

Chenchen Ren, Ph.D. (she/her)

Incoming Postdoctoral Researcher

University of Bonn (from 15 November 2026)

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Research Interests

My research examines how structural conditions shape agricultural sustainability and climate resilience. These conditions span multiple scales, from farm- and household-level resource endowments and socioeconomic characteristics, such as farm size, land fragmentation, and demographic composition, to broader institutional, policy, and political-economic contexts at subnational and national levels. I investigate how these factors shape access to and use of critical resources, particularly nitrogen, water, and land, and how they influence food production, resource-use efficiency, environmental outcomes, and the capacity to adapt to climate change.

Using interdisciplinary approaches that combine household surveys, large-scale environmental and socioeconomic datasets, and econometric modelling, I seek to explain why similar climate and resource pressures produce different outcomes across places and social groups, and to identify the structural constraints and enabling conditions that support transitions toward sustainable and climate-resilient agriculture.

Academic Appointments

Incoming Postdoctoral Researcher, University of Bonn, Germany

Starting November 15, 2026

Postdoctoral Fellow, Carnegie Science, Stanford, CA, USA

2023–2026

Education

Ph.D. of *Land Resource Management* 2019-2023

Zhejiang University, China

Master of *Land Resource Management* 2017-2019

Zhejiang University, China

Bachelor of *Land Resource Management* 2013-2017

Shandong Agricultural University, China

Publications

- 1) Wang, C., Zhang, X., **Ren, C.**, Xuan, X., Cheng, L., Zou, Y., Xu, J., Gu, B., 2026, Climate change and interprovincial trade move grain production and environmental burdens northwards in China. *Nature Food* 7, 565–576.
- 2) **Ren, C.**, Rosa, L., 2026, Cost-competitiveness of irrigation and nutrient management strategies for closing global yield gaps. *Environmental Research Letters* 21, 104005.
- 3) Zheng M., Cui, J., Cheng, L., Wang S., Wang X., Xu X., Zhang, X., Wang, C., **Ren, C.**, Gu, B., 2026, Integrated climate effects on nitrogen cycles in global grasslands. *Science Advances* 12, eaec5940.

- 4) Cheng, L., Zhang, X., Zhu, Z., **Ren, C.**, Wang, C., Reis, S., Gu, B., 2026. Managing livestock farm size to reduce nitrogen loss in China. *Resources, Environment and Sustainability* 25, 100330.
- 5) He, L., **Ren, C.**, Rosa, L., 2026, Reclaiming abandoned croplands to adapt wheat production to a warmer world. *Communications Earth & Environment* 7, 392.
- 6) Gong, X., **Ren, C.**[#], (co-first author), Wang, C., Gu, B., 2025, Inequality of global crop diversity changes driven by socioeconomic factors. *Science Bulletin* 70, 4230-4240.
- 7) **Ren, C.**, Rosa, L., 2025, Global energy and emissions of irrigation and fertilizers management for closing crop yield gaps. *Environmental Research Letters* 20, 104026.
- 8) Xu, J., **Ren, C.**, Zhang, X., Wang, C., Wang, S., Ma, B., He, Y., Hu, L., Liu, X., Zhang, F., Lu, L., Li, S., Zhang, J., Zhu, Y., Vitousek, P., Gu, B. 2025. Soil health contributes to variations in crop production and nitrogen use efficiency. *Nature Food* 6, 597–609.
- 9) **Ren, C.**, He, L., Rosa, L., 2025, Integrated irrigation and nitrogen optimization is a resource-efficient adaptation strategy for US maize and soybean production. *Nature Food* 6, 389–400.
- 10) Cui, J., Gao Y., van Grinsven, H., Zheng M., Zhang X., **Ren C.**, Ma. T., Xu, J., Gu, B., 2025. Adaptive Mitigation of Warming-Induced Food Crisis and Nitrogen Pollution. *Environmental Science & Technology* 59, 3527-3536
- 11) Bohra, A., Nottmeyer, S., **Ren, C.**, Chen, S., Ma, Y., 2025. Advancing Corn Yield Mapping in Kenya Through Transfer Learning. *Remote Sensing* 17, 1717.
- 12) **Ren, C.**, He, L., Ma, Y., Reis, S., van Grinsven, H., Lam, S., Rosa, L., 2024. Trade-offs in agricultural outcomes across various farm sizes. *Earth Critical Zone* 1, 100007.
- 13) Duan, J., Liu, H., Zhang, X., **Ren, C.**, Wang, C., Cheng, L., Xu, J., Gu, B., 2024. Agricultural management practices in China enhance nitrogen sustainability and benefit human health. *Nature Food* 5, 378–389.
- 14) **Ren, C.**, Zhou, X., Wang C., Guo Y., Diao Y., Shen S., Reis, S., Li, W., Xu, J., Gu, B., 2023. Aging threatens sustainability of smallholder farming in China. *Nature* 616, 96–103.
- 15) **Ren, C.**, Zhang, X., Reis, S., Wang, S., Jin, J., Xu, J., Gu, B. 2023. Climate change unequally affects nitrogen use and losses in global croplands. *Nature Food* 4, 294–304.
- 16) Chen, B., **Ren, C.**, Wang, C., Duan, J., Reis, S., Gu, B., 2023. Driving forces of nitrogen use efficiency in Chinese croplands on county scale. *Environmental Pollution* 316, 120610.
- 17) Gu, B., Zhang, X., Lam, S.K., Yu, Y., van Grinsven, H.J.M., Zhang, S., Wang, X., Bodirsky, B.L., Wang, S., Duan, J., **Ren, C.**, Bouwman, L., de Vries, W., Xu, J., Sutton, M.A., Chen, D., 2023. Cost-effective mitigation of nitrogen pollution from global croplands. *Nature* 613, 77–84.
- 18) **Ren, C.**, Zhang, X., Reis, S., Gu, B., 2022. Socioeconomic barriers of nitrogen management for agricultural and environmental sustainability. *Agriculture, Ecosystems & Environment* 333, 107950.
- 19) Wang, C., Duan, J., **Ren, C.**, Liu H., Reis, S., Jin, J., Xu, J., Gu, B., 2022 Ammonia emissions from croplands decrease with farm size in China. *Environmental Science & Technology* 56, 9915–9923.
- 20) Cheng, L., Zhang, X., Reis, S., **Ren, C.**, Xu, J., Gu, B., 2022. A 12% switch from monogastric to ruminant livestock production can reduce emissions and boost crop production for 525 million people. *Nature Food* 3, 1040-1051.

