

Mary Heskell, Ph.D.

CONTACT INFORMATION

Macalester College
Department of Biology
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EDUCATION

Columbia University, New York City, NY

Ph.D., Ecology, Evolution, & Environmental Biology 2013

M.A., Ecology, Evolution, & Environmental Biology 2011

- Dissertation: "Environmental Controls on Foliar Respiration in Arctic Tundra Plants"
- Advisors: Kevin L. Griffin, Hilary Callahan
- Committee: Shahid Naeem, Matthew Turnbull, O. Roger Anderson

City College of New York, New York, NY

M.A. Education, Concentration in Secondary Science Education, *Honors* 2008

University of Pennsylvania, Philadelphia, PA

B.A. Biology, Minor in History of Art, *cum laude* 2006

- Semester at James Cook University, Townsville, QLD, Australia
- Summer at New York University in Madrid, coursework in Spanish & Art History

RELATED EXPERIENCE

The Ecosystems Center, Marine Biological Laboratory, Woods Hole, MA

Rosenthal Postdoctoral Scholar 2014-2018

- Advisor: Jianwu (Jim) Tang
- Field research at Harvard Forest, MA on scaling seasonal canopy carbon cycling
- Undergraduate Research Mentor for Semester in Environmental Science Program

University of Minnesota, Saint Paul, MN

Postdoctoral Associate, Department of Forest Resources 2014

- Advisor: Peter Reich & Owen Atkin (ANU)
- Field research in Northern Minnesota on climate change impacts on carbon cycling

The Australian National University, Canberra, ACT, Australia

Postdoctoral Research Fellow, Division of Plant Sciences 2013-2014

- Advisor: Owen Atkin (ANU)
- Field campaigns in temperate & boreal forests in USA & Sweden

New York City Department of Education, New York, NY

High School Teacher, Urban Assembly Academy for Government & Law 2006-2008

- Taught Regents Living Environment and Human Biology at under-resourced, Title I school in the Lower East Side
- Developed original curriculum, led field trips and after-school enrichment program

RESEARCH INTERESTS

Plant ecophysiology, photosynthesis & respiration, leaf-to-canopy scaling, phenology, global change, arctic, boreal & temperate ecosystems

2020

28. Prager C, Boelman N, Eitel JUH, Gersony JT, Greaves HE, **Heskel MA**, Magney TS, Menge DNL, Naeem S, Shen C, Vierling LA, Griffin KL. A mechanism of expansion: Arctic deciduous shrubs capitalize on increasing nutrient availability. *Oecologia*. 192 (3):671-685.

- Field-based experimental study examining shrub growth response to nutrient gradient in arctic Alaska published in a broadly-read ecology journal (IF: 2.9); MH contributed to idea formulation and writing/editing.

27. Collalti C, Tjoelker MG, Hoch G, Mkel A, Guidolotti G, **Heskel M**, Petit G, Ryan MG, Battipaglia G, Matteucci G, Prentice IC. Plant Respiration: Controlled by photosynthesis or biomass? *Global Change Biology*. 26(3): 1739-1753 doi: d10.1111/gcb.14857

- Modeling study with multi-national collaboration team comparing how carbon vegetation models account for and quantify respiration, published in a top-ranked discipline journal (IF: 8.88); MH contributed to idea formulation and writing/editing.

2019

26. Liu Z, Lu X, An S, **Heskel M**, Tang J. Advantage of multi-band solar-induced chlorophyll fluorescence to derive canopy photosynthesis in a temperate forest. *Agriculture and Forest Meteorology*, 279:107691. doi: 10.1016/j.agrformet.2019.107691

- Field and modeling study reconciling novel approaches to quantify forest carbon fluxes, published in a highly regarded sub-discipline journal, (IF: 4.19); MH contributed to writing, editing, and feedback on analysis.

25. Mo Q, Li Z , Sayer EJ, Lambers H, Li Y, Zou B, Tang J, **Heskel M**, Ding Y, Wang F. Foliar phosphorus fractions reveal how tropical plants maintain photosynthetic rates despite low soil phosphorus availability. *Functional Ecology*, 33(3): 503-513. doi:10.1111/1365-2435/13252

- Field-based experimental study based in sub-tropical China forests examining soil-plant nutrient relationships published in a broadly-read, ecology journal (IF: 5.03); MH contributed to writing/editing and quantitative analysis process.

2018

24. **Heskel MA**, Tang J. Environmental controls on light inhibition of respiration and leaf and canopy daytime carbon exchange in a temperate deciduous forest. *Tree Physiology*, 38(12):1886-1902. doi.org/10.1093/treephys/tpy103

- Field-based experimental study based at Harvard Forest that links leaf-to-canopy carbon fluxes to examine seasonal exchange published in an ecophysiology (IF: 3.44); MH conceived of and developed ideas, collected all field and lab data, performed analyses, and wrote manuscript.

