Thomas A. Lake

Postdoctoral Research Scholar, Center for Geospatial Analytics
North Carolina State University
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Professional Summary

Computational plant scientist and machine learning researcher with 7+ years of experience. Expertise in image-based predictive models, deep learning workflows, and geospatial analytics for large-scale ecological, agricultural, and plant-trait imaging datasets. Proven ability to design experiments, analyze multimodal data, and deliver insights for stakeholders. Experienced collaborator across computational, biological, and academic teams.

Education

Postdoctoral Research Scholar 2023-present
Center for Geospatial Analytics, North Carolina State University, Raleigh, NC
Advisor: Dr. Ross Meentemeyer

Ph.D., Plant & Microbial Biology 2018-2023
University of Minnesota Twin Cities, Minneapolis, MN
Thesis: Improving predictive models of range expansion in invasive species
Advisor: Dr. David Moeller

B.S., Conservation Biology 2013-2017
Minor: Geographic Information Sciences
University of Minnesota Twin Cities, Minneapolis, MN

Research & Teaching

Graduate Research Assistant, Ph.D. Candidate. University of Minnesota 2021-2023

Graduate Teaching Assistant, Plant, Algal, and Fungal Diversity and Adaptation 2019-2020
University of Minnesota

Graduate Teaching Assistant, Foundations of Biology, University of Minnesota 2019

Researcher 1, USDA ARS Cereal Disease Lab, St. Paul, MN 2017-2018

Undergraduate Teaching Assistant, Plant Immunity Gene Discovery, University of Minnesota 2017

Undergraduate Research Assistant, UROP, University of Minnesota 2015-2017

Grants, Fellowships, & Awards

NASA-MSU Professional Enhancement Award, NASA-Michigan State University 2024
$1,000. Supported travel and research on applying computer vision models to street-view imagery.

Doctoral Dissertation Research Fellowship, University of Minnesota Graduate School 2022-2023
$35,000. Satellite-imagery-based predictive model workflows to monitor plant invasions.
Competitive internal fellowship for PhD candidates.

Climate Innovation Challenge, Google 2022-2023
$13,500 in Google Cloud Platform credits for deep learning models and data pipelines.

Hatch Grant, USDA National Institute of Food and Agriculture 2021-2023
Satellite image time series and classification models to track invasive species across landscapes.
Contributed to grant writing and submission, awarded $65,000 for research.

Bell Museum Dayton Natural History Award, University of Minnesota 2020-2021
$2,500. Does adaptive genetic differentiation facilitate or impede future plant invasions? Award to support PhD field research in plant adaptation and climate change study.

Bill Dahl Graduate Student Research Award, Botanical Society of America 2020-2021
$1,500. Award funding image phenotyping study of invasive plant adaptation to climate change.

Earth Observation Grant, European Space Agency 2020-2021
$12,000 equivalent to access high-resolution multispectral satellite imagery.

Accelerated Data Science Grant, NVIDIA 2019-2020
$1,000. Awarded Nvidia V100 graphics processing unit (GPU) for accelerated computing.

Grants-in-Aid, University of Minnesota 2018-2022
$5,000 total. Four small internal grants supporting field research and travel.

Undergraduate Research Opportunity Program, University of Minnesota 2016-2017
$3,600. Award for undergraduate research in plant horticulture, breeding, and cytogenetics.

Publications & Presentations

Refereed Publications

1. **Lake, T. A.**, Runquist, R. D. B., Flagel, L. E., & Moeller, D. A. (2023). Chronosequence of invasion reveals minimal losses of genomic diversity, niche expansion, and trait divergence in the polyploid, leafy spurge. *Evolutionary Applications*, 16(10), 1680-1696.

2. **Lake, T. A.**, Briscoe Runquist, R. D., & Moeller, D. A. (2022). Deep learning detects invasive plant species across complex landscapes using Worldview-2 and Planetscope satellite imagery. *Remote Sensing in Ecology and Conservation*, 8(6), 875-889.

3. Briscoe Runquist, R. D., **Lake, T. A.**, & Moeller, D. A. (2021). Improving predictions of range expansion for invasive species using joint species distribution models and surrogate co-occurring species. *Journal of Biogeography*, 48(7), 1693-1705.

