Awards and Recognition

• After many decades as one of Canada's finest limnologists, Bill Keller has decided to retire. However, we are delighted that he has agreed to retain a desk at the Lake Centre as a Senior Fellow in Northern Studies.

• Dr. Brie Edwards joined the Co-op Unit as the MOECC Research Scientist, Northern Lakes Monitoring. Dr. Edwards has an extensive foundation in aquatic community ecology and aquatic sciences, particularly in the quantification and assessment of ecological and water quality responses to multiple stressors. Welcome to the team!

• On May 28, 2017 Dr. Nadia Mykytczuk won the Early Researcher Award from the Ministry of Research and Innovation and Science (2017-2021). Projects were evaluated through a peer review process and successful projects were chosen based on the researcher’s experience, the quality of the research, development of newer talent and strategic value to Ontario. She then graced the stage with Minister of Science Dr. Kirsty Duncan on Aug. 15 to represent more than 250 researchers across Canada, as a recipient of support from the J.R. Evans Leaders Fund from the Canadian Foundation for Innovation for her project using microbes to clean up mine waste. Her bilingual address on behalf of all research recipients was magnificent. Congratulations!

• Dr. Heidi Swanson won the Early Researcher Award from the Ministry of Research and Innovation and Science (2018-2022) at Waterloo! Dr. Swanson also won the Outstanding Faculty Performance Award at the University of Waterloo. Amazing work and outstanding outreach – Congratulations Dr. Swanson!

• Dr. Nathan Basiliko, is leading a team of international researchers in a $2.0M NSERC-OCE project entitled Landscape Carbon Accumulation through Reductions in Emissions (L-CARE). This project received the highest ranking from a blue-ribbon panel in this, the
inaugural year of the NSERC-OCE GHG program. Participating universities include: Laurentian, Cambridge, Cornell, UQAM, Queen’s, McMaster, Trent and Sherbrooke. Partners include Vale, Glencore’s Sudbury Integrated Nickel Operations and the City of Greater Sudbury. The project was awarded in 2017 and officially announced during Research Week in 2018.

- Dr. John Gunn had his Tier I Canada Research Chair in Stressed Aquatic Systems renewed for a third term. He serves as Co-PI with Dr. Basiliko on the L-CARE grant.

- Dr. Peter Beckett was named Honorary Research Fellow at the International Centre of Land Reclamation and Ecological Restoration for Mining Areas at China University of Mining and Technology, Beijing. He was also the invited plenary presentation at LRER 2017, Second International Symposium on Land Reclamation and Ecological Restoration, in Xian, China October 2017 (Lessons Learned from a Lifetime of Healing and Creating Novel Functional Ecosystems on an Impacted Smelter Landscape). He was a member of the organizing committee, the chair of 3 conference sessions and a leader in round table discussions of international co-operation in land reclamation and ecological restoration. As an international expert, he was an invited participant in an international group of 10 reclamation scientists for a 5 day tour and discussions at 3 Chinese Universities offering degrees in land reclamation and visited headquarters of several coal companies to review progress in land reclamation activities (Xuzhou, Huainan, Yangguah).

- Under the leadership of Dr. Chantal Barriault, the Science Communication Program became a Master’s Program in 2016 and accepted its first round of Master’s students in the Fall of 2017. It is the first program of its kind in Canada and one of just a handful in the world.

- On June 28, 2017, Dr. David Pearson was presented with the Order of Ontario for his outstanding contribution to science communication in all its forms but in particular for his assistance of the public, and society at large, in understanding the current and potential impacts of climate change. Thank you David and Congrats!

- The Cooperative Freshwater Ecology Unit was renewed as a Research Centre at Laurentian and was granted a 5 year renewal by Laurentian’s Research Advisory Committee.

- Dr. Erik Emilson joined the Co-op Unit as an adjunct professor and new research scientist at the Canadian Forest Service in Sault Ste. Marie, ON. He takes the reins with the retirement of Dr. David Kreutzweiser, a long time CFEU member and colleague.

- Dr. Ashley Scott was a finalist in the IChemE Global Award for Sustainability. A Bioengineer and new member of the Co-op Unit, Dr. Scott and his students are conducting several exciting and innovative projects involving the generation of biofuels and other algal products using waste heat and gases at the Glencore Sudbury Integrated Nickel Operation.
**Student Scholarships, Fellowships, Bursaries**

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

- Michael Carson, PhD Candidate Laurentian (Basiliko)
  - Oral Presentation Award, Canadian Soil Science Society Annual Conference, Trent University. Third place in student presentation contest ($100 CAD)
  - International CSSS Travel Grant, Canadian Soil Science Society International Travel and related expenses to ESM Helsinki, Finland ($3,400 CAD)

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

- Stéphanie Guernon, MSc Candidate co-supervised at Université du Québec à Montréal/Waterloo (Swanson), continued to be supported by an NSERC CREATE ÉcoLac scholarship and received an FQRNT.


- Mike Lavender, PhD Candidate Queen’s (Arnott/Rusak/Schamp), won the Queen Elizabeth II Graduate Scholarship in Science and Technology.

- Jamie Montgomery, MSc Candidate Laurentian (Johnston/Gunn), was the recipient of the Fisheries and Oceans Canada Habitat and Restoration Scholarship.

- Robyn Rumney, MSc Candidate Laurentian (Gunn/Basiliko), received the Laurentian Dean’s Entrance Scholarship ($5000) and an EcoLac NSERC CREATE scholarship (2017-2019).

- Pascale Savage, MSc Candidate Laurentian (Johnston/Gunn), was the recipient of the R.W. Drysdale memorial Scholarship in Aquatic Science as well as the Fisheries and Oceans Canada Habitat and Restoration Scholarship.

- Sam Woodman, PhD Candidate Cambridge (Tanentzap), was the recipient of the William and Margaret Brown Cambridge International Scholarship. This scholarship covers the full cost of tuition and living expenses associated with a PhD at Cambridge University. Sam was in Sudbury in the summer of 2017 and his research will look at how insect outbreaks influence lake C cycles in the Sudbury, Dorset, and Turkey Lake areas.
• Caleb Yee, MSc Candidate Queen’s (Arnott), received the Queen’s University R.Samuel McLaughlin Fellowship.

Community Outreach

• Dr. Shelley Arnott gave a public lecture entitled “Salting our Lakes: Are we doing enough to protect them?” to the Kingston Society of Conservation Biology, March 2018. She also gave the following departmental lectures:
  ~ Fleming College, February 2017
  ~ Wilfrid Laurier University, February 2017
  ~ Ryerson University, Toronto, November 2017
  ~ University of Toronto-Mississauga, March 2018

• Dr. Peter Beckett is the Outreach Coordinator with the VLWLC. He served in the following Capacities in 2017:
  ~ 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 also gave the following talks and tours:
    ▪ Presentation to Environmental Monitoring & Impact Assessment and Environmental Technicians Program. Cambrian College, 2 Feb 2017 (>40 people)
    ▪ Camborne School of Mines, United Kingdom (Mining Professional Program International Tour), Jane Goodall Trail, 9 Jul 2017 (15 people)
    ▪ Summer High School Program (Canadian Ecology Centre) Jane Goodall Trail Tour, 26 Jul 2017 (55 students)
    ▪ Teachers Resources and Mining Education Tour (Canadian Ecology Centre) Kelly Lake Hill and environs, 22 Aug 2017 (45 people)
    ▪ Presentation and Kelly Lake Hill/ Dynamic Earth Transplant Plots with Regreening crew tours to 12 students from Ontario universities in Ontario Universities Field Biology Program – Restoration Ecology Course, Aug 2017

• Dr. Nathan Basiliko serves on the Regreening Advisory Committee (VETAC) for the City of Greater Sudbury and also took part in a 2-part radio and web vignette on CBC Sudbury’s Morning North for the Soil Conservation Canada “Soil your Undies” initiative (video viewed 10k times).

