Lei Song
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EDUCATION

2023 **Ph.D. Geography**
Clark University, Worcester, MA, USA
Advisor: Lyndon D. Estes

2021 **M.A. Geography**
Clark University, Worcester, MA, USA

2015 **M.S. Applied Meteorology**
Nanjing University of Information Science & Technology, Nanjing, CHINA

2012 **B.S. Geographic Information Science**
Nanjing University of Information Science & Technology, Nanjing, CHINA

APPOINTMENTS

2025-Present **Assistant Professor,** Department of Geography, Rutgers University-New Brunswick

2023-2025 **Postdoctoral Research Fellow**, Department of Geography, University of California, Santa Barbara, CA, USA.

2023 **Postdoctoral Research Fellow**, School of Geographical Sciences and Urban Planning, Arizona State University, Tempe, AZ, USA.

GRANTS & FELLOWSHIPS

2020 - 2023 *NASA Future Investigators in NASA Earth and Space Science and Technology (FINESST),* Combining Spatially-explicit Simulation of Animal Movement and Earth Observation to Reconcile Agriculture and Wildlife Conservation. Award No. 80NSSC20K1640. $135,000. (Role: FI)

HONORS & AWARDS

2025 *Individualized Professional Skills(IPS) Grant,* University of California, Santa Barbara
NASA–MSU Professional Enhancement Award, IALE-North America

2018 *The Pruser Dissertation Enhancement Awards*, Clark University

2018 *Harvard Design and Map Company Enhancement Award*, Clark University

2015 *The First Prize Scholarship*, Nanjing University of Information Science & Technology

2011 *The Third Prize Scholarship*, Nanjing University of Information Science & Technology

2009 *The First Prize Scholarship*, Nanjing University of Information Science & Technology

PEER-REVIEWED ARTICLES

10. **Song, L.**, Frazier, A. E., Estes, A. B., & Estes, L. D. (2025). A multi-scale approach for integrating species distribution models with landscape connectivity to identify critical

linkage zones for African savanna elephants (Loxodonta africana). Ecological Modelling, 507, 111198. https://doi.org/10.1016/j.ecolmodel.2025.111198

9. Araujo, D. S., Enquist, B. J., Frazier, A. E., Merow, C., Roehrdanz, P. R., Moulatlet, G. M., Zvoleff, A., **Song, L.**, Maitner, B., & Nikolopoulos, E. I. (2025). Global Future Drought Layers Based on Downscaled CMIP6 Models and Multiple Socioeconomic Pathways. Scientific Data, 12(1), 295.
8. Khallaghi, S., Abedi, R., Abou Ali, H., Alemohammad, H., Dziedzorm Asipunu, M., Alatise, I., Ha, N., Luo, B., Mai, C., **Song, L.**, Wussah, A. O., Xiong, S., Yao, Y.-T., Zhang, Q., & Estes, L. D. (2025). Generalization Enhancement Strategies to Enable Cross-Year Cropland Mapping with Convolutional Neural Networks Trained Using Historical Samples. Remote Sensing, 17(3). https://doi.org/10.3390/rs17030474.
7. Frazier, A. E., & **Song, L.** (2025). Artificial Intelligence in Landscape Ecology: Recent Advances, Perspectives, and Opportunities. *Current Landscape Ecology Reports*, *10*(1), 1-13. https://doi.org/10.1007/s40823-024-00103-7
6. **Song, L.**, Estes, A. B., & Estes, L. D. (2023). A super-ensemble approach to map land cover types with high resolution over data-sparse African savanna landscapes. *International Journal of Applied Earth Observation and Geoinformation*, 116, 103152. https://doi.org/10.1016/j.jag.2022.103152
5. **Song, L.**, & Estes, L. (2023). ITSDM: Isolation forest-based presence-only species distribution modelling and explanation in R. *Methods in Ecology and Evolution*, 2041-210X.14067. https://doi.org/10.1111/2041-210X.14067
4. Estes, L. D., Ye, S., **Song, L.**, Luo, B., Eastman, J. R., Meng, Z., Zhang, Q., McRitchie, D., Debats, S. R., Muhando, J., Amukoa, A. H., Kaloo, B. W., Makuru, J., Mbatia, B. K., Muasa, I. M., Mucha, J., Mugami, A. M., Mugami, J. M., Muinde, F. W., … Caylor, K. K. (2022). High Resolution, Annual Maps of Field Boundaries for Smallholder-Dominated Croplands at National Scales. *Frontiers in Artificial Intelligence*, 4, 744863. https://doi.org/10.3389/frai.2021.744863
3. Elmes, A., Alemohammad, H., Avery, R., Caylor, K., Eastman, J., Fishgold, L., Friedl, M., Jain, M., Kohli, D., Laso Bayas, J., Lunga, D., McCarty, J., Pontius, R., Reinmann, A., Rogan, J., **Song, L.**, Stoynova, H., Ye, S., Yi, Z.-F., & Estes, L. (2020). Accounting for Training Data Error in Machine Learning Applied to Earth Observations. *Remote Sensing*, 12(6), 1034. https://doi.org/10.3390/rs12061034
2. Shi, Y., & **Song, L.** (2015). Spatial Downscaling of Monthly TRMM Precipitation Based on EVI and Other Geospatial Variables Over the Tibetan Plateau From 2001 to 2012. *Mountain Research and Development*, 35(2), 180–194. https://doi.org/10.1659/MRD-JOURNAL-D-14-00119.1
1. Shi, Y., **Song, L.**, Xia, Z., Lin, Y., Myneni, R., Choi, S., Wang, L., Ni, X., Lao, C., & Yang, F. (2015). Mapping Annual Precipitation across Mainland China in the Period 2001–2010 from TRMM3B43 Product Using Spatial Downscaling Approach. *Remote Sensing*, 7(5), 5849–5878. https://doi.org/10.3390/rs70505849