- 21) Cheng, L., **Ren, C.**, Zhang, X., Gu, B., 2022. Nitrogen emissions from livestock production driven by climate and socioeconomic factors. *Journal of Agricultural Resources and Environment* 39, 510-519.
- 22) Duan, J., **Ren, C.**,[#] (co-first author), Wang, S., Zhang, X., Reis, S., Xu, J., Gu, B., 2021. Consolidation of agricultural land can contribute to agricultural sustainability in China. *Nature Food* 2, 1014-1022.
- 23) **Ren, C.**, Jin, S., Wu, Y., Zhang, B., Kanter, D., Wu, B., Xi, X., Zhang, X., Chen, D., Xu, J., Gu, B., 2021. Fertilizer overuse in Chinese smallholders due to lack of fixed inputs. *Journal of Environmental Management* 293, 112913.
- 24) Zhang, X., **Ren, C.**, Gu, B., Chen, D., 2021. Uncertainty of nitrogen budget in China. *Environmental Pollution* 286, 117216.
- 25) Wang, C., Cheng, K., **Ren, C.**, Liu, H., Sun, J., Reis, S., Yin, S., Xu, J., Gu, B., 2021. An empirical model to estimate ammonia emission from cropland fertilization in China. *Environmental Pollution* 288, 117982.
- 26) Wang, M., Houlton, B.Z., Wang, S., **Ren, C.**, van Grinsven, H., Chen, D., Xu, J., Gu, B., 2021. Human-caused increases in reactive nitrogen burial in sediment of global lakes. *Innovation* 2, 100158.
- 27) Jin, S., Zhang, B., Wu, B., Han, D., Hu, Y., **Ren, C.**, Zhang, C., Wei, X., Wu, Y., Mol, A.P.J., Reis, S., Gu, B., Chen, J., 2021. Decoupling livestock and crop production at the household level in China. *Nature Sustainability* 4, 48-55.
- 28) Gu, B., Zhang, L., Van Dingenen, R., Vieno, M., Van Grinsven, H.J., Zhang, X., Zhang, S., Chen, Y., Wang, S., **Ren, C.**, Rao, S., Holland, M., Winiwarter, W., Chen, D., Xu, J., Sutton, M.A., 2021. Abating ammonia is more cost-effective than nitrogen oxides for mitigating PM2.5 air pollution. *Science* 374, 758-762.
- 29) Gu, B., Duan, J., **Ren, C.**, Wang, S., Wang, C., 2021. Large-scale farming promotes agricultural green development in China. *Journal of Agricultural Resources and Environment* 38, 709-715
- 30) **Ren, C.**, Liu, S., van Grinsven, H., Reis, S., Jin, S., Liu, H., Gu, B., 2019. The impact of farm size on agricultural sustainability. *Journal of Cleaner Production* 220, 357-367.

Working Papers

- 1) **Ren, C.**, Gong, X., Zhu, Y. Gu, B., The role of crop diversity in agricultural nitrogen sustainability. Under Review.
- 2) **Ren, C.**, Davis, F. K., Rosa, L., Agricultural inputs reshape food self-sufficiency of nations. Under Review.

