Sophie Ruehr, Ph.D.

email: sophie.ruehr@berkeley.edu
citizenship: united states
publications: Google Scholar
website: sruehr.github.io

Research Interests

My research focuses on carbon-water coupling dynamics in terrestrial ecosystems. I use remote sensing, eddy covariance flux tower data, and machine learning techniques to explore landscape-level responses to water availability, with an emphasis on near-surface remote sensing, solar-induced fluorescence, drought response, and ecosystem management. My work improves understanding of ecosystem response to climate variability and sustainable water management in a changing climate.

Education

University of California Berkeley — Berkeley, CA
Ph.D. in Environmental Science, Policy, & Management — 2020–2025
Coadvised by Trevor Keenan & Manuela Girotto

> **"Optimizing water-carbon trade-offs: Plant, ecosystem, and management strategies across scales."** My dissertation focuses on the coupling of carbon and water cycles in terrestrial ecosystems using remote sensing, eddy covariance flux tower, and machine learning, with a focus on solar-induced fluorescence, drought, and sustainable water management in agricultural systems.

Yale University — New Haven, CT
B.S. in Geology & Geophysics, *cum laude* — 2014–2018

> **"A mechanistic investigation of the oasis effect in the Zhangye cropland in semiarid western China."** My senior honors thesis used surface energy balance theory to partition the observed oasis effect between irrigated cropland and surrounding desert.

Research & Professional Experience

Carnegie Institution at Stanford — Stanford, CA
Max Planck-Caltech-Carnegie-Columbia MC^3 4 Earth Center Postdoctoral Fellow — 2025

> Research on the water-saving effects of sustainable management using remote sensing, AI, and biophysical modeling with Drs. Lorenzo Rosa and Jeff Dukes.

University of California Berkeley — Berkeley, CA
Postdoctoral Scholar — 2025

> Remote sensing data to quantify effects of expanding sustainable management practices towards drought-resilient ecosystems, with a new focus on fire-drought compound events.

Independent Data Consulting — Remote
Analysis and Visualization Consultant (Part-time) — 2020–Present

> I provide data analysis, visualization, interpretation, and modeling solutions to clients across various sectors, including environmental and biomedical start-ups.

Provincetown Independent Provincetown, MA
Newspaper reporter 2019-2020

As a reporter for a weekly newspaper, I covered a range of topics, including environmental science, policing, and immigration.

Yale University Port Vila, Vanuatu
Huang Fellow 2018-2019

I conducted a year-long independent research project on the historic impacts of climate change, sea level rise, and intensifying cyclones in Vanuatu, a Pacific Island Nation, for use in paleoclimatology research at the Woods Hole Oceanographic Institution.

Woods Hole Oceanographic Institution Woods Hole, MA
Summer Student Fellow 2017

In Dr. Jeffrey Donnelly's Coastal Group, I analyzed paleoclimate hurricane dynamics estimated from sediment cores to determine deposition dynamics in a coastal pond.

Publications

In Review

Ruehr, S., Bassiouni, M., Kang, Y., Socolar, Y., Magney, T., Keenan, T.F. Crop rotation enhances agricultural water use efficiency in California's Central Valley (preprint here: 10.21203/rs.3.rs-6322235/v1)

Climate & Environment

Ruehr, S., Gerlein-Safdi, C., Falco, N., Seibert, P., Chou, C., Albert, L., Keenan, T.F. Quantifying seasonal and diurnal cycles of solar-induced fluorescence with a novel hyperspectral imager. 2024.*Geophysical Research Letters*, 51, 14. 10.1029/2023GL107429.

Ruehr, S., Girotto, G., Verfaillie, J., Baldocchi, D., Cabon, A., Keenan, T.F. 2023. Ecosystem groundwater use enhances carbon sinks in a semi-arid oak savanna. *Agricultural & Forest Meteorology*, 342, 109725. 10.1016/j.agrformet.2023.109725.

Ruehr, S., Keenan, T.F., Williams, C., Zhou, Y., Lu, X., Bastos, A., Canadell, P., Prentice, I.C., Sitch, S., Terrer, C. Evidence and attribution of the enhanced land carbon sink. 2023. *Nature Reviews Earth & Environment*, 4, 518-534. 10.1038/s43017-023-00456-3.