4. **Lake, T. A.**, Runquist, R. D. B., & Moeller, D. A. (2020). Predicting range expansion of invasive species: Pitfalls and best practices for obtaining biologically realistic projections. *Diversity and Distributions*, 26(12), 1767-1779.

5. Briscoe Runquist, R. D., **Lake, T. A.**, Tiffin, P., & Moeller, D. A. (2019). Species distribution models throughout the invasion history of Palmer amaranth predict regions at risk of future invasion and reveal challenges with modeling rapidly shifting geographic ranges. *Nature Scientific Reports*, 9(1), 1-12.

Manuscripts in Review

1. **Lake, T. A.**, Runquist, R. D. B., & Moeller, D. A. (in review). Two decades of satellite images reveal the spatial and temporal dynamics of leafy spurge invasion and improve species distribution models. *bioRxiv*.

2. **Lake, T. A.**, Laginhas, B. B., Jones, C. M., & Meentemeyer, R. K. (in review). Continental-scale computer vision models reveal generalizable patterns and pitfalls for urban tree inventories with street-view images. *bioRxiv*.

3. Sanchez, F., **Lake, T. A.**, Galvis, J.A., Jones, C. M., & Machado, G. (in review). Predicting the spatial distribution and demographics of commercial swine farms in the United States. *Arxiv*.

Selected Presentations

1. **Lake, T. A.**, Briscoe Runquist, R. D., & Moeller, D. A. Two decades of satellite images reveal the spatial and temporal dynamics of leafy spurge invasion and improves species distribution models. Ecological Forecasting Initiative Conference (EFI). Blacksburg, VA. 05/2025.

2. **Lake, T. A.**, Laginhas, B. B., Jones, C. M., & Meentemeyer, R. K. Mapping species occurrences with street-view remote sensing and computer vision. International Association of Landscape Ecology (IALE). Raleigh, NC. 04/2025.

3. **Lake, T. A.** Deep learning, an introduction and applications. Invited Lecturer. Center for Geospatial Analytics. North Carolina State University. 01/2025.

4. **Lake, T. A.**, Jones, C. M., & Meentemeyer, R. K. Detecting tree species with computer vision and street-view imagery. International Association of Landscape Ecology (IALE). Oklahoma City, OK. 04/2024.

5. **Lake, T. A.**, Briscoe Runquist, R. D., & Moeller, D. A. Detecting invasive plant species across complex landscapes using satellite imagery and deep learning. Upper Midwest Invasive Species Conference, Green Bay, WI. 10/2022.

6. Briscoe Runquist, R. D., **Lake, T. A.**, & Moeller, D. A. Landscape genetics of Common Tansy reveals spatial genetic differentiation. Upper Midwest Invasive Species Conference, Green Bay, WI. 10/2022.

Technical Skills & Competencies

Programming: Python, R, SQL, Bash, Git

Machine Learning & AI: PyTorch, Keras/TensorFlow, Hugging Face, CNNs, Vision Transformers, Scikit-Learn, Multimodal models, Object detection, Instance segmentation, Image classification, Explainable AI

Geospatial Analytics: Google Earth Engine, GDAL, Rasterio, Geopandas, Spatial statistics, Bayesian uncertainty

Cloud & HPC: Google Cloud, HPC environments, MLOps (W&B), Model versioning, Tb-scale image analysis

Data Engineering: ETL workflows, Data harmonization, Large-scale batch processing, Model inference pipelines

Software & DevOps Tools: Conda environments, VS Code, Jupyter, Reproducible research workflows

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Service & Outreach

Mentorship

Undergraduates: Brennen Farrell, Lindsey Howell, Jessica Zhang, Nolan Kerr, Christina Berg
Graduates: Felipe Sanchez, Brit Laginhas, Joan Barreto Ortiz, Alina Smolskaya

CFANS Mentor Program, University of Minnesota 2018-2022

CFANS Mentor Matching Committee, University of Minnesota 2021, 2022

Peer Reviews

Ecological Applications, Journal of Ecology, Diversity and Distributions, GIScience & Remote Sensing, Urban Ecosystems, Global Ecology and Conservation

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References

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Professor
Plant and Microbial Biology
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Ross Meentemeyer
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