

Liam Heffernan, PhD

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Biogeochemist with experience in enzymology and microbial activity, soil carbon storage, greenhouse gas fluxes, stable isotopes, organic matter quality, and the use of these techniques to assess mechanistic pathways and constraints on organic matter decomposition across ecosystem boundaries. Research interests are biogeochemical cycling in northern terrestrial and aquatic ecosystems and perturbations to the carbon cycle due to climate change. I have extensive experience in conducting and leading field work in remote locations and a wide variety of laboratory techniques. I am fluent in R and comfortable with uni- and multivariate statistics and modelling.

Professional Positions

2023 – present	Assistant Professor Vrije Universiteit, Department of Earth Sciences, Faculty of Science
2022 – 2023	Researcher Uppsala University, Department of Ecology and Genetics/Limnology
2020 – 2022	Postdoctoral Fellow Uppsala University, Department of Ecology and Genetics/Limnology
2015 – 2020	Research and Teaching Assistant University of Alberta, Department of Renewable Resources
2014	Research Assistant École Polytechnique Fédérale de Lausanne, Ecological Systems Laboratory (ECOS)
2011	Research Assistant University College Dublin, School of Biology and Environmental Science

Education

- 2015 – 2020 **PhD in Soil Science**
University of Alberta, Department of Renewable Resources
Thesis: The Net Effect of Permafrost Thaw on the Carbon Balance of a Boreal Peatland
Supervisor: Dr. David Olefeldt
- 2012 – 2013 **MSc in Plant Biology and Biotechnology**
University College Dublin, School of Biology and Environmental Science
Thesis: The Chemistry of Irish Peatlands; an Integration of 15 years of Data
Supervisor: Dr. Florence Renou-Wilson
- 2008 – 2011 **BSc in Environmental Science – Plant Biotechnology**
University College Cork, School of Biological, Earth, and Environmental Sciences
Thesis: The effect of ZnO nanoparticles and UV light on *Lemna minor*
Supervisor: Dr. Marcel Jansen

Teaching Experience

- 2023 – present **Vrije Universiteit**
AM_450332, Global Biogeochemical Cycles
Course coordinator
Graduate course with ~20 students
- 2021 – 2023 **Uppsala University**
1BG513, Ecosystems in the Anthropocene
Graduate course with ~20 students
- 2021 – 2023 1BG417, Ecological Effects of Climate Change
Undergraduate course with ~20 students
- 2021 **University of British Columbia**
LWS 510, Land and Water Systems
Undergraduate course with ~20 students
Title: Northern Peatlands: Small but Mighty Players in Global Biogeochemistry
- 2016 – 2020 **University of Alberta**
RENR 299, Environmental and Sciences and Forestry Field School
Undergraduate field course with ~90 students

2018	RENr 333, Wetland Sciences and Management Undergraduate course with ~15 students per class group
2017 – 2019	RENr 210, Introduction to Soil Science Undergraduate course with ~30 students per class group
2017 – 2019	RENr 442/742, Soil Biogeochemistry Undergraduate and graduate course with ~20 students
2015 – 2016	RENr 120, Woody Plants; Introduction to Plant Identification Undergraduate course with ~30 students per class group

Teaching Qualifications

2017	Graduate Teaching and Learning Course: Pedagogy and Course Design--Deepening Understanding (Level 3) , University of Alberta
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Students Supervised

2024	Mandy Bakker, MSc student, Vrije Universiteit
2024	Marloes van der Kraan, BSc student, Vrije Universiteit
2022	Isak Eksell, MSc student, Uppsala University
2022	Evelina Eklund, MSc student, Uppsala University
2018	Maya Frederickson, BSc student, University of Alberta
2017	Melissa Wheatley, BSc student, University of Alberta
2016	Jessie Steinke, BSc student, University of Alberta

Grants and Awards

2023	Interact Transnational Access – EURO 15,000
2022	Liljewalchs Travel Award – SEK 13,950
2021	Olsson-Borgh Grant 2021 – SEK 300,000
2021	Jänes Grant 2021 – SEK 20,000
2021	Vidfelts Grant 2021 – SEK 300,000
2021	Ymer-80 2021 – SEK 30,000
2021	Eco-DAS XIV Participant
2016 & 2018	Ashley and Janet Cameron Travel Award
2016, 2017, & 2018	University of Alberta Northern Research Award
2017	Allan Robertson Research Grant: International Peatland Society

