

Dr. McKenzie A. Kuhn

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EDUCATION & EXPERIENCE

National Science Foundation Biology Postdoctoral Fellow *Aug. 2021-present*

University of New Hampshire, NH, USA

- Dr. Ruth K. Varner, supervisor (University of New Hampshire)
- Dr. Virginia Rich, supervisor (The Ohio State University)

Ph.D. Land and Water Resource Management *June 2021*

University of Alberta, AB, CA

- Thesis title: “Greenhouse gas emissions from northern ecosystems: Circumpolar and Local Perspectives”
- Outstanding Thesis Award, University of Alberta
- Dr. David Olefeldt, research supervisor

B.A. Environmental Science | Wheaton College, MA, USA *May 2015*

- Honors Thesis title: “Methane Dynamics in Vernal Pools”
- GPA: 4.0 Summa Cum Laude

RESEARCH INTERESTS

I am broadly interested in carbon and nutrient cycling in temperate and aquatic and terrestrial ecosystems. I combine in situ field measurements with lab incubations, data synthesis, GIS analysis, and empirical modeling approaches to understand both the drivers and the magnitude of methane (CH₄) and carbon dioxide (CO₂) evasion from wetlands and inland waters. In my postdoctoral position I am working on assessing the microbial presence and activity of methane-producing organisms in subarctic lake sediments as well as quantifying the stable carbon isotope signatures of methane from wetlands across the Arctic-boreal region.

RESEARCH EXPERIENCE

NSF Postdoctoral Research Fellow, University of New Hampshire, USA *2021-present*

- Leading a NASA-funded project that explores microbial dynamics and stable isotope methane fluxes from peatlands across the circumpolar north
- Using meta-omic sequencing techniques to explore the microbial drivers of methane production and emission from northern lakes
- University media article on postdoc work: [Warming Waters](#)

Ph.D. Student, University of Alberta, Canada *2016-21*

- Lead a Permafrost Carbon Network synthesis in which I compiled methane flux data from 200 studies to use in an empirical mixed effects model using R software to scale methane emissions from lakes and wetlands across the circumpolar north
- Co-developed a wetland and lake land cover map specific to scaling methane emissions across the boreal-arctic region using expert assessment and random forest modeling and explore future changes in landscape composition
- Organized a 3-year field campaign across a 3000 km reach of boreal western Canada to study the sediment and water biogeochemistry and methane cycling of 25 lakes
- Built and deployed floating chambers and bubble traps lakes to assess the spatial distribution of methane emissions
- Used stable and radiocarbon isotopes to determine the age of lake carbon emissions

Scientist in Residence, Adventure Canada *Aug. 2017*

- Measured greenhouse gas concentrations in glacial ponds in western Greenland and Nunavut, Canada over a two-week period
 - Gave a seminar about carbon cycling in the Arctic to 150 cruise passengers
- Research Consultant**, *Woodwell (formerly Woods Hole) Research Center* June 2016
- Provided project design input and helped conducted fieldwork looking at wetland and lake carbon fluxes, post-fire in the Yukon-Kuskokwim Delta, Alaska
 - Project title: “The Carbon Balance of Arctic River Deltas: Tundra Fire as an Agent of System Change” (NSF RAPID grant #1561437)
- Fulbright Fellow**, *US Fulbright Student Program, Abisko/Umeå, Sweden* 2015-16
- Collaborated with and published a study with researchers at the Climate Impacts Research Centre in Abisko, Sweden. We assessed the importance of small thaw pond emissions within a wetland ecosystem carbon balance
- Research Assistant**, *The Polaris Project, Cherskiy, Russia* July 2015, July 2016
- Examined how carbon emissions from aquatic and terrestrial landscapes vary along a fire severity gradient in Siberian larch forest using in situ gas flux measurements
 - Performed sediment incubations to look at the effects of fire on potential carbon production from lake sediments and forest soils
- Student**, *The Polaris Project, Cherskiy, Russia* July 2014
- Conducted an independent field research project looking at dissolved nutrient and oxygen concentrations along an elevation gradient in a beaded stream in the Arctic tundra and blogged about my experiences
- Intern**, *Graduate School of Oceanography REU, University of Rhode Island, RI* Summer 2013
- Analyzed ambient ozone fluxes in Rhode Island using MATLAB software
- Research Assistant**, *Chemistry Department, Wheaton College, MA* Summer 2012
- Used liquid ion chromatography to reconstruct sea ice development and melting from ice cores off the shore of Antarctica

