Nicole M. Hayes, Ph. D.

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Education

2015 Ph. D., Miami University, Ecology, Evolution and Environmental Biology

2006 B.S., University of Wisconsin-Madison, Botany and Zoology, Certificate in Environmental Studies

Professional Appointments

2020 - Assistant Professor, University of Wisconsin – Stout, Department of Biology

2018 - 2020 Grand Challenges Postdoctoral Fellow, University of Minnesota – Twin Cities, Department of Ecology, Evolution and Behavior

2015 – 2018 Postdoctoral Fellow, University of Regina, Biology Department

Research Grants and Fellowships

2019 - 2024 Long Term Research in Environmental Biology, National Science Foundation. Response of a reservoir ecosystem to changing subsidies of nutrients and detritus, senior personnel ($634,999)

2019 - 2020 Grant in Aid of Research, University of Minnesota. Heterotrophic fixation of nitrogen in lakes of the Upper Midwest ($30,250)

2018 - 2020 Grand Challenges in Biology Postdoctoral Fellowship, College of Biological Sciences, University of Minnesota ($157,500)

2018 - 2020 National Geographic Explorer grant. Thermal controls on methane dynamics in Icelandic lakes: In-situ incubations across a geothermal temperature gradient ($42,613)

2017 - 2019 Saskatchewan Cattlemen's Association. Dugout management for improved water quality ($45,220)

2011 - 2014 Doctoral Dissertation Improvement Grant, National Science Foundation. Causes and consequences of cyanobacteria dominance and toxin production: interactions among nutrient supply, nutrient ratios and light intensity ($14,750)

Publications

* mentee is first author

Hayes, NM, HA Haig, GL Simpson, and PR Leavitt. 2020. Seasonal and interannual evidence that environmental change increases the magnitude, duration, and risk of exposure to the cyanobacterial toxin microcystin. *Limnology and Oceanography Letters.* doi: 10.1002/lol2.10164

Bogard, MJ, RJ Vogt, NM Hayes, PR Leavitt. Unabated nitrogen pollution favors growth of toxic cyanobacteria over chlorophytes in most hypereutrophic lakes. *Environmental Science & Technology* 54(6): 3219-3227. doi: 10.1021/acs.est.9b06299

*Haig, HA, NM Hayes, GL Simpson, Y Yi, B WIssel, KR Hodder, PR Leavitt. 2020. Comparison of isotopic mass balance and instrumental techniques as estimates of basin hydrology in seven connected lakes over 12 years. *Journal of Hydrology* 6(100046) doi: 10.1016/j.hydroa.2019.100046

Webb, JR, NM Hayes, GL Simpson, PR Leavitt, H Baulch, K Finlay. 2019. Widespread nitrous oxide undersaturation in farm waterbodies: An unexpected greenhouse gas sink. *PNAS*, doi: 10.1073/pnas.1820389116

Leach, TH, LA Winslow, NM Hayes, and KC Rose. 2019. Decoupled trophic responses to recovery from acidification and associated browning in lakes. *Global Change Biology,* doi: 10.1111/gcb.14580.

Hayes, NM, A Patoine, HA Haig, GL Simpson, VJ Swarbrick, E Wiik, and PR Leavitt. 2019. Spatial and temporal variation in the importance of net nitrogen fixation to phytoplankton growth in productive hardwater lakes. *Freshwater Biology* 64(3), doi:10.1111/fwb.13214.

Wiik, E, HA Haig, NM Hayes, K Finlay, GL Simpson, R Vogt, and PR Leavitt. 2018. Generalized additive models of climatic and metabolic controls of sub-annual variation in pCO_2 in productive hardwater lakes. *Biogeosciences* 123(6): 1940-1959.

Hayes, NM and MJ Vanni. 2018. Microcystin concentrations are low in most Ohio lakes but can be predicted with phytoplankton biomass and watershed morphology. *Inland Waters* 8(3).

