

Curriculum Vitae

Jacob L. Watts

PhD Candidate

University of Colorado at Boulder

Ecology and Evolutionary Biology

COLO Herbarium

Boulder, CO USA

Jacob.watts-1@colorado.edu • 814-490-6692

RESEARCH INTERESTS

I am a broadly interested botanist and lichenologist pursuing projects in floristics, taxonomy, and biodiversity discovery, as well as functional ecology and symbiotic co-evolution via next-generation sequencing methods. I am most interested in linking the functional traits of organisms or communities to their environmental and evolutionary contexts. I have worked on a range of topics such as fern reproductive ecology, the evolution of epiphytism, plant community responses to climate change, photosynthesis modelling, linking the root economic spectrum to life history strategies. Most recently during my PhD, I have become enamored with lichen biodiversity and ecology in the southern Rocky Mountains of Colorado. My dissertation focuses on both enumerating the diversity of the local 'biota' but also understanding how lichen functional traits modulate community composition in such varied, mountainous environments. I strongly feel that documenting biodiversity and researching the physiological capacity of plants and lichens to adapt to changing climates is and will increasingly be one of the most pressing ecological issues in the coming century. I aspire to become a professor of ecology.

EDUCATION

University of Colorado at Boulder: PhD (Sept. 2022 – May 2027)

Department: Ecology and Evolutionary Biology

Advisor: Dr. Erin Manzitto-Tripp

Committee: Dr. Barbara Demmig-Adams, Dr. Jingchun Li, Dr. Stacey Smith, & Dr. Danial Stanton

Dissertation: *Patterns of Lichen Functional Adaptation and Symbiont Coevolution Across Scales*

University of Cambridge: MPhil (Sept. 2021 – Sept. 2022)

Department: Plant Sciences

Honors: Churchill Scholar

Advisor: Dr. Adam Pellegrini

Thesis: *Whole-plant life-history strategies explained by the multidimensional root economic spectrum*

Colgate University: Bachelor of Arts (May 2021)

Major: Biology (minor in Geography)

Honors: Dean's List with Distinction (All semesters), summa cum laude

Advisor: Dr. James (Eddie) Watkins Jr.

GPA: 3.98

RESEARCH APPOINTMENTS

Jun 2023-Present **Jacob Watts Private Lichen Herbarium Curator** (n = 7,526 specimens)
Jacob Watts Private Residence

Supervisor: None
Project: *The lichen biota of the Front Range foothills and the southern Rocky Mountains*

Sep 2023-Present **Acting Genetic Lab Manager** (n = 1,100 genomic samples)
University of Colorado Boulder
Supervisor: Dr. Erin Manzitto-Tripp
Project: *A DNA barcoding database of the lichens of the southern Rocky Mountains*

Jun 2023-Jun 2025 **Lichen Rarity Research Assistant**
University of Colorado Boulder
Supervisor: Dr. Erin Manzitto-Tripp
Project: *Resurveys of historical populations and discovery of new populations of the 10 rarest lichens in Colorado*

Jan 2025 **Tropical Field Lichenologist**
Universidad Nacional Toribio Rodríguez de Mendoza
Supervisor: Thiago Kossman
Project: *Fungal inventory (both lichenized and non-lichenized) of the Cloud Forests of Amazonas, Peru*

May 2021-Aug 2021 **Botanical Research Assistant**
University of Hawaii at Manoa/UC Davis
Supervisor: Dr. Christopher Muir
Projects: *The photosynthetic advantage of optimal stomatal arrangement in amphistomatous leaves across different light environments*
CO₂ diffusion modeling of leaves with varying internal anatomies

May 2019-Aug 2020 **Beckman Undergraduate Researcher**
Colgate University
Supervisor: Dr. Eddie Watkins
Project: *Ecophysiology and drought tolerance of Asplenium australasicum in the face of climate change*

Jan 2018-May 2021 **Research Assistant**
Colgate University
Supervisor: Dr. Eddie Watkins
Projects: *Tropical fern gametophyte physiology: desiccation tolerance of epiphytes;*
Physiological survey of co-occurring Equisetum spp. in NY;
Fern gametophyte sperm swimming speed and longevity in differing pH solutions;
Hybrid and polyploidy gametophyte physiology in the complex genus Dryopteris;
Microarthropod mediated sperm transfer in fern gametophytes