• Vanessa Bourne co-facilitated a Canadian Aquatic Biomonitoring Network (CABIN) field training course for numerous First Nation communities at the Living with Lakes Centre.
• Dr. Brie Edwards participated in the following public outreach initiatives in 2017:
  ~ Served as an invited expert in a research planning workshop for Friends of the Muskoka Watershed’s OTF Seed Grant Initiative "Hauling Ash to Solve Ecological Osteoporosis" or "HATSEO". November 2017
  ~ Gave a lecture as part of the LU Department of Biology Seminar Series entitled "Ecological Approaches for Freshwater Monitoring and Protection: Past Highlights and Future Directions"

• Dr. David Pearson and his team have visited 11 Far North Ontario First Nations Communities as part of his Climate Change Adaptation work and engaged school-aged children with hands-on environmental science and climate change activities. Communities included Wunnumin, Eabamatoong (Fort Hope), Fort Severn, Attawapiskat, Kitchenuhmaykoosib Inninuwug (Big Tout Lake), Sandy Lake, Moose Cree, Constance Lake, Weagamow (North Caribou), Fort Albany, and Kashechewan.

• Dr. John Gunn participated in the following public outreach initiatives in 2017:
  ~ Served as an expert member for the City Watershed Advisory Panel

• Dr. Charles Ramcharan Participated in the following outreach initiatives in 2017:
  ~ Served as a member of the City of 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. The GSFPC recently ratified Sudbury’s first official food charter. This was the culmination of three years of work. Sudbury City Council ratified the food charter on 26 Feb 2018.
  ~ Served as a member of the Greater Sudbury Community Garden Network
  ~ Served as a member of the Greater Sudbury Foodshed Network
  ~ He was interviewed on CBC Radio in July 2018 on the topic of cyanobacteria blooms

• Dr. Bjorn Rosseland gave the following public lectures in 2017:
  ~ New and Old Pollution Challenges: From Hg and POPs to nanosilver and microplastics. invited plenary lecture in Vale Cavern, Science North, Sudbury, ON. as Vale Living with Lakes Centre International Scholar in Residence 5 Oct 2017
  ~ Military defence, environmental pollution and ecotoxicology (Forsvaret, miljøgifter og økotoksikologi). Kolbotn Rotary, 29 Nov 2017
  ~ Fish in River Sandvikselva. Historical events and the future for the most important seatrout and Atlantic salmon river in the Oslofjord (Fisk i Sandviksvassdraget. Historisk
Consumption advice. Are fish as healthy as we believe, or are we biased? (Kosthaldsråd. Er fisk så sunt som vi trur eller blir vi rundlurt?). Norwegian Game and Fishery Union (Norges jeger og fiskeforbund). Agder conference on 27 Jan 2017

Armed forces, environmental pollution and ecotoxicology (Forsvaret, miljøgifter og økotoksikologi). The Armed Forces Environmental Conference (Forsvarssektorens miljøvernseminar) 15 Jun 2017

- Dr. Graeme Spiers served as a member of VETAC and gave numerous talks and tours to students, international visitors and the general public in 2017.

- Dr. Heidi Swanson participated in the following outreach activities in 2017:
  - Worked with 5 First Nation community monitors in ‘on-the-land’ camps in summer 2017 (> 30 days)
  - Performed a demonstration of mercury analysis at ‘researcher fair,’ Northern Contaminants Program meeting, Yellowknife, NT

- Dr. Andrew Tantentzap participated in the following public outreach initiatives in 2017:
https://www.youtube.com/watch?v=1cd5irO5ENU

- Dr. Shaun Watmough helped organize the North American Envirothon in July 2017 and was a VIP Judge. He was also interviewed by Chex TV (Trent Market Garden) and gave a TSE Webinar.

2017 Watershed Lecture with Dr. Irena Creed
We were honoured to have Dr. Irena Creed give the annual Watershed Lecture for 2017 on Friday, September 29th in the Ramsey Room at Science North.

Dr. Creed is the Executive Director and Professor of the School of Environment and Sustainability at the University of Saskatchewan. She is a former Canada Research Chair at Western University in the Department of Biology, with cross-appointments to Geography and Earth Sciences. She investigates the ecological outcomes of hydrological and biogeochemical processes in freshwater ecosystems under present and predicted climate scenarios, including the interactions between terrestrial and aquatic ecosystems and the formation of potentially harmful algal blooms. She tracks the movement and fate of nutrients within and through watersheds, which are released to the atmosphere (generating greenhouse gases) and aquatic systems (affecting productivity and diversity), work that is relevant to integrative disciplines like ecosystem health and ecosystem services. Her research has improved understanding of watershed hydrological and
biogeochemical functions, and has been used by governments to support policies and management measures to reduce risk to water supplies.

Cambridge University Project: RELATED 2014-2017
This three year $900K NERC funded project called RELATED (Restoring Ecosystems by Linking Aquatic and Terrestrial Ecosystem Dynamics) was a collaborative project between the VLWLC and Cambridge University. The principal investigator was Dr. Andrew Tanentzap, our former Banting Fellow and now a faculty and Chair of the Ecosystems and Global Change Group at Cambridge University. Drs. Nadia Mykytczuk, Nathan Basiliko and John Gunn were the Laurentian collaborators on this project. Cambridge Postdoctoral Fellow Erik Emilson split his time between the Vale Living with Lakes Centre and the University of Cambridge. The goal of the project was to assess how changing terrestrial landscapes affect productivity (zooplankton, microbes, benthic invertebrates) of nearshore waters and their release of greenhouse gases (CH₄, CO₂, H₂S).

The Cambridge project supported a full time research technician at the Lake Centre (Cyndy Desjardins, followed by Amanda Lavallee) and 3 Cambridge staff/students in 2017. Isabel Hilgendag and Jordan Courchesne continued the study through 2017/18 as their 4th year Honours thesis projects (examining the effects of sediment organics on zooplankton abundance) under the supervision of Drs. John Gunn and Brie Edwards, with statistical advice from Andrew Tanentzap and Colleen Bobbie.
Cambridge Project Team: (Back) John Gunn, Timo Rossberg, Erik Szkokan-Emilson, Cassia Michel, Andrew Tanentzap, Cyndy Desjardins, Jasmine Louste-Fillion, Amelia Fitch, Kurt Yakimovich, (Front) Erin Palmer, Chloé Orland, Emily Smenderovac and mascot Keagan.

