

Zheng Shi
Research Scientist
Institute for Environmental Genomics
University of Oklahoma, Norman OK
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EDUCATION

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- Ph.D.** Global Change Ecology, University of Oklahoma, OK, Advisor: Prof. Yiqi Luo, 2015
M.Sc. Soil Science, University of Alberta, Canada, Advisor: Prof. Scott Chang, 2010
M.Sc. Ecology, Nanjing Forestry University, China, Advisor: Prof. Honghua Ruan, 2007
B.Sc. Ecology, Shandong University, China, 2004

PROFESSIONAL EXPERIENCE

Research Scientist	Sep. 2021-Present
Institute for Environmental Genomics University of Oklahoma, Norman OK	
Postdoctoral Research Fellow	Sep. 2020-Sep. 2021
Computational Earth Sciences Group Oak Ridge National Laboratory, Oak Ridge, TN	
Postdoctoral Research Fellow	Jun. 2018-Sep 2020
<i>University of California, Irvine</i> , Irvine, CA 92697 Department of Ecology and Evolutionary Biology	
Postdoctoral Research Fellow	Aug. 2015-May 2018
<i>University of Oklahoma</i> , Norman, OK 73069 Department of Meteorology	

TEACHING EXPERIENCE

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- Soil carbon modeling. Invited lecture for course GEOG/GEOL (4970, 5970 - 002): *Measuring, Monitoring, and Modeling the Terrestrial Carbon Cycle*. Fall semester, 2025. OU.
 - Soil carbon modeling – MEND model as an example. Invited lecture for course GEOG/GEOL (4970, 5970 - 001): *Soil Biogeochemistry*. Spring 2023. OU.
 - Soil carbon and nitrogen modeling. Lecturer. Seminar series. Fall semester 2022. OU.
 - Carbon cycling – soil. Invited lecture for course *Ecosystem Biogeochemistry*. Fall semester 2022. UIUC.
 - Soil carbon and nitrogen modeling. Lecturer. Seminar series. Spring semester 2022. OU.
 - Ecosystem modeling. Lecturer. Online graduate class. Spring semester 2021.
 - Experimental design and data analysis: t test and ANOVA. Lecturer. Online short course. Fall semester, 2020.
 - New advances in land carbon cycle modeling. Lecturer. Training course. Spring 2018.
 - Ecological modeling. Teaching assistant for Dr. Yiqi Luo at OU. Spring 2013.
 - Soil physics and classification. Teaching assistant for Dr. Scott Chang at University of Alberta. Fall 2009.

- Ecosystem ecology. Teaching assistant for Dr. Honghua Ruan at Nanjing Forestry University. Spring, 2006.

FUNDING

- *Experimental-data-informed, machine-learning-enabled benchmarking and development of land carbon cycle in Earth system models.* 2024-2027. Department of Energy. **Lead PI.** \$900,000.
- *Ecosystems and Networks Integrated with Genes and Molecular Assemblies (ENIGMA).* 2025-2026. Department of Energy. **CoPI.** \$624,126. (Renewable)

PUBLICATIONS (google scholar citations: 5642; *: mentored graduate students)

