

# Bailey A. Murphy

POSTDOCTORAL RESEARCH ASSOCIATE

Environmental Science Division, Oak Ridge National Laboratory

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## Research Interests

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- Terrestrial carbon cycle, ecosystem modeling, data assimilation, biosphere-climate feedbacks, forest management, regional impacts of climate change, Nature-based Climate Solutions

## Education

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### Ph.D., Atmospheric and Oceanic Science

Madison, WI

UNIVERSITY OF WISCONSIN-MADISON

Sept. 2020 - Aug. 2023

- **Research Advisor:** Dr. Ankur Desai
- **Dissertation:** A macrosystems approach towards improved understanding of interactions between forest management, structure, function and climate change, and implications for the terrestrial carbon cycle

### M.S., Atmospheric and Oceanic Science

Madison, WI

UNIVERSITY OF WISCONSIN-MADISON

Sept. 2018 - Aug. 2020

- **Research Advisor:** Dr. Ankur Desai
- **Masters Thesis:** The devil is in the details: Emulation-based data assimilation to constrain a dynamic ecosystem model

### B.S. with Research Honors, Environmental Science

Corvallis, OR

OREGON STATE UNIVERSITY

Sept. 2011 - Sept. 2015

- **Minor:** Land-Air Interactions
- **Research Advisor:** Dr. Christoph Thomas
- **Undergraduate Thesis:** Soil respiration flux in response to changing soil temperature, moisture, and pH

## Research Experience

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### Oak Ridge National Laboratory

Oak Ridge, TN

POSTDOCTORAL RESEARCH ASSOCIATE

Oct. 2023 - Present

- **PI:** Dr. Benjamin Sulman
- Member of the Next Generation Ecosystem Experiment Arctic research project within the plant-soil interactions group at ORNL
- Biogeochemical modeling incorporating large observational datasets to improve representation of above-belowground connections in Arctic systems

### University of Wisconsin-Madison

Madison, WI

GRADUATE RESEARCH ASSISTANT

Sept. 2020 - Aug. 2023

- **PI:** Dr. Ankur Desai
- Evaluation of mechanistic relationships between LiDAR-derived canopy structural complexity and ecosystem productivity, highlighting drivers of productivity as well as scale dependencies and mediation effects.
- Exploration of regional interactions between forest management, function, and climate in centennial model projections, contributing to the development of a framework for scaling hypotheses regarding ecosystem function.

### University of Wisconsin-Madison

Madison, WI

GRADUATE RESEARCH ASSISTANT

Sept. 2018 - Aug. 2020

- **PI:** Dr. Ankur Desai
- Utilization of novel emulation-based Bayesian parameter data assimilation (PDA) techniques to constrain a dynamic vegetation model, using the Predictive Ecosystem Analyzer (PEcAn). Showed that error-space emulation-based PDA is a viable option to reduce predictive uncertainty related to carbon cycle dynamics in a computationally expensive model.

### Montana State University

Bozeman, MT

RESEARCH TECHNICIAN

Sept. 2017 - Aug. 2018

- **PI:** Dr. Mary Burrows
- Assisted with study of the wheat streak mosaic pathosystem complex through the collection and analysis of field samples using ELISA techniques, and cultivation of mite populations to understand variance in pathogen transfer rates. This project contributed to the understanding of agricultural management impacts on disease incidence and severity, with the goal of supporting Montana farmers in making informed decisions.
- Wet lab analysis of samples, maintaining chemical supplies and greenhouse experiments, inoculation and field sampling.

## United States Department of Agriculture-ARS

Corvallis, OR

### RESEARCH TECHNICIAN

May 2015 - Feb. 2016

- **PI:** Dr. Claire Phillips
- Characterization of biochar properties and its potential to mitigate climate change impacts on agricultural systems as well as its potential in remediation efforts of soils contaminated with toxic mine tailings.
- Assisted with projects establishing greenhouse gas budgets of agricultural systems.
- Investigation of biochar application to address soil freeze-thaw cycle damage.
- In addition to wet lab analysis (cation exchange capacity, CHN, soil physics, etc.) I fabricated equipment for field trials, conducted field work, and managed multiple greenhouse studies.

