

## Justin M. Mathias

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### Professional Appointments

- 2021-*pres.* Postdoctoral Fellow, Department of Forest, Rangeland, and Fire Sciences, University of Idaho, Moscow, Idaho
- 2020-2021 Postdoctoral Scholar, Department of Geography, University of California Santa Barbara, Santa Barbara, California

### Education

- 2020 Ph.D., Biology, West Virginia University, Morgantown, WV
- 2013 Bachelors of Science in Biology, West Virginia University, Morgantown, WV

### Publications

#### *Accepted*

- 2022 Bryant, K.N., J. Stenzel, **J.M. Mathias**, H. Kwon, C. Kolden, L. Lynch, and T.W. Hudiburg. Boosts in leaf-level photosynthetic capacity aid *Pinus ponderosa* recovery from wildfire. *Environmental Research Letters*. DOI: 10.1088/1748-9326/ac9cf2.
- 2022 **Mathias, J.M.** and T.W. Hudiburg. isocalcR: An R package to streamline and standardize stable isotope calculations in ecological research. *Global Change Biology*. DOI: 10.1111/gcb.16407.
- 2022 **Mathias, J.M.** and A.T. Trugman. Climate change impacts plant carbon balance, increasing mean future carbon use efficiency but decreasing forest extent at dry range edges. *Ecology Letters*. DOI: 10.1111/ele.13945.
- 2021 **Mathias, J.M.** and R.B. Thomas. Global tree intrinsic water use efficiency is enhanced by increased atmospheric CO<sub>2</sub> and modulated by climate and plant functional types. *Proceedings of the National Academy of Sciences*. DOI: 10.1073/pnas.2014286118.
- 2018 **Mathias, J.M.** and R.B. Thomas. Disentangling the effects of acidic air pollution, atmospheric CO<sub>2</sub>, and climate change on recent growth of red spruce trees in the Central Appalachian Mountains. *Global Change Biology*. DOI: 10.1111/gcb.14273.
- 2016 Smith, K.R., **J.M. Mathias**, B.E. McNeil, W.T. Peterjohn, and R.B. Thomas. Site level importance of broadleaf deciduous trees outweighs the legacy of high nitrogen (N) deposition on ecosystem N status of Central Appalachian red spruce forests. *Plant and Soil*. DOI: 10.1007/s11104-016-2940-z.

*Submitted*

**Mathias, J.M.**, K.R. Smith, K.E. Lantz, K.T. Allen, M.J. Wright, A. Sabet, K. Anderson-Teixeira, and R.B. Thomas. Differential isotope-inferred leaf gas exchange strategies explain responses of *Quercus rubra* and *Liriodendron tulipifera* intrinsic water use efficiency to air pollution and climate change. *In revision at Global Change Biology*.

*In preparation*

Hudiburg, T.W., **J.M. Mathias**, K.N. Bryant, D. Berardi, L. Lynch, E. Graham, K. Bartowitz, C. Kolden, and R. Betts. Forest and peatland carbon dynamics in an era of increasing wildfire. *Editor invited and approved review in preparation for Nature Climate Change*.

**Research Grants**

*Pending*

- 2022      **Co-PI: Mathias, J.M.** NSF Long Term Research in Environmental Biology. *LTREB: Collaborative Research: Quantifying the recovery of central Appalachian forests during the final chapter of society's inadvertent nitrogen fertilization experiment*. PI: E.R. Brzostek (West Virginia University), Co-PI: E. Morrissey (West Virginia University). (\$599,843 requested).
- 2022      **PI: Mathias, J.M.** NSF Macrosystems Biology and NEON-Enabled Science. *MRA: Wildfire smoke impacts on local to regional forest carbon trajectories*. Co-PI: T.W. Hudiburg (University of Idaho). (\$616,516 requested).
- 2022      **PI: Mathias, J.M.** USDA NIFA AFRI Postdoctoral Fellowship. *Resolving the impact of wildfire smoke on forest carbon cycling*. (\$225,000 requested).
- 2022      **Co-PI: Mathias, J.M.** NSF Division of Environmental Biology Ecosystem Science. *Collaborative research: Microbe-to-biome response of temperate conifer forests to increasing fire and drought*. PI: T.W. Hudiburg (University of Idaho), Co-PIs: L. Lynch (University of Idaho), K. Bryant (University of Idaho), Kristopher Waynant (University of Idaho). (\$1,261,937 requested).

*Awarded*

- 2017      **PI: Mathias, J.M.** Smithsonian Center for Tropical Forest Science – ForestGEO Grants Program. Using dendroisotopes to disentangle processes of forest recovery from decades of acid deposition. (\$13,140.14).

