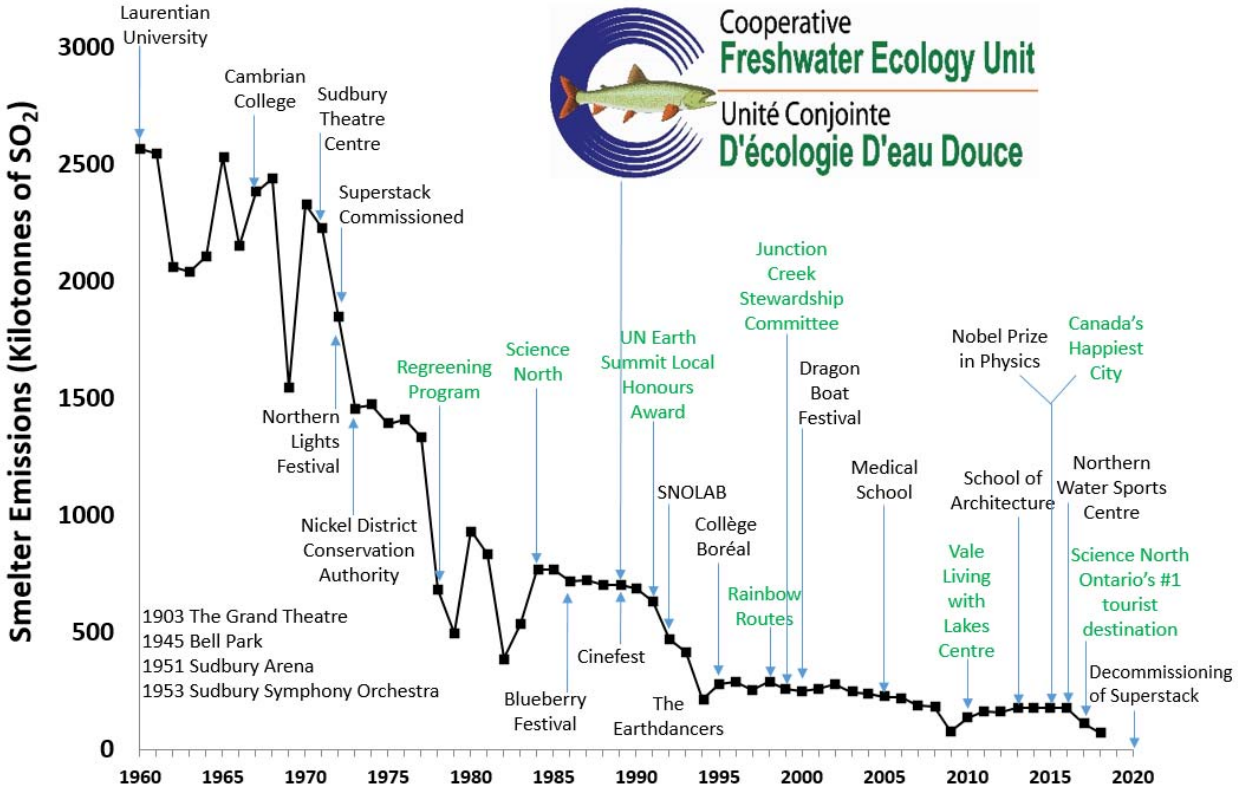
Cooperative
Freshwater Ecology Unit
Unité Conjointe
D'écologie D'eau Douce

2019
Annual Report
Cooperative Freshwater Ecology Unit
Celebrating 30 Years of Partnership
1989-2019



Timeline of the creation of the CFEU and other community assets plotted against the background of the declining pollution levels in Sudbury.

Awards and Recognition

- 2019 marked 30 years of partnership for the Cooperative Freshwater Ecology Unit! We celebrated all year long, beginning with a Builders and Founders wine and cheese event on April 17, then a special CBC Ideas episode on April 22, followed by the 7th International Mining and Environment Conference with a special L-Care symposium on June 27, then the Annual Watershed Lecture/grad student symposium featuring CFEU member Dr. Shelley Arnott on September 20, and finally a 30th Anniversary Homecoming weekend and family camping event for CFEU Alumni in Killarney in September 20-22. The CFEU unique university/government/industry partnership was also featured as the cover story in Laurentian's 2019 issue of The Key for Research Week, and by Vale Ltd., one of our industrial partners, in the Vale News in June. It was a great year, we had much to celebrate, and we are looking forward to celebrating many more milestones in the future! Symbolic of this forward looking perspective was the ceremonial planting of the first trees in the "carbon offset forest" at the Lake Centre.

- We were delighted to be part of a CBC Special about Sudbury produced and hosted by Paul Kennedy on International Earth Day, Monday April 22, 2019. The episode entitled "The Sudbury Effect: Lessons from a Regreened City", with its many CFEU voices, reached a global audience with our important story on how good leadership, regulations and innovations can save an economy and help a community to grow.

- Dr. Nadia Mykytczuk represented women in science, youth, innovation and technology, and of course Laurentian University, as part of a panel on 'Our planet's future: Are we doomed or is there hope?', at the Glen Gould Theatre in Toronto on June 5, 2019 as Paul Kennedy hosted his last recording of CBC IDEAS, ending a 50 year career in radio. She shared the stage with the famous Indigenous scholar Henry Lickers and the award winning photographer Edward Burtynsky. The program was broadcast on June 24.

- Dr. Nathan Basiliko took home a Top 10 Research Achievement award in Feb. 2019 during Laurentian's Research Week. He was also named President of the Canadian Society of Soil Science.

- Dr. David Pearson became an Honourary Member of the Ontario Association of Architects (OAA) in May 2019 at their Annual Conference in Quebec City, QC. Dr. Pearson was recognized for the key roles he has played in the development of some incredible building projects in Sudbury (Science North, Lake Centre etc.).

- MASc Candidates Miranda Gauthier and Merritt Kennedy, PhD Candidate Sabrina Desjardins, Post Doc Dr. Gerusa Senhorinho, Dr. Corey Laamanen, Dr. Ashley Scott and Dr. Nathan Basiliko were a winning combination when their project won The Voyageurs Innovation Challenge at Laurentian's Research Week in 2019. Their project aims to help remote northern communities capture carbon dioxide from diesel-powered generators, and use that captured gas to grow microalgae. Those microalgae produce beneficial compounds that include antioxidants and other health benefits.

- We welcome Dr. Corey Laamanen, master lecturer in The Bharti School of Engineering and a member of the ONGEN research and development group, as a new member of the CFEU.

- Dr. John Gunn and Dr. Nadia Mykytczuk represented Laurentian University in a tour of a number of Peruvian universities on May 5-10, with a final presentation describing the Sudbury recovery story at the Canadian embassy in Lima.

Student Scholarships, Fellowships, Bursaries

- Jade Dawson, MSc Candidate Laurentian (Edwards/Gunn), Dean's Entrance Scholarship and Tom Peters Memorial Mine Reclamation Award (for poster)

- 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.

- Varun Gupta, PhD Candidate Laurentian (Mykytczuk/Gunn), won the Tom Peters Memorial Mine Reclamation Award for Student Oral Presentation, 1st Place at the International Mining and Environment Conference in Sudbury, ON

- Adam Kirkwood, MSc Candidate Laurentian (Roy-Léveillée/Basiliko) won an NSERC CGS scholarship in 2019 and the W. Garfield Weston Award in Northern Research. He also won Best Student Presentation 2019 at 18th International Conference on Cold Regions Engineering & 8th Canadian Conference on Permafrost

- Jonathan Lavigne, MSc Candidate Laurentian (Basiliko), was the recipient of the St. Lawrence Seaway Climate Change Scholarship

- Sarah Lehman, MSc Candidate Laurentian (Gunn/Johnston), was the recipient of the R.W. Drysdale memorial Scholarship in Aquatic Science

- Gretchen Lescord, PhD Laurentian (Gunn/Johnston), received the Governor General's Gold Medal, awarded to the graduating student enrolled at Laurentian University who has achieved the highest academic standing, with first class honours, in their Masters or PhD degree program on the occasion of her graduation in Jun 2019.

- Eric Massa, PhD Candidate Queen's (Arnott) received an International Tuition Award.

- Katie Mitchell, MSc Candidate Laurentian (Mykytczuk), won the Tom Peters Memorial Mine Reclamation Award for Student Oral Presentation, 3rd Place at the International Mining and Environment Conference in Sudbury, ON

- Shrisha Mohit, MSc Candidate Queen's (Arnott), received a Craigie Fellowship for Aquatic Research and won Best Poster at ICAIS in Montreal Oct. 2019.

- Aparna Mukerji, MSc Candidate Laurentian (Gunn), received the DFO- Fisheries and Ocean Canada's Bursary and a NSERC OGS scholarship.

- Science Communication student Chelsea Pike won the 3-minute thesis Competition at Laurentian's Research Week in 2019. Chelsea's research looks at online discourse (through social media) around the topic of fetal alcohol spectrum disorder.

- Robyn Rumney, MSc Candidate Laurentian (Gunn/Basiliko), won a Tom Peters Memorial Mine Reclamation Award for her Student Poster Presentation at the International Mining and Environment Conference in Sudbury, ON

- Undergraduate student Megan Silverthorn won an NSERC USRA Queen's (Arnott)

- Xinyu Sun, PhD Candidate Queen's (Arnott), received a Craigie Fellowship for Aquatic Research, International Tuition Award.