First or Co-first articles

- Shi, Z., F. M. Hoffman, M. Xu, U. Mishra, S. D. Allison, J. Zhou, and J. T. Randerson. 2024. Global-Scale Convergence Obscures Inconsistencies in Soil Carbon Change Predicted by Earth System Models. *AGU Advances* 5:e2023AV001068.
- Shi, Z., & Lu, X. 2024. Coupled Carbon-Nitrogen Matrix Models. In Land Carbon Cycle Modeling (pp. 34-44). *CRC Press*.
- Shi, Z., Allison, S.D., He, Y., Levine, P.A., Hoyt, A.M., Beem-Miller, J., Zhu, Q., Wieder, W.R., Trumbore, S. and Randerson, J.T., 2020. The age distribution of global soil carbon inferred from radiocarbon measurements. *Nature Geoscience*, 13(8): 555-559.
- Shi, Z., S. Crowell, Y. Luo, and B. Moore. 2018. Model structures amplify uncertainty in predicted soil carbon responses to climate change. *Nature Communications* 9:2171, doi:10.1038/s41467-018-04526-9.
- Shi, Z., Y. Lin, K. R. Wilcox, L. Souza, L. Jiang, J. Jiang, C. G. Jung, X. Xu, M. Yuan, X. Guo, L. Wu, J. Zhou, and Y. Luo. 2018. Successional change in species composition alters climate sensitivity of grassland productivity. *Global Change Biology* 24(10), 4993-5003.
- Wilcox, K. R#, Z. Shi#, L. A. Gherardi, N. P. Lemoine, S. E. Koerner, D. L. Hoover, E. Bork, K. M. Byrne, J. Cahill, S. L. Collins, S. Evans, A. K. Gilgen, P. Holub, L. Jiang, A. K. Knapp, D. LeCain, J. Liang, P. Garcia-Palacios, J. Peñuelas, W. T. Pockman, M. D. Smith, S. Sun, S. R. White, L. Yahdjian, K. Zhu, and Y. Luo. 2017. Asymmetric responses of primary productivity to precipitation extremes: A synthesis of grassland precipitation manipulation experiments. *Global Change Biology* 23:4376-4385. (#: Equal Contribution)
- Jiang, L#, Z. Shi#, J. Xia, J. Liang, X. Lu, Y. Wang, and Y. Luo. 2017. Transient traceability analysis of land carbon storage dynamics: procedures and its application to two forest ecosystems. *Journal of Advances in Modeling Earth Systems* 9:2822-2835. (#: Equal Contribution)
- Shi, Z., X. Xu, L. Souza, K. Wilcox, L. Jiang, J. Liang, J. Xia, P. García-Palacios, and Y. Luo. 2016. Dual mechanisms regulate ecosystem stability under decade-long warming and hay harvest. *Nature Communications* 7:11973, doi:10.1038/ncomms11973.
- Xu, X#, Z. Shi#, X. Chen, Y. Lin, S. Niu, L. Jiang, R. Luo, and Y. Luo. 2016. Unchanged carbon balance driven by equivalent responses of production and respiration to climate change in a mixed-grass prairie. *Global Change Biology* 22:1857-1866. (#: Equal Contribution)
- Shi, Z., R. Sherry, X. Xu, O. Hararuk, L. Souza, L. Jiang, J. Xia, J. Liang, and Y. Luo. 2015. Evidence for long-term shift in plant community composition under decadal experimental warming. *Journal of Ecology* 103:1131-1140.

- **Shi, Z.**, X. Xu, O. Hararuk, L. Jiang, J. Xia, J. Liang, D. Li, and Y. Luo. 2015. Experimental warming altered rates of carbon processes, allocation, and carbon storage in a tallgrass prairie. *Ecosphere* 6:1-16.
- **Shi, Z.**, Y. Yang, X. Zhou, E. Weng, A. C. Finzi, and Y. Luo. 2015. Inverse analysis of coupled carbon–nitrogen cycles against multiple datasets at ambient and elevated CO₂. *Journal of Plant Ecology* 9: 285-295.
- **Shi, Z.**, M. L. Thomey, W. Mowll, M. Litvak, N. A. Brunsell, S. L. Collins, W. T. Pockman, M. D. Smith, A. K. Knapp, and Y. Luo. 2014. Differential effects of extreme drought on production and respiration: synthesis and modeling analysis. *Biogeosciences* 11:621-633.

Full list

2025

[60] Su, Y., Guo, X., Gao, Y., Feng, J., Wu, L., Lei, J., Liu, S., Gao, Q., Zeng, Y., Qin, W. **Shi, Z.**, Liang, Z., Ye, Z., Yuan, M., Ning, D., Wu, L., Zhou, J., Yang, Y. 2025. Warming stimulates cellulose decomposition by recruiting phylogenetically diverse but functionally similar microorganisms. ISME Communications, 5(1), p.ycae152.
doi.org/10.1093/ismeco/ycae152

