

Kai Lan

Assistant Professor of Sustainability Science and Engineering
Department of Forest Biomaterials, North Carolina State University
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EDUCATION

North Carolina State University, NC, USA

Ph.D. in Forest Biomaterials 2017-2020

University of Michigan Ann Arbor, MI, USA

Master of Science in Mechanical Engineering 2014-2016

Shanghai Jiao Tong University, Shanghai, China

Bachelor of Science in Mechanical Engineering 2010-2014

PROFESSIONAL EXPERIENCE

Assistant Professor of Sustainability Science and Engineering 2024 -present

Department of Forest Biomaterials, North Carolina State University, Raleigh, NC

Postdoctoral Associate 2021-2023

Yale School of the Environment, Yale University, New Haven, CT

Postdoctoral Researcher 2020-2021

Department of Forest Biomaterials, North Carolina State University, Raleigh, NC

Research Assistant 2017-2020

Department of Forest Biomaterials, North Carolina State University, Raleigh, NC

RESEARCH INTERESTS

- Sustainable bioenergy and sustainable biomaterials
- Carbon footprint and climate change mitigation
- Upcycling solid waste
- Green building
- Artificial intelligence
- Process design and simulation
- Techno-economic analysis (TEA) and life cycle assessment (LCA) of emerging technologies

PUBLICATIONS

Peer-Reviewed Journal Articles

1. **Lan, K.**, Zhang, B., Lee, T., & Yao, Y. (2024). Soil organic carbon change can reduce the climate benefits of biofuel produced from forest residues. *Joule* (*IF* = 46.1).
2. Yao, Y., **Lan, K.**, Graedel, T. E., & Rao, N. D. (2024). Models for Decarbonization in the Chemical Industry. *Annual Review of Chemical and Biomolecular Engineering*, 15.
3. Sulis, D.B., Jiang, X., Yang, C., Marques, B.M., Matthews, M. L., Miller, Z., **Lan, K.**, Cofre-Vega, C., Liu, B., Sun, R., Sederoff, H., Bing, R. G., Sun, X., Williams, C. M., Jameel, H., Phillips, R., Chang, H., Peszlen, I., Huang, Y., Li, W., Kelly, R. M., Sederoff, R. R., Chiang, V. L., Barrangou, R.* and Wang, J. P.* (2023). Multiplex CRISPR editing of wood for sustainable fiber production. *Science*, 381(6654), 216-221.
4. **Lan, K.**[#], Zhang, B.[#], Harris, T. B., Ashton, M. S. and Yao, Y.* (2023). Climate-smart forestry through innovative wood products and commercial afforestation and reforestation on marginal land. *Proceedings of the National Academy of Sciences*, 120(23), e2221840120.
5. Wu, N., **Lan, K.**, & Yao, Y. (2023). An integrated techno-economic and environmental assessment for carbon capture in hydrogen production by biomass gasification. *Resources, Conservation & Recycling*, 188, 106693.

6. **Lan, K.**, & Yao, Y.* (2022). Feasibility of gasifying mixed plastic waste for hydrogen production and carbon capture and storage. *Communications Earth & Environment*, 3, 300.
7. **Lan, K.**, Zhang, B., & Yao, Y.* (2022) Circular utilization of urban tree waste contributes to the mitigation of climate change and eutrophication. *One Earth (Cell sister journal, IF= 16.7)*, 5(8), 944-957.
8. Ding, Y., Pang, Z., **Lan, K.**, Yao, Y., Panzarasa, G., Lo Ricco, M., Rammer, D. R., Zhu, J. Y., Hu, M., Pan, X., Li, T., Burgert, I., & Hu, L.* (2022) Emerging Engineered Wood for Building Applications. *Chemical Reviews (IF= 72.1)*.
9. **Lan, K.**, & Yao, Y.* (2022). Dynamic life cycle assessment of energy technologies under different greenhouse gas concentration pathways. *Environmental Science & Technology, Cover Paper*, 56(2), 1395–1404.
10. Liao, M., **Lan, K.**, & Yao, Y.* (2021) Sustainability Implications of Artificial Intelligence in the Chemical Industry: A Conceptual Framework. *Journal of Industrial Ecology*, 26(1), 1-19.
11. **Lan, K.**, Xu, Y., Kim, H., Ham, C., Kelley, S. S., & Park, S.* (2021). Techno-economic analysis of producing xylo-oligosaccharides and cellulose microfibrils from lignocellulosic biomass. *Bioresource Technology*, 340, 125726.
12. **Lan, K.**, Ou, L., Park, S., Kelley, S. S., English, B. C., Yu, T. E., Larson, J., & Yao, Y.* (2020). Techno-Economic Analysis of Decentralized Preprocessing Systems for Fast Pyrolysis Biorefineries with Blended Feedstocks in the Southeastern United States. *Renewable & Sustainable Energy Reviews*, 143, 110881.
13. **Lan, K.**, Kelley, S. S., Nepal, P., & Yao, Y.* (2020). Dynamic Life Cycle Carbon and Energy Analysis for Cross-Laminated Timber in Southern US. *Environmental Research Letters*, 15(12), 124036.
14. **Lan, K.**, & Yao, Y.* (2019). Integrating Life Cycle Assessment and Agent-Based Modeling: A Dynamic Modeling Framework for Sustainable Agricultural Systems. *Journal of Cleaner Production*, 238, 117853.
15. **Lan, K.**, Ou, L., Park, S., Kelley, S. S., Nepal, P., Kwon, H., Cai, H.*, & Yao, Y.* (2021). Dynamic Life Cycle Carbon Analysis for Fast Pyrolysis Biofuel Produced from Pine Residues: Implications of Carbon Temporal Effects. *Biotechnology for Biofuels*, 14(1), 1-17.
16. **Lan, K.**, Park, S., Kelley, S. S., English, B. C., Yu, T. E., Larson, J., & Yao, Y.* (2020). Impacts of uncertain feedstock quality on the economic feasibility of fast pyrolysis biorefineries with blended feedstocks and decentralized preprocessing sites in the Southeastern United States. *GCB Bioenergy*, 12(11), 1014-1029
17. **Lan, K.**, Ou, L., Park, S., Kelley, S. S., & Yao, Y.* (2019). Life Cycle Analysis of Decentralized Preprocessing Systems for Fast Pyrolysis Biorefineries with Blended Feedstocks in the Southeastern United States. *Energy Technology*, 1900850.
18. Zhang, Z. & **Lan, K.*** (2021). Understanding the impacts of plant capacities and uncertainties on the techno-economic analysis of cross-laminated timber production in the Southern U.S. *Journal of Renewable Materials*, 10(1), 53.
19. **Lan, K.**, Sun, H.*, & Bernitsas, M. M. (2018). Two Tandem Cylinders with Passive Turbulence Control in Flow-Induced Vibration: Relation of Oscillation Patterns to Frequency Response. *Journal of Offshore Mechanics and Arctic Engineering*, 140(3).