Massoud, E.C., Andrews, L., Reichle, R., Molod, A., Park, J., **Ruehr, S.**, Girotto, M. 2022. Seasonal forecasting skill for the High Mountain Asia region in the Goddard Earth Observing System. *Earth System Dynamics*, 14, 147–171. 10.5194/esd-14-147-2023.

Ruehr, S. 2021. Beyond the vulnerability/resilience dichotomy: Perceptions of and responses to the climate crisis on Emau, Vanuatu. *Island Studies Journal*. 10.24043/isj.151.

Ruehr, S., Lee, X., Smith, R., Li, X., Xu, Z., Liu, S., Yang, X., Zhou, Y. 2020. A mechanistic investigation of the oasis effect in the Zhangye cropland in semiarid western China. *Journal of Arid Environments*, 176, 104120. 10.1016/j.jaridenv.2020.104120.

Espeland, M., Hall, J.P., DeVries, P.J., Lees, D.C., Cornwall, M., Hsu, Y., Wu, L., Campbell, D.L., Talavera, G., Vila, R., Salzman, S., **Ruehr, S.**, Lohman, J.D., Pierce, N.E. 2015. Ancient Neotropical origin and recent recolonisation: Phylogeny, biogeography and diversification of the Riodinidae (Lepidoptera: Papilionoidea). *Molecular Phylogenetic Evolution*, 93, 296-306. 10.1016/j.ympev.2015.08.006.

Data Consulting

Rutkove, S.B., Le, M., Nagy, J.A., **Ruehr, S.**, Semple, C., Sanchez, B. 2022. Design and pilot testing of a 26-gauge impedance-electromyography (iEMG) needle in wild type and ALS mice. *Nerve & Muscle*, 65, 6. 10.1002/mus.27551.

Chin, A., **Ruehr, S.**, Tarulli, A., Rutkove, S. 2007. Saline-saturated Balsa Wood as a Testing Mediumfor Rotational Electrical Impedance Myography. *IFMBE Proceedings*, 17, 272-275. 10.1007/978-3-540-73841-1_72.

Mentorship

Sponsored Projects for Undergraduate Research University of California, Berkeley
Mentor 2020-2025

I mentor undergraduate students on senior honor thesis research projects, which have included biomass estimation using remote sensing image classification over an oak savanna, bonsai tree 3D modeling, and science communication on social media.

2024-	Eden Gonzalez, UC Berkeley undergraduate
2023-2024	Adam Rashid, UC Berkeley graduate
2022-2024	Megan Hur, UC Berkeley undergraduate
2022-2023	Tyler Goldstein, UC Berkeley undergraduate

Be a Scientist! University of California, Berkeley
Mentor 2020-2022

I mentored 7th grade students on semester-long research experiments.

Teaching

Guest Lectures

"Land Surface Modeling" University of California, Berkeley
EPS 251: Carbon Cycle Dynamics Spring 2025

"Remote Sensing of the Biosphere" University of California, Berkeley
ESPM 111: Ecosystem Science Spring 2024

Courses & Centers

ESPM 111: Ecosystem Science University of California, Berkeley
Graduate Student Instructor Spring 2024

In this upper-level undergraduate class led by Dr. Dennis Baldocchi, I taught two sections of 35 students each, designed lesson plans, developed assignments, and gave a guest lecture on remote sensing.

D-Lab University of California, Berkeley
Data Consultant 2020-2024

I consulted graduate students across campus on questions related to data science, statistical methods and coding in R, Python, and Googl Earth Engine.

Funding & Fellowships: $450,000 total

Chancellor's Advisory Committee; $54,000 2025
University of California Berkeley
Field safety equipment loan program for students, faculty and staff

Be Smart About Safety; $25,000 2025
University of California Berkeley
Funding towards department-wide field safety equipment and training

Postdoctoral Fellowship in Land-Surface Modeling; $82,500 annually 2024
Max Planck-Caltech-Carnegie-Columbia MC^3 4 Earth Center
Up to four years of postdoctoral funding

Future Investigators in NASA Earth and Space Science and Technology; $150,000 2022
National Aeronautics and Space Administration (NASA)
Three years of graduate funding

