2018
Annual Report
Cooperative Freshwater Ecology Unit
Awards and Recognition

- The Science Communication Program was honoured to receive the 2018 William Edmond Logan Award from the Royal Canadian Institute for Science. This award celebrates outstanding contributions to the public understanding of science by a Canadian organization.

- Dr. Norm Yan was appointed Senior Research Fellow in Aquatic Biology at the Vale Living with Lakes Centre on April 19, 2018

- Dr. Bjorn Rosseland, emeritus professor at the Norwegian University of Life Sciences has also agreed to continue to serve the Lake Centre in his new roll as Senior Research Fellow in Ecotoxicology.


- The Up North on Climate Team led by Dr. David Pearson launched the climate change website, UpNorthOnClimate.ca in April 2018.

- Dr. Ashley Scott was the recipient of the 30 in 30 Best Paper Award from the Journal of Research, Conservation and Recycling. This journal recognized the 30 best papers (one/year) published over their first 30 years. The winning paper was: Iver RS and JA Scott. 2001. Power station fly-ash – A review of value-added utilization outside of the construction industry.

- Dr. Heidi Swanson won the Early Researcher Award from the Ministry of Research and Innovation and Science (2018-2022) at Waterloo!
• Dr. Nathan Basiliko had his Tier 2 Canada Research Chair in Environmental Microbiology renewed for a second term (2018-2023) and he was also elected President of the Canadian Society of Soil Science for the term beginning in 2020.

• Dr. John Gunn was appointed as lead for Environmental Strategic Planning (Outcome 18, Environmental Goals), by the VP Research for the period 2018-2023. He also accepted an invitation from the Dean to renew the Directorship of the Lake Centre/CFEU for a further three year term.

• Varun Gupta, PhD Candidate and Co-supervisor Dr. Nadia Mykytczuk won the Innovation Challenge at Research Week for their project on constructed floating wetlands for remediation of acid mine drainage. The Innovation Challenge Prize came with a $2000 Bursary for Varun from Laurentian, a $1000 bursary from Science North and a $5000 grant from Laurentian to support the research project.

• NRCan joined the Cooperative Freshwater Ecology Unit officially by signing a MOU with Laurentian University in 2018. Dr. Erik Emilson from the Canadian Forest Service in Sault Ste. Marie, ON., will represent our new federal partner in the CFEU.

• The Mining and Environment International Conference established 6 student awards including the Dr. Peter Beckett Doctoral Bursary and the Dr. Graeme Spiers Undergraduate Bursary on March 13, 2018.

• Dr. Nadia Mykytczuk, NOHFC Research Chair in Bioremediation, Biomining and Science Communication was promoted to the level of Associate Professor.

• The Rainbow Routes Association unveiled a sculpture of a river otter named “Peter” in honour of Dr. Peter Beckett on July 4, 2018. “Peter’ can be found on the New Sudbury Historical Trail.
Student Scholarships, Fellowships, Bursaries

- Tara Boag, MSc Candidate Waterloo (Swanson), received a Northern Scientific Training Program grant.

- Vanessa Bourne, MSc Candidate Laurentian (Gunn/Bailey), received a travel grant from NSERC CNAES to attend ASLO 2018

- Kelly Chan-Yam, PhD Candidate Laurentian (Basiliko), won the Mining and the Environment Dr. Peter Beckett Doctoral Bursary, the Goodman School of Mines Scholarship, and a Queen Elizabeth II scholarship

- Jordan Courchesne, MSc Candidate Laurentian (Edwards/Gunn), received the Fisheries and Oceans Canada Habitat and Restoration Scholarship

- Jade Dawson, BSc Honours University of Guelph (Edwards/Gunn/McCann), Dean’s Honours List Scholarship

- Rachel DeJong, MSc Candidate University of Waterloo (Swanson), received a travel grant from NSERC CNAES to attend ASLO 2018

- Michelle Dart, MSc Candidate Laurentian University (Basiliko), received an OGS Scholarship $15,000 (2017-2018)

- Erika Freeman, PhD Candidate University of Cambridge (Tanentzap/Emilson), was the recipient of a Gates Cambridge Trust Scholarship. Erika will be looking at how different forestry management practices influence the quality of dissolved organic matter exported from catchments into receiving waters and will be working in the Turkey Lakes area with the Canadian Forest Service.

- Danielle Greco, MSc Candidate Queen’s (Arnott), received a Craigie Fellowship for Aquatic Research.

- Adam Kirkwood, MSc Candidate Laurentian (Roy-Léveillé/Basiliko) won the following scholarships in 2018:
  ~ NSECR CGS-M
  ~ WCS Canada Fellowship
  ~ OGS Masters
  ~ Dean’s Entrance Scholarship, Laurentian University
  ~ Goodman School of Mines Masters Scholarship
  ~ Northern Scientific Training Program grant (Undergraduate and Masters)

- Adrian Kuchtaruk, Queen’s University (Basiliko) received a NSERC USRA in 2018.
• Alexandra Methe, MSc Candidate Laurentian (Mykytczuk/Merritt), won a NSERC OGS Scholarship as well as the Mining and Environment Dr. Douglas Goldsack Graduate Scholarship.

• Katie Mitchell, MSc Candidate Laurentian (Mykytczuk), won the Tom Peters Student Award from the Canadian Land Reclamation Association and the Mining and Environment Dr. Douglas Graduate Scholarship.

• Shrisha Mohit, MSc Candidate Queen’s (Arnott), received a Craigie Fellowship for Aquatic Research.

• Jamie Montgomery, MSc Candidate Laurentian (Johnston/Gunn), was the recipient of the R.W. Drysdale memorial Scholarship in Aquatic Science.

• Robyn Rumney, MSc Candidate Laurentian (Gunn/Basiliko), received the Fisheries and Oceans Canada Habitat and Restoration Bursary worth $5000 and two EcoLac NSERC CREATE scholarships.

• Rosie Smith, MSc Candidate Waterloo (Swanson), received a NSERC CGS and a Northern Scientific Training Program grant.

• Yinyu Sun, PhD Candidate Queen’s (Arnott), received a Craigie Fellowship for Aquatic Research.

Community Outreach

• Dr. Shelley Arnott gave the following public lectures in 2018:
  ~ Queen’s University Residence High Table, ‘Climate Change: What to expect and what can we do about it?’
  ~ Queen’s University Conservation Society, ‘Salting our lakes: Are we doing enough to protect them?’
  ~ Frontenac Secondary School, Gr. 11 Science class, ‘Evolution and adaptation: Living in a world of environmental change’

• Dr. Nathan Basiliko serves on the Regreening Advisory Committee (VETAC) for the City of Greater Sudbury, he is part of Circles Canada (Sudbury) and is a member of the Board of Directors for the Laurentian Child and Family Centre.

• Dr. Peter Beckett is the Outreach Coordinator with the VLWLC. He served in the following Capacities in 2018:
  ~ VETAC: Chair
  ~ Canadian Land Reclamation Association (Ontario Chapter): Director
~ American Society of Mining and Reclamation: Chief Student Presentations Judge
~ Junction Creek Stewardship Committee: Technical Advisor
~ Rainbow Routes: Environmental Advisor and Board Member
~ Sudbury Naturalists: Co-chair
~ Friends of Mashkinonje Park: President
~ Dr. Beckett was also featured in:
   ▪ ‘One on One with Markus – Peter Beckett’, CBC Radio Morning North with Markus Schwabe, 2 Oct 2018
   ▪ ‘Still got lots to do’ in Sudbury’s regreening program, ecologist says, CBC News, 7 May 2018

• Vanessa Bourne co-facilitated the following activities:
  ~ A workshop with Keith Somers entitled ‘RCA statistical methods development and assessment in R’ at the Living with Lakes Centre, March 2018.
  ~ Canadian Aquatic Biomonitoring Network (CABIN) field training course, at the Living with Lakes Centre, May 2018.

• Dr. Brie Edwards was an invited participant at Environment Canada’s CCAP Inland Lake Monitoring Network planning workshop and gave a presentation entitled ‘Regional inland lake monitoring in northern Ontario: Sudbury and the Ring of Fire’ in December 2018.

• Dr. John Gunn participated in the following public outreach initiatives in 2018:
  ~ Served as an expert member for the City of Greater Sudbury Watershed Advisory Panel
  ~ Gave a lecture entitled ‘Science at the Lake Centre’ to the Rainbow District Secondary School Teachers (17 May)
  ~ Made public presentation on ‘Science in the Park’ at Killarney Provincial Park (25 June)
  ~ Made public presentation on ‘Recovery, reforestation and carbon Capture in Sudbury’ to Manitoulin Streams (Sept.)
  ~ Served as a Panel member on Salt and Ramsey Lake 5 Feb 2018
  ~ Hosted First Nations students enrolled in an Environmental Certification Program at Yukon College as part of an environmental monitoring course (Oct)
  ~ Featured in article ‘Road salt is damaging Ramsey Lake and we aren’t doing enough about it: panel’, A. McDougall, Northern Life, 6 Feb 2018
  ~ Featured in article ‘Sudbury’s ‘challenging time bomb”’, J. Moodie, The Sudbury Star, 6 Feb 2018
  ~ Featured in radio interview and article ‘Sudbury scientist says Canada can’t afford to take water for granted’, Morning North, CBC Radio 20 Mar 2018
  ~ Featured in ‘Salt a worry in Lake Ramsey, new report warns’, J. Moodie, The Sudbury Star, 15 Nov 2018
  ~ Guest columnist for The Sudbury Star, ‘Ramsey Lake facing premature demise’ 25 Nov 2018
  ~ Contributed ‘Who cleans up? Where climate change, industrial waste and college dorms combine’, The Soapbox Column, Northern Life, 22 Dec 2018
Guest columnist for The Sudbury Star, ‘Sudbury needs to prepare for floods’, The Sudbury Star, 28 Dec 2018

Adam Kirkwood, MSc Candidate at Laurentian, participated (along with researchers from OMNRF) in a 4 day outreach event on Aug. 15-18 organized by Mushkegowuk Environmental Steward from Peawanuck, Sam Hunter. The researchers camped at Hawley Lake with approximately 30 community members, including youth and elders, and conducted demonstrations and workshops related to their research activities.