Manuscripts in review/revision

11. **Song, L.**, Frazier, A. E., Crawford, C. L., Estes, A. B., & Estes, L. D. (Under revision). Optimizing future cropland allocation in a biodiverse savanna by integrating agricultural benefits and ecological costs. Preprint: https://doi.org/10.31219/osf.io/4xnwb
12. Bohner, T., Duncanson, L., Nikolopoulos, E., Frazier, A., Araujo, D., Brock, C., Cui, D., Hinojo-Hinojo, C., Krieger, J.M., Maitner, B.S., Moulatlet, G.M., Roehrdanz, P.R., **Song, L.**, Merow, C. and Enquist, B.J. (Under review). Forecasting global drought exposure reveals biome-specific risk to Earth's forests and tallest trees.

13. Moulatlet, G.M., Boyle, B., Feng, X., Frazier, A., Hinojo-Hinojo, C., Maitner, B.S., Merow, C., Newman, E.A., Roehrdanz, P.R., **Song, L.**, Villalobos, F., Marquet, P.A., Svenning, J.-C. and Enquist, B.J. (Under revision). General laws of biodiversity: climatic niches predict plant range size and ecological dominance globally.
14. Moulatlet, G.M., Capparelli, M., Thomas, C., Boyle, B., Feng, X., Frazier, A., Hinojo-Hinojo, C., Herrera-Perez, J., Kajiki, L., Lechner, A., Maitner, B.S., Newman, E.A., Nikolopoulos, E., Roehrdanz, P.R., **Song, L.**, Valencia-Rodriguez, D., Yang, W., Merow, C., Silman, M., Villalobos, F., Macklin, M. and Enquist, B.J. (Under review). Amazon biodiversity is at risk from metal contamination due to mining activity

Manuscript in prep

15. **Song, L.**, Frazier, A.E., Kedron, P., Araujo, D.S., Enquist, B.J., Maitner, B., Merow, C., Moulatlet, G.M., Nikolopoulos, E.I. and Roehrdanz, P.R. (In prep). Explainable Artificial Intelligence Reveals Spatially Divergent Effects of Global Change on Mammals.

PEER-REVIEWED CONFERENCE PROCEEDINGS

2024 **Song, L.**, Frazier, A.E., Kedron, P., Araujo, D.S., Cui, D., Enquist, B.J., Maitner, B., Merow, C., Moulatlet, G.M., Nikolopoulos, E.I. and Roehrdanz, P.R., (2024). Explainable artificial intelligence to interpret spatially-explicit impacts of future climate change on species distribution. In *I-GUIDE Forum*. October 2024.

TEACHING EXPERIENCE

2025 *GEOG 274 – Conservation GIS,* Spring. University of California, Santa Barbara (Co-instructor)

2021 *GEOG 246/346 - Geospatial Analysis with R*, Spring. Clark University (Lecturer). Evaluation: **4.75/5**.

2020 *GEOG 246/346 - Geospatial Analysis with R*, Fall. Clark University (Teaching Assistant). Evaluation: **4.92/5**.

GEOG 246/346 - Geospatial Analysis with R, Spring. Clark University (Teaching Assistant). Evaluation: **4.70/5**.

2017 *GEOG 293/383 - Introduction to Remote Sensing*, Fall. Clark University (Teaching Assistant).

2015 *Principles of Remote Sensing*, Spring. Nanjing University of Information Science & Technology (Teaching Assistant)

2014 *IDL programming*, Fall. Nanjing University of Information Science & Technology (Teaching Assistant)

PROFESSIONAL EXPERIENCE

2018 – 2020 Graduate Research Assistant, Clark University, Worcester, USA

- *Mapping Africa project*

2012 - 2015 Graduate Research Assistant, Nanjing University of Information Science & Technology, Nanjing, CHINA

INVITED TALKS AND PRESENTATIONS

2023 **Song, L.**, Combining Earth Observation and Animal Movement to Reconcile Agriculture and Wildlife Conservation. *Center for Spatial Studies and Data Science, University of California, Santa Barbara*. 01 Nov. 2023

Song, L., A super-ensemble approach to map land cover types with high resolution over data-sparse African savanna landscapes. *8th NICFI Satellite Data Program Scientific Research Roundtable*. Online. 01 June 2023

CONFERENCE PRESENTATIONS & POSTERS

2025 **Song, L.**, Kedron, P. (2025). Strategic Breakout: The Role of GIScience in Causal Inference. *UCGIS Symposium 2025, June 2025*.