23. **Heskel MA** Small flux, global impact: Integrating the nuances of leaf mitochondrial respiration in estimates of ecosystem carbon exchange. *American Journal of Botany*, 105(5):1-4. doi.org/10.1002/ajb2.1079

- Invited review essay on plant respiration written for a broad plant biology and ecology audience, published in a botany journal (IF: 2.84), MH conceived of and wrote manuscript.

22. Patterson AE, Arkebauer R, Quallo C, **Heskel MA**, Ximeng Li, Boelman N, Griffin KL. Temperature response of respiration and respiratory quotients of 16 co-occurring temperate tree species. *Tree Physiology*, 38(9):1319-1332. doi: 10.1093/treephys/tpx176

- Field-based experimental study based at Black Rock Forest, NY, examining plant respiration responses to temperature, in an ecophysiology journal (IF: 3.44); MH contributed to data collection, writing, and data analysis.

21. Liang L, Arcus V, **Heskel MA**, OSullivan O, Weerasinghe L, Creek D, Egerton J, Tjoelker M,

Atkin OK, Schipper L. Macromolecular rate theory (MMRT) provides a thermodynamics rationale to underpin the convergent temperature response in plant leaf respiration. *Global Change Biology*. 24(4):1538-1547. doi:10.1111/gcb.13936

- Modeling study with international collaboration team that uses a new biochemical model to understand plant respiration across short-term temperature change published in a top-ranked discipline journal (IF: 8.88); MH provided data and contributed to writing/editing. Paper developed from new collaboration based around Heskell et al. 2016 data and has led to funding of a large Marsden Fund grant in 2019.

2017

20. Huntingford C, Atkin OK, Martinez-de la Torre A, Mercado L, **Heskell MA**, Harper A, Bloomfield K, OSullivan O, Reich PB, Wythers K, Butler E, Chen M, Griffin KL, Meir P, Tjoelker MG, Turnbull MH, Sitch S, Wiltshire A, Mahli Y. Implications of improved representations of plant respiration in a changing climate. *Nature Communications*. 8:1602. doi: 10.1038/s41467-017-01774-z

- Modeling study with international collaboration team that applied findings from Atkin et al. 2015 and Heskell et al. 2016 to an Earth System Model, published in a broadly read science journal (IF: 11.88); MH helped conceive of paper, provided data and contributed to analysis and writing.

19. Tcherkez G, Gauthier P, Buckley T, Busch F, Barbour MM, Bruhn D, **Heskell MA**, Gong XY, Crous KY, Griffin KL, Way DA, Turnbull MH, Adams M, Atkin OK, Farquhar GD, Cornic G. Leaf day respiration: low CO₂ flux but high significance for metabolism and carbon balance. *New Phytologist*. 216:986-1001. doi:10.1111/nph.14816

- Collaborative review on light respiration based out of invited international symposium, published in a top plant biology journal (IF: 7.43); MH attended and presented at symposium where essay was conceived, contributed to writing/editing.

18. Yang H, Yang X, **Heskell M**, Sun S, Tang J. Seasonal variations of leaf and canopy properties tracked by ground based NDVI imagery in a temperate forest. *Scientific Reports*. 7:1267.

- Field study based at Harvard Forest applying novel techniques to understand forest carbon cycling through the season, published in a broadly read, open-access science journal (IF: 4.53); MH helped analyze data, write/revise paper.

17. Prager C, Naeem S, Boelman N, Eital J, Greaves H, **Heskell MA**, Magney T, Menge D, Vierling L, Griffin KL. A gradient of nutrient enrichment reveals non-linear impacts of fertilization on Arctic plant diversity and ecosystem function. *Ecology & Evolution*. 7(7): 2449-2460 doi: 10.1002/ece3.2863

- Field-study in arctic Alaska examining global change impacts on biodiversity in the tundra, published in an open-access ecology journal (IF: 2.34); MH contributed to idea formulation and writing/editing.

16. Tcherkez G, Gauthier P, Buckley T, Busch F, Barbour MM, Bruhn D, **Heskell MA**, Gong XY, Crous KY, Griffin KL, Way DA, Turnbull MH, Adams M, Atkin OK, Bender M, Farquhar GD, Cornic G. Tracking the origins of the Kok effect, 70 years after its discovery. *New Phytologist*. 214 (2):506-510 doi: 10.1111/nph.14527

- Collaborative short-review and summary of an international symposium, published in a top plant biology journal (IF: 7.43); MH attended and presented at symposium where essay was conceived, contributed to writing/editing.