*Not Awarded*

- 2022      **PI: Mathias, J.M.** NSF Macrosystems Biology and NEON-Enabled Science. *MRA: Downstream direct effects of wildland fire smoke on forest ecosystem carbon cycling*. Co-PI: T.W. Hudiburg (University of Idaho). (\$471,275 requested).
- 2022      **Co-PI: Mathias, J.M.** DOE Biological and Environmental Research Environmental System Science. *Resilience of above- and belowground forest ecosystem processes to changing wildfire regimes*. PI: T.W. Hudiburg (University of Idaho), Co-PIs: L. Lynch (University of Idaho), J. Shuman (National Center for Atmospheric Research), E. Graham (Pacific Northwest National Laboratory). (\$1,000,000 requested).

## Software Development

- 2022 **Mathias, J.M.** isocalcR: Isotope calculations in R. R package version 0.1.0.  
<https://CRAN.Rproject.org/package=isocalcR>.

## Awards and Fellowships

### *Postdoctoral – Nationally Competitive*

- 2022 U.S. Carbon Program Leadership Award. (\$1000).

### *Postdoctoral – University wide*

- 2022 Institute for Health in the Human Ecosystem Research and Travel Award, University of Idaho. (\$1000).

### *Graduate – Internationally competitive*

- 2019 W.D. and S.M. Billings Award (for Contrasting trends in growth and intrinsic water use efficiency of four eastern U.S. tree species), Ecological Society of America, Physiological Ecology Section.
- 2019 European Geosciences Union Roland Schlich Early Career Scientist's Travel Support to attend the 2019 European Geosciences Union annual meeting in Vienna, Austria. (\$265).
- 2019 *Plants* journal travel award to attend the 2019 European Geosciences Union annual meeting in Vienna, Austria. (\$400).
- 2018 Elizabeth Sulzman Outstanding Publication Award (for Disentangling the effects of acidic air pollution, atmospheric CO<sub>2</sub>, and climate change on recent growth of red spruce trees in the Central Appalachian Mountains), Ecological Society of America, Biogeosciences Section.

### *Graduate – University wide*

- 2019 Eberly College of Arts and Sciences Doctoral Travel Award (\$1000).
- 2019 West Virginia University Professor Charles H. Baer Graduate Scholarship (\$2,250).
- 2019 West Virginia University BGSA Productivity Award (\$1,000).
- 2018 David Blaydes Biology Dissertation Scholarship (\$1,133).
- 2018 Eberly College of Arts and Sciences Doctoral Travel Award (\$800).
- 2018 West Virginia University Earl L. Core Memorial Scholarship (\$2,000).
- 2018 West Virginia University BGSA Productivity Award (\$1,000).
- 2017 Eberly College of Arts and Sciences Doctoral Travel Award (\$900).
- 2015 Eberly College of Arts and Sciences Doctoral Travel Award (\$700).
- 2014 Eberly College of Arts and Sciences Doctoral Research Award (\$700).
- 2013-2016 Ruby Distinguished Doctoral Fellowship (\$96,000 across 3 years).

## Invited Presentations

- 2023 **Mathias, J.M.** Differential isotope-inferred leaf gas exchange strategies explain responses of *Quercus rubra* and *Liriodendron tulipifera* intrinsic water use efficiency to air pollution and climate change. Smithsonian's National Zoo and

Conservation Biology Institute & Smithsonian Tropical Research Institute,  
Front Royal, VA.

- 2022 **Mathias, J.M.** Historical responses and future trajectories of forest function under climate change. University of Idaho, Moscow, ID.
- 2022 Hudiburg, T.W\*. and **Mathias, J.M.\***. Preliminary results from an on-field trial supporting climate smart agriculture on tribal lands in Weippe, Idaho. Northwest Intertribal Agricultural Council, Tamastslitk Cultural Institute, Pendleton, OR. *\*Indicates co-presentation.*
- 2022 **Mathias, J.M.** Forests in an era of global change: linking tree physiological processes to the environment through the 21<sup>st</sup> century. University of Kentucky, Lexington, KY.
- 2021 **Mathias, J.M.** Forests in an era of global change: linking tree physiological processes to the environment through the 21<sup>st</sup> century. West Virginia University, Morgantown, WV.
- 2021 **Mathias, J.M.** and R.B. Thomas. Tree intrinsic water use efficiency during the twentieth century: from global trends to local drivers. Dendrochronology Intensive Summer Course, University of Arizona.
- 2021 **Mathias, J.M.** and R.B. Thomas. Tree growth and water use efficiency during the twentieth century: from global trends to local drivers. University of Maryland Center for Environmental Science, Appalachian Laboratory.
- 2018 **Mathias, J.M.** and R.B. Thomas. Using a multi-proxy tree ring approach to examine the effects of environmental change on eastern U.S. forests. United States Forest Service Forest Air Resource Management team.
- 2018 **Mathias, J.M.** and R.B. Thomas. Red spruce recovery in the Central Appalachian Mountains. At: Central Appalachian Spruce Restoration Initiative's Partnerships for Connectivity Conference. Canaan Valley Resort and Conference Center, Canaan, WV.
- 2018 **Mathias, J.M.** and R.B. Thomas. Using a multi-proxy approach to explore recent growth increases in red spruce trees in the Central Appalachian Mountains. At: Dynamics of Forest Growth and Resource Use Symposium. University of Virginia, Charlottesville, Virginia.
- 2015 **Mathias, J.M.** and R.B. Thomas. Widespread forest recovery across the central Appalachian Mountains (U.S.) following reductions in pollutant emissions. Chinese Academy of Forestry, Beijing, China.