OUPFB Students Engage in Sudbury Discoveries
The VLWLC hosted the Ontario University Field Biology Course entitled “Restoration Ecology: From Fish to Microbes” on August 21-September 2, 2017 with 12 students from 6 universities (Guelph, Toronto, McMaster, Ottawa, Carleton, Western). Drs. Gunn, Beckett, Mykytczuk, Basiliko, Edwards and Spiers were the instructors and TA support was provided by Robyn Rumney and Leland Johnston. In addition to intensive research projects, students were certified in the regreening module of the new signature course “Environmental Remediation: Global Lessons from the Sudbury Story” produced by Dr. Mykytczuk and supported by the Goodman School of Mines. We also held the ICP Waters Dissection course again this year. Emily Smenderovac led the dissection course and provided assistance with the Stream Team.
**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., the City of Greater Sudbury and Glencore’s Sudbury Integrated Nickel Operations. 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.

The project is lead by Dr. Nathan Basiliko with Co-PI’s at:

Trent: Dr. S. Watmough
Sherbrooke: J-P Bellenger
UQAM: Drs. P. del Giorgio and Y. Prairie
Cambridge: Dr. A. Tanentzap
Queen’s: Drs. J. Smol, A. Paterson (OMOECC)

Collaborators are located at Canadian Forest Service, NRCan (Dr. E. Emilson), the OMNRF (Dr. T. Jones) and Collège Boréal (M. Hubert).

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.
Aquatic Restoration Group - Sudbury Environmental Study Lakes

In 2017, the Ministry of the Environment and Climate Change at the Cooperative Freshwater Ecology Unit continued sampling lakes for the Sudbury Environmental Study (SES) under 2 main programmes which complement each other: SES Extensive and SES Intensive. 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. The lakes are sampled once annually during the period 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. During 2017, all 44 lakes in the SES Extensive lake set were sampled once for standard water chemistry parameters, and twelve of these, which were selected in 2016 to represent lakes with differing current acidification status and lake size, were additionally sampled for zooplankton.

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 only visited periodically, and in 2017 all 24 of these lakes were sampled for chemistry. They will be sampled once more in 2018, concluding a planned three year effort, at which time we will have three sets of three-year records with which to begin looking at changes in these 24 lakes over time (1981-1983; 2003-2005 and 2016-2018).

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 transparency, oxygen/temperature profiles, zooplankton, and phytoplankton), which provide a greater variety and intensity of data on a smaller group of lakes. In 2017 there were 10 lakes sampled monthly (May - October) and 1 lake sampled twice-monthly (Swan lake) under the SES Intensive programme.

The zooplankton taxonomy lab continued to process samples collected for the MOECC’s lake monitoring programs, including the SES and the Ring of Fire. Samples were also processed for various partners and collaborators to assess recovery trends over time, linked to a variety of environmental stressors. These groups included the Severn Sound Environmental Association, Ministry of Natural Resources and Forestry, and the Climate Change and Multiple Stressor Research Programme. Samples from Lake Simcoe were processed specifically for spiny water flea screening as has been done in the past. In addition, a set of Lake Simcoe samples were processed as part of a method development project, examining the possible use of hydroacoustic techniques to characterize the zooplankton community. Samples from Lake Nipissing were processed to assess seasonal changes in zooplankton, particularly the spiny water flea, and possible implications on food web dynamics. In total 356 zooplankton samples were processed in 2017. Two undergraduate honours students (Jordan Courchesne and Isabel Hilgendag) were also trained under the Senior Zooplankton taxonomist, Lynne Witty.

Database management during 2017 was lead by database manager Colleen Bobbie, who has implemented several exciting updates on the databases that house data produced from our programmes. Highlights of this effort include the addition of 7 years (approximately 400 records)
as well as a massive QAQC process to ensure data quality across the existing database. Colleen also developed an optimized data importation method for the input and quality assurance of future years’ data. In addition, 27 data requests were addressed from partners and collaborators and a new mapping query feature was created to easily locate sites and stations on Google Earth. Support for other projects, including graduate student projects, was also provided (data, expertise and logistics). There is a current ongoing focus on generating updated lake reports summarising data collected through 2016.

These Sudbury area 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. In recent years, these studies have also figured prominently in large-scale collaborations investigating the effects of other major environmental stressors such as climate change, UV-B irradiation, changes in DOC concentrations and declines in calcium. Results from these sampling programmes have been presented and interpreted by ARG partners and numerous collaborators. Publication highlights for 2016 included a zooplankton recovery paper published by Norm Yan et al., in the *Journal of Limnology* that used historical ARG lake chemistry and zooplankton data. As well, following a series of 2015 papers published in *Nature-Scientific Data* and *Geophysical Research Letters* focused on changes in surface temperature, preliminary assessment of trends in the associated full temperature profile data were presented at the Society for Freshwater Science Conference. In addition, initial findings from a project initiated in 2015 to develop eDNA detection methodologies for zooplankton have now been presented. Further details of recent publications arising from this programme can be found within the publication section of this report. These products underscore the value of continuing the long-term monitoring of the Sudbury SES lakes.

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

An extensive network of collaboration has been established with international researchers. These collaborations are resulting in many journal papers examining climate change/multiple stressor effects on northern aquatic systems. Many more papers are in preparation.

Good working relationships have been developed and are being maintained with First Nation communities at Fort Severn and Peawanuck. Results from our scientific studies in their traditional lands have been provided to the communities on an ongoing basis. Discussions with communities are underway to develop sampling plans in the far north of Ontario for summer 2018. Engaging First Nations in northern science is a continuing priority.

W. Keller is part of a multi-University NSERC network programme – the Canadian Network for Aquatic Ecosystem Services (CNAES). A key element of this programme is the assessment of aquatic ecosystems in the Attawapiskat River watershed of northern Ontario. He has also been assisting with the baseline assessment of aquatic ecosystems in the Ring of Fire area being conducted by the Ontario Ministry of Environment and Climate Change.

During the summer of 2017, field studies focused on two areas of the far north of Ontario.
1) Rivers near Fort Severn (Wasahow First Nation) including the Severn River and the Pipowatin River were sampled for chemistry. These waters are important fishery resources for the community of Fort Severn and their fisheries are under study with university and First Nation collaborators. In the Pipowatin River recording thermisters were also used to track temperature conditions during the sea trout spawning run. Discussions were begun on initiating sampling of sturgeon in the Severn River by community members.

2) Sampling was continued near the community of Peawanuck (Weenusk First Nation). Water chemistry samples were collected from the Winisk River, which is the focus of ongoing fish studies because of its importance as a community food source. Recording thermisters were again used to track thermal conditions in the Sutton River, east of Peawanuck, a world class sea trout fishery.

Science transfer activities focused on the preparation of scientific manuscripts to disseminate the knowledge gained so far from our northern studies. Work has continued on creating a useful, accessible database of far north lake and river data from the studies completed or coordinated to date by the Climate Change and Multiple Stressors Aquatic Research Program at Laurentian University (2009-2017). Datasets on various aspects of lake chemistry and biology have been transferred to the Ministry of the Environment and Climate Change for inclusion in their broad northern Ontario database.

**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 2017 was primarily directed at two fields of research:

1) **Food web structure and contaminant bioaccumulation in northern fish populations.** This work is supported by MNRF Far North Branch, MNRF Regional Operations, MNRF Aquatic Research and Monitoring Section, MOECC Environmental Monitoring and Reporting Branch, NSERC CNAES, 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 2017 was carried out primarily on Near North lakes to support research on ecosystems with multiple apex predators (Savage, MSc). Lake Nipissing was also sampled to support a study of its food web structure (Montgomery, MSc).