- Undergraduate student Nicholas Zannier won an NSERC USRA Laurentian (Basiliko)

Community Outreach

- Dr. Shelley Arnott gave the following public lectures in 2019:
  - ~ Presentation for Queen's Saturday Club, Salty Waters: How winter road salt application is impacting freshwater zooplankton communities, Wed, 20 Nov.
  - ~ Math/Biology symposium, Queen's University Biological Station, Invasive species in the Rideau lakes.
  - ~ Aqua-hacking workshop, subject expert and co-presenter, Being Less Salty. 13 July

- 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 2019:
  - ~ 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 and Board Member
  - ~ Rainbow Routes: Environmental Advisor and Board Member
  - ~ Sudbury Naturalists: Co-chair
  - ~ Friends of Mashkinonje Park: President
  - ~ Sudbury Science Fair Judge

  Dr. Beckett also made the following presentations:
  - ~ Gave presentation at Cambrian College on Healing the Sudbury Landscape to 30 students from the College's Environmental Monitoring and Impact Assessment Program and Environmental Technician Program Mar 8

~ Gave a presentation (with G. Spiers) on Regreening Sudbury and a tour of Kelly Lake hill before and after treatment sites as well as Copper Cliff sites to 20 students enrolled in the Mineral Exploitation and Biosphere Program at Laurentian University Mar 31
~ Gave a presentation (with G. Spiers) presentation on 40+ years of Regreening the Sudbury Landscape and a tour of a number of treated sites to 15 students from Camborne School of Mines (United Kingdom) as part of the M.Sc Field School Ontario 2019 Tour Apr 10
~ Gave tour of the Jane Goodall Trail for 25 participants from the Ontario Nature Regional meeting with F. Mariotti and G. Spiers May 11
~ Led a Geology and Regreening Tour of Sudbury for 50 delegates attending the Sudbury Mining and the Environment International Conference (with Shirley Péloquin, Sudbury District Geologist) Jun 23
~ Gave a regreening tour around the Jane Goodall Trail for 25 Grade 12 students from Canadian Ecology Centre Earth and Space Science Course Jul 4
~ Led field walks on behalf of VETAC for Sudbury residents and visitors at the Jane Goodall Trail and Dynamic Earth respectively Jul 6
~ Provided an on-site seminar and tour (with G. Spiers) for 28 teachers from Mining Teachers Tour Course from Canadian Ecology Centre Aug 12
~ Gave a presentation followed by a tour (with G. Spiers) on 40 years of Sudbury Regreening to 15 students in the third year field camp from the Environmental Monitoring program from Sault College Sept 5
~ Spoke to 70+ First year School of Architecture Students on aspects of regreening Sudbury in a crowded BioSki Cottage Sept 5
~ Gave an invited lunchtime review of Sudbury Regreening over 40 years to the Laurentian University Retirees Group at the Northbury Hotel Nov 15
~ On behalf of the Minnow Lake Restoration Group Peter gave a Thanksgiving tour to over 100 residents of and visitors to Sudbury though the Oak Forest trails that included looking at past Regreening activities Oct 14

Dr. Beckett was also featured in the following articles:

~ 'Seeing is believing – Sudbury's Regreening Program', Green Living magazine, EarthCare Sudbury, page 15. Summer 2019
~ 'Regreening plays a big role in protecting water quality, study finds', by Darren MacDonald, Sudbury.com Aug 19
~ 'Vale continues annual aerial seeding targeting barren land south of Coniston - Company says annual reseeding across area an attempt to correct 'some historic mistakes', CBC News Sept. 25
~ 'Sudbury's acid-damaged lakes have recovered faster than expected, experts say', C. Romaniuk, Northern Ontario Business, 30 Oct 2019 and Sudbury.com 31 Oct 2019
~ 'Sudbury's regreening inspired this Seattle architect to rethink how humans build', C. Romaniuk, Sudbury.com Nov 8
~ Sudbury's green miracle still not complete - 'We've shown the world what we can do. Now it's time to finish the job that we started four decades ago', Bill Steer (based on interview with P. Becket), Special to The Nugget, Sudbury Star. 25 Sept

- Rachel DeJong M.Sc. was a guest lecturer for Fisheries Ecology Course, Laurentian University, Sudbury, ON. Jan. 2019. “Life history characteristics of lake whitefish (*Coregonus clupeaformis*), cisco (*Coregonus artedi*), and northern pike (*Esox lucius*) in rivers of the Hudson Bay Lowlands”.

- Dr. Brie Edwards was an invited at MECP Inland Lakes and Northern Science Unit, Science Day, Huntsville ON, May 2019. “50 years of monitoring Sudbury lake recovery”.

- Dr. Erik Emilson served as a Judge in the Sault Ste. Marie Rotary Science Fair in April and Hosted Indigenous Interns from local communities at the Great Lakes Foresty Centre in winter 2019.

- Dr. John Gunn participated in the following public outreach initiatives in 2019:
  - ~ Served as an expert member for the City of Greater Sudbury Watershed Advisory Panel
  - ~ Made public presentation on ‘Science in the Park’ at Killarney Provincial Park (Sept)
  - ~ Featured in article ‘Lots done, lots still to do, top biologist says’, The Sudbury Star, 13 Jan
  - ~ Contributed ‘Cleaning up abandoned mines means we all pay the price’, The Conversation, 31 Jan. This article was picked up by the National Post and run on 1 Feb.
  - ~ Featured in ‘Research Week: 30 Years of Successful Partnership at the Co-op Unit: Many More to Come’ by M Homayed, Sudbury.com 21 Mar 2019
  - ~ Guest columnist for Northern Ontario Business, ‘Moonscape Sudbury deserves global recognition for its environmental 180’, 7 Jun 2019
  - ~ Featured in ‘Why not try to return what was there?’, J. Moodie, The Sudbury Star, 13 Sept 2019
  - ~ Featured in Mount Allison Summer 2019 issue of The Record ‘Online Exclusive: Living with Lakes’
  - ~ Featured in ‘Sudbury’s acid-damaged lakes have recovered faster than expected, experts say’, C. Romaniuk, Northern Ontario Business, 30 Oct 2019 and Sudbury.com 31 Oct 2019
  - ~ Travelled with the Laurentian Goodman School of Mines delegation to Peru 5-10 May 2019 and presented ‘The Sudbury Story’
  - ~ Participated in One Day workshop for Developing Indigenous Environmental Keepers Program on ‘Environmental Remediation, Global Lessons from the Sudbury Story’, 8 Jan 2019

- MSc Student Adam Kirkwood was on CBC radio on Mar 1 to discuss the Fridays a Future Climate Strike. #FridaysforFuture is a peoples movement following the call from @GretaThunberg to school strike for climate action. Adam spent time with a great group of motivated kids doing science based activities and making posters and also organized and information picket at the main entrance to Laurentian that afternoon. Adam sits on the Fridays for a Future Steering Committee and helped organize events thoughout the year including a Climate Rally on Sept. 26 that drew over 700 people at which he was also an

emcee. He was featured in the Sudbury Star article 'Call for climate justice – Sudbury rally draws more than 700' by B Leeson on Sept. 27, 2019.

- Dr. Nadia Mykytczuk participated in the following outreach initiatives in 2019:
  - ~ Invited Panelist for 'She and Her: UN International Day of Women and Girls in STEM', 11 Feb 2019
  - ~ Participated in One Day workshop for Developing Indigenous Environmental Keepers Program on 'Environmental Remediation, Global Lessons from the Sudbury Story', 8 Jan 2019
  - ~ Presented a talk entitled 'Innovation in biomining and bioremediation' at the Modern Mining and Technology Sudbury Luncheon 12 Apr 2019.
  - ~ Presented 'Innovation in booming and bioremediation and the Environmental Remediation Course' to the Columbian Mining Delegations at the Sudbury GSDC, 26 Jun 2019
  - ~ Participated in discussions with Minister Catherine McKenna at Laurentian University 7 Mar 2019
  - ~ Travelled with the Laurentian Goodman School of Mines delegation to Peru 5-10 May 2019 and presented 'Innovación en biolixiviación y biorremediación. Remediación Ambiental -Lecciones globales de la historia de Sudbury.' (in Spanish)
  - ~ Presented ' Innovation in biomining and bioremediation to both the Finnish and Australian Mining delegations at the Sudbury GSDC 5 Mar 2019
  - ~ Interviewed for 'Des bacteries pour decontaminer les sols', with D Grapton on CBC Radio Canada, 21 Apr 2019
  - ~ Featured in 'Returning green to a blackened landscape Microbiologist opens MMTS week with talk on mine remediation using microbes', by K McKinley, Northern Ontario Business, 15 Apr 2019
  - ~ Featured in 'THE DRIFT: Finding the value in a mine waste pile', by I Ross, Northern Ontario Business, Mar 2019

- Dr. David Pearson participated in the following public outreach initiatives in 2019:
  - ~ Was interviewed by the Sudbury Star https://www.thesudburystar.com/news/local-news/sudbury-accent-that-moment-is-burned-into-my-memory and TVO https://www.tvo.org/article/thats-no-moon-before-these-nasa-astronauts-went-to-space-they-went-to-sudburyregarding the 50th anniversary of the moon landing (July)
  - ~ Was Interviewed by CBC Sudbury on One on One with Markus https://www.cbc.ca/player/play/1546930243561 (Jun 2019)
  - ~ Presented to the Lake Wanapitei Home and Campers Association, 30 Oct 2019, Right about the rocks of your lake's past but wrong about the weather of your future

- 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
- ~ Member of the Laurentian University Environmental Sustainability Committee
- ~ CBC interview on the topic of the invasive aquatic species, Eurasian Water Milfoil.
- ~ Coordinator of the Laurentian Community Garden.

- Dr. Pascale Roy- Léveillée participated in the following outreach initiatives in 2018:
  - ~ Participated in 1 week of community meetings and School Workshops in Peawanuck in collaboration with OMNRF and the Wildlife Conservation Society in October 2019.
  - ~ Featured in 'The great thaw is already happening.' X Wang, The Nib. Published on 30 Dec 2019.
  - ~ Featured in 'Why developing Ontario's far North is Risky Business.' K. Wallace, The Star. 27 May 2019.
  - ~ Interviewed for Election 2019: 'L'enjeu du pergélisol vu par les scientifiques'on Radio-Canada's Les années lumières (national), 6 Oct 2019.
  - ~ Interview 'Discussion des émission de carbone pendant l'hiver en zone pergélisolées', with Eric Robitaille on Radio-Canada's Jonction 11-17 (regional, N Ontario), 24 Oct 2019.
  - ~ Interviewed for 'Le defi de la fonte du pergélisol', with Marie Villeneuve on Radio-Canada's Phare Ouest (regional, BC-Yukon), 15 Oct 2019.
  - ~ Interviewed for 'Laurentian University gets federal funding for research into permafrost' with Markus Schwabe on CBC's Morning North, 16 Sept 2019.
  - ~ Interviewed for 'Le réchauffement climatique et son impact sur le pergélisol' with Frédéric Projean on Radio-Canada's Les Matins du Nord, 6 Sept 2019.

- Chantal Sarrazin-Delay
  - ~ 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, July 2019.
  - ~ Provided weather stations to a number of northern communities to encourage community-based climate change networking. Parameters measured include temperature, rainfall and wind. Not all far north communities have an Environment Canada weather station and instead get regional weather. These community-run stations allow members to their local weather on the smart phones or computers.

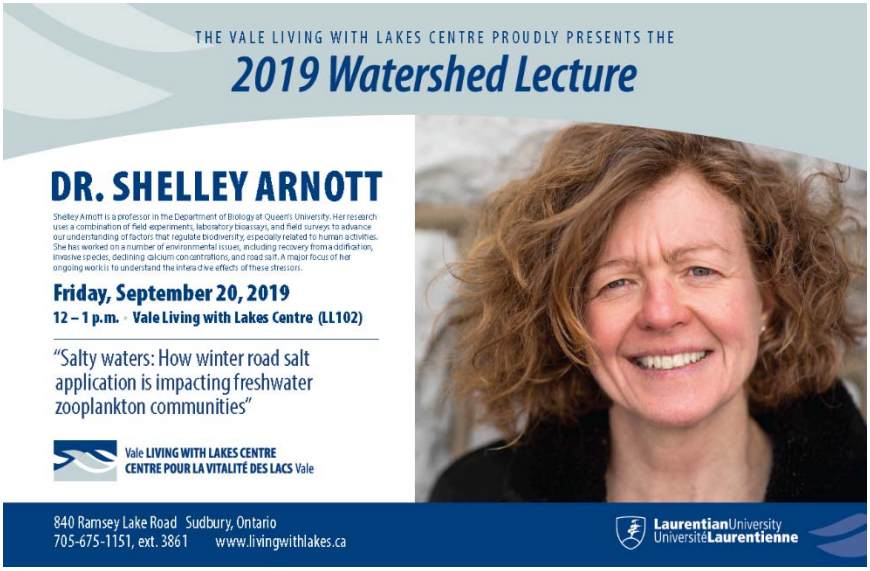
- Dr. Graeme Spiers served as a member of VETAC and gave numerous talks and tours to students, international visitors and the general public in 2019.