15. Yang H, Yang X, Zhang Y, **Heskell MA**, Lu X, Munger W, Sun S, Tang J. Chlorophyll fluorescence tracks seasonal variations of photosynthesis from leaf to canopy in a temperate forest. *Global Change Biology*. 23 (7):2874-2886. doi: 10.1111/gcb.13590

- Field study based at Harvard Forest scaling a new method (SIF) in physiology and ecosystem ecology published in a top-ranked discipline journal (IF: 8.88); MH helped analyze data, write/revise paper.

14. O'Sullivan OS, **Heskel MA**, Reich PB, Tjoelker MG, Weerasinghe KWLK, Penillard A, Zhu L, Egerton JJG, Bloomfield KJ, Creek D, Bahar NHA, Griffin KL, Hurry V, Meir P, Turnbull MH, Atkin OK. Thermal limits of leaf metabolism across biomes. *Global Change Biology*. 23 (1): 209-223 doi: 10.1111/gcb.13477

- Field study including 17 sites around the world examining high-temperature plant physiology, published in a top-ranked discipline journal (IF: 8.88); MH collected and analyzed field data at multiple sites, contributed to data analysis, writing, and revisions.

2016

13. Carey JC, Tang J, Templer PH, Kroeger KD, Crowther TW, Burton AJ, Dukes JS, Emmet B, Frey SD, **Heskel MA**, Jiang L, Machnuller M, Mohan J, Panetta AM, Reich PB, Reinsch S, *et al*. Temperature response of soil respiration largely unaltered with experimental warming. *Proceedings of the National Academy of Sciences*. 113 (48): 13797-13802 doi:10.1073/pnas.1605365113

- Large analysis of warming experiments impact on the temperature response of respiration, conceived of at an invited workshop sponsored by the USGS Powell Center, published in high-impact top-3 science journal (IF: 9.58); MH participated in invited symposium, contributed to conception of modeling approach.

12. **Heskel MA**, OSullivan OS, Reich PB, Tjoelker MG, Weerasinghe L, Penillard A, Egerton J, Creek D, Bloomfield K, Xiang J, Sinca F, Stangl Z, Martinez-de la Torre A, Griffin KL, Huntingford C, Hurry V, Meir P, Turnbull MH, Atkin OK. *Reply to Adams et al.*: Empirical versus process-based approaches to modelling temperature responses of leaf respiration. *Proceedings of the National Academy of Sciences*. 113 (41):E5996-E5997 doi: 10.1073/pnas.1612904113

- Reply to a response letter to Heskel et al. 2016, published in high-impact top-3 science journal (IF: 9.58); MH and OA led writing response.

11. **Heskel MA**, OSullivan OS, Reich PB, Tjoelker MG, Weerasinghe L, Penillard A, Egerton J, Creek D, Bloomfield K, Xiang J, Sinca F, Stangl Z, Martinez-de la Torre A, Griffin KL, Huntingford C, Hurry V, Meir P, Turnbull MH, Atkin OK. Convergence in the temperature response of leaf respiration across biomes and plant functional type. *Proceedings of the National Academy of Sciences*, 113 (14): 3832-3837. doi: 10.1073/pnas.1520282113

- Massive field and modeling study on temperature response of respiration, includes Earth System Modeling impacts of leaf-level physiology, published in high-impact top-3 science journal (IF: 9.58); MH contributed to conception of idea, collected data at multiple international and US sites, led writing, data analysis, and revisions.

2015

10. Murren CJ, Auld JR, Callahan HS, Ghalambor CK, Handelsman CA, **Heskel MA**, Kingsolver J, Maclean HJ, Masel J, Maughan H, Pfennig DF, Relyea RA, Seiter S, Snell-Rood E, Steiner UK, Schlichting CD. Constraints on the evolution of phenotypic plasticity: limits and costs of phenotype and costs of plasticity. *Heredity*, 115:293-301 doi: 10.1038/hdy.2015.8

- Examination on trade-offs to plasticity conceived from invited workshop organized by National Evolutionary Synthesis Center, published in open-access evolution discipline journal (IF: 3.80); MH attended and contributed to workshop where manuscript was conceived, contributed to data collection efforts, writing/editing.