Hayes, NM, BR Deemer, JR Corman, NR Razavi, and KE Strock. 2017. Key differences between lakes and reservoirs modify climate signals: a case for a new conceptual model. *Limnology and Oceanography Letters* 2(2): 47-62.

Hundey, EJ, JH Olker, C Carreira, RM Daigle, AK Elgin, M Finiguerra, NJ Gownaris, NM Hayes, L Heffner, NR Razavi, PD Shirey, BB Tolar, and EM Wood-Charlson. 2016. A shifting tide: recommendations for incorporating science communication into graduate training. *Limnolology and Oceanography Bulletin* 25(4): 109-116.

*Downs, KM, NM Hayes, AM Rock, MJ Vanni, and MJ González. 2016. Light and nutrient supply mediate intraspecific variation in the nutrient stoichiometry of juvenile fish. *Ecosphere* 7(10): e01452.

Hayes, NM, MJ Vanni, MJ Horgan, and WH Renwick. 2015. Drought and land use interactively affect lake phytoplankton nutrient limitation status. *Ecology* 96(2): 392-402.
Awarded the Thomas M. Frost Award for Excellence in Graduate Research

Hayes, NM, KJ Butkas, JD Olden, and MJ Vander Zanden. 2009. Behavioral and growth differences between experienced and naïve populations of a native crayfish in the presence of invasive rusty crayfish. *Freshwater Biology* 54: 1876-1887.

In Review or Revision
*Haig, HA, NM Hayes, GL Simpson, Y Yi, B Wissel, KR Hodder, and PR Leavitt. *Journal of Hydrology.* Relative importance of seasonal-, and interannual-scale, hydrological variability in a chain of seven sub-humid lakes measured using water isotopes (δ^2H, $\delta^{18}O$).

*Bergbush, NT, NM Hayes, GL Simpson, PR Leavitt. *Limnology and Oceanography*. Unexpected shift from phytoplankton to periphyton in small eutrophic streams of the northern Great Plains due to wastewater influx.

Teaching Experience

Instructor

Miami University
2013 Environmental Biology (42 students), sole responsibility for lecture

Teaching Assistant
Miami University
2015 Fundamentals of Human Physiology, 2 sessions (39 students)
2014 Limnology, 2 sections (24 students)
2010 Limnology, 2 sections (24 students), designed a semester long course-based research experience

Guest Lecturer
University of Minnesota
2019 Lake metabolism (2 lectures) in General Ecology
2018 Nitrogen biogeochemistry (1 lecture) in Biogeochemistry

University of Regina
2017 Phytoplankton ecology (6 lectures) in Limnology
2017 Toxicology (2 lectures) in Environmental Biology
2016 Phytoplankton ecology (5 lectures) in Limnology
2016 Carbon biogeochemistry (1 lecture) in Biogeoscience
2015 Nitrogen biogeochemistry (1 lecture) in Biogeoscience

Miami University
2014 Biogeochemical cycles (2 lectures) in Honors Ecology
2013 Population and community ecology (2 lectures) in Honors Ecology
2011 Global change ecology (1 lecture) in Honors Ecology

Professional Teacher Training
2019 Broadening Participation in the Classroom workshop, University of Minnesota
2010 Lilly Conference on Evidence-Based Teaching and Learning, Miami University
2008 – 2009 Graduate Student Enhancement Program (GSTEP), Miami University