## Oregon State University

Corvallis, OR

### UNDERGRADUATE RESEARCH ASSISTANT

June 2014- May 2015

- **PI:** Dr. Christoph Thomas
- Evaluated soil respiration contributions to mature forest net ecosystem exchange and productivity, and explored climate-driven variables impacting respiration and carbon storage estimates.
- Assisted with the construction of study plots in the H.J. Andrews Experimental Forest and conducted field work to download data, collect samples, and maintain equipment, in addition to data analysis and instrument calibration and maintenance.
- Conceived of and wrote a research thesis of my own design, evaluating soil respiration flux in response to changing soil temperature, moisture, and pH.

## Publications

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### Peer-Reviewed

\*updated June 2024

- Shveytser, V., Stoy, P. C., Butterworth, B. J., Wiesner, S., Skaggs, T., **Murphy, B.A.**, Wutzler, T., El-Madany, T. S., Desai, A. R. (2024). Evaporation and transpiration from multiple proximal forests and wetlands. *Water Resources Research*, 60(1), e2022WR033757. <https://doi.org/10.1029/2022WR033757>
- Desai, A.R., **Murphy, B.A.**, Wiesner, S., Thom, J., Butterworth, B.J., Koupaei-Abyazani, N., Muttaqin, A., Paleri, S., Talib, A., Turner, J., Mineau, J., Merrelli, A., Stoy, P., Davis, K. (2022). Drivers of decadal carbon fluxes across temperate ecosystems. *Journal of Geophysical Research: Biogeosciences*, 127. <https://doi.org/10.1029/2022JG007014>
- **Murphy, B.A.**, May, J.A., Butterworth, B.J., Andresen, C.G., Desai, A.R. (2022). Unravelling forest complexity: resource use efficiency, disturbance, and the structure-function relationship. *Journal of Geophysical Research: Biogeosciences*. doi:<https://doi.org/10.1101/2021.04.28.441243>  
**\*Selected for an EOS Research Spotlight by the editorial board of the American Geophysical Union (<https://eos.org/research-spotlights/how-forest-structure-drives-productivity>), ranked within the top 10 percent of JGR: Biogeosciences downloads for 2022, and highlighted by the University of Wisconsin-Madison College of Letters and Sciences Magazine (<https://lsmagazine.wisc.edu/issues/fall-2022/can-wisconsins-forests-be-managed-for-carbon/>)**
- Fer, I., Shiklomanov, A., Novick, K.A., Gough, C.M., Altaf Arain, M., Chen, J., **Murphy, B.A.**, Desai, A.R., Dietze M.C. (2021). Capturing site-to-site variability through Hierarchical Bayesian calibration of a process-based dynamic vegetation model. *bioRxiv*. 2021.04.28.441243; doi:<https://doi.org/10.1101/2021.04.28.441243> (pre-print)

### In Review, Revision, or Preparation

\*updated June 2024

- Fitzpatrick, L., **Murphy, B.A.**, Dietze, M. C., Desai, A.R., Rollinson, C.R. Management Legacies Interact with Forest Structure to Influence Biomass Responses to Increases in Atmospheric Water Vapor Deficit. *Ecological Applications* (in revision)
- **Murphy, B.A.**, Rollinson, C.R., Dietze, M.C., Staudhammer, C.L., vonHedemann, N.R., Schultz, C.A., Kleindl, W.J., Desai, A.R. Insights for Nature-Based Climate Solutions: managing forests for climate resilience and carbon stability. *Global Change Biology* (in review)
- **Murphy, B.A.**, Rollinson, C.R., Dietze, M.C., Stoy, P.C., Staudhammer, C.L., vonHedemann, N.R., Kleindl, W.J., Schultz, C.A., Desai, A.R. Management versus climate change as drivers of multi-decadal variability in forest function across two US regions. (in preparation for *Journal of Geophysical Research: Biogeosciences*)
- Karimi, H., Binford, M., Kleindl, W.J., Starr, G., **Murphy, B.A.**, Desai, A.R., Fu, C., Dietze, M.C., Staudhammer, C.L. Drivers of forest productivity in two regions of the United States: relative impacts of management and environmental variables. (in preparation for *Science of the Total Environment*)
- **Murphy, B.A.**, Sulman, B.N., Yuan, F., Salmon, V.G., Kumar, J., Yang, D., Dengel, S., Torn, M.S., Herndon, E., Fettrow, S., Iverson, C.M. Incorporation of Diverse Arctic Vegetation Types in a Land Surface Model Improves Representation of Spatial Variability in Carbon Dynamics Across a Tundra Landscape. (in preparation for *Journal of Geophysical Research: Biogeosciences*)

