# Yanlan Liu

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## APPOINTMENTS

**The Ohio State University**, Columbus, OH                                      2021-*present*
  Assistant Professor, School of Earth Sciences & of Environment and Natural Resources
**Lawrence Berkeley National Lab**, Berkeley, CA                              2020-2021
  Postdoctoral Scholar, Earth and Environmental Sciences Area
**Stanford University**, Stanford, CA                                                  2019-2020
  Postdoctoral Scholar, Department of Earth System Science

## EDUCATION

**Duke University**, Ph.D. in Environmental Science                              2019
**Duke University**, M.S. in Statistical Science                                     2019
**Tsinghua University**, B.Eng. in Hydraulic Engineering                        2014

## RESEARCH INTERESTS

Ecohydrology, hydrology and water resources, land-atmosphere interactions, plant hydraulics, high-latitude vegetation dynamics, postfire recovery, ecosystem vulnerability and resilience, environmental statistics, remote sensing, numerical modeling

## HORNERS & AWARDS

Distinguished Graduate Faculty Teaching Award, SES, The Ohio State University      2023
Outstanding student paper award, American Geophysical Union                         2017
Excellent thesis award, Tsinghua University                                         2014
First class academic performance fellowship, Tsinghua University                    2014

## GRANTS ($1.53M total funded; $738K as lead PI)

**NASA Terrestrial Ecology Program** (PI, awarded, $250K)                        2022-2025
  Characterizing Arctic-boreal vegetation resilience under climate change and disturbances
**USGS Water Resources Research Act Program** (Co-PI, awarded, $620K)      2024-2026
  Enhance water budget predictions through below-ground processes
**Ohio Department of Higher Education** (PI, awarded, $365K)                    2024-2026
  Quantifying cropland water-carbon-nutrient coupling for climate-resilience production
**Nationwide AgTech Innovation Hub** (Co-PI, awarded, $148K)                   2023-2024
  Drought risk reduction through automated drainage water management
**Data-intensive Climate Analytics Research Pilots, OSU** (PI, awarded, $40K)    2023-2024
  Interpretable data-driven prediction of droughts at a seasonal-to-subseasonal time scale
**DOE's NGEE-Arctic Project Subcontract** (PI, awarded, $43K)                   2022-2022
  Representing seed dispersal in a dynamic vegetation model
**DOE's NGEE-Arctic Project Subcontract** (PI, awarded, $40K)                   2023-2023

Predicting impacts of vegetation demographics and fire on artic vegetation change
**Sustainability Research Seed Grant, OSU** (Co-I, awarded, $25K)                    2022-2023
Sustainable Adoption of climate-smart agroforestry in the Sahel

## MENTORING

| | |
|---|---|
| Qian Zhao, Postdoc in Earth Sciences, OSU | 2023- |
| Ziyang Tan, Ph.D. student in Earth Sciences, OSU | 2024- |
| Yidong Tong, Ph.D. student in Environmental Science Graduate Program, OSU | 2023- |
| Zhaozhe Chen, Ph.D. student in Earth Sciences, OSU | 2022- |
| Yue Zhang, Ph.D. student in Earth Sciences, OSU | 2021- |
| Colette Brown, Ph.D. student in ERG, UC Berkely | 2021- |
| Briana McNeal, undergrad in Earth Sciences, OSU | 2023- |
| Claire Sneed, undergrad in Earth Sciences, OSU | 2022- |
| Shengxi Gui, Ph.D. student in Civil, Environmental & Geodetic Engineering, OSU | 2022-2023 |
| Lauren McIntosh, undergrad in Earth Sciences, OSU | 2022-2023 |
| Jacob Bolton, undergrad in Earth Sciences, OSU | 2021-2022 |
| Olivia Flournoy, undergrad in Geophysics, Stanford | 2019-2020 |
| Yan Bai, visiting Ph.D. student in ESPM, UC Berkeley | 2019-2020 |

## TEACHING

| | |
|---|---|
| ENR 5194 Plant-water interactions, OSU | 2023 |
| EARTHSC 5656 Ecohydrology, OSU | 2022, 2024 |
| EARTHSC 5641 Geostatistics, OSU | 2022, 2023 |

## PUBLICATIONS (Citations = 925, h-index = 14. See [Google Scholar Page](#) for updates)

Advised students/scholars are underscored; *denotes corresponding author.