### Contributed Presentations

- 2022 **Mathias, J.M.**, K.R. Smith, K.E. Lantz, K.T. Allen, M. Wright, A. Sabet, K. Anderson-Teixeira, R.B. Thomas. Air pollution exerts stronger controls than climate on intrinsic water use efficiency in two broadleaf deciduous tree species in the eastern U.S. Ecological Society of America Annual Meeting. Montreal, Canada.
- 2021 **Mathias, J.M.**, K. Bartowitz, L. Hicke, N. Srodes, and T.W. Hudiburg. Integration of multiple data streams reveals the impact of environmental change on

- northern Rocky Mountain forests. American Geophysical Union Annual Meeting. New Orleans, LA.
- 2021 **Mathias, J.M.** and A.T. Trugman. Climate change impacts plant carbon balance, increasing mean future carbon use efficiency but decreasing total forest extent at dry range edges. Ecological Society of America Annual Meeting. Long Beach, CA.
- 2020 **Mathias, J.M.** and R.B. Thomas. A global meta-analysis of historical changes in intrinsic water use efficiency of trees using the dual isotope method. Ecological Society of America Annual Meeting. Salt Lake City, UT.
- 2019 **Mathias, J.M.**, K.R. Smith, and R.B. Thomas. Contrasting trends in growth and intrinsic water use efficiency of four eastern U.S. tree species. Ecological Society of America Annual Meeting. Louisville, KY.
- 2019 **Mathias, J.M.** and R.B. Thomas. Using a multiproxy tree ring approach to examine the effects of environmental change on eastern U.S. forests. European Geosciences Union Annual Meeting. Vienna, Austria.
- 2018 **Mathias, J.M.** and R.B. Thomas. Using a multiproxy tree ring approach to examine the effects of environmental change on eastern U.S. forests. American Geophysical Union Annual Meeting. Washington D.C.
- 2018 **Mathias, J.M.** and R.B. Thomas. Using multiple proxies of ecosystem function to assess long-term growth and physiology of two deciduous tree species in the Fernow Experimental Forest, WV. Ecological Society of America Annual Meeting. New Orleans, LA.
- 2018 Thomas, R.B. and **J.M. Mathias**. Tracing historical stomatal conductance using stable isotopes. At: Dynamics of Forest Growth and Resource Use Symposium. Charlottesville, VA.
- 2017 **Mathias, J.M.** and R.B. Thomas. Stable nitrogen isotopes in tree rings are an integrator of historical changes in nitrogen cycling dynamics in red spruce (*Picea rubens* Sarg.) forests in West Virginia. Ecological Society of America Annual Meeting. Portland, OR.
- 2017 Thomas, R.B. and **J.M. Mathias**. Disentangling the complexity behind red spruce forest ecosystem recovery from acid deposition. At: High Elevation Forest Restoration Workshop and CASRI/SASRI Meeting. Gatlinburg, TN.
- 2017 Lantz, K.E., **J.M. Mathias**, and R.B. Thomas. Exploring tree growth during the Anthropocene: the Fernow Experimental Forest as a case study. WVU 1<sup>st</sup> Annual Undergraduate Spring Symposium.
- 2015 **Mathias, J.M.**, L.A. Scholtz, B.T. Russell, and R.B. Thomas. Using tree rings of red spruce in the Central Appalachian Mountains to explore growth trends before and after the Clean Air Act. Ecological Society of America Annual Meeting. Baltimore, MD.
- 2015 Smith, K.R., **J.M. Mathias**, and R.B. Thomas. Hardwood abundance outweighs the impact of N deposition on soil N status in red spruce forests

in Central Appalachia. Society of American Foresters National Convention. Baton Rouge, LA.

