

YARROW AXFORD

William Deering Professor in Geological
Sciences, Dept. of Earth and Planetary Sciences
Northwestern University
2145 Sheridan Road, Evanston IL 60208 USA

EDUCATION

- Ph.D., 2007* Geological Sciences, University of Colorado, Boulder CO
- M.S., 2000* Geology, Utah State University, Logan UT
- A.B., 1997* Geology, *Summa cum laude*, Mount Holyoke College, S. Hadley MA

PRIMARY AREAS OF EXPERTISE

Arctic and global climate change; Quaternary paleoclimate and paleolimnology; science communication; teaching and mentorship in higher education

ACADEMIC EMPLOYMENT

- Sept 2023 – present* William Deering Professor in Geological Sciences
Northwestern University, Dept. of Earth and Planetary Sciences
- Sept 2017 – Aug 2023* Associate Professor (& Director of Graduate Admissions 2020-2023)
Northwestern University, Dept. of Earth and Planetary Sciences
- Jan 2012 – Aug 2017* Assistant Professor (& Director of Undergraduate Studies 2014-2017)
Northwestern University, Dept. of Earth and Planetary Sciences
- Sept 2010 – Dec 2011* Visiting Assistant Professor
Northwestern University, Dept. of Earth and Planetary Sciences
- Mar 2010 – Aug 2010* Adjunct Lecturer
Northwestern University, Dept. of Earth and Planetary Sciences,
Evanston IL
- Oct 2008 – Mar 2010* Research Associate
University of Colorado, Institute of Arctic and Alpine Research,
Boulder CO
- May 2007 – Oct 2008* Comer Science & Education Foundation Postdoctoral Fellow
University of Iceland, Earth Science Institute, Reykjavík, Iceland
(Áslaug Geirsdóttir, supervisor)
- and Research Assistant Professor
Dept. of Geology, University at Buffalo, Buffalo NY

SELECTED AWARDS, FELLOWSHIPS, RECOGNITIONS

NSF Faculty Early Career Development (CAREER) Award, Office of Polar Programs
Early Career Investigator Award, Institute for Sustainability and Energy at Northwestern
Finalist Nominee, AAAS Early Career Award for Public Engagement with Science
Postdoctoral Fellowship, Gary S. Comer Science & Education Foundation
NSF IGERT Graduate Fellowship, Carbon Climate and Society Initiative, Univ. of Colorado
J. Hoover Mackin Research Award, GSA Quaternary Geology & Geomorphology Division,
awarded to the top Ph.D. proposal submitted to the Division
Arthur D. Howard Research Award, GSA Quaternary Geology & Geomorphology Division,
awarded to the top M.S. proposal submitted to the Division

PEER-REVIEWED JOURNAL ARTICLES, PAST 5 YEARS

* Starred names are supervised graduate students or postdocs.

** Double stars indicate supervised undergraduates.

Axford indicates senior author/principal investigator role.

In Press

57. *Larocca, L.J., Twining-Ward, M., Axford, Y., Schweinsberg, A.D., Larsen, S.H., Westergaard-Nielsen, A., Luetzenburg, G., Briner, J.P., Kjeldsen, K.K., and Björk, A.A. 2023. Greenland-wide accelerated retreat of peripheral glaciers in the twenty-first century. *Nature Climate Change*.
56. *McFarlin, J.M., Axford, Y., Kusch, S., Masterson, A.L., *Lasher, G.E., and Osburn, M.R. Aquatic plant wax hydrogen and carbon isotopes in Greenland lakes record shifts in methane cycling during past Holocene warming. *Science Advances* 9, eadh970.
55. *Puleo, P.J.K., and Axford, Y. 2023. Duration and ice thickness of a late Holocene outlet glacier advance near Narsarsuaq, South Greenland. *Climate of the Past* 19, 1777-1791.
54. *Puleo, P.J.K., Masterson, A.L., Medeiros, A.S., Schellinger, G., **Steigleder, R., Woodroffe, S., Osburn, M., and Axford, Y. 2022. Younger Dryas and early Holocene climate in South Greenland inferred from oxygen isotopes of chironomids, aquatic moss, and moss cellulose. *Quaternary Science Reviews* 296, 107810.
53. Medeiros, A.S., Chipman, M., Francis, D.R., Hamerlik, L., Langdon, P., *Puleo, P.J.K., Schellinger, G., **Steigleder, R., Walker, I.R., Woodroffe, S., and Axford, Y. 2022. A continent-scale chironomid training set for reconstructing arctic temperatures. *Quaternary Science Reviews* 294, 107728.
52. **Brooks, J.P., *Larocca, L., and Axford, Y. 2022. Little Ice Age climate in South Greenland inferred from quantitative geospatial analyses of alpine glacier reconstructions. *Quaternary Science Reviews* 293, 107701.