Dr. Nadia Mykytczuk participated in the following outreach initiatives in 2018:
- Designed and executed a full day field and lab exercise entitled ‘Biomining Exercise’, for high school students (24) for High Skills Majors Day at Science North (31 May)
- Provided expert advice and consultation through design, prototype and testing for Science North/Dynamic Earth Biomining Exhibit (Jan-Mar)
- Featured in ‘Winter workers: How cold-adapted bacteria can benefit miners’, C. Pollon, CIM Magazine 13(9), August 2018

Dr. David Pearson participated in the following public outreach initiatives in 2018:
- Presented at Chapleau Cree community meeting regarding climate change impacts
- Presented at Missanabie Cree community meeting regarding climate change impacts
- Engaged school-aged children at Poplar Hill School raising awareness of climate change
- Engaged youth at a Grand Treaty 3 Youth summit, raising awareness of climate change
- Presented to Ontario Power Generation conference on climate change issues in the north, 3 April
- Was interviewed by CBC Sudbury and argued that a Federal Carbon tax was a good first step in combating climate change, 24 Oct https://www.cbc.ca/news/canada/sudbury/sudbury-environmentalists-federal-carbon-tax-1.4875446
- Co-hosted and presented climate change issues at a meeting of Northern Chiefs Tribal Council and communities in Thunder Bay, 27-28 Nov
- Attended a presentation for Federal Government employees and politicians on water treatment on First Nation reserves, Parliament Hill, Ottawa, 29 Nov
- Co-hosted and presented climate change issues at a Mattawa Tribal Council and communities meeting in Thunder Bay, 11-12 Dec
- Community visits – Fort Severn (May, Aug), Ginoogaming, Long Lac 58 (Jan), Poplar Hill (Feb). Tribal Council mtgs. Thunder Bay, Kenora, Sioux Lookout.

Dr. Charles Ramcharan participated in the following outreach initiatives in 2018:
- Served as a member of the City of Greater Sudbury Watershed Advisory Panel
Served as a member of the Ramsey Lake Stewardship Committee
Served as a voting member of the Greater Sudbury Food Policy Council.
Served as a member of the Greater Sudbury Community Garden Network
Served as a member of the Greater Sudbury Foodshed Network
He also made presentations to both the Simon Lake Stewardship Association and the Lake Panache Stewardship Association

• Brittany Rantala-Sykes co-led a hands-on workshop entitled ‘Ecosystem Restoration in the Schoolyard’ at Mushkegowuk Council’s teacher conference, the Great Moon Gathering.

• Bjorn Rosseland gave 14 seminars and public lectures in 2018 on varying topics ranging from the history of the Norwegian salmon and sea trout rivers, acid rain, water quality, multiple stressors and metals.

• Chantal Sarrazin-Delay
  ~ Engaged a group of youth from the Colombian National Training Service (Servicio Nacional de Aprendizaje, SENA) in benthic macroinvertebrate biomonitoring. They applied what they learned while sampling Junction Creek.
  ~ Led a day-long, outdoor, hands-on aquatic ecology workshop during Camp Chikepak, a week-long summer camp for children 9-14 from Mushkegowuk Council communities.
  ~ Trained Mushkegowuk’s Environmental Stewards in benthic invertebrate sampling through 2 in-person sessions and online module support which culminated in CABIN (Canadian Benthic Biomonitoring Network) certification; benthic invertebrate sampling kits were donated to Mushkegowuk to allow Stewards to apply their new knowledge.
  ~ Facilitated workshops for instruction on community-run weather stations to a number of northern communities to encourage community-based climate change networking. Not all far north communities have Environment Canada weather stations and instead get regional weather. These community-run stations allow members to monitor their local weather on the smart phones or computers.

• Dr. Graeme Spiers served as a member of VETAC and gave numerous talks and tours to students, international visitors and the general public in 2018.

• Dr. Heidi Swanson participated in the following outreach activities in 2018:
  ~ Worked with 3 First Nation community monitors in ‘on-the-land’ camps in the summer (> 14 days) in the Dehcho Region, NT
  ~ Worked with 8 Inuit assistants on a fish tracking project near Kugluktuk, NU
  ~ Made presentations on results at four communities in NT in November/December

• Dr. Shaun Watmough served as a judge at the Peterborough Science Fair in May 2018 and as an Elected Board Member for the Canadian Colleges and University Environmental Network (CCUEN)
Dr. Norm Yan gave the following lectures to the general public:

~ ‘Changing ion balance in our lakes: responding to the threats of road salt and calcium decline’ invited presentation to the Haliburton Ecocafe, Haliburton, ON. 13 Nov 2018.
~ ‘Wood ash and nutrient studies’, invited talk at the Algonquin Maple Syrup Producers fall workshop and picnic, Huntsville, ON. 29 Sept 2018.
~ ‘What plants know’, invited presentation to the Knox Church Discussion Group, Bracebridge, ON. 5 May 2018.
~ ‘Using wood ash to solve Muskoka’s calcium decline problem’, invited presentation to the Bracebridge Lion’s Club. 26 Apr 2018.
~ ‘Environmental good news stories’, presentation in the Food for Thought Series, Friends of the Muskoka Watershed, Main Street Deli, Bracebridge, ON. 15 Feb 2018.
~ ‘Are plants conscious’, presentation in the Food for Thought Series, Friends of the Muskoka Watershed Main Street Deli, Bracebridge, ON. 1 Feb 2018.
~ ‘Are plants conscious’, presentation in the Food for Thought Series, Friends of the Muskoka Watershed, Main Street Deli, Bracebridge, ON. 18 Jan 2018.
2018 Watershed Lecture with Dr. Jake Vander Zanden

Dr. Jake Vander Zanden from the University of Wisconsin gave the annual Watershed Lecture on Friday, September 14, 2018 entitled: Everywhere, or hardly there? New perspectives in invasive species in inland lakes.

Dr. Vander Zanden is the Director of the Center for Limnology, University of Wisconsin – Madison. He did his undergraduate and PhD at McGill University in Montreal, where his research focused on using stable isotopes to quantify and compare boreal lake food webs. He held a Smith Postdoctoral Fellowship at University of California-Davis. His basic research has focused on developing a more holistic understanding of lake food webs that includes benthic pathways and linkages among habitats and ecosystems. On the applied side, his research includes efforts to understand and predict the spread and impact of aquatic invasive species in inland waters. While his current research focuses on Wisconsin lakes, he has worked on aquatic ecosystems around the world. Jake has trained over 35 graduate students and postdocs, authored over 130 peer-review publications, and has won numerous awards.

While here, Dr. Vander Zanden, Dr. Norm Yan and Dr. Bjorn Rosseland hosted the 2018 Watershed Symposium with our graduate students.

Dr. Vander Zanden’s lecture, along with previous Watershed Lectures, can be found on our website at: https://www3.laurentian.ca/livingwithlakes/research/instructional-videos/
NSERC OCE Program L-CARE 2017-2020

Landscape Carbon Accumulation through Reduction in Emissions

L-CARE is a $2.0M project funded by NSERC and OCE through the Target GHG Program in partnership with Vale Canada Ltd., Glencore’s Sudbury Integrated Nickel Operations and the City of Greater Sudbury. The objective is to qualify how massive sulphur and metal emissions reductions in Ontario’s largest mining and smelting centre, coupled with novel ecosystem reclamation practices, can lead to long-term C sequestration and influence the underlying processed of primary production, mineralization of C and energy transfer through ecosystems and interrelated GHG fluxes.

L-CARE was officially launched during research week at Laurentian University on March 26, 2018.

The project is led by Nathan Basiliko and John Gunn with Co-PI’s at:
Trent: S. Watmough
Sherbrooke: J-P Bellenger
UQAM: P. del Giorgio and Y. Prairie
Cambridge: A. Tanentzap
Queen’s: J. Smol, A. Paterson (MECP)
McMaster: M. Waddington

Collaborators are located at Canadian Forest Service, NRCan (E. Emilson, T. Jones), Cornell University (J. Yavitt) the Northern Ontario School of Medicine (G. Ross), Collège Boréal (M. Hubert) and the City of Greater Sudbury (S. Monet, T. McCaffrey).

The 5 Themes of L-CARE are:
I  New C sequestration trial in uplands and tailings
II  C and GHG dynamics in existing reclaimed upland
III  C and GHG dynamics in peatland
IV  Aquatic C stocks, GHG dynamics and aquatic food web processes
V  Scaling-Up, Integrative and Future Projections
The first L-CARE planning meeting was held February 22, 2018.

Sudbury Environmental Study (SES) Lakes
In 2018, the Ministry of the Environment, Conservation and Parks (MECP) at the Cooperative Freshwater Ecology Unit (CFEU) continued sampling lakes for the Sudbury Environmental Study (SES) under 2 main programmes which complement each other: SES Intensive and SES Extensive. The SES Intensive programme is a set of lakes sampled monthly or twice-monthly through the ice-free season for a wide range of physical, biological and chemical parameters (water chemistry, Secchi disc water clarity, temperature/oxygen profiles, zooplankton, and phytoplankton), which provide a greater variety and intensity of data on a smaller group of lakes. In 2018 there were 10 lakes sampled monthly (May - October) and 1 lake sampled twice-monthly (Swan lake) under the SES Intensive programme.

The SES Extensive programme includes a set of 44 lakes, located within a 100 km zone around Sudbury. These lakes were all acidified to below pH 5.5 in the early 80s, but are now in various stages of recovery. These lakes are sampled once annually during the period from late June through July. The data are intended to provide information on regional patterns in water quality and lake recovery in the lakes near Sudbury. Associated with the Extensive lakes are a set of 24 reference lakes, all of which were non-acidic during the original lake surveys in the 1980s. These lakes are visited cyclically in the same mid-summer window, for three consecutive years per cycle with approximately 10 years between cycles (1981-1983; 2003-2005 and 2016-2018). During 2018, all 44 Extensive lakes and 24 Reference lakes were sampled once for standard water chemistry parameters.

In addition to the standard SES sampling, in 2018 MECP partnered with CFEU colleagues and researchers from numerous academic and government institutions under the L-CARE umbrella, to conduct a major extended mid-summer sampling campaign. A total of 82 lakes in the Sudbury region, including the entire SES suite and additional study lakes, as well as the Dorset ‘A’ Lakes and the Turkey Lakes, were sampled for water chemistry, biological indicators (zooplankton, phytoplankton, chlorophyll), physico-limnological characteristics (temperature/oxygen profiles,
clarity, etc.), paleo-limnological reconstruction (top-bottom sediment cores) and gas flux dynamics. A number of more detailed sediment cores and spring/fall gas flux samples were also collected for selected lakes.

Between 2013 and 2016, SES sampling methodologies were extended to include 24 far north lake monitoring sites, most of them multi-year, as part of MECP’s Ring of Fire Baseline Environmental Data Collection Programme. In 2018, 12 previously sampled lake sites were revisited to provide new information about inter-annual variability in far north lake environments and zooplankton communities. Efforts were also directed at analyzing data collected up to 2016 for upcoming release in a MECP Ring of Fire Baseline Monitoring report. This draft report includes contributions from all MECP groups involved with research and monitoring in this area (groundwater, streams, air, terrestrial). More detailed analyses will follow the release of the report, with plans for future publications.