AWARDS, GRANTS, and FELLOWSHIPS

Biology Postdoctoral Research Fellow, National Science Foundation, \$138,000 USD	2022-24
“Carbon Gatekeepers” grant, United States Dept. of Energy, \$3.4M USD	2022-2025
● Developed figures and content for proposal lead by PI Dr. Ruth Varner	
Iola Hubbard Climate Change Endowment, University of New Hampshire, \$20,000 USD	2022
Michael Smith Foreign Study Supplement, \$6,000	2020
Weston Garfield Northern Studies Ph.D. Award, \$50,000 CD	2018-20
Vanier Scholar, \$150,000 CD	2018-2020
Graduate Student Association travel award, University of Alberta, \$500 CD	2018
Northern Research Award, UAlberta North, \$9,000 CD	2017-19
Renewable Resources Graduate Student Travel Funding, U. of Alberta, \$500 CD	2017
Recruitment scholarship, Renewable Resources Dept., U. of Alberta, \$25,600 CD	2016
Graduate Research Fellowship, National Science Foundation, \$96,000 USD	<i>declined May 2016</i>
Fulbright Research Fellowship (Sweden), Inst. of International Education, \$11,000 USD	2015-16
Sally Gale Gilman Award, Wheaton College, \$3,000 USD	2015
Howard Meneely Prize, Wheaton College, \$1,000 USD	2015
All-Academic Team, New England Women’s and Men’s Athletic Conference	2013-15
Balfour Scholar, Wheaton College, \$68,000 USD	2012-15
Honorable Mention, Goldwater Scholarship	2014
Davis International Fellow, Wheaton College, \$5,000 USD	Summer 2014
Undergraduate Award in Analytical Chemistry, Wheaton College	Spring 2014

MENTORSHIP, OUTREACH, and RELEVANT TRAINING**Lead Mentor, EMERGE Research Experience for Undergraduates** Summer 2022-present

- Participant in the application review committee, including reading 50 applications and conducting interviews with the top candidates
- Developing three undergraduate projects based in northern Sweden looking at the effects of climate change on carbon emissions from lakes
- Mentored students over a 9-week period, helping them develop and conduct their research including instruction on fieldwork and lab techniques, as well as data analysis and poster development for the American Geophysical Union Fall 2022 Conference

Participant, Mentor Workshop, University of New Hampshire Jan. 2022

- Participated in an 8-hour interactive workshop focused on mentoring students at the undergraduate level

Participant, Fieldwork Initiative FISST training May 2021, Jan. 2022

- Participated in a four-hour workshop focused on preventing trauma and sexual assault in the field (<http://fieldworkinitiative.org/the-fisst-training/>)

Pod Leader, Unlearning Racism in Geoscience (URGE) course Jan.-May 2021

- Let pod discussions around the bi-weekly readings assignments and facilitated the creation of associated deliverables
- Helped create a Field Safety plan for the University of Alberta Renewable resources department
- Advised a new departmental DEI working group on key goals to help the department improve DEI in faculty and graduate student recruitment processes based on URGE course content

Mentor, University of Alberta Research Exploration Opportunity program Spring 2021

- Guided high school students through a 5-day virtual research project and R coding workshop while answering their questions about the university process and STEM

Participant, Land Carbon Modeling Course, University of Northern Arizona
May 2018

- Learned how to build process-based land carbon models using a matrix approach and how to run data assimilations with field data

Mentor, Summer Undergraduate Thesis Candidates, University of Alberta 2017-19

- Johanna Winder, "Microbial communities in Arctic lake sediments" (2019)
- Maya Frederickson, "Enzyme concentrations in a northern Alberta bog" (2018)
- Jordis Stuhrenberg, "Methane and carbon dioxide production rates of organic sediments in peatland ponds in boreal Canada" (2018)
- Eva Riechert, "Redox controls on carbon production in lake sediments" (2017)
- Megan Schmidt, "Carbon stocks and history of peatland lake sediments" (2017)

Judge, Belgravia Elementary School Science Fair April 2017

- Discussed and facilitated discussions about research presented by elementary students

Workshop Host, TELUS World of Science Research Showcase April 2017, April 2018

- Created a workshop titled "The Wonders of Wetlands" for elementary students and their parents

Mentor, Science Outreach Program, Talbert Middle School Spring 2016, Spring 2017

- Corresponded with five seventh-grade students; shared information about my research in the Arctic and why I like being a scientist

Participant, National Science Foundation Arctic Field Training Workshop Spring 2014

- Developed and practiced outdoor survival skills including bear safety and treatment and prevention of cold weather injuries and how to react during emergencies

