

## Hannah E. Holland-Moritz, Ph.D

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Hannah Holland-Moritz investigates the biotic and abiotic conditions which influence microbial community assembly and the molecular mechanisms behind community functional traits. Her work focuses on microbial communities in soils and plant-soil feedbacks with particular focus on arctic and boreal ecosystems. She uses molecular tools, bioinformatics, machine learning, and data science to identify microbial traits of interest and incorporate those traits in predictive biogeochemical models at the landscape to global scale.

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### EDUCATION

University of Colorado, Boulder	Ecology & Evolutionary Biology <i>Advisor: Dr. Noah Fierer</i>	Ph.D.	2021
University of California, Davis	Biochemistry & Molecular Biology with Honors <i>Minor: Quantitative Biology &amp; Bioinformatics</i>	B.S.	2014

### ACADEMIC POSITIONS

2023 – present	<b>Microbiome Research Scientist</b> , Department of Natural Resources and the Environment <i>University of New Hampshire, Durham NH, USA</i>
2021 – 2022	<b>Postdoctoral Researcher</b> , Department of Natural Resources and the Environment <i>University of New Hampshire, Durham NH, USA</i>
2015 – 2021	<b>Graduate Research Assistant</b> , Cooperative Institute for Environmental Sciences <i>University of Colorado, Boulder CO, USA</i>
June 2020 – August 2020	<b>Graduate Research Assistant</b> , Land Model Working Group <i>National Center for Atmospheric Research (NCAR), Boulder CO, USA</i>
2014 – 2015	<b>Junior Specialist Researcher</b> , UC Davis Genome Center <i>University of California, Davis, Davis CA, USA</i>
2011 – 2014	<b>Undergraduate Research Assistant</b> , UC Davis Genome Center <i>University of California, Davis, Davis CA, USA</i>
<i>Affiliate Positions</i>	
2022-2023	<b>Affiliate Faculty</b> , Department of Forest and Rangeland Stewardship, <i>Colorado State University, Fort Collins, CO, USA</i>

### PUBLICATIONS

(Peer-Reviewed Total = 12, First Author = 3)

*Forthcoming (papers submitted, in review, and in revision; manuscript available upon request)*

1. Fenton, N. Oke, T., Bell, N., Berdugo, M., Bisang, I., Caners R., Chmielewski, M., Coe, K., Davidson, S., **Holland-Moritz, H.**, Kraichak, E., Lindo, Z., McIntosh, T., Slate, M., Stanton, D., Villarreal Auillar, J. C., Vitt, D., Wang, Z., *In Review at Nature Geoscience*, Global terrestrial moss ecosystem services: Balanced geographic representation is required
2. Rocci, K. Cleveland, C. Easatman, B. Georgiou, K., Grandy, A. S., Hartman, M. Hauser, E., **Holland-Moritz, H.**, Kyker-Snowman, E., Pierson, D., Reich, P., Schlerman, E., Wieder, W., *In Review at Soil Biology and Biogeochemistry*, Aligning theoretical and empirical representations of soil carbon-to-nitrogen stoichiometry with process-based terrestrial biogeochemistry models
3. Jay, K., Wieder, W., Swenson, S., Knowles, J., Elmendorf, S., **Holland-Moritz, H.**, Suding, K., *In Review at JGR Biogeosciences*, Topographic Heterogeneity and Aspect Moderate Exposure to Climate Change Across an Alpine Tundra Hillslope
4. Texeira, C. D. S., **Holland-Moritz, H.**, Bayer, C. Eichelberger Granada, C., Sausen, T. S., Tonial, F. Petry, C. Frey, S. D. Conversion to managed land uses reduces soil carbon stocks and alters microbial community structure and function in a subtropical Atlantic Forest, *In Revision for Soil Biology and Biogeochemistry*
5. **Holland-Moritz, H.**, Vanni, C., Fernandez-Guerra, A., Bissett, A., Fierer, N., *BioRxiv*, An ecological perspective on microbial genes of unknown function in soil <https://doi.org/10.1101/2021.12.02.470747>

