

CAITLIN HODGES

Assistant Professor, Critical Zone Geoscience, University of Oklahoma

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876 Sarkeys Energy Center
Norman, OK 73019

Education

- PhD** Soil Science and Biogeochemistry August 2021
Pennsylvania State University
University Park, PA
Dissertation: "The interactions between minerals, carbon dioxide, and oxygen in the critical zone"
- MS** Ecology May 2017
University of Georgia
Athens, GA
Thesis: "Characterizing Iron Reduction in Upland Soils"
- BSES** Water and Soil Resources May 2014
University of Georgia
Athens, GA
Summa Cum Laude
First Honor Graduate

Funded Research Grants

- USDA-NIFA (Lead-PI) - \$880,000** 2024-2027
"Partnership: Soil carbon pools and fluxes in grassland: responses to and recovery from drought and land use intensification"
- NASA (Co-PI) - \$590,000** 2024-2026
"Efficiency of geophysical methods for assessment of biogeochemical and mineralogical subsurface variation in extreme redox gradients - advancing tools to predict habitability in the subsurface"
- NASA (Co-PI) - \$550,00** 2023 – 2025
"Salts and Clays – Investigating Clay Formation and Alteration in High Salinity Brines"
- Oklahoma Department of Transportation (Co-PI) - \$180,000** 2023 – 2024
"A paired catchment comparison of erosion control devices at construction sites"
- NSF (Co-I) - \$195,787 to OU** 2023 – 2025
"Network Cluster CINet: Critical Interface Network in Intensively Managed Landscapes"
- USDA NIFA (Lead-PI) – \$179,000** 2020 - 2023
"Quantifying the mechanisms and biogeochemical impact of anaerobic microsites in upland soils"

NSF CZO SAVI International Scholars (Sole – PI) - \$5,000	2019
“A climate gradient approach to examining the role of manganese in plant litter decomposition”	
Penn State EESL Student Seed Grant (Sole – PI) - \$2,230	2019
“The effect of soil physical structure on redox-mediated nutrient cycling”	
NSF CZO SAVI Summer Interns (Sole – PI) - \$5,500	2018
“A cross-CZO study examining the role of near-stream soils as regulators of terrestrial inputs.”	

Awards and Honors

SSSA Wilde Early Achievement Career Award	2023
Black Travel Award	December 2018
Pennsylvania State University, College of Agricultural Sciences	
McKenna Fellowship	Aug. 2017 - May 2019
Pennsylvania State University, College of Agricultural Sciences Endowed Fellowship	
Claypoole Distinguished University Fellowship	Aug. 2017 - May 2019
Pennsylvania State University	
UGA Plant and Soil Symposium	November 2016
3 rd place oral presentation	
UGA Amazing Student	May 2015
Top-Up Graduate Scholarship	Aug. 2014 - May 2015
University of Georgia, Odum School of Ecology Graduate Program	

Research Appointments

Soil Systems Research Fellow	2024-Present
Institute for Resilient Environmental and Energy Systems, University of Oklahoma	
Assistant Professor, Critical Zone Geoscience	2021 - Present
University of Oklahoma, School of Geosciences, Norman, OK	
PhD Student	2017 - 2021
Pennsylvania State University, State College, PA	
Advisor: Jason Kaye	
Co-Advisor: Susan Brantley	
Master’s Student	2014 - 2017
University of Georgia, Athens, GA	
Advisor: Aaron Thompson	
Undergraduate Research Assistant	2012 - 2014
Environmental Soil Chemistry lab of Aaron Thompson	

Teaching

University of Oklahoma	
Biogeochemistry of the Critical Zone	Fall Odd Years
Genesis and Properties of Soils	Fall Even Years
Introduction to Physical Geology	Annually, Fall

Earth Resources and the Environment
Topics in Critical Zone Science

Annually, Spring
Semesterly

Elsewhere

Introduction to Soils Laboratory, Pennsylvania State University
Generated all laboratory exercises for remote learning

Fall 2020

Introduction to Soils Guest Lecture, Pennsylvania State University
Potassium and Micronutrients in Soils

Fall 2019

Introduction to Soils Laboratory, Pennsylvania State University
Primary Instructor