51. Miller, G.H., Wolfe, A.P., **Axford, Y.**, and 14 others. 2022 Last interglacial lake sediments preserved beneath Laurentide and Greenland Ice sheets provide insights into Arctic climate amplification and constrain 130 ka of ice-sheet history. *Journal of Quaternary Science* 37, 979-1005.
50. *Larocca, L., and **Axford, Y.** 2022. Arctic glaciers and ice caps through the Holocene: a circumpolar synthesis of lake-based reconstructions. *Climate of the Past* 18, 579–606.
49. Medford, A.K., Hall, B.L., Lowell, T.V., Kelly, M.A., Levy, L.B., Wilcox, P.S., and **Axford, Y.** 2021. Holocene glacial history of Renland Ice Cap, East Greenland, reconstructed from lake sediments. *Quaternary Science Reviews* 258, 106883
48. Carlson, A., Reyes, A., Gusterson, E., **Axford, Y.**, Wilcken, K., and Rood, D. 2021. Direct evidence for thinning and retreat of the southernmost Greenland ice sheet during the Younger Dryas. *Quaternary Science Reviews* 267, 107105.
47. Otto-Bliesner, B.L., Brady, E.C., Zhao, A., Brierley, C., **Axford, Y.**, Capron, E., Govin, A., Hoffman, J., Isaacs, E., Kageyama, M., Scussolini, P., Tzedakis, P.C., Williams, C., Wolff, E., Abe-Ouchi, A., and 22 others. 2021. Large-scale features of Last Interglacial climate: results from evaluating the lig127k simulations for the Coupled Model Intercomparison Project (CMIP6)–Paleoclimate Modeling Intercomparison Project (PMIP4). *Climate of the Past* 17, 63-94.
46. **Axford, Y.**, de Vernal, A., and Osterberg, E.C. 2021. Past warmth and its impacts in Greenland during the Holocene Thermal Maximum. *Annual Review of Earth and Planetary Sciences* 49, 279–307.
45. *Medeiros, A.S., Milošević, Đ., Francis, D.R., Maddison, E., Woodroffe, S., Long, A., Walker, I.R., Hamerlík, L., Quinlan, R., Langdon, P., Brodersen, K.P., and **Axford, Y.** 2020. Arctic chironomids of the northwest North Atlantic reflect environmental and biogeographic gradients. *Journal of Biogeography*, DOI 10.1111/jbi.14015
44. *Larocca, L.J., **Axford, Y.**, Woodroffe, S.A., *Lasher, G.E., and **Gawin, B. 2020. Holocene glacier and ice cap fluctuations in southwest Greenland inferred from two lake records. *Quaternary Science Reviews* 246, 106529.
43. **Dion-Kirschner, H., *McFarlin, J.M., Masterson, A., **Axford, Y.**, and Osburn, M.R. 2020. Modern constraints on the sources and climate signals recorded by plant waxes in west Greenland. *Geochimica et Cosmochimica Acta* 286, 336–354.
42. *Larocca, L., **Axford, Y.**, *Lasher, G.E., **Brooks, J., and Bjørk, A.A. 2020. Local glaciers record delayed peak Holocene warmth in South Greenland. *Quaternary Science Reviews* 241, 106421.
41. **Puleo, P.J.K., **Axford, Y.**, *McFarlin, J.M., Curry, B.B., Barklage, M., and Osburn, M.R. 2020. Late glacial and Holocene paleoenvironments in the midcontinent United States, inferred from Geneva Lake leaf wax, ostracode valve, and bulk sediment chemistry. *Quaternary Science Reviews* 241, 106384.
40. *Lasher, G.E., **Axford, Y.**, **Berman, K.S., and *Larocca, L.M. 2020. Holocene temperature and landscape history of southwest Greenland inferred from oxygen isotopes and geochemical lake sediment proxies. *Quaternary Science Reviews* 239, 106358.
39. Kaufman, D.S., McKay, N., Routson, C., Erb, M., Davis, B., Heiri, O., Jaccard, S., Tierney, J., Dätwyler, C., Axford, Y., Brussel, T., Cartapanis, O., Chase, B., Dawson, A., de Vernal, A., Engels, S., Jonkers, L., Marsicek, J., Moffa-Sánchez, P., Morrill, C., Orsi, A.,