*Peer Reviewed*

6. Fierer, N., **Holland-Moritz, H.**, Alexiev, A., Batther, H., Dragone, N. B., Friar, L., Gebert, M. J., Gering, S., Henley, J. B., Jech, S., Kibby, E. M., Melie, T., Patterson, W. B., Peterson, E., Schutz, K., Stallard-Olivera, E., Sterrett, J., Walsh, C., and Mansfeldt, C., 2022, A metagenomic investigation of spatial and temporal changes in sewage microbiomes across a university campus *mSystems*
7. Fan, K., **H. Holland-Moritz**, C. Walsh, X. Guo, D. Wang, Y. Bai, Y. Zhu, N. Fierer, H. Chu. 2022. Identification of rhizosphere microbes that actively consume plant-derived carbon. *Soil Biology & Biochemistry*.
8. Vincent, K., **Holland-Moritz, H.**, Solon, A.J., Gendron, E.M.S., Schmidt, S.K., 2022. Crossing Treeline: Bacterioplankton communities of alpine and subalpine Rocky Mountain Lakes *Frontiers in Microbiology*
9. Dragone, N. B., Henley, J. **Holland-Moritz, H.**, Diaz, M., Hogg, I., Lyons, W.B., Wall, D. Adams, B., Fierer, N., 2021, Elevational constraints on the composition and genomic attributes of soil microbial communities in the Transantarctic Mountains. *mSystems*
10. Stuart, J., **Holland-Moritz, H.E.**, Jean, M., Miller, S.N., Ponciano, J.M., McDaniel, S.F., Mack, M.C. 2021. The relationship of C and N stable isotopes to high latitude moss-associated N<sub>2</sub>-fixation. *Oecologia*
11. **Holland-Moritz, H.**, Stuart, J., Lewis, L. R., Miller, S., Mack, M., Ponciano, J.M., McDaniel, S., and Fierer, N. 2021. The bacterial communities of Alaskan mosses and their contributions to N<sub>2</sub>-fixation. *Microbiome*
12. Stuart, J., **Holland-Moritz, H.**, Lewis, L., Jean, M., Miller, S., McDaniel, S., Fierer, N., Ponciano, J. M., and Mack, M., 2020. Host identity as a driver of moss-associated N<sub>2</sub>-fixation rates in Alaska. *Ecosystems*
13. Jean, M., **Holland-Moritz, H.**, Melvin, A., Johnstone, J., and Mack, M. 2020. Experimental assessment of tree canopy and leaf litter controls on the microbiome and nitrogen fixation rates of two boreal mosses. *New*

### *Phytologist*

14. Carini, P., Delgado-Baquerizo, M., Hinckley, E. S., **Holland-Moritz, H.** Brewer, T. E., Rue, G., Vanderburgh, C., McKnight, D., and Fierer, N. 2020. Effects of Spatial Variability and Relic DNA Removal on the Detection of Temporal Dynamics in Soil Microbial Communities. *mBio*.
15. Ward, L. M., Cardona, T., and **Holland-Moritz, H.** 2019. Evolutionary Implications of Anoxygenic Phototrophy in the Bacterial Phylum Candidatus Eremiobacterota (WPS-2). *Frontiers in Microbiology*
16. **Holland-Moritz, H.**, J. Stuart, L. R. Lewis, S. Miller, M. C. Mack, S. F. McDaniel, and N. Fierer. 2018. Novel bacterial lineages associated with boreal moss species. *Environmental Microbiology*
17. Gunawardana, M., S. Chang, A. Jimenez, D. Holland-Moritz, **H. Holland-Moritz**, T. P. La Val, C. Lund, M. Mullen, J. Olsen, T. a Sztain, J. Yoo, J. a Moss, and M. M. Baum. 2014. Isolation of PCR quality microbial community DNA from heavily contaminated environments. *Journal of microbiological methods*.

### *Non-Peer Reviewed*

1. **Holland-Moritz, H. E.**, D. R. Bevans, J. M. Lang, A. E. Darling, J. A. Eisen, and D. A. Coil. 2013. Draft genome sequence of *Leucobacter* sp. strain UCD-THU (phylum *Actinobacteria*). *Genome announcements* 1:e00325--13.
2. **Holland-Moritz, H. E.**, D. A. Coil, J. H. Badger, G. I. Dmitrov, H. Khouri, N. L. Ward, F. T. Robb, and J. A. Eisen. 2014. Draft genome sequence of the pyridinediol-fermenting bacterium *Synergistes jonesii* 78-1. *Genome announcements* 2:e00833--14.