Scientific Service

2024	Session Convener Arctic Wetlands in a Changing Climate. International Conference on Permafrost, 2024
2022	Session Convener

	Old Peat, New Voices: Frontiers in global peatland research from early career researchers. European Geophysical Union Meeting, 2022
2022	Workshop co-organiser Institutionen för ekologi och genetic (IEG) Day 2022 IEG day is a workshop which aims to bring together the four different departments working within the Institutionen för ekologi och genetic , at Uppsala University
2020 – present	Co-founder Peatland ECR Action Team (PEAT) Network PEAT is a globally diverse and inclusive network and community for early career peatland researchers and fans of any ethnicity, gender, sexual orientation, or ability.
2020 – 2023	Executive Committee Member Department of Limnology Executive Board, Uppsala University
2020	Session Convener Old Peat, New Voices: Frontiers in global peatland research from early career researchers. American Geophysical Union, Fall Meeting, 2020
2020	Session Convener Vulnerability of Permafrost Carbon and Environmental Drivers to Climate Change. American Geophysical Union, Fall Meeting, 2020
2018 – present	Journal Reviewer Nature Communications, Global Change Biology, EGU Biogeosciences, Biogeochemistry, Global Biogeochemical Cycles, Nature Communications Earth & Environment, Journal of Geophysical Research – Biogeosciences, Geoderma, Science of the Total Environment, Hydrological Processes, Freshwater Biology, Mires and Peat, Permafrost and Periglacial Processes
2017 – 2019	Executive Committee Member British Ecological Society, Peatlands Special Interest Group
2017 – 2018	Vice President Circum-polar Students Association, University of Alberta
2016 – 2019	Treasurer CONFORWest Interdisciplinary Conference on Natural Resources, Environment and Forestry Sciences
2016 – 2018	Executive Committee Member

Graduate Student Association (GSA), Appeals and Complaints
Board, University of Alberta
2016 – 2018 **Executive Committee Member**
Renewable Resources Graduate Student Association, University of
Alberta

Professional Memberships

2022 – present International Society of Limnology
2020 – present European Geophysical Union
2016 – present Permafrost Carbon Network
2016 – present American Geophysical Union

Publications (*corresponding author, § papers from PhD work)

- 2024 **Heffernan, L.* §**, Estop-Aragonés, C., Kuhn, M.A., Knorr, K.-H., Olefeldt, D.: (2024) Changing climatic controls on the greenhouse gas balance of thermokarst bogs during succession after permafrost thaw, Global Change Biology, accepted
- 2024 See, C.R., Virkkala, A.M., Natali, S.M., Roger, B.M., Mauritz, M., Biasi, C., Bokhorst, S., Boike, J., Bret-Harte, M.S., Celis, G., Chae, N., Christensen, T.R., Connon, S.J.M., Dengel, S., Dolman, H., Edgar, C.W., Elberling, B., Emmerton, C.A., Euskirchen, E.S., Göckede, M., Grelle, A., **Heffernan, L.**, ... Schuur, E.A.G.: (2024) Decadal increases in carbon uptake offset by respiratory losses across northern permafrost ecosystems, Nature Climate Change, accepted
- 2024 **Heffernan, L.***, Kothawala, D. N., and Tranvik, L. J.: (2024) Review article: Terrestrial dissolved organic carbon in northern permafrost, The Cryosphere, 18, 1443–1465, <https://doi.org/10.5194/tc-18-1443-2024>
- 2023 Harris, L. I., Olefeldt, D., Pelletier, N., Blodau, C., Knorr, K.-H., Talbot, J., **Heffernan, L.**, & Turetsky, M. (2023). Permafrost thaw causes large carbon loss in boreal peatlands while changes to peat quality are limited. Global Change Biology, 29, 5720–5735. <https://doi.org/10.1111/gcb.16894>
- 2023 Schulze, C., Sonnentag, O., Voigt, C., Thompson, L., van Delden, L., **Heffernan, L.**, et al. (2023). Nitrous oxide fluxes in permafrost peatlands remain negligible after wildfire and thermokarst disturbance. Journal of Geophysical Research: Biogeosciences, 128, e2022JG007322. <https://doi.org/10.1029/2022JG007322>