### Other Publications

\*updated June 2024

- Phillips, C.L., Trippe, K., Kwon, H., **Murphy, B.A.**, Moore, W., Hanson, C.V., Law, B., Schmidt, A. (2021). Annual carbon balance of a second-year tall fescue seed crop. Seed Production Research Report. Oregon State University and the United States Department of Agriculture - Agricultural Research Service. Corvallis, Oregon.
- Wisconsin Academy of Arts, Science and Letters (2020). Natural climate solutions for Wisconsin: critical considerations and strategies. Madison, WI.

## Presentations

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#### 2024

- Ground Truthing Land Surface Models: A Multi-Data Approach for Validation. Oak Ridge Postdoctoral Association Annual Research Symposium (poster). Oak Ridge, TN. Jul. 2024
- Incorporation of Diverse Arctic Vegetation Types in a Land Surface Model Improves Representation of Spatial Variability in Carbon Dynamics Across a Tundra Landscape. Department of Energy Earth Systems Science PI Meeting (poster). Reston, VA. Apr. 2024
- The future of US forest function under changing environment, disturbance, and forest management. NSF Macrosystems Biology Community Meeting (talk). Virtual. Feb. 2024
- Forest Management as a Nature-based Climate Solution. NSF Macrosystems Biology Community Meeting (poster). Virtual. Feb. 2024

#### 2023

- Forest management as a Nature-based Climate Solution: Impacts on forest structure, functional stability, and regional interactions with climate change. American Geophysical Union Conference (talk). San Francisco, CA. Dec. 2023
- A Macrosystems Approach Towards Improved Understanding of Interactions Between Forest Management, Structure, Function and Climate Change, and Implications for the Terrestrial Carbon Cycle (Ph.D. defense). Madison, WI. Aug. 2023
- From the soil to the atmosphere (and everything in between): a multi-scale approach to understanding the dynamic response of terrestrial ecosystems to a changing climate. Oak Ridge National Laboratory (talk). Mar. 2023
- Advancing scale-aware predictive understanding of management impacts on forest function, and development of an integrated framework for representation in earth system models. Pacific Northwest National Laboratory, Linus Pauling Distinguished Postdoctoral Fellowship presentation (talk). Jan. 2023

#### 2022

- Management legacies interactions with forest structure influence forest biomass responses to climatic increases in atmospheric water vapor demand. American Geophysical Union Conference (poster). Chicago, IL. Dec. 2022
- Does management reinforce or mitigate climate change driven shifts in forest function? American Geophysical Union Conference (talk). Chicago, IL. Dec. 2022
- Global change in the upper Midwest: Drivers of decadal carbon fluxes across temperate ecosystems. Ameriflux Annual Meeting (talk). Pellston, MI. Sept. 2022
- A crash course in networking, Atmospheric and Oceanic Sciences Undergraduate Mentorship Program. University of Wisconsin-Madison (workshop). Madison, WI. Apr. 2022
- Unraveling forest complexity: Resource use efficiency, disturbance, and the elusive structure-function relationship. 11th annual Atmospheric, Oceanic, and Space Sciences Community Poster Reception (poster). Madison, WI. Feb. 2022

#### 2021

- Exploring natural climate solutions: could flux towers be useful at industrial scales? American Geophysical Union Conference (poster). New Orleans, LA. Dec. 2021
- Unraveling forest complexity: Resource use efficiency, disturbance, and the elusive structure-function relationship. American Geophysical Union Conference (poster). New Orleans, LA. Dec. 2021
- Undergraduate resume and CV workshop, Atmospheric and Oceanic Sciences Mentorship Program. University of Wisconsin-Madison (workshop) Oct. 2021
- Unraveling forest complexity and the elusive structure-function relationship. RUBISCO-Ameriflux Lecture Series (talk) Sept. 2021
- From half hour to quarter century: Drivers of carbon fluxes across a northern ecosystem tower cluster. Ameriflux Annual Meeting (poster) Sept. 2021