- Dr. Andrew Tanentzap was interviewed by the BBC on his recent paper on methane emissions and it played nationally on repeat for breakfast audiences.

- Dr. Shaun Watmough participated in the following outreach activities in 2019:
  - ~ Gave a TSE Webinar, Jan 2019
  - ~ Served as a judge at the Peterborough Science Fair, May 2019

~ Hosted Gene Likens for the Sheperd Lecture at Trent

2019 Watershed Lecture with Dr. Shelley Arnott



Dr. Shelley Arnott from the Queen's University gave the annual Watershed Lecture on Friday, September 20, 2019 entitled: Salty waters: How winter road salt application is impacting freshwater zooplankton communities.

Dr. Shelley Arnott is a professor in the Department of Biology at Queen's University. Her research uses a combination of field experiments, laboratory bioassays, and field surveys to advance our understanding of factors that regulate biodiversity, especially related to human activities. She has worked on a number of environmental issues, including recovery from acidification, invasive species, declining calcium concentrations, and road salt. A major focus of her ongoing work is to understand the interactive effects of these stressors. Dr. Arnott is also a long time member of the Cooperative Freshwater Ecology Unit.

While here, Dr. Arnott hosted the 2019 Watershed Symposium with our graduate students.

Dr. Shelley Arnott'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:
Laurentian: P. Beckett, B. Edwards (OMECP), N. Mykytczuk and G. Spiers
Trent: S. Watmough. Emily Smenderovac served as project manager.
Sherbrooke: J-P Bellenger
UQAM: P. del Giorgio and Y. Prairie
Cambridge: A. Tanentzap
Queen's: J. Smol, A. Paterson (OMECP)
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

LCARE AGM June 27, 2019

Sudbury Environmental Study (SES) Lakes

In 2019, the Ministry of the Environment, Conservation and Parks 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 2019 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 only 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 2019, all 44 Extensive lakes and 6 Reference lakes were sampled once for standard water chemistry parameters.

In addition to the standard SES sampling, in 2019 MECP partnered with CFEU colleagues and researchers from numerous academic and government institutions under the L-CARE umbrella, to extend some of our standard SES sampling. Surface water dissolved gas and carbon samples were completed in May, July and September on select Intensive and project lakes. Several Intensive, Extensive and Reference lakes were sampled mid-summer for traditional biological indicators (zooplankton, phytoplankton, chlorophyll), physico-limnological characteristics (temperature/oxygen profiles, clarity, etc.), as well as to characterize microbial communities in the water column and lake bottom sediments (top-bottom sediment cores) and gas flux dynamics.

MECP also provided information and analytical support for pilot whole-lake community surveys, in collaboration with CFEU colleagues Tom Johnston and John Gunn, to launch the Community Restoration of Acid Damaged Lakes project (CRADL).

The zooplankton taxonomy lab continued to process samples collected for the MOECC's lake monitoring programs, including the regular SES, the L-CARE campaign, and the Ring of Fire up until the end of September. At which point Lynne Witty transitioned to independent taxonomic consulting and identification services with the launch of Identazoop! https://www.identazoop.ca/

SES Database management during 2019 was lead by database managers Rachel DeJong and Jerry Warmbold, as well as program coordinator Jocelyne Heneberry. Major activities included: 1. Updating and cleaning the Intensive and Extensive data sets, including de-bugging the data import process, and verifying and documenting all data gaps, or suspicious data. We have also been able to fill some gaps, in particular, incorporating some previously unavailable chlorophyll data for Clearwater, Lohi, Middle and Hannah. 2. Overhaul of our Dissolved Oxygen and Temperature profiles database, that also houses our other field collected data (eg. Secchi). We are also working towards better linkages between this database and the chemistry database. 3. Continuing to work towards updating the Zooplankton database as samples are counted for both the Sudbury and DESC groups under ILNSU. We will be working with Jim Rusak and Johnny Su at DESC on a major overhaul in the near future. In addition, 14 data requests were addressed from partners and collaborators. 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 the first products of the L-CARE aquatic theme,

Carsten Meyer-Jacob et al.'s assessments (2019) using lake paleolimnological reconstruction of dissolved organic carbon patterns across low and high acid-deposition areas of central Canada (https://www.nature.com/articles/s41598-019-52912-0). In addition, Bill Keller et al.'s (2019) comprehensive review and interpretation of Extensive lake trends as they relate to ongoing recovery and concurrent changes in the region was officially released (https://www.nrcresearchpress.com/doi/abs/10.1139/er-2018-0018#.XpckaMhKiUk) and the preliminary report on CRADL survey results from 2019 was drafted by Jasmine Louste-Fillion. These products underscore the value of continuing the CFEU lake monitoring programs.

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 2019 was primarily directed at two fields of research:

i) **Food web structure and contaminant bioaccumulation in northern fish populations.** This work was supported in 2019 by 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 on Near North waters, with a focus on the historical acid-deposition zone of NE Ontario.

ii) **Reproductive ecology of northern fishes.** This research was funded in 2019 by the MNRF Aquatic Research and Monitoring Section, and MNRF Policy Division. Experimental work on a Lake Nipissing walleye spawning stock continued in 2019 to assess the interactive effects of parental traits and spring warming rates on walleye spawning success as part of a MSc student project. A parallel project with a similar experimental design, but using Lake Huron lake whitefish, was completed in April 2019 as part of a BSc Honour's thesis project.

Contaminant burdens and speciation profiles in freshwater fishes

A project related to the Northern Fisheries Research is the analysis of various metals in freshwater fish from across Ontario and beyond. This work is being led by post-doctoral fellow and recent CFEU PhD graduate Gretchen Lescord and John Gunn in collaboration with Alan Lock and others at the new Purdue Central Analytical Facility (PCAF) and several researchers with the Wildlife Conservation Society (WCS) Canada. A key component of the research, which began in February 2019, is to better understand which affects arsenic (As) and chromium (Cr) bioaccumulation and speciation in Ontario fish; recent reports from the provincial monitoring program suggest that subsistence consumers should lower their consumption of locally-harvested fish due to elevated As and Cr concentrations. This research is funded by an NSERC CRD partnership with DeBeers Canada (533736-18, Gunn and Branfireun, "Development of New Analytical Methods for Speciation of Chromium in Subsistence Fish from northern Ontario"), as

well as a MITACS partnership with WCS Canada (IT13105, Lescord, “Metal concentrations and speciation in fish from the Far North of Ontario; implications for subsistence consumption and the Ring of Fire development”), 2019-2022. It also included a chromium/Ring of Fire session at the Mining and the Environment Conference held in June 2019 with participants from the US and Canada across research sectors.

The Ion Chromatography (IC) paired with Inductively Coupled Plasma Mass Spectrometry (ICP-MS) set-up at the Purdue Central Analytical Facility (PCAF). The equipment was installed in Spring 2019 and is being used to develop analytical methods for chromium speciation (i.e. differentiating between harmful Cr^6 and benign Cr^3) in fish tissue. These results will be used to refine fish consumption advisories.

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 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 2018, FIRNNO sampling was extended to include more than 200 additional sites as part of MOECC's Ring of Fire (ROF) 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 2019, efforts were directed at database management, QA/QC and analyzing data. Jocelyne Heneberry and Jerry Warmbold have been working on a QA\QC of the most recent benthic invertebrate data entered into the Canadian Aquatic Biomonitoring Network (CABIN) database, as well as following up on corrections needed to historical data. A roll up of all previous data audits performed on our behalf by Environment Canada is underway. Baseline monitoring information collected up to 2018 in the ROF was prepared for release to First Nation communities in the fall. Analyses of this data is currently under way to support a MECP Ring of Fire Baseline Monitoring report to be completed in late spring 2020. This draft report will include contributions from all MECP groups involved with research and monitoring in this area (groundwater, streams, air, terrestrial). Peer reviewed publications will be prepared following the release of the report.

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.

Ontario University Program in Field Biology (OUPFB)

CFEU scientist John Gunn and Research Administrator Karen Oman served as the "Super coordinators" for the 30 OUPFB courses offered by the 15 Universities across Ontario in 2019. A total of nearly 350 students participated in courses throughout the world, including Belize, Costa Rica, US, etc. Our own course in Restoration Ecology attracted a talented group of students from 7 Different universities. Instructors included Drs. Gunn, Beckett, Spiers, Mykytczuk with the able assistance of M.Sc. students Jade Dawson and Johnathan Lavigne as teaching assistants.

Laurentian's OUPFB Class of 2019 in Killarney Park, ON.

Science Communication at the Vale Living with Lakes Centre
www.sciencecommunication.ca

Master's and Graduate Diploma in Science Communication (MSCom, G.Dip)
The Science Communication Graduate Program continues to contribute to the important and leading scientific research that goes on at the Vale Living with Lakes Centre. We do this through research projects and communication initiatives that focus on the work being done by CFEU researchers and LWL scientists. The following paragraphs will highlight some of the many successes our students and our faculty had in 2019.
This year, 14 full time students, and two part time students, graduated with a Master's in Science Communication in the fall. As word continues to spread about the Master's degree, our number of applicants remains over 35 for 15 spots! This demand ensures our program's sustainability, and is a testament to the growth of science communication as a field of study in our country. We are still uniquely positioned as the first and only Master's degree of its kind in North America since 2005.

Student achievements:
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 graduate students and researchers allows CFEU and VLWL research to be 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 2019, 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 lead 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. Both the SCOM and BIOL students gained valuable experiential learning by writing a compelling script that told the research story to an informed but non-specialist audience.
SCOM was in the spotlight during LU Research Week 2019! Our students judged over 50 research presentations during the Graduate Research Symposium and competed in Laurentian's Three Minute Thesis (3MT) event. Our own Chelsea Pike won the competition and went on to represent Laurentian University at the provincial championship in Hamilton.

Finally, we were 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.

Program and Faculty Highlights:

Articulation Agreement with Fleming College's Environmental Visual Communication Graduate Diploma Program.

Approval was granted at ARA and the articulation agreement was officially signed by both institutions in June 2019. This is the first agreement that provides a pathway for college graduates (graduate diploma EVC) to a Master's degree at a university in Ontario.

Science Communication Professional Development and Workshops. The 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 2019, Dr. Chantal Barriault and Michelle Reid facilitated science communication workshops for graduate students from across the country at both the Canadian Foundation for Innovation in Ottawa and at the first COMSciCon Canada conference at McMaster University. We also developed and delivered workshops for undergraduate and graduate students at Laurentian throughout the year.