Early Career Secondment; $8,000 2022
FLUXNET
Research fellowship for 6 weeks at CREAF, Universitat Autònoma de Barcelona, Spain

Carol Baird Fieldwork Grant; $33,000 2020
University of California Berkeley
In support of solar-induced fluorescence imaging fieldwork

Achievement Rewards for College Scientists Fellowship; $100,000 2020
ARCS Northern California Chapter
Two years of graduate funding

Parker Huang Undergraduate Travel Fellowship; $36,000 2018
Yale University
In support of independent paleoclimate research in Vanuatu

Karen Von Damm 1977 Fellowship; $5,000 2017
Yale University Dept. of Geology & Geophysics
In support of senior honors thesis field research in Lanzhou, China

Summer Student Fellowship; $8,000 2017
Woods Hole Oceanographic Institution
Fellowship on hurricane paleoclimatology research

Service

Committees

Field Safety Committee 2024-2025
Dept. of Environmental Science, Policy & Management, UC Berkeley

LGBTQ+ Coalition 2022-2024
College of Natural Resources, UC Berkeley

Diversity, Equity & Inclusion Committee 2021-2024
AmeriFlux

Graduate Diversity Council 2020-2024
Dept. of Environmental Science, Policy & Management, UC Berkeley

Reviewing

Regular reviewer for Agricultural & Forest Meteorology, Nature Communications Earth & Environment, Hydrology, Nature Communications, Earth's Future, AGU Advances, Proceedings of the National Academy of Sciences, Geophysical Research Letters, Journal of Arid Environments

Awards

Honorable Mention 2022
National Science Foundation Graduate Research Fellowship Program

First Place: Science/Technology Reporting 2021
New England Newspaper Association

First Place: Health Reporting 2021
New England Newspaper Association

Hammer Prize 2017
Department of Geology & Geophysics, Yale University
Awarded for excellence in the oral presentation of the senior thesis

Media

Outreach & Journalism

2023	FLUXNET blog
2022	Keenan Group TikTok
2022	AmeriFlux 25 years data visualization tool
2022	Berkeley Science Review
2019, 2020	Provincetown Independent
2019	InsideClimate News
2019	WOMR Cape Cod's Outermost Radio
2016, 2018	Provincetown Banner

External Press

2023	Ask MIT Climate
2023	Phys.org

Workshops

Identity-Based Risks in Field Work 2025
University of California Berkeley

Strategies to mitigate identity-based risks to members of a field team

Center for Climate Sciences Summer School 2024
NASA Jet Propulsion Lab, CA

Week-long course on remote sensing and climate modeling at CalTech and JPL

Spring Teaching Conference 2024
University of California Berkeley

Participation in a one-day workshop on teaching, ethics, and inclusion

FieldFutures Harassment Prevention Training 2024
University of California Berkeley

Participation in a full-day workshop on sexual harrassment prevention in fieldwork

DroneCamp 2024
CSU Monterey Bay, CA

5-day field course on mission planning, drone piloting, photogrammetry, and data processing

AmeriFlux Field Safety Workshop 2022
Virtual

Leading a one-day workshop for safety and inclusivity in field work

FluxCourse 2022
AmeriFlux at Niwot Ridge, Nederland, CO

Two-week field course on eddy covariance flux data and modeling

Skills

Languages
Bislama (advanced), French (advanced), Italian (basic)
Computer languages
Python, R, MATLAB, Bash, Git
Software
LaTeX, Wordpress, GIS, ENVI, RStudio, Google Earth Engine
Field work
Hyperspectral imager deployment, snow depth and water equivalent, GPS survey, sediment core collection and processing, tree diameter measurement, leaf-level physiology measurements, anthropological research methods, eddy covariance flux tower deployment

Presentations

Invited Lectures

Ruehr, S. Evidence and attribution of the land carbon sink's historic enhancement (Fall 2023). EEBIOMASS virtual workshop. Max-Planck Institute for Biogeochemistry, Jena, Germany.

Ruehr, S. Carbon emissions and offsets: Global and local research (August 2021). Distinguished speaker, ARCS Forward National Speaker Series.

Ruehr, S. Celebration of Distinguished Fellows Selected Student Speaker (April 2021). University of California Berkeley, CA.

