

Lindsay A. McCulloch

NOAA Climate & Global Change Postdoctoral Fellow

Harvard University

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Professional Positions

- 2021 Postdoctoral Fellow, NOAA Climate & Global Change, Harvard University
Department of Organismic and Evolutionary Biology
- 2016 – 2021 PhD, **Brown University**, Providence, RI
Department of Ecology and Evolutionary Biology
- 2019 M.Sc., **Brown University**, Providence, RI
- 2016 B.A. **Colgate University**, Hamilton, NY.
Environmental Biology (Advisor: Dr. Catherine Cardelús)
Geography (Advisor: Dr. Mike Loranty)
Cum Laude

Research Interests

I am an ecosystem ecologist seeking to better understand carbon and nutrient cycling in forest ecosystems now and into the future. My research is primarily motivated by a two-part question: How does the environment effect how species interact with one another and what influence do these interactions have on the environment? I use tools from DNA sequencing to large-scale manipulative field experiments integrated with innovative statistical frameworks to study the controls on species interactions and the implications these species interactions have on biogeochemical cycling and ecosystem function. My work primarily focuses on understanding tropical forest nutrient cycling dynamics under a changing climate through the lens of plant-microbe interactions. I study what constrains plant symbioses with nitrogen-fixing bacteria and arbuscular mycorrhizal fungi (influential symbioses to the nitrogen and phosphorus cycles) under variable abiotic conditions predicted to change in the future. I am interested in understanding the how dynamics of these symbioses alter landscape-scale carbon and nutrient cycles, and how these interactions affect ecosystem function and response to disturbance.

Publications

*indicates undergraduate advisee

8. **McCulloch L.A.**, Brown B., Kartzinel T.R., and S. Porder. *In prep.* Higher symbiotic nitrogen fixation rates found when non-*Rhizobia* partners are present in Neotropical legume nodules. *Nature*.
7. Cusack D.F., Addo-Danso S., Agee E.A., Andersen K.M., Arnaud M., Batterman S.A., Brearley F.Q., Ciochina M., Cordeiro A.L., Dallstream C., Diaz-Toribio M.H., Diatterich L.H., Fisher J.B., Fleischer K., Fortunel C., Fuchslueger L., Guerrero-Ramirez N., Kotowska M., Figueiredo Lugli L., Marín C., **McCulloch L.A.**, Maeght J.L., Metcalfe D., Norby R.J., Oliveira R.S., Powers J.S., Reichert T., Smith S.W., Smith-Martin C., Soper F., Toro L., Umana M.N., Valverde-Barrantes O., Weemstra M., Werden L., Wong M., Wright S.J., and D. Yaffar. *Accepted*. Tradeoffs and Synergies in Tropical Forest Root Traits for Nutrient and Water Acquisition: Field and Modeling Advances. *Frontiers in Forests and Global Change*.
6. **McCulloch L.A.** and S. Porder. 2021. Light fuels while nitrogen suppresses symbiotic nitrogen fixation hotspots in Neotropical canopy gap seedlings. *New Phytologist*. doi: 10.1111/nph.17519

5. Ficano, N.*, Porder S., **L.A. McCulloch**. 2021. Tripartite legume-rhizobia-mycorrhizae relationship is influenced by light and soil nitrogen in Neotropical canopy gaps. *Ecology*. doi: 10.1002/ecy.3489
4. **McCulloch, L.A.**, Piotta D., S. Porder. 2021. Effect of drought and soil nutrients on symbiotic nitrogen fixation in seedlings of eight species of Neotropical woody legumes. *Biotropica*. doi: 10.1111/btp.12911
3. **McCulloch L.A.**, Kropp H., Kholodov A., Cardelús C.L., Natali S., and M.M. Loranty. 2020. Variation in fine root characteristics and nutrient dynamics across Alaskan ecosystems. *Ecosystems*. doi: 10.1007/s10021-020-00583-8
2. **McCulloch L.A.** and S. Porder. 2020. Lower nodule biomass with increased nitrogenase efficiency in *Robinia pseudoacacia* seedlings when grown under low soil phosphorus conditions. *Springer Nature Applied Sciences*, 2(1785), 1-9. doi: 10.1007/s42452-020-03518-z
1. Rudic, T.E.*, **McCulloch, L.A.**, and K.C. Cushman. 2020. Comparison of Smartphone and Drone Lidar Methods for Characterizing Spatial Variation in PAI in a Tropical Forest. *Remote Sensing*, 12(1765) p. 1-13. doi:10.3390/rs12111765

Teaching Experience

+Indications Instructor of record

+Instructor, Teaching Fellow, Wheaton College 2020-21
Designed and taught an upper-level biology course, *Plants and their Partners: Exploring mutualisms and their effect on how ecosystems work* while attending new faculty training seminars.

Invited Guest Lecturer, William and Mary 2021
Provided a guest lecture for *Ecosystem Ecology* seminar on terrestrial biogeochemistry

+Summer@Brown Instructor, Biodiversity & Ecology of Tropical Forests, Brown University 2019
Designed and implemented summer course that included lectures, R-tutorials and science skill lessons.

Course Design Seminar, Sheridan Center, Brown University 2019
Semester long seminar for designing courses and syllabi that are inclusive and engaging to students.

Teaching Assistant, Terrestrial Biogeochemistry, Brown University 2018
Held office hours, lectured two classes, led weekly paper discussions and graded assignments and exams.

Teaching Assistant, Introduction to Environmental Science, Brown University 2016
Held office hours, led exam review sessions, and graded assignments and exams.