In 2019, Dr. Chantal Barriault was invited by the US based organizations, the Alan Alda Center for Science Communication, and COMPASS, to participate in the formation of the Science Communication Training Network in San Francisco. She was an invited keynote speaker and panelist at the International Symposium on Science Education and Science Communication in Science Museums at the *Instituto de Butantan, Sao Paulo, Brazil*, 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. As part of a Peruvian delegation visit to Laurentian University, led by Dr. Nadia Mykytczuk, Chantal attended a day-long visit at Dynamic Earth and delivered a presentation on our Science Communication Graduate Program to the delegates.

<u>Carbon Offset Forest</u>

The City's recent celebration of 40 years of regreening, under the leadership of many, including CFEU scientist Dr. Peter Beckett, has focused primarily on the beautification and increased biodiversity of the region, but increasingly we recognize the importance of reforestation of barren industrial landscapes in carbon sequestration as well. Our researchers have, for example recently estimated that more than 1 million tons of C have been captured through the regreening efforts to date and through the return of a natural regenerating forest with cleaner air. That is the amount of carbon in wood needed to build over 550 Living with Lakes Centres. However, much more is needed in the battle to slow the rise in atmospheric CO_2. In 2019 CFEU contributed to the science needed to enhance carbon sequestration through its L-CARE research, but it also worked to encourage the University and partners to continue to cooperate on pollution reduction and remediation projects, and to promote a restored landscape through tree planting events.

Dino Otranto, COO Vale Ltd., McGill Professor and Activist Dr. Cindy Blackstock and Peter Xavier, VP Sudbury Integrated Nickel Operations Glencore, all planted trees in 2019.

Up North on Climate - Northern Climate Change and Adaptation Study Group

During 2019 our "Up North on Climate" team finalized agreements with 6 tribal council for phase 1 "Scoping priorities for building adaptation capacity of First Nations in Northern Ontario, including the need for a regional adaptation knowledge exchange network" and phase 2 "Building Climate Change Adaptation Capacity of First Nations in Far Northern Ontario Through Knowledge-Exchange and Collaboration" of a NRCan supported project through the Building Regional Adaptation Capacity and Expertise (BRACE) program.

The objectives of the project are to build climate change adaptation capacity in northern First Nations, to establish an interactive, regional, online adaptation knowledge network, to co-produce culturally appropriate adaptation resources and to co-design and co-delivery in-person knowledge exchange workshops on key climate change topics that will include traditional and scientific knowledge.

The process we have developed involves recruiting, training and paying a Climate Change Specialist (CCS) in each of 6 co-lead tribal councils. The role of the Climate Change Specialist is to promote climate change adaptation in their tribal council and member communities.

This project is capitalizing on previously written community reports produced as part of "Climate Change Impact and Adaptation Study for the North", that splice community-gathered Traditional Ecological Knowledge with climate science. CCSs are using gathered information to help communities develop a climate change adaptation plan.

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.

We also developed a 100-page adaptation section that has been included in each community report that 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.

A 100-term climate change glossary has been finalized and 2-page resources on various climate change and adaptation topics are being developed.

All resources will be posted on our 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 2020. 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. Graphics and visualizations continue to be developed for climate change concepts and projections.

We also launched AcclimateNow, a closed Facebook Group for climate change professionals in northern Ontario First Nations; it serves as a social learning and discussion platform. Bi-weekly 100-word posts keep CCS engaged and stimulate conversations. 2-pagers are also being posted on ACClimateNow to allow for ease of access to printable resources for CCS to distribute to their communities. Similar 100-word posts are also being provided to the general public on our open FB page, Up North On Climate.

Special attention continued to be given to riverbank 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 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.

Engagement of youth in understanding climate change remains a priority. We had the opportunity to spend a full day with Mushkegowuk youth at Camp Chikepak in July 2019 where we ran aquatic monitoring and climate change workshops. For youth engagement visits, we take wifi microscopes and iPads along with a wide variety of specimens, for youth 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.

Conference Organizing, Program Coordination and Editorial Activities

Arnott, S

- Associate Editor for Ecology 2016-present
- Associate Editor for Ecological Monographs
- Co-chair (with J. Rusak) of Global Lake Ecological Observatory Network, GLEON 21 All-Hands Meeting, Huntsville, ON, Nov 2019.
- Organizer of Global Salt Experiment workshop at Queen's University Biological Station, 1-6 Oct
- Served on organizing committee representing ASLO for the Joint Aquatic Sciences Meeting (JASM) 2022 to be held in Grand Rapids, MI

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 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 the Research Journal of Environmental Sciences
- 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
- NSERC DG and CRD program reviewer
- Ontario-Wide Coordinator (with K. Oman) of Ont. Univ. Program in Field Biology
- NSERC Site Reviewer for Strategic Network Grant

Mykytczuk, N

- Editor, Canadian Journal of Microbiology (2017-present)
- Associate Editor, Water, Air, and Soil Pollution (2016-present)

- Served on the Editorial Board for the Journal of Microbiological Methods (2014-present)
- Review Editor: Frontiers, Terrestrial Microbiology, Biogeochemical Dynamics (2018-Present)
- NSERC DG program external reviewer (2013-present)
- NSERC CRD program External reviewer (2017-present)

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 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).
- Board Member, Canadian Colleges and University Environmental Network
- Editorial Board Member for The Science of the Total Environment
- Performed grant reviews for the Alberta Conservation Authority, NSERC Discovery Grant and National Research Foundation in South Africa
- Reviewed 19 journal manuscripts

Partners and Collaborators

Industry

Vale Ltd. Glencore Sudbury INO

Partners and Collaborators
- Algoma University
- Appalachian State University
- Carleton 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
- Grand Council Treaty 3
- Great Lakes Forestry Centre, NRCAN-CFS

- Keewaytinook Okimakanak (Northern Chiefs) Tribal Council and member First Nations
- Lakehead University
- Laurentian University
- Laval University
- Matawa Tribal Council (Four Rivers Inc.) and member First Nations
- McGill University
- McMaster University
- Michigan Tech U
- Mushkegowuk Tribal Council and member First Nations
- Natural Resources Canada
- Nipissing University
- Nokiiwin Tribal Council and member First Nations
- OMECP
- OMNRF
- Ontario Forest Research Institute (MNRF)
- Queen's University
- Ryerson University
- Shibogama Tribal Council and member First Nations
- Skidmore College
- South West U. of Science &Technology
- Tianjin Univ. of Science &Technology
- Trent University
- Universidad de Santiago de Chile
- University of Alberta
- University of Cambridge
- University of Geneva, Switzerland
- University of Guelph
- University of New Brunswick
- Université du Québec à Montréal
- University of Sherbrooke
- University of Toronto
- University of Waterloo
- University of Winnipeg
- Western University
- Wilfrid Laurier University
- York University

<u>Others</u>

- Anbaric LLC
- BBA Engineering
- Canadian Kraft Papers
- Council of National Research, Italy
- Churchill Northern Studies Centre
- Climate Risk Institute
- Dartmouth College, New Hampshire
- Domtar Inc.
- DMI- Peace River
- Dryden Forest Management Company
- Forest Protection Limited
- Greater Sudbury Utilities
- Haliburton Forest and Wildlife Reserve
- Health Canada
- Independent First Nations Alliance, IFNA
- Indigenous Services Canada
- Invasive Species Centre
- Irving Pulp and Paper
- Kivalik Inuit Association
- Manitoulin Streams
- Matawa Tribal Council (Four Rivers Inc.) and member First Nations
- Memorial University
- Ministère des Forêts, de la Faune et des Parcs
- National Research Council
- Nishnawbe Aski Development Fund
- Obishikokaang Resources Corporation
- Ontario First Nations Technical Services Corporation
- Ontario Forest Research Institute (MNRF)
- Ontario Ministry of Indigenous Relations and Reconciliation (OMIRR)
- Rayonier Advanced Materials

- Sandy Lake First Nation
- Severn Sound Environmental Association
- Severtsov Institute of Ecology and Evolution
- Société de protection des forêts contre les insectes et maladies
- Thunder Bay District Health Unit
- United States Forest Service
- Universität Konstanz
- University of Toledo
- Vuntut Gwitchin First Nation
- Webequie First Nation
- Weyerhauser Canadian Timberlands
- Wildlife Conservation Society Canada
- Weenusk First Nation
- Yukon Research Institute

Book Chapters

Dunn JL, JL Knowlton, RM Handler, EC Pischke, KE Halvorsen, M Azahara Mesa-Jurado, T Selfa, D Flaspohler, J Licata, E Mata, R Medeiros, C Moseley, E Nielsen, C Picasso, JC Sacramento-Rivero, T Souza, C Vazquez and N Basiliko. 2019. Lessons from the Transdisciplinary International BIOPIRE Project. IN KE Halvorsen, C Schelly, R Handler and JL Knowlton, Eds., A Research Agenda for Environmental Management. Edward Elgar Publishers, Cheltenham, United Kingdom. Pages 107–120. ISBN: 978 1 78811 518 6

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Publications

Co-op Unit Members authored or co-authored numerous publications in 2019:

Alarie Y. 2020. The Hydradephaga (Coleoptera, Haliplidae, Gyrinidae, Dytiscidae) fauna of Manitoulin Island, Ontario, Canada, the world largest freshwater island. The Coleopterists Bulletin. Submitted.

Alarie Y and MC Michat. 2020. Description of the larvae of three *Agabus* (*Agabus*) Leach, 1817 (Coleoptera: Dytiscidae: Agabinae) with phylogenetic considerations. Aquatic Insect. Submitted.

Alarie Y, MC Michat and CHS Watts. 2020. Evolution of Sternopriscina larval forms (Coleoptera: Dytiscidae, Hydroporinae); descriptions of four species of *Sternopriscus* Sharp, 1880 and phylogenetic considerations. Aquatic Insects. Submitted.

Alarie Y, MC Michat and CHS Watts. 2020. Larval morphology of *Megaporus* Brinck, 1943 (Coleoptera: Dytiscidae): description of *M. hamatus* (Clark, 1862) and *M. gardnerii* (Clark, 1862) and phylogenetic considerations. The Coleopterists Bulletin. In press.

Alarie Y. 2019. Further contributions to the Hydradephaga (Coleoptera, Haliplidae, Gyrinidae, Dytiscidae) fauna of Cape Breton Island, Canada: new records, distributions and faunal composition. ZooKeys 897:49-66.

Alarie Y, MC Michat and CHS Watts. 2019. Larval morphology of the Australian radiation Sternopriscina (Coleoptera: Dytiscidae, Hydroporinae): description and phylogenetic placement of the genus *Chostonectes* Sharp, 1880. Aquatic Insects 40(4): 328-354.

Alarie Y, MC Michat, F Jia and J Hajek. 2019. *Hydrotrupes chinensis* Nilsson, 2003 (Coleoptera: Dytiscidae: Agabinae): new records, description of larvae, and notes on its biology and phylogenetic relationships. Aquatic Insects $40(3)$:236-256.

