

Lindsay A. McCulloch
Postdoctoral Researcher
University of South Florida
Smithsonian Tropical Research Institute
(631) 487-1066
LA.McCulloch9@gmail.com
LAMcCulloch.com

Professional Positions

2021 – 2023 Postdoctoral Fellow, NOAA Climate & Global Change, Harvard University
Department of Organismic and Evolutionary Biology (PI: Dr. Ben Taylor)

2016 – 2021 PhD, **Brown University**, Providence, RI (Advisor: Dr. Stephen Porder)
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

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, plant community dynamics, and ecosystem function. My work has primarily focused on understanding both (1) tropical forest nutrient cycling dynamics under a changing climate through the lens of plant-microbe interactions, and (2) the influence of seed-fungal interactions on plant community dynamics. My current project is testing the effect of environment versus genotype on context dependence of seed-fungal interactions and their implications for seed germination and plant survivorship, while experimentally testing the primary symbiont hypothesis. With this work, I seek to understand the how dynamics of these symbioses alter landscape-scale biogeochemical cycling and plant community ecology, and how these interactions affect ecosystem function and response to disturbance.

Publications

*indicates undergraduate advisee, ** indicates graduate student mentee

14. **McCulloch L.A.**, Church, L.A., Chari, N.R**, Berlingeri, C., Prada, C., Schuster, W., Heslop C., Terlizzi, K., and B.N. Taylor. *In prep.* Shifts in fungal communities with Oak die-off in U.S. Northeastern forests. *Forest Ecology and Management*.
13. Mora Sibaja, J.I., **McCulloch L.A.**, Clifton, E., B.N. Taylor. *In prep.* The role of termites, *Nasutitermes corniger*, in Neotropical nitrogen cycling. *Ecology*
12. **McCulloch L.A.**, Dalling, J., C. Zalamea. *In review.* Standardizing seed dormancy determination with permeability measures for physically dormant seeds. *Seed Science Research*.
11. Cusack, D., Smith-Martin, C., Bradley, C., Andersen, K., Cordeiro, A., Fleischer, K., Wright, S J., Guerrero-Ramirez, N., Lugli L., **McCulloch, L.A.**, Sanchez, M., Batterman, S., Dallstream, C., Fortunel, C., Toro, L., Fuchslueger, L., Wong, M., Yaffar, D., Fisher, J., Arnaud, M., Dietterich,

- L., Addo-Danso, S., Valverde-Barrantes, O. J., Weemstra, M., Ng, J., Norby, R. *In revision*. Toward a coordinated understanding of tropical forest hydro-biogeochemical root functions for applications to vegetation models. *New Phytologist*.
10. **McCulloch L.A.**, Church, L.A., Bauters M., Lee M.Y., Liao W., Prada C.M., Toro L., Van de Velde V., Weissflog A., Wong, M., and B.N. Taylor. *In revision*. The belowground foundations of tropical forest restoration. *Invited Biotropica Commentary*.
 9. **McCulloch L.A.**, Brown B., Kartzinel T.R., and S. Porder. *In revision*. Neotropical legumes show higher rates of nitrogen fixation in association with both Actinobacteria and rhizobia partners. *Nature Communications Biology*.
 8. Suissa, J.S.**, Preisler, Y., Watkins Jr, J.E. and **McCulloch, L.A.**, 2022. Vulnerability Segmentation in Ferns and Its Implication on Their Survival During Drought. *American Fern Journal*, 112(4), pp.336-353. doi: 10.1640/0002-8444-112.4.336
 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., Dietterich L.H., Fisher J.B., Fleischer K., Fortunel C., Fuchslueger L., Guerrero-Ramirez N., Kotowska M., Figueiredo Lugli L., Marin 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. 2021. Tradeoffs and Synergies in Tropical Forest Root Traits for Nutrient and Water Acquisition: Field and Modeling Advances. *Frontiers in Forests and Global Change*. doi: 10.3389/ffgc.2021.704469
 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

Other Publications

- L.A. McCulloch** and J.I. Mora Sibaja. 2023 Plant-microbial mutualisms in canopy gap recovery: How do soil microbial symbionts help tropical forests recover from treefall gaps?. OCELOTS Incubator: Creating an online module in tropical biology, (Version 2.0). QUBES Educational Resources. doi:10.25334/989X-RW04
- Winbourne, J.B. and **L.A. McCulloch**, 2022. Herbivores drive scarcity of some nitrogen-fixing tropical trees. *Nature: News and Views* 612, 411-412 doi: 10.1038/d41586-022-04170-w
- Berlingeri, C., Prada-Cordero, C., **McCulloch, L.A.**, B.N. Taylor. 2022. Where Plants Experience the

Future. *Silva*. <https://arboretum.harvard.edu/stories/where-plants-experience-the-future/>
Ficano, N., Porder, S. and **L.A. McCulloch**, 2021. Three-Partner Symbiosis among Legumes, Mycorrhizae, and N-Fixing Bacteria Changes with Light and Soil Nitrogen Conditions. *Bulletin of the Ecological Society of America*, 102(4), pp.1-3.