Ruehr, S. Achievement Rewards for College Scientists Symposium Selected Scholar (April 2021). ARCS National Chapter, USA.

Ruehr, S. Tracing ancient cyclones: paleoclimate, oral history & climate futures (November 2018). University of the South Pacific Emalus Campus, Vanuatu.

Ruehr, S. & Lee, X. Intrinsic Biophysical Mechanism Theory & the Oasis Effect (March 2018). Key Laboratory of West China's Environmental System, Lanzhou University, Gansu, China.

Ruehr, S. & Lee, X. Intrinsic Biophysical Mechanism Theory & the Oasis Effect (March 2018). School of Geography, Beijing Normal University, Beijing, China.

Oral Presentations

Ruehr, S., Kang, Y., Bassiouni, M., Magney, T., Socolar, Y., Keenan, T.F. Emerging satellite products unveil cropland water use efficiency trends and drivers in California's Central Valley (December 2024). GC21G-04. AGU fall meeting, Washington D.C., USA.

Ruehr, S. Groundwater drought decreases carbon fixation in a semi-arid oak savannah (Fall 2023). CREAF, Barcelona, Spain.

Ruehr, S., Girotto, M., Verfaillie, J., Baldocchi, D., Keenan, T.F. Groundwater drought decreases carbon fixation in a semi-arid oak savannah (Fall 2022). GC55A-03. AGU fall meeting, Chicago, IL, USA.

Ruehr, S., Seibert, P., Gerlein-Safdi, C., Falco, N., Wu, Y., Chou, C., Keenan, T.F. Hyperspectral imagery illuminates drivers of solar-induced fluorescence across landscapes (Fall 2022). B43C-04. AGU fall meeting, Chicago, IL, USA.

Ruehr, S., Girotto, M., Keenan, T.F. Quantifying ecosystem reliance on groundwater (Fall 2021). H51E-01. AGU fall meeting, New Orleans, LA, USA.

Ruehr, S., Gerlein-Safdi, C., Falco, N., Keenan, T.F., Torn, M. S. Picturing SIF: field readiness and initial results from a novel SIF imaging instrument (Fall 2021). B22C-09. AGU fall meeting, New Orleans, LA, USA.

Ruehr, S., Lee, X., Smith, R... Latent heat drives cooling over oases (December 2020). H026-01A. AGU Fall Meeting, USA.

Ruehr, S. Stakeholder feedback for a paleoclimate study. (December 10, 2019). Coastal Research Laboratory, Woods Hole Oceanographic Institution, Woods Hole, MA, USA.

Ruehr, S. The Oasis Effect: Evaluating Intrinsic Biophysical Mechanism Theory and its Implications for Sustainable Water Management in Zhangye, Gansu, China. (May 11, 2018). Dept. of Geology & Geophysics, Yale University, New Haven, CT, USA.

Poster Presentations

Ruehr, S., Gerlein-Safdi, C., Falco, N., Keenan, T.F., Torn, M. S. Picturing SIF: field readiness and initial results from a novel SIF imaging instrument (Fall 2021). B22C-09. AGU fall meeting, New Orleans, LA, USA.

Ruehr, S., Girotto, M., Keenan, T.F. Quantifying ecosystem reliance on groundwater (Fall 2021). H51E-01. AGU fall meeting, New Orleans, LA, USA.

Ruehr, S., Keenan, TF., Girotto, M. Inter-annual groundwater variation affects ecosystem productivity. (October 2021). AmeriFlux Fall Meeting.

Ruehr, S., Lee, X., Smith, R... A mechanistic investigation of the oasis effect in the Zhangye cropland in semiarid western China. (October 2020). AmeriFlux Fall Meeting.

Castagno, K., Ruehr, S., Donnelly, J., Woodruff, J. Grain-size distribution and patterns in storm-induced event beds in a coastal pond. (October 2018). EP13D-2125. American Geophysical Union Fall Meeting.

Ruehr, S., Castagno, K., Donnelly, J. Newfound aspects of ancient hurricanes: reconstructing storm intensity and sediment deposition dynamics in northeastern coastal ponds. (August 2017). Summer Student Fellow Poster Session, Woods Hole Oceanographic Institution, Woods Hole, MA.