

**Interim Report of the Cold Regions Research Centre (CRRC)
to the Office of Research Services
31 May, 2016**

The CRRC was established in 1987. Since that time, Laurier has become recognised internationally for its expertise in cold regions in both the biophysical sciences and social sciences. The CRRC's expansion in recent years through the appointment of five Research Chairs (Wolfe, Quinton, Baltzer, Marsh, Slocombe) has brought with it new and notable CRRC initiatives (e.g. Laurier-GNWT Partnership Agreement, CFI-CALIBER, etc.). Over the last 12 months, several of Laurier's major research initiatives build on previous CRRC achievements, and are both initiated by and led by CRRC researchers. Two back-to-back multi-million dollar CFI grants (i.e. CALIBER and CANet, both led by the CRRC) is a strong endorsement from both the Tri-Council and the international research community of the growing strength of Laurier's cold regions expertise. CANet will provide 1) new buildings and laboratories in the NWT for Laurier researchers to base their field operations, 2) a suite of new field research stations ("living labs") and improvements to existing stations; 3) a range of roving analytical tools; and 4) community-based research infrastructure. The CRRC, in cooperation with the GNWT, will operate a cluster of over 15 research sites/stations throughout the NWT. Presently, two of the CRRC research stations (Scotty Creek, Trail Valley Creek) are among the largest field research stations in Canada's North in terms of person days. Cold regions research and capacity building continues to be a major strength at Laurier, as it has been for the last 40 years. CRRC activities over the last twelve months demonstrate growth in research funding and productivity, and expansion of engagement with northern organisations and local communities.

The Laurier-GNWT Partnership Agreement is the flagship for the CRRC. We continue to expand the Partnership beyond biophysical sciences into the social sciences (e.g., governance, food security, community health). A central focus of the CRRC within the Partnership is engagement with communities through the development of evidence-based predictive tools for use by researchers, practitioners, communities and other end users. The CRRC provides training to a wide range of user communities on these tools. CRRC initiatives in NWT Aboriginal communities focus on food security and sustainability and community health and aim to building capacity in northern communities. The CRRC engages local communities through outreach mechanisms including media, public lectures, workshops, and educational activities. At Laurier, the CRRC has a vibrant speaker series involving experts in the biophysical and social sciences from across North America to speak at Laurier. Much emphasis within the CRRC has been within the biophysical sciences directly supporting the Environment Cluster of the SRP. Such research focuses on impacts of climate change on high latitude ecosystems CRRC membership has expanded to include research focused on food security and its impact on Aboriginal community health and well-being, the impact of climate and land cover change on traditional ways of life, and traditional vs. wage-based economies in the North.

The following is a brief update of activities by the Cold Regions Research Centre over the last year. Greater detail on each point can be found from the CRRC website (currently being updated), and on the websites of individual CRRC faculty members. The focus of this report is on CRRC events, new initiatives, and student achievements. Attached to this report are 11 appendices (A to N), which provide additional information on individual CRRC events, promotions and initiatives.

1. CRRC Events:

- Laurier-GNWT Partnership Panel Discussion "Water + Ice: Precious Resources, Principled Neighbours", 29 April, 2015 (Appendix A)
- Hosted Laurier/McMaster Metals Research Review/Update, 18 June, 2015 (<https://coldregions.ca/>)
- Hosted Dave Olesen's Book Launch "Kinds of Winter: Four Solo Journeys by Dogteam in Canada's Northwest Territories", 29 September, 2015 (Appendix B)