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Benetti CJ, MC Michat, Y Alarie and N Hamada. 2019. Description of the second and third instars of *Platynectes decemnotatus* (Aubé, 1838) (Coleoptera: Dytiscidae). Zootaxa 4544(3): 381-394.

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Conference Presentations

Alarie Y. Dealing with Hairy Beasts: How larval chaetotaxy impacting the understanding of evolutionary history of aquatic beetles. Annual Meeting of the Entomological Society of Ontario, Huntsville, ON. 1-3 Nov 2019. Keynote.

Alarie Y. The Evolution of the Sternopriscina (Coleoptera: Dytiscidae, Hydroporinae) Larval Forms. International Congress of Entomology (ICE) 2020. Helsinki, Finland. 19-24 Jul 2019. Invited.

Antwi E, L Venier, EJS Emilson, T Jones, C Trudeau, H Macdonald and S Mayor. Sustainability assessment of mine affected Indigenous communities in Ontario: A foundation for evidence based policy and decision-making intervention. NRCan Science Forum, Fredericton, NB.

Arnott SE. Salty Waters: How winter road salt application is impacting freshwater zooplankton communities, 2019 Annual Living with Lakes Watershed Lecture, Laurentian University. Oct 2019. Invited Keynote.

Arnott SE. Multiple environmental stressors shape community response to invasive species. International Conference on Aquatic Invasive Species (ICAIS), Montreal, QC. Oct 2019. Invited Plenary.

Arnott SE, A McClymont, D Greco and M Celis-Salgado. The influence of environmental context on zooplankton response to NaCl. Ecological Society of America, Louisville, KY. Aug 2019.

Arnott SE, D Greco and A McClymont. Salty waters - zooplankton community response to road salt. Dorset Environmental Science Day, Huntsville, ON. May 2019.

Arnott SE. Changing ion concentrations in Canadian Shield Lakes. University of Konstanz, Germany. Jan 2019.

Asemaninejad A et al. Vertical stratification of tailings microbial communities along geochemical gradients 10 years after application of a thick organic cover. Mining and the Environment International Conference, Sudbury, ON. Jun 2019. Poster

Basiliko N. The regreening of the Sudbury landscape and landscape carbon accumulation following reductions in smelter emissions. Université du Québec en Abitibi-Témiscamingue. Jan 2020. Invited.

Basiliko N, W Knight, K Greer and P Anderson. Excavating the history of soil science in Canada. Canadian Society of Soil Science meeting, Saskatoon, SK. 9-13 Jul 2019. Poster.

Basiliko N and P Roy-Leveillee. 2019. Permafrost Muskeg in a warming climate. Mushkegowuk Climate Summit 2019, Timmins, ON. 28-29 Jan 2019.

Beckett, P. Sudbury, Canada – 40+ years of regreening and healing a smelter-impacted landscape. Latornell Conservation Symposium, Alliston, ON. 19-21 Nov 2019. Invited Keynote.

Beckett P and G Spiers. Sudbury, Ontario, Canada: 40+ years of healing a smelter-impacted landscape through creating novel functional ecosystems. SETAC North America 40th Annual Meeting, Toronto, ON. 3-7 Nov 2019. Poster.

Beckett P. Sudbury, Ontario, Canada: 40+ years of healing and creating novel functional ecosystems on a smelter- impacted landscape. The Society of Ecological Restoration: 8th World Conference on Ecological Restoration (SER2019). Cape Town, South Africa. 24-28 Sept 2019.

Beckett P and G Spiers. Sudbury Landscape Status Forty Five Years after the Superstack. A Session within a workshop 'Soil Resilience and Extreme Events' at the 56th Annual Alberta Soil Science Workshop, Calgary, AB. 19-21 Feb 2019

Belzile N and Y-W Chen. 2019. Factors affecting biogeochemical processes of inorganic pollutants in aquatic sediments: field and laboratory answers. School of Environmental Resources and Engineering, Southwest University of Science and Technology, Mianyang, China.

Belzile N and Y-W Chen. 2019. Environmental studies and specific approaches to understand aquatic systems. School of Environmental Resources and Engineering, Southwest University of Science and Technology, Mianyang, China.

Branfireun B, Z Lindo, J Tian, E James, EJS Emilson, R Petrone and J McLaughlin. Experimental climate warming leads to increasing carbon gas fluxes in boreal peatlands. British Ecological Society Annual Meeting, Belfast, Ireland.

Celis-Salgado M and SE Arnott. Road salt: Ecotoxicity to multiple daphniid species from Boreal Shield lakes. Dorset Environmental Science Day, Huntsville, ON. May 2019.

Chan-Yam et al. Comparing organic amendment treatments for land reclamation. Mining and the Environment International Conference, Sudbury, ON. Jun 2019. Poster.

Chen Y-W and N Belzile. 2019. Importance of good analytical practices in environmental studies. School of Environmental Resources and Engineering, Southwest University of Science and Technology, Mianyang, China.

Courchesne B, M Schindler and N Mykytczuk. Bioleaching potential of Co and Ag from alkaline mine tailings in Northeastern Ontario. Mining and the Environment International Conference, Sudbury, ON. Jun 2019. Poster.

Dawson JC, BA Edwards and JM Gunn. Freshwater food web recovery responses. Latornell Conservation Symposium, Alliston, ON. Nov 2019.

Dawson JC, KS McCann, MM Guzzo, BA Edwards and JM Gunn. Catchment reclamation accelerates recovery in smelter-damaged lakes. Mining and the Environment International Conference, Sudbury, ON. Jun 2019. Poster.

Dawson JC, BA Edwards and JM Gunn. Multi-trophic recovery responses. Landscape carbon accumulation through reductions in emissions (L-CARE) Annual General Meeting, Sudbury, ON. Jun 2019.

Dawson JC, KS McCann, MM Guzzo, BA Edwards and JM Gunn. Effects of catchment reclamation on biological recovery across heavily smelter-damaged lakes in Sudbury, Ontario. Western University Student Research Conference, London, ON. Mar 2019. Poster.

Desjardins SM, W Quesnel, S Muinonen, CA Laamanen and JA Scott. Use of acidophilic bioprospected microalgae with industrial off-gas emissions for the production of biodiesel. Process Integration, Modelling and Optimisation for Energy Saving and Pollution Reduction (PRES 19). Crete, Greece. Oct 2019.

Desjardins SM, CA Laamanen, JA Scott et al. Using smelter off-gas with acidophilic regionally bioprospected microalgae for the production of clean burning biodiesel. Mining and the Environment International Conference, Sudbury, ON. Jun 2019. Poster.

Emilson EJS, L Hall, E Smenderovac and S Watmough. What's up DOC? Drivers of lake dissolved organic carbon change in a re-greening forest landscape. Mining and the Environment International Conference, Sudbury ON, 23-28 Jun 2019.

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.

Emilson EJS, T Jones, C Trudeau and H MacDonald, H. A Meeting of Two Rivers: A study in cumulative effects research from blending Western and Indigenous approaches. NRCan Science Forum, Québec, QC.

Fournier IB, D Greco and SE Arnott. Indirect effects of freshwater salinization on drinking water quality. North American Lake Management Society meeting, Burlington, VT. Nov 2019. Poster.

Gauthier M, JA Scott et al. Green microalgae from mining impacted environments as a potential source of antioxidants. Mining and the Environment International Conference, Sudbury, ON. Jun 2019. Poster.

Gilbert Parks S and S Watmough. The influence of drought on uranium geochemistry in a contaminated wetland complex. Mining and the Environment International Conference Symposium, Sudbury, ON. 23-28 Jun 2019.

Greasley A, N Belzile and G Yang. 2019. H_2S attenuates cardiac hypertrophy through regulation of selenoproteins. The 47th Southern Ontario Undergraduate Student Chemistry Conference. Toronto, ON.

Greco D and SE Arnott. Effects of chloride and nutrients on freshwater zooplankton communities. North American Lake Management Society meeting, Burlington, VT. Nov 2019.

Gupta V, J Gunn and N Mykytczuk. Constructed floating wetlands to treat sulfate-dominated mine drainage. Mining and the Environment International Conference, Sudbury, ON. Jun 2019.

Gupta V, J Gunn and N Mykytczuk. Constructed floating wetlands to treat sulfate-dominated mine drainage. Canadian Institute of Mining and Metallurgy AGM, Montreal, QC. 28 Apr-1 May 2019.

Hart S, N Basiliko, L Venier and D Morris. Fungal biodiversity within coarse woody debris in northern Ontario boreal forests. Canadian Society of Soil Science meeting, Saskatoon, SK. 9-13 Jul 2019.

Hart S et al. Fungal biodiversity within coarse woody debris in northern Ontario boreal forests. Mining and the Environment International Conference, Sudbury, ON. Jun 2019. Poster.

Heerschap MJ, TA Johnston, W Keller, MT Arts and JM Gunn. 2019. Ecology and food quality of riverine fishes of the Hudson Plains Ecozone, northern Ontario. Canadian Conference for Fisheries Research, London, ON, 3-6 Jan 2019.

Holloway J and P Roy-Leveillee. 2019. Women in permafrost science. Panel presentation and workshop organized by the Permafrost Young Researchers Network, 18th International Conference on Cold Regions Engineering and 8th Canadian Permafrost Conference, Quebec, QC. 18-22 Aug 2019.

Humphry W, S Watmough, P Beckett and N Basiliko. Biodiversity patterns along a forest chronosequence in a remediated industrial landscape. Mining and the Environment International Conference Symposium, Sudbury, ON. 23-28 Jun 2019. Poster.

Johnston L, et al. Developing Pulp & Paper Mill Residuals for Land Application. Mining and the Environment International Conference, Sudbury, ON. Jun 2019. Poster.

Johnston TA, M Quesnel, PL Savage, GL Lescord and JM Gunn. 2019. Influence of growth rate and food web position on inter-individual variation in fish mercury concentrations in lakes of northern Ontario, Canada. 40th Annual Meeting of the Society of Environmental Toxicology and Chemistry, Toronto, ON, 4-7 Nov 2019. Poster.

Kellaway E, S Watmough, C Eimers, P Beckett and N Basiliko. Legacy effects of liming on soils in a smelter degraded landscapes in afforested and natural regrowth forests. Mining and the Environment International Conference Symposium, Sudbury, ON. 23-28 Jun 2019. Poster.

Kennedy M, JA Scott et al. Value-added algal products from mitigation of CO_2in the emissions of stand-alone electricity generators. Mining and the Environment International Conference, Sudbury ON, 23-28 Jun 2019. Poster.

Khan M and N Mykytczuk. Genomics-driven optimization of the bio-recovery of refractory gold from arsenic-rich materials. Scientific Day in Biohydrometallurgy, CTRI Val d'Or, QC. 26 Sept 2019

Khan M, T Clark, J Weisner, P Miller and N Mykytczuk. Genomics-driven optimization of the bio-recovery of refractory gold from arsenic-rich materials. Mining and the Environment International Conference, Sudbury, ON. Jun 2019.