The zooplankton taxonomy lab continued to process samples collected for the MECP’s lake monitoring programmes, including the regular SES, the L-CARE campaign, and the Ring of Fire. Samples were also processed for various partners and collaborators to assess recovery trends over time as well as aquatic responses to a variety of emerging environmental stressors. These groups included the Severn Sound Environmental Association, Ministry of Environment, Conservation and Parks, Ministry of Natural Resources and Forestry, and the Climate Change and Multiple Stressor Research Programme. Samples from Lake Simcoe were processed for MECP specifically for spiny water flea screening as has been done in the past. Samples from Lake Nipissing were processed for MNRF to assess seasonal changes in zooplankton, particularly the spiny water flea, and possible implications on food web dynamics. Samples from Georgian Bay near Parry Sound were processed for MNRF to allow them to ground truth new hydro acoustic survey techniques. In total 259 zooplankton samples were processed in 2018.

Database management during 2018 was led by database managers Colleen Bobbie, and Rachel DeJong. Highlights of this effort include a massive QAQC process to ensure data quality across the existing database for lakes sampled as part of the SES Extensive, SES Intensive, and Reference programmes; metadata were also assembled for historical water chemistry data for all lakes as part of these programmes. In addition, 31 data requests were addressed from partners and collaborators, including several large requests as part of the L-CARE research network. Support for other projects, including graduate student projects was also provided (data, expertise and logistics).

These monitoring programmes continue to be a critical component of Canadian and international efforts to assess the effects of acid deposition and the responses of lakes to sulphur emission controls, as well as numerous emerging concerns for Boreal Shield waters. Results from these sampling programmes have been presented and interpreted by CFEU partners and numerous collaborators. Publication highlights included Josef MacLeod et al.’s assessments of lake chemistry (2017) and zooplankton community (2018) patterns across the physiographic regions of Ontario’s far north, and Bill Keller et al.’s (2018) comprehensive review and interpretation of Extensive lake trends as they relate to ongoing recovery and concurrent changes in the region.
Zooplankton data from SES lakes was also featured in two publications (2017, 2018) by Lamothe, Jackson and Somers elucidating long-term biological community trajectories and implications for resistance and resilience. These products underscore the value of continuing the CFEU lake monitoring programmes.

**Climate Change and Multiple Stressor Aquatic Research Programme**

The Climate Change and Multiple Stressor Aquatic Research Programme at Laurentian University ended in December 2018. It was initiated in 2009 through the support of the Ontario Ministry of Environment and Climate Change (now the Ontario Ministry of Environment, Conservation and Parks). The overall objective was “To promote, facilitate and conduct aquatic research in the far north of Ontario in order to advance the scientific knowledge of the effects of multiple stressors on northern aquatic ecosystems”. This objective was addressed through two major elements, including:

1) Conducting collaborative, multidisciplinary studies of aquatic ecosystems in the far north of Ontario, creating northern aquatic datasets, and publishing study findings

2) Collaborating with a large network of scientists on analyzing and publishing results from ongoing studies in northeastern Ontario and internationally with importance to aquatic ecosystems in the near and far north.

Given the complexity of aquatic ecosystems in northern Ontario and the variety of stressors affecting them, our overall approach was to engage scientists at many Ontario universities and resource management agencies, and international scientists, in collaborative studies. Sharing resources provided a very efficient, cost-effective way to conduct northern science, and collaborations developed the multidisciplinary approach necessary to address complex northern environmental issues. Since the far north of Ontario is primarily the home of First Nation communities, we involved a number of First Nations (especially Wasaho, Weenusk, and Eabametoong First Nations) in the planning and execution of our studies in their traditional lands. The far north work could not have been completed without the enthusiastic help of local First Nation peoples.

Various collaborative surveys were completed on lakes and rivers in the far north (see map below) a very remote area of Ontario with little previous study of aquatic ecosystems. Many papers on our study findings were published in scientific journals; some of them and many others from colleagues working in northern areas of Manitoba, Ontario, and Quebec were included in a Special Issue of the journal Arctic, Antarctic, and Alpine Research on *Environmental Change in the Hudson and James Bay Region, Canada. Volume 46 (2014)* produced through our programme. It is anticipated that publications will continue to appear in future from the many collaborations and datasets developed as part of the programme. Four progress reports ([www.livingwithlakes.ca](http://www.livingwithlakes.ca)) were completed to keep stakeholders, including Government and First Nations, informed and updated on our studies and to make data available. A number of graduate student projects were also supported.
While the far north was the programme focus, we continued to participate in lake studies in the near north of Ontario. In particular, findings from Sudbury area lakes in northeastern Ontario are continuing to advance the understanding of chemical and biological recovery processes after atmospheric sulphur emission reductions. However, it has become apparent that the recovery of lakes from acidification is closely linked with the responses to, and interactions with, other large-scale environmental stressors like climate change, water browning and calcium declines. Developing a better understanding of the responses of northern lakes to multiple stressors and the future outcomes within such a multiple stressor context is difficult. It demands the merging of various approaches including monitoring, experimentation, paleolimnology and modelling, and requires effective collaboration between different research and monitoring sites and various agencies and institutions engaged in environmental science. Through the Climate Change and Multiple Stressor Aquatic Research Programme we have addressed these needs through developing extensive collaborations examining various aspects of lake responses to the interactions of multiple anthropogenic stressors.

Overall, the Climate Change and Multiple Stressor Research Programme has established a new far north database for over 200 lakes and 26 rivers and streams in Ontario, some sampled multiple times. Elements of the database include water chemistry, thermal structure, plankton, and benthic invertebrates. Our collaborations have resulted in 42 published journal papers to date, and we assisted with 14 graduate student projects.
**Northern Fisheries Research Program**

This program improves our understanding and aids the management of the fish populations that support the recreational, commercial and subsistence fisheries of northern Ontario. The program is led by Tom Johnston (MNRF) and has included a variety of projects examining the biology, ecology, and ecotoxicology of northern fish populations. Work on this program in 2018 was primarily directed at two fields of research:

i) **Food web structure and contaminant bioaccumulation in northern fish populations.** This work was supported in 2018 by MNRF Far North Branch, MNRF Biodiversity and Monitoring Section, MNRF Aquatic Research and Monitoring Section, MECP Environmental Monitoring and Reporting Branch, NSERC Discovery Grants Program, and Wildlife Conservation Society Canada. The geographic focus of this work is split between the Near North and Far North of Ontario. Fish sampling in 2018 was carried out on Arctic drainage lakes in both regions to extend the research on food quality of fish initiated in the Heerschap MSc project.

ii) **Reproductive ecology of northern fishes.** This research was funded in 2018 by the MNRF Aquatic Research and Monitoring Section, and MNRF Policy Division. Experimental work on a Lake Nipissing walleye spawning stock continued in 2018 to assess the interactive effects of parental traits and spring warming rates on walleye spawning success, and a MSc student joined the project. A parallel project with a similar experimental design, but using Lake Huron lake whitefish, was launched in Nov 2018 as part of a BSc Honour’s thesis project.

**Freshwater Invertebrate Research Network of Northern Ontario (FIRNNO)**

Biological indicators such as benthic macroinvertebrates (BMI) are useful in gauging the degree of impact due to human activities. The Reference Condition Approach (RCA) to bioassessment is implemented when traditional before-after/ upstream-downstream designs are not feasible, and is based on the premise that when a site is to be assessed, its BMI community is compared to that of many minimally impacted reference sites with similar habitat characteristics. Effective implementation of the RCA design requires a large network of reference sites encompassing many habitat types from which to best match a site of interest. Such a network is currently maintained by CFEU.

The Freshwater Invertebrate Research Network of Northern Ontario (FIRNNO) was designed to assist the metal mining industry in locating suitable reference sites to meet the Environmental Effects Monitoring (EEM) requirements of the Fisheries Act. Ongoing objectives of FIRNNO include the maintenance of an accessible database of BMI abundance and chemical/physical habitat characteristics for Northern Ontario lakes and streams and use of these resources to assess and monitor anthropogenic effects on surface waters by detecting any change in BMI community structure. The FIRNNO data and associated Near and Far North assessment tools are managed through the Canadian Aquatic Biomonitoring Network (CABIN) online database.
Since FIRNNO’s establishment in 2003, BMI data for over 400 sites have been collected in the vicinity of 4 mining centers including Red Lake, Hemlo, Sudbury and Timmins along with accompanying water chemistry as well as site, channel and watershed level habitat data. Between 2013 and 2016, FIRNNO sampling was extended to include more than 200 additional sites as part of MOECC’s Ring of Fire Baseline Environmental Data Collection Programme. Crews from the Co-op Unit and Marten Falls First Nation added both new and temporal repeat samples across the Attawapiskat River Basin and Upper Albany River Basin, distributed across both the Hudson Bay Lowlands and Boreal Ecozones. These data provide information on the unique freshwater environments that extraction activities, infrastructure and potential transportation corridors are expected to pass through.

In 2018, 21 previously sampled stream sites were revisited to provide new information about inter-annual variability in far north stream environments and BMI communities. In addition to CABIN sampling, stream fish communities were sampled in collaboration with the Ministry of Natural Resources and Forestry. Efforts were also directed at analyzing data collected up to 2016 for upcoming release in a MECP Ring of Fire Baseline Monitoring report. This draft report includes contributions from all MECP groups involved with research and monitoring in this area (groundwater, streams, air, terrestrial). More detailed analyses will follow the release of the report, with plans for future publications.