Awards and Fellowships

Anthony Coates Postdoctoral Fellowship, Smithsonian Tropical Research Institute (declined)	2023
Organization for Tropical Studies, Early-Career Rexford Daubenmire Fellowship	2022-2023
Climate and Global Change Postdoctoral Fellow, NOAA	2021-2023
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

Invited Seminars

McCulloch, L.A. 2023. Plant-microbial interactions effect on Neotropical forest biogeochemical cycling. Presentation: Organization for Tropical Studies 60th Anniversary Event.

McCulloch L.A. 2022. The role of plants (and their partners) in the nutrient cycling of neotropical forests. Presentation: Occidental College.

McCulloch L.A., 2022. Plants and their microbial mutualists role in the nutrient cycling of our current and future forests. Presentation: Colby College

Presentations and Posters

*Indicates undergraduate advisee

McCulloch L.A., B.N. Taylor. 2023. Canopy Gap Effect: Elevated Symbiotic Nitrogen Fixation in Neotropical Forests. Presentation: *Ecological Society of America; Abstract.*

Church, L.A., Taylor, B.N., **McCulloch L.A.**, Chari, N.R., Berlingeri, C., Prada, C., Schuster, W., Heslop C., K. Terlizzi. 2023. Oak mortality leads to increased diversity and shifting community composition of soil fungi in a temperate hardwood forest. Poster: *Ecological Society of America; Abstract.*

Mora Sibaja, J.I., **McCulloch L.A.**, Clifton, E., B.N. Taylor. 2023. The potential role of termites in nitrogen cycling. Poster: *Ecological Society of America; Abstract.*

McCulloch L.A. 2022. Determining the canopy gap effect on the biogeochemical cycling of Neotropical forests. Presentation: NOAA Climate and Global Change Summer Institute

McCulloch L.A. 2022. Non-rhizobia partners in Neotropical legume nodules are associated with higher rates of nitrogen fixation. Presentation: *Association for Tropical Biology and Conservation; Abstract.*

McCulloch L.A. 2022. Tropical forest restoration: Role of soil biota-root symbioses. Symposium Organizer: *Association for Tropical Biology and Conservation; Abstract.*

McCulloch L.A. 2022. Neotropical canopy gaps: potential unmeasured symbiotic nitrogen fixation hotspots. Presentation: NOAA Climate and Global Change Seminar Series

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.*

Mentoring Experience

Plant-microbial Ecology Journal Club, Smithsonian Tropical Research Institute 2023
Lead weekly journal club for interns and graduate students at STRI on plant-microbial ecology to increase exposure to the literature while developing skills in scientific writing and experimental design.

Intern Independent Project, Linda Wu, University of Pennsylvania 2023
Mentored an intern in designing, implementing, and analyzing data from a 3-month project on the primary symbiont hypothesis in seeds and seedlings at the Smithsonian Tropical Research Institute, Panama.

Undergraduate Honor's Thesis and Publication, Nikayla Ficano, *Brown University* 2018-21
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*.

Independent Research Projects for High School Students, *Polygence* 2021-23
One on one mentoring for high school students interested in developing their own 10-week long independent research project.

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. Published in *Remote Sensing*.

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.

Service

Mentor, Harvard College Women's Center, Women in STEM Mentorship Program 2021-22
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* 2020-22
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.

Peer Review

Journal of Ecology (2022), *Nature Plants* (2021), *New Phytologist* (2021, 2022), *Oikos* (2021, 2022), *Ecosphere* (2020), *Biogeochemistry* (2022)

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

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, *Brown University*** 2022
 Guest lecturer for *Principles of Ecology* seminar on disturbance, forest ecology, and climate change
- Invited Guest Lecturer, *William and Mary*** 2021
 Guest lecturer for *Ecosystem Ecology* seminar on terrestrial biogeochemistry
- Teaching Assistant, Tropical Ecology Extended Study, *Colgate University*** 2020
 Taught tropical ecology, statistics, and R during an extended study in Costa Rica for undergraduates
- +Teaching module designer, Online Content for Experimental Learning of Tropical Systems** 2022
 Selected for a two-semester long incubator to design an online teaching module through OCELOTS on the role of plant microbial symbionts on tropical forest recovery.
- +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.

Language Skills: Proficient in Spanish and conversational in Portuguese