## SELECTED PRESENTATIONS AND INVITED TALKS

### *Seminars and Invited Talks*

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|------------------------|--|
| 2022                   | An ecological perspective on microbial genes of unknown function in soils, Lawrence Berkeley National Lab  |
| 2022                   | Phylogenetic and environmental controls on the structure of boreal moss microbiomes, in “From desert to the Arctic: ecological significance of bryophytes across systems”, ESA, Montreal, Canada (Lightning talk and invited panelist) |
| 2022                   | Assembly of microbes in thawing permafrost, Extreme Microbiome seminar series, virtual   |
| 2021                   | Microbes, mosses, and metagenomes, EEB seminar, Case Western University  |
| 2021                   | Microbial Assembly in Thawing Permafrost, Regional Conference on Permafrost, Boulder, CO USA/Virtual (invited talk)  |
| 2021                   | “Ecological Assembly”, EMERGE Biological Integration Institute Summer Workshop (invited talk)  |
| 2020                   | Microbes, mosses, and metagenomes, Departmental Colloquium, University of Colorado, Boulder  |
| 2020,<br>2018,<br>2017 | Research Experience for Community College Students (RECCS) Program, Q&A panelist and invited talk “How to communicate your research.”  |
| 2016                   | “Microbial Communities of Boreal Mosses” EBIO Lunch and Learn, University of Colorado, Boulder   |

2014 “rRNA Sequence Analysis in QIIME.” UC Davis Bioinformatics Club, invited talk

#### *Contributed Talks*

- 2022 Biological and environmental drivers of microbial community assembly in a thawing permafrost ecosystem, Ecological Society of America, Montreal, Canada (Contributed talk)
- 2021 Microbial Assembly in Thawing Permafrost, American Geophysical Union, New Orleans, LA USA/Virtual (Contributed talk)
- 2020 Primary succession of microbial communities in terrestrial environments: an experimental cross-site investigation, Ecological Society of America General Meeting, Salt Lake City, UT, USA/Virtual Meeting (Contributed talk)
- 2019 Phylogenetic and Environmental Controls on N<sub>2</sub>-fixation in the boreal moss microbiome, Front Range Microbiome Symposium, Fort Collins, CO, USA. (Contributed Talk and poster)
- 2017 Taxonomic and Functional Attributes of the Boreal Moss Microbiome, Future Arctic Conference on Bryophytes and Lichens, Quebec, Canada (Contributed Talk)
- 2017 Taxonomic and Functional Attributes of the Boreal Moss Microbiome, Guild of Rocky Mountain Ecologists and Evolutionary Biologists, Nederland, CO, USA (Contributed Talk)

#### *Poster Presentations*

- 2023 **Holland-Moritz, H.**, Hicks Pries, C., Wieder, W., Grandy, A. S., Ernakovich, J. “Strategies for translating microbial ‘omics into function in models of Arctic priming” EMERGE Institute Workshop, Tuscon AZ, USA
- 2018 **Holland-Moritz, HE**, Stuart, J, Lewis, LR, Ponciano, JM, McDaniel, S, Mack, M, Fierer, N “Phylogenetic and Environmental Controls on the Boreal Moss Microbiome” Poster Presentation, 2018, *International Society for Microbial Ecology Meeting*, Leipzig, Germany.
- 2014 **Holland-Moritz, HE**, Lang, JM, Stachowicz, J, Eisen, JA "Exploring the biogeography of microbial communities on the surface of seagrasses." Poster Presentation: *20th Annual International Conference on Microbial Genomics* 2014 Lake Arrowhead, CA, USA.
- 2014 **Holland-Moritz, HE**, Lang, JM, Stachowicz, J, Eisen, JA "The Seagrass Microbiome" Poster Presentation at: University of California, Davis *Undergraduate Research Symposium* 2014. Davis, CA, USA.