FIRNNO scientists are working to enhance collaboration and integration with the broader Ontario Benthic Biomonitoring Network (OBBN) of MECP. Brie Edwards has recently joined the OBBN Science Advisory Panel and is working with Chris Jones to advance OBBN research initiatives and to make FIRNNO holdings available through the OBBN database. Using fall 2017 side-by-side CABIN and OBBN surveys of Sudbury area long-term impact and reference streams, which were processed and identified over the course of 2018, Jocelyne Heneberry is leading a methodological comparison study to elucidate any biases and inform data integration approaches. Data for the reference sites is also being used in collaboration with MNRF colleagues Tom Johnston and Lee Haslam to investigate multi-trophic biological recovery in local streams. BMI data will also eventually be incorporated into an updated Near North RCA Model.
Mine of Knowledge Program: Finding Microbial Solutions to Ecosystems Problems

The Mine of Knowledge program is a 5-year $1.65 NSERC funded CREATE program designed to train students in multi-disciplinary research to provide the mining industry with highly qualified personnel in environmental management and restoration of ecosystem services at mining locations around the world. Laurentian University joins with the University of Montréal, INRS, McMaster, and Ottawa universities in this bilingual Quebec/Ontario program. Bacterial metabolism represents the root cause of deleterious mine drainage, but is also a significant untapped opportunity to enhance mine sustainability through strategic characterization of its roles in these ecosystems. In addition to providing students with hands-on experience, the SMART-MINE initiative will provide them with training in analytical and environmental chemistry, mine waste mineralogy, biogeochemistry, ecotoxicology, environmental genomics and molecular microbiology using state-of-the-art instrumentation and modeling approaches. Graduate projects will range from fundamental laboratory-based projects on membrane protein transport to large-scale field studies on the bioremediation of mine drainage. This bilingual Quebec/Ontario training program will form a new generation of environmental scientists who understand the needs of mining industries and are prepared to propose innovative solutions to improve the environmental sustainability of this key Canadian economic sector. With the increasing overlap associated with expansion of mining activities into the Canadian north between Canadian mining activities and First Nations communities, this program will emphasize First Nations representation and involvement.
**Indigenous Student Workshops - 60° of Separation**

In October 2018 we hosted two indigenous youth training workshops in relation to environmental assessment studies. The unique aspect of the workshops were the climate differences among the participants. The first group were Indigenous students enrolled in the Environmental Certification Program at Yukon College (>60°N) and the second, a group of Indigenous women from Columbia (~3°N) who were here at the same time taking a short course entitled ‘Introducció al Monitoreo Ambiental’, with Dr. Daniel Campbell.

This provided a unique opportunity for these two groups to work on a variety of our training modules including invertebrate sampling and identification at the same time. Two groups, from regions 60 degrees apart, united in their learning at the Lake Centre. In the pictures below, the Columbian students are the ones in the toques!

![Image of participants in training](image)

**Science Communication at the Vale Living with Lakes Centre**

[www.sciencecommunication.ca](http://www.sciencecommunication.ca)

*Master’s and Graduate Diploma in Science Communication (MSCom, G.Dip)*

The Science Communication Program had an exciting year, as we were honoured to receive the 2018 William Edmond Logan Award from the Royal Canadian Institute for Science. This award celebrates outstanding contributions to the public understanding of science by a Canadian organization, and has been awarded in previous years to IBM Canada, Sanofi Pasteur Canada, and Celestica. The Logan Award is the companion to the Sanford Fleming Medal and Citation, which was awarded this year to Dr. John Smol. According to Dr. Reinhart Reithmeier, Chair of the Royal Canadian Institute for Science, “These graduates are taking science communication in this country to new heights, helping Canadians of all ages recognize, understand and appreciate science in the world around them. We believe that this is key to fostering a strong science culture in Canada.”
Dr. David Pearson and Dr. Chantal Barriault accepted the 2018 William Edmond Logan Award at an event at the Fort York National Historic Site on February 5, 2019.

This year our program celebrated the graduation of 13 full time and 3 part time students. As word continues to spread about our new Master’s degree that we offer alongside the Graduate Diploma stream, the number of interested applicants is on the rise. We received over 40 applications for 15 full time positions in our 2018-2019 cohort. Fall 2018 welcomed 14 full time and 6 part time students seeking to obtain a Master’s degree, upgrade their existing Graduate Diploma, or extend their credentials through our program’s articulation agreement with Sir Sanford Fleming College’s Environmental Visualization and Communication graduate program.

In March 2018, alumnus and sessional lecturer Michelle Reid joined the program as the Technical Advisor, where she assists with coordinating student applications, internship placements, guest speakers and workshops, major research projects, multimedia production, and experiential learning opportunities.

The new Master’s program continues to solidify our profile as experts in the field in this country. Internal and external requests for professional development training in science communication have become commonplace as university and government scientists seek guidance on effectively communicating with stakeholders and the public. In 2018, Dr. Chantal Barriault and Michelle Reid facilitated full day science communication workshops with SNOLAB, the MECP Environmental Monitoring and Reporting Branch, and for undergraduate and graduate biology students at Laurentian. Together with the science communication students, Chantal and Michelle judged over 50 presentations as part of the Laurentian Research Week Graduate Symposium.

In 2018, Dr. Chantal Barriault was an invited panelist for the Canada Science Policy Conference where she discussed innovative approaches for training the next generation of communicators. She was an invited speaker for two symposia as part of her involvement with the NSERC ReNewZoo program, led a workshop for L’Association francophone pour le savoir, and facilitated a number of professional development sessions for science communication research and best practices at Science North.
The Science Communication Graduate students continue to benefit from belonging to the Lake Centre. Collaborations between the Science Communication program and Vale Living with Lakes researchers are growing as this research becomes the focus of student projects and assignments. Students produced 14 infographics detailing different aspects of Sudbury’s environmental history, building off of the online course “Environmental Remediation: Global Lessons from the Sudbury Story.” The production of high quality research profile videos continues to provide Lake Centre researchers with effective communication products that showcase their work for various audiences, through social and traditional media. In 2018, students created videos for the L-CARE project featuring Dr. Nathan Basiliko and Dr. John Gunn, and created videos and project cards for the Elements of Biomining project alongside Dr. Nadia Mykytczuk. We also continued the tradition of having the science communication students join forces with their peers in the Biology Graduate Seminar course to create compelling presentations and videos for the biology students’ research projects. This partnership led to the BioScom “Ted Talks” being a highlight of Laurentian Research Week, and a number of excellent videos that were shared at the annual Eagle Awards Gala.

Finally, we are pleased to be able to continue to offer bursaries to our students from the interest on a dedicated endowment fund totaling $560,000. The largest contributors have been the F. Jean MacLeod Trust and the TD Financial Group, as well as the Grace Rumball Bursary.

**Climate Change Impact and Adaptation Study for the North**

During 2017 our small “Up North on Climate” team finalized most of the agreements required for the “Climate Change Impact and Adaptation Study for the North”. We have collaborated with First Nations across the north of the province, supported by Ontario’s Green Investment Fund through the Ministry of Indigenous Relations and Reconciliation (MIRR), documenting the impacts of changing climate through the traditional knowledge of Elders and community members. We are splicing traditional knowledge with projections of climate change to 2050 and beyond, based on modelling. The purpose of the work is to provide reports to First Nations with information to help them adapt and prepare for the future as climate change impacts in the north become more deeply felt and some risks become more threatening. The reports are confidential to each community.

Our work in the north since April 2016 has been part of a larger agreement between the province and the Ontario Centre for Climate Impacts and Adaptation Resources (OCCIAR) at Laurentian. We have collaborated with communities through formal agreements with five northern Tribal Councils: Matawa, Keewaytinook Okimakanak, Nokiwin, Mushkegowuk, and Grand Council Treaty 3, as well as with several independent First Nations. The larger agreement was designed to build capacity and develop understanding of climate change in First Nations across Ontario; to reduce greenhouse gas emissions through energy planning and renewable energy generation; as well as to engage First Nations in discussion of economic opportunities through Ontario’s former cap and trade program. OCCIAR partnered with the Ontario First Nations Technical Services Corporation to deliver the energy related and emission reduction objectives of the mandate.
The process we developed in 2016 for our work in the north involves recruiting, training and paying a Climate Change (CC) Specialist in a community (also called an Environmental Steward, CC Monitor or CC Coordinator in some communities) and a Climate Change Leader in each participating Tribal Council. Each CC Specialist is responsible for interviewing about ten Elders and harvesters in their community using a standard list of questions. These recorded observations and knowledge of changes on the land and in weather patterns, are used as indicators of important impacts to assist in determining the climate change vulnerabilities of their communities and community members.

We developed a “Community-based Climate Change Impact, Risk and Adaptation Planning Matrix” for integrating traditional knowledge and conventional science, leading from recognition of vulnerabilities to consideration of adaptation priorities and plans in communities. As the work is being finalized, the CC specialists and the CC leaders collaborate with team members from Laurentian to summarize Traditional Ecological Knowledge (TEK) and prepare risk statements and adaptation actions for consideration by community leaders and community members.

Our work in the last year has been with the Matawa, Keewaytinook Okimakanak, Nokiwin, and Mushkegowuk Tribal Councils as well as with several independent First Nations. We began discussion with Grand Council Treaty 3 in 2017 and were pleased to welcome them and their twenty-six communities into the project early in 2018. Their Climate Change Community Liaisons were trained in TEK collection and received orientation to climate change science and adaptation issues. Grand Treaty 3 Environmental Staff were trained in processing TEK resulting in reports for each of the sixteen participating communities. Over fifty First Nations have now been engaged to differing extents with forty-one having collected TEK in the form of audio-recorded interviews of Elders and harvesters. Twenty-five reports have been provided to communities with Grand Council Treaty 3 having prepared sixteen of their own additional reports.

In addition to assembling TEK observations and Environment Canada RCP 8.5 projections of climate change for 2050, much effort went into providing adaptation options. The 100-page adaptation section in each community report covers drought, ecosystem shifts, fire, flooding, food security, human health, infrastructure and transportation. The adaptation section was designed to stand alone to allow for a broader First Nation audience to benefit from this assemblage from previous community projects, online resources and scientific papers.

Special attention continued to be given to river bank erosion in Fort Severn for the Wasaho FN. Hudson Bay Co. archives and aerial photos show that ninety-seven metres have been lost to erosion from the bank along the edge of the current community since 1815. Permafrost probing in and around the community in 2016 and again in 2017 revealed that permafrost still exists in some places in the community. In 2018, in one such area on the site of the former Hudson Bay post close to the river bank, several half-metre deep cracks developed which are being monitored using tensiometers. Chief and Council are aware and Indigenous Services Canada (formerly INAC) has been apprised of the situation.
Three major river bank slumps less than 10 kms upstream of the community that occurred in August of 2009 and 2010, first reported by the Ontario Geological Survey in 2011, were visited in 2018 to confirm that no obvious fresh slumping had occurred. Photographs taken days after the 2009 slump were provided by a community member, dates for the 2009 and 2010 slumps were confirmed, and the occurrence of a fire at the site confirmed. In the light of these slumps and the cracks near the crest of the river bank in the community, we have recommended a “caution zone” of 100 metres from the crest of the bank in the community be implemented as a precaution.

Bird song meters or recorders, on loan from Four Rivers Environmental Services of the Matawa Tribal Council, were used to catalogue songbird species and frog species. Song meters were deployed by Environmental Stewards near Peawanuck, Attawapiskat and Fort Severn in the spring of 2018 for a third year adding to the work done in 2016 in Fort Hope and Fort Severn. Meters were also installed in the traditional lands of Missanabie Cree, Chapleau Cree, Moose Cree and Fort Albany by their respective Environmental Stewards. The intent is to add to the observations of community members about the declining numbers of bird and frog species in the north. Both these special projects will be reported on in the community reports.