Jan 2020-Feb 2020 **Field Research Assistant**
Museo Argentino de Ciencias Naturales "Bernardino Rivadavia"
Supervisor: Dr. Agustina Yañez
Project: *Epiphyte communities on the tree fern Alsophila setosa in Misiones, AR*

Jun 2018-Aug 2018 **Research Assistant**
Macalester College
Supervisor: Dr. Kelly MacGregor

TEACHING EXPERIENCE

- 2024 – 2025** **Course Instructor:** *Evolution Teaching Assistant*
University of Colorado at Boulder, EBIO Department
Design and lead labs to aid in learning lecture material and research methods
- 2020 – 2021** **Course Instructor:** *Intro Biology Tutor*
Colgate University, Biology Department
Mentor students one on one on difficult course material
- 2020 – 2021** **Course Instructor:** *Intro Biology Course Student Leader*
Colgate University, Biology Department
Lead weekly study sessions with small groups to discuss class topics
- 2018 – 2019** **Course Instructor and Mentor:** *Sustainability Intern*
Colgate University, Sustainability Office
Developed and taught undergraduate seminars on sustainable living and plant ID
- 2017 – 2021** **Course Instructor:** *Outdoor Education Leader*
Colgate University, Outdoor Education
Undergraduate, week/weekend-long courses on outdoor skills and techniques
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INVITED TALKS

*Denotes presenting authorship

- 2025** **Colorado Native Plant Society Invited Seminar.** Boulder, CO.
*Boulder's Crown Jewel: The Incredibly Diverse Lichen Biota of OSMP & Surrounding Foothills **
- 2025** **Estes Valley Watershed Coalition Invited Seminar.** Estes Park, CO.
A Synopsis of Lichenology Research Conducted in Colorado, Plans for Future Exploration, and More!
- 2025** **Colorado Natural Heritage Program Invited Seminar.** Fort Collins, CO.
*Discovering the Lichens of Colorado **
- 2024** **Salisbury University Invited Seminar.** Salisbury, MD.
*Lichens: extremophile symbioses that teach us the rules of life **
- 2024** **Colorado Native Plant Society Invited Seminar.** Virtual.
*An Introduction to the Lichens of Colorado **
- 2024** **City of Boulder Open Space & Mountain Parks Invited Seminar.** Boulder, CO.
*The Lichens of Boulder OSMP**
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CONTRIBUTED TALKS AND POSTERS

*Denotes presenting authorship; †Denotes poster

- 2025 GREEBS 2025: Guild of Rocky Mountain Ecologists and Evolutionary Biologists Annual Meeting. CU Mountain Research Station, CO.**
*Trait Syndromes & Biogeography Reveal Emergent Groups of North American Lichens**
- 2025 Botany Conference. Palm Springs, CA.**
A (Lichen) Diamond Mine in a Gold Diggers State
Pyroenlichenment: Fire Drives Cladonia Presence, Abundance and Diversity in Florida Sugar Sand Scrub Habitat
- 2024 Botany Conference. Grand Rapids, MI.**
Lichens and Associated Fungi of the Indian Peaks Wilderness, Front Range Mountains, Colorado
*A preliminary lichen biota of the City of Boulder's Open Space and Mountain Parks, Colorado, USA**
*Trait and environmental correlations of the lichen communities at the Great Plains and Southern Rocky Mountains ecotone**
- 2023 Botany Conference. Boise, ID.**
*Microclimate and substrate shape lichen community composition and functional diversity in the foothills of the Southern Rocky Mountains**
- 2023 Society of Systematic Biologists Standalone Meeting. Mexico City, Mexico.**
*Revisiting the question: How many ways are there to make a purple flower? A phylomorphospace study in Ruellia**
- 2022 Botany Conference. Anchorage, AK.**
*Whole-plant life-history strategies explained by the multidimensional root economic spectrum**
- 2021 Botany Conference. Virtual.**
*Microarthropods increase sporophyte formation and enhance fitness of ferns**
- 2021 Botany Conference. Virtual.**
Ecotypic variation in stress response of Polystichum munitum gametophytes under climate change
- 2020 Beckman Symposium 2020, Virtual.**
*A case study on the epiphyte Asplenium australasicum and climate change†**
- 2020 Colgate Summer Research Poster Session, Virtual.**
*A case study on the epiphyte Asplenium australasicum and climate change†**
- 2019 Annual Colgate Biology Poster Session, Hamilton, NY.**
*Hymenasplenium volubile: the first report of hemiepiphytism in the Aspleniaceae†**
- 2019 Botany Conference. Tucson, AZ.**
*Hymenasplenium volubile: the first report of hemiepiphytism in the Aspleniaceae†**
- 2019 OTS Tropical Ferns and Lycophytes Course, 2019. La Selva Biological Station, Costa Rica.**
Hemiepiphytes and morphological evolution in the Aspleniaceae
- 2018 Geological Society of America Annual Meeting. Indianapolis, IN.**