#### 2020

- The devil is in the details: emulation-based data assimilation to constrain a dynamic ecosystem model. American Geophysical Union Conference (poster) Dec. 2020
- The devil is in the details: emulation-based data assimilation to constrain a dynamic ecosystem model. Graduate Climate Conference (poster) Oct. 2020
- The devil is in the details: emulation-based data assimilation to constrain a dynamic ecosystem model. University of Wisconsin-Madison (master's defense). Madison, WI. Jul. 2020
- Introducing the Atmospheric and Oceanic Sciences Undergraduate Mentoring Program. University of Wisconsin-Madison (talk). Madison, WI. Feb. 2020
- Applying for Grants and Fellowships. University of Wisconsin-Madison (workshop). Madison, WI. Feb. 2020
- Assessing management impacts and representation of ecosystem heterogeneity in Northern Wisconsin forests: modeling for better stewardship. University of Wisconsin-Madison Climate Change Symposium (poster). Madison, WI. Feb. 2020

#### 2019

- Assessing management impacts and representation of ecosystem heterogeneity in Northern Wisconsin forests: modeling for better stewardship. American Geophysical Union Conference (poster). San Francisco, CA. Dec. 2019
- Impact of forest management and disturbance regimes on carbon and water cycling. RUBISCO-Ameriflux Workshop (talk). Berkeley, CA. Oct. 2019
- Forecasting for Better Stewardship. Community Terrestrial Systems Model (CTSM) Workshop, National Center for Atmospheric Research (poster). Boulder, CO. Feb. 2019

#### 2018

- Stratospheric ozone and the ozone hole (guest lecture), Global Change - Atmospheric Issues, University of Wisconsin-Madison. Madison, WI. Fall 2018

#### 2015

- Soil Respiration Flux in Response to Soil Temperature, Moisture, and pH. Celebrating Undergraduate Excellence Research Symposium (poster), Oregon State University. Corvallis, OR. May 2015. **\*Won award for best poster**

## Workshops and Professional Development \_\_\_\_\_

- Summer Policy Colloquium. American Meteorological Society—June-Aug. 2021
- Unlearning Racism in Geosciences (URGE). University of Wisconsin-Madison—Feb.-May 2021
- New Advances in Land Carbon Cycle Modeling Workshop. Northern Arizona University—July 2020
- Reducing Uncertainties in Biogeochemical Interactions through Synthesis and Computation (RUBISCO) Workshop. Berkeley, CA—Oct. 2019
- TERENO/NEON Carbon Users Workshop. Duren, Germany—July 2019
- Community Terrestrial Systems Model (CTSM) Workshop. National Center for Atmospheric Research, Boulder, CO—Feb. 2019
- Teaching in Science and Engineering. University of Wisconsin-Madison—Sept.-Dec. 2018

## Honors and Awards

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### FUNDING AWARDS

- Department of Atmospheric and Oceanic Sciences travel award for travel to the American Geophysical Union conference, University of Wisconsin-Madison (\$1,000)—Dec. 2022
- Secured continued financial support for the Department of Atmospheric and Oceanic Sciences undergraduate mentorship program (\$350/yr)—Nov. 2022
- Department of Atmospheric and Oceanic Sciences travel award for travel to the American Geophysical Union conference, University of Wisconsin-Madison (\$965)—Dec. 2021
- American Meteorological Society Summer Policy Colloquium Support, National Science Foundation (\$5,300)—Apr. 2021
- Department of Atmospheric and Oceanic Sciences travel award for travel to the American Geophysical Union conference, University of Wisconsin-Madison (\$1,000)—Oct. 2019
- Department of Atmospheric and Oceanic Sciences travel award for travel to the National Center for Atmospheric Research, University of Wisconsin-Madison (\$570)—Jan. 2019
- Outstanding Civic Engagement Scholarship, Oregon State University (\$1,000)—2014

### HONORS

- Department Student Service Award. Atmospheric and Oceanic Sciences, University of Wisconsin-Madison. —Apr. 2022
- Best poster, Celebrating Undergraduate Excellence Research Symposium, Oregon State University —May 2015
- Graduation honors, undergraduate research fellow, Oregon State University —2015

## Service and Outreach

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### SERVICE TO THE SCIENTIFIC COMMUNITY