- Rehfeld, K., Saunders, K., Sommer, P., Thomas, E., Tonello, M., Tóth, M., Vachula, R., Andreev, A., and 63 others. 2020. A global database of Holocene paleo-temperature records. *Scientific Data* 7, 115.
38. Engels, S., Medeiros, A.S., **Axford, Y.**, Brooks S.J., Heiri, O., Luoto, T.P., O., Nazarova, L., Porinchu, D.F., Quinlan, R., and Self, A.E. 2019. Temperature change as a driver of spatial patterns and long-term trends in chironomid (Insecta: Diptera) diversity. *Global Change Biology* 26, 1155-1169.
37. *McFarlin, J.M., **Axford, Y.**, Masterson, A., and Osburn, M.R. 2019. Calibration of modern sedimentary $\delta^2\text{H}$ plant wax-water relationships in Greenland lakes. *Quaternary Science Reviews* 225, 105978.
36. Khider, D. and 101 others. 2019. PaCTS v1.0: A Crowdsourced reporting standard for paleoclimate data. 2019. *Paleoceanography and Paleoclimatology*, DOI 10.1029/2019PA003632.
35. Capron, E., Rovere, A., Austermann, J., **Axford, Y.**, Barlow, N.L.M., Carlson, A.E., de Vernal, A., Dutton, A., Kopp, R.E., McManus, J.F., Meniel, L., Otto-Bliesner, B.L., Robinson, A., Shakun, J.D., Tzedakis, P., and Wolff, E.W. 2019. Challenges and research priorities to understand interactions between climate, ice sheets and global mean sea level during past interglacials. *Quaternary Science Reviews* 219, 308-311.
34. **Axford, Y.**, *Lasher, G.E., Kelly, M.A., Osterberg, E.C., Landis, J., Schellinger, G., **Pfeiffer, A., Thompson, E., and Francis, D.R. 2019. Holocene temperature history of northwest Greenland – with new ice cap constraints and chironomid assemblages from lake Deltasø. *Quaternary Science Reviews* 215, 160-172.
33. *Lasher, G.E., and **Axford, Y.** 2019. Medieval warmth confirmed at the Norse Eastern Settlement in Greenland. *Geology* 47, 267-270.
32. *McFarlin, J.M., **Axford, Y.**, Osburn, M.R., Kelly, M.A., Osterberg, E.O., and Farnsworth, L.B. 2018. Pronounced summer warming in northwest Greenland during the Holocene and Last Interglacial. *Proceedings of the National Academy of Sciences* 115, 6357-6362.
- (31 additional journal articles in previous years)

PUBLIC WRITING

Axford, Y. Climate change is here: What now? *American Scientist* v. 111, September-October 2023.

Axford, Y., Awad, A., and Pratt, A. Integrating climate science into NGSS-aligned high school STEM courses. *In the Trenches*, The News Magazine of the National Association of Geoscience Teachers, January 2019.

*McFarlin, J., *Larocca, L., *Lasher, G.E., and **Axford, Y.** A holiday guide: Talking with family about climate change. *Helix Magazine*, online, December 22, 2016.

Axford, Y. Thanks to the glass ceiling breakers. *Science*, print issue, September 2, 2016.

Axford, Y. No, global warming isn't suddenly a myth because it's really cold out. *U.S. News and World Report*, online, January 25, 2014.

Axford, Y. What's really on trial in the Arctic: the future. *Huffington Post*, online, November 22, 2013.

Axford, Y. Scientists and reporters: Tips for scientists who talk with the media. *Geotimes*, November 2002. p. 38-39.

EXTERNAL RESEARCH FUNDING, PAST 5 YEARS

Funded by: National Science Foundation, Arctic System Sciences

Title: *Collaborative Research: Climate change and human adaptation in Arctic-like environments across the Pleistocene-Holocene transition.* With lead PIs: Nathaniel Kitchel and Meredith Kelly (Dartmouth College).

Dates: 2023-2027

Total funding to Axford: \$301k

Funded by: National Science Foundation, Paleoclimate Perspectives on Climate Change & Polar Programs

Title: *Seasonality of abrupt climate change over Greenland: Direct tests for the Younger Dryas and 8.2 ka event using paleolimnology.* With co-I Magdalena Osburn, Northwestern University.

Dates: 2020-2024

Total funding: \$641k (plus polar field logistics costs ~\$100k)

Funded by: National Science Foundation, Division of Polar Programs

Title: *CAREER: South Greenland's Holocene climate history reconstructed using three paleolimnological approaches*

Dates: 2015-2021

Total funding: \$598k (plus polar field logistics costs ~\$150k)

Funded by: National Science Foundation, Geography and Regional Sciences

Title: *Doctoral Dissertation Research: A geospatial analysis of alpine glacial variability.* With Ph.D. student Laura Larocca.