Khan M, J Champagne, P Miller and N Mykytczuk. Genomics-driven optimization of the bio-recovery of refractory gold from arsenic-rich materials. Canadian Institute of Mining and Metallurgy AGM, Montreal, QC. 28 Apr-1 May 2019.

Khan M, J Wiesner, T Clark, P Miller and N Mykytczuk. The effect of impeller configuration on mass transfer coefficients and particle suspension in stirred-tank, bench-scale bioreactors. Canadian Institute of Mining and Metallurgy AGM, Montreal, QC. 28 Apr-1 May 2019. Poster.

Kielstra B, R Mackereth, S Melles and EJS Emilson. Cumulative and comparative effects of disturbance on fish mercury across boreal landscapes. OMNRF Symposium on Cumulative Effects, Thunder Bay, ON.

Kirkwood A, P Roy-Léveillée, N Basiliko, M Packalen and J McLaughlin. 2019. Assessing the relationship between palsa thermal regime and the temperature sensitivity of greenhouse gas production. ArcticNet Annual Scientific Meeting, Halifax, NS. 2-5 Dec 2019.

Kirkwood A, P Roy-Léveillée, N Basiliko, M Packalen and J McLaughlin. 2019. Evolution of palsas and peat plateaus in the Hudson Bay Lowlands: permafrost degradation mechanisms and the production of greenhouse gases. 18th International Conference on Cold Regions Engineering and 8th Canadian Permafrost Conference, Quebec, QC. 18-22 Aug 2019.

Kuchtaruk A et al. Could a novel biosolid be more effective than conventional fertilizer-plus-lime addition to restore soils and vegetation affected by Sudbury's smelting pollution? Mining and the Environment International Conference, Sudbury ON, 23-28 Jun 2019. Poster.

Lavigne J et al. Upgrading your backyard: Evaluating the efficiency of novel restoration techniques in Sudbury semi-barren lands. Mining and the Environment International Conference, Sudbury ON, 23-28 Jun 2019. Poster.

Lescord GL, TA Johnston, MJ Heerschap, B Keller, M Southee, C O'Connor, R Dyer, BA Branfireun, and JM Gunn. 2019. Arsenic, chromium, and other elements of concern in fish from remote boreal lakes and rivers: drivers of variation and implications for subsistence consumption. 40th Annual Meeting of the Society of Environmental Toxicology and Chemistry, Toronto, ON, 4-7 Nov 2019. Poster.

Lescord GL, TA Johnston, BA Branfireun and JM Gunn. 2019. Mercury in freshwater fish across the Far North of Ontario; implications of climate change and the Ring of Fire development. 46th Canadian Ecotoxicity Workshop, Quebec City, 6-9 Oct 2019.

Lescord GL, CM O'Connor, TA Johnston, M Heerschap, BA Branfireun and JM Gunn. 2019. Chromium, arsenic, mercury, selenium, and other elements of concern in fish from remote boreal lakes and rivers; implications for subsistence fishers. Mining and the Environment International Conference, Sudbury ON, 23-28 Jun 2019.

Lescord GL, TA Johnston, AL James, BA Branfireun and JM Gunn. 2019. The use of non-traditional oxygen stable isotopes in delineating trophic ecology and mercury bioaccumulation in freshwater fish. Canadian Conference for Fisheries Research, London, ON, 3-6 Jan2019.

Levasseur P and S Watmough. Carbon sequestration due to regreening across time. Mining and the Environment International Conference Symposium, Sudbury, ON. 23-28 Jun 2019.

McClymont A, SE Arnott and J Rusak. Are water quality guidelines enough to protect lake zooplankton from road salt pollution? Global Lakes Ecological Observatory Network (GLEON21) meeting, Huntsville, ON. Nov 2019. Poster.

McLean SH, J Chenier, S Muinonen, C Laamanen and JA Scott. Recovery and application of low-grade thermal resources in the mining industry. Process Integration, Modelling and Optimisation for Energy Saving and Pollution Reduction (PRES 19). Crete, Greece. Oct 2019.

McLean S, CA Laamanen, JA Scott et al. Repurposing of otherwise waste low-grade heat in mineral processing. Mining and the Environment International Conference, Sudbury ON, 23-28 Jun 2019. Poster.

Methe A, A Bieniek, T Merritt and N Mykytczuk. A meta-genomic and meta metabolomic analysis of a microbial community enriched from high arsenic mine tailings. Mining and the Environment International Conference, Sudbury, ON. Jun 2019.

Mitchell K and N Mykytczuk. An evaluation of silica-Bacillus microencapsulation for reducing acid mine drainage from sulfur waste rock in cold climates. Mining and the Environment International Conference, Sudbury, ON. Jun 2019.

Mitchell K and N Mykytczuk. An evaluation of silica-Bacillus microencapsulation for reducing acid mine drainage from sulfur waste rock in cold climates. Canadian Institute of Mining and Metallurgy AGM, Montreal, QC. 28 Apr-1 May 2019.

Mohit S, SE Arnott and TB Johnson. Systematic review on the efficacy of recreational watercraft decontamination measures to reduce the overland dispersal of aquatic invasive species. International Conference on Aquatic Invasive Species (ICAIS), Montreal, QC. Oct 2019. Won Prize for best Poster.

Moreau K,R. Bose, H Shang and JA Scott. Mining technologies for deep mines: strategies for increased productivity, and long-term economic and environmental sustainability. Process

Integration, Modelling and Optimisation for Energy Saving and Pollution Reduction (PRES 19). Crete, Greece. Oct 2019. Poster.

Moreau K, JA Scott et al. Technologies for improved productivity and sustainability of deep mines. Mining and the Environment International Conference, Sudbury ON, 23-28 Jun 2019. Poster.

Mozzon CM, JJ Montgomery, GL Lescord, PL Savage, JM Gunn and TA Johnston. 2019. The trophic niche of sculpins (*Cottus* sp.) in forage fish assemblages of boreal lakes: a tale of two regions. Canadian Conference for Fisheries Research, London, ON, 3-6 Jan 2019. Poster.

Munford K, S Watmough, A Asemaninejad, N Mykytczuk, N Basiliko and S Glasauer. Insights into vegetation establishment and survival on mine tailings. Mining and the Environment International Conference Symposium, Sudbury, ON. 23-28 Jun 2019. Poster.

Mykytczuk N. Aptitudes que demandan la mineria del future: lessons from the Sudbury story. CIEMIN, Arequipa, Peru. 18 Sept 2019. Invited.

Mykytczuk N. Convertir Pasivos Mineros en Activos: Turning mining liabilities into assets. Perumin conference. 34 Convencion Minera, Arequipa, Peru. 22-27 Sept 2019. Invited.

Mykytczuk N, V Papangelakis and S Baldwin. Overview of the elements of biomining project. Mining and the Environment International Conference, Sudbury, ON. Jun 2019.

Mykytczuk N. Overview of Research program in biomining, bioremediation and science communication. Pan Northern Mining Research Alliance, Toronto, ON. 5 Mar 2019. Invited.

Omelon C and N Mykytczuk. Evidence for sub-permafrost microbial communities revealed through perennial spring activity, Axel Heiberg Island, Nunavut. 24th International Symposium on Environmental Biogeochemistry. Postdam, Germany. 22-29 Sept 2019. Poster.

Pearson D. Changing Climate means Changing Risks, Matawa Environment Gathering, Thunder Bay, ON. 10-12 Dec 2019

Pearson D. Preparing for the climate of the future. GCT3 Knowledge Sharing Gathering. Fort Frances, ON. 29 Nov 2019

Pearson D. Practical ways of adapting to climate change in northern communities. Northern Ontario First Nations Environment Conference, Thunder Bay, ON. 10 Oct 2019.

Pearson D. Climate Adaptation and YOU. Climate Change Workshop, Territorial Planning Unit of Grand Council Treaty #3 Wauzhushk Onigum Nation, Kenora, ON. 13 Feb 2019.

Pearson D. Leadership among young people – Guardians. Mushkegowuk Climate summit, Timmins, ON. 29 Jan 2019.

Pearson D. Preparing for Changing Risks in a Changing Climate, Kitchenuhmaykoosib Inninuwug, Big Trout Lake, ON. 22 Feb 2019.

Pearson D. Communities planning for the climate of the future, Nokiiwin Tribal Council workshop, Thunder Bay, ON. 24 Jan 2019.

Preston M and the LCARE team. Landscape Carbon Accumulation through Reductions in Emissions (L-CARE): developing land reclamation and brownfield management protocols for carbon sequestration and habitat use. Canadian Society of Soil Science meeting, Saskatoon, SK. 9-13 Jul 2019.Poster.

Preston M, M Brummell, B Rantala-Sykes, G Sherman, N Basiliko, P Beckett and M Hebert. Carbon sequestration following re-greening of a barren landscape: A chronosequence study. Mining and the Environment International Conference, Sudbury ON, 23-28 Jun 2019.

Robinson C, P Roy-Léveillée, P Hazlett, E Horrigan and N Basiliko. 2019. Assessing "shrubification" patterns in subarctic tundra and associated changes in conditions, including decomposition and nutrient release rates for *Betula glandulosa* and *Carex aquatilis*. ArcticNet Annual Scientific Meeting, Halifax, NS. 2-5 Dec 2019.

Robinson C, P Roy-Léveillée, P Hazlett, E Horrigan and N Basiliko. 2019. Comparing the decomposition rates of *Betula glandulosa* and *Carex aquatilis* in context of climate-induced "shrubification" of tundra ecosystems. 2019 Canadian Soil Science Society Annual Meeting, Saskatoon, SK. 9-13 Jul 2019.

Roy-Léveillée P and A Kirkwood. 2019. Assessing risk where there is nearly no field data: expected permafrost and ground ice distribution in the proposed Kivalliq Hydro-Fibre line corridor. ArcticNet Annual Scientific Meeting, Halifax, NS. 2-5 Dec 2019.

Roy-Léveillée P and CR Burn. 2019. Application of an analytical solution for near-shore talik development in expanding, shallow, thermokarst lakes. 18th International Conference on Cold Regions Engineering and 8th Canadian Permafrost Conference, Quebec, QC. 18-22 Aug 2019.

Rumney R, JM Gunn and N Basiliko. Increasing landscape carbon storage by restoring smelter-impacted landscapes. Canadian Society of Soil Science meeting, Saskatoon, SK. 9-13 Jul 2019.

Rumney R, JM Gunn and N Basiliko. Facilitating Landscape Carbon Storage Through Brownfield Restoration. Mining and the Environment International Conference, Sudbury ON, 23-28 Jun 2019. Poster.

Senhorinho G, JA Scott et al. Bioprospecting freshwater microalgae from water bodies near abandoned mine sites for antibacterial and anticancer activities. Mining and the Environment International Conference, Sudbury, ON. Jun 2019. Poster.