2) **Reproductive ecology of northern fishes.** This research is funded by the MNRF Aquatic Research and Monitoring Section, and NE Regional Operations. Research on Lake Nipissing continues to explore the effects of multiple stressors (spawning stock decline, food web disruption) on energy allocation and reproductive ecology of its walleye and white sucker populations. Experimental work was initiated in 2017 to assess the interactive effects of parental traits and spring warming rates on walleye spawning success.
**The 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 Co-op Unit.

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 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 are managed through the Canadian Aquatic Biomonitoring Network (CABIN) online database. Assessment tools for the Near North and Far North of Ontario were designed at the Co-op Unit following review by a national panel of aquatic bioassessment science experts and are now available through the CABIN site.

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 type of environment extraction activities, infrastructure and potential transportation corridors are expected to pass through. A subset was used to support Vanessa Bourne’s MSc research, which she defended this year, examining seasonal variability of biota and water chemistry across the two Ecozones. In addition to CABIN sampling, stream fish communities were sampled in collaboration with the Ministry of Natural Resources and Forestry. Live invertebrates (zooplankton and amphipods) and fish (slimy sculpin) were also collected and transported to Wilfrid Laurier University for future ecotoxicology studies.

No field program was run in 2017, but rather efforts were directed at analyzing data collected to date for upcoming release in a MOECC Ring of Fire Baseline Monitoring report. This report slated for release in 2018 will include contributions from all MOECC groups involved with research and monitoring in this area (groundwater, streams, air, terrestrial). More detailed analyses will follow the production of the report, with plans for future publications.
Fall 2017 FIRNNO sampling focused on a side-by-side comparison of OBBN (Ontario Benthic Biomonitoring Network) and the CABIN (Canadian Aquatic Biomonitoring Network) methods. This comparison study was carried out using existing long-term monitoring sites; both historically impacted by mining activities within Sudbury, as well as some reference sites located further from the city. Sampling for benthic invertebrates was conducted using the standard protocols for each method, in the same location separated by a two week refresh period. Sample data are just becoming available, with statistical comparison of the methods to follow. Data for the reference sites will also eventually be incorporated into an updated Near North RCA Model.

In a new collaborative effort with MNRF colleagues Tom Johnston and Lee Haslam, fish communities were also sampled at these long-term stream monitoring sites. These samples will be examined to provide among the first standardized assessments of biological recovery at the higher trophic level of fishes in the region. Additional samples for water quality, periphyton and sediment were collected once only, in part to have more potential variables for the methods comparison, but also to add to our general knowledge of these long-term sites.

Mine of Knowledge Program: Finding Microbial Solutions to Ecosystems Problems

The Mine of Knowledge program is 5 year $1.65 NSERC funded CREATE program designed to train students in a 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.

**Canadian Network for Aquatic Ecosystems Services (CNAES)**

**Network Lead Scientist**
Dr. Don Jackson, University of Toronto

**Theme I Co-Leaders:**
Dr. John Gunn, Laurentian University
Dr. Brian Branfireun, Western University

**LU/CFEU participants:**
J. Bailey, D. Campbell, J. Gunn, T. Johnston, B. Keller, D. Pearson, H. Swanson

**NSERC funding:** Total of $4,416,625.00 from 2012-17

**Participating Universities:** Toronto, Laurentian, UBC, UQAM, Western, Guelph, Trent, UNB, Waterloo, McGill, Nipissing

**CNAES Graduate Students at LU (to date):**

*Project 1.3 Characterize the structure and function of aquatic ecosystems*

1.3(a) RCA invertebrate surveys – MSc Nicole Novodvorsky (PI John Bailey/John Gunn)
RCA Invertebrate temporal trends – MSc Vanessa Bourne (PI John Bailey/John Gunn)
1.3(b) Zooplankton and Phytoplankton – MSc Josef MacLeod (PI Bill Keller/John Gunn)

1.4 Impact of nutrient additions on wetlands – MSc Amanda Lavallee (PI Daniel Campbell)

*Project 1.5 Characterize the distribution of Hg and MeHg in surface water and freshwater biota*

1.5(a.1) Headwater to Coast Hg Survey – PhD Gretchen Lescord (PI Tom Johnston/John Gunn)
1.5(a.2) Stable Isotopes and Hg – MSc Alexandra Sumner (PI John Gunn/Tom Johnston)
1.5(c) Anadromy and Hg – MSc Rachel DeJong (PI Heidi Swanson, Waterloo)
1.5(d) Anadromy and Fatty Acids – MSc Matt Heerschap (PI Tom Johnston/John Gunn)

1.6 Science Communication and First Nation Engagement – (PI Chantal Sarrazin-Delay/David Pearson)
Partnering agencies: Ontario Ministry of the Environment and Climate Change, Ontario Ministry of Natural Resources and Forestry, Canadian Forest Service, Natural Resources Canada, Parks Canada, Fisheries and Oceans Canada, Central & Arctic Region, Le Ministère des Ressources naturelles et de la Faune du Québec

Partnering Industries and Foundations: DeBeers Canada, Alberta Innovation Technology, Kongsberg Maritime, David Suzuki Foundation

In 2017, the annual CNAES meeting was held at the University of Toronto on April 26-28.

The Sudbury Story – Launched as a Multi-Media Credit Course
Several years in the making, Dr. Nadia Mykytczuk and her team finally launched “Environmental Remediation: Global Lessons from the Sudbury Story” in Jan. 2017 as an in class course (ENSC 4116). With financial support from the Goodman School of Mines, Laurentian, NSERC, industry and private donors, this innovative new e-learning model has taken shape as a spectacular potential signature course for Laurentian University.

The content engages students with past and current VLWLC research findings and gives them access to our vast monitoring data sets, archive of photos and images, as well as interviews with more than 40 of the key industry, government and First Nations scientists who are part of the Sudbury story. In addition to the in-class course, in 2018 the course will be launched online through Laurentian Distance Education and translated into Spanish for wider distribution.

Dr. Nadia Mykytczuk and Chris Elliott put in many long hours filming content for the course.
Twenty seventeen was an exciting year for the Science Communication Program. We officially launched our Masters program in September with a public event at the Vale Living with Lakes Centre. The event attendees heard engaging testimonials from alumni and students about the impact that the program has had on their career path. Our first cohort of Masters students graduated in October 2017 and most of them were employed in their field before walking across the stage to receive their diplomas. Employers of our graduates in 2017 included SNOLab, Climate Change Adaptations Project “UpNorth on Climate” at the Lakes Centre, Science North’s Thunder Bay Outreach operations, Department of Fisheries and Oceans in Ottawa, UNESCO GeoPark Project in Sudbury, the University of Waterloo’s Mathematics Department, and Laurentian University’s Office of Research Services, to name a few.

Dr. Chantal Barriault at the official launch of the Science Communication Masters Program Sept. 18, 2017.

The new Master’s degree has increased the number of applications to the program. We received nearly 40 applications for 15 spots in 2017! We also began offering upgrading opportunities to Graduate Diploma alumni who want the Masters degree. In addition, a draft articulation agreement is in the works with the Environmental Visualization and Communication Graduate Diploma at Sir Sanford Fleming College. This agreement would encourage their graduates to enrol in the Masters degree as an extension of their diploma.