Teaching Certificate I, Sheridan Center, Brown University 2016
Teaching program for graduate students to improve and create an inclusive learning environment.

Mentoring Experience

Undergraduate Honor's Thesis, Nikayla Ficano, Brown University 2018-2021
Mentored an undergraduate in writing a first-author paper based on her senior thesis project on arbuscular mycorrhizal fungi and legumes, including fieldwork in Costa Rica. Published in *Ecology*.

NSF REU LSAMP Program, La Selva Biological Station 2020
Selected to mentor two undergraduates from Louis Stokes Alliances for Minority Participation (LSAMP) institutions in REU independent projects (canceled due to COVID-19).

Undergraduate Research and Publication, Tamara Rudic, Brown University 2018-20
Mentored an undergraduate in an independent project comparing smart phone images and LiDAR estimates of plant area index in a tropical forest and mentored through publication.

Undergraduate Honor's Thesis, Kelsey Fenn, *Brown University* 2017-18
Mentored an undergraduate in a senior thesis project on arbuscular mycorrhizal fungi that included two extensive field trips to Brazil.

Undergraduate Journal Club, *Brown University* 2018
Led 5 undergraduates in a weekly journal club on the effect of species interactions on biogeochemistry.

Awards and Fellowships

Climate and Global Change Postdoctoral Fellow, NOAA 2021
Postdoctoral Research Fellowship in Biology Awardee, NSF (declined) 2021
Brown-Wheaton Teaching Faculty Fellow 2020-21
IBES Graduate Fellow, Brown University 2018-19
Graduate Research Fellowship Program, NSF, Honorable Mention 2018
IBES Research and Training Grant, Brown University 2017
IBES Research and Training Grant, Brown University 2016
Christopher Oberheim Memorial Award, Colgate University 2016
Natural Science Fellowship for Summer Research 2014-15

Leadership Experience

500 Women Scientists Pod Leader 2017-21
Facilitated the development and ongoing operations of a "500 Women Scientist" group in Providence that strives to create and foster a more inclusive scientific community.

Brown Bag Seminar Co-Coordinator, *Brown University* 2017
Organized speakers for the Ecology and Evolutionary Biology department's weekly seminar series.

Institute at Brown for Environment and Society Graduate Council Member 2017
Facilitated the development of a graduate student community among institute graduate affiliates from across university natural and social sciences departments

Service

Mentor, Harvard College Women's Center, Women in STEM Mentorship Program 2021-21
One-on-one weekly mentoring with an undergraduate interested in a career in STEM.

Tutor, Brown University Refugee Youth Tutoring and Enrichment (BRYTE) 2016-20
At home tutoring in reading, writing, and math provided to a recently resettled refugee child.

Planning committee member for department's Preview Day, *Brown University* 2020
Organized Preview Day for prospective students from historically underserved backgrounds to increase interest in the department and demystify the graduate school application process.

Contributor and Edit-a-thons facilitator, *Wikipedia* 2020-21
Completed a course on writing and editing Wikipedia biographies for women in STEM to increase the visibility of women scientists. Help lead Wikipedia Edit-a-thons.

Published Datasets

McCulloch L.A., Natali S., Kholodov A., and M. Loranty. 2020. Fine root biomass and nutrient concentrations from Alaskan borehole sites, 2015 (ViPER project). Arctic Data Center. doi:10.18739/A2ZS2KD6V

Presentations and Posters

*Indicates undergraduate advisee

- McCulloch L.A.** 2021. The abiotic and biotic controls of symbiotic nitrogen fixation in Neotropical canopy gaps. Presentation: Arnold Arboretum, Harvard University.
- Ficano, N.*, Porder S., **L.A. McCulloch**. 2020. Mycorrhizal community response to light and nitrogen conditions in a Costa Rican lowland tropical rainforest. *Ecological Society of America; Abstract*.
- McCulloch L.A.**, 2019. Symbiotic nitrogen fixation response to light and soil N availability in forest gaps. Presentation: La Selva Biological Station, Costa Rica.
- McCulloch L.A.**, D. Piotto, R. Rocha, S. Porder. 2019. Symbiotic nitrogen fixation response to drought in eleven Neotropical legume species. *American Geophysical Union; Abstract*.
- McCulloch L.A.**, J. Winbourne, S. Porder. 2018. Symbiotic Nitrogen Fixation Response to Nutrient Patches. *Ecological Society of America; Abstract*.
- McCulloch L.A.**, M.M. Loranty, A.L. Kholodov, S.M. Natali. 2016. Belowground Biomass across Alaskan Boreal and Tundra Ecosystems. *American Geophysical Union; Abstract*.
- McCulloch L.A.**, M.M. Loranty, A.L. Kholodov, S.M. Natali. 2015. Live and dead root biomass in Alaska tundra and boreal forest ecosystems. *American Geophysical Union; Abstract*.
- Cardelús, C.L., C.L. Woods, M. C. Baez, P. Ryan, **L.A. McCulloch**, T. Wobby, S. Young. (2015). Nutrient addition and water exclusion impacts on epiphytes in a lowland rainforest in Costa Rica. *Association for Tropical Biology and Conservation; Abstract*.
- Woods, CL., Cardelús, C.L., P. Ryan, M. C. Baez, **L.A. McCulloch**, S. Young. (2015). The physiological and morphological responses of vascular epiphytes to long-term nutrient addition and water exclusion in a lowland wet rainforest in Costa Rica. *Association for Tropical Biology and Conservation; Abstract*.

Language Skills: Proficient in Spanish and conversational in Portuguese