2024

- [59] Wang, D., Candry, P., Hunt, K.A., Flinkstrom, Z., **Shi, Z.**, Liu, Y., Wofford, N.Q., McInerney, M.J., Tanner, R.S., De León, K.B. and Zhou, J., 2024. Metaproteomics-informed stoichiometric modeling reveals the responses of wetland microbial communities to oxygen and sulfate exposure. *npj Biofilms and Microbiomes*, 10(1), p.55.
- [58] **Shi, Z.**, & Lu, X. 2024. Coupled Carbon-Nitrogen Matrix Models. In Land Carbon Cycle Modeling (pp. 34-44). *CRC Press*.
- [57] **Shi, Z.**, F. M. Hoffman, M. Xu, U. Mishra, S. D. Allison, J. Zhou, and J. T. Randerson. 2024. Global-Scale Convergence Obscures Inconsistencies in Soil Carbon Change Predicted by Earth System Models. *AGU Advances* 5:e2023AV001068.
- [56] Tao, F., B. Z. Houlton, S. D. Frey, J. Lehmann, S. Manzoni, Y. Huang, L. Jiang, U. Mishra, B. A. Hungate, M. W. I. Schmidt, M. Reichstein, N. Carvalhais, P. Ciais, Y.-P. Wang, B. Ahrens, G. Hugelius, T. D. Hocking, X. Lu, **Z. Shi**, K. Viatkin, R. Vargas, Y. Yigini, C. Omuto, A. A. Malik, G. Peralta, R. Cuevas-Corona, L. E. Di Paolo, I. Luotto, C. Liao, Y.-S. Liang, V. S. Saynes, X. Huang, and Y. Luo. 2024a. Reply to: Model uncertainty obscures major driver of soil carbon. *Nature* 627:E4-E6.
- [55] Tao, X., Z. Yang, J. Feng, S. Jian, Y. Yang, C. T. Bates, G. Wang, X. Guo, D. Ning, M. L. Kemper, X. J. A. Liu, Y. Ouyang, S. Han, L. Wu, Y. Zeng, J. Kuang, Y. Zhang, X. Zhou, **Z. Shi**, W. Qin, J. Wang, M. K. Firestone, J. M. Tiedje, and J. Zhou. 2024. Experimental warming accelerates positive soil priming in a temperate grassland ecosystem. *Nature Communications* 15:1178.

2023

- [54] Elias C Massoud, Forrest Hoffman, **Zheng Shi**, Jinyun Tang, Elie Alhajjar, Mallory Barnes, Renato K Braghieri, Zoe Cardon, Nathan Collier, Octavia Crompton, P James Dennedy-Frank, Sagar Gautam, Miquel A Gonzalez-Meler, Julia K Green, Charles Koven, Paul Levine, Natasha MacBean, Jiafu Mao, Richard Tran Mills, Umakant Mishra, Maruti Mudunuru, Alexandre A Renchon, Sarah Scott, Erica R Siirila-Woodburn, Matthias Sprenger, Christina Tague, Yaoping Wang, Chonggang Xu, Claire Zarakas. 2023.