Seward S, et al. Peatland microbial community composition is driven by a natural climate gradient. Canadian Society of Soil Science meeting, Saskatoon, SK. 9-13 Jul 2019.

Seward J et al. An Analysis of Sphagnum Loss in Smelter Impacted Peatlands in Relation Carbon Cycling. Mining and the Environment International Conference, Sudbury ON, 23-28 Jun 2019. Poster.

Smoke E, R Spade, E Carlson and P Roy-Léveillée. 2019. Ethical principles and practice in research involving indigenous communities. Panel presentation organized by the Maamwazing Research Institute for the Laurentian University Research Week: Northern Roots, Global Reach, Sudbury, ON. 18-22 Mar 2019.

Spiers G. The Sudbury Protocol – 40 years of Landscape Healing. 7th Annual North Dakota Reclamation Conference. Dickinson, ND. 25-26 Feb 2019. Invited Keynote.

Sun X and SE Arnott. Examining the Interactive Effects of High Salinity and Acute Thermal Stress on Freshwater Zooplankton Communities and the Influence of Timing. Global Lakes Ecological Observatory Network (GLEON21) meeting, Huntsville, ON. Nov 2019. Poster.

Tanentzap AJ, J Fonvielle, S Cottingham and T Dittmar. The chemical and microbial diversity of European lakes. Global Lake Ecological Observatory Network 21st Annual Meeting, Huntsville, ON. 4-8 Nov 2019. Poster.

Tanentzap AJ, EJS Emilson, A Fitch, C Orland, KM Yakimovich, N Basiliko, NCS Mykytczuk and JM Gunn. A moveable feast: coordinated experiment reveals how lake sediments respond to changing terrestrial organic matter inputs. Global Lake Ecological Observatory Network 21st Annual Meeting, Huntsville, ON. 4-8 Nov 2019. Poster.

Tremblay N and N. Mykytczuk. Isolation and genomic characterization of microorganisms for the improvement of biomining technology. Mining and the Environment International Conference, Sudbury, ON. Jun 2019. Poster.

Wiesner J, M Khan, T Clark, P Miller and N Mykytczuk. The effect of impeller configuration on mass transfer coefficients and particle suspension in stirred-tank, bench-scale bioreactors. Mining and the Environment International Conference, Sudbury, ON. Jun 2019.

Research Grants

Arnott, S

- ArcticNet, Ensuring water security in the High Arctic: understanding the impacts of changing permafrost, hydrology, and water quality on aquatic ecosystems (2019-2024) Lafreniere (PI)
- 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, A multi-scale approach to identifying the ecological impact of co-occurring environmental stressors (2019-2024)
- OMECP, Assessing the cumulative impacts of calcium decline and the non-native predator, *Bythotrephes longimanus*, in Ontario's inland lakes: a multi-scale approach (2015-2020)
- 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 Discovery (DG) The tiny majority: how microbes mediate ecosystem functioning under anthropogenic stressors in boreal environments (2019-2024)
- NSERC/Environment Canada Advancing Climate Change Science in Canada program: Winter carbon losses in wetland ecosystems under current and future climates. With F Rezanezhad PI et al. at (U Waterloo), P Roy-Léveillée (Laurentian) (2019-2022)
- MITACS Accelerate. Capture and repurposing of waste industrial emissions for improved economic and environmental sustainability. With Scott (PI) and Laamanen (2019-2021)
- SSHRC Partnership Development Grant. Reassembling Ontario's "Near North": Reparation through university-museum-Indigenous research partnerships. With Greer (PI) Peltier and Helmsworth (Nipissing U) (2019-2021)
- MITACS Accelerate. Mitigation of CO_2 in the emissions of stand-alone electricity generators. With Scott (PI) and Laamanen (Laurentian) (2019)
- Ontario Centres of Excellence (OCE) VIP-II Prospecting for non-ore resources in Ontario's mining sector. With Scott (PI), Laamanen (Laurentian) (2018-2020)
- 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. 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 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)
- NSERC Discovery Grant: The functional role of microbial diversity in terrestrial ecosystems.

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

- NSERC Discovery Grant: Study of factors to improve the removal of trace metals/elements from mine effluents using low cost adsorbents. (2019-2024)
- Sichuan International Science Technology Research Grant. Geochemical study of the Three Gorges Reservoir on the Yangtze River. (2016-2020)
- Southwest University of Science and Technology, Mianyang, China. Travel Grant (2019-2020)

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)
- Community Restoration of Acid Damaged Lakes (CRADL), Funding through Vale Ltd., Co-PI with Gunn and Johnston

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 CRD – Chromium in Fish study in partnership with DeBeers, with Gretchen Lescord, Brian Branfireun(Western), Al lock (PCAF)
- MITACS/WCS – for PDF support of Dr. Gretchen Lescord
- LURF – logistical support for northern wetland studies with Pascale Roy-Leveillee
- Community Restoration of Acid Damaged Lakes (CRADL), Funding through Vale Ltd., Co-PI with Edwards and Johnston

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, Policy Division. Potential effects of climate warming on walleye spawning success (2018-2020)
- Wildlife Conservation Society Canada. Food quality of fishes in the Far North of Ontario (2018-2019)
- Community Restoration of Acid Damaged Lakes (CRADL), Funding through Vale Ltd., Co-PI with Gunn and Edwards

Mykytczuk, N

- NOHFC IRC in Biomining, Bioremediation and Science Communication
- NSERC Discovery- Understanding variability in microbial biomining and bioremediation consortia; adaptation mechanisms for multiple extremes. (2019-2024)

- CFI/ORF John R Evan Leader's Fund: A field and laboratory analysis facility for advancing biomining and bioremediation of mine wastes. PI (2017-2021)
- MRI Early Researcher Award. Application of acid mine drainage microbial communities to remediation of mining wastes in northern environments. PI (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. Co-Lead (2016-2020)
- 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 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

- Building Regional Adaptation Capacity and Expertise (BRACE), NRCan, January 23, 2019-March 31, 2021
- National Climate Change Impacts and Adaptation Assessment, NRCan, Co-lead Ontario Chapter with Al Douglas (Climate Risk Institute, formerly OCCIAR) 2018-2020

Ramcharan, C

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

Roy-Léveillée, P

- NSERC, Strategic Partnership Grants for Networks, Permafrost Partnership Network for Canada. Co-PI (2019-2024)
- ArcticNet, Supporting Humans in a Thawing Landscape. Co-PI(2019-2021)
- Anbaric Development Partners, Permafrost Conditions along the Proposed Kivalliq Hydro-Fibre Link Corridor. PI (2019)
- NSERC Advancing Climate Change Science in Canada, Winter Carbon Losses in Wetland Ecosystems under Current and Future Climates. Co-PI (2018-2021)
- Laurentian University AIR Fund, Integrating Western Science with Indigenous Traditional Knowledge to Support Local Stewardship and Ecological Conservation. PI (2019)
- Laurentian University Research Fund, Tectonic rebound and permafrost dynamics near Churchill, Manitoba. PI (2019)

- Polar Knowledge Canada, Permafrost vulnerability assessment near the community of Old Crow, Yukon (2017-2019)

Scott, JA

- Mitacs, Capture and repurposing of waste industrial emissions for improved economic and environmental sustainability (2019-2022)
- Mitacs, Mitigation of CO_2 in the emissions of stand-alone electricity generators (2019-2020)
- Mitacs Accelerate, Automated Deep Mining (2018-2020)
- OCE VIP II, Prospecting for non-ore resources in Ontario's mining sector (2018-2020)
- LURF, New technology to protect drinking water supplies for remote communities in Norther Canada.

Spiers, G

- Barrick Gold, Hemlo Operations: Manufacturing viable soil covers for waste rock (2011-2019)
- Glencore's Sudbury Integrated Nickel Operations, Environment, Health and Safety: Organic residual cover materials on tailings create technosols for biomass production (2014-2021)
- 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)
- Denison Environmental. Quantification of Radium in Effluents. (2014-2019).
- 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)

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 (2019-2024)

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

Hasnain, Sarah. PhD. 2019. *Daphnia* vertical position and implications for the impact of the invasive zooplankton predator, *Bythotrephes longimanus*, on plankton communities in south-central Ontario. Queen's University (Arnott, Co-advised by Dr. Troy Day, Math and Statistics)

MSc

Bieniek, Arielle. MSc. 2019. A metagenomic analysis of tailings microbial communities from both cold and hot environments. Laurentian University (Mykytczuk/Merritt)

Dart, Michelle. MSc. 2019. The impacts of environmental changes on peatland microbial community structure and function. Laurentian University (Basiliko)

Deighton, Holly. MSc. Effects of wood ash addition on soil chemical properties and sugar maple (*Acer saccharum*, Marsh.) seedling growth in two northern hardwood forest sites in central Ontario. Trent University (Watmough)

Hart, Saskia. MSc. 2019. Fungal community dynamics and carbon mineralization in *Populus tremuloides*, *Picea mariana* and *Pinus banksiana* coarse woody debris in two ecoregions of northern Ontario. Laurentian University (Basiliko/Venier)

Johnston, Leland. MSc. 2019. Developing pulp and paper mill residuals for land application. Laurentian University (Basiliko)

Kirkwood, Adam. MSc. 2019. Microbial community and C cycling across permafrost peatlands in the Hudson Bay Lowlands: feedbacks on in-situ degradation and simulated warming. Laurentian University (Roy-Léveillée/Basiliko)

Munford, Kimber. MSc. Patterns of Vegetation Succession on Nickel-Copper Mine Tailings near Sudbury, Ontario.Trent University (Watmough)

Rumney, Robyn. MSc. 2019. Effects of restoration on carbon storage in smelter-impacted industrial barrens. Laurentian University (Gunn/Basiliko)

Yee, Caleb. MSc 2019. Species distribution models for aquatic invasive species screening assessments. Queen's University (Arnott, Co-advised by Dr. Tim Johnson, Ontario Ministry of Natural Resources and Forestry)

MSCom, Laurentian University

Bailey, Victoria. MSCom. Understanding how young adults in Sudbury perceive health

Black, Ian. MSCom. Assessing how fruit flies and fruit fly research is portrayed by Canadian news media

Bouchard, Sabine. MSCom. Media portrayal of human-wildlife interactions in Sudbury, Ontario

Brandt Nunes, Renata. MSCom. A tool to increase zoo visitors' understanding of biodiversity

Byne, Kyelle. MSCom. Best practice in 'podagogy': What makes a good science podcast?