We stayed in regular contact with the Mushkegowuk TC Environmental Stewards through regular teleconference meetings every one or two weeks. We also hosted the Stewards at Laurentian in November 2018, offering benthic invertebrate identification certification. We also provided them with weather stations to encourage community-based climate change networking. Parameters measured include temperature, rainfall and wind. Most far north communities do not have an Environment Canada weather station and instead get regional weather. These community-run stations allow members to monitor their local weather on smart phones or computers.

A major opportunity for networking and discussion came through the “Up North on Climate Change Conference” for 160 northern First Nation participants from 53 northern First Nations and Tribal Councils on April 24 -26 in Thunder Bay. The agenda covered all major climate change vulnerabilities felt in the north from wildfires to winter roads, flooding, invasive species, degradation of permafrost and the vulnerability of peatlands, as well as impacts on fish and mammals; the Indigenous Guardians program, and workshops on community-based monitoring, as well as potential funding sources for adaptation projects.

The conference afforded the project the opportunity to launch the climate change resource website, UpNorthOnClimate.ca. Meant to facilitate interaction and knowledge transfer among communities, the currently unilingual (English) website is being translated into Ojibway, Cree, and Oji-Cree with the hope of a quadrilingual website being live by mid-2019. The website showcases locally-developed data visualizations and GIFs on the greenhouse effect, seasonal temperature and precipitation change, fire seasons, drought, all of which work equally well in print or as website content. A climate change glossary has been developed in English and this technical language is currently being developed in Oji-cree, Ojibway and Cree. Graphics and visualizations continue to be developed for climate change concepts and projections. Projection data from models by Dan McKenney at the Canadian Forest Service, NRCan, and Richard Peltier at the University of Toronto are being represented in accessible format.
At the same time as preparing reports, we have visited many communities, engaging with people in understanding the science, trends and impacts of climate change by speaking with Band Councils, at community gatherings, as well as at Tribal Council planning meetings, in schools and at various northern First Nation conferences and symposia. Near the end of 2017, we helped in the Mushkegowuk Tribal Council’s planning and then participated in a second Climate Change Summit in early 2018 following the notable success of the first in late 2016.

We hope and are encouraging that future work in the communities will see the CC Specialists involved in community-based climate change adaptation planning, the details of which are currently under discussion, as well as community-based environmental monitoring. Training and CABIN certification sessions in sampling and identifying aquatic invertebrate species that indicate water quality have been held by Chantal Sarrazin-Delay of our project team, in communities as well as at Laurentian, in preparation for that being one of the important skills for climate change impact monitors.

Engaging youth in understanding climate change was an ongoing part of the project in 2018 when time could be made available. The project team, led by Chantal Sarrazin-Delay, has visited schools for day-long, hands-on outdoor and classroom sessions. We also had the opportunity to spend a full day with Mushkegowuk youth at Camp Chikepak in July 2018 where we ran and aquatic monitoring and climate change workshops.

For school visits, as well as for community open houses, we take wifi microscopes and iPads along with a wide variety of specimens, for students and community members to examine. We also have desktop demonstrations of the greenhouse effect, ocean acidification, ocean water level increases, water stratification and the use of water monitoring equipment; fossils and minerals; tree cookies, animal bones; fish aging structures; lichens, and whatever local material is available at the time.

Conference Organizing, Program Coordination and Editorial Activities

Arnott, S

- Associate Editor for Ecology 2016-present
- Associate Editor for Ecological Monographs

Basiliko, N

- Associate Editor, Soil Research
- Associate Editor, Canadian Journal of Soil Science (2013-present)
- Associate Editor, FEMS Microbiology Letters
- Ad-hoc reviewer of >20 journal manuscripts and grant applications
Beckett, P
- Co-Chair of the organizing committee for the Mining and Environment International Conference VII being held at Laurentian University in Sudbury, ON June 23-28 2019.

Belzile, N
- Associate Editor for the Journal of Geochemical Exploration
- Served on the Editorial Board of Geochemistry: Exploration, Environment, Analysis
- Served on the Editorial Board of Green and Sustainable Chemistry

Gunn, J
- Director of the Vale Living with Lakes Centre, Laurentian University (2011-present)
- Appointed Strategic Plan Lead for Outcome 18, Environmental Goals (2018-2023)
- Special Editor PNAS

Mykytczuk, N
- Associate Editor, Canadian Journal of Microbiology (2017-present)
- Associate Editor, Water, Air, and Soil Pollution (2016-present)
- NSERC DG program external reviewer (2013-present)
- Session organizer and co-Chair (w Jake Mckinley): Microbes in Unusual Environments. Canadian Society of Microbiologists AGM, Winnipeg, MB. 18-22 Jun 2018
- Session organizer and Chair: Technologies to mitigate environmental liabilities. Canadian Institute of Mining and Metallurgy AGM, Vancouver, BC. 6-9 May 2018

Pearson, D
- Co-hosted a 1 ½ day adaptation workshop with Keewaytinook Okimakanak (Northern Chiefs) Tribal Council in Thunder Bay
- Presented to member First Nations of Grand Council Treaty 3 in Kenora
- Co-hosted a 1 ½ day adaptation workshop with Matawa Tribal Council and member First Nations in Thunder Bay
- Hosted a 3-day conference, UpNorthOnClimate, in Thunder Bay with over 200 attendees, 35 speakers and 53 northern First Nation communities represented with the goal of discussing the effects of climate change in the north and promoting adaptation initiatives.
- Arranged for speakers to participate and present at the 2018 Mushkegowuk Climate Summit in Timmins.
- Co-hosted a 1-day Health adaptation workshop: climate impacts and health risks for First Nations in their region, with Dr. Emily Groot of Thunder Bay District Health Unit

Ramcharan, C
- Associate Editor, Canadian Journal of Fisheries and Aquatic Sciences.
Spiers, G

- Co-Chair of the organizing committee for the Mining and Environment International Conference VII being held at Laurentian University in Sudbury, ON June 23-28 2019.

Swanson, H

- Associate Editor, Arctic Science
- Associate Editor, Canadian Journal of Fisheries and Aquatic Sciences

Tanentzap, AJ

- Associate Editor at the Journal Nature Scientific Reports
- Associate Editor at Journal of Vegetation Science
- Associate Editor for PLoS Biology

Watmough, SA

- Director of the Trent School of the Environment (appointed June 2016).
- Performed program reviews the Environmental and Earth Science Program at the University of Windsor, The Depart. Of Environment and Geography at the University of Manitoba, and the Environmental Studies Program at St. Mary’s University in Halifax.
- Helped organize the Precision Agriculture Summit in Peterborough in Feb 2018
- Performed grant reviews for the Alberta Conservation Authority and the NSERC College and Community Innovation Grant
- Oversaw the Trent University site visit by Eco Canada (accreditation was awarded to 6 degrees)
- Ad-hoc reviewer of 29 journal manuscripts

**Partners and Collaborators**

**Industry**

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**Partners and Collaborators**

- Algoma University
- Appalachian State University
- Brock University
- City of Greater Sudbury
- Cornell University
- Dept. of Fisheries and Oceans Canada
- Dorset Environmental Science Centre
- Environment and Climate Change Canada
- Goodman School of Mines
- Government of Northwest Territories
- Great Lakes Forestry Centre, NRCAN-CFS
- Invasive Species Centre
- Laurentian University
- McGill University
- McMaster University
- Memorial University
- Michigan Tech U
- Natural Resources Canada
- National Research Council
- Nipissing University
• OMECP
• OMIRR
• OMNRF
• Ontario Forest Research Institute (MNRF)
• Queen’s University
• Ryerson University
• Saskatchewan Min. of the Environment
• Skidmore College
• South West U. of Science & Technology
• Tianjin Univ. of Science & Technology
• Trent University
• Universidad de Santiago de Chile

• University of Cambridge
• University of Geneva, Switzerland
• University of New Brunswick
• Université du Québec à Montréal
• University of Sherbrooke
• University of Toronto
• University of Waterloo
• University of Windsor
• University of Winnipeg
• Western University
• Wilfrid Laurier University
• York University

Others
• Aboriginal Aquatic Resources and Oceans Management Program
• Agnico Eagle Mine
• Canadian Kraft Papers
• Dartmouth College, New Hampshire
• Dehcho First Nations
• Domtar Inc.
• DMI- Peace River
• Dryden Forest Management Company
• Forest Protection Limited
• Grand Council Treaty 3
• Great Lakes Fishery Commission
• Greater Sudbury Watershed Alliance
• Haliburton Forest and Wildlife Reserve
• Health Canada
• Hunters and Trappers Organization, Kugluktuk NU
• Institute of Ecology and Evolution, Russia
• Irving Pulp and Paper
• Keewaytinook Okimakanak (Northern Chiefs) Tribal Council and member First Nations
• Kitchenuhmaykoosib Innuuwug
• Manitoba Infrastructure
• Manitoulin Streams
• Marten Falls First Nation

• Matawa Tribal Council (Four Rivers Inc.) and member First Nations
• Moose Creek First Nation
• Mushkegowuk Tribal Council and member First Nations
• National Research Council, Italy
• Nokiiwin Tribal Council and member First Nations
• NORCAT
• Ministère des Forêts, de la Faune et des Parcs
• Obishikokaang Resources Corporation
• Ontario Centre for Climate Impacts and Adaptation Resources (OCCIAR), LU
• Ontario First Nations Technical Services Corporation (with OCCIAR)
• Prince Albert Grand Council, Sask.
• Rayonier Advanced Materials
• Rensselaer Polytechnic Institute
• Sandy Lake First Nation
• Severn Sound Environmental Association
• Société de protection des forêts contre les insectes et maladies
• Thunder Bay District Health Unit
• United States Forest Service
• United States Fish and Wildlife Service
- United States Geological Survey
- Universität Konstanz
- Vuntut Gwitchin First Nation
- Webequie First Nation
- Weyerhauser Canadian Timberlands
- Wildlife Conservation Society Canada
- Winisk First Nation
- Yukon Research Institute

**Book Chapters**


**Publications**

Co-op Unit Members authored or co-authored numerous publications in 2018:


Azan SSE, ND Yan, MP Celis-Salgado, SE Arnott, JA Rusak and P Sutey. 201X. Could a residential wood ash recycling program be part of the solution to calcium decline in lakes and forests in Muskoka (Ontario, Canada)? FACETS. Accepted.