9. Atkin OK, Bloomfield KJ, Reich PB, Tjoelker MG, Asner GP, Bonal D, Buisch G, Bradford M, Cernusak LA, Cosio EG, Creek D, Crous KY, Domingues T, Dukes JS, Egerton JJG, Evans JR,

Farquhar GD, Fyllas NM, Gauthier PPG, Gloor E, Gimeno TE, Griffin KL, Guerrieri R, **Heskel MA**, Huntingford C, Ishida FY, Kattge J, Lambers H, Liddell MJ, Lusk CH, Martin RE, Maximov TC, Maksimov AC, Mahli Y, Medlyn BE, Meir P, Mercado LM, Mirotchnick N, Ng D, Niinemets , OSullivan OS, Philips OL, Poorter L, Poot P, Prentice IC, Salinas N, Rowland LM, Ryan MG, Sitch S, Slot M, Smith NG, Turnbull MH, VanderWel MC, Valladares F, Veneklaas EJ, Weerasinghe LK, Wirth C, Wright IJ, Wythers K, Xiang J, Xiang S, Zaragoza-Castells J. Global variability in leaf respiration in relation to climate, plant functional types, and leaf traits. *New Phytologist*, 206(2): 614-636. doi:10.1111/nph.13253

- Massive field data-based modeling analysis on the environmental and biological controls on respiration around the world, published in a top plant biology journal (IF: 7.43); MH contributed to data collection and writing process.

2014

8. **Heskel MA**, Greaves HE, Turnbull MH, OSullivan OS, Shaver GR, Griffin KL, Atkin OK. Thermal acclimation of shoot respiration in an Arctic woody plant species subjected to 22 years of warming and altered nutrient supply. *Global Change Biology*, 20 (8): 2618-2630. doi: 10.1111/gcb.12544

- Field-study in arctic Alaska examining global change impacts on respiration response in shrubs, published in a top-ranked discipline journal (IF: 8.88); MH helped collect field data, led analysis and writing.

7. Murren CJ, Maclean HJ, Diamond SE, Steiner UK, **Heskel MA**, Handelsman CA, Ghalambor CK, Auld JR, Callahan HS, Pfennig DW, Relyea RA, Schlichting CD, Kingsolver J. Evolutionary change in continuous reaction norms. *The American Naturalist*, 183(4): 453-467. doi: 10.5061/dryad.4s286

- Examination on phenotypic plasticity across taxa and at least three environmental conditions conceived from invited workshop organized by National Evolutionary Synthesis Center, published in highly-ranked ecology and evolutionary biology journal (IF: 4.265); MH attended and contributed to workshop where manuscript was conceived, contributed to data collection efforts, writing/editing.

6. **Heskel MA**, Bitterman D, Atkin OK, Turnbull MH, Griffin KL. Seasonality of foliar respiration in two dominant plant species from the Arctic tundra: response to long-term warming and short-term temperature variability. *Functional Plant Biology*, 41(3): 287-300. doi: 10.1071/FP13137

- Field-study in arctic Alaska on the seasonal carbon cycling of plants under warming, published in a plant biology journal (IF: 2.32); MH conceived of and designed study, collected data, led analysis and writing.

2013 and earlier

5. **Heskel MA**, Atkin OK, Turnbull MH, Griffin KL. Bringing the Kok effect to light: A review on the integration of daytime respiration and net ecosystem exchange. *Ecosphere*, 4: art 98. doi:10.1890/ES13-00120.1

- Literature review on daytime leaf and ecosystem carbon exchange, published in an open-access ecology journal (IF: 2.75); MH conceived of idea and wrote paper.

4. **Heskel M**, Greaves HE, Gough L, Kornfeld A, Atkin OK, Turnbull MH, Shaver GR, Griffin KL. Differential physiological responses to environmental change promote woody shrub expansion. *Ecology and Evolution*, 3 (5) 1149-1162. doi: 10.1002/ece3.525

- Field-study in arctic Alaska on tundra plant physiology and community ecology under global change experiments, published in an open-access ecology journal (IF: 2.34); MH conceived of and designed study, collected data, led analysis and writing.

3. Kornfeld A, **Heskel M**, Atkin OK, Gough L, Griffin KL, Horton TW, Turnbull MH. Respiratory

flexibility and efficiency are affected by simulated global change in Arctic plants. *New Phytologist*, 197 (4): 1161-1172. doi:10.1111/nph.12083

- Field-study in arctic Alaska on biochemistry and physiology of respiration under global change, published in a top plant biology journal (IF: 7.43); MH contributed field and lab data, helped with writing/editing.

2. Griffin KL & **Heskel M**. Breaking the cycle: How light, CO₂, and O₂ affect plant respiration. *Plant, Cell & Environment*, 36 (2): 498-500. doi: 10.1111/pce.12039

- Short review on biochemical basis of light inhibition of respiration, introducing a data-paper in the journal, published in a top plant physiology journal (IF: 5.624); MH contributed to writing.