- Reviewer: Earth's Future, Biogeosciences
- Early Career Editorial Fellow, Journal of Geophysical Research: Biogeosciences editorial board—2024-2026
- Session convener: advances in land carbon cycle modeling, American Geophysical Union annual conference. Washington D.C.—Dec. 2024
- Seminar organizer, FLUXNET Early Career Network—2024
- Session convener: advances in land carbon cycle modeling, American Geophysical Union annual conference. San Francisco, CA—Dec. 2023
- Judge, NASA GLOBE Midwest Earth System Science Symposium—May 2021
- Leadership Team, 500 Women Scientists, Madison Pod. Madison, WI—2019-2021
- Forestry working group, Natural Climate Solutions for Wisconsin. Wisconsin Academy. Madison, WI—2020
- Volunteer, Fourth National Adaptation Forum. Madison, WI—Apr. 2019

### UNIVERSITY SERVICE

- Treasurer, Atmospheric and Oceanic Sciences Graduate Student Association. University of Wisconsin-Madison—2022
- Organizer, Atmospheric and Oceanic Sciences Faculty Flash Talks. University of Wisconsin-Madison—Mar. 2022
- Member, Atmospheric and Oceanic Sciences Colloquium Committee. University of Wisconsin-Madison—2021-2023
- Faculty Liaison, Atmospheric and Oceanic Sciences Graduate Student Association. University of Wisconsin-Madison—2021
- Member, Teaching Assistants' Association. University of Wisconsin-Madison—2019-2023
- Member, Atmospheric and Oceanic Sciences Graduate Student Association. University of Wisconsin-Madison—2018-2023
- Facilitator, Atmospheric and Oceanic Sciences Graduate Student Association. University of Wisconsin-Madison—2020-2021
- Founding Member, Atmospheric and Oceanic Sciences Undergraduate Mentorship Program. University of Wisconsin-Madison—2019-2023
- Seminar Committee Chair, Atmospheric and Oceanic Sciences Graduate Student Association. University of Wisconsin-Madison—2019-2020
- Member, Graduate Women in Science. Madison Chapter—2018-2020
- Senior Staff Mentor, Student Sustainability Initiative. Oregon State University—2015
- Renewable Energy Projects Coordinator, Student Sustainability Initiative. Oregon State University—2013-2015
- Renewable Energy Projects Intern, Student Sustainability Initiative. Oregon State University—2012
- Member and Student Liaison, Environmental Sciences Club. Oregon State University—2015

### COMMUNITY OUTREACH

- Panelist, Reaching a New Energy Sciences Workforce (RENEW) program student visit, Oak Ridge National Laboratory —June 2024
- Collaboration with the Learning Partnership (Chicago, IL) on a vegetation model based learning unit series about forest management and climate change —2022-2023
- Research Narrator, Seldom's production of FLOE: Dance theater work about climate instability. Madison, WI—Jan. 2019
- Member and Student Liaison, Energy Action Team. Corvallis Sustainability Coalition. Corvallis, OR—2013-2015
- Community Outreach and Education Intern, Avery House Nature Center. Corvallis, OR—2013

#### PROFESSIONAL MEMBERSHIPS

- American Geophysical Union, 2019-Present
- American Meteorology Society, 2021-2022
- Ecological Society of America, 2019-2021

## Teaching and Mentoring

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#### TEACHING ASSISTANT

- AOS 171: Global Change - Atmospheric Issues. University of Wisconsin-Madison, Fall 2018 and Fall 2020
- BIO 151: Concepts in cellular and molecular biology, genetics and mammalian anatomy and physiology (taught 3 discussion sections/wk). University of Wisconsin-Madison, Fall 2019

#### LEAD INSTRUCTOR

- English, GrapeTree English Academy. Seoul, South Korea. Feb. 2016-March 2017

#### MENTORING

- Mentor, Atmospheric and Oceanic Sciences Undergraduate Mentorship Program. University of Wisconsin-Madison—2020-2023
- Research Mentor Training Program. University of Wisconsin-Madison—2020
- Founding Member, Atmospheric and Oceanic Sciences Undergraduate Mentorship Program. University of Wisconsin-Madison—2019-2020
- *Mentored Undergraduates*: Connor Steinke, Ilana Greenspan, Jacob Coulombe, Calvin Luo