- Hosted panel Discussion “Climate warming and aboriginal communities in Northern Canada: Uncertain futures”, 19 November, 2015 (Appendix C)
- CRRC Seminars:
 - Dr. Michael Pisaric, Brock University. A paleoecological perspective of natural and human induced change from Inuvik, NWT
 - Dr. Heidi Swanson, University of Waterloo. Aquatic ecology and contaminant accumulation in the North: Understanding and predicting change
 - Dr. Hendrik Poinar, McMaster University. Of Mammoth and Men; The Population Dynamics and Extinction of the Woolly Mammoth (*M. primigenius*)
 - Dr. Jennifer Baltzer, Wilfrid Laurier University. Land cover change in high latitude ecosystems.
 - Dr. Philip Marsh, Wilfrid Laurier University. The western Canadian Arctic: Past and future changes in climate and hydrology
 - Dr. Alex Latta, Wilfrid Laurier University. Aboriginal peoples and the NWT Water Stewardship Strategy: Research notes on resource governance in an inter-cultural, inter-territorial and inter-governmental space.
- Scotty Creek Research Day, including Map Exercise led by aboriginal Elder from the Fort Simpson, NWT, 20 November, 2015 (Appendix D)
- Host, Laurier-GNWT Partnership Agreement, Annual General Meeting, Waterloo, ON, 13-14 January, 2016 (Appendix E)
- Co-Host, Cumulative Impacts Monitoring Programme (CIMP) Results Workshop, Fort Simpson, 19-20 Jan., 2016 (Appendix F)
- R Statistical Package, Workshop and Training Session, 27 January, 2016
- CRRC Day, 11 March, 2016 (<https://coldregions.ca>)
- Co-sponsor, Camille Seaman Arctic Photographic Display “Connection and Purpose: How to Audaciously Stand up for the Planet”, Waterloo, ON January 28, 2016 (<https://coldregions.ca>)
- CRRC Guest Speaker: Dr. Kenneth Hewitt, 11 March, 2016 (Appendix G)
- CRRC Guest Speaker: Dr. Jim McLaughlin, 7 April, 2016 (Appendix H)
- CRRC Guest Speaker: Dr. Bob Baxter, 3 May, 2016 (Appendix I)

2. Promotion of the CRRC:

- New CRRC Brochure sent to printer 29 April, 2016 (Appendix J)
- New CRRC brochures for Scotty Creek Research Station (Appendix K),
- New CRRC brochures in preparation (draft) for Hoarfrost River (Appendix L),
- New CRRC brochures for other stations/sites including in preparation Trail Valley Creek (in preparation), Kakisa (in preparation).
- New CRRC drinking water bottles for gifts, guests, prizes etc. (Appendix M)

3. New Initiatives:

- CRRC researchers were institutional leads on a Canada First Research Excellence Fund application “Global Water Futures: Solutions to Water Threats in an Era of Global Change” in partnership with the University of Saskatchewan, University of Waterloo and McMaster University. This proposal had a total CFREF funding request of \$83M and if successful, will bring the largest ever, single pot of research operating funds to

Laurier valued at between \$10-15M to support the University’s strategic research focus on Cold Regions Water Science.

- The CRRC negotiated a special reduced rate with the Yellowknife Inn for CRRC researchers and students (Appendix N).
- Introduction of the “Cold Regions Research Centre Visiting Fellowship”. This is a one-term (i.e. 4 month) position for a researcher visiting Laurier from another university or government research office. The CRRC Visiting fellowship would come with furnished office space at the CRRC or in an academic department. The CRRC Visiting Fellow also includes full library access including access to electronic journals, possible status as an Adjunct Professor, and a \$2,000 travel support (from the Research Office) to assist with temporary relocation costs. Starting September, 2016.
- Discussions with senior management of the Ontario Ministry of Natural Resources and Forestry for partnership and collaboration with the CRRC for research and capacity building in Ontario’s far North.

4. CRRC Post-doctoral and Student Research:

Students are central to the CRRC. As such, much of the CRRC’s activities are aimed at supporting and promoting student research. These include:

- The CRRC administers the Northern Student Training Program (NSTP), federal funding that supports student research in the North. The program has been growing annually at Laurier and in 2015 totalled \$66,700 of funding supporting 23 student research projects in the North demonstrating the collective strength of our northern research program. This is much larger NSTP revenue than raised by other universities of similar size. A similar level of funding was secured in 2016.
- The annual Cold Regions Student Research Symposium during which undergraduate, graduate, and postdoctoral trainees present their research
- Initiation of a part-time graduate student option for residents of the NWT to provide post-secondary educational opportunities in the North.
- CRRC members consistently provide field research opportunities for undergraduate students interested in exploring northern communities and ecosystems.
- During 2015/16 our students have been the recipients of 22 national and international scholarships and awards.