Fall 2019

Pennsylvania State University Soil Judging Team
Assistant Coach

2018 – 2021

University of Georgia Soil Judging Team
Assistant Coach

2014 –2016

Introduction to Soils and Hydrology
Laboratory Teaching Assistant

2015

Mentoring

Graduate Students at University of Oklahoma

Brittany Moehnke, PhD Student

2024 - Present

Dani Storms, MS Student

2024 - Present

Dodger Stankewitz, MS Student

2023 - Present

Tiffany Legg, PhD Student

2022 - Present

Jacob Clements, MS Student

2022 - 2024

Brittany Moehnke, MS Student

2022 - 2024

Undergraduate Students at University of Oklahoma

Gabe Jandebaur, Honors Capstone Research

2022 - Present

Dodger Stankewitz, Undergraduate Research Assistant

2022 - 2023

Bryson Fetters, Undergraduate Research Fellowship

2021

Alyssa Pascoe, Undergraduate Research Fellowship

2021 – Present

Lab Alumni

Jacob Clements, MS
PhD Student at University of Tennessee, Knoxville, Department of Biosystems Engineering
and Soil Science

Undergraduate Students Elsewhere

Trisha Poorbaugh, Women in Science Experience in Research
Pennsylvania State University

2020 – 2021

Willow Blew, Undergraduate Research Assistant
Pennsylvania State University

2019 – 2021

Elise Elizondo, Women in Science Experience in Research
Pennsylvania State University

2018 – 2019

Serena Mon, Young Scholars High School Summer Intern
University of Georgia

2015

Shannon Burns, Undergraduate Research Assistant

2015 – 2016

Publications

- *Richardson, J., E. M. Herndon, D. M. Rempe, H. L. Buss, C. Hodges. Manganese and iron biogeochemistry in the Critical Zone: signals from weathering, vegetation, and pollution. *In prep for submission, Biogeochemistry, Spring 2024.*
- *Geyer, C., Elwood Madden, A. S., Hodges, C., Elwood Madden, M. (2024). Preferential liberation of Al during reaction of kaolinite with near-saturated brines. *In Prep for Submission, Clays and Clay Minerals, Spring 2024*
- *Legg, T., Moehnke, B., Souza, L., Hodges, C. (2024). Drought-Driven Flux: Soil Inorganic Carbon Stocks Shift Across Sub-Decadal Scales. *In Prep for Submission, Vadoze Zone Journal, Spring 2024.*
- Legg, T., & Hodges, C. (2024). Towards a community-engaged framework for sampling urban soils. *In Review, Soil Science Society of America Journal*
- Hodges, C., Araujo, P. I., Hess, L. J., Vivanco, L., Kaye, J., & Austin, A. T. (2023). Metal cation concentrations improve understanding of controls on soil organic carbon across a precipitation by vegetation gradient in the Patagonian Andes. *Geoderma*, 440, 116718.
- Hodges, C. A., Regan, J., Forsythe, B., Oakley, D., Kaye, J., Brantley, S. (2023). Using fixed-potential electrodes to quantify iron and manganese redox cycling in upland soils. *Biogeochemistry*. <https://doi.org/10.1007/s10533-022-01012-9>.
- Hodges, C., Brantley, S. L., Sharifironizi, M., Forsythe, B., Tang, Q., Carpenter, N., & Kaye, J. (2021). Soil carbon dioxide flux partitioning in a calcareous watershed with agricultural impacts. *Journal of Geophysical Research: Biogeosciences*, 126(10), e2021JG006379.
- Kaye, J. P., Brantley, S. L., Zan Williams, J., and the SSHCZO team. Proposed Best Practices for Collaboration at Cross-disciplinary Observatories. (2019). *Biogeosciences Discussions*. <https://doi.org/10.5194/bg-2019-249>
- Hodges, C., H. Kim, S. L. Brantley, J. Kaye. (2019). Soil CO₂ and O₂ concentrations illuminate the relative importance of weathering and respiration to seasonal soil gas fluctuations. *Soil Science Society of America Journal*. doi: 10.2136/sssaj2019.02.0049
- Hodges, C., J. Mallard, D. Markewitz, A. Thompson. (2019). Seasonal and spatial variability of iron reduction in the soils of the Southeastern Piedmont of the US. *Catena*. doi: 10.1016/j.catena.2019.03.026
- Hodges, C., E. King, J. C. Pett-Ridge, A. Thompson. (2018). Potential for iron reduction increases with rainfall in Montane Basaltic Soils of Hawaii. *Soil Science Society of America Journal*. doi:10.2136/sssaj2017.06.0193
- King, E., A. Thompson, C. Hodges, J. C. Pett-Ridge. (2014). Towards understanding temporal and spatial patterns of molybdenum in the critical zone. *Proceedings of the tenth Geochemistry of the Earth's Surface Conference*. doi: 10.1016/j.proeps.2014.08.011