The new Masters 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 the summer and fall of 2017, Dr. Chantal Barriault, Director of the Science Communication Program, was an invited expert and panellist for the Science Journalist Educators Symposia at Concordia University, and for the Canada Science Policy Conference in Ottawa.
One of the highlights of 2017 was attending The Science Writers and Communicators of Canada. Ten Science Communication students were able to participate in this conference thanks in part to the scholarships we received from the Giving Tuesday campaign at Laurentian University. Our program was well represented by the 20 alumni that were also in attendance as part of their job!

The Science Communication Masters 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. The production of high quality research profile videos, will provide Lake Centre researchers with effective communication products that showcase their work for various audiences, through social and traditional media. We also continue 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 synergy is reinforcing our Lake Centre culture of high quality communication, as well as providing excellent videos for our annual Eagle Awards Student Film 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 continued the second and final year of 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 combining 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 that 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.

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. The agreement is designed to build capacity and develop understanding of climate change in First Nations across Ontario; to reduce greenhouse gases through energy planning and renewable energy generation; as well as to engage First Nations in discussion of economic opportunities through Ontario’s cap and trade program. OCCIAR has partnered with the Ontario First Nations Technical Services Corporation to deliver the energy related 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 options and plans in communities. As the work continues, the CC specialists and the CC leaders will 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, Nokiiwin, and Mushkegowuk Tribal Councils as well as with several independent First Nations. We also trained thirteen of NAN’s (Nishnawbe Aski Nation) Climate Change Coordinators and subsequently collaborated with several of them in their communities. 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. Sixteen now have CC Monitors. Over forty First Nations have now been engaged to differing extents with eighteen having completed collection of TEK in the form of audio-recorded interviews of Elders and harvesters.

Special attention has been given to the melting of permafrost and potentially related river bank erosion in the report for Wasaho FN in Fort Severn. We believe there is risk of serious river bank slumping likely related to the thawing of permafrost in the bank. Slumping has already happened in the last ten years just a few kilometres upstream of the community. Seventy five metres has been lost to erosion from the bank along the edge of the current community since 1815.

Another project is using bird song meters or recorders, on loan from Four Rivers Environmental Services of the Matawa Tribal Council, to catalogue songbird species and frog species. Song meters were deployed near Peawanuck, Attawapiskat and Fort Severn in the spring of 2017 adding to the work done in 2016 in Fort Hope and Fort Severn. 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, 2017, where they discussed the results of their interviews, participated in workshops covering greenhouse gas production by bacteria and environmental monitoring techniques, as well as hydroponics with a local high school indigenous leadership program. Environmental staff from GC Treaty 3 were hosted for workshops and training in early 2018.

A major opportunity for networking and discussion will come through the “Up North on Climate Change Conference” for up to 260 invited northern First Nation participants from about 60
northern communities on April 24 -26 in Thunder Bay. The agenda will cover 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.

To further facilitate interaction and knowledge transfer among communities, a trilingual (Ojibway, Cree, and English, with some sections in Oji-Cree) website is being developed. We have created data visualization content and GIFs on the greenhouse effect, seasonal temperature and precipitation change, fire presence, fire seasons, drought, all of which work equally well in print or as website content. An Oji-Cree climate change glossary project has also been initiated. We hope it can eventually be accompanied by the creation of Ojibway and Cree glossaries.

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 impact monitoring, the details of which are currently under discussion. Content will be tried out by the Wildlife Conservation Society in two workshops of the April 24 – 26 conference. 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 is an ongoing part of the project when time can be made available. The project team, led by Chantal Sarrazin-Delay has visited schools for day long, hands-on outdoor and classroom sessions in six schools (Kichenuhmaykoosib Inninuwug, Fort Severn, Attawapiskat, Sandy Lake, Peawanuck, and Poplar Hill) during community visits. In Attawapiskat high school students collected abiotic and biotic baseline data in two comparative studies; pond vs. river and upland vs lowland. We also had the opportunity to spend a full day with Mushkegowuk youth at Camp Chikepak in July 2017 where we ran carbon cycle 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 desk top 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.
Encouraging adaptation to a longer growing season by encouraging people in outdoor vegetable gardening is a community and family-oriented component of the project. In Mocreebec, a dozen family gardens were supported in successfully producing vegetables and fruits this past summer.

Conference Organizing, Program Coordination and Editorial Activities

Arnott, S
- Associate Editor for Ecology 2016-present
- Member of the Canadian Consortium of Aquatic Science Societies (representing ASLO)
- Member of organizing committee for the Joint Aquatic Sciences Meeting
- NSERC RTI Committee Panel 2017
- Chair of Physical Sciences, Mathematics and Statistics, and Computing/Information Sciences Subcommittee of Senate Advisory Committee, Queen’s University, 2016/17

Basiliko, N
- Served as Associate Editor, Canadian Journal of Soil Science (2013-present)
- Served as Review Editor, Frontiers in Microbiology (2011-present)
- Served as Associate Editor, FEMS Microbiology Letters
- Ad-hoc reviewer of >20 journal manuscripts and grant applications

Beckett, P
- Served on organizing committee, was chair of 3 conference sessions and a leader in round table discussions on international co-operation in land reclamation and ecological restoration. LRER 2017, Second International Symposium on Land Reclamation and Ecological Restoration, in Xian, China October 2017.

Belzile, N
- Served as 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
- Science Committee Member and Theme 1 Co-leader for NSERC CNAES program
- Organized the “Get Real” workshop with the Mushkegowuk Environmental Stewards and 4th year Fisheries Science students Sept. 29, 2017

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)
Pearson, D
- Mushkegowuk TC visited the Vale Living with Lakes Centre in November where their climate change Specialist discussed the results of their Traditional Ecological Knowledge interviews and participated in various workshops, organized by D. Pearson and the Climate Change team, including greenhouse gas production by bacteria, environmental monitoring techniques and hydroponics with a local high school's indigenous leadership program.

Ramcharan, C
- Associate Editor, Canadian Journal of Fisheries and Aquatic Sciences.
- Member of the Science, Engineering, and Architecture Executive Council

Swanson, H
- Associate Editor, Canadian Journal of Fisheries and Aquatic Sciences
- Session co-organizer and co-chair, Society for Ecotoxicology and Chemistry North America Meeting, Minneapolis, MN

Tanentzap, AJ
- Served as Associate Editor at the Journal Nature Scientific Reports
- Served as Associate Editor at Journal of Vegetation Science

Watmough, SA
- Director of the Trent School of the Environment (appointed June 2016).
- Member of the selection panel for Ontario Research Fund/CFI (Environment) – Toronto, May 2017
- Helped organize Canadian Soil Science Society Meeting at Trent, June 2017
- Member of a NSERC industrial Chair Evaluation Committee, Thompson River University
- Ad-hoc reviewer of 28 journal manuscripts

**Partners and Collaborators**

**Industry**
- Vale Ltd.
- Glencore Sudbury INO
- DeBeers Canada Inc.

**Partners and Collaborators**
- Algoma University
- Appalachian State University
- City of Greater Sudbury
- Cornell University
- Dept. of Fisheries and Oceans Canada
- Environment and Climate Change Canada
- Goodman School of Mines
- Government of Northwest Territories
- Great Lakes Forestry Centre, NRCAN-CFS
- Lakehead University
- Laurentian University
- McGill University
- McMaster University
- Michigan Tech U
• Natural Resources Canada
• Nipissing University
• OMOECC
• OMNRF
• Ontario Forest Research Institute (MNRF)
• Queen’s University
• Ryerson University
• Skidmore College
• South West U. of Science & Technology
• Trent University