- 2015 Thomas, R.B. and **J.M. Mathias**. Widespread forest recovery across the central Appalachian Mountains (U.S.) following reductions in pollutant emissions. International Acid Rain Conference, October 19-23, 2015 in Rochester, NY.
- 2015 Thomas, R.B. and **J.M. Mathias**. A new story from old trees: possible causes of a recent anomaly in tree growth in the Central Appalachian Mountains (USA). Forest Ecosystem Services for Biodiversity and the Bioeconomy. September 14-20, 2015 in Beijing, China.
- 2014 Smith, K.R., **J.M. Mathias**, B. Hedin, W.T. Peterjohn, and R.B. Thomas. Interannual variability of soil respiration is linked to soil N availability in high-elevation red spruce (*Picea rubens*) forests in Central Appalachia. Ecological Society of America Annual Meeting. Sacramento, CA.
- 2013 Walton, D.R., P.M. Crim, L.A. Scholtz, **J.M. Mathias**, K.R. Smith and R.B. Thomas. Historical trends in stomatal function using herbarium specimens. Summer Undergraduate Research Symposium 2013. Morgantown, WV.
- 2013 **Mathias, J.M.**, K.R. Smith, B. McNeil, W.T. Peterjohn, and R.B. Thomas. Do increased N inputs influence rates of soil N cycling in high-elevation red spruce forests along a gradient of atmospheric deposition? Ecological Society of America Annual Meeting. Minneapolis, MN.
- 2013 Smith, K.R., **J.M. Mathias**, B. McNeil, W.T. Peterjohn, and R.B. Thomas. Who is behind the wheel? The drivers of soil N availability in high-elevation red spruce (*Picea rubens* Sarg.) forests along a gradient of atmospheric deposition. Ecological Society of America Annual Meeting. Minneapolis, MN.

## Teaching

### *Instructor of record*

- 2022 FOR 501, Integrated Forest Processes, UI. \**Co-instructor of record*.
- 2022 ENVS 497, Senior Experience, UI.
- 2016 BIOL 105, Environmental Biology, WVU.

### *Guest lectures and teaching coursework*

- 2020 BIOL 327, WVU, Professional Development: How to ensure success as a graduate student.
- 2018 BIOL 191, WVU, First-Year Seminar: Identifying a path towards graduate school.
- 2018 BIOL 493A, WVU, Plant-Microbial Interactions: Red spruce forest responses to environmental change.
- 2017 BIOL 327, Professional Development, WVU: How to ensure success as a graduate student.
- 2017 BIOL 493B, Ecosystem Modeling, WVU: Scaling photosynthesis from the leaf to

the globe.

- 2015 BIOL 593N, Advanced Plant Physiology, WVU: Nutrients and plants: sources and sinks.
- 2014 BIOL 693I, Methods in Environmental Physiology, WVU: Sap flux methods for estimating transpiration.

*Teaching assistant*

- 2019 BIOL 106, Environmental Biology Laboratory, WVU.
- 2019 BIOL 298C, Honors Introductory Biology, WVU.
- 2018 BIOL 298E, Honors Introductory Biology, WVU.
- 2017 BIOL 298D, Honors Introductory Biology, WVU.
- 2017 BIOL 106, Environmental Biology Laboratory, WVU.
- 2016 BIOL 298D, Honors Introductory Biology, WVU.
- 2015 BIOL 298D, Honors Introductory Biology, WVU.

**Activities and Service**

*Service to the Profession*

- 2022-pres. Registered professional mentor available as part of the National Research Mentoring Network.
- 2022 Topic co-editor for the journal *Frontiers in Forests and Global Change. Understanding Forest Ecosystems: The Use of Stable Isotopes and Physiological Measurements.*
- 2022 Invited ad-hoc reviewer for the National Science Foundation Division of Earth Sciences Postdoctoral Fellowship.
- 2021 Invited panelist providing expertise in climate science and literacy for Exploring Innovation in Appalachia: an undergraduate research symposium. West Virginia University, Morgantown, West Virginia.
- 2019 Co-convended “B118 – Examining Transpiration and Photosynthesis from Ecosystem to Global Scales: Observations, Linkages, and Drivers” at the American Geophysical Union annual meeting, San Francisco, California.
- 2019 Judge for the Gene E. Likens award, Biogeosciences section of Ecological Society of America.
- 2017-pres. Reviewed manuscripts for *Agricultural and Forest Meteorology, Botany, Biogeochemistry, Ecology and Evolution, Ecosystems, Environmental Pollution, Geophysical Research, Global Change Biology, Letters, JGR-Biogeosciences, Nature, Nature Communications, Nature Communications Earth and Environment, New Phytologist, PLoS, and Restoration Ecology.*

*Service to the University*

- 2018 Peer mentor for the WVU Biology Graduate Student Association’s Peer Mentoring Program.