### **GRANTS, FELLOWSHIPS, AND FUNDING**

*(totaling \$15,551)*

Dept. of Ecology and Evolutionary Biology (EBIO) Graduate Research Grant	2019	\$2500
Beverly Sears Graduate Student Grant	2019	\$1000
Dept. of Ecology and Evolutionary Biology (EBIO) Graduate Research Grant	2018	\$2500

EBIO Travel Grant	2018	\$300
CU Boulder Graduate School Domestic Travel Grant	2017	\$500
Wood's Hole Marine Biological Laboratory Summer Fellowship	2016	\$8751
NSF-GRFP Honorable Mention	2017	
- <i>The Diversity and Activity of Moss Associated Nitrogen-Fixing Bacteria in Boreal Ecosystems</i>	2016	
- <i>Sandbox Succession: Phylogenetics and Function of Microbial Pioneers in Climatic Context</i>	2015	
- <i>Exploring Disturbance in Microbial Systems through Winogradsky Model Communities</i>		

## TEACHING

### *Courses and Workshops*

UNH-CRREL Bioinformatics Group – Introduction to Metagenomics Workshop Series	2021, 2022
EMERGE Biology Integration Institute Summer Program Instructor	2021- 2023
Courses:	
- Introduction to Community Assembly	
- Tools of Environmental Microbiology	
- An ecosystem of models: Using Predictive Models Across Spatial and Temporal Scales	
Co-instructor – Graduate Course: Sewage Metagenomics	2020
Lead instructor – Using Make and Makefiles for automating analysis pipelines Workshop	2020
Lead instructor – Collaboration and Version Control with git Workshop and Hackathon	2020
Lead instructor – Science and the Creative Process: Training Creative Thinking (Workshop)	2019, 2021
Co-instructor – High-throughput sequence data workshop series	2018
Lab Instructor – Undergraduate Course: Principles of Ecology	2017

### *Pedagogical Training Training and Professional Development*

Mentorship Academy – UNH	2022
Graduate course in Mentorship and Leadership in STEM	2017

## MENTORSHIP AND ADVISING

*\* indicates service on student's thesis committee*

### Graduate Students

Adeena Ahsan (MS) *	2022 - present
Sean Schaefer (PhD)	2021 - present
Nate Blais (MS/PhD)	2021 - present
Ember Bradbury (PhD, Colorado State University)	2022 - present
Cristhian Teixeira (PhD)	2022
Louisa Kimmell (MS, Colorado State University) *	2021-2023
Joy O'Brien (MS)	2021-2022

## Undergraduates

Torin Scalora-Riley	Summer 2022 - present
Tallulah Biletzkov	Summer REU 2022
Parker Stoddard	Summer REU 2022
Mikayla Lopez	Summer 2021
Savanna Pierce	Summer 2019
Lady Grant	2018 - 2019
Maya Montoya-Pimolwatana	2017 - 2018
Alexander Kaaua	2015 - 2016
Ruth Lee	2014 - 2015
Briana Pompa-Hogan	2014 - 2015

## High School Students

Henna Hundal	Summer 2014
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## AWARDS

Dept. of Ecology and Evolutionary Biology Graduate Student Service Award	2019
Integrated Studies Honors Scholar	2011 - 2014
University of California Regents Scholar	2010 - 2014

## RELEVANT SKILLS

**Computational:** Terminal/Bash (proficient), Git version control (proficient), R (proficient), Linux (proficient), use of high power computing systems (proficient), Python (familiar with), Perl (familiar with), C (familiar with), LaTeX (familiar with)

**Bioinformatics:** Genome assembly, metagenomics (read-based and assembly), environmental amplicon-sequencing analysis, phylogenetic tree-building, gene annotation, plotting and visualization of biological data, hierarchical bayesian modeling, terrestrial climate modeling with Community Land Model (CLM), machine learning

**Language (ILR Scale):** English (native), French (full professional proficiency), German (limited working proficiency), Japanese (limited working proficiency), Arabic (elementary proficiency) [*Language learning is a personal hobby.*]

**Other:** Social Media (Twitter: @hhollandmoritz)

## SELECTED SYNERGISTIC ACTIVITIES

### 1. Educator

- Lead instructor in numerous data science skills workshops including workshops focused on version control, make, reproducible science, and best practices in scientific coding (2018-present)

- Created microbial analysis pipeline tutorial and led workshops in its use for CU Boulder Center for Microbial Exploration, and UNH's SoilBioME group. (2019-2022)
- Contributed multiple workshops on quantitative topics including R, multivariate analysis, and Bayesian statistics to EBIO Department's weekly Quantitative Discussion working group (2016-2019).