Dates: 2018-2021

Total funding: \$18k

Funded by: National Geographic Society, Changing Polar Systems RFP

Title: *Fire history of SW Greenland: Characterizing long term climate-fire relationships using lake sediments.* With PI Dr. Melissa Chipman (formerly NU postdoctoral scholar).

Dates: 2018-2020

Total funding: \$43k

SELECTED MEDIA APPEARANCES & PUBLIC LECTURES

12/2022 Panelist, *Navigating Climate Change Communication*, Fall Symposium of the Institute for Sustainability and Energy at Northwestern

11/2022 Arctic meltdown? Long-term perspectives on climate change from layers of mud, Lecture for Alumnae "Puzzles in Science" course, Northwestern University

08/2022 Television interview, How can inevitable sea level rise be dealt with? Al Jazeera, Inside Story

- 07/2022 Public lecture in Greenland, Greenland's climate since the last ice age: history written in lake mud, Thule Air Base, Greenland
- 04/2022 Panelist, Panel on Climate Change Education, Northwestern University
- 02/2022 Television interview, *UN climate report: extreme flooding in Midwest expected to get worse*, ABC Nightly News Chicago
- 01/2020 Profile, Crain's Chicago Business *Takeaway* column
- 04/2019 *Two must-do's for effective science communication, from proposals to the local pub*. Lecture for the Northwestern Graduate Student Association and Science Policy Outreach Task Force
- 06/2019 Featured scientist, NPR's *Wow in the World*
- 05/2019 *Arctic climate change*. Lecture for Alumnae "New Frontiers in Science" course, Northwestern University
- 04/2019 Scientist of the Month, Association for Women in Science – Chicago
- 02/2019 Guest speaker for AP Environmental Science class, Whitney M. Young Magnet High School, Chicago
- 02/2019 *Solving the climate mystery of the Vikings*. CNN coverage of research paper, A. Strickland, CNN, Feb 6 2019. <https://www.cnn.com/2019/02/06/world/viking-greenland-climate-study/index.html>
- 01/2019 Live television interview, *These scientists study the Arctic. What's their take on 'Chiberia'?* WTTW, Chicago Tonight, <https://news.wttw.com/2019/01/31/these-scientists-study-arctic-what-s-their-take-chiberia>
- 01/2019 *Arctic, Antarctic vets offer warm advice for surviving the polar vortex*. R. McCoppin, Chicago Tribune, Jan 30 2019.
- 06/2018 Keynote speaker and lead organizer, 2-day professional development workshop on climate science for K-12 teachers, Northwestern University
- 06/2018 *Ancient Greenland was shockingly warm, study finds*. Gizmodo.com coverage of research paper, M. Stone, June 7 2018.
- 07/2017 Live television interview, *Giant iceberg the size of Delaware breaks off Antarctica*. WTTW, Chicago Tonight
- 07/2017 Live radio interview, *Ice breaks off Antarctic shelf*. WGN Radio, The John Williams Show
- 04/2017 Podcast, *Life in the Headlines: Interviews with climate scientists*. Urban Plains podcast, Drake University
- 04/2017 Public lecture, *Arctic meltdown? Perspectives from a polar geologist*. Chicago Taste of Science, Chicago
- 02/2017 Panel member, *Does truth stand a chance?* Science and Human Culture Program, Northwestern University
- 02/2017 Public lecture and community discussion, *Weather and climate change*. Northwestern Libraries and One Book One Northwestern.

UNIVERSITY COURSES

Energy and Climate Change

Interdisciplinary lecture- and discussion-based class for graduate students and advanced undergraduates in all fields. Surveys history and geography of energy use, and fundamental climate science with a focus on Earth's energy balance. Matriculates students from all Northwestern schools including WCAS, McCormick, Kellogg, and Medill. Core course for the M.S. in Mechanical Engineering with Specialization in Sustainability/Energy.

Quaternary Climate Change – Ice Ages to the Age of Oil

Course covers methods for reconstructing and dating past environmental change, causes of natural climate change, major climatic events of the Cenozoic up to present-day, and their relevance for understanding current climate change. Lecture and discussion. Homework assignments focus on quantitative aspects of radiometric dating and on interpretation of surficial geologic maps.