The following table outlines the breadth of our student training and expertise and summarizes range of awards that have been received in the past year.

HQP Type	Thesis title	Awards/Recognition
PDF		
Gord McNickle, PDF completed	Modeling boreal forest dynamics using a game theoretic approach	Banting PDF (2013-2015); Smithsonian Institute Research Grant (2014)
Justin Adams, PDF in progress	Remote sensing of thawing permafrost	
Nicola Day, PDF in progress	Post-fire mycorrhizal community dynamics	NSERC PDF (2016-18)
Ali Toure	High resolution hydrological modeling in the subarctic tundra	
Barrett Kurylyk, PDF	Thermal modelling of thawing permafrost	

in progress		
Vanessa Pedinotti, PDF in progress	Hydrological (MESH) modelling of northern wetlands	
Christoforos Pappas, PDF in progress	Dynamic vegetation modeling of subarctic forests	Swiss National Science Foundation Postdoctoral Fellowship (2015 –17)
Lauren MacDonald, PDF completed	Thermokarst lake water balance in subarctic North America from isotope tracers.	
PhD		
Lauren MacDonald, PhD Completed	Integration of paleolimnological and contemporary hydroecological analyses to decipher effects of multiple stressors on water-rich northern landscapes	WB Pearson Medal (PhD) in recognition of creative research in Biology
Bhaleka Persaud, PhD in progress	Climate warming in the southern Taiga Plains Ecoregion	
Andrew Spring, PhD in progress	Land cover change and food security in the north	SSHRC Doctoral (2016-18); OGS (2015); NSTP Malcolm Ramsay Award (2015)
Cory Wallace, PhD in progress	The causes and consequences of tundra shrubbing	OGS (2016); Laurie Consaul Northern Research Scholarship (2015); CSEE Travel Scholarship (2015)
Ana Sniderhan, PhD in progress	Black spruce climate-growth dynamics from treeline to treeline	OGS (2014, 2015)
Ryan Connon, PhD in progress	Hydrology of seasonal bog connections in permafrost terrain	NSERC (2015); OGS (2014); W. Garfield-Weston Award for Northern Research (2014); DM Gray Award for best Student Paper (CGU) (2016).
Katherine Standen, PhD in progress	Functional trait variation across a latitudinal gradient of subarctic forests	OGS-QEII (2016)
Geoff Kershaw, PhD in progress	Impacts of climate warming on alpine tundra ecosystems	OGS (2016)
A. Balasubramaniam, PhD in progress	Assessing linkages among climate, hydrology and aquatic ecology for the development of biomonitoring protocols in the Old Crow Flats, Yukon Territory	
W. Mohammed, PhD in progress	Development and application of periphyton-based biomonitoring methods to assess changes in hydro-limnological conditions of lakes in a water-rich northern landscape (Old Crow Flats, Yukon)	
Hilary White, PhD in progress	Contemporary and paleolimnological approaches for assessing the effects of climate change on the hydrology and greenhouse gas behaviour of shallow subarctic lakes in Wapusk National Park, Manitoba	
MSc/MES		
Allison McManus, MSc completed	Galling herbivory alters ground thaw processes in a high latitude boreal peatland	
John Gordon, MSc completed	Methyl Mercury fluxes from peatlands with thawing permafrost	
Jocelyn Beatty, MES completed	This Land is Your Land: Exploring the Sea to Sky Land and Resource Management Plan through the Lens of Indigenous Planning	
Jennifer Hickman MSc completed	Seasonal Evolution of Active Layer Formation in Subarctic Peat Plateaux and Implications for Dissolved Organic Matter Composition and Transfer	

