Thomas A. Lake

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

Machine learning and AI researcher specializing in geospatial and computer vision applications for agriculture and environmental systems. Experience developing predictive models using remote sensing and multimodal data to improve decision-making in plant health, invasive species management, and agricultural risk forecasting. Experience leading interdisciplinary research, securing competitive funding, and translating research into applications.

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

Academic Appointments

Postdoctoral Research Scholar, Center for Geospatial Analytics, North Carolina State University   2023–present
> Developed and lead research on AI-enabled surveillance systems for agricultural risk forecasting and invasive species monitoring. Supervised graduate and undergraduate researchers, and collaborated with teams across ecology, computer science, and plant sciences.

Graduate Research Assistant, Department of Plant & Microbial Biology, University of Minnesota   2018–2023
> Developed predictive models of invasive species spread using genomic, climatic, and satellite data. Applied models to improve ecological forecasting under climate change scenarios.

Researcher I, USDA Agricultural Research Service (ARS), Cereal Disease Laboratory, St. Paul, MN   2017–2018
> Conducted applied research in plant pathology for disease gene discovery.
> Collaborated with federal scientists on agricultural biosecurity and crop health research.

Teaching Experience

Invited Lecturer, Deep Learning: Introduction and Applications, NC State   2025
> Delivered invited seminar introducing neural networks, computer vision, and applied AI workflows to undergraduate and graduate students in geospatial analytics.

Graduate Teaching Assistant, Plant, Algal, Fungal Diversity and Adaptation, University of Minnesota   2020–2021
> Led laboratory sections and facilitated discussions on plant evolution, biodiversity, and adaptation. Mentored students in experimental design, statistical analysis, and scientific communication.

Graduate Teaching Assistant, Foundations of Biology, University of Minnesota   2019
> Instructed undergraduate laboratory sections (60+ students) covering core biological principles. Integrated quantitative reasoning and data analysis into laboratory instruction.

Grants, Fellowships, & Awards

Deep Learning Models for Tree of Heaven, a Key Host for Spotted Lanternfly, USDA AFRI   2025
  (in review; $300,000). Improving species distribution models with high resolution imagery (PI).

AI Survey Tools for Detecting Tree Hosts of Invasive Pests and Pathogens, USDA APHIS   2025
  (in review; $165,000). Developing computer visions models to map tree species distributions (co-PI).

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.
  Co-authored funded USDA Hatch proposal ($65,000) supporting satellite time-series modeling.

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.**, Laginhas, B. B., Jones, C. M., & Meentemeyer, R. K. (2026). Continental-scale computer vision models reveal generalizable patterns and pitfalls for urban tree inventories with street-view images. *ISPRS Open Journal of Photogrammetry and Remote Sensing*, 19(1). doi: 10.1016/j.ophoto.2026.10012.

2. **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.

3. **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.

4. 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.

5. **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.

6. 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. 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. *BioRxiv*.

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.**, 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.

4. **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.

5. 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: CI/CD 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

Mentored 6 undergraduate and 5 graduate students on plant biology and ecological forecasting.
Undergraduates: Promit Saha, Brennen Farrell, Lindsey Howell, Jessica Zhang, Nolan Kerr, Christina Berg
Graduates: Mark Feinberg, 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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