Mentoring Experience
2019 - Brianna Loeks-Johnson, Ph. D., Heterotrophic nitrogen fixation in lake sediments
2019 - Benton Fry, Effects of temperature increase on phytoplankton nutrient limitation
2018 - 2020 Julia Turnbow, Phosphene, methane, and nitrous oxide – The stoichiometry of greenhouse gas emissions in Minnesota lakes
2018 - 2020 Rachel Krewson, The effects of lake temperature on rates of methane production and oxidation in two Sub-Arctic lakes
2018 – 2019 Madaline Ritter, The effects of DOC quantity and quality on methane production, oxidation, and emission in Icelandic lakes
2018 – 2019 Josie Verter, The role of methanotrophs in fueling aquatic food webs and resulting effects on methane cycling in Icelandic lakes
2018 Justin Odynski, Nitrogen cycling in prairie lakes: a stable isotope approach to quantifying under-ice processes
2017 - Nat Bergbusch, M.Sc., Impacts of biological nitrogen removal from wastewater on lake nutrient retention
2015 – 2016 Brady O'Connor, Paleolimnological reconstruction of the nitrogen cycle in a prairie lake using real time qPCR
2015 – 2016 Michelle Lang, $\delta^{13}C$ of dissolved carbon in the Qu'Appelle River and Wascana Creek in 2011 and 2012
2014 Irene Queen, Measurement of ecosystem metabolism -comparison of two methodologies
2010 – 2013 Keslea Downs, The interactive effects of light, nutrients, and nutrient loading rates on fish fitness and trophic position

2012 John Whalen, A comparison of phytoplankton quantifying techniques to assess nutrient limitation of communities

2011 – 2012 Jessica St-Pierre, Food chain efficiency and herbivore food quality: linking small-scale bioassays and large-scale experiments. Presented a poster at a regional conference (2nd place in poster competition)

2009 – 2010 Elizabeth Brownson, Phytoplankton nutrient limitation along a gradient of land use in Ohio reservoirs.

Presentations

* mentee is first author

Hayes, NM. 2019. Invited speaker. Ecosystem effects of harmful algal blooms. Water Resources Conference, St. Paul, MN.

*Bergbusch, N, Z Quinones-Rivera, H Haig, V Swarbrick, NM Hayes, PR Leavitt. 2019. Unintended effects of nitrogen-rich discharge from a tertiary wastewater treatment plant on primary producers in phosphorus-rich streams of the Northern Great Plains. Association for the Sciences of Limnology and Oceanography, San Juan, Puerto Rico.

Deemer, B, NM Hayes, K Strock, J Corman, R Razavi, K Dibble, C Yackulic. 2019. Catchment and management characteristics are key to determining reservoir response to climate change. Association for the Sciences of Limnology and Oceanography, San Juan, Puerto Rico.

Hayes, NM. 2018. Invited seminar. A landscape view of the causes and consequences of cyanobacteria blooms. St. Croix Watershed Research Station, St. Croix, MN.

Hayes, NM. 2018. Invited seminar. A landscape view of the causes and consequences of cyanobacteria blooms. Water Resources Science, University of Minnesota, St. Paul, MN.

*Bergbush, NT, VJ Swarbrick, NM Hayes, PR Leavitt. 2018. Poster. Effects of nitrogen from a tertiary wastewater treatment plant on primary producers in phosphorus-rich streams of the northern great plains. Association for the Sciences of Limnology and Oceanography, Victoria, BC.

Hayes, NM, RJ Vogt, K Finlay, G Simpson, PR Leavitt. 2018. Oral Presentation. Phytoplankton periodicity provides insights into seasonal and catchment-specific drivers of environmental change. Association for the Sciences of Limnology and Oceanography, Victoria, BC.

Leach, TH, L Winslow, NM Hayes, K Rose. 2018. Oral Presentation. Does space equate to time? A long-term assessment of ecological impacts of increasing dissolved organic matter in 28 lakes. Association for the Sciences of Limnology and Oceanography, Victoria, BC.

Leavitt, PR, HM Baulch, NM Hayes, et al. 2018. Oral Presentation. Coupled carbon and nitrogen biogeochemistry in productive hardwater lakes: insights from mass fluxes of gases, solutes, and particles over 25 years. Association for the Sciences of Limnology and Oceanography, Victoria, BC.

Hayes, NM. 2018. Invited seminar. Individual and interactive effects of climate change and nutrient pollution on aquatic ecosystems. Wellesley College, Wellesley, MA.