## 2. *Community Service*

- Created, organized and co-run SoilBioME writing cooperative – a collaborative peer-writing group of soil scientists and students (2022)
- EMERGE-BII (Biology Integration Institute) DEI committee. Led efforts to improve cross-institutional reporting structure, community agreement, and field safety (2022)
- Co-organized the departmental graduate student orientation. (2020, 2017)
- Served as the Graduate Student Representative to the Faculty. Led efforts to improve mentorship, financial stability, and accessibility for graduate students. (2017-2019)
- Colloquium committee member and travel coordinator for weekly colloquium series for CU Boulder's EBIO Department. (2015 - 2019)
- Graduate student representative on Departmental Climate and Graduate Degree Program Committees for departmental 7-year Academic Review and Planning Advisory Committee review. (2018)
- Graduate student representative to two faculty search committees. (2018)
- Organized and ran departmental graduate student writing cooperative. (Summer 2017)
- Drafted departmental Inclusion, Diversity, and Excellence in Academics (IDEA) plan, led initiative to increase diversity of graduate student applicant pool, and foster an inclusive graduate student environment as member of EBIO Diversity and Inclusion Working Group (2017-2021)

## 3. *Mentor*

- Research mentor to 7 graduate students (2 as a committee member), 10 undergraduates, and 1 high school student
- Served as a peer mentor for four graduate students in departmental mentoring program. (2016-2019)

## 4. *Science Communicator*

- Designed, coordinated, and carried out community science research project focused on microbial succession with middle and high school educators across the USA. (2018 - 2019)
- Co-chair and participant of CU Boulder Evolution Outreach Committee. Annually organized continuing education "Teaching Controversial Science Topics" workshop for local middle and high school teachers, and Museum Family Day on evolution. (2015 – 2019)
- "Mysterious Microbes of Soil" Workshops and Webinar series. Helped organize, plan, and run workshops for K-12 teachers and gave public webinar presentations focused on microbial ecology. (2016)

## 5. *Reviewer*

- For journals including: Applied and Environmental Biology, Global Change Biology, PeerJ, American Journal of Botany, Ecosystems, Functional Ecology, Trends in Microbiology, Oecologia, Microbiome, ISMEJ, Journal of Ecology, New Phytologist, and Science of the Total Environment.
- Invited judge for undergraduate research presentations at the annual EBIO departmental Spring Symposium (2018).

## FURTHER RELEVANT RESEARCH & WORK EXPERIENCE

- Participant, NSF EMERGE-BII Summer Institute, Virtual* 2021  
- a two-week workshop on integrative ecosystem biology with courses in modeling, microbial processes, multi-omics integration, isotopic gas flux measurements, team science, and mentoring
- Participant, Anvi'o workshop, University of California, Irvine* 2017  
- a multi-day workshop focused on the use of Anvi'o in 'omics analyses
- Participant, MBL Microbial Diversity Course, Woods Hole, MA* 2016  
- a 6.5 week course dedicated to training students in laboratory and theoretical aspects of microbial diversity
- Research Internship, Drs. Manjula Gunawardana and Marc Baum, Oak Crest Institute of Science* 2009 - 2010  
- Researched extraction methods of PCR-quality DNA from heavily hydrocarbon-polluted environmental samples (e.g. asphalt pools).

## REFERENCES

- Jessica Ernakovich, Ph.D. (Postdoctoral Advisor) [jessica.ernakovich@unh.edu](mailto:jessica.ernakovich@unh.edu)  
University of New Hampshire  
Dept. of Natural Resources and the Environment
- Noah Fierer, Ph.D. (PhD Advisor) [noah.fierer@colorado.edu](mailto:noah.fierer@colorado.edu)  
University of Colorado, Boulder  
Dept. of Ecology and Evolutionary Biology
- Will Wieder, Ph.D. (Summer Research Mentor, current collaborator) [wwieder@ucar.edu](mailto:wwieder@ucar.edu)  
National Center for Atmospheric Research  
Climate & Global Dynamics Lab