- Perspectives on Artificial Intelligence for Predictions in Ecohydrology. *Artificial Intelligence for the Earth Systems*. <https://doi.org/10.1175/AIES-D-23-0005.1>, in press.
- [53] Chai*, X., Li, G., **Shi, Z.** Ruan, H. Soil radiocarbon abundance in global forest ecosystems controlled by climate and soil properties. 2023. *Plant Soil* **489**, 125–137.
- [52] Li* G, Chai X, **Shi Z**, Ruan H. Interactive Effects Determine Radiocarbon Abundance in Soil Fractions of Global Biomes. 2023. *Land*. 12(5):1072. <https://doi.org/10.3390/land12051072>
- [51] **Shi, Z.**, Forrest M. Hoffman, Min Xu, Umakant Mishra, Steven D. Allison, Jizhong Zhou, James T. Randerson. 2023. Uncertain predictions of soil carbon change during the 21st century. *Research Square*. preprint. <https://doi.org/10.21203/rs.3.rs-2973284/v1>
- [50] Zhang, Y., D. Ning, L. Wu, M. M. Yuan, X. Zhou, X. Guo, Y. Hu, S. Jian, Z. Yang, S. Han, J. Feng, J. Kuang, C. R. Cornell, C. T. Bates, Y. Fan, J. P. Michael, Y. Ouyang, J. Guo, Z. Gao, **Z. Shi**, N. Xiao, Y. Fu, A. Zhou, L. Wu, X. Liu, Y. Yang, J. M. Tiedje, and J. Zhou. 2023. Experimental warming leads to convergent succession of grassland archaeal community. *Nature Climate Change* **13**:561-569.
- [49] Tao, F., Y. Huang, B. A. Hungate, S. Manzoni, S. D. Frey, M. W. I. Schmidt, M. Reichstein, N. Carvalhais, P. Ciais, L. Jiang, J. Lehmann, Y.-P. Wang, B. Z. Houlton, B. Ahrens, U. Mishra, G. Hugelius, T. D. Hocking, X. Lu, **Z. Shi**, K. Viatkin, R. Vargas, Y. Yigini, C. Omuto, A. A. Malik, G. Peralta, R. Cuevas-Corona, L. E. Di Paolo, I. Luotto, C. Liao, Y.-S. Liang, V. S. Saynes, X. Huang, and Y. Luo. 2023. Microbial carbon use efficiency promotes global soil carbon storage. *Nature*. [10.1038/s41586-023-06042-3](https://doi.org/10.1038/s41586-023-06042-3)
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- [46] Heckman, K., Hicks Pries, C.E., Lawrence, C.R., Rasmussen, C., Crow, S.E., Hoyt, A.M., von Fromm, S.F., **Shi, Z.**, Stoner, S., McGrath, C. and Beem-Miller, J. 2022. Beyond bulk: Density fractions explain heterogeneity in global soil carbon abundance and persistence. *Global change biology*, 28(3), pp.1178-1196.

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- [45] **Shi, Z.**, Allison, S.D., He, Y., Levine, P.A., Hoyt, A.M., Beem-Miller, J., Zhu, Q., Wieder, W.R., Trumbore, S. and Randerson, J.T., 2020. The age distribution of global soil carbon inferred from radiocarbon measurements. *Nature Geoscience*, 13(8): 555-559.
- [44] Chang, S. X., **Shi, Z.**, & Thomas, B. R. (2020). Soil respiration and net ecosystem productivity in a chronosequence of hybrid poplar plantations. *Canadian Journal of Soil Science*, 1-15.
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Asefaw Berhe, M. Keilweit, Á. Della Rosa Kuhnen, E. Marin-Spiotta, A. F. Plante, A. Thompson, **Z. Shi**, J. P. Schimel, L. J. S. Vaughn, S. F. von Fromm, and R. Wagai. 2020. An open-source database for the synthesis of soil radiocarbon data: International Soil Radiocarbon Database (ISRaD) version 1.0. *Earth Syst. Sci. Data* 12:61-76.

2019

- [42] Huang, Y., M. Stacy, J. Jiang, N. Sundi, S. Ma, V. Saruta, C. G. Jung, **Z. Shi**, J. Xia, P. J. Hanson, D. Ricciuto, and Y. Luo. 2019. Realized ecological forecast through an interactive Ecological Platform for Assimilating Data (EcoPAD, v1.0) into models. *Geosci. Model Dev.* 12:1119-1137.
- [41] Jung, C. G., X. Xu, S. Niu, J. Liang, X. Chen, **Z. Shi**, L. Jiang, and Y. Luo. 2019. Experimental warming amplified opposite impacts of drought vs. wet extremes on ecosystem carbon cycle in a tallgrass prairie. *Agricultural and Forest Meteorology* 276-277
- [40] Xu, Y., Y. Iida, H. Huang, **Z. Shi**, S. B. Franklin, Y. Luo, D. Bao, X. Qiao, Z. Lu, and M. Jiang. 2019. Linkages between tree architectural designs and life-history strategies in a subtropical montane moist forest. *Forest Ecology and Management* 438:1-9.
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2018