CO-CURRICULAR ACTIVITIES

- Coach**, Edmonton Southwest Youth Basketball Team 2017-19
- President**, Circumpolar Student Association 2016-19
- Organized a conference for interdisciplinary research pertaining to northern studies
 - Held monthly events encouraging northern researchers to share their work
- Co-Chair**, Association of Canadian Universities for Northern Studies 2018 Conference 2016-18
- Managed and organized a team of 15 graduate students on a student-led organizing committee for an international, Arctic-themed conference with 200 participants
- Treasurer**, Renewable Resources Graduate Student Association 2016-18
- Maintained all transactions and monetary responsibilities for the group
- Co-Chair**, CONFORWest Student Conference Committee 2016-17
- Organized a student-led conference for 50+ graduate students to share their research in environmental science
 - Managed all logistics pertaining to venue, catering, and transportation for the staff and participants

TEACHING EXPERIENCE

- Guest Lecturer**, Arctic Ecology | University of New Hampshire Fall 2022
- Leading lecture on Arctic methane emissions and carbon budgets
- Guest Lecturer**, Wetlands (RenR330) | University of Alberta Fall 2019, 2020
- Led lectures on carbon cycling in northern wetlands
- Guest Lecturer**, Environmental Science | Yellowhead College, Edmon., CA Spring 2018
- Led a lecture on limnology and climate change
- Lab Instructor**, Introduction to Soils (RenR 210) | University of Alberta Fall 2017, Fall 2018
- Lectured and guided the students in basic techniques for handling soils in the laboratory (5 hrs/week)
- Instructor**, Field Course Wetlands (RenR 410) | U. of Alberta May 2017, 2018
- Developed curriculum and led a 2-day field course for 90 undergraduate students on the fundamentals of wetlands hydrology
- Teaching assistant**, Environmental Impacts Assessment (RenR340) | U. of Alberta Spring 2017
- Guided students in how to develop and write environmental impacts assessments

PUBLICATIONS (*undergraduate student mentee)

- **Kuhn, M.A.**, *Schmidt, M., Heffernan, L., Knorr, K.H, Estop-Aragonés, C., *Stuhrenberg, J., *Reichart, C., Broder, T., Moguel, R., Douglas, P., Olefeldt, D. “High greenhouse gas emissions from a peatland thermokarst lake edge driven by millennial-aged peat and released through ebullition have small impact on whole-lake methane budget.” In press in *Limnology and Oceanography*.
- **Kuhn, M.A.**, Thompson, L., *Winder, J., Brage, L., Tanentzap, J., Bastviken, D., & Olefeldt, D. “Opposing effects of climate and permafrost thaw on methane and carbon dioxide emissions from boreal lakes.” *AGU Advances*, 2021. 10.1029/2021AV000515
 - Featured as an editor's highlight in [EOS](#)
- **Kuhn, M. A.**, Varner, R. K., Bastviken, D., Crill, P., MacIntyre, S., Turetsky, M., Walter Anthony, K., McGuire, A. D., and Olefeldt, D.: “BAWLD-CH4: A Comprehensive Dataset of

Methane Fluxes from Boreal and Arctic Ecosystems”, Earth Syst. Sci. Data Discuss. <https://doi.org/10.5194/essd-2021-141>, 2021.

- Press [release](#) from the University of Alberta, featured in phys.org
- 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. <https://doi.org/10.5194/essd-2021-140>, 2021.
- Tanentzap, A., Burd, K., **Kuhn, M. A.**, Estop-Aragones, C., Tank, S., Olefeldt, D. “Ancient permafrost soils contribute little to contemporary carbon cycling downstream of thawing peatlands.” *Global Change Biology*. <https://doi.org/10.1111/gcb.15756>, 2021.
- **Kuhn, M. A.**, Johansson, M., Geisler, R., Lundin, E., and J. Karlsson. “Carbon emission from thaw ponds largely offset the land carbon sink of discontinuous permafrost wetlands.” 2018. *Scientific Reports*. <https://doi.org/10.1038/s41598-018-27770-x>

