KATHERINE (KAYE) SHEK, Ph.D.

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PROFESSIONAL EXPERIENCE AND APPOINTMENTS

NSF Postdoctoral research fellow 2022-2024

Projects: Integrating scale-dependency of geomicrobial controls on soil C dynamics in predictive models (NSF-EAR-2204571); LTER: Ecological Metagenome-derived Reference Genomes and Traits (EMERGENT; NCEAS)

Graduate teaching fellow, University of Oregon Dept. of Biology, Eugene, OR 2017-2022
Research technician, U Oregon COVID-19 Monitoring and Assessment Program, Eugene, OR 2021-2022
Research and teaching assistant, Barnard College Biology Dept., Columbia U., New York, NY 2015-2017
Research technician, Duncan Menge laboratory, Columbia U. E3B Dept. New York, NY 2016-2017

EDUCATION

Doctor of Philosophy Biology, U of Oregon, Institute of Ecology and Evolution Eugene, OR 2022
Dissertation: Soil microbial assembly and function in agroecosystems under various management and disturbance regimes

Bachelor of Arts, Barnard College, Columbia University New York, NY 2015
Major: Biology / **Minor:** Chemistry
Thesis: Community assembly of ectomycorrhizal fungi is driven more by soil properties than tree host-specificity in a SE Asian tropical forest ; **Academic honors:** Hermann Botanical Prize

Objectives: My research aims to integrate microbial genetic and physiological processes into biogeochemical models, with a particular focus on ecosystem responses to climate variability and change. My recent research focuses on cross-scale interactions between microbial metabolism, traits and the carbon cycle. I utilize a big data synthesis approach with machine learning with aims to improve the predictive ability of large-scale models with more accurate trait-based microbial parameters. I am currently fusing ecological niche theory with global-scale multi 'omic datasets to better understand general patterns of microbial controls on the carbon cycle.

TEACHING EXPERIENCE

University of Oregon, IEE *Graduate teaching fellow, researcher and mentor*

Projects: Effects of agricultural management on the structure and function of vineyard soil microbiomes; A novel approach for preparing amplicon libraries for Illumina sequencing in microbial ecology; Coffee farm management drives shifts in soil enzymatic potential and fungal community composition in Chiapas, Mexico; Composition and function of common mycorrhizal networks in a PNW prairie system (L. Silva lab)

Courses taught: Mycology (F2018, F2019); Intro to Biology: Cells (F2017, W2018); Microbiology (S2018-19, S2021); Microbiology Laboratory (S2021 UO, F2015-16 Barnard Coll.); Bioinformatics (F2016 Barnard Coll.)

PUBLICATIONS

Anthony, W. E., Allison, S. D., Broderick, C. M., Chavez Rodriguez, L., Clum, A., Cross, H., Eloe-Fadrosh, E., Evans, S., Fairbanks, D., Gallery, R., Brandao Gontijo, J., Jones, J., McDermott, J., Pett-Ridge, J., Record, S., Rodrigues, J. L. M., Rodriguez-Reillo, W., Shek, K. L., Takacs-Vesbach, T., Blanchard, J. L. From soil to sequence: filling the critical gap in genome-resolved metagenomics is essential to the future of soil microbial ecology. *Environmental Microbiome* **19**, 56 (2024). https://doi-org.unh.idm.oclc.org/10.1186/s40793-024-00599-w

Dawson, H.R., Shek, K.L., Maxwell, T.M., Reed, P.B., Bomfim, B., Bridgham, S.D., Bohannan, B.J.M., Silva, L.C.R. (2024). Plant functional types and tissue stoichiometry explain nutrient transfer in common arbuscular mycorrhizal networks of temperate grasslands. *Functional Ecology*, 38, 2184–2195. https://doi-org.unh.idm.oclc.org/10.1111/1365-2435.14634

Rhodes, M.E., McGuire, K.L., Shek, K.L., Gopal, T.S. (2023). Going Up: Incorporating the Local Ecology of New York City Green Roof Infrastructure into Biology Laboratory Courses. In: Rivera Maulucci, M.S., Pfirman, S., Callahan, H.S. (eds) Transforming Education for Sustainability. Environmental Discourses in Science Education, vol 7. Springer, Cham. https://doi.org/10.1007/978-3-031-13536-1_10

Shek, K.L., Dawson, H.R., Maxwell, T.M., Bomfim, B., Reed, P.B., Bridgham, S., Bohannan, B., Silva, L.C.R. (2022). Local and regional scale mycorrhizal network assembly in an experimental prairie-pasture system. *bioRxiv* doi:10.1101/2022.10.05.510876.