1. **Heskel MA**, Anderson OR, Atkin OK, Turnbull MH, Griffin KL. Leaf- and cell-level carbon cycling responses to a nitrogen and phosphorus gradient in two Arctic tundra species. *American Journal of Botany*, 99 (10): 1702-1714. doi: 10.3732/ajb.1200251

- Field and lab-based study on cell and leaf responses to soil nutrient change in arctic tundra plants, published in plant ecology/botany journal (IF: 2.84); MH conceived of and designed study, collected data, led analysis and writing.

PEER-REVIEWED BOOK CHAPTERS

2. **Heskel MA**, Mergenthal JGA*. Learning from the many, teaching to the many: Applying EcoJustice principles to undergraduate pedagogy in ecology and environmental science classrooms. Connecting Ecojustice Research and Teaching: Narratives from the Field. Eds: Rivera Maulucci MS, Callahan H, Pfirman S. *Environmental Discourses in Science Education*, Springer International. Draft with editors, anticipated publish date Fall 2020.

- Invited chapter co-written with a Macalester College undergraduate student on inclusive teaching practices in environmental science and how they can be guided by student experience and environmental justice.

*Macalester College undergraduate student

1. Atkin OK, Bahar NHA, Bloomfield KJ, Griffin KL, **Heskel MA**, Huntingford C, Martinez de la Torre A, Turnbull MH. Leaf Respiration in Terrestrial Biosphere Models. In: *Plant Respiration: Metabolic Fluxes and Carbon Balance*, Volume 43. Eds: Tcherkez G, Ghashghaie, Springer, Cham. doi:10.1007/978-3-319-68703-26. Published 2017.

- Invited chapter on the application of new respiration models to better inform Earth System Models and how they calculate biological aspects of the terrestrial carbon cycle; MH contributed to idea formation and writing process.

MANUSCRIPTS IN PROGRESS

Heskel MA, Bermudez Villaneuva R, Stefanski A, Atkin OK, Reich PB. High temperature physiology altered with growth under warming. Target journal: *Global Change Biology*

- Field-based study examining global change impacts on high-temperature carbon cycling and acclimation in species occupying the boreal-temperate ecotone; MH collected data, led data analysis and writing.

Heskel MA, Pengra J*, Kruper A*, Anderson M, Dosch J, Hahn S*, Hoffman S*, Goldstein L*. Age and canopy position drive understory photosynthesis more than invasive status in a temperate forest. Target journal: *American Journal of Botany or PLOS Biology*

- Field-based study on the role of canopy microclimate and season on the carbon physiology of native and invasive species; MH conceived of idea, led data collection, analysis, and writing.
- *Macalester Undergraduates, research occurred at Macalester's Ordway Field Station

Mirotnick N, **Heskel MA**, Greaves HE, Atkin OK, Turnbull MH, Griffin KL. Inhibition of plant

respiration in the night-less Arctic growing season and implications for carbon cycling. Target journal: *New Phytologist*.

- Physiological field survey of over 40 species in arctic Alaska; MH helped with analysis, writing.

INVITED TALKS &
CONFERENCE
PRESENTATIONS

2020

Confronting uncertainties in models of plant carbon cycling: Arctic and global perspectives. University of Wisconsin-Madison, Polar Ecology seminar series co-hosted by Botany, Integrative Biology, Forest & Wildlife Ecology and Geography Departments. February 2020. (invited talk)

2019

Plants, Carbon, and Time Travel. Macalester College Series Center Scholarly Lives Seminar, November 2019.

Changing Canopies and Future Fluxes: Tracking physiology from leaf to ecosystem in a warming world. University of Minnesota-Duluth, Integrative Biology Seminar, November 2019. (invited talk)

Will Plants Save Us from Climate Change? Carleton College Biology Departmental Seminar Series. February 2019. (invited talk).

2018

From leaf to globe: Shared patterns of respiration across diverse species and biomes. Ecological Society of America Annual Meeting, New Orleans, LA. August 2018. (invited talk)

2017

Environmental controls of daytime leaf carbon exchange: Implications for estimates of ecosystem fluxes in a deciduous forest. American Geophysical Union Fall Meeting. New Orleans, LA. December 2017. (talk)

Changing Canopies and Future Fluxes: Tracking physiology from leaf to ecosystem in a warming world. Macalester College Environmental Studies/Biology Seminar, November 2017 (invited talk).