PAPERS IN REVIEW or PREPARATION

- Thompson, L., **Kuhn, M.**, Braga, L., Tanentzap, A., *Winder, J., Olefeldt, D. “Methylmercury concentrations and hgcA gene patterns in streams and ponds along a permafrost gradient.” In review with *Limnology and Oceanography*.
- *Winder, J., Braga, L., Thompson, L., **Kuhn, M.**, Olefeldt, D., Tanentzap, A. “Microbes in permafrost lakes respond differently to changes in climate versus hydrology.” In review with *ISME: Multidisciplinary Journal of Microbial Ecology*.
- **Kuhn, M. A.**, Varner, R. K., Bastviken, D., Crill, P., MacIntyre, S., Turetsky, M., Walter Anthony, K., McGuire, A. D., Treat, C., Del Sontro, T., Watts, J., Malhotra, A., and Olefeldt, D. “Methane emissions from the Arctic-Boreal region are influenced by climate warming and wetland hydrological shifts.” In preparation for *Nature Climate Change*.
- **Kuhn, M.**, Schade, J., Natali, S., & Alexander, H. “Impacts of fire on greenhouse gas emissions from larch forest stands in northeast Siberia.” In preparation for *Inland Waters*.
- **Kuhn, M.A.**, Knorr, K.H, Estop-Aragonés, C., *Stuhrenberg, J., *Reichert, C., Broder, T., Olefeldt, D. “Hydrological controls on redox conditions in boreal peatland lakes.” In preparation for *Biogeosciences*.

SELECT POSTERS and PRESENTATIONS as a lead author

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| Poster Presentation , American Geophysical Union Fall Meeting | Dec. 2021 |
| ● “Integrating Microbial, Isotopic and Landscape-Scale Observations to Quantify Methane Emissions and Isotopic Fluxes from Global High-Latitude Ecosystems” | |
| Invited Talk , Woodwell Climate Arctic-Boreal Flux Workshop | Oct. 2020 |
| ● “Methane emission from northern wetlands: directions forward” | |
| Invited Talk , Jackson Lab, Stanford University | Sept. 2020 |
| ● “The Boreal-Arctic Wetlands and Lakes Dataset: Carbon emissions across the north” | |
| Poster Presentation , NASA ABOVE 2020 Science Team Meeting | May 2020 |
| ● Kuhn, M., Thompson, L., Olefeldt, D. “Methane and carbon dioxide emissions from peatland lakes in the Taiga Plains: Opposing latitudinal trends indicate high climate sensitivity” | |
| Oral Presentation , Global Methane Session, American Geophysical Union Meeting | Dec. 2019 |

- “Using a methane-specific land cover model to improve bottom-up estimates of pan-arctic biogenic methane emissions”
- Invited Speaker**, *Wheaton College Chemistry Department* *April 2018*
- “Drivers of methane emissions from northern lakes”
- Poster Presentation**, *Assn. Sciences of Limnology and Oceanography Conference* *March 2018*
- “Groundwater connectivity, sediment redox conditions, and methane emissions from western Canadian peatland lakes”
- Poster Presentation**, *American Geophysical Union Meeting* *Dec. 2017*
- “Spatial distribution of methane emissions from a peatland pond in northern Alberta”
- Poster Presentation**, *CONFORWest student conference* *April 2017*
- “Greenhouse gas emissions from western Canadian peatland lakes”
 - Award: Best poster presentation
- Poster Presentation**, *Assn. Sciences of Limnology and Oceanography Conference* *Feb. 2017*
- “Emissions from thaw ponds largely offsets the carbon sink of discontinuous permafrost mires”
- Oral Presentation**, *U. of Alberta Graduate Student Association Seminar* *Feb. 2017*
- “Arctic Ponds: Sink or Source of Greenhouse gases?”
- Poster Presentation**, *American Geophysical Union Meeting* *Dec. 2016*
- “Impacts of fire on greenhouse gas emissions in lowland larch forests in northeast Siberia”
- Oral Presentation**, *Dept. of Environmental Studies, Umeå University* *May 2016*
- “Atmospheric carbon exchange in subarctic ponds”
- Poster Presentation**, *American Geophysical Union Meeting* *Dec. 2015*
- “The effects of fire on methane emissions from ponds in a littoral forest in Northeastern Siberia”
- Invited Oral Presentation**, *KBC Days Conference, Umeå University, Sweden* *Nov. 2015*
- “Atmospheric Carbon dynamics in ponds”

ACADEMIC SERVICE

- Peer Reviewer** *2021-Present*
- PNAS, Global Change Biology, Journal of Geophysical Research: Biogeochemistry, Biogeosciences, Environmental Research Letters, Science of the Total Environment, Limnology and Oceanography

TECHNICAL SKILLS

- R
- QGIS
- Excel
- Microsoft Suite

PROFESSIONAL MEMBERSHIPS

- Member, Permafrost Carbon Network
- Member, American Geophysical Union
- Member, United States Permafrost Association
- Member, Association for the Sciences of Limnology and Oceanography
- Member, North American Lake Management Society (NALMS)

REFERENCES

- Dr. David Olefeldt, University of Alberta: olefeldt@ualberta.ca
- Dr. Andrew Tanentzap, Cambridge University: ajt65@cam.ac.uk
- Dr. Ruth Varner, University of New Hampshire: ruth.varner@unh.edu