Bomfim, B., Dawson, H.R., Reed, P.B., Shek, K.L., Bohannan, B., Bridgham, S., Silva, L.C.R. (2022) Quantifying climate change impacts on plant functional composition and soil nitrogen fixation in Mediterranean grasslands. *bioRxiv* doi:10.1101/2022.09.16.508323.

Spencer, M.W., Shek, K.L., Meyer, K., Weisz, J., Jones, G., McGuire, K.L. (2022) Teasing apart *terroir*: the influence of management style on native yeast communities within Oregon wineries and vineyards. IVES Conference Series. 3-8. https://ives-openscience.eu/13232/

Mackin, H.*, Shek, K.L.*, Thornton, T., Evens, K., Hallett, L.M., McGuire, K.L., Peterson, M.L., Roy, B.A. (2020). The "black box" of plant demography: How do seed type and climate affect grass seed germination and fungal communities? *New Phytologist*, 231: 2319-2332. https://doi.org/10.1111/nph.17532

*co-first authors

Jurburg, S.D., Shek, K.L., and Mcguire, K. (2020). Soil microbial composition varies in response to coffee agroecosystem management. *FEMS Microbiology Ecology*, Volume 96, Issue 9, fiaa164, https://doi.org/10.1093/femsec/fiaa164

Meyer, K. M., A. H. Morris, K. Webster, A. M. Klein, M. E. Kroeger, L. K. Meredith, A. Brændholt, F. Nakamura, A. Venturini, L. F. de Souza, K. L. Shek, R. Danielson, J. van Haren, P. B. de Camargo, S. M. Tsai, F. Dini-Andreote, J.

M. S. de Mauro, K. Nüsslein, S. Saleska, J. L. M. Rodrigues, and B. J. M. Bohannan. (2020). Belowground changes to community structure alter methane-cycling dynamics in Amazonia. *Environment International* 145:106131. https://doi.org/10.1016/j.envint.2020.106131

Brodsky, O.L., Shek, K.L., Dinwiddie, D., Bruner, S.G., Gill, A.S., Hoch, J.M., Palmer, M.I., and Mcguire, K.L. (2019). Microbial Communities in Bioswale Soils and Their Relationships to Soil Properties, Plant Species, and Plant Physiology. *Frontiers in Microbiology* 10. doi: 10.3389/fmicb.2019.02368

Hoch, J. M. K., Rhodes, M. E., Shek, K. L., Dinwiddie, D., Hiebert, T. C., Gill, A. S., Salazar Estrada, A. E., Griffin,

K. L., Palmer, M. I., McGuire, K. L. (2019). Soil microbial assemblages are linked to plant community composition and contribute to ecosystem services on urban green roofs. *Frontiers in Ecology and Evolution* 7, doi:10.3389/fevo.2019.00198

Essene, A. L., Shek, K. L., Lewis, J. D., Peay, K. G. & McGuire, K. L. (2017). Soil Type Has a Stronger Role than Dipterocarp Host Species in Shaping the Ectomycorrhizal Fungal Community in a Bornean Lowland Tropical Rain Forest. *Frontiers in Plant Science* 8, 1828, doi:10.3389/fpls.2017.01828

Journals reviewed: ISME, Plant and Soil, Functional Ecology, Geoderma, New Phytologist, Science of the Total Environment, Frontiers in Sustainable Food Systems

PRESENTATIONS AND POSTERS

Shek, K.L. Microbial trait-environment interactions at the continental scale. Special seminar at the University of Edinburgh School of GeoSciences, Edinburgh, UK. 24 February 2025. (*invited*)

Shek, K.L. Modeling microbial trait-soil C interactions at the continental scale. Special seminar at Laboratoire des Sciences du Climat et de l'Environnement (LSCE), Paris, France. 21 Feb 2025. (*invited*)