Science Communications and Outreach

University of Oklahoma High School Summer Academies – Earth Cycles Camp Program Leadership. June 2023

Soil as a Carbon Sink across the Landscape. University of Oklahoma High School Summer Academies – Earth Cycles. Field and Laboratory Demonstration. June 2022

- Hodges, C., A. Shaughnessy, F. Tutella. The soil of Nittany Valley. The Arboretum at Penn State Garden Wonderings. September 2020. <https://youtu.be/BuVWZjGZ5RM>
- Hodges, C. 2019. Roots and Microbes increase soil weathering at the Shale Hills CZO. SciWri 2019 Science Writer's Shale Hills CZO fieldtrip. State College, PA. October 2019.
- Hodges, C. 2019. Welcome to the Susquehanna Shale Hills CZO. NSF GEOPaths introduction to the critical zone seminar. State College, PA. May 2019.
- Hodges, C. 2019. It's Alive! How soil organisms shape and influence their environment. San Diego Nerd Nite SSSA Takeover. San Diego, CA. January 2019.
- Hodges, C. 2018. How do Soil Microbes Influence Nutrient Availability? Soil Science Society of America Soils Matter Blog.
- Hodges, C. 2018. What is Vermicompost? Soil Science Society of America Soils Matter Blog.

Published Presentation Abstracts

- Legg, T., Moehnke, B., Souza, L. A., Hodges, C. A. (2023). Soil Inorganic Carbon Response to Short-Term Precipitation Variability: Evidence from a Global Drought Manipulation Study. AGU.
- Clements, J., Hodges, C. A. (2023). Controls on Riparian Pollutant Removal Under Anticipated Climate Change Scenarios in Central Oklahoma, USA.. ASA, CSSA, SSSA International Annual Meeting.
<https://scisoc.confex.com/scisoc/2023am/meetingapp.cgi/Paper/152695>
- Barbre, K., Elwood Madden, M. E., Madden, A. S., Hodges, C. A. (2023). Ferrihydrite Transformation Products in Near-Saturated Martian Brines (1775th ed., vol. 2806). LPI Contributions <https://par.nsf.gov/servlets/purl/10460894>
- Valles, K., Hodges, C. A., Jimenez-Moreno, G., Harris, B., Flynn, M., Dulin, S. A., Soreghan, G. S. (2023). Preliminary Results of a Paleoclimate-Paleofire Record from the Early Pleistocene of the Uncompahgre Plateau (Rocky Mountains, Colorado). Geological Society of America Annual Meeting.
- Moehnke, B., Legg, T., Souza, L. A., Hodges, C. A. (2023). Clay Mineral Species and Crystallinity Impact Mineral-Associated Organic Matter Stability across a Precipitation Gradient. ASA-CSSA-SSSA.
<https://scisoc.confex.com/scisoc/2023am/meetingapp.cgi/Paper/154130>
- Barbre, K., Elwood Madden, M. E., Madden, A. S., Hodges, C. A. (2023). Influence of Near-Saturated Brine Chemistry on Ferrihydrite in Martian Soils. ASA-CSSA-SSSA.
<https://scisoc.confex.com/scisoc/2023am/meetingapp.cgi/Paper/152735>
- Legg, T., Moehnke, B., Souza, L. A., Hodges, C. A. (2023). Soil Inorganic Carbon Response to Short-Term Precipitation Variability: Evidence from a Global Drought Manipulation Study. ASA-CSSA-SSSA.
<https://scisoc.confex.com/scisoc/2023am/meetingapp.cgi/Paper/150917>
- Legg, T., Hodges, C. A. (2023). Towards a Community-Engaged Framework for Sampling Urban Soils. ASA-CSSA-SSSA.
<https://scisoc.confex.com/scisoc/2023am/meetingapp.cgi/Paper/154163>
- Barbre, K. S., Elwood Madden, A. S., Hodges, C. A., Elwood Madden, M. E. (2022). Jarosite and Ferrihydrite Transformation Products in Near-Saturated Martian Brines. Abstracts with Programs (5th ed., vol. 54). Geological Society of America.
<https://doi.org/10.1130/abs/2022AM-379654>.