Katherine Black, MSc in progress	Water and nutrient limitations of tall shrubs on the subarctic tundra	NSERC PGSM (2015); OGS (2016); W. Garfield-Weston Award for Northern Research (2016)
Elise Mathieu, MSc in progress	Impacts of fire on the active layer thermal regime	
Lindsay Stone, MSc in progress	Hydraulic properties of channels fens	
Emily Haughton, MSc in progress	Soil moisture recharge from snowmelt	
Stacey VanOpstal, MSc in progress	Hydraulics of channel fens	
Kevin Maccoll, MSc in progress	An assessment of plant performance and mycorrhizal infectivity in soils collected from the Giant Mine watershed	
Rebecca Hamp, MSc in progress	Assessing revegetation efforts at the Colomac Mine, NWT	
Meagan Warkentin, MSc in progress	Hydrological change and forest regeneration in a subarctic boreal peatland	OGS (2016)
Branden Walker, MSc in progress	Contribution of snowmelt to streamflow at Trail Valley Creek, NWT	NSERC USRA (2015); OGS (2015, 2016)
Casey Remmer, MSc in progress	Multi-year record of isotope hydrology of lakes in the Peace-Athabasca Delta: A foundation for hydrological monitoring	NSERC PGSM (2016)
Nick Wilson	Assessing the role of changing snowpack structure on the Bathurst caribou herd	NSTP - ACUNS Caribou Research and Management Award 2016.
Michael Braverman, MSc in progress	New geophysical methods of seismic disturbance monitoring	
Philip Mann, MSc in progress	End of winter snow cover dynamics at Trail Valley Creek, NWT	
N. Meyers, MSc in progress	Isotope hydrology of prairie wetlands in southern Alberta	
Natalia Wegrzyn, MES in progress	Highway Traveler Tourism Experience in Yukon	
Stephanie Roy, MSc in progress	Developing a hydroecological monitoring program for Wapusk National Park, Manitoba	
James Telford, MSc in progress	Reconstruction of past hydrological conditions and baseline metal deposition in lakes of the Marian River watershed, NWT	
Evan Wilcox, MSc in progress	Water budget of low arctic lakes during freeze and thaw periods	
Kirsten Reid, MSc in progress	The role of fire severity in determining boreal forest succession in the NWT	
Alison White, MSc in progress	Post-fire community assembly processes in southern taiga forests in the NWT	
Jason Paul, MSc in progress	The role of forest stand development in near surface ground ice content	
BSc Thesis Students		
James Bannister, BSc completed	Impacts of gold mining on soil bacterial communities in the Northwest Territories	
Sarantia Katsaras B.A. completed	The importance of a changing snowpack on the Bathurst Caribou herd	
Elise Wagenaar, BSc	Modelling key hydrological processes on a subalpine	

completed	tundra hillslope	
Sarah Mediouni, BSc completed	Impact of Tundra Mine on wetland vegetation and mycorrhizal fungi	
Evan Wilcox, BSc completed	Factors controlling lake levels in the subarctic tundra	
A. Frey, BSc completed	Monitoring the effects of Lesser Snow Goose disturbance on ponds in Wapusk National Park (WNP), northern Manitoba	
K. Thomson, BSc completed	Reconstructing hydrological conditions and contaminant deposition in the Athabasca Delta, Alberta, from paleolimnological analysis	
Erik Wagenaar, BSc completed	Snowmelt, ground thaw and runoff processes on alpine tundra hillslopes in the Yukon	
Matthew Tsui	Snow accumulation and snow ablation over the Trail Valley basin	
Grant Harrison	Reproduction and health of walleye and lake whitefish in Kakisa and Tathlina lakes, NT	NSERC CREATE (Canadian Rivers Institute; 2014-2016)