Changing Canopies and Future Fluxes: Tracking physiology from leaf to ecosystem in a warming world. Forestry and Natural Resource Management Departmental Seminar, SUNY-ESF. March 21 (invited talk)

2016

Shedding light on the dark side of carbon cycling: Environmental impacts on plant respiration. Biology Department Seminar, Syracuse University. December 1. (invited talk)

Shedding light on the dark side of carbon cycling: Environmental impacts on plant respiration. Department of Ecology and Evolution Seminar, University of Michigan, Ann Arbor. October 13. (invited talk)

Light inhibition of respiration in arctic ecosystems. 18th New Phytologist Workshop: The Kok effect: beyond the artefact, emerging leaf mechanisms, July 6-8, Angers, France. (talk)

The impact of phenology on the temperature response of photosynthesis and respiration in the dark and light. Annual Harvard Forest Ecology Symposium, Petersham, MA. March 15. (poster)

2015

Global patterns in leaf respiration and its temperature response. American Geophysical Union Fall Meeting. San Francisco, CA. December 15 (invited talk)

Warming and species range mediate the temperature response of respiration in plants at the temperate-boreal ecotone. 100th Annual Meeting of the Ecological Society of America, Baltimore, MD. December 15. (talk)

Convergence in the temperature response of leaf respiration across biomes and plant functional types. Harvard Plant Biology Symposium, Harvard Arboretum, Boston, MA. May 6. (poster)

Phenological patterns and temperature sensitivity of daytime carbon cycling: Linking leaf-level physiology, canopy imagery, and net ecosystem exchange. Annual Harvard Forest Ecology Symposium, Petersham, MA. March 17. (poster)

2014

Plant Respiration in a Changing World: Global Patterns and Evidence from the Arctic. The Ecosystems Center, Marine Biological Laboratory, Woods Hole, MA. May 2. (invited talk)

Plant Respiration in a Changing World: Tales from the Arctic and Beyond. Biology and Marine Biology Departmental Seminar, University of North Carolina, Wilmington. April 14. (invited talk)

Environmental controls on respiration in arctic plants: Seasonality and acclimation. Plant Ecophysiology Seminar, Division of Plant Sciences, Australian National University, Canberra, ACT. March 3. (talk)

Before 2014

Examining vertical trends in Arctic tundra shrub canopies: Implications for carbon cycling in a changing environment. Poster. American Geophysical Union Fall Meeting, San Francisco, CA. December 7 2012. (poster)

Seasonal dynamics of photosynthesis and respiration in Arctic tundra plants. 97th Annual Meeting of the Ecological Society of America, Portland, OR. August 7 2012. (talk)

Environmental controls on foliar respiration in Arctic tundra plants. Arctic LTER Annual Meeting. Marine Biological Laboratory, Woods Hole, MA. March 23 2012. (poster)

Mitochondria and leaf-level respiration response to a nitrogen and phosphorus gradient in arctic tundra species. 27th New Phytologist Symposium: Stoichiometric flexibility in terrestrial ecosystems under global change. Biosphere 2, Oracle, AZ, September 25-28 2011. (poster)

Mitochondrial response to fertilization and warming in two dominant tundra species. 95th Annual Meeting of the Ecological Society of America, Pittsburgh, PA. August 5 2010 (poster)

Mitochondrial response to fertilization and warming in two dominant tundra species. April 13. 24th New Phytologist Symposium: Plant respiration and climate change: scaling from mitochondria to the globe. St. Hughs College, Oxford, UK. April 13 2010. (poster)

Mitochondrial response to fertilization and warming in two dominant tundra species. Arctic LTER Annual Meeting. Marine Biological Laboratory, Woods Hole, MA. March 5 2010. (poster)

WORKSHOPS & PROFESSIONAL DEVELOPMENT

Collaborator on “Impacts of climate change on Western Siberia: Colligating the land surfaces, animal communities, and peoples of the Arctic”, an NSF-funded Navigating the New Arctic research synthesis team, PI Valeriy Ivanov, University of Michigan. (2019-Present)

Invited NCAR/NEON Workshop Participant, “Predicting life in the Earth System: linking geosciences and ecology, NCAR and NEON” (2019-Present)

Participant in California Summer Institute for Scientific Teaching, a week-long active and inclusive pedagogy workshop held at UCSD, funded through a competitive grant from American Society for Plant Biology. (2019)

Planting Science Fellow and Science Liaison, Digging Deeper Program, Selected to participate in a collaborative NSF-funded workshop and mentoring program bringing together plant scientists and secondary school teachers. (2017)

Flux Course Participant, Mountain Research Center, Colorado, Attended short course on measuring and modeling ecosystem fluxes; awarded Ray Leuning Scholarship by course organizers (2016)

Invited participant, 18th New Phytologist Workshop: “The Kok effect: beyond the artefact, emerging leaf mechanisms”, July 6-8, Angers, France (2016)

Woods Hole Bayesian Statistics Course, Attended two-week course on Bayesian statistics led by Prof. Tom Hobbs conducted at Woods Hole Research Center (2016)