- 2015 Social coordinator for the WVU Biology Graduate Student Association.
- 2014-2015 Biology graduate student representative for the WVU Graduate Student Advisory Committee.
- 2014 Biology graduate student representative for the WVU Board of Governors visit to the Biology Department.

*Service to the Public and Outreach*

- 2020 Foothill Elementary School Geography Awareness Week outreach, University of California, Santa Barbara: a brief introduction to a changing world—climate change from Santa Barbara to the globe
- 2018 Osher Lifelong Learning Institute at WVU guest lecture: forest ecosystems, learning from the past.
- 2018 Eastwood Elementary Citizen Science Day: linking ecosystem processes and highlighting Appalachian forest services.
- 2017 Aided in the distribution of a donation of ~\$12,000 in supplies and used scientific equipment to Richwood High School in Nicholas County, WV, which was severely flooded and closed.
- 2016 Participated in planting of ~10,000 red spruce trees at the Canaan Valley Wildlife Refuge in Davis, WV.
- 2015 Osher Lifelong Learning Institute at WVU guest lecture: learning from the past to predict the future: how air pollution and climate interactively affect forest ecosystems.

**Diversity, Equity, Inclusion, and Justice**

- 2020 Attended and actively participated in a workshop led by the LGBTQ+ center at West Virginia University that provided the toolkit and knowledge to serve as a better ally to the LGBTQ+ community.

**Professional memberships**

- 2018-pres. European Geosciences Union
- 2018-pres. American Geophysical Union
- 2012-pres. Ecological Society of America

**Undergraduates Mentored**

- 2021 Evan Blodgett – B.S. candidate at the University of Idaho.
- 2019 Whitney Johnson – B.S. candidate at West Virginia University.
- 2019 Dylan Sunzeri – B.S. in Biology, West Virginia University. Employed at Alliance Pharma.
- 2019 Lauren Borho – B.S. candidate at West Virginia University.
- 2018 Keanan Allen – B.S. candidate at West Virginia University. Ph.D. Student at Cornell University.
- 2018 Marvin Wright – B.S. in Biology, West Virginia University. M.S. candidate at West



Virginia University.

- 2018 Afsoon Sabet – B.S. in Biology, West Virginia University. Research assistant at Mississippi State University.
- 2017 Kristin Lantz – B.S. in Biology, West Virginia University. Research assistant at Montana State University.
- 2016 Benjamin Russell – B.S. in Biology, West Virginia University. Attending medical school at Joan C. Edwards School of Medicine, Marshall University.
- 2016 Adam Christian – B.S. in Biology, West Virginia University. Attending medical School at Joan C. Edwards School of Medicine, Marshall University.
- 2015 Stacy Simon – B.S. in Biology, West Virginia University. M.S. in Biotechnology, Northeastern University. Employed at AstraZeneca Pharmaceuticals.

**Selected Media Coverage**

- 2021 Study finds trees growing taller due to climate change for Virginia Public Radio. February 26, 2021.
- 2021 New WVU biology study of trees has implications for future climate change predictions in Charleston Gazette-Mail. February 14, 2021.
- 2021 WVU biologists uncover forests' unexpected role in climate change in WVU Today. February 8, 2021.
- 2019 Red spruce sprout atop coal mines that helped kill them in E&E News. April 3, 2019.
- 2018 Red spruce forest research highlighted in the WVU Eberly College of Arts and Sciences Fall 2018 Magazine.
- 2018 WVU researchers studying forests' past and future in WVNews. June 1, 2018.
- 2018 WVU biology student links Clean Air Act to red spruce recovery in Appalachia. May 22, 2018.
- 2018 Red spruce forest research highlighted online in WVU Magazine Viewfinder. Summer, 2018.
- 2018 How red spruce trees tell the story of forest recovery. National Science Foundation. May 25, 2018.
- 2017 WVU biology students investigate the impact of climate change on Appalachian forests. Katlin Swisher, Interim Director, Communications and Marketing, WVU, September 20, 2017.
- 2015 Increase in red spruce growth tied to the Clean Air Act. Jeff Atkins, PLOS Ecology Field Reports. Jeff Atkins, PLOS Ecology Field Reports, August 11, 2015.