### 2023

20. Hu, T., Zhang, X., Bohrer, G., **Liu, Y.**, Zhou, Y., Martin, J., Li, Y. & Zhao, K.* (2023). Crop yield prediction via explainable AI and interpretable machine learning: Dangers of black box models for evaluating climate change impacts on crop yield. Agricultural and Forest Meteorology, 336, 109458.

### 2022

19. Zhao, M.*, A, G., **Liu, Y.**, & Konings, A. G. (2022). Evapotranspiration frequently increases during droughts. Nature Climate Change, 12, 1024-1030.

18. Bai, Y., **Liu, Y.**, Kueppers, L. M., Li, E., Zhang, C., Yu, K., Yang, X., & Li, X.* (2022). Hydraulic sensitivity and stomatal regulation of two desert riparian species. Journal of Geophysical Research: Biogeosciences, 127(10), e2022JG006971.

17. Zhang, Y.*, Gentine, P., Luo, X., Lian, X., **Liu, Y.**, Zhou, S., Michalak, A. M., Sun, W., Fisher, J. B., Piao, S., & Keenan, T. F.* (2022). Increasing sensitivity of dryland vegetation greenness to precipitation due to rising atmospheric $CO_2$. Nature communications, 13(1), 4875.

16. **Liu, Y.**[*], <u>Flournoy, O.</u>, Zhang, Q., Novick, K. A., Koster, R. D., & Konings, A. G. (2022). Canopy height and climate dryness parsimoniously explain spatial variation of unstressed stomatal conductance. Geophysical Research Letters, 49(15), e2022GL099339.

15. **Liu, Y.**[*], Riley, W. J., Keenan, T. F., Mekonnen, Z. A., Holm, J. A., Zhu, Q., & Torn, M. S. (2022). Dispersal and fire limit Arctic shrub expansion. Nature Communications, 13(1), 3843.

14. <u>Li, Y.</u>, **Liu, Y.**, Bohrer, G., Cai, Y., Wilson, A., Hu, T., Wang, Z., & Zhao, K.[*] (2022). Impacts of forest loss on local climate across the conterminous United States: Evidence from satellite time-series observations. *Science of The Total Environment*, *802*, 149651.

13. Wu, D.[*], Vargas G., G., et al., [7 authors incl. **Liu, Y.**], & Xu, X.[*] (2022). Reduced ecosystem resilience quantifies fine-scale heterogeneity in tropical forest mortality responses to drought. Global Change Biology, 28, 2081– 2094

**2021**

12. <u>Bai, Y.</u>, **Liu, Y.**, Kueppers, L. M., Feng, X., Yu, K., Yang, X., Li, X., & Huang, J.[*] (2021). The coupled effect of soil and atmospheric constraints on the vulnerability and water use of two desert riparian ecosystems. Agricultural and Forest Meteorology, 311, 108701.

11. Konings, A. G.[*], Saatchi, S. S., Frankenberg, C., et al. [33 authors, incl. **Liu, Y.**] (2021). Detecting forest response to droughts with global observations of vegetation water content. Global Change Biology, 27, 6005– 6024.

10. **Liu, Y.**[*], Holtzman, N. M., & Konings, A. G. (2021). Global ecosystem-scale plant hydraulic traits retrieved using model–data fusion. *Hydrology and Earth System Sciences*, *25*(5), 2399-2417.

9.  Mekonnen, Z. A.[*], Riley, W. J., Berner, L. T., et al. [11 authors, incl. **Liu, Y.**] (2021). Arctic tundra shrubification: a review of mechanisms and impacts on ecosystem carbon balance. Environmental Research Letters, 16(5), 053001.