- Hodges, C. A., Clements, J., Stankewitz, D., Woodrow, R. (2022). Legacy sediment stimulates subsurface iron redox cycling in a well-drained floodplain in Central Oklahoma, USA. Soil Science Society of America Annual Meeting.
- Hodges, C. L. Vivanco, P. Araujo, L. J. T. Hess, J. Kaye, A. T. Austin. (2022, July). Investigating Mineral Weathering and Soil Carbon Accumulation Across a Pedogenic Matrix in the Patagonian Andes. Goldschmidt Annual International Meeting. Honolulu, HI. (Oral)
- Hodges, C., Brantley, S. L., & Kaye, J. P. (2021, November). Mineralogy Acts as a Control on Carbon Dioxide and Oxygen Concentrations in Soils at the Susquehanna Shale Hills Critical Zone Observatory. In *ASA, CSSA, SSSA International Annual Meeting*. ASA-CSSA-SSSA.
- Hodges, C., Brantley, S., & Kaye, J. (2021, April). Soil carbon dioxide and oxygen concentrations indicate mineralogy plays a key role in controlling soil pCO₂. In *EGU General Assembly Conference Abstracts* (pp. EGU21-8036).
- Hodges, C., A. T. Austin, L. Vivanco, J. Kaye. 2020. The Effects of Pine Afforestation and Climate on Soil Metals and Carbon Accumulation across a Patagonian Rainfall Gradient. ASA CSSA & SSSA Annual Meeting. Virtual. November 2020. (Poster)
- Hodges, C., J. Regan, J. Kaye, B. Forsythe, D. Oakley, A. Nyblade, S. L. Brantley. Quantifying in Situ Metal Redox in Soils of the Susquehanna Shale Hills Critical Zone Observatory Using Fixed Potential Electrodes. ASA CSSA & SSSA Annual Meeting. Virtual. November 2020. (Oral)
- Hodges, C., J. Regan, J. Kaye, B. Forsythe, D. Oakley, A. Nyblade, S. L. Brantley. 2020. Quantifying *in situ* metal redox in response to fluctuating soil moisture using electrical resistivity and fixed potential electrodes. NSF/UKRI Signals in the Soil. Virtual. September 2020. (Poster)
- Brantley, S. L., A. Nyblade, J. Regan, B. Forsythe, C. Hodges, J. Kaye, D. Oakley. 2020. EAGER SitS: Emergent properties of soil development at the Susquehanna Shale Hills Critical Zone Observatory. NSF/UKRI Signals in the Soil. Virtual. September 2020. (Poster)
- Thompson, A., C. Hodges, O. Chadwick. 2020. The window of active soil iron redox activity across the time-climate pedogenic matrix of the Hawaiian Islands. Goldschmidt Annual International Meeting. Virtual. June 2020. (Oral)
- Hodges, C., J. Regan, B. Forsythe, S. L. Brantley, J. Kaye. 2019. Using apparent respiratory quotient and fixed-potential electrodes to quantify iron redox in the Susquehanna Shale Hills Critical Zone Observatory. American Geophysical Union Annual Meeting. San Francisco, CA. December 2019. (Poster)
- Oakley, D., A. Nyblade, S. L. Brantley, N. J. Acardo, C. Hodges, J. Regan, J. Kaye. 2019. Seismic ambient noise and electrical resistivity imaging of subsurface water changes in the Susquehanna Shale Hills CZO, Pennsylvania. American Geophysical Union Annual Meeting. San Francisco, CA. December 2019. (Oral)
- Hodges, C., H. Kim, S. L. Brantley, J. Kaye. 2019. Soil pCO₂ and pO₂ at Shale Hills and Garner Run indicate anaerobic respiration driven by metal redox. Susquehanna Shale Hills CZO All Hands Meeting. State College, PA. May 2019. (Oral)
- Brantley, S.L., A. Nyblade, J. Regan, B. Forsythe, C. Hodges, J. Kaye. 2019. EAGER SITS: Emergent properties during soil formation at the Susquehanna Shale Hills Critical Zone Observatory. NSF/DARPA/ARPA-E Signals in the Soil Project Meeting. National Science Foundation, Alexandria, VA. April 2019. (Poster)
- Hodges, C., S. L. Brantley, J. Kaye. 2019. Untangling the influence of biotic and abiotic factors driving soil CO₂ and O₂ concentrations at the Shale Hills CZO. Penn State Geochemistry Forum. University Park, Pa. March 2019. (Oral)