PEER-REVIEWED PUBLICATIONS (excluding manuscripts in prep)

1. Schmidt-Knapik R. J., Ackerfield J., Gostel M., Heberling J. M., King M. R., Krosnick S., Graves S. M., Raynor S. J., Thiers B., **Watts J. L.**, Weeks A., Manzitto-Tripp E. A., and Struwe L. 100 uses for an herbarium, well actually 143: reassessing the true value of herbaria. *Proceedings of the National Academy of Sciences*, in review
2. **Watts, J. L.** & Manzitto-Tripp, E. A. Boulder's Crown Jewel: The Remarkably Diverse Lichen Biota of the City's Open Space and Mountain Parks, Colorado, USA. *Journal of the Botanical Research Institute of Texas*, in review
3. **Watts, J. L.**, Knudsen, K. & Manzitto-Tripp, E. A. *Trimmatothelopsis rufiocellata* sp. nov. (Acarosporaceae) from the southern Rocky Mountains. *Phytotaxa*, in review
4. **Watts, J. L.**, Raynor S. J., Tsai Y-H. E., Lendemer J. C., Manzitto-Tripp E. A. Trait syndromes reveal emergent groups of North American lichens. *Ecosphere*, in review
5. Clark, E. Z., **Watts, J. L.**, Chaves-Fallas, J. M., and Manzitto-Tripp, E. A. The roles of pseudocyphellae and thallus traits in modulating water relations of the lichen *Crocodia aurata* (Ach.) Link (Peltigeraceae) across a precipitation gradient in a Costa Rican premontane tropical forest. *The Lichenologist*, in press
6. Knudsen, K., Kocourková J., Kondrysová E., Jedličková L., Hollinger J., Noell N., Leavitt S., Manzitto-Tripp E. A., and **Watts J. L.** (2026). Five New Species of Acarosporaceae (Acarosporales, Lecanoromycetes) from Southwestern North America. *Herzogia* 38: 405–427. <https://doi.org/10.13158/heia.38.2.2025.405>
7. Krieg, C. P., **Watts, J. L.**, Chambers, S. M., Baxi A., and McCulloh, K. A. (2026). Fern Gametophytes Exhibit Distinct Patterns of Niche Expansion and Convergence in Ecophysiological Functioning, *Ecology and Evolution*, 16(4): e73324. <https://doi.org/10.1002/ece3.73324>
8. **Watts J. L.**, Medina N., Kiel C., Smith. S. D., and Manzitto-Tripp E. A. (2026). Flowers occupy color-space extremes: an anthocyanin-derived theoretical floral color-space approach, *American Journal of Botany*, 113: e70149. <https://doi.org/10.1002/ajb2.70149>
9. Manzitto-Tripp E. A., **Watts, J. L.**, & Raynor, S. J. (2025). New and Noteworthy Reports of Lichens and Allied Fungi to Colorado, including Descriptions of Two Species New to Science, *Journal of the Botanical Research Institute of Texas*, 19(4), 389–418. <https://doi.org/10.17348/jbrit.v19.i4.1438>
10. **Watts, J. L.**, Raynor, S. J., & Manzitto-Tripp, E. A. (2025). Character evolution in *Heterodermia* s.l. (Physciaceae; Caliciales) and two new species from the southern Rocky Mountains, USA, *Phytotaxa*, 698(2), 061–081. <https://doi.org/10.11646/phytotaxa.698.2.1>