**2020**

8.  **Liu, Y.**[*], Kumar, M., Katul, G. G., Feng, X., & Konings, A. G. (2020). Plant hydraulics accentuates the effect of atmospheric moisture stress on transpiration. Nature Climate Change, 10(7), 691-695.

7.  Kulmatiski, A.[*], Yu, K., Mackay, D. S., Holdrege, M. C., Staver, A. C., Parolari, A. J., **Liu, Y.**, Majumder, S. and Trugman, A. T. (2020). Forecasting semi-arid biome shifts in the Anthropocene. New Phytologist, 226(2), 351-361.

**2019 and earlier**

6.  **Liu, Y.**, Kumar, M.[*], Katul, G. G., & Porporato, A. (2019). Reduced resilience as an early warning signal of forest mortality. Nature Climate Change, 9(11), 880-885.

5.  Mrad, A.[*], Sevanto, S., Domec, J. C., **Liu, Y.**, Nakad, M., & Katul, G. G. (2019). A dynamic optimality principle for water use strategies explains isohydric to anisohydric plant responses to drought. Frontiers in Forests and Global Change, 49.

4.  Wang, D., **Liu, Y.**, & Kumar, M.[*] (2018). Using nested discretization for a detailed yet computationally efficient simulation of local hydrology in a distributed hydrologic model. Scientific reports, 8(1), 1-13.

3. **Liu, Y.**, Parolari, A. J., Kumar, M.[*], Huang, C. W., Katul, G. G., & Porporato, A. (2017). Increasing atmospheric humidity and $CO_2$ concentration alleviate forest mortality risk. Proceedings of the National Academy of Sciences, 114(37), 9918-9923.
2. **Liu, Y.**, & Kumar, M.[*] (2016). Role of meteorological controls on interannual variations in wet-period characteristics of wetlands. Water Resources Research, 52(7), 5056-5074.
1. **Liu, Y.**, & Lei, H.[*] (2015). Responses of natural vegetation dynamics to climate drivers in China from 1982 to 2011. Remote Sensing, 7(8), 10243-10268.

## PRESENTATIONS

**First author oral presentations**

28. Identifying soil and atmospheric moisture thresholds of evapotranspiration reduction across CONUS, December 2023, **American Geophysical Union Fall Meeting**, San Francisco, CA.
27. Vegetation Dynamics in Fast Warming Northern High Latitudes (**invited**), November 2023, **Environmental Research 2023** Virtual Event Series (remote).
26. Vegetation Dynamics in Fast Warming Northern High Latitudes (**invited**), October 2023, Department of Environmental Sciences, **University of Virginia**, Charlottesville, VA.
25. Vegetation Dynamics in Fast Warming Northern High Latitudes (**invited**), October 2023, Department of Earth Sciences, **Indiana University-Perdue University Indianapolis**, Indianapolis, IN.
24. Vegetation Dynamics in Fast Warming Northern High Latitudes (**invited**), April 2023, Department of Evolution, Ecology and Organismal Biology, **The Ohio State University**, Columbus, OH.
23. Large divergence of projected Arctic plant composition and productivity due to functional trait uncertainty, March 2023, **1st Eastern Regional Dynamic Global Vegetation Modeling Conference**, Woods Hole, MA.
22. Characterizing Arctic-boreal vegetation resilience under climate change and disturbances, January 2023, **NASA Arctic-Boreal Vulnerability Experiment Science Team Meeting**, San Diego, CA.
21. Large divergence of projected Arctic plant composition and productivity due to functional trait uncertainty, December 2022, **American Geophysical Union Fall Meeting**, Chicago, IL.
20. Plant-atmosphere connections from landscapes to whole Earth (**invited**), June 2022, **Gordon Research Conference on Multiscale Plant Vascular Biology**, Newry, ME.
19. Dispersal and fire limit Arctic shrub expansion, May 2022, **NASA Arctic-Boreal Vulnerability Experiment Science Team Meeting**, Fairbanks, AK.
18. Large uncertainty of plant traits in projected Arctic vegetation shift, February 2022, **Annual Next-Generation Ecosystem Experiments Arctic All Hands Meeting** (remote).
17. Plant water use, resilience, and shift in response to warming and droughts (**invited**), December 2021, Department of Hydraulic Engineering, **Tsinghua University** (remote).
16. Plant hydraulic response to water stress and global retrieval of hydraulic traits (**invited**), March 2021, Carbon and Ecosystems Group, **Jet Propulsion Laboratory** (remote).
15. Plant hydraulic response to water stresses and the ecohydrological impacts (**invited**), March 2021, Department of Civil and Environmental Engineering, **University of Pittsburgh** (remote).

