

# Mike Mahoney

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## Education

### State University of New York College of Environmental Science and Forestry (SUNY-ESF)

DOCTOR OF PHILOSOPHY IN ENVIRONMENTAL SCIENCE (AREA OF STUDY: COUPLED NATURAL AND HUMAN SYSTEMS)

Syracuse, New York

August 2020 - Present

## Publications

### PREPRINTS AND IN REVIEW

- 2024 Johnson, L. K., **Mahoney, M. J.**, Domke, G. M., and Beier, C. M. 2022. New allometric models for the USA create a step-change in forest carbon estimation, modeling, and mapping In Review at Remote Sensing of Environment. <https://doi.org/10.48550/arXiv.2405.04507>
- 2023 **Mahoney, M. J.** In Review. waywiser: Ergonomic methods for assessing spatial models. In review at The Journal of Statistical Software. <https://doi.org/10.48550/arXiv.2303.11312>
- 2023 **Mahoney, M. J.**, Johnson, L. K., Silge, J., Frick, H., Kuhn, M., and Beier, C. M. In Review. Assessing the performance of spatial cross-validation approaches for models of spatially structured data. In review at Environmental Modelling & Software. <https://doi.org/10.48550/arXiv.2303.07334>

### PEER-REVIEWED PUBLICATIONS

#### Journal Articles

- 2023 Johnson, L. K., **Mahoney, M. J.**, Desrochers, M. L., and Beier, C. M. 2023. Mapping historical forest biomass for stock-change assessments at parcel to landscape scales Forest Ecology and Management, 546, 121348. <https://doi.org/10.1016/j.foreco.2023.121348>
- 2022 **Mahoney, M. J.**, Johnson, L. K., Guinan, A. Z., and Beier, C. M. 2022. Classification and mapping of low-statured 'shrubland' cover types in post-agricultural landscapes of the US Northeast. The International Journal of Remote Sensing, 43(19-24), 7117-7138. <https://doi.org/10.1080/01431161.2022.2155086>
- 2022 Johnson, L. K., **Mahoney, M. J.**, Bevilacqua, E., Stehman, S. V., Domke, G. M., and Beier, C. M. 2022. Fine-resolution landscape-scale biomass mapping using a spatiotemporal patchwork of LiDAR coverages The International Journal of Applied Earth Observation and Geoinformation, 114, 103059. <https://doi.org/10.1016/j.jag.2022.103059>
- 2022 **Mahoney, M. J.**, Johnson, L. K., Bevilacqua, E., and Beier, C. M. 2022. Ground noise filtering produces inferior models of forest aboveground biomass. GIScience and Remote Sensing, 59(1), 1266-1280. <https://doi.org/10.1080/15481603.2022.2103069>
- 2022 **Mahoney, M. J.**, Beier, C. M., and Ackerman, A. C. 2022. unifir: A Unifying API for Interacting with Unity from R. Journal of Open Source Software, 7(73), 4388. <https://doi.org/10.21105/joss.04388>
- 2022 Tamiminia, H., Salehi, B., Mahdianpari, M., Beier, C. M., Johnson, L. K., Phoenix, D. B., and **Mahoney, M. J.** 2022. Decision tree-based machine learning models for above-ground biomass estimation using multi-source remote sensing data and object-based image analysis. Geocarto International. <https://doi.org/10.1080/10106049.2022.2071475>
- 2022 **Mahoney, M. J.**, Beier, C. M., and Ackerman, A. C. 2022. terrainr: An R package for creating immersive virtual environments. Journal of Open Source Software, 7(69), 4060. <https://doi.org/10.21105/joss.04060>
- 2020 **Mahoney, M. J.** and Stella, J. C. 2020. Stem size selectivity is stronger than species preferences for beaver, a central place forager. Forest Ecology and Management, 475, 118331. <https://doi.org/10.1016/j.foreco.2020.118331>

## Book Chapters and Conference Proceeding Papers

- 2023 **Mahoney, M. J.**, Johnson, L. K., and Beier, C. M. 2023. AI for Shrubland Identification and Mapping. In: Artificial Intelligence in Earth Science: Best Practices and Fundamental Challenges. (Z. Sun, N. Cristea, P. Rivas, Eds). Elsevier, Amsterdam..
- 2021 **Mahoney, M. J.**, Beier, C. M., and Ackerman, A. C. 2021. Interactive landscape simulations for visual resource assessment. VRSC 2021 Conference Proceedings.