11. Manzitto-Tripp E. A. & **Watts J. L.** (2025). The Thin Horizon of a Plan is Almost Clear: Towards a Lichen Biodiversity Inventory of the Southern Rocky Mountains, USA. *Phytotaxa*, 712(3), 207-229. <https://doi.org/10.11646/phytotaxa.712.3.1>
12. Manzitto-Tripp E. A. & **Watts J. L.** (2025). *Ochrolechia raynori*, a New Lichen Species from the Southern Rocky Mountains (Colorado, USA) and Key to Asexually Reproducing *Ochrolechia* in Western North America. *Wild*, 2, 28. <https://doi.org/10.3390/wild2030028>
13. Raynor S. J., **Watts J. L.**, & Manzitto-Tripp E. A. (2025). *Polycauliona pancakeana*, a new species to science from the Southern Rocky Mountains. *The Bryologist*, 128(3), 556-566. <https://doi.org/10.1639/0007-2745-128.3.556>
14. Raynor, S. J., **Watts, J. L.**, Manzitto-Tripp, E. A. (2024). *Sarea cirrhendocarpa*, a fungus species new to science from the southern Rocky Mountains. *Phytotaxa*, 671(1), 087-097. <https://doi.org/10.11646/phytotaxa.671.1.5>
15. **Watts, J. L.**, Raynor, S. J., Li, Y., Meier, R., Cook, C., Casini, G., Chadwick, E., & Manzitto-Tripp, E. A. (2024). *Lecanora exspersa*: A new lichen record for North America and a key to sorediate *Lecanora* (Lecanoraceae) in western North America. *The Bryologist*, 127(4), 427-440. <https://doi.org/10.1639/0007-2745-127.4.427>
16. **Watts, J. L.**, Dow, G. J., Buckley, T. N., & Muir, C. D. (2024). Does stomatal patterning in amphistomatous leaves minimize the CO₂ diffusion path length within leaves?. *AoB Plants*, 16(2), plae015. <https://doi.org/10.1093/aobpla/plae015>
17. **Watts, J. L.** & Watkins Jr, J. E. (2022). New Zealand Fern Distributions from the Last Glacial Maximum to 2070: A Dynamic Tale of Migration and Community Turnover. *American Fern Journal*, 112(4), 354-372. <https://doi.org/10.1640/0002-8444-112.4.354>
18. **Watts J. L.** & Watkins Jr J. E. (2021). Crossing the Divide: An Exploration of Functional Traits in Ferns that Grow Across Terrestrial, Epipetric, and Epiphytic Habitats, *American Fern Journal*, 111(4), 308-326. <https://doi.org/10.1640/0002-8444-111.4.308>
19. Harrington, A. D. & **Watts J. L.** (2021). Low Trunk Epiphytic Fern Gametophyte and Sporophyte Occurrence Is Influenced by Moss Height and Density in a Costa Rican Lowland Tropical Rainforest. *International Journal of Plant Sciences*, 182(4), 286-294. <https://doi.org/10.1086/713443>
20. **Watts J. L.**, Moran R. C., & Watkins Jr J. E. (2019). *Hymenasplenium volubile*: documentation of its gametophytes and the first record of a hemiepiphyte in the Aspleniaceae. *Annals of Botany*, 124(5), 829-835. <https://doi.org/10.1093/aob/mcz124>

POPULAR SCIENCE ARTICLES & BOOKS

1. **Watts J. L.**, Manzitto-Tripp, & Raynor S. J. A Field Guide to the Lichens of the Colorado Front Range foothills, *Botanical Research Institute of Texas*, in prep
2. **Watts J. L.** (2023) Colorado Field Botany Course. *Aquilegia: Magazine for the Colorado Native Plant Society*, 47(3), 10-12.

