudolph

Organization: University of Waterloo

Project Description

The project work plan is based on a five-year schedule and is designed to be able to take advantage of additional leveraged funding opportunities that the project team has identified as being potentially available during the lifetime of this project. We anticipate that these additional funds that can be marshalled for use within the current project will specifically support field and equipment costs in mid to later stages of the project.

Considering the large scale of the study area, it is proposed that a specific section of the total area be identified as the main focus of the field investigations. This would be considered a pilot area and the results from this area would then be expanded to the larger region as seen fit by the major partners and stakeholders. It is anticipated that the lease area 494 managed by Husky Oil Operations Ltd. would be the focus of the main initial activity.

Year 1 Work Plan

The initial year of the study would be dedicated to developing a conceptual methodology to conduct extended baseline hydrologic and ecologic monitoring within the field study area. The work will be divided into a series of specific activities that are outlined below.



Photo: ConocoPhillips Canada

Step 1: Review of Overall Project Plan with Key Stakeholders

As an initial step in the project, we propose to submit this proposal and work plan to the appropriate partners and stakeholders to solicit additional input and guidance prior to the start of the technical activities associated with Year 1. We anticipate that this is likely best achieved through a series of conference calls that GNWT authorities will help to coordinate on our behalf. Based on the input received through the partner and stakeholder meetings, the scope of work will be modified as appropriate.

Step 2: Convene a Project Workshop

Following the initial consultation meetings noted above, a two-day workshop will be held with the investigative team and interested partners, likely in southern Ontario. The meeting will be focused to review and enhance the conceptual model of the field site, assess all available monitoring technologies and to structure a multi-year monitoring strategy to ensure a comprehensive baseline monitoring program is implemented. The workshop will be convened within two months of approval of the Year 1 work plan. Main topics of discussion will include innovative sensors and monitoring approaches that require minimal site access and drilling costs, spatial and temporal requirements for data collection and graduate student recruitment requirements. Remote sensing through orbit-based systems, low flying aerial geophysics and drone-supported sensor systems will be the main areas of consideration. We believe that it will be critical for several members of the research team, who have not previously had the chance to visit the area, to plan a guided field trip during the course of the Year 1 program. This will also be discussed and initial plans developed during the workshop.

Step 3: Hiring of Highly Qualified Professionals (HQP)

Over the course of the entire proposed research program it is anticipated that we will engage one PhD student, two MSc students and a Post-doc fellow to work on the main technical components of the project.

The exact backgrounds for each of the HQP will be discussed in detail at the initial workshop and the people will be stationed at the University of Waterloo and Wilfrid Laurier University. The research team will collaborate to recruit the best candidates for the HQP positions.

Step 4: Assembling Available Data Sets

The technical work activities will first involve the compilation of all available relevant data on the geology, hydrology and ecology of the site through various stakeholder sources. This will include the historical baseline data from a wide range of sources. These data will provide the critical foundation of understanding for the field conditions and will be used to initiate the design of the baseline monitoring strategies that would be appropriate for the conditions encountered at the field area. Of specific interest will be the baseline data collected by the oil and gas companies who have been active in the area with an emphasis on the information and infrastructure (monitoring wells) managed by Husky Oil Operations Ltd. Another valuable data source is related to the seismic shot hole data throughout the region. These data have been collated and prepared in database format by Dr. Rod Smith of NRCan and have been made available to the research team.

A major emphasis during the Year 1 program will be to investigate the available and potential future opportunities associated with remote sensing data. Several of the team members are international experts in this area and are associated with emerging opportunities, including the ABoVE program associated with NASA. The remote sensing data will be used to assist in selecting terrestrial monitoring locations that will provide optimal baseline information as related to dynamic hydrology and ecology. Specific focus on annual land cover dynamics, locations of icings, vegetation and groundwater-surface water interactions.