## Awards and Honors

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- 2023 AGU Outstanding Student Presentation Award
- 2023 AGU Student Travel Grant
- 2023 US Research Software Engineer Association Travel Award
- 2023 STAC Sprint Travel Award
- 2023 Outstanding PhD Scholar Award
- 2023 Excellence in Academic Research Award
- 2021 New York State GIS Association Application Award
- 2020 EarthCube AGU Scholarship
- 2018 Robin Hood Oak Award for Academic Excellence
- 2018 Robert M. Hicks Award for Academic Achievement
- 2018 ESF Career Fellowship
- 2017 Outstanding Student Award for Accomplishments in Field Ecology and Dendrology

## Fellowships

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2022-2023 Federation of Earth Science Information Partners (ESIP) Community Fellowship - Machine Learning Cluster

## Invited Talks

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- 2023 **Mahoney, M. J.** spatialsample: Infrastructure for spatial cross-validation EcoHealth Alliance, New York, NY (Virtual).
- 2023 **Mahoney, M. J.** waywiser: An ergonomic toolbox for assessing spatial models EcoHealth Alliance, New York, NY (Virtual).
- 2023 **Mahoney, M. J.** Making Sausage: How open source scientific software gets made – and what keeps us from making more Federation of Earth Science Information Partners (ESIP) Open Science Cluster (Virtual).
- 2023 **Mahoney, M. J.** Mapping shrublands across New York State: Targeted ML for informing management decisions Federation of Earth Science Information Partners (ESIP) July Meeting, Burlington, VT.
- 2023 **Mahoney, M. J.** Make Reproducibility Easy Federation of Earth Science Information Partners (ESIP) January Meeting, Annapolis, MD (Virtual).
- 2022 **Mahoney, M. J.** Building trust in AI outputs: Approaches from NY's forest carbon monitoring program. Federation of Earth Science Information Partners (ESIP) July Meeting, Pittsburgh, PA.
- 2022 **Mahoney, M. J.** Using AI/ML to help New York State manage lands for net zero carbon. Federation of Earth Science Information Partners (ESIP) January Meeting, Annapolis, MD (Virtual).
- 2021 **Mahoney, M. J.** terrainr: Spatial data access and visualization in R. Federation of Earth Science Information Partners (ESIP), Severna Park, MD (Virtual).
- 2021 Nell, C., **Mahoney, M. J.**, and Platt, L. Accessing the USGS National Map and making 3D maps with terrainr. USGS Center for Data Integration, Lakewood, CO (Virtual).
- 2021 **Mahoney, M. J.** terrainr: Landscape visualizations using data from The National Map. USGS National Geospatial Technical Operations Center, Denver, CO (Virtual).

## Conference Activity

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### SESSIONS ORGANIZED

- 2023 Rao, Y., Sun, Z., Stocks, K., **Mahoney, M. J.**, Redmon, R. FAIR for AI in Geoscience: From AI-Ready Data to Practical AI Models Session organized at the Federation of Earth Science Information Partners (ESIP) January Meeting, Annapolis, MD (Virtual).
- 2022 Sun, Z., Ma, M., Burgess, A., Nga, C., Newman, D., Rao, D., **Mahoney, M. J.**, Koren, G., and Kale, A. AI for All People: How to Make AI Useful for Earth Science Applications? Session organized at the Federation of Earth Science Information Partners (ESIP) July Meeting, Pittsburgh, PA.
- 2022 Sun, Z., Rao, Y., **Mahoney, M. J.**, Lin, C., and Burgess, A. Improving "FAIRness" and "Fairness" of AI/ML in Geoscience. Session organized at the Federation of Earth Science Information Partners (ESIP) January Meeting, Annapolis, MD (Virtual).

## WORKSHOPS FACILITATED

- 2021 **Mahoney, M. J.**, Beier, C. M., and Ackerman, A. C. Interactive 3D visualizations of environmental data using the terrainr R package. Workshop organized at the Visual Resources Stewardship Conference, Syracuse, NY (Virtual).