3. **Watts J. L. (2021).** A terrifically Pteridological adventure takes a turn south. *AFS Fiddlehead Forum*, 47(3), 1-5.
 4. **Watts J. L. (2019).** American Fern Society Fern Foray: “Let’s go to the woods”. *AFS Fiddlehead Forum*, 46(3), 41-45.
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FELLOWSHIPS AND GRANTS AWARDED (\$294,600 award total)

- 2026 Culberson & Hale Award for Field Research in Lichenology** *American Bryological & Lichenological Society* (\$1200)
- 2026 BSA Bryological and Lichenological Section Student Travel Award** *BSA* (\$700)
- 2026 Colorado Mountain Club Foundation Fellowship** *CMCF* (\$2000)
- 2026 Graduate Student Research Grant** *CU Boulder Ecology and Evolutionary Biology* (\$2000)
- 2025 Graduate Student Research Grant** *CU Boulder Ecology and Evolutionary Biology* (\$2000)
- 2025 Graduate Summer Fellowship** *CU Boulder Graduate School* (\$6000)
- 2025 BCNA Grant For Research** *Boulder County Nature Association* (\$4000)
- 2024 Graduate Student Research Grant** *CU Boulder Ecology and Evolutionary Biology* (\$2000)
- 2023 Graduate Student Research Grant** *CU Boulder Ecology and Evolutionary Biology* (\$2500)
- 2023 Funded Research Program** *City of Boulder Open Space and Mountain Parks* (\$8500)
- 2023 Biodiversity Challenge Grant** *International Association of Plant Taxonomists* (\$3000)
- 2023 Beverly Sears Graduate Student Grant** *CU Boulder* (\$1000)
- 2023 Lewis and Clark Fund for Exploration and Field Research Grant** *American Philosophical Society* (\$3400)
- 2023 Graduate Student Research Award** *Society of Systematic Biologists* (\$3000)
- 2023 Graduate Student Research Grant** *CU Boulder Ecology and Evolutionary Biology* (\$2500)
- 2023 Graduate Student Research Grant** *American Society of Plant Taxonomists* (\$1200)
- 2021 Raymond J. Myers Award** *Colgate Biology Department* (\$100)
- 2021 Graduate Research Fellowship** *National Science Foundation* (\$138,000)
- 2021 Churchill Scholarship** *Winston Churchill Foundation* (\$60,000)
- 2019 Editor’s Choice Award** *Annals of Botany*

- 2019 Goldwater Scholarship** *Barry Goldwater Scholarship Foundation (\$7,500)*
- 2019 Udall Honorable Mention** *Morris K. Udall and Stewart L. Udall Foundation*
- 2019 Beckman Scholar Fellowship** *Arnold and Mabel Beckman Foundation (\$20,000)*
- 2019 Phi Beta Kappa Daniel H. Saracino Prize** *Colgate University (\$500)*
- 2018 Research Travel Grant** *Colgate Center for Learning Teaching and Research (\$1,500)*
- 2018 Undergraduate Research Fellowship** *Colgate University (\$4,500)*
- 2017 Alumni Memorial Scholar Independent Research Grant** *Colgate University (\$6,000)*
- 2017 Principal's Award** *North East High School (\$1,000)*
- 2017 Academic Scholarship** *Orris & Beatrice Hirtzel Memorial Foundation Scholarship (\$12,000)*
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OUTREACH

- 2026** Colorado Native Plant Society Lichen Field Excursion
- 2025** @lichensofcolorado Instagram Page
- 2025** Moss Goblins: a Queer Outreach Field Excursion
- 2024** Front Range Field Immersion for Underrepresented High School Students
- 2024** Colorado Native Plant Society Intro to Lichenology Talk and Field Excursion
- 2022** Plants of the Cam, Cambridge, UK Field Excursion
- 2019** Fiddlehead Forum Article Author
- 2018** Sustainability Intern
- 2017** Outdoor Education Staff Member
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FEATURED POPULAR SCIENCE AND RESEARCH ARTICLES

Contrib. Writers (2025). @newscpr and @npr Instagram Pages: Colorado scientists discovered new lichen species. They named them after the Indigo Girls.