14. Impact of seed dispersal and fire on Arctic shrub expansion, January 2021, **Annual Next-Generation Ecosystem Experiments Arctic All Hands Meeting** (remote).
13. Global ecosystem-scale plant hydraulic traits retrieved using model-data fusion, December 2020, **American Geophysical Union Fall Meeting** (remote).
12. Plant water use, resilience and mortality under climate variations and change (**invited**), October 2020, **GeoInsider webinar series** (remote).
11. Forest water use, resilience, and mortality under climate variations and change (**invited**), June 2020, **Beijing Normal University** (remote).
10. Forest water use, resilience, and mortality under climate variations and change (**invited**), March 2020, **Lawrence Berkeley National Laboratory** (remote).
9. Understanding the mechanisms of forest resilience and mortality under drought (**invited**), March 2020, **Pacific Northwest National Laboratory**, Richland, WA.
8. Plant response to current and future water stress (**invited**), March 2020, School of Earth Sciences, **The Ohio State University,** Columbus, OH.
7. Forest response to current and future water stresses, January 2020, Joint Hydrology Group Seminar Series, **Stanford University**, Stanford, CA.
6. Plant hydraulics enhances atmospheric moisture stress on transpiration but mutes soil moisture stress (**highlighted**), December 2019, **American Geophysical Union Fall Meeting**, San Francisco, CA.
5. Plant hydraulics enhances atmospheric moisture stress on transpiration, October 2019, **Keck Institute for Space Studies workshop,** Pasadena, CA
4. Forest mortality risk under climate changes and variability (**invited**), May 2019, **Duke Kunshan University Scholarly Presentations**, Durham, NC.
3. Influence of plant hydraulics on evapotranspiration across climate and land cover types, December 2018, **American Geophysical Union Fall Meeting**, Washington, DC.
2. Reduced resilience as an early warning signal of forest mortality (**invited**), August 2018, **Ecological Society of America Annual Meeting**, New Orleans, LA.
1. Impact of long-term climate change on forest mortality risk (**invited**), July 2017, **Tsinghua University**, Beijing, China.

**First author poster presentations**

8. Predicting the Impacts of Climate Change and Fire on Arctic Vegetation: FATES Modeling and Remote Sensing, May 2023, **DOE Environmental System Science (ESS) Program annual Principal Investigators Meeting**, Bethesda, MD.
7. Warming and Disturbances Threaten Arctic-Boreal Vegetation Resilience, May 2023, **NASA Carbon Cycle & Ecosystems Joint Science Workshop**, Maryland, MD.
6. Evidence for the importance of dispersal and fire on Arctic shrub expansion, December 2021, **American Geophysical Union Fall Meeting** (remote).
5. Detection of early warning signals of forest mortality in California, December 2017, **American Geophysical Union Fall Meeting**, New Orleans, LA.
4. Influence of individual and combined climate change on forest mortality risk, May 2017, **Calhoun Critical Zone Observatory All Hands Meeting**, Calhoun, SC.
3. Increasing atmospheric humidity and $CO_2$ concentration alleviate forest mortality risk, December 2016, **American Geophysical Union Fall Meeting**, San Francisco, CA.

2. Role of meteorological controls in interannual variations in wet-period characteristics of wetlands, March 2016, **North Carolina Wetland Symposium**, Durham, NC
1. Role of meteorological controls in interannual variations in wet-period characteristics of wetlands, December 2015, **American Geophysical Union Fall Meeting**, San Francisco, CA.