Song, L., Frazier, A.E., Roehrdanz, P.R., Yang, W., Krieger, J., McManus, N., Noguera Urbano, E., Rodriguez Buriticá, S. and Willett, D. (2025). Modeling climate adaptive habitat connectivity for conservation planning. In *IALE-North America Annual Meeting*, *April 2025*.

2024 **Song, L.**, Frazier, A. E., Crawford, C. L., Estes, A. B., & Estes, L. D. (2024). Balancing agricultural benefits and ecological costs: pathways to address the land gap of agriculture in Tanzania. In *AAG Annual meeting, April 2024*.

2022 **Song, L.**, & Estes, L. D. (2022, December). Using a Nested Multi-Scale Method to Characterize Landscape Utilization and Conservation Status of African Savanna Elephant. In *AGU Fall Meeting Abstracts* (Vol. 2022, pp. B22D-1486).

Song, L., Estes, L., Estes, A., Using a nested multi-Scale method to characterize landscape utilization and conservation status of African Savanna Elephant, in *NASA Biological Diversity and Ecological Forecasting Team Meeting, September 20-22, 2022*.

Song, L., & Estes, L. *itsdm*: Isolation Forest-based presence-only species distribution modeling and explanation in R. In *2022 ESA Annual Meeting, August 14-19*.

Song, L., Estes, L., Luo, B., Estes, A., A super-ensemble approach to map land cover types with high resolution over data-sparse African savanna landscapes, in *the 4th International Electronic Conference on Remote Sensing, 25-27 January 2022*, online, **Best Poster Award**

2021 **Song, L.**, Estes, L., Luo, B., Estes, A., Land cover mapping in data-sparse regions, in *NASA Biological Diversity and Ecological Forecasting Team Meeting, October 19-21, 2021*, online

2020 **Song, L.**, Luo, B., Ye, S., Zhang, Q., & Estes, L. D. (2020, December). Using mixed labels and a multi-stage approach to map crop types over smallholder-dominated agricultural systems. In *AGU Fall Meeting Abstracts* (Vol. 2020, pp. GC034-04).

Song, L., & Estes, L. Broad-scale spatial distribution of African bush elephant (Loxodonta Africana) using combination of machine learning algorithms. In *2020 ESA Annual Meeting (August 3-6)*. ESA.

2019 Estes, L. D., Ye, S., **Song, L.**, Avery, R. B., McRitchie, D., Eastman, R., ... & Caylor, K. K. (2019, December). Improving maps of smallholder-dominated croplands through tight integration of human and machine intelligence. In *AGU Fall Meeting Abstracts* (Vol. 2019, pp. IN42A-04).

2018 Avery, R.B., Caylor, K.K., Estes, L.D., Eastman, R., Ye, S., **Song, L.**, Zhang, K., Xiong, S., McRitchie, D. and Woodard, T. (2018, December). A Convolutional Neural Network Approach to Segmenting Smallholder Agriculture. In *AGU Fall Meeting Abstracts* (Vol. 2018, pp. B31I-2597).

Estes, L.D., Debats, S.R., McRitchie, D., Eastman, R., **Song, L.**, Woodard, T., Xiong, S., Ye, S., Zhang, K., Avery, R.B. and Caylor, K.K. (2018, December). Using active learning to quantify how training data errors impact classification accuracy over smallholder-dominated agricultural systems. In *AGU Fall Meeting Abstracts* (Vol. 2018, pp. B22A-05).

TECHNOLOGY AND SOFTWARE DEVELOPMENT

Lead author	itsdm: An R package to use an interpretable Isolation Forest model for species distribution modeling.
	hrlcm: A high resolution land cover mapping workflow of using ensemble labels, Random Forest, and U-Net.
	sentinelPot: A python package to pre-processing Sentinel-1&2 level-1 images.
	waspire: A template to build docker image to run WASP (Weighted Average Synthesis Processor) to create cloud-free syntheses with Sentinel-2 level-2A.
	cscdc: Crop type detection and classification in Africa using multi-source images.
Co-author	labeller: Labelling platform for Mapping Africa active learning project.
	learner: Machine learning component of the active learning project.
	imager: A repo to prepare PlanetScope images for labelling platform and modeling.

UNIVERSITY & SCHOOL SERVICE

2019 Promotion Committee, Graduate School of Geography, Clark University

PROFESSIONAL AFFILIATIONS

American Association of Geographers (AAG)
American Geophysical Union (AGU)
The Ecological Society of America (ESA)
British Ecological Society (BES)
International Society for Ecological Modeling (ISEM)
North American Regional Association of the International Association for Landscape Ecology (IALE-NA)

PEER REVIEWER

Landscape Ecology
Remote Sensing of Environment
Environmental Earth Sciences
Remote Sensing
Ecology and Society
PeerJ – Life and Environment
Frontiers in Artificial Intelligence, AI in Food, Agriculture and Water