Burke SM, CE Zimmerman, BA Branfireun, JC Koch and H Swanson. 2018. Patterns and controls of mercury accumulation in lake sediments from the Arctic Coastal Plain of Alaska. Aquatic Sciences 80:1.


Chan‐Yam K, J Goordial, C Greer, A Davila, C McKay and L Whyte. 2018. Microbial activity and habitability of an Antarctic Dry Valley water track. Astrobiology. Accepted.
Chen YW, X Yu, E Appiah-Hagan, J Pizarro, GA Arteca, L Mercier, Q Wei and N Belzile. 2018. Utilization of low-cost adsorbents to remove anionic As(V), Cr(VI), Mo(VI) and Se(IV) from mine waters. Journal of Environmental Chemical Engineering 6:2470-2479 (+ 10 pages of on-line supporting information).


Durant AC, MP Celis-Salgado, S Ezatollahpour, ND Yan, SE Arnott and A Donini. 2018. Ca^{2+} levels in Daphnia hemolymph may explain occurrences of daphniid species along recent Ca gradients in Canadian soft-water lakes. Comparative Biochemistry and Physiology, Part A 218:8-15.


Gilliam FS, DA Burns, CT Driscoll, SD Frey, GM Lovett and SA Watmough. 2019. Responses of forest ecosystems of eastern North America to decreased nitrogen deposition. Environmental Pollution 244: 560-574.


Horn KJ, RQ Thomas, CM Clark, LH Pardo, ME Penn, GB Lawrence, SS Perakis, EAH Smithwick, D Baldwin, S Braun, A Nordin, CH Perry, JN Phelan, PG Schaberg, SB St. Clair, R Warby and SA Watmough. 2018. Growth and survival relationships of 94 tree species with nitrogen and sulfur deposition across the conterminous U.S. PLOS ONE doi.org/10.1371/journal.pone.0205296


Nie J, L Bian, X Gu, X Jiang, H Dong, M Song, F Dong, L Zhang, H He, P He, N Belzile, Y-W Chen and S Sun. 2018. Biosynthesized magnetite-perovskite (XFe2O4-BiFeO3) interfaces for toxic trace metal removal from aqueous solution. Ceramics International 21210-21220.


Schmidt E, N Mykytczuk and AI Schulte-Hostedde. 2018. Effects of the captive and wild
environment on diversity of the gut microbiome of deer mice (*Peromyscus maniculatus*). ISMEJ DOI: 10.1038/s41396-019-0345-8


St. Pierre K, VL St. Louis, I Lehnerr, S Schiff, D Muir, A Poulain, JP Smol, C Talbot, M Ma, D Findlay, W Findlay and SE Arnott. 201X. Contemporary limnology of the rapidly changing glaciated watershed of the world's largest High Arctic lake. Scientific Reports. Accepted.


**Reports**


Pearson D, K Fram and B Rantala-Sykes, C Sarrazin-Delay, E Smenderovac, E Hulley and K Middleton. Up North on Climate, 2018 Keewaywin, McDowell Lake and Deer Lake Adapting to a changing climate; for consideration in preparing a community-based climate change adaptation plan, Climate Change Impact and Adaptation Study for the North publication, Sudbury, ON. 208 pp.


**Conference Presentations**


Arnott, SE, M Overhill, S Azan, A Ross, A Cox. The Effect of Calcium Decline on Lake Communities. Departmental Seminar, University of Toronto, Mississauga, ON.


Basiliko N. Microbes, carbon, and methane in peat soils. Poster in English and Cree with brief oral overview at the 2018 Mushkegowuk Climate Summit, Timmins, ON. Jan 2018.


DeJong R, TA Johnston, B Keller, JM Gunn and HK Swanson. Life history characteristics of lake whitefish (Coregonus clupeaformis), cisco (Coregonus artedi), and northern pike (Esox lucius) in rivers of the Hudson Bay Lowlands. Association for the Sciences of Limnology and Oceanography, Aquatic Sciences Meeting, Victoria, BC, Canada. 10-15 Jun 2018.

Emilson EJS, M Stastny, M Gray, S Heard, R Johns, K Kidd, J Leach, T Linnansaari and L Venier. Spruce budworm pest management as a conservation tool for critical habitat and ecological integrity of forest watersheds. SERG International Workshop, Québec, QC 5-7 Feb 2019.


Harris L, JS Moore, R Tallman, D Yurkowksi and H Swanson. The use of otolith microchemistry to investigate the anadromous migrations of Arctic char, Salvelinus alpinus, from the Cambridge Bay region of Nunavut. 9th International Charr Symposium, Duluth, MN. 18-21 Jun 2018.


Kirkwood A, P Roy-Léveillé, N Basiliko and J McLaughlin. Greenhouse gas emissions from thawing permafrost in Polar Bear Provincial Park – b∩Ρ∪\ ∧\  \> b∩Ρ\ ∨\ Δ\∎\ P\ʃb\.
Mushkegowuk Climate Summit, Timmins, ON. 24-25 Jan 2018.


Kissinger B, H Swanson, J Reist and W Tonn. Use of marine-influenced waters by Lake Charr throughout Arctic North America. 9th International Charr Symposium, Duluth, MN. 18-21 Jun 2018.

Kornis M, DB Bunnell, H Swanson and C Bronte. Spatiotemporal patterns in trophic niche overlap among Lake Char (Salvelinus namaycush) and nonnative salmonines in Lake Michigan, USA. 9th International Charr Symposium, Duluth, MN. 18-21 Jun 2018. Poster.

Lescord GL, TA Johnston, BA Branfireun and JM Gunn. The ratio of methylmercury to total mercury concentrations in fish muscle varies with body size and between species. Canadian Conference for Fisheries Research, Edmonton, AB, Canada, 4-7 Jan 2018. Poster.


Methe A. A metabolomic study of psychrotolerant microbe Acidithiobacillus ferrivorans. Maamwizing Conference, Laurentian University, Sudbury ON. Poster.


Packalan M, N Basiliko, P Roy-Léveillé, A Kirkwood and J McLaughlin. Peat and permafrost workshop with 1hr oral group presentation. UpNorthOnClimate Conference. Thunder Bay, ON, Canada. 24-26 Apr 2018


Pearson D. Northern Climate Change Issues, MOECC Environmental Assessment and Permissions Branch, Toronto, ON. 23 May 2018.


Smith R, L Adjun, A Dumond, K Kristensen and H Swanson. Migration and overwintering habitat of anadromous Arctic char (Salvelinus alpinus) near Kugluktuk, NU. Arctic Net Science Meeting, Ottawa, ON. 10-13 Dec 2018.


Swanson HK. Why do fish in northern lakes have such variable mercury concentrations: case study from the Dehcho region, NT. Freshwater Institute Seminar Series, Winnipeg, MB. 8 Nov 2018. Invited.

Swanson HK. We Want to Drink the Water and Eat the Fish: Community-Partnered Contaminant Research in Canada’s North. Water Institute Research Conference, University of Waterloo. 24 Sept 2018.

Swanson HK. We Want to Eat the Fish: investigating levels of mercury in northern fishes. Lubinsky Memorial Public Lecture, University of Manitoba, Winnipeg, MB. 1 Mar 2018. Invited.


Swanson H, M Vinson and L Chavarie. Differences in trophic ecology among morphotypes of Lake Char. 9th International Charr Symposium, Duluth, MN. 18-21 Jun 2018.
Tanentzap AJ. Regreening landscapes: from RELATED to L-CARE. L-CARE Initiation Workshop, Sudbury, ON. 22 Feb 2018.

Vinson M and H Swanson. Lean and siscowet Lake Char trophic overlap in Lake Superior. 9th International Charr Symposium, Duluth, MN. 18-21 Jun 2018.


**Research Grants**

**Arnett, S**
- Canadian Institute of Ecology and Evolution (CIEE), Responses of freshwater zooplankton to road salt pollution: A global perspective (funding to host a workshop at QUBS) (2019)
- Queen’s-Dartmouth Fund, Assessing zooplankton response and resilience to chloride contamination (2019-2021)
- NSERC Discovery Grant, Community response to environmental change: the role of dispersal, local adaptation, and species interactions (2013-2018)
- OMNRF, Model to predict risk of introduction and spread of invasive species in Ontario (2016-2018)
- OMECP, Best in Science, Linking road salt application, lake chloride concentration, and biotic thresholds in Canadian Shield lakes (2017-2020)
- OMECP, Drivers of food web change in Lake Simcoe (2017-2019)
- OMECP, Development of phytoplankton counting and measuring software (2017-2020)
- OMNRF, Testing the efficacy of decontamination methods for preventing the spread of invasive species (2017-2019)

**Basiliko, N**
- NSERC Canada Research Chair Tier II in Environmental Microbiology (2018-2023)
• NSERC Collaborative Research and Development Grant- Ontario Centres of Excellence TargetGHG program. Landscape Carbon Accumulation through Reductions in Emissions (L-CARE): developing brownfield management protocols for carbon sequestration and habitat use. N Basiliko (PI) with J Gunn (co-PI), N Mykytczuk, G Spiers, P Beckett (Laurentian), J Smol, A Paterson (Queens University), JM Waddington (McMaster University), S Watmough (Trent University), P del Giorgio, Y Prairie (UQAM), JP Bellenger (University of Sherbrooke). $2,000,000 from NSERC, OCE, and industrial partners Vale Ltd. and Glencore’s Sudbury Integrated Nickel Operations (2018-2020).
• Environment Canada, Environmental Damages Fund. Microbial consortia in mining waste rock: understanding microbial dynamics to optimize metal recovery, minimize metal migration and facilitate revegetation in cold environments with Susan Glasaur (PI, Guelph), S Watmough (Trent), N Mykytczuk, T Merritt and N Basiliko (LU) (2016-2020)
• NSERC Discovery Grant: The functional role of microbial diversity in terrestrial ecosystems.
• Canada Foundation for Innovation and Ontario Research Fund infrastructure funding for an advanced laboratory in microbial ecology and biogeochemistry.
• NSERC Strategic Project Grant: Northern Peatland Ecosystem Responses to Climate change with B Branfireun PI (Western) and 3 others
• NSERC Collaborative Research and Development Grant (CRD): Enhancing dewatering, drying, combustion and utilization of pulp and paper mill biosludge with G Allen (PI) and 7 others (2017-2020)

Beckett, P
• NSERC Collaborative Research and Development Grant- Ontario Centres of Excellence TargetGHG program. Landscape Carbon Accumulation through Reductions in Emissions (L-CARE): developing brownfield management protocols for carbon sequestration and habitat use (see Basiliko)