Others

• Aboriginal Aquatic Resources and Oceans Management Program
• Arctic Institute of Community Based Research
• Canadian Kraft Papers
• Dehcho First Nations
• Domtar
• DMI- Peace River
• Grand Council Treaty 3
• Great Lakes Fishery Commission
• Haliburton Forest and Wildlife Reserve
• J.D. Irving Ltd.
• Keewaytinook Okimakanak (Northern Chiefs) Tribal Council and member First Nations
• Kitchenuhmaykoosib Inninuwug
• Kluane First Nation
• Manitoulin Streams
• Marten Falls First Nation
• Matawa Tribal Council (Four Rivers Inc.) and member First Nations
• Universidad de Santiago de Chile
• University of Alberta
• University of Cambridge
• University of Geneva, Switzerland
• University of New Brunswick
• University of Sherbrooke
• University of Toronto
• University of Waterloo
• University of Winnipeg
• Western University
• Wilfrid Laurier University
• York University

Book Chapters


Publications
Co-op Unit Members authored or co-authored numerous publications in 2017:


Azan SSE and SE Arnott. 201X. The impact of calcium decline on population growth rates of crustacean zooplankton in Canadian Shield lakes. Limnology and Oceanography 63:602-616.


Celis-Salgado MP, W Keller, MT Arts and ND Yan. 201X. Digestive tract variations as indicators of metal induced stress in four species of Daphnia. Hydrobiology. Under review.


Cott PA, AM Muir, CC Krueger, TA Johnston and JM Gunn. 201X. Buoyancy control mechanisms in deepwater fish assemblages of Nearctic lakes. Fish and Fisheries. Under review.


Diochon A, N Basiliko, M Krzic, T Yates, E Olson, J Masse, B Amiro and D Kumaragamagam. 2017. Profiling Undergraduate Soil Science Education in Canada: Status and Projected Trends. Canadian Journal of Soil Science 92:122-132 *Note that this paper has been highlighted as a Canadian Science Publisher’s “Editor’s Choice”.

Durant AC, MP Celis-Salgado, S Ezatollahpour, ND Yan, SE Arnott, A Donini. 2018. Ca\textsuperscript{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.

Eimers MC, N Hillis and SA Watmough. 201X. Phosphorus deposition in a low phosphorus landscape: sources, accuracy and contribution to declines in surface water P. Ecosystems. DOI: 10.1007/s10021-017-0184-2.

Emilson C, D Kreutzweiser, J Gunn and N Mykytczuk. 2017. Leaf-litter microbial communities in boreal streams linked to forest and wetland sources of dissolved organic carbon. Ecosphere 8(2) e01678.10.1002/ecs2.1678.


Senhorinho GNA, CA Laamanen and JA Scott. 201X. Bioprospecting freshwater microalgae for antibacterial activity from water bodies associated with abandoned mine sites. Phycologia. In press.


Sinclair JS and SE Arnott. 201X. Local context and connectivity determine the response of zooplankton communities to salt contamination. Freshwater Biology. Revision submitted.


Reports


Conference Presentations


Baker LF, KJ Artym and HK Swanson. Optimal sampling methods for modeling the occupancy of Arctic Grayling (Thymallus arcticus) in the Canadian barrenlands. CCFFR/CCRP/SCL. Montreal, QC. 5-8 Jan 2017.


Bourne V, J Bailey and JM Gunn. Biomonitoring under changing climate conditions: assessing seasonal variability of benthic macroinvertebrate communities and stream characteristics in two ecozones in northern Ontario, Canada. SFS, Raleigh, NC. 4-8 June 2017


Branfireun BA, N Zabel and HK Swanson. Mercury and methylmercury in tributary inputs to Kluane Lake, Yukon Territory, Canada. 13th International Conference on Mercury as a Global Pollutant, Providence, RI. 16-21 Jul 2017.


Gunn JM, B Keller, N Yan. Ecosystem services revealed by massive remedial efforts in the mining region of Sudbury, Canada. SFS, Raleigh, NC. 4-8 June 2017


Laird M, J Aristizabal Henao, K Stark, G Low, H Swanson, M Ratelle and B Laird. Characterizing dietary methylmercury exposure in subarctic First Nations communities in the Dehcho region of
the Northwest Territories, Canada. 13th International Conference on Mercury as a Global Pollutant, Providence, RI. 16-21 Jul 2017.

Lavender TM and 10 others. InVestIng in Aquatic Ecosystem Services: Improving conservation decision-making with the incorporation of a seasonal cryosphere in the modelling of water quantity. GLEON 19 All Hands’ Meeting, New Paltz, NY. Nov 2017. Poster.

Lavender TM and 10 others. InVestIng in Aquatic Ecosystem Services: Improving conservation decision-making with the incorporation of a seasonal cryosphere in the modelling of water quantity. CCFFR/CCRP/SCL. Montreal, QC. 5-8 Jan 2017.


Lescord GL, B Branfireun, TA Johnston, E Szkokan-Emilson and JM Gunn. Assessing dissolved organic matter (DOM) quality and its effects on mercury (Hg) bioaccumulation across a large freshwater watershed in the Canadian boreal zone prior to mining development. CCFFR/CCRP/SCL. Montreal, QC. 5-8 Jan 2017. Poster.


Spiers G and PJ Becket. From Barrens to Recovery – The Sudbury experience of repairing damaged ecosystems. Faculty of Soil Science, Moscow State University. 4 April 2017. Invited.


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


Swanson HK. Community-driven research in understanding and predicting fish mercury levels in northern lakes: two case studies. Environment Canada (Canada Center for Inland Waters) Seminar Series. 23 Mar 2017. Invited.


Swanson HK, G Low and BA Branfireun. Among-lake variability in food fish mercury concentrations in the Dehcho region, NT. Northern Contaminants Meeting 25th Anniversary Results Workshop, Yellowknife, NT. 26-28 Sept 2017.


Tanentzap AJ. Regreening landscapes: from RELATED to L-CARE. L-CARE Initiation Workshop, Sudbury, ON. 22 Feb 2018.

Tanentzap AJ. Loosening the pipes on the global carbon cycle: is fire releasing old carbon into receiving waters? ArcticNet International Arctic change Conference, Québec City, QC. 11-15 Dec 2017.


Research Grants

Alarie, Y
- NSERC Discovery 2016-2017

Arnott, S
- 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)
- OMOECC, Best in Science, Linking road salt application, lake chloride concentration, and biotic thresholds in Canadian Shield lakes (2017-2020)
- OMOECC, Drivers of food web change in Lake Simcoe (2017-2019)
- OMOECC, 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 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). EOI successful in March 2017; full proposal submitted in April 2017 for NSERC administrative review and final proposal submitted in June 2017. $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 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.