<https://www.instagram.com/p/DMi4qg1Madw/>

Lauren Antonoff Hart (2025). CPR News: A CU Boulder team found new lichen species. They named them after the Indigo Girls.

<https://www.cpr.org/2025/07/24/cu-new-lichen-species-named-after-indigo-girls/>

Michael Booth (2025). The Colorado Sun Environment News: Colorado lichenologists name discoveries after Indigo Girls and bring science closer to fine

<https://coloradosun.com/2025/07/24/cu-boulder-lichenology-naming-indigo-girls-red-rocks/>

Contrib. Writers (2021). Undergraduate Feature: Jacob Watts '21. Colgate University News Features.

<https://www.colgate.edu/news/features/jacob-watts-21>

Elizabeth Preston (2021). Jacob Watts '21 Looks Ahead to Research With Churchill and NSF Awards.

Colgate University News. <https://www.colgate.edu/news/stories/jacob-watts-21-looks-ahead-research-churchill-and-nsf-awards>

Contrib. Writer (2021). Colgate senior receives Churchill Scholarship. Colgate National Fellowships and Scholarships. <https://www.colgate.edu/success-after-colgate/national-fellowships-and-scholarships/national-fellowships-and-scholarships-1>

Contrib. Writer (2021). Colgate student and alumnus win NSF Graduate Research Fellowship. Colgate National Fellowships and Scholarships. <https://www.colgate.edu/success-after-colgate/national-fellowships-and-scholarships/national-fellowships-and-scholarships-4>

Stephen Watts (2020). Former North East Graduate Earns International Recognition. North East News Journal. <https://www.northeastnewsjournal.com/hometown-news/former-north-east-graduate-earns-international-recognition/>

<https://www.northeastnewsjournal.com/hometown-news/former-north-east-graduate-earns-international-recognition/>

Mark Walden (2020). Colgate Biology Major Earns Goldwater Scholarship. Colgate University News.

<https://www.colgate.edu/news/stories/colgate-biology-major-earns-goldwater-scholarship>

Jacob Watts, Ed. Jenn Jones (2020). Jacob Watts '21: Exploring Tropical Fern Research Methods and Learning Spanish. Colgate Alumni Memorial Scholars. <https://www.colgate.edu/academics/scholars-programs/alumni-memorial-scholars/alumni-memorial-scholars-news-updates/jacob>

<https://www.colgate.edu/academics/scholars-programs/alumni-memorial-scholars/alumni-memorial-scholars-news-updates/jacob>

Alun Salt (2019). A fern thought to grow on trees still keeps a root on the ground. Botany One.

<https://www.botany.one/2019/10/a-fern-thought-to-grow-on-trees-still-keeps-a-root-on-the-ground/>

Akshara Ramaseshan (2019). Jacob Watts '21: Graduate course on Tropical Ferns and Lycophytes in Costa Rica. Colgate Alumni Memorial Scholars. <http://blogs.colgate.edu/ams/2019/02/jacob-watts-21-graduate-course-on-tropical-ferns-and-lycophytes-in-costa-rica.html>

<http://blogs.colgate.edu/ams/2019/02/jacob-watts-21-graduate-course-on-tropical-ferns-and-lycophytes-in-costa-rica.html>

Jacob Watts, Ed. Jenn Jones (2019). Jacob Watts '21: Costa Rica Tropical Ferns and Lycophytes Graduate Course. Colgate Alumni Memorial Scholars. <https://www.colgate.edu/academics/scholars-programs/alumni-memorial-scholars/alumni-memorial-scholars-updates/jacob-watts>

<https://www.colgate.edu/academics/scholars-programs/alumni-memorial-scholars/alumni-memorial-scholars-updates/jacob-watts>

PROFESSIONAL SOCIETY MEMBERSHIPS

American Fern Society

Botanical Society of America

Society of Systematic Biologists

American Bryological and Lichenological Society

American Society of Plant Systematics

SKILLS

Spanish – Conversational Fluency

Data Analysis & Visualization in R – Advanced

GIS and Spatial statistics in R – Advanced

Outdoor Skills Instructor – Wilderness First Responder Certified; CPR Certified

Technical Camping and Field Work skills – Advanced