Belzile, N
• SWUST (Southwest University of Science and Technology) Travel Grant

Edwards, B
• NSERC Collaborative Research and Development Grant- Ontario Centres of Excellence TargetGHG program. Landscape Carbon Accumulation through Reductions in Emissions (L-CARE): developing brownfield management protocols for carbon sequestration and habitat use (see Basiliko)
• Ministry of the Environment, Conservation and Parks. Ring of Fire Baseline Data Collection Programme

Emilson, E
• NSERC Collaborative Research and Development Grant- Ontario Centres of Excellence TargetGHG program. Landscape Carbon Accumulation through Reductions in Emissions
(L-CARE): developing brownfield management protocols for carbon sequestration and habitat use (see Basiliko)

- MOU Partnership between Western University and NRCan. The role of peatlands in boreal forest land-use carbon management under climate change. Co-lead with Branfireun and Lindo (2019-2020)
- Atlantic Canada Opportunities Agency. Spruce budworm pest management as a conservation tool for critical habitats and ecological integrity of forest watersheds. Co-Lead with Statsny (2018-2021)
- NSERC Strategic Partnership Grant. Identifying and evaluating the effectiveness of best management practices to mitigate mercury contamination in managed forests. Collaborator with Mitchell, Kidd and Melles

Gunn, J
- NSERC Canada Research Chair Tier 1 in Stressed Aquatic Systems
- NSERC Discovery, Terrestrial ecosystem services and recovery of damaged aquatic systems (2016-2020)
- NSERC Collaborative Research and Development Grant- Ontario Centres of Excellence TargetGHG program. Landscape Carbon Accumulation through Reductions in Emissions (L-CARE): developing brownfield management protocols for carbon sequestration and habitat use (see Basiliko)
- NSERC CREATE Training Program (ÉcoLac) for the study of lake and river ecology (2014-2019-, 11 co-PIs)

Johnston, T
- NSERC Discovery Program. Individual specialization and the trophic niche of aquatic consumers (2015-2020)
- Ontario Ministry of Natural Resources and Forestry, Aquatic Research and Monitoring Section. Northern fisheries research (2004 – present, renewed annually)
- Ontario Ministry of Natural Resources and Forestry, Far North Information and Knowledge Management Program. Mercury in fish communities of Ontario’s Far North. (Since 2010 - renewed annually)

Keller, B
- Ontario Ministry of Environment, Conservation and Parks; Climate Change and Multiple Stressor Research Programme support.
Mykytczuk, N

- NOHFC IRC in Biomining, Bioremediation and Science Communication
- Ontario Centers of Excellence VIP II: Bioleaching with Genomics: optimizing gold recovery Bioleaching with genomics: optimizing bio-processes for gold recovery for BacTech Environmental Corp. (2017-2018) $150,000
- MRI Early Researcher Award. Principal Investigator (2017-2021)
- Ontario Research Fund, Research Excellence Round 8: Elements of Bio-Mining (EBM): Genomics-Driven Improvements in Bioleaching, Sulfur and Selenium Stabilization in Mine Operations. $4,000,000 (2016-2020) Role: Co-lead
- Environment Canada Environmental Damages Fund (Guelph U, Laurentian): Microbial consortia in mining waste rock: understanding microbial dynamics to optimize remining and metal recovery, minimize AMD, and facilitate re-vegetation in cold environments. Co-Investigator (2016-2020)
- Natural Resources Canada, Canadian Forestry Service Genomic R&D Initiative: Developing molecular and environmental genomic approaches on microbial and invertebrate communities to assess forest ecosystem integrity in forest management (2015-2019)
- NSERC Discovery- Ecology and molecular biology of the effects of cold temperatures on acid mine drainage microbial communities. (2013-2018)
- NSERC Collaborative Research and Development Grant- Ontario Centres of Excellence TargetGHG program. Landscape Carbon Accumulation through Reductions in Emissions (L-CARE): developing brownfield management protocols for carbon sequestration and habitat use (see Basiliko)

Pearson, D

- Ontario Ministry of Indigenous Relations and Rehabilitation, MECP Green Investment Fund, in partnership with Ontario Centre for Climate Impacts and Adaptation Resources (OCCIAR)
- NSERC Canadian Network for Aquatic Ecosystem Services, (CNAES) Project 1-6, Outreach (2012-2017)
- Co-lead Ontario Chapter of the National Climate Change Impacts and Adaptation Assessment with Al Douglas (OCCIAR)

Ramcharan, C

- Northern Ontario Heritage Fund Corporation, Prototyping an innovative aquatic sonde (2017-2019)

Roy-Léveillé, P

- Polar Knowledge Canada, Permafrost vulnerability assessment near the community of Old Crow, Yukon (2017-2019)
• Weston Foundation & Wildlife Conservation Society, Fellowship to support field work by MSc student on carbon and mercury stores in palsa fields of the Hudson Bay Lowlands (2018)
• Churchill Northern Studies Research Centre, Support for a first field trip to examine permafrost conditions near Churchill (2018)
• Northern Scientific Training Program, Decomposition potential of organic material and the positive feedback to climate change from permafrost peatlands (2018)

Scott, JA
• Mitacs Accelerate, Automated Deep Mining (2018-2020)
• OCE VIP II, Prospecting for non-ore resources in Ontario’s mining sector (2018-2020)

Spiers, G
• OMECP: Cr speciation in environmental samples (with Karanssios at Waterloo) (2014-2018)
• Russian Science Foundation: Bioremediation – From technological wasteland to restored natural ecosystems in the Kola Subarctic. Lead: G.A. Spiers with G Kopstik and S Kopstik and others at Moscow State University (2015-2019)
• NSERC Collaborative Research and Development Grant- Ontario Centres of Excellence TargetGHG program. Landscape Carbon Accumulation through Reductions in Emissions (L-CARE): developing brownfield management protocols for carbon sequestration and habitat use (see Basiliko)

Swanson, H
• Early Researcher Award, Province of Ontario, Understanding ecology, life history, and mercury levels in fish.
• Fisheries and Oceans Coastal Restoration Fund, Restoration of anadromous Arctic Char (Salvelinus alpinus) and Dolly Varden (Salvelinus malma malma) near Kugluktuk, NU
• POLAR Canada, The state of Northwest Territories country food systems: planning for long-term sustainability
• Canada First Research Excellence Fund, Northern Water Futures
• Cumulative Impacts Monitoring Program (CIMP), Government of Northwest Territories, Understanding and predicting spatial variability in fish mercury levels in the Dehcho region
• Northern Contaminants Program, Understanding fish mercury levels in Dehcho lakes
Tanentzap, AJ
- NSERC Collaborative Research and Development Grant- Ontario Centres of Excellence TargetGHG program. Landscape Carbon Accumulation through Reductions in Emissions (L-CARE): developing brownfield management protocols for carbon sequestration and habitat use (see Basiliko)
- European Research Council, Ecological and evolutionary importance of molecular diversity in dissolved organic matter (5-year programme to study the biological relevance of chemical diversity in dissolved organic matter)

Watmough, SA
- NSERC Discovery, Calcium in the environment: the highs and the lows (2016-2021)
- Environment Canada, Microbial consortia in mining waste rock: understanding microbial dynamics to optimize metal recovery, minimize metal migration and facilitate revegetation in cold environments (with 4 others) (2016-2019)
- NSERC Collaborative Research and Development Grant- Ontario Centres of Excellence TargetGHG program. Landscape Carbon Accumulation through Reductions in Emissions (L-CARE): developing brownfield management protocols for carbon sequestration and habitat use (see Basiliko)

Yan, N
- Ontario Trillium Foundation, Hauling Ash To Save Our Forest’s Future. (2019-2021) with Trent University, University of Victoria, Laurentian University, District Municipality of Muskoka, Dorset Environmental Science Centre, Learning for a Sustainable Future, the Ontario Maple Syrup Producers Association, and Westwind Forest Stewardship Inc.

Theses Completed

PhD

Carson, Michael, PhD. Methane production in peatlands. Laurentian University (Basiliko)

Jones, Chris, PhD. The ecology of lakes and rivers in the southern Boreal Shield: Water quality, community structure, and cumulative effects. Laurentian University (Gunn/Edwards)

Lescord, Gretchen, PhD. Mercury cycling in a remote boreal drainage basin. Laurentian University (Gunn/Johnston)

Orland, Chloe, PhD. Assembly and functioning of microbial communities along terrestrial resource gradients in boreal lake sediments. University of Cambridge (Tanentzap)

Senhorinho, Gerusa, PhD Biomolecular Sciences. Antibacterial activity of freshwater green microalgae isolated from water bodies near abandoned mine sites in Ontario, Canada.
Laurentian (Scott)

Sinclair, James, PhD. The relative importance of population size, colonist quality, and colonist arrival frequency for population success. Queen’s University (Arnott)

MSc

Bird, Adam, MSc. Nitrogen retention of terricolous lichens in a jack pine forest in northern Alberta. Trent University (Watmough)

Hoage, Jesse, MSc. Metabarcoding soil microarthropods for soil quality assessment: Importance of integrated taxonomy, phylogenetic marker selection and sampling design. Laurentian University (Basiliko)

Lewis, Brent, MSc. Comparing habitat use and mercury accumulation in Arctic Grayling (*Thymallus arcticus*) from two northern ecosystems University of Waterloo (Swanson)


Savage, Pascale, MSc. A multi-predator analysis: Comparing trophic niche dimensions and mercury concentrations among four sympatric piscivores of boreal lakes. Laurentian University (Gunn/Johnston)

Suenaga, Erin. MSc. Assessing the chemical and biological recovery of Killarney Provincial Park lakes from historical acidification. Queen’s University (Arnott)

Valiquette, Nicole, MSc. Genomic insights into the psychrotrophic microbial leaching of low sulfide waste rock in kinetic testing systems. Laurentian University (Mykytczuk/Merritt)

Vanderhorst, Renate, MSc. Technosol evaluation for mine site reclamation in the Boreal Shield. Laurentian University (Beckett/Spiers)

Wittmann, Amanda, MSc. Biological recovery in an urban industrial stream: Using the reference condition approach to assess the current state of Junction Creek, Sudbury, Ontario. Laurentian University (Gunn/Edwards)
**Undergraduate**

Bloomfield, Emma. BSc Honours. Phenotypic plasticity in the phototactic behaviour of *Daphnia mendotae* may have evolved in response to the invasive predator *Bythotrephes longimanus*. Queen’s University (Arnott)

Casamatta, Maria, BSc Honours. Nutrient re-translocation in paper birch growing on mine tailings. Trent University (Watmough)