Step 5: Design of Terrestrial Sentry Sampling Locations

A main component of the Year 1 activities will be to select specific terrestrial monitoring locations, based on the review of all available physical data, so that the most critical and informative baseline data are collected over the course of the investigation. Considering the large spatial scale of the study area and the difficult access restrictions, we propose to focus ground monitoring activities at a very specific network of locations that will provide the best opportunity to detect change in water quality and quantity over the annual climatic cycle and, ultimately, as/when shale oil and gas exploration is resumed in the future. These locations will include obvious groundwater spring and seep areas, locations near active surface water features and sensitive ecological settings. These stations will provide valuable ground truthing data for different scales of remote sensing. The experience of the research collaborators, who have worked extensively in NWT over the last several decades, and specifically the scientists from WLU, NRCan and the NWT Geological Survey,

will be invaluable in selecting the terrestrial monitoring locations and the monitoring/sampling strategies. Of critical importance, however, will be discussions and advice from our local partners in the vicinity of Norman Wells and Tulita. We propose to specifically engage the appropriate personnel in identifying monitoring locations based on traditional knowledge that are the most sensitive and important to local residents. We anticipate that this will be the most valuable information and advice that we can receive in selecting the terrestrial monitoring locations. It is anticipated that initial location visits and preliminary sampling will take place during the planned site visit during the Year 1 program. The details of this initial sampling activity will be developed through consultation with the research team, GNWT authorities and our local partners.

Step 6: Leveraging the Research Program

We anticipate that the costs associated with conducting the field activities, geophysical surveys and combined data analysis that is envisaged for subsequent years of the project will require additional leveraging. We have several opportunities to combine funding efforts and to solicit additional support through, for example, the new Global Water Futures program, which several of the research team members are directly associated with. During the Year 1 program, a continuous focus will be placed on arranging additional leveraged funds to support costly aspects of the anticipated field activities. If the overall project is approved, work would commence immediately in the winter of 2017.

Relevance for the NWT

Recently, the Sahtú Settlement Area (SSA) of the Central Mackenzie Valley (CMV) in the Northwest Territories (NWT) has been an area of focus for evaluating the potential for oil and gas production from the Canol Formation, a Devonian petroliferous shale (AMEC, 2014). One area of active exploration has been established along the Mackenzie River between Tulita and Norman Wells in the NWT. The oil and gas companies involved in these exploration activities have completed studies related to the baseline hydrologic and ecologic conditions in the area. The initial data sets derived from these studies represent reference values that can be used to assess potential environmental disturbances that may influence local hydrologic and ecologic conditions associated with future development of the shale oil resources within the Canol Formation in this area.

Due primarily to economic drivers, the exploration activities within the SSA have been significantly reduced over the last few years. This hiatus in oil and gas activity provides an opportunity to expand the baseline understanding of the Sahtú region. This project aims to address some of the current groundwater related knowledge gaps in preparation for when oil and gas activity increases once again.

NWT ESRF Funding: \$100,000 for Year 1

4. Trajectory surveillance tools for Boreal caribou conservation and management

Project leader: Colin Robertson

Organization: Wilfrid Laurier University

Project Description

The use of GPS collaring to track individuals and populations has grown extensively in recent years. New methods for estimating home ranges, species interactions, movement patterns and individual behaviour modelling have proliferated in the spatial analysis academic literatures. Yet the application of cutting edge methods in applied conservation and management remains limited. This study will investigate the application of new approaches for modelling individual and population parameters from trajectory data for conservation and planning of Boreal caribou. New tools will be implemented in open source software and made available as research outputs. Existing caribou collar data will be used for this study, covering the period 2008 to 2016 in the Dehcho and South Slave regions. While previous methods derived from telemetry data with low temporal resolution have been used for range mapping, new higher resolution trajectory data offer the opportunity for more fine-grained understanding of animal movement and space-use. We will begin with tools implemented in the

recently developed wildlifeTG R package, which implement methods based on time geographic research. We will then assess the utility of these new approaches relative to the short and medium-term conservation and planning needs for Boreal caribou. Finally, we will test an implementation of these approaches within an automated modelling context, and develop decision-support tools based on these findings.