- NSERC Canada Research Chair Tier II in Environmental Microbiology (2013-2018)

- 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. B Branfireun PI (Western), N Basiliko and 3 others

- NSERC Collaborative Research and Development Grant (CRD) Enhancing dewatering, drying, combustion and utilization of pulp and paper mill biosludge. G Allen (PI), N Basiliko and 7 others (2017-2020)

- US Department of Energy, Joint Genome Initiative. Fungal, bacterial, and archaeal communities mediating C cycling and trace gas flux in peatland ecosystems subject to climate change. E Lilleskov (USFS) PI, Basiliko, and 3 others

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

- Vale Ltd., Aquatic Restoration Group
- Glencore’s Sudbury Integrated Nickel Operations, Aquatic Restoration Group
- Ministry of Environment and Climate Change, Aquatic Restoration Group
• Ministry of Environment and Climate Change, Ring of Fire Baseline Data Collection Programme

**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 Canadian Network for Aquatic Ecosystem Services (2012-2017 Jackson et al.)
- NSERC CREATE Training Program (ÉcoLac) for the study of lake and river ecology (2014-2019-, 11 co-PIs)
- Wildlife Conservation Society Canada, Food web structure and mercury bioaccumulation in fish communities of large rivers of the Far North of Ontario (with Keller and Johnston)

**Johnston, T**

- NSERC Discovery Program. Individual specialization and the trophic niche of aquatic consumers (2015-2020)
- NSERC Canadian Network for Aquatic Ecosystem Services (2012-2017 Jackson et al.)
- 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**

- NSERC Canadian Network for Aquatic Ecosystem Services (2012-2017 Jackson et al.)
- Ontario Ministry of the Environment and Climate Change, Climate Change and Multiple Stressor Research Support

**Mykytczuk, N**

- NOHFC IRC in Bioming, 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, MOECC 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)

• NSERC Strategic Network Enhancement Initiative – video workshops (SNEI / CNAES)

Spiers, G


• Ontario Ministry of the Environment and Climate Change: 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**
- Fisheries and Oceans Coastal Restoration Fund: Restoration of anadromous Arctic Char (*Salvelinus alpinus*) and Dolly Varden (*Salvelinus malma malma*) near Kugluktuk, NU
- NSERC Discovery Program, Aquatic ecology and contaminant accumulation in northern lakes: understanding and predicting change
- NSERC Northern Research Supplement, Aquatic ecology and contaminant accumulation in northern lakes: understanding and predicting change
- NSERC Collaborative Research and Development Grant, Investigating occupancy, habitat use, and migrations of Arctic Grayling (*Thymallus arcticus*) in northern barrenland streams
- DeBeers Canada Inc., Movement and habitat use of Arctic grayling (*Thymallus arcticus*) near a diamond mine development
- US Fish and Wildlife Service: Biological responses to warming lake temperatures in the Barrow/Atqasuk focus watershed
- Cumulative Impacts Monitoring Program: Bioaccumulation and biomagnification of mercury in Dehcho lakes

**Tanentzap, AJ**
- UK Department for Business, Energy and Industrial Strategy with support from NERC Arctic Office, Loosening the pipes on the global carbon cycle: is fire releasing old carbon into receiving waters? Collaborating with U of A on permafrost peatlands in western NWT.
- 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)
- Royal Society, Explaining large-scale variation in methane emissions from a major ecological source

**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)
- OMNRF, Modelling Ca patterns in low Ca Boreal Lakes (2016-2017)
• 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)

Theses Completed

PhD
Appiah-Hagan, Emmanuel, PhD Material Sciences. Utilization of coal fly ash and grape waste to remove toxic metal ions in mining waste waters. Laurentian University (Belzile/Chen)

Sinclair, James, PhD. Teasing apart the relative importance of propagule size, number, diversity, and condition. Queen’s University (Arnott)

Stasko, Ashley, PhD. Investigations into food web structure in the Beaufort Sea. University of Waterloo (Swanson)

MSc
Bourne, Vanessa, MSc. 2017. Biomonitoring under changing climate conditions: Assessing seasonal variability of benthic macroinvertebrate communities and stream characteristics in two ecozones in Northern Ontario, Canada. Laurentian University (Gunn/Bailey)

Brekke, Lorraine (Sawdon), MSc. Comparison of two indexed gill-netting protocols for fish community surveys in northern lakes. Laurentian University (Gunn/Johnston)

DeJong, Rachel M.Sc. The influence of anadromy on mercury concentration of fish in coastal rivers of the Hudson Bay Lowlands. University of Waterloo (Swanson)

Fitch, Amelia, MPhil. Links between land and lakes: Effects of terrestrially-sourced organic matter on sediment bacterial functioning and diversity in a dark and clear boreal lakeUniversity of Cambridge (Tanentzap)

Hanson, Andrea, MSc. Testing technosols over an ultramafic gradient for rehabilitation of diamond mine wastes in a subarctic region. Laurentian University (Campbell)

Heerschap, Matthew, MSc. Ecology and food quality of fishes in coastal rivers of the Far North of Ontario. Laurentian University (Gunn/Johnston)

Jamieson, Tyler, MSc. The direct and indirect effects of woody debris influx resulting from selective timber harvest on in-stream nutrient pools in streams located in the Canadian Shield region of south-central Ontario. Trent University (Co-Sup Watmough)
Lavallee, Amanda MSc. The effects of simulated wastewater nutrient amendments on Sphagnum productivity and decomposition within a subarctic ribbed fen. Laurentian University (Campbell)

Nicholson, Michele, MSc. Community-level response following treatment with Zequanox© - a biocide for invasive zebra and quagga mussels. Queen’s University (Arnott /Johnson)

Rantala-Sykes, Brittany M.Sc. Developing protocols for the collection and valuation of wild native seed from the Hudson Bay Lowland. Laurentian University (Campbell)

Treasure, Theresa, MSc. The impact of selection harvesting on soil properties and understory vegetation in canopy gaps and skid roads in central Ontario. Trent University (Co-Sup Watmough)

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

Yakimovich, Kurt. M.Sc. Examining anaerobic microbial communities that direct the fate of terrestrial carbon in lake sediments. Laurentian University (Basiliko/ Mykytczuk)

Zabel, Nelson. M.Sc. Environmental controls of sediment mercury accumulation in a large, glacially-fed lake. University of Waterloo (Swanson)

Undergraduate

Brougham, Kaitlyn, BSc Honours. A multiyear assessment of the relative importance of local and regional factors in driving zooplankton community composition in the Frontenac Arch Biosphere. Queen’s University (Arnott)

Calabrese, Deanna, BSc Honours. Comparing calcium depleted lakes and soils in Muskoka, Ontario. Trent University (Watmough)

Ciric, Emma, BSc Honours. Beaded Streams: A case study in the Blackstone Uplands, Yukon Canada. Laurentian University (Roy-Léveillé)

Grimm, Eric, BSc Honours. Is there evidence of forest eutrophication caused by industrial emissions in the Athabasca Oil Sands Region (AOSR) of Alberta? Trent University (Watmough)

Murray, Liam, BSc Honours. The impact of anthropogenic debris dams on benthic invertebrate communities in a selectively harvested watershed. Trent University (Watmough)
**HQP Supervised**