Courchesne, Jordan, BSc Honours. Assessing the impact of sediment organic matter on zooplankton abundance using an experimental mesocosm. Laurentian University (Gunn/Edwards)

Girard, Lianne and Rachel Mariani, BSc Honours. Effects of different types and levels of road salt on *Daphnia*. Laurentian University (Ramcharan)

Hilgendag, Isabel, BSc Honours. The use of in-situ mesocosms in determining the effects of organic matter on zooplankton in acidic and neutral lakes in Sudbury, ON. Laurentian University (Gunn /Edwards)

Kirkwood, Adam, BSc Honours. Lability and methane production potential of organic matter in degrading palsas of Polar Bear Park Laurentian University (Roy-Léveillé)

Louste-Fillon, Jasmine, BSc Honours. Use of Gut Microbiomes in Creek Chub (*Semotilus atromaculatus*) to Assess the Environmental Effects of Mine Effluents in Sudbury Streams. Laurentian University (Gunn)

Mozzon, Christina, BSc Honours. The trophic niche of sculpins (*Cottus* sp.) in forage fish communities of Near North and Far North lakes in Ontario. Laurentian (Johnston)

Quesnel, Michelle, BESc Honours. Influence of growth rate and food web position on inter-individual variation in fish mercury (Hg) concentrations in lakes of northern Ontario. Laurentian (Johnston)

Remillard-Scott, Candice, BSc Honours. A preliminary assessment of permafrost distribution based on vegetation cover near the community of Fort Severn, Ontario. Laurentian University (Roy-Léveillé)

Spence, Rebecca, BSc Honours. Sediment properties affecting invertebrate abundance in the James Bay Shoreline. Trent University (Watmough Co-sup)
**HQP Supervised**

Appleby, Amber, BSc Honours in progress. Laurentian University (Mykytczuk)
Baker, Sara, BSc Honours in progress. Queen’s University (Arnott)
Centurione, Adam, BSc Honours in progress. Trent University (Watmough)
Dawson, Jade, BSc Honours in progress. University of Guelph (Edwards/Gunn/McCann)
Greasly, Adam, BSc (Biochemistry) Laurentian University (Belzile)
Humphries, Zoe, BSc Honours in progress. University of Waterloo (Swanson)
Johnson, Lauren, BSc Honours in progress. Queen’s University (Arnott)
Kuchtaruk, BSc Honours in progress. Queen’s (Grogan/Basiliko)
Larochelle, Luc, BSc Honours in progress. Laurentian University (Johnston)
Laframboise, Amy, BSc Honours in progress. Laurentian University (Basiliko)
Ott, Neil, BSc Honours in progress. Trent University (Watmough)
Packull-McCormick, Sara, BSc Honours in progress. University of Waterloo (Swanson)
Patterson, Heather, BSc Honours in progress. Laurentian University (Basiliko/Beckett)
Pyne, Cassandra, BSc Honours in progress. Queen’s University (Arnott)
Rathie, Brooke, BSc Honours in progress. Queen’s University (Arnott)
Read, Sharayah BSc (Chemistry) Laurentian University (Belzile)
Robinson, Chantae, BSc Honours in progress. Laurentian University (Basiliko/Roy-Léveillé)
Waterton, Kathleen, BSc Honours in progress. Queen’s University (Arnott)
Whitehouse, Jacob, BSc Honours in progress. University of Waterloo (Swanson)

Beckett, Anna, MSc Candidate, Queen’s University (Arnott/Young)
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Courchesne, Brittaney, MSc Candidate, Laurentian University (Mykytczuk/Schindler)
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Dart, Michelle, MSc Candidate, Laurentian University (Basiliko)
Deighton, Holly, MSc Candidate, Trent University (Watmough)
Ellenor, Jared, MSc Candidate, University of Waterloo (Swanson)
Gilbert Parkes, Spencer, MSc Candidate, Trent University (Watmough)
Greco, Danielle, MSc Candidate, Queen’s University (Arnott/Schamp)
Guernon, Stephanie, MSc Candidate, University of Waterloo (Swanson Co-sup.)
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Hasnain, Sarah, PhD Candidate, Queen’s University (Arnott/Day)
Jiao, Yongmei, PhD Candidate, Laurentian University (Scott)
Lavender, Mike, PhD Candidate, Queen’s University (Arnott/Schamp/Rusak)
Levasseur, Pat, PhD Candidate, Trent University (Watmough)
McDonough, Andrew, PhD Candidate, Trent University (Watmough)
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Moreau, Kyle, PhD Candidate, Laurentian University (Scott)
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Seward, James, PhD Candidate, Laurentian University (Basiliko)
Tafvizi, Arghavan, PhD Candidate, Laurentian University (Ramcharan/James)
Van Leeuwen, Pauline, PhD Candidate, Laurentian University (Mykytczuk/Schulte-Hostedde)

Asemaninejad Hassankiadeh, Asma, PDF, Laurentian (Basiliko/Mykytczuk)
Baker, Leanne, PDF, University of Waterloo (Swanson)
Brummell, Martin, PDF, Laurentian (Basiliko)
Celis-Salgado, Martha, PDF, FLAMES lab (Arnott)
Govindarajan, Srinath, PDF, Laurentian (Mykytczuk)
Khan, Madiha, PDF, Laurentian (Mykytczuk)
Porter, Teresita, PDF, NRCan (Emilson)
Puukila, Stephanie, PDF, NOSM (Boreham/Gunn)
Senhorinho, Gerusa, PDF, Laurentian (Scott/Basiliko)
Tharmalingam, Sujeeenthar, PDF, NOSM (Boreham/Gunn)
Thome, Christopher, PDF, NOSM (Boreham/Gunn)
Adkinson, Kevin, Research Technician, Trent University (Watmough)
Nguyen, Amy, Lab Technician, University of Waterloo (Swanson)
Rathie, Brooke, Summer Work Experience Program, Queen’s University (Arnott)
Richardson, Haley, Summer Work Experience Program, Queen’s University (Arnott)
Wong, Nathaniel, Software designer, Queen’s University (Arnott)

**Staff**
Laurentian University Main Campus
Alarie, Yves – Biosystematics
Belzile, Nelson - Environmental Chemistry
Dirszowsky, Randy – Geomorphology/Paleolimnology
Ramcharan, Charles - Aquatic Ecologist
Spiers, Graeme – Chemistry, Science and Engineering

Canadian Forest Service, NRCan, Sault Ste. Marie
Emilson, Erik

Queen’s University
Arnott, Shelley

Trent University
Watmough, Shaun A.

University of Cambridge, UK
Tanentzap, Andrew
Desjardins, Cyndy – Project Manager
Lavallee, Amanda - Field Technician

University of Waterloo
Swanson, Heidi

Wilfrid Laurier University
McGeer, Jim

Living with Lakes Centre
Bamberger, Elizabeth - Business Manager, LU
Barriault, Chantal – Director, Science Communication Program, LU
Basiliko, Nathan – Canada Research Chair in Environmental Microbiology, LU
Beckett, Peter - Education and Outreach, Faculty LU
Bobbie, Colleen -Data Manager, MECP/LU (Dep. Oct 2018)
Bourne, Vanessa - Freshwater Ecology and Bioassessment Biologist, MECP/LU (Dep. May 2018)
DeJong, Rachel - Freshwater Ecology and Bioassessment Biologist, MECP/LU
Edwards, Brie - MECP Research Scientist/ LU Adjunct
Fram, Kim - Taxonomist and Research Assistant, LU
Gunn, John - Canada Research Chair in Stressed Aquatic Systems, LU
Hanson, Andrea - GIS and Reporting Assistant, LU (Dep. Jan 2018)
Haslam, Lee - Senior Fisheries Technician, MNRF
Heneberry, Jocelyne - Monitoring Coordinator, MECP
Johnston, Tom - MNRF Senior Research Scientist/LU Adjunct
McCourt, Jason - Environmental Officer, MECP
Middleton, Katherine - Public and First Nations Communications Specialist, LU (Dep. Feb 2018)
Mykytczuk, Nadia - NOHFC IRC in Biomining, Bioremediation and Science Communication, LU
Oman, Karen – Research and Administration, LU
Patterson, Kristen – Research Biologist, MNRF
Pearson, David - Climate Change Impact Project Lead, Science Communication, LU
Rantala-Sykes, Brittany, Climate Change Research Assistant (Pearson)
Reid, Michelle, Science Communication (Mykytczuk)
Roy-Léveillé, Pascale – Permafrost, Faculty, LU
Sarrazin-Delay, Chantal - Associate Project Lead, Climate Change and Ecology, LU
Smenderovac, Emily – Research Project Manager LCARE, LU
Snucins, Ed – Research Scientist, MECP
Strangway, Carrie – Research Scientist, MECP
Warmbold, Jerry – Research Technician, MNRF
Witty, Lynne – Invertebrate Taxonomist, MECP/LU

Senior Research Fellows (SRF)
Keller, Bill - SRF in Northern Studies, Vale Living with Lakes Centre (VLWLC)
Rosseland, Bjorn - SRF in Ecotoxicology, VLWLC (Emeritus Norwegian University of Life Sciences)
Yan, Norm - SRF in Aquatic Ecology, VLWLC (Emeritus York University)

Field Technicians and Research Assistants
Bayley, Victoria, SCOM Graduate Research Assistant, LU (Pearson)
Barette, Rachelle, Computer Sci., Data visualization and processing: Python, PT, LU (Pearson)
Bull, James, Summer Workstudy Student, LU (Gunn/Basiliko)
Courchesne, Brittaney, NSERC USRA, LU (Mykytczuk)
Courchesne, Jordan, Field Technician, MECP/LU (Edwards)
Dawson, Jade, Field Technician, MECP/LU (Edwards)
Duhaime, Manon, Workstudy Fall/Winter Research Assistant, LU (Pearson)
Homayed, Meerna, SCOM Graduate Research Assistant, LU (Pearson)
Hulley, Emily, Climate Change Research Assistant, PT, LU (Pearson)
KC, Kalpana, Field Technician, LU (Gunn/Basiliko)
Kirkwood, Adam, Summer Research Assistant, LU (Basiliko)
Kuchtaruk, Adrian, NSERC USRA, LU (Basiliko)
Lavigne, Jonathan, Field Technician, LU (Basiliko)
Mozzon, Christina, Summer Student, MNRF (Johnston)
Quesnel, Michelle, Summer Student, MNRF (Johnston)
Rysdale, Aaron, Field Technician, LU (Gunn)
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Tremblay, Nathalie, Summer Workstudy Student, LU (Mykytczuk)
Tuszkiewicz, Heidi, Undergraduate Research Assistant, LU (Scott)
Ward, Meghan, Field Technician, LU (Gunn)