- 2023 Sim, T. G., Swindles, G. T., Morris, P. J., Baird, A. J., Gallego-Sala, A. V., Wang, Y., Blaauw, M., Camill, P., Garneau, M., Hardiman, M., Loisel, J., Väliranta, M., Anderson, L., Apolinarska, K., Augustijns, F., Aunina, L., Beaulne, J., Bobek, P., Borken, W., ... Zhang, H. (2023). Regional variability in peatland burning at mid-to high-latitudes during the Holocene. *Quaternary Science Reviews*, 305, 108020. <https://doi.org/10.1016/j.quascirev.2023.108020>
- 2022 Kuhn, M.A., Schmidt, M., **Heffernan, L.**, Stührenberg, J., Knorr, K.-H., Estop-Aragonés, C., Broder, T., Gonzalez Moguel, R., Douglas, P.M.J. and Olefeldt, D. (2022), High ebullitive, millennial-aged greenhouse gas emissions from thermokarst expansion of peatland lakes in boreal western Canada. *Limnol Oceanogr.* <https://doi.org/10.1002/lno.12288>
- 2022 Estop-Aragonés, C., **Heffernan, L.**, Knorr, K.-H., Olefeldt, D. (2022). Limited potential for mineralization of permafrost peatland soil carbon following thermokarst: Evidence from anoxic incubation and priming experiments. *Journal of Geophysical Research: Biogeosciences*, 127, e2022JG006910. <https://doi.org/10.1029/2022JG006910>
- 2022 **Heffernan, L.*** §, Cavaco, M. A., Bhatia, M. P., Estop-Aragonés, C., Knorr, K.-H., Olefeldt, D (2022). High peatland methane emissions following permafrost thaw: enhanced acetoclastic methanogenesis throughout the peat profile during early successional stages. *Biogeosciences*, 19, 3051–3071, 2022. <https://doi.org/10.5194/bg-19-3051-2022>
- 2022 Ghosh, A., Robison, A.L., Chiapella, A.M., Bertolet, B.L., Selden, C., Perry, D., Reich, H.G., Oleksy, I., Isanta-Navarro, J., Aho, K.S., Ganley, L., Soares, L.M., **Heffernan, L.**, Sasaki, M., Ray, N.E., Peleg, O., Thibodeau, P., Reis, P.C., Ramulifho, P.A., Maher, R.L., LaBrie, R. and Speir, S.L. (2022), Ecological Dissertations in the Aquatic Sciences: An Effective Platform for Developing Professional Collaborations Among Early Career Aquatic Scientists. *Limnology and Oceanography Bulletin*, 31: 27-29. <https://doi.org/10.1002/lob.10485>
- 2021 **Heffernan, L.*** §, Jassey, V. E. J., Frederickson, M., MacKenzie, M. D., & Olefeldt, D. (2021). Constraints on potential enzyme activities in thermokarst bogs: Implications for the carbon balance of peatlands following thaw. *Global Change Biology*, 00, 1-16. <https://doi.org/10.1111/gcb.15758>
- 2021 Olefeldt D., **Heffernan L.**, Jones M.C., Sannel A.B.K., Treat C.C., Turetsky M.R. (2021) Permafrost Thaw in Northern Peatlands: Rapid Changes in