Collier, Alan. MSCom. Denial in the age of social media: A linguistic analysis of #climatehoax and #climaterealism

Ellsworth, Katie. MSCom. Knowledge of, and opinions about turtle road mortallity mitigation efforts on Hwy 69 in Sudbury, Ontario

Fisher, Diane. MSCom. Historical response to mining impacts in Sudbury, Ontario: A case study for the application of Kollmuss & Agyeman's model of pro-environmental behavior

Kaur Maker, Jagpreet. MSCom. Understanding the perceived barriers toward application of biomining in the Canadian mining sector

Kim, Ki-Youn. MSCom. Framing of the opioid crisis in regional Canadian daily newspapers during 2015 - 2019

Mankis, Tobias. MSCom. On-screen presenter versus off-screen narrator: Video presentation format and learning in YouTube science videos

Pike, Chelsea. MSCom. Canadian Twitter Discourse around FASD: A Summary and recommendations

Richard, Kaitlin. MSCom. Evaluating changes in experimentation, critical thinking, and sense of wonder in participants of Science North in school outreach programs

Vokey, Sarah. MSCom. The queer STEM experience: What do we share? Analyzing the common themes in the posts of '500 queer scientists'

Undergraduate

Appleby, Amber. BSc Thesis. Using sulfide-free gold mine waste rock as a soil amendment in nutrient-lacking agricultural soils. Laurentian University (Mykytczuk)

Baker, Sara. BSc Thesis. Adaptive life history responses of *Daphnia pulicaria* to road salt. Queen's University (Arnott)

Dawson, Jade. BSc Thesis. Effects of catchment reclamation on biological recovery across heavily smelter-damaged lakes in Sudbury, Ontario. University of Guelph (McCann/Edwards/Gunn).

Greasly, Adam. BSc Thesis (Biochemistry). Hydrogen selenide as possible gasotransmitter. Laurentian University (Belzile).

Johnson, Lauren. BSc Thesis. Nutrient limitation of autotrophic and heterotrophic communities in northeastern Ontario lakes. Queen's University (Arnott)

Laframboise, Amy. BSc Thesis. Soil microbial carbon cycling across a reclaimed forest chronosequence: Sudbury, ON. Laurentian University (Basiliko)

Larochelle, Luc. BSc Thesis. Maternal influences on Lake Whitefish (*Coregonus clupeaformis*) embryonic fitness in an exploited Lake Huron stock. Laurentian University (Johnston)

Louste-Fillion, Jasmine. BSc Thesis. Use of gut microbiomes in Creek Chub to assess the environmental effects of mine effluents in Sudbury streams. Laurentian University (Gunn/Edwards)

Patterson, Heather. BSc Thesis. Chronosequence analysis of carbon sequestration in reclaimed forest soils in Sudbury, Ontario. Laurentian University (Basiliko/Beckett)

Pyne, Cassandre. BSc Thesis. The effect of salt exposure on the tolerance of *Daphnia pulicaria* to multiple stressors: nutrient quality and salt concentration. Queen's University (Arnott)

Rathie, Brooke. BSc Thesis. Population and physiological responses of *Daphnia pulicaria* to road salt. Queen's University (Arnott, Co-advised by Chris Moyes, Queen's University)

Read, Sharayah. BSc Thesis (Chemistry). Adsorption of trace elements by low-cost adsorbent grape pulpLaurentian University (Belzile).

Robinson, Chantae. BSc Thesis. Long term decomposition experiment: comparing decomposition rates of *Betula glandulosa* and *Carex aquatilis* under the frame-work of climate-induced shifts in vegetation in Tundra ecosystems. Laurentian University (Basiliko/Roy-Léveillée)

Waterston, Kathleen. BSc Thesis.Assessing the effectiveness of the herbicide Reward as a chemical control for the eradication of the invasive aquatic plant species, the European water chestnut (*Trapa natans*). Queen's University (Arnott, Co-supervised by Kyle Borrowman, Ducks Unlimited).

HQP Supervised

Hall, Laura. BSc Thesis in progress, Trent University (Watmough)
Shi, Shuhong. BSc Thesis in progress, Queen's University (Arnott)
Silverthorn, Megan. BSc Thesis in progress, Queen's University (Arnott)

Beckett, Anna. MSc Thesis Student, Queen's University (Arnott/Young)
Batool, Syeda. MSc Thesis Student, Trent University (Watmough)
Courchesne, Brittaney. MSc Thesis Student, Laurentian University (Mykytczuk/Schindler)
Dawson, Jade. MSc Thesis Student, Laurentian University (Gunn/Edwards)
Gauthier, Miranda. MASc Thesis Student, Laurentian University (Scott)
Gilbert Parkes, Spencer. MSc Thesis Student, Trent University (Watmough)
Greco, Danielle. MSc Thesis Student, Queen's University (Arnott/Schamp)
Humphrey, William. MSc Thesis Student, Trent University (Watmough)
Kellaway, Ed. MSc Thesis Student, Trent University (Watmough)
Kennedy, Merritt. MASc Thesis Student, Laurentian University (Scott/Basiliko)
Lavigne, Jonathan, MSc Thesis Student, Laurentian University (Basiliko/Beckett)
Lehman, Sara, MSc Thesis Student, Laurentian University (Gunn/Johnston)
Little, Shannon, MSc Thesis Student, Laurentian University (Scott)
Mahrie, Kayla. MSc Thesis Student, Trent University (Watmough)
McClymont, Alexandra. MSc Thesis Student, Queen's University (Arnott)
Methé, Alexandra. MSc Thesis Student, Laurentian University (Mykytczuk/Merritt)
Mitchell, Katlyn. MSc Thesis Student, Laurentian University (Mykytczuk)
Montgomery, Jamie. MSc Thesis Student, Laurentian University (Gunn/Johnston)
Mohit, Shrisha. MSc Thesis Student, Queen's University (Arnott/Johnson)
Mukerji, Aparna. MSc Thesis Student, Laurentian University (Gunn)
Ott, Neil. MSc Thesis Student, Trent University (Watmough)
Robinson, Chantae. MSc Thesis Student, Laurentian University (Roy-Léveillée)
Snyder, Tom. P/T MSc Thesis Student, Laurentian University (Basiliko)
Tremblay, Nathalie. MSc Thesis Student, Laurentian (Mykytczuk)

Chan-Yam, Kelly. PhD Thesis Student, Laurentian University (Basiliko)
Desjardins, Sabrina. PhD Thesis Student, Laurentian University (Scott/Basiliko)
Fawcett, Claire. PhD Thesis Student, Laurentian University (Scott)
Freeman, Erika. PhD Thesis Student, University of Cambridge (Tanentzap/Emilson)
Gupta, Varun. PhD Thesis Student, Laurentian University (Gunn/Mykytczuk)
Jiao, Yongmei. PhD Thesis Student, Laurentian University (Scott)
Lavender, Mike. PhD Thesis Student, Queen's University (Arnott/Schamp/Rusak)
Lejoie, Celine. PhD Thesis Student, McMaster University (Emilson/Kidd)
Levasseur, Pat. PhD Thesis Student, Trent University (Watmough)
Massa, Eric. PhD Thesis Student, Queen's University (Arnott/Rusak)
McDonough, Andrew. PhD Thesis Student, Trent University (Watmough)
McLean, Shannon. PhD Thesis Student, Laurentian University (Scott)
Moreau, Kyle. PhD Thesis Student, Laurentian University (Scott)
Reid, Carolyn. PhD Thesis Student, Trent University (Watmough)
Seward, James. PhD Thesis Student, Laurentian University (Basiliko/ Roy-Léveillée)
Sun, Xinyu. PhD Thesis Student, Queen's University (Arnott/Rusak)
Tafvizi, Arghavan. PhD Thesis Student, Laurentian University (Ramcharan/James)
Van Leeuwen, Pauline. PhD Thesis Student, Laurentian (Mykytczuk/Schulte-Hostedde)
Woodman, Samuel. PhD Thesis Student, Cambridge University (Tanentzap)

Asemaninejad Hassankiadeh, Asma, PDF, Laurentian (Basiliko/Mykytczuk)
Celis-Salgado, Martha, PDF, FLAMES lab (Arnott)
Cottingham, Samuel, PDF, Cambridge (Tanentzap)
Fonvielle, Jérémy, PDF, Cambridge (Tanentzap)
Govindarajan, Srinath, PDF, Laurentian (Mykytczuk)
Khan, Madiha, PDF, Laurentian (Mykytczuk)
Kielstra, Brian, PDF, NRCan (Emilson)
Porter, Teresita, PDF, NRCan (Emilson)
Preston, Michael, PDF, Laurentian (Basiliko/Edwards/Gunn)
Senhorinho, Gerusa, PDF, Laurentian (Scott/Basiliko)

Hurley, Mikkealla, Aquatic Ecology Technician and Taxonomist, NRCan (Emilson)
Nguyen, Amy, Lab Technician, University of Waterloo (Swanson)
Pope, Emily, Summer Student, 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

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
DeJong, Rachel - Freshwater Ecology and Bioassessment Biologist, MECP/LU (dep. Mar/2019)
Edwards, Brie - MECP Research Scientist/ LU Adjunct
Fram, Kim - Taxonomist and Research Assistant, LU
Gunn, John - Canada Research Chair in Stressed Aquatic Systems, LU
Haslam, Lee - Senior Fisheries Technician, MNRF
Heneberry, Jocelyne - Monitoring Coordinator, MECP
Johnston, Tom - MNRF Senior Research Scientist/LU Adjunct
McAuliffe, Cassidy – Communication Specialist, LU
McCourt, Jason - Environmental Officer, MECP
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) (dep. Feb/2019)
Reid, Michelle, Science Communication (Mykytczuk)
Roy-Léveillée, Pascale – Permafrost, Faculty LU
Sarrazin-Delay, Chantal - Associate Project Lead, Climate Change and Ecology, LU
Smenderovac, Emily – Research Project Manager LCARE, LU
Warmbold, Jerry – Research Technician (MNRF), Freshwater Biologist/ Data Manager (MECP/LU)
Witty, Lynne – Invertebrate Taxonomist, MECP/LU (dep. Sept/2019)

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

Ashie, Claudia, Field Technician, LU (Basiliko/Gunn)
Barrette, Rachelle, Data visualization and processing: Python, p.t. (Pearson)
Cooper, Madison, Research Assistant, LU (Mykytczuk)
Clarke, Thomas, Lab Technician, LU (Mykytczuk)
Dawson, Jade, Field Technician, MECP/LU (Edwards)
Debono, Dylan, Summer Student, MNRF/LU
Duhaime, Manon, Workstudy Summer and Fall/Winter Research Assistant (Pearson)
Godfrey, Melissa, DIEK Intern and Field Technician, LU (Gunn)
Graham, David, Field Technician, LU (Basiliko)
KC, Kalpana, Field Technician, LU (Basiliko/Gunn)
Kuchtaruk, Adrian, Research Assistant, LU (Basiliko)
Maiangowi, Adam, DIEK Intern and Field Technician, LU (Gunn)
Ortega, Lourdes, Field Technician, LU (Basiliko/Gunn)
Patterson, Heather, NSERC USRA, LU (Gunn)
Ramadan, Awab, Summer Workstudy Student, LU (Gunn/Basiliko)
Robinson, Chantae, NSERC USRA, LU (Mykytczuk)
Weisner, Julian, Lab Technician, LU (Mykytczuk)
White, Kendra, Co-op Student Technician, MECP/Waterloo (Edwards)
Zannier, Nicholas, NSERC USRA, LU (Basiliko)