Teaching and Mentoring Experience

Mentor, Carnegie Science 2023-now
 Mentored undergraduate students in analyzing and quantifying the impacts of irrigation water and climate change on crop and livestock production.

Mentor, Zhejiang University 2019-2023

Guided graduate and undergraduate students in exploring and quantifying the effects of climate change, population dynamics, and policy changes on crop production, nitrogen pollution, and agricultural sustainability.

Teaching Assistant, Zhejiang University 2018

Simulation Principles of Terrestrial Ecosystem Ecology

Instructed undergraduate students in developing and implementing class project ideas and FAQs, graded assignments and exams

Volunteered Mathematics Instructor 2014-2018

Taught mathematics in under-resourced regions of China, as an Olympiad instructor for middle school students, and as a primary school teacher in Indonesia. Gained experience adapting teaching methods to diverse learning environments and fostering inclusive, supportive classrooms—skills that continue to shape my student-centered approach to higher education.

Ph.D. Thesis Mentorship

Managing Livestock Production to Reduce Nitrogen Losses and Greenhouse Gas Emissions
(Luxi Cheng, *Expected defense: 2027*)

Crop Diversity as a Nature-Based Solution for Global Nitrogen Use in Cropland Systems
(Xuerong Gong, *Defense date: 2026*)

Impact of Urbanization on the Production and Environmental Effects of Agricultural Systems
(Sitong Wang, *Defense date: 2026*)

Achieving Sustainable Food-Energy-Water Coupling in China through Agricultural Nitrogen Management
(Binhui Chen, *Defense date: 2026*)

Impacts of Scale Farming and Optimized Management Practices on Nitrogen Cycles in Cropland
(Jiakun Duan, *Defense date: 2024*)

Grants

Open Project of State Key Laboratory of Soil Pollution Control and Safety, China,
Developing a Soil Health Assessment System and Risk Management Pathways (NO. SPCS-2025-01003), Project Leader, ~\$20k 2025-2027

National Natural Science Foundation of China, INFEWS: U.S.-China: Managing Agricultural Nitrogen to Achieve Sustainable Food-Energy-Water Nexus in China and the U.S. (NO.42061124001), Co-author, ~\$410k 2021-2023

National Natural Science Foundation of China, Agricultural Nitrogen Cycle (NO. 41822701), Co-author, ~\$180k 2019-2021

Ministry of Science and Technology of the People's Republic of China, Ammonia Emission Inventory Compilation and Emission Reduction Technology Assessment in Agriculture and Animal Husbandry (2018YFC0213304), Co-author, ~\$650k 2018-2021

Conference

AGU Fall Meeting 2025, New Orleans, 2025, Oral

AGU Fall Meeting 2024, Washington, D.C., 2024, Session Convener

AGU Fall Meeting 2024, Washington, D.C., 2024, Poster

AGU Fall Meeting 2023, San Francisco, 2023, Poster

AGU Fall Meeting 2021, New Orleans, LA & Online Everywhere, 2021, Poster

14th National Congress of the Soil Science Society of China, Harbin, China, 2020, Oral presentation

3rd International Symposium on Nitrogen Cycling and Its Environmental Impacts in East Asia, Jinju, Korea, 2019, Oral presentation

Public and Professional Service

Member of the Editorial Board of Communications Sustainability

Member of the Editorial Board of Earth Critical Zone

Member of Nitrogen and Climate Working Group, iN-Net

Research Fellow, International Nitrogen Network (iN-Net) 2026–present

Reviewer Activities

Nature, Nature Food, Nature Communications, Proceedings of the National Academy of Sciences (PNAS), Earth Future, Communications Earth & Environment, Journal of Environmental Management, Land Use Policy, International Journal of Agricultural Sustainability, Environmental Research

Honors and Awards

Stanford Center for Teaching and Learning (CTL) & CIRTLL

Introduction to Evidence-Based Undergraduate STEM Teaching, Certificate of Completion, 2025

Advancing Inclusive Mentoring (AIM): Mentor Training Completion 2024

Zhejiang University Doctoral Freshman Scholarship; Doctoral Excellent Position Grant; Excellent Doctoral Candidate 2019-2023

Zhejiang University Group Psychological Counselor Certificate 2021

Zhejiang University Outstanding Graduate Student of Zhejiang University; Outstanding Postgraduate 2017-2019

Shandong Agricultural University First-class Outstanding Student Scholarship of Shandong Agricultural University; Top ten College students of School of Resources and Environment 2013-2017

Skills

Analysis: Geospatial analysis; agroecosystem and environmental data integration; econometric modeling; scenario analysis; uncertainty quantification

Methods: Panel data analysis (fixed- and random-effects models); causal inference (2SLS); structural equation modeling; cost–benefit analysis

Software: Python; Stata; ArcGIS; Origin; Adobe Photoshop

Field Experience: Soil sampling; household surveys in agricultural systems

Language: English (Fluent)/Mandarin (Native)