## CONTRIBUTED TALKS

- 2023 **Mahoney, M. J.** Ackerman, A. C., and Beier, C. M. Creating Data-Driven Interactive Virtual Environments for Communicating Forest Change. American Geophysical Union Fall Meeting, San Francisco, CA.
- 2023 **Mahoney, M. J.** Johnson, L. K., and Beier, C. M. Consistent Workflows for Assessing Model Performance: Tools and Applications to Natural Climate Solutions. American Geophysical Union Fall Meeting, San Francisco, CA.
- 2023 **Mahoney, M. J.** spatialsample: A tidy approach to spatial cross-validation. Greater Boston useR Group, Boston, MA.
- 2022 **Mahoney, M. J.** Beier, C. M., and Ackerman, A. C. Virtual Environments for Communicating Changing Forests. Forest Ecosystem Monitoring Collective Conference, Burlington, VT.
- 2022 Johnson, L. K., **Mahoney, M. J.**, and Beier, C. M. A Map-based Stock Change Approach for Fine-scale Biomass and Carbon Accounting in NYS.. Forest Ecosystem Monitoring Collective Conference, Burlington, VT.
- 2022 Johnson, L. K., **Mahoney, M. J.**, and Beier, C. M. Historical Time Series Biomass Modeling: To Train on Plots or Pixels?. American Geophysical Union Fall Meeting, Chicago, IL.
- 2022 **Mahoney, M. J.**, Johnson, L. K., and Beier, C. M. Detecting regenerating forestland at a landscape level. Ecological Society of America and Canadian Society for Ecology and Evolution Joint Annual Meeting, Montreal, Quebec, Canada.
- 2022 **Mahoney, M. J.**, Beier, C. M., and Ackerman, A. C. unifir: A Unifying API for Working with Unity in R. useR! 2022, Nashville, Tennessee (Virtual).
- 2022 **Mahoney, M. J.**, Johnson L. K., Bevilacqua E., and Beier C. M. Filtering ground noise from LiDAR returns produces inferior models of forest aboveground biomass. North American Forest Ecology Workshop, Sault Ste Marie, Ontario (Virtual).
- 2022 **Mahoney, M. J.** It's not what it looks like: learning to question assumptions when debugging ML models. Data Mishaps Night, Virtual.
- 2021 Johnson, L. K., **Mahoney, M. J.**, Bevilacqua, E., and Beier, C. M. Broad-scale forest biomass mapping: generating contiguous high-resolution predictions using a spatio-temporal patchwork of LiDAR coverages across a mixed-use landscape. American Geophysical Union Fall Meeting, New Orleans, LA.
- 2021 Johnson, L. K., Beier, C. M., and **Mahoney, M. J.** Greening Up Before Growing Up: Challenges in Modeling Forest Biomass Recovery Post-Harvest Using Satellite Imagery. Society of American Foresters National Convention, Virtual.
- 2021 **Mahoney, M. J.**, Beier, C. M., and Ackerman, A. C. Interactive 3D visualizations of environmental data using the terrainr R package. Paper presented at the Visual Resources Stewardship Conference, Syracuse, NY (Virtual).
- 2021 **Mahoney, M. J.**, Beier, C. M., and Ackerman, A. C. Virtual Environments: Using R as a Frontend for 3D Rendering of Digital Landscapes. useR! 2021, Zürich, Switzerland (Virtual).
- 2018 **Mahoney, M. J.** and Stella, J. C. Beaver Foraging Preferences and Impacts on Forest Structure in the Adirondack Mountains of New York. Forest Ecosystem Monitoring Collective Conference, Burlington, VT.
- 2018 **Mahoney, M. J.** and Stella, J. C. Beaver Foraging Preferences and Impacts on Forest Structure in the Adirondack Mountains of New York. Rochester Academy of Sciences Fall Scientific Paper Session, Geneseo, NY.

## POSTER PRESENTATIONS

- 2023 Johnson, L.K., **Mahoney, M. J.**, Domke, G., and Beier, C. M. Bridging the Gap Between Pixels and Minimum Estimation Units: Small-Area Uncertainty Estimation with Forest Aboveground Biomass Maps. American Geophysical Union Fall Meeting, San Francisco, CA.
- 2023 **Mahoney, M. J.** Assessing spatial models in scientifically sound ways is hard. New tools for the tidymodels modeling framework can help make it easier. Federation of Earth Science Information Partners (ESIP) July Meeting, Burlington, VT.
- 2022 Woodley, M. **Mahoney, M. J.**, Beier, C. M., and Tuttle, S. E. Spatiotemporal Dynamics of Snowpack in a Forested Watershed in the Adirondack Mountains, NY American Geophysical Union Fall Meeting, Chicago, IL.