Communicating Science Beyond Academia

Open to graduate students in all STEM disciplines, this course explores strategies for successful scientific communication beyond academia. How can we break through barriers to understanding and foster engagement with scientific information, while still conveying nuance and uncertainty? What happens when science becomes politicized and controversial? Among other hands-on exercises, students complete peer-reviewed writing assignments which they may choose to publish for public audiences.

Lake Michigan and Climate Change

Graduate-level seminar focused on reading and discussing primary research literature and major review papers and reports. Students lead discussions on readings pertaining to fundamental physical limnology and ecology of Lake Michigan, and projected impacts of climate change and other anthropogenic pressures on the Laurentian Great Lakes.

Paleoclimate Perspectives on Future Climate Change

What does Earth's eventful climate history tell us about our future? Emphasis on understanding methods used to reconstruct Cenozoic climates, and on exploring the causes and consequences of climate shifts from the PETM to the late Holocene. Graduate-level discussions of primary literature.

Arctic Environments – Past, Present, Future

Graduate-level seminar focused on reading and discussing primary research literature and major review papers and reports. Students lead discussions on readings pertaining to arctic paleoenvironments and paleoclimate, dynamics of present-day arctic environments, and perspectives on the Arctic's future.

Earth: A Habitable Planet

Introduction to Earth system science and the physical science of diverse environmental problems. Required for Environmental Science and Environmental Engineering majors. Large lecture format.

Global Warming: The Scientific Evidence

Freshman seminar addressing the science behind debates over climate change. Student-centered, discussion-based format, emphasizing the improvement of student writing and critical thinking skills, and critique of science-based arguments.

SELECTED LEADERSHIP ROLES

- 2022 - Co-chair, Northwestern University Organization of Women Faculty, advocacy & networking group representing 800+ women faculty at Northwestern
- Previously a steering committee member 2016-2022. Accomplishments included advising University central administration on pandemic responses for faculty career development and well-being, advocating for improved faculty salaries and salary equity.
- 2022 - Co-founder, Medill Media and Science Communication graduate certificate program for Northwestern STEM Ph.D. students. With founder and program leader Patti Wolter, Helen Gurley Brown Magazine Professor of Journalism
- 2021 - Editorial Board member, *Journal of Quaternary Sciences*
- 2020 - Leadership Council member, American Quaternary Association (AMQUA) and: Chair of Awards Committee
Member, Committee on Diversity, Equity and Inclusion
- 2019 - Faculty advisor, Science Policy Outreach Task Force (SPOT; provides Northwestern researchers with training in and opportunities for science outreach and policy advocacy)
- 2012 - 20+ guest lectures on climate science to Weinberg College of Arts and Sciences, Medill (journalism), McCormick (engineering) and Law School classes at Northwestern and NU-Qatar
- 2010 - Primary adviser to 7 PhD students thus far, and research adviser/supervisor for 28 undergraduate research assistants and honors thesis students. Advisee outcomes include numerous tenure-track faculty jobs and permanent government research positions; Fulbright, NSF GRF, and other graduate fellowships; and admissions to excellent graduate programs.
- 2020 - 2023 Director of Graduate Admissions and Recruitment, Department of Earth and Planetary Sciences, Northwestern University

- 2020-2023 Administrative Board of The Graduate School, Representative for Weinberg College Division I (Sciences), Northwestern University
- 2018-2022 Faculty advisor, Chicago Women in STEM Initiative and STEM Circuits (peer mentoring program for postdocs and graduate students in STEM fields)
- 2018 - 2021 Advisory board member, Department of Geology, Utah State University
- 2018 Lead organizer and keynote presenter: *Integrating Climate Science into Your STEM Courses*. Led a two-day professional development workshop on teaching climate science for Chicago-area high school teachers, supported by NSF Division of Polar Programs and Northwestern Office of Community Education Partnerships. <http://bit.ly/NWUclimate>
- 2018 Collaborator on developing community college curriculum for Indigenous students: *Climate Change Curriculum for the Environmental Technology Program of Nunavut Arctic College*. Supported by Indigenous and Northern Affairs Canada. Iqaluit, Nunavut, Canada
- 2014 - 2017 Director of Undergraduate Studies, Department of Earth and Planetary Sciences, Northwestern University
- 2013 - 2014 Public Voices Fellow, OpEd Project, Northwestern University
- 2010 Lead organizer and panelist, *Communicating Science to the Public*, panel discussion with journalists, filmmaker and policy scientist at the 40th International Arctic Workshop, Winter Park CO
- 2008 Lead organizer and presenter, *Mini-Course for Arctic Researchers: How to Work with the News Media*, training course at the 38th International Arctic Workshop, Boulder CO