Hayes, NM. 2017. Invited seminar. Individual and interactive effects of climate change and nutrient pollution on aquatic ecosystems. University of Calgary, Calgary, AB.

Leavitt, PR, MJ Bogard, L Bunting, DB Donald (1), DB Donald (2), K Finlay, RI Hall, NM Hayes, S McGowan, V Swarbrick, A Patoine, JA Rusak, GL Simpson, RJ Vogt, Limnology Field Team. 2017. Oral Presentation. Regulation of lake production and phytoplankton community composition by

fluxes of nitrogen – A synthesis of 25 years of ecosystem ecology. Association for the Sciences of Limnology and Oceanography, Honolulu, HI.

*Haig, HA, NM Hayes, GL Simpson, KR Hodder, PL Leavitt. 2017. Oral Presentation. Quantifying the relative effects of climate and catchment controls upon isotopic mass balances in lakes of the North American great plains. Association for the Sciences of Limnology and Oceanography, Honolulu, HI.

Hayes, NM, HA Haig, GL Simpson, PR Leavitt. 2017. Oral Presentation. Climatic and urban control of the timing and magnitude of microcystin peaks in hardwater eutrophic lakes. Association for the Sciences of Limnology and Oceanography, Honolulu, HI.

*O'Connor, B, NM Hayes, E Wiik, C Yost, and PR Leavitt. 2016. Poster. Development of methods for the analysis of sedimentary DNA in eutrophic prairie lakes. Canadian Society of Microbiologists, Toronto, ON.

*Haig, HA, GL Simpson, B Wissel, NM Hayes, and PR Leavitt. 2016. Oral Presentation. Quantification of hydrological variability in riverine lakes using stable isotopes of water. Association for the Sciences of Limnology and Oceanography, Santa Fe, NM.

Hayes, NM, A Patoine, HA Haig, GL Simpson, and PR Leavitt. 2016. Oral Presentation. Evaluation of the role of nitrogen fixation in meeting the nitrogen demands of phytoplankton communities in eutrophic lakes. Association of the Sciences of Limnology and Oceanography, Santa Fe, NM.

Rock, AM, JD St-Pierre, NM Hayes, MJ Vanni, MJ González. 2016. Oral Presentation. Evaluating how light and nutrient supply constrain herbivore growth via changes in phytoplankton quantity and quality. Association of the Sciences of Limnology and Oceanography, Santa Fe, NM.

Rock, AM, LJ Ginger, MR Hall, KN Downs, NM Hayes, MJ Vanni, and MJ González. 2015. Poster. Changes in phytoplankton stoichiometry do not carry over to affect carnivore body stoichiometry in a 3-level food chain with bluegill. Conference on Biological Stoichiometry, Petersborough, ON.

Hayes, NM, MJ Vanni, MJ Gonznález, WH Renwick, and MJ Horgan. 2014. Oral Presentation. Agricultural land use change and climate influence phytoplankton community and phytoplankton traits in a eutrophic reservoir. Joint Aquatic Sciences Meeting, Portland, OR.

Rock, AM, NM Hayes, KN Downs, MJ Vanni, and MJ González. 2014. Oral Presentation. Interactive effects of light, phosphorus, and N:P supply ratio on aquatic food chain efficiency. Joint Aquatic Sciences Meeting, Portland, OR.

González, MJ, JM Bobson, KN Downs, MR Hall, NM Hayes, EM Mette, AM Rock, FE Rowland, and MJ Vanni. 2014. Oral Presentation. Exploring the generality of light and nutrient effects in aquatic food chain efficiency. Joint Aquatic Sciences Meeting, Portland, OR.

*Downs, KN, NM Hayes, AM Rock, MJ Vanni, and MJ González. 2013. Poster. The effects of light and nutrient supply on juvenile fish (bluegill, *Lepomis macrochirus*) fitness and nutrient stoichiometry. Midwest Ecology and Evolution Conference, South Bend, IN.