## TOOLS & DATASETS DEVELOPED (open source at https://github.com/yanlanliu)

**Large-scale seed dispersal in land surface model**                                                    2023
A new version of ELM-FATES accounting for seed dispersal that allows simulating large-scale vegetation distribution change under future climate.

**Global ecosystem-scale plant hydraulic traits**                                                    2021
Global maps of plant hydraulic traits retrieved from microwave remote sensing for improved modeling of plant response to water stress.

**Model-data fusion for parameter retrieval**                                                    2018
A tool to estimate model parameters from observation using Markov chain Monte Carlo, demonstrated using a plant hydraulic model.

**Bayesian dynamic linear model**                                                    2017
A state-based time series model for prediction and inference on time-varying states, applied to estimate time-varying forest resilience.

**Soil-plant-atmosphere continuum model**                                                    2016
A physically based ecohydrological model that simulates plant hydraulic states and biosphere-atmosphere water/carbon fluxes.

**Bayesian regression and variable selection model**                                                    2015
A Bayesian lienar model that estimates the relative contributions and uncertainties of independent variables.

## SELECTED MEDIA COVERAGE

- Arctic shrub expansion limited by seed dispersal and wildfire, 2022, Science Daily
- Arctic shrubs spreading slower despite climate change, 2022, Polar Journal.
- Focus collection on forest carbon, 2021, Nature Climate Change.
- Study shows dry air drives overlooked changes in how plants drink and breathe, 2020, Phys.org.
- Scientists may now be able to predict forest die-off up to 19 months in advance, 2019, NOVA.
- Foretelling forest death from above, 2019, EOS.
- Researchers develop tool to diagnose dying forests, 2019, SciGlow.
- How forests balance the books in a changing climate, 2017, Ars Technica.

## PROFESSIONAL AFFILIATIONS

- NASA Arctic-Boreal Vulnerability Experiment
- Next-Generation Ecosystem Experiments-Arctic
- AmeriFlux
- American Geophysical Union
- Ecological Society of America

## PROFESSIONAL SERVICES

**Conferences**
- Session convener for Biogeosciences Session: Advances in Understanding Water-Energy-Carbon Interactions, American Geophysical Union Fall Meeting, 2023, San Francisco, CA.
- Session convener for Biogeosciences Session: Advances in Understanding Water-Energy-Carbon Interactions, American Geophysical Union Fall Meeting, 2022, Chicago, IL.
- Session convener for Biogeosciences Session: Advances in Understanding Vegetation Shifts in the Arctic, American Geophysical Union Fall Meeting, 2021, New Orleans, LA.
- Session convener for Biogeosciences Session: Advances in Understanding Water-Energy-Carbon Interactions, American Geophysical Union Fall Meeting, 2021, New Orleans, LA.

**Departmental**
- School of Environment and Natural Resources, Stream Ecology Faculty Search Committee, 2023-2024
- School of Earth Sciences, Communication Committee, 2021-*present*
- Byrd Polar & Climate Research Center, Postdoctoral Fellowship Selection Committee, 2023

**Editorial**
- Guest editor for the Special Issue in Journal of Hydrology: Changes in hydrological processes and water resources in the context of climate change and carbon neutrality, 2022.

**Review work**
- **Proposal panels**
  Swiss National Science Foundation, Mathematics, Physical and Engineering Sciences Division, 2023.
  United States Department of Agriculture, National Institute of Food and Agriculture, Small Business Innovation Research Program, 2022.
  United States Department of Energy, Office of Science, Office of Biological and Environmental Research, Earth and Environmental Systems Sciences Division, 2022 & 2023.
- **Journals**
  Reviewed 39 journal articles by February 2024 in Science, Nature Climate Change, Nature Communications, Proceedings of the National Academy of Sciences, New Phytologist, Remote Sensing of Environment, Science of the Total Environment, Journal of Hydrology, Geophysical Research Letters, Water Resources Research, Journal of Geophysical Research: Biogeosciences, Earth's Future, Agricultural and Forest Meteorology, Remote Sensing.