Working Group Participant, Powell Center for Analysis and Synthesis, USGS “Advancing understanding of ecosystem responses to climate change with warming experiments: What we have learned and what is unknown?” PIs: Kevin Kroeger, USGS, Jim Tang, MBL; Pam Templer Boston University. (2014-2015)

Working Group Participant, National Evolutionary Synthesis Center (NESCent) “Costs of Phenotypic Plasticity to Novel Environments” PIs: Courtney Murren (College of Charleston) and Carl Schlichting (UConn) (2009-2011)

Research Assistant, Goldman Lab, Penn Muscle Institute, University of Pennsylvania Purified and fluorescently labeled calmodulin, myosin and actin from tissue for nanomolecular microscopy assays (2005-2006)

GRANTS, AWARDS, & RECOGNITION

Grants & Fellowships

- Marsden Fund grant awarded for “Macromolecular Rate Theory (MMRT) and the temperature-dependence of the terrestrial biosphere over time and space”, PI Prof Vic Arcus, **M Heskell** is one of 11 co-Is on collaborative team. 2019-2022. (\$3,000,000 NZD)
- LI-COR LEEFS Program for undergraduate ecophysiological research, 2018 (\$37,605)
- Rosenthal Postdoctoral Scholar & Northeast Climate Science Center Fellow, 2014-2017. (\$125,000)

Awards from Professional Organizations

- American Society for Plant Biology, Transforming Education in Plant Biology, 2019 (\$3500)
- Planting Science Fellow (\$2000)
- Ray Leuning Scholarship to attend Flux Course, 2016 (\$2850)

Awards & Grants from Macalester College

- Collaborative Student Research Award to fund Elizabeth Hrycyna '21, Summer 2020 (\$4950)
- Wallace Award to support faculty research, Summer 2020 (\$4580)
- Macalester College Student Government Academic Affairs Committee Nomination for *Educator of the Year*, 2018-2019, 2019-2020
- Collaborative Student Research Awards to fund Jean Pengra '20 and Ally Kruper '21, Summer 2019 (\$11,000)
- Macalester College Sustainability Office Small Grant, 2018 (\$650)

Awards & Grants before 2013

- Summer Teaching Scholar, School of Arts & Sciences, Columbia University, 2012 (\$5500)
- New Phytologist Symposium Travel Grant, 2011 (\$1000)
- Torrey Botanical Society Graduate Student Research Fellowship, 2010 (\$1000)
- New Phytologist Symposium Travel Grant, 2010 (\$1000)
- Summer Travel Research Grant, E3B Department, Columbia University, 2009 (\$2500)
- Thune Fellowship, History of Art Department, University of Pennsylvania, 2005 (\$2500)

SERVICE TO THE
SCIENTIFIC
COMMUNITY

Editorial Positions

Section Chief Editor, *Annals of Botany - Plants*, 2018-present

Review Editor in Forest Ecophysiology, *Frontiers in Forests and Global Change*, 2018-present

Board of Advisors, *New Phytologist*, 2016-present

Editorial Board, *IOP SciNotes*, 2020-present

Peer Reviewer for:

Science, Journal of Experimental Botany, New Phytologist, Nature Geosciences, PLOS One, Annals of Botany, Nature Climate Change, Physiologia Plantarum, Plant, Cell & Environment, Global Change Biology, Plant Ecology, Ecosystems, Estuaries and Coasts, Arctic, Antarctic, & Alpine Research, Biogeochemistry, Ecology Letters, Functional Ecology

Grant Proposal & Panel Review

Invited Review Panelist, US-Israel Binational Science Foundation, Winter 2020

Invited Review Panelist, Dept. of Energy Biological & Environmental Research, NGEER Arctic Program, Spring 2019

Invited Review Panelist, Dept. of Energy Biological & Environmental Research Critical Ecosystems Arctic, Spring 2016

Proposal Reviewer, NSF Division of Environmental Biology - Population & Community Ecology, Fall 2015

TEACHING
INTERESTS

Courses in: plant ecology & physiology; data organization, analysis, interpretation; science communication; global change; introductory biology/ecology, arctic ecology

Pedagogical interests: inclusive teaching; active learning for small and large classrooms, writing and communication in science; graphing and quantitative methods practice; teaching R through ecology

TEACHING
EXPERIENCE
(COLLEGE)

Macalester College, St. Paul, Minnesota

All of the following courses are cross-listed between Biology & Environmental Studies departments.