## POSTER PRESENTATIONS (CONT.)

- 2021 **Mahoney, M. J.**, Johnson, L. K., Bevilacqua, E., and Beier, C. M. Filtering ground noise from LiDAR returns produces inferior models of forest aboveground biomass. American Geophysical Union Fall Meeting, New Orleans, LA.
- 2019 Dillon, G., **Mahoney, M. J.**, Chase, S., and Johnston, M. Nutritional Impacts on Invasive Beech Scale Quantification in Beech Bark Disease Aftermath Forests. New York Society of American Foresters Annual Meeting, Syracuse, NY.
- 2018 **Mahoney, M. J.**, Zevin, R., and Stella, J.C. Impacts of Beaver on Forest Structure and Composition. Spotlight on Student Research, Syracuse, NY.
- 2018 **Mahoney, M. J.**, Leimanis, V., Desrochers, M. L., Giambona, B., Johnston, M. T., Yanai, R. D., and Dillon, G. A. Impacts of Fertilization on Causal Organisms of Beech Bark Disease. Spotlight on Student Research, Syracuse, NY.
- 2017 Lasser, G. A., Johnston, M., **Mahoney, M.**, Leimanis, V., and Stoodley, J. An Investigation of Nutritional Effects on Beech Bark Disease Causal Organisms. Forest Ecosystem Monitoring Collective Conference, Burlington, VT.
- 2017 Lasser, G. A., Johnston, M., **Mahoney, M.**, Leimanis, V., and Stoodley, J. An Investigation of Nutritional Effects on Beech Bark Disease Causal Organisms. Poster session presented at the Rochester Academy of Sciences Fall Scientific Paper Session, Rochester, NY.

## Research Experience

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2020- **Climate And Applied Forest Research Institute (SUNY-ESF)**  
Present Research Assistant

## Teaching Experience

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### GRADUATE COURSES

**Machine Learning Concepts and Applications.** Instructor of Record. Fall 2021.

### WORKSHOPS FACILITATED

- 2023 **Foundations of Scientific Computing.** Mahoney, M. J., Johnson, L. K., and Desrochers, M. L. SUNY-ESF, Syracuse, NY.
- 2023 **Foundational Computing Skills: The Unix Shell, Version Control with Git, and Introduction to R.** Mahoney, M. J., and Johnson, L. K. SUNY-ESF, Syracuse, NY (Virtual).
- 2021 **Software Carpentry: The Unix Shell, Version Control with Git, and R for Reproducible Scientific Analysis.** Mahoney, M. J., and Devlin, M.D. SUNY-ESF, Syracuse, NY (Virtual).

## Service To Profession

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- 2024 - **Associate Editor** Journal of Open Source Software  
Present
- 2023 **Reviewer:** rOpenSci; PNAS Nexus
- 2022 **Reviewer:** Journal of Statistical Software; Journal of Open Source Software; 11th International Conference on Climate Informatics.
- 2022 - **Data Carpentry Geospatial Curriculum Advisory Committee.** Member.  
Present

## Non-Academic Experience

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- Permian Global Research Limited** Data Scientist (Consultant).  
Consultant (full-time equivalent) with Permian Global's research arm, working on tool development enabling teams to download spatial data, fit biomass and carbon models, predict large footprints, and assess results. Transformed multi-week modeling workflows into hours-long processes. Assisted with field sample design and model architecture reviews.
- RStudio PBC.** Open Source Engineering Intern.  
Intern with RStudio's tidymodels team, working on the R packages 'spatialsample' for spatial cross-validation, 'rsample' for resampling and cross-validation, 'waywiser' for measuring spatial autocorrelation in model residuals, and 'applicable' for calculating model applicability domains.

## Community Involvement and Outreach

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- 2019-2020 **Code for Boston - Clean Slate Project.** Data Scientist and Project Manager (Volunteer).  
Project working with Greater Boston Legal Society to advance criminal justice reform efforts.

## Software Development

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- 2022 **waywiser:** Lead developer  
Infrastructure for assessing spatial autocorrelation in model residuals
- 2022 **rsample:** Developer  
Data resampling infrastructure for model evaluation
- 2022 **geojsonio:** Maintainer  
Utility to convert geographic data to GeoJSON and TopoJSON formats
- 2022 **spatialsample:** Developer, Maintainer  
Functions for spatial resampling with the 'rsample' package
- 2022 **unifir:** Lead developer  
A Unifying API for working with Unity in R
- 2021 **terrainr:** Lead developer  
Retrieve Data from the USGS National Map and Transform it for 3D Landscape Visualizations.
- 2020 **heddlr:** Lead developer  
Tools to enable functional programming workflows for dynamic R Markdown document generation.
- 2020 **spacey:** Lead developer  
USGS and ESRI data access for beautiful landscape visualization.

## Affiliations

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- 2021 - Present **The Carpentries.** Instructor in good standing.
- 2021 - Present **American Geophysical Union.** Member.
- 2021 - Present **NYS GIS Association.** Member.
- 2019 - Present **Data Visualization Society.** Member.