CRRC Funding

CRRC member	Funding source	Amount/Time period
Brent Wolfe		
	NSTP-2 students	5,400/2015-16
	Parks Canada	919/2016
+ 4 others	NSERC CRD	409,056/2015-18
+ 4 others	BC Hydro	90,000/2015-18
+ 4 others	Canadian Natural Resources Ltd	180,000/2015-18
+ 4 others	Suncor Energy Ltd	180,000/2015-18
+ 4 others	Alberta Environmental Monitoring, Evaluation and Reporting Agency	150,000/2015-18
+ 4 others	Wood Buffalo National Park	33,040(in-kind)/2015-18
	NSERC Discovery	190,000/2012-17
	NSERC Res. Supplement	75,000/2012-17
+ 1 other	Tlicho Government	31,805/2016
+ 14 others	NSERC ADAPT Discovery Frontiers	4,000,000/2011-16
Mike English		
+ 5 others	ArcticNet	405,000/2015-17
+ 2 others	Cumulative Impact Monitoring Program	160,000/2015-17
Colin Robertson		
	NSERC Discovery	75,000/2016-20
Bill Quinton		
	Canadian High Arctic Research Station (CHARS)	\$289,737 /2015-2018
	Cumulative Impacts Monitoring Program (CIMP)	\$55,000/2016-2017

	Canada Foundation for Innovation (CFI)	\$3,400,000 / 2015-2022
	NSERC Northern Supplement	\$100,000 / 2015-2020
	NSERC Northern Discovery	\$165,000 / 2015-2020
	Petroleum Technology Alliance of Canada (PTAC)	\$181,413 / 2015-2018
	GeoScience BC	\$65,000 / 2015-2018
	NSERC Collaborative Research and Development (CRD)	\$294,478 / 2013-2018
	NSERC-CCAR	\$5,000,000 / 2013-2016
	Canada Research Chairs	\$500,000 / 2010-2015
	Canadian Foundation for Innovation in partnership with the Government of the Northwest Territories	\$6,300,000 / 2011-2015
	Nexen Energy Research Funding	\$400,000 / 2016-2019
Phil Marsh		
+ 7 others	CFI Changing Arctic Network	8,200,000/2015-2019
	NSERC Discovery	125,000/2016-2020
	NSERC Res. Supplement	75,000/2016-2020
	ArcticNet	390,000/2015-2017
	Polar Knowledge Canada	300,000/2015-2017
	NSERC Changing Cold Regions Network	150,000/2013-2017
	Polar Continental Shelf Project	46,000/2016
	Canada Research Chairs Program	1,400,000/2013-2019
	CFI	500,000/2013-17
	WLU in support of CRC	300,000/2013-17
Alison Blay-Palmer		
	Cumulative Impacts Monitoring Program	150,000/2016-18
Jennifer Baltzer		
	Canada Research Chairs Program	500,000/2016-20
	Cumulative Impacts Monitoring Program	360,000/2015-17
	Polar Continental Shelf Program	45,170/2016
	NSERC Discovery	137,500/2014-18
	NSERC Res. Supplement	82,500/2014-18
	NSERC CCRN	150,000/2013-17
	Polar Knowledge Canada	252,600/2015-17

	ArcticNet	450,000/2015-18
	Laurier International Res. Grant	7,478/2016
Kevin Stevens		
	Aboriginal Affairs and Northern Development Canada (AANDC)	50,770/2015
	Tides Canada Foundation	\$7,000/2015
	GNWT, Environment & Natural Resources/Fisheries and Oceans Canada	\$8,000
	AANDC	19,981/2015
+ R. Slawson	NSERC Discovery (Team)	180,000/2014-2018
	AANDC	14,472/2015
	Flat River Consulting	6,000/2015
	OMNRF – 3 projects	90,114/2016
Jason Venkiteswaran		
+ 4 others	NSERC- Strategic	726,564/2013-16
+ 3 others	NSERC-RTI	211,206/2016-18
+ 4 others	Swedish Research Council- 2grants	1,219,998/2013-15
+ 3 others	Environment Canada	12,000/2015
+ 3 others	UW Water Institute	16,667/2015
+ 3 others	International Atomic Energy Agency	12,000/2016-18
Deborah MacLatchy		
	Cumulative Impact Monitoring Program	90,000/ 2013-2016
	NSERC Discovery	150,000/ 2013-2018
	NSERC CREATE (Canadian Rivers Institute)	44,000/ 2014-2016