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- [37] Huang, Y., X. Lu, **Z. Shi**, D. Lawrence, C. D. Koven, J. Xia, Z. Du, E. Kluzek, and Y. Luo. 2018. Matrix approach to land carbon cycle modeling: A case study with the Community Land Model. *Global Change Biology* 24:1394-1404.
- [36] **Shi, Z.**, S. Crowell, Y. Luo, and B. Moore. 2018. Model structures amplify uncertainty in predicted soil carbon responses to climate change. *Nature Communications* 9:2171, doi:10.1038/s41467-018-04526-9.
- [35] van Gestel, N., **Z. Shi**, K. J. van Groenigen, C. W. Osenberg, L. C. Andresen, J. S. Dukes, M. J. Hovenden, Y. Luo, A. Michelsen, E. Pendall, P. B. Reich, E. A. G. Schuur, and B. A. Hungate. 2018. Predicting soil carbon loss with warming. *Nature* 554:E4, doi:10.1038/nature25745.
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- [33] Jiang, J., Y. Huang, S. Ma, M. Stacy, **Z. Shi**, D. M. Ricciuto, P. J. Hanson, and Y. Luo. 2018. Forecasting responses of a Northern peatland carbon cycle to elevated CO₂ and a gradient of experimental warming. *Journal of Geophysical Research: Biogeosciences* 123:1057-1071.
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Increased vegetation growth and carbon stock in China karst via ecological engineering.
Nature Sustainability **1**:44-50.

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2017

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- [24] Ren, C., F. Zhao, **Z. Shi**, J. Chen, X. Han, G. Yang, Y. Feng, and G. Ren. 2017. Differential responses of soil microbial biomass and carbon-degrading enzyme activities to altered precipitation. *Soil Biology and Biochemistry* **115**:1-10.
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Decharme, I. Gouttevin, T. Hajima, D. J. Hayes, K. Huang, D. Ji, G. Krinner, D. P. Lettenmaier, P. A. Miller, J. C. Moore, B. Smith, T. Sueyoshi, **Z. Shi**, L. Yan, J. Liang, L. Jiang, Q. Zhang, and Y. Luo. 2017. Terrestrial ecosystem model performance in simulating productivity and its vulnerability to climate change in the northern permafrost region. *Journal of Geophysical Research: Biogeosciences* **122**:430-446.

2016

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2015

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SELECTED TALKS

- Shi Z.** 2025. Experimental Benchmark and Model Perturbation Simulation Experiments. International Land Model Benchmarking (ILAMB) Meeting. New Orleans, Louisianan.
- Shi Z.** 2025. Applications of machine learning and artificial intelligence in microbiome analysis. Institute for Environmental Genomics (IEG) seminar. University of Oklahoma.
- Shi Z.** 2024. Nitrogen limitation in ecosystem responses to climate change. IEG seminar. University of Oklahoma.
- Shi Z.** 2022. Soil carbon dynamics and modeling. Online workshop. UIUC.
- Shi Z.** et al. 2021. Predicted soil carbon gain in Earth system models during the 21st century. American Geophysical Union. San Francisco, California, USA.
- Shi Z.** et al. 2019. The age distribution of global soil carbon inferred from radiocarbon measurements. American Geophysical Union. San Francisco, California, USA.
- Shi Z.** et al. 2018. Model structures amplify uncertainty in predicted soil carbon responses to climate change. Mini-symposium and short training course on new advances in land carbon cycle modeling. Flagstaff, Arizona, USA.

- Shi Z.** et al. 2017. Uncertainty in ecosystem carbon cycle under climate change: perspectives from long-term experiments and modeling. In Nanjing Forestry University, Nanjing, China.
- Shi Z.** et al. 2015. Application of data assimilation in ecosystem carbon modeling. Soil carbon workshop in Flagstaff, Arizona, USA.
- Shi Z.** et al. 2014. Differential effects of extreme drought on production and respiration: synthesis and modeling analysis. 99th ESA Annual Meeting, Sacramento, California, USA.

PROFESSIONAL SERVICE

- Review manuscripts over 100 time for *Nature*, *Nature Climate Change*, *Nature Ecology and Evolution*, *Nature Communications*, *Science Advances*, *Ecology Letters*, *Global Change Biology*, *Journal of Ecology*, *Functional Ecology*, *Ecosystems*, *Journal of Geophysical Research: Biogeosciences*, *Science of The Total Environment*, *Ecological Modeling*, *Ecosphere*, *Oecologia*, *Agricultural and Forest Meteorology*, *Journal of Plant Ecology*, *Geoderma*, *Plant and Soil* etc
- Review proposals for National Science Foundation and European Research Council.