Anderson-Butcher, Jennifer, BSc Honours in progress, Laurentian (Mykytczuk)
Basso, Jacob, BSc Honours in progress. University of Waterloo (Swanson)
Bloomfield, Emma, BSc Honours in progress. Queen’s University (Arnott)
Casamatta, Maria, BSc Honours in progress. Trent University (Watmough)
Courchesne, Jordan, BSc Honours in progress. Laurentian University (Gunn /Edwards)
Hilgendag, Isabel, BSc Honours in progress. Laurentian University (Gunn /Edwards)
Humphries, Zoe, BSc Honours/Co-op. University of Waterloo (Swanson)
Kirkwood, Adam, BSc Honours in progress. Laurentian University (Roy-Léveillé)
Lousté-Fillion, Jasmine, BSc Honours in progress. Laurentian University (Gunn)
Mozzon, Christina, BSc Honours in progress. Laurentian (Johnston)
Packull-McCormick, Sara, BSc Honours/Co-op. University of Waterloo (Swanson)
Quesnel, Michelle, BSc Honours in progress. Laurentian (Johnston)
Remillard-Scott, Candice, BSc Honours in progress. Laurentian University (Roy-Léveillé)
Spence, Rebecca, BSc Honours in progress. Trent University (Watmough)
Tremblay, Nathalie, NSERC USRA and BSc Honours in progress, Laurentian (Mykytczuk)

Bieniek, Arielle, MSc Candidate, Laurentian University (Mykytczuk/Merritt)
Bird, Adam, MSc Candidate, Trent University (Watmough)
Dart, Michelle, MSc Candidate, Laurentian University (Basiliko)
Deighton, Holly, MSc Candidate, Trent University (Watmough)
Desjardins, Sabrina, MASc Candidate, Laurentian University (Scott/Basiliko)
Gilbert Parkes, Spencer, MSc Candidate, Trent University (Watmough)
Greco, Danielle, MSc Candidate, Queen’s University (Arnott)
Guernon, Stephanie, MSc Candidate, University of Waterloo (Swanson)
Hart, Saskia, MSc Candidate, Laurentian University (Basiliko)
Hoage, Jesse, MSc Candidate, Laurentian University (Basiliko)
Johnston, Leland, MSc Candidate, Laurentian University (Basiliko)
Kerr, Mary, MSc Candidate, Laurentian University (Roy-Léveillé)
Lewis, Brent, MSc Candidate, University of Waterloo (Swanson)
McClymont, Alexandra, MSc Candidate, Queen’s University (Arnott)
Methé, Alexandra, MSc Candidate, Laurentian University (Mykytczuk/Merritt)
Mitchell, Katlyn, MSc Candidate, Laurentian University (Mykytczuk)
Montgomery, Jamie, MSc Candidate, Laurentian University (Gunn/Johnston)
Munford, Kimber, MSc Candidate, Trent University (Watmough)
Principe, Emilia, MSc Candidate, Laurentian University (Mykytczuk/Schindler)
Rumney, Robyn, MSc Candidate, Laurentian University (Gunn/Basiliko)
Savage, Pascale, MSc Candidate, Laurentian University (Gunn/Johnston)
Schmidt, Elliott, MSc Candidate, Laurentian University (Mykytczuk/Schulte-Hostedde)
Serré, Jasmine, MSc Candidate, Laurentian University (Beckett/Spiers)
Snyder, Tom, P/T MSc Candidate, Laurentian University (Basiliko)
Suenaga, Erin, MSc Candidate, Queen’s University (Arnott)
Valiquette, Nicole, MSc Candidate, Laurentian University (Mykytczuk/Merritt)
Wittmann, Amanda, MSc Candidate, Laurentian University (Gunn/Edwards)
Yee, Caleb, MSc Candidate, Queen’s University (Arnott)

Burke, Samantha, PhD Candidate, University of Waterloo (Swanson)
Carson, Michael, PhD Candidate, Laurentian University (Basiliko)
Gupta, Varun, PhD Candidate, Laurentian University (Gunn/Mykytczuk)
Hasnain, Sarah, PhD Candidate, Queen’s University (Arnott/Day)
Jones, Chris, PhD Candidate, Laurentian University (Gunn/Edwards)
Lavender, Mike, PhD Candidate, Queen’s University (Arnott)
Lescord, Gretchen, PhD Candidate, Laurentian University (Gunn/Johnston)
McDonough, Andrew, PhD Candidate, Trent University (Watmough)
Orland, Chloe, PhD Candidate, University of Cambridge (Tanentzap)
Reid, Carolyn, PhD Candidate, Trent University (Watmough)
Woodman, Sam, PhD Candidate, University of Cambridge (Tanentzap)

Asemaninejad Hassankiadeh, Asma, PDF, Laurentian (Basiliko/Mykytczuk)
Baker, Leanne, PDF, University of Waterloo (Swanson)
Celis-Salgado, Martha, PDF, FLAMES lab (Arnott)
Khan, Madiha, PDF, Laurentian (Mykytczuk)
Puukila, Stephanie, PDF, NOSM (Boreham/Gunn)
Tharmalingam, Sujeenthar, PDF, NOSM (Boreham/Gunn)
Thome, Christopher, PDF, NOSM (Boreham/Gunn)

Adkinson, Kevin, Research Technician, Trent University (Watmough)
Coppock, Alice, Research Assistant, Cambridge (Tanentzap)
Olson, Freya, Research Assistant, Cambridge (Durham) (Tanentzap)
Nguyen, Amy, Lab Technician, University of Waterloo (Swanson)

**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, Sault Ste. Marie
Emilson, Erik

Norwegian University of Life Sciences
Rosseland, Bjorn O.

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

York University
Yan, Norman (Emeritus)

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, MOECC
Bourne, Vanessa - Freshwater Ecology and Bioassessment Biologist, MOECC
Edwards, Brie - MOECC 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
Haslam, Lee - Senior Fisheries Technician, MNRF
Heneberry, Jocelyne - Monitoring Coordinator, MOECC
Johnston, Tom - MNRF Senior Research Scientist/LU Adjunct
Keller, Bill - Director, Climate Change and Multiple Stressor Aquatic Research, LU
McCourt, Jason - Environmental Officer, MOECC
Middleton, Katherine - Public and First Nations Communications Specialist, LU
Mykytczuk, Nadia - NOHFC IRC in Biomining, Bioremediation and Science Communication, LU
Novodvorsky, Nicole – Freshwater Ecology and Bioassessment Biologist, MOECC (Dep. April)
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 - Lab Manager and Climate Change Project, Living with Lakes Centre, LU
Witty, Lynne – Invertebrate Taxonomist, MOECC

Field Technicians and Research Assistants
Anderson-Butcher, Workstudy Summer Research Assistant (Mykytczuk)
Boudreau, Amy, Research Assistant (Johnston)
Couchesne, Jordan, Workstudy Summer Research Assistant (Gunn)
Croteau, Tannis, Workstudy Summer Research Assistant (Pearson)
Lehman, Sara, Term Fisheries Technician, MNRF (Johnston)
Louste-Fillion, Jasmine, Summer Research Assistant (Gunn)
Moxam, Keely, Research Assistant (Basiliko)
Mozzon, Christina, MNRF Summer Tech, Fall Research Assistant (Johnston)
Quesnel, Michelle, MNRF Summer Tech, Fall Workstudy Research Assistant (Johnston)
Remillard-Scott, Candice, Summer Research Assistant (Pearson)
Robinson, Bryce, Lab Technician (Basiliko)
Wilcox, Eric, Field Technician, MOECC (Heneberry)