Shek, K.L. Microbial community structure and function in soils under various land use and climate contexts. Special seminar at Wageningen University and Research Soil Biology Group, Wageningen, NL. 18 Feb 2025. (*invited*)

Shek, K.L., Stegen, J., Roebuck, A., Goldman, A., Borton, M., Wrighton, K., Wymore, A. Modeling microbial functional trait-environment interactions at the continental scale. European Geosciences Union General Assembly. 2024

Shek, K.L. Detecting generalizable patterns in large-scale microbiome datasets for enhanced prediction of carbon dynamics across scales. Ecological Society of America. Portland, OR 2023 (*invited*)

Shek, K.L., Wymore, A. Microbial niche breadth as a tool to identify controls on carbon and nutrient cycling across environmental gradients. European Geosciences Union General Assembly. 2023

Shek, K.L. Machine Learning and the Microbiome. Bridging the Bench-Machine Learning Gap Workshop Series. University of Oregon Data Science & Genetics Training Program. 2022 (*invited*)

Shek, K. L. Soil Microbial Assembly and Function in Agroecosystems Under Various Management and Disturbance Regimes. University of Oregon Department of Biology. 2022

Shek, K. L., Hiebert, T., Youtsey, B., Meyer, K. M., McGuire, K. L. Hierarchical structuring of soil microbial communities in vineyard agroecosystems. Ecological Society of America. Salt Lake City, UT. 2020

Guest lecture, University of Oregon: Microbiology, Methods in Microbial Ecology. 2019

Shek, K. L. Assembly, function and resilience of arbuscular mycorrhizal fungi under compounded disturbances in viticulture. University of Oregon. 2018

Shek, K. L. Investigating biotic and abiotic factors structuring ectomycorrhizal communities in a lowland tropical rain forest. Student Research Symposium: Hughes Science Pipeline Project 2015

Shek, K. L. Community assembly of ectomycorrhizal fungi is driven more by soil properties than tree host-specificity in a SE Asian tropical forest. Senior Thesis Presentation, Barnard College 2015

Shek, K. L., Essene, A., McGuire, K. L. Ectomycorrhizal Fungal Associations and DNA Barcoding of Tropical *Shorea* spp. on Malaysian Borneo. Barnard Summer Research Institute Poster Session 2014

AWARDS AND GRANTS

2022 NSF Earth Science Postdoctoral Fellowship ($180,000)
2019 O'Day Fellowship, University of Oregon (co-recipient with mentee E. Hill - $10,000)
2015 Recipient of the Hermann Botanical Prize for excellence in Biology
2014 HHMI: Hughes Science Pipeline Project, Summer Research Internship ($4,000)

OUTREACH AND SYNERGISTIC ACTIVITIES

Mentor for underrepresented minority students throughout application process for graduate programs in STEM – Cientifico Latino, Graduate Student Mentor Initiative (2020-2023)

Taught workshops for bioinformatics processing of raw sequence data and statistical analyses of fungal functional groups for students in Puerto Rico (Universidad Ana G. Mendez) and Univ. of Oregon

Mentored undergraduate and graduate students in lab technique, statistical analysis and scientific writing, including 3 Honors college theses and Bioinformatics Master's Program externship projects

Trained female high school students and teachers in molecular microbial methods from Brearley High School (New York, NY)

SKILLS AND CERTIFICATIONS

Languages: English, Mandarin Chinese, German (speaking proficiency), Python, R, Unix

Lab techniques and data share platforms: Protocol development for high-throughput sequencing (amplicon, RNAseq, PacBio), PCR/qPCR primer design and protocol development, nucleic acid extraction, microscopy (Light; Confocal: Zeiss LSM 880), NMR Spectroscopy, CHN sample prep and analysis (Costech), completed ICP-MS training, Stable Isotope Probing (SIP) implementation in field and lab, DNA-SIP lab protocols; GitHub data and code sharing, Overleaf collaborative manuscript platform, HPC environment data storage and transfer, data processing and analysis in HPC environment (SLURM), Globus, data access protocol development for NEON repository