- Ecosystem and Landscape Functions. In: Canadell J.G., Jackson R.B. (eds) Ecosystem Collapse and Climate Change. Ecological Studies (Analysis and Synthesis), vol 241. Springer, Cham. https://doi.org/10.1007/978-3-030-71330-0_3
- 2021 Olefeldt, D., Hovemyr, M., Kuhn, M. A., Bastviken, D., Bohn, T. J., Connolly, J., Crill, P., Euskirchen, E. S., Finkelstein, S. A., Genet, H., Grosse, G., Harris, L. I., **Heffernan, L.**, Helbig, M., Hugelius, G., Hutchins, R., Juutinen, S., Lara, M. J., Malhotra, A., Manies, K., McGuire, A. D., Natali, S. M., O'Donnell, J. A., Parmentier, F.-J. W., Räsänen, A., Schädel, C., Sonnentag, O., Strack, M., Tank, S., Treat, C., Varner, R. K., Virtanen, T., Warren, R. K., and Watts, J. D.: The Boreal-Arctic Wetland and Lake Dataset (BAWLD), Earth Syst. Sci. Data Discuss. 13, 5127–5149 (2021). <https://doi.org/10.5194/essd-13-5127-2021>
- 2020 **Heffernan, L.*** §, Estop-Aragonés, C., Knorr, K.-H., Talbot, J., & Olefeldt, D. (2020). Long-term impacts of permafrost thaw on carbon storage in peatlands: Deep losses offset by surficial accumulation. Journal of Geophysical Research: Biogeosciences, 125, e2019JG005501. <https://doi.org/10.1029/2019JG005501>
- 2018 Estop-Aragonés, C., Czimczik, C.I., **Heffernan, L.**, Gibson, C., Walker, J.C., Xu, X., Olefeldt, D. (2018). Respiration of aged soil carbon during fall in permafrost peatlands enhanced by active layer deepening following wildfire but limited following thermokarst. Environmental Research Letters, vol. 13, issue 8, pp: 085002. <https://doi.org/10.1088/1748-9326/aad5f0>
- 2018 Jagodzinski L., O'Donoghue M., **Heffernan L.**, van Pelt F., O'Halloran J., Jansen M.A.K. (2018). Wood ash residues cause of mixture of growth promotion and toxicity in *Lemna minor*. Science of the Total Environment, 625, 667-676. <https://doi.org/10.1016/j.scitotenv.2017.12.233>

Presentations (presenting author only)

- 2024 **Heffernan, L.**, Peacock, M., Mehrshad, M., Papadopoulou, S., Robroek, B.J.M., Davidson, S. Compounding effect of fire history and freeze thaw cycles on ecosystem resilience in northern temperate peatlands. Oral presentation. European Geophysical Union, General Assembly, 2024
- 2023 **Heffernan, L.**, Cooper, E.J., Olofsson, J., Tranvik, L. Vulnerability of organic matter to enhanced enzymatic degradation in terrestrial and

- aquatic tundra ecosystems, Oral presentation. European Conference on Permafrost, 2023
- 2022 **Heffernan, L.**, Kothawala, D. N., Tranvik, L. Dissolved organic carbon concentrations in terrestrial ecosystems across the northern circumpolar permafrost region, Oral presentation. International Society of Limnology (SIL) 36th Congress, 2022
- 2022 **Heffernan, L.**, Grasset, C., Kothawala, D. N., Tranvik, L. The Effect of Permafrost Thaw on the Controls and Pathways of Assessing the constraints on the enzymatic degradation of peat, Oral presentation. European Geophysical Union, General Assembly, 2022
- 2020 **Heffernan, L.**, Kothawala, D. N., Tranvik, L. Dissolved Organic Carbon in Permafrost Soils: Where, When, and How Much Will be Released? Oral presentation, B120-15. American Geophysical Union, Fall Meeting, 2020
- 2019 **Heffernan, L.**, Cavaco, Estop-Aragónés, C., M. A., Bhatia, M. P., Jassey, V. E., Olefeldt, D. The Effect of Permafrost Thaw on the Controls and Pathways of Decomposition that Regulate the Carbon Balance of Boreal Peatlands. Oral presentation, B43E-03. American Geophysical Union, Fall Meeting, 2019
- 2018 **Heffernan, L.**, Estop-Aragónés, C., Knorr, K.-H., Olefeldt, D. Long-Term Net Effect of Permafrost Thaw on the Carbon Balance of Boreal Peatlands: Evidence from Several Complementary Approaches. Oral presentation, B12C-05. American Geophysical Union, Fall Meeting, 2018
- 2018 **Heffernan, L.**, Estop-Aragónés, C., Knorr, K.-H., Olefeldt, D. The impact of permafrost thaw on the carbon store of a peatland complex in western Canada. Oral presentation. Alberta Soil Science Workshop, 2018
- 2018 **Heffernan, L.**, Estop-Aragónés, C., Olefeldt, D. Stability of old soil C in boreal peatlands following permafrost thaw: contrasting and complementary findings from anaerobic incubations, radiocarbon analysis of field fluxes, and priming experiments. Poster presentation, B23G-2608. American Geophysical Union, Fall Meeting, 2018
- 2016 **Heffernan, L.**, Estop-Aragónés, C., Blodau, C., Olefeldt, D. Contrasting approaches to determine the impact of permafrost thaw on C cycling in northern peatlands. Poster presentation, B43C-0607. American Geophysical Union, Fall Meeting, 2016