Project Rationale and Logistics

This project aims to test new methods for spatial analysis of caribou collar data to meet the management needs of NWT. As well, the project proposes to develop new tools and models that implement these methods in a decision-support context. As such, this research proposes to bridge the gap between operational spatial planning of Boreal caribou and recent contributions to the academic literature on spatial analysis methods.

Relevance for the NWT

This research will provide analytic tools that will provide for greater decision-support capacity for caribou management and conservation to be realized from the ongoing collaring program.

NWT ESRF Funding: \$10,000



Budget for NWT ESRF Supported through 2017-2018 Levies

1. Administration of the Fund

This budget provides funding for a half-time equivalent position to perform Secretariat functions. Other costs associated with the budget are related to Board travel, direct meeting expenses and communications.

2. Science Program Budget

The following science programs were recommended for approval by the ESRF Management Board.

NWT ESRF Project Funding	
Industrial activity and caribou populations	\$ 100,000
Proposed Baseline Hydrogeological Evaluation of Central Mackenzie Valley Oil and Gas Exploration Areas Sahtú Region, NWT	\$ 100,000

3. Summary

Overall funding requirement recommended for support through levies is the total for both administration and initial science program support. The budget breakdown is as follows:

Administration	\$ 98,000
Science Programs	\$ 200,000
Total	\$ 298,000



Photo: Joseph Hanlon

Financial Statement of the NWT ESRF for the Fiscal Year 2016-2017

Administration	
Revenue *	\$ -
Expenses	
Compensation and Benefits	\$ (50,000)
Travel	\$ (4,064)
Communications and Promotions	\$ (4,515)
Publications	\$ (3,210)
Other	\$ (7,600)
Total Expenses	\$ (69,389)
Total Administration Surplus (Deficit)	\$ (69,389)
Science Program	
Revenue *	
Industry Levies	\$ 291,629
Expenses	
Sahtú Groundwater - Travel	\$ (9,960)
Wolves/Caribou	\$ -
Caribou Genetics	\$ -
Total Expenses	\$ (9,960)
Total Science Program Surplus (Deficit)	\$ 281,669
Total 2016-2017 Surplus (Deficit)	\$ 212,280

Summary	
Opening Balance (April 1, 2016)	\$ 284,777
Revenue *	\$ 291,629
Expenses	\$ (79,349)
Closing Balance (March 31, 2017)	\$ 497,057

* Industry levies are shown in the Main Estimates in the year they are invoiced. However, these amounts are to fund the projects for the following fiscal year. For the purposes of this report, revenue is shown in the year the work has been budgeted.

Main Estimates 2016-2017 (Actuals)	
Revenue *	\$ 292,000
Expenses	\$ (79,000)
Surplus (Deficit)	\$ 213,000
Opening Balance (April 1, 2016)	\$ 534,000
Closing Balance (March 31, 2017)	\$ 747,000

Proposed Budget of the NWT ESRF for the Fiscal Year 2017-2018

Administration	
Revenue *	\$ -
Expenses	
Compensation and Benefits	\$ (58,000)
Travel	\$ (20,000)
Communications and Promotions	\$ -
Publications	\$ -
Other	\$ (20,000)
Total Expenses	\$ (98,000)
Total Administration Surplus (Deficit)	\$ (98,000)
Science Program	
Revenue *	
Industry Levies	\$ -
Expenses	
Caribou Studies	\$ (100,000)
Sahtú Hydrogeological Baseline	\$ (100,000)
Total Expenses	\$ (200,000)
Total Science Program Surplus (Deficit)	\$ (200,000)
Total 2016-2017 Surplus (Deficit)	\$ (298,000)

Summary	
Opening Balance (April 1, 2017)	\$ 497,057
Revenue *	\$ -
Expenses	\$ (298,000)
Closing Balance (March 31, 2018)	\$ 199,057

Main Estimates 2017-2018 (Actuals)	
Revenue *	\$ -
Expenses	\$ (298,000)
Surplus (Deficit)	\$ (298,000)
Opening Balance (April 1, 2017)	\$ 624,000
Closing Balance (March 31, 2018)	\$ 326,000