- Hodges, C., H. Kim, S. L. Brantley, J. Kaye. Soil gas concentrations at the Susquehanna Shale Hills CZO indicate different physical and chemical drivers of gas production and consumption in shale and sandstone watersheds. International Soils Meeting. San Diego, CA. January 2019. (Oral)
- Thompson, A., C. Chen, N. Noor, C. Hodges, D. Barcellos, D. deB. Richter. The potential for iron reduction in upland soils in Calhoun Critical Zone Observatory. American Geophysical Union 2017 Fall Meeting, New Orleans, LA, 11-15 December 2017. (Oral).
- Hodges, C., J. Mallard, D. Markewitz, A. Thompson. Temporal variation of water and carbon influence the distribution of upland iron reduction in soils. Soil Science Society of America Annual Meeting. Phoenix, AZ. November 2016. (Oral)
- Hodges, C., D. Markewitz, A. Thompson. Variation of iron reduction with depth and time at the Calhoun CZO. Calhoun Summer Science Meeting, Union, SC. May 2016. (Oral).
- Thompson, A., C. Hodges, O. Chadwick. Delineating climactic regions of upland soil iron reduction. American Geophysical Fall Meeting. San Francisco, CA. December 2015. (Poster).
- Hodges, C., D. Markewitz, A. Thompson. Linking spatial and temporal patterns of soil moisture with iron reduction. American Geophysical Union Fall Meeting. San Francisco, CA. December 2015. (Poster)
- Thompson, A., C. Hodges. Probing iron reduction from cm to km scales in forested ecosystems. Soil Science Society of America Annual Meeting. Minneapolis, MN. November 2015. (Oral).
- Thompson, A., C. Hodges, E. King, J. Pett-Ridge, O. Chadwick. Measuring soil iron reduction potential across rainfall gradients. Hawaii Ecosystems Meeting. Hilo, HI. July 2015. (Oral).
- Mon, S., A. Thompson, C. Hodges. Elucidating environmental controls on the potential for soil iron reduction. Young Scholars Research Symposium. Athens, Ga. July 2015. (Poster).
- Hodges, C., D. Markewitz, A. Thompson. Mapping the potential for iron reduction using electromagnetic induction. Southeastern Biogeochemistry Symposium. Atlanta, GA. March 2015. (Poster).
- Hodges, C., E. King, J. Pett-Ridge, A. Thompson. Characterizing iron reduction along a Hawaiian climate gradient. Ecology Graduate Student Symposium. Athens, GA. January 2015. (Oral).
- Hodges, C., and A. Thompson. Deploying passive redox samplers across Hawaiian climate gradients. Hawaii Ecosystems Meeting. Hilo, HI. July 2013. (Oral)

Service and Affiliations

Mineralogy Division Chair	2024 - Present
Soil Science Society of America	
Associate Editor	2022 - Present
Soil Science Society of America Journal, Pedology Division	
Chair-Elect	2022 - 2023
Soil Science Society of America, Mineralogy Division	
Environmental Studies Program, Geosciences Liaison	2021 - Present
School of Geosciences, Undergraduate Studies Committee	2021 - Present
ESM Diversity, Equity, and Inclusion Sub-Committee	
Graduate Student Representative	2020 – 2021
Environmental Chemistry and Microbiology Student Symposium	

Co-chair	2019
Susquehanna Shale Hills CZO Executive Committee	
Graduate Student Representative	August 2018 – 2021
SSSA Science Communication Committee	2017 – 2021
Professional Society Membership:	
American Geochemical Society	2022 - Present
American Geophysical Union	2015 – Present
ASSA/CSSA/SSSA	2014 – Present
Reviewer for the following Journals:	
Nature Geoscience; Global Biogeochemical Cycles; Ecosphere; Ecological Indicators; Water Resources Research; Catena; New Phytologist; Wetlands; Soil Science Society of America Journal; Journal of Environmental Quality	