Sophie Ruehr, Ph.D.

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citizenship: united states website: sruehr.github.io

Research Overview

My interdisciplinary research focuses on global water-carbon cycling, land surface feedbacks, and management implications in terrestrial ecosystems. I use remote sensing, field work and machine learning methods to explore landscape-level responses to water availability, with an emphasis on drought and near-surface observations of solar-induced fluorescence. My work evaluates strategies to build resilience in water-scarce ecosystems through climate solutions, mitigation, and adaptation.

Education

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

> **"Optimizing water-carbon trade-offs: Plant, ecosystem, and management strategies across scales."** My dissertation focused on the coupling of carbon and water cycles in terrestrial ecosystems using machine learning, with a focus on near-surface remote-sensing technologies and sustainable water management in agricultural systems.

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

> **"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 (temperature depression) between irrigated cropland and surrounding desert.

Research & Professional Experience

Max Planck-Caltech-Carnegie-Columbia MC^3 4 Earth Center — Stanford, CA
Land Surface Modeling Postdoctoral Fellow — 2025

> Food-water-energy nexus research on the water-saving effects of sustainable management using remote sensing, machine learning, and biophysical modeling with Drs. Lorenzo Rosa and Jeff Dukes at the Carnegie Institution at Stanford.

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 Preparation

Ruehr, S., Dukes, J., Rosa, L. Irrigation infrastructure and multi-cropping can buffer rainfall extremes in South American agricultural landscapes. (Target journal: *Nature Sustainability*) .

Ruehr, S., Pierrat, Z., Parazoo, N., Keenan, T.F. Harnessing solar-induced fluorescence for agricultural research and management: Recent advances and outstanding needs. (Target journal: *Environmental Research Letters*) .

Cabiyo, B., **Ruehr, S.**, Arora, T., Nolan, C.J., Kueppers, L., Field, C. The durability of forests in a changing climate. (Target journal: *Nature*)

In Review

Ruehr, S., Bassiouni, M., Kang, Y., Socolar, Y., Magney, T., Keenan, T.F. Crop rotation enhances agricultural water use efficiency (preprint here: 10.21203/rs.3.rs-6322235/v1)

Friedlingstein, P., Bastos, A., **Ruehr, S.**, Warszawski, L., & colleagues. The state of land carbon sinks. In: 10 New Insights in Climate Science 2025, *Earth League & Future Earth*.

Pierrat, Z.A., Gustine, R.N., Boser, A., **Ruehr, S.**, Lee, C.M., Reager, J.T., Bassiouni, M., Kang, Y., Socolar, Y., Magney, T., Cawse-Nicholson, K. Human contributions to evapotranspiration mitigate swings in dry to wet year transitions.

Rao, M. P., Pacheco-Solana, A., Li, R., Oryan, B., Jensen, J., Rodriguez, M., Klinek, L., Pierrat, Z., **Ruehr, S.**, Oelkers, R., Boeschoten, L. E., Griffin, K., McCormack, M. L., Yang, X., Verfaillie, J., Baldocchi, D., Hise, J., Turner, A., Scanlon, T. M., Hayles, L.-A., Eitel, J., Pederson, N., Griffin, D., Stahle, D., Maxwell, J., Voelker, S., Kannenberg, S., Peñuelas, J., Magney, T. Atmospheric aridity decouples carbon assimilation and growth in temperate deciduous oaks.

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.

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

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

Mentorship

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

> I have loved my experiences mentoring graduate and undergraduate students on research projects, which have included biomass estimation using remote sensing image classification over an oak savanna, bonsai tree 3D modeling, and science communication. Two of my students have presented their work at the American Geophysical Union's fall conference.

Current and past mentees

2025-	Jackson Coldiron, UC Santa Barbara masters student
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 Prof. 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.

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 Nature Communications, PNAS, Science Advances, One Earth, Geophysical Research Letters, Agricultural & Forest Meteorology, Nature Communications Earth & Environment, Hydrology, Earth's Future, AGU Advances, & Journal of Arid Environments.

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

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, Java, HTML, 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. Ecohydrology insights for water resource management in agroecosystems (December 2025). American Geophysical Union Fall Conference, Frontiers in Ecohydrology, Invited Speaker.

Ruehr, S. Supporting and understanding resilient ecosystems (Summer 2025). Lawrence Livermore National Lab, Livermore, CA.

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.