Ecology and the Environment

Spring 2019, 2020

Large lecture (45 students) and lab course that is a requirement of both Biology and Environmental Studies majors. Fundamental concepts of Ecology are taught with an emphasis on four lenses: Environmental Justice, Climate Change, Ecosystem Services, and Land Use Change. Students learn through lab and field activities, group case study investigations on globally diverse systems, real data interpretation, and guided reading of primary literature. The 2019 re-design of this course from previous iterations prioritized inclusion, community-building in a large class, and application in the 21st century.

Plants, Environment, & Society

Spring 2020

Non-majors course that introduces basics of plant biology, and covers topics including: GM foods, agriculture, urban greenspaces & environmental inequities, biodiversity of our ecosystems and in our diets.

Plant Ecophysiology **Fall 2018, 2019**
Upper-level lecture and lab course that examines plants' role and function in ecosystems. We scale from cell to globe, with topics including: photosynthesis, respiration, water transport, nutrient uptake, and growth. This course emphasizes measurements through weekly labs and data analysis, and reflects regularly on the intersection of climate change and environmental justice. Students read primary literature weekly and develop an original research proposal.

Big Data in Ecology **Fall 2019**
Upper-level seminar on the organization, management, analysis, and visualization of *real, messy* environmental and ecological data in R/RStudio. Team-based active learning covering four modules: water quality in agricultural landscapes; climate change and human livelihoods; forest carbon cycling; and animal migration and conservation. Students write up short data-driven narratives alongside code and analysis, and complete semester with an independent project.

Arctic Ecology **Spring 2019**
Upper-level seminar that applied a 'systems science' approach to studying the Arctic - integrating climate science, paleoecology, anthropology, plant ecology, animal physiology, and soil science. Weekly discussions of primary literature, and emphasis on writing and science communication.

Global Change Biology **upcoming Fall 2020**
Co-developing and co-leading with Environmental Studies Professor Christine O'Connell, this course will explore different biomes from Arctic to Tropics and how they are impacted by climate change.

The Ecosystems Center, Marine Biological Laboratory, Woods Hole, Massachusetts

Canopy Photosynthesis field and modeling module **Fall 2015-2017**
Taught field methods (LAI and PAR measurement, LiCOR 6400 and WALZ fluorometer measurements of leaves) with a class of 20 undergraduate students as a part of a week-long data collection and modeling module for the Semester of Environmental Studies.

Columbia University, New York, New York

Nature in the City: Ecology of NYC's Ecosystems, Instructor of record **Summer 2012**
Awarded a Summer Teaching Scholarship to develop and teach a new summer course for Columbia undergraduates. Weekly field explorations of different ecosystems in NYC, and an emphasis on transferable skills including data analysis, effective literature searches, and interpretation of graphs and statistics. Students developed original research proposals for final assessment.

Environmental Biology **Fall 2011, 2009**
Life Systems **Spring 2010**
Teaching assistant for introductory biology and earth systems science courses taught by Profs. Paul Olson, Kevin Griffin, Shahid Naeem, and Dustin Rubenstein

TEACHING
EXPERIENCE
(K-12)

New York City Department of Education, New York City, New York

Biology Teacher, Urban Assembly Academy of Government and Law **2006-2008**
Taught 9th grade Human Biology and Regents Living Environment with lab at an under-resourced, Title I high school in New York's Lower East Side. Developed new curriculum for both courses, led field trips, and served as 9th Grade Advisory Leader. Achieved alternative secondary science certification through the New York City Teaching Fellows, and completed MA coursework at City College of New York.

Student Teacher, Wadleigh Secondary School, Harlem **Summer 2006**
Taught in Earth Science (9-10th grades) and Math A classes during summer school session as a part of Teaching Fellows training.

UNDERGRADUATE
RESEARCH
COLLABORATORS

Macalester College

Elizabeth Hrycyna '21, Collaborative Summer Research on urban air quality & tree isotopes (2020)
Jennings GA Mergenthal '21, Independent study on herbarium specimens & climate change (2020)
Lianna Goldstein '20, Summer research on elevated CO2 adaptations in plants at SPRUCE (2019)
Jean Pengra '20, Collaborative Summer Research on invasive species & photosynthesis (2019)
Ally Kruper '21, Collaborative Summer Research on seasonal photosynthesis at Ordway (2019)
Arceus Pogany '19, Independent study on urban campus trees & carbon storage (2019)

The Ecosystems Center, Marine Biological Laboratory

Caitlyn Linehan, Trinity College '19, Semester in Environmental Studies (2017)
Melissa Martinez, Clarkson University '18, Semester in Environmental Studies (2015)
Jonathan Michelsen, University of Chicago '18, summer research (2015)

PROFESSIONAL
AFFILIATIONS

American Society of Plant Biology
American Geophysical Union
Earth Science Women's Network
Ecological Society of America
NYC Teaching Fellows, Cohort 11

Updated May 15, 2020