*Whalen, J, EM Mette, NM Hayes, and MJ Vanni. 2013. Poster. A comparison of phytoplankton quantifying techniques to assess nutrient limitation of communities. Midwest Ecology and Evolution Conference, South Bend, IN.

Hayes, NM, AM Rock, MJ Gonzalez, and MJ Vanni. 2013. Poster. Comparing nutrient limitation in chlorophytes and cyanobacteria under contrasting conditions of nutrient supply, nutrient ratios and light. Association for the Sciences of Limnology and Oceanography, New Orleans, LA.

Mette, EM, LB Knoll, MJ Vanni, and NM Hayes. 2012. Poster. Phytoplankton primary production: a tale of two methods. Global Lakes Ecological Observatory Network, Mulranny, Mayo Co., Ireland.

Hayes, NM, MJ Vanni, MJ Horgan, and WH Renwick. 2012. Oral Presentation. Climate and land use interact to determine phytoplankton nutrient limitation. Ecological Society of America, Portland, OR.

*Downs, KN, NM Hayes, AM Rock, MJ Vanni, and MJ González. 2012. Poster. The effects of light and nutrient supply on juvenile fish (bluegill, *Lepomis macrochirus*) fitness and nutrient stoichiometry. Ecological Society of America, Portland, OR.

Hayes, NM, J Brentrup, M Gaglione, et al. 2012. Poster. Sensing climate change: Using sensors to identify drivers of climate change in aquatic ecosystems. IGERT PI-meeting, Washington D.C.

*St-Pierre, JD, AM Rock, NM Hayes, MJ Vanni, and MJ González. 2012. Poster. Food chain efficiency and herbivore food quality: linking small-scale bioassays and large-scale experiments. Midwest Ecology and Evolution Conference, Cincinnati, OH.

Hayes NM, EB Brownson, and MJ Vanni. 2011. Oral Presentation. Precipitation mediates the importance of land use on nutrient limitation and cyanotoxin production. Association for the Sciences of Limnology and Oceanography Meeting. San Juan, PR.

Hayes, NM. 2006. Oral Presentation. The Rusty Crayfish. Wisconsin's Invasive Species Educator's Conference, Trees for Tomorrow, Eagle River, WI.

Vennie, EB, NM Hayes, JT Maxted, and MJ Vander Zanden. 2005. Poster. Smart Prevention of the Rusty Crayfish. Aquatic Invasive Species in the Upper Great Lakes Conference, Lac du Flambeau, WI.

Awards and Honors

Thomas M. Frost Award for Excellence in Graduate Research from the aquatic ecology section of the Ecological Society of America, 2015.

Ecological Dissertations in the Aquatic Sciences (Eco-DAS)

Service

2020	Minnesota Master Naturalist instructor, Cedar Creek Ecosystem Reserve, MN
2019	Market Science, Bagley, MN.
2019	Mississippi River Headwaters Days, Itasca State Park, MN.
2017	Canada Wide Science Fair judge
2016	Regina Regional Science Fair
2016	Association for the Science of Limnology and Oceanography, session organizer
2014	Joint Aquatic Science Meeting, session organizer
2013	STEM Exploration Academy, session leader
2012 – 2014	Lacawac Ecological Observatory Workshop, planning committee
2012 – 2014	Global Lakes Ecological Observatory Network, member relations committee
2012	Talawanda Science Week, session leader
2011	Ecology lunch seminar coordinator, Miami University
2010	Talawanda Science Week, session leader
2009	Talawanda Science Week, session leader

Reviewer for *Aquatic Ecology*, *American Midland Naturalist, Biogeochemistry, Canadian Journal of Fisheries and Aquatic Sciences, Freshwater Biology, Freshwater Sciences, Global Change Biology, Limnology and Oceanography: Letters, Marine and Freshwater Research,* and *Soil, Water, and Air Pollution*

Memberships

Association for the Sciences of Limnology and Oceanography (ASLO)
Ecological Society of America (ESA)

Global Lakes Ecological Observatory Network (GLEON)