Book Chapters

1. **Lan, K.**, Park, S., & Yao, Y.* (2020). Key Issue, Challenges, and Status Quo of Models for Biofuel Supply Chain Design. In *Biofuels for a More Sustainable Future* (pp. 273-315). Elsevier.

RESEARCH GRANTS

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- Innovative Wood-Product as a Nature-Based Solution to Planetary Challenges. Yale Planetary Solutions Project. Key Personnel. \$80,000
 - The Natural Carbon Consequence of Cross Laminated Timber. Yale Center for Natural Carbon Capture. Key Personnel. \$100,000

AWARDS

- ISSST Poster Award (2019)
- University Graduate Fellowship (2017)
- Outstanding Undergraduate Student of Shanghai (2014)
- China National Scholarship (2013)
- SIOMMS First Prize (Students International Olympiad on Mechanism and Machine Science) 2013
- Excellent Undergraduate (2013)
- First Prize in National Physics Competition (2012)
- China National Scholarship (2012)

SERVICES

Committee and Advisory Board

- Committee member, Forests & Embodied Carbon Committee, 2022-2023.

Service to Scientific and Professional Organizations

- Theme chair for International Symposium for Sustainable Systems and Technology, 2021

Invited Reviewer

- Journal Reviewer:

Resources, Conservation & Recycling

GCB Bioenergy

One Earth

Journal of Cleaner Production

Scientific Reports

ACS Sustainable Chemistry & Engineering

Clean Waste Systems

Transactions on Microwave Theory and Techniques

Food and Energy Security

Fluid Dynamics Research

European Journal of Wood and Wood Products

Sustainability

Energies

Processes

BioResources

IEEE Transactions on Automation Science and Engineering

Thermo

Aircraft Engineering and Aerospace Technology

- Conference Reviewer:

International Symposium on Sustainable Systems and Technology, 2019, 2021

Design for Manufacturing and the Life Cycle, 2021

International Design Engineering Technical Conferences & Computers and Information in Engineering, 2021, 2022

PROFESSIONAL AFFILIATIONS

- Member, International Society of Industrial Ecology (ISIE) (2021-present)

EDUCATION ACTIVITIES

North Carolina State University, NC, USA

Course Instructor PSE 476/FB 576 Environmental Life Cycle Analysis Yale University, CT, USA	2023
Course Coordinator ENV 884 Industrial Ecology	2021
Course Coordinator ENV 838 Life Cycle Analysis North Carolina State University, NC, USA	2021,2022
Course Instructor PSE 476/FB 576 Environmental Life Cycle Analysis	2020

INVITED TALKS

- Utilizing urban tree waste for climate change and eutrophication mitigation. Seminar, In: *Yale University, CT.* Mar 2022
- Process Modeling of Decentralized Fast Pyrolysis Biorefineries with Blended Feedstocks in the Southeastern United States. Project Annual Meeting, In: *Auburn University, AL.* Dec 2020
- System Analysis of Decentralized Fast Pyrolysis Biorefineries with Blended Feedstocks in the Southeastern United States. Project Annual Meeting, In: *Auburn University, AL.* Nov 2019
- Life Cycle Analysis of Decentralized Preprocessing Systems for Fast Pyrolysis Biorefineries with Blended Feedstocks in the Southeastern U.S. Invited Seminar, In: *U of Tennessee: Knoxville, TN.* Oct 2018
- Techno-economic analysis of Decentralized Preprocessing Systems for Fast Pyrolysis Biorefineries with Blended Feedstocks in the Southeastern United States. Project Annual Meeting, In: *Idaho National Laboratory, ID.* Aug 2018

CONFERENCE PRESENTATIONS

Oral Presentations

1. **Lan, K.,** Kelley, S. S., Nepal, P., & Yao, Y. (June 2021). Understanding the dynamic and variabilities in life cycle carbon and energy analysis for cross-laminated timber produced in the Southeastern United States. *International Symposium for Sustainable Systems and Technology (ISSST) 2021, Virtual.*
2. **Lan, K.,** Ou, L., Park, S., Kelley S. S. and Y. Yao (November 2020). Carbon and Energy Implications of Fast Pyrolysis Biorefineries with Blended Feedstocks and Decentralized Supply Chain Design in the Southeastern United States. *AIChE Annual Meeting 2020, Virtual.*
3. **Lan, K.,** & Yao, Y. (June 2019). An Integrated Life-Cycle Modeling Framework for Dynamic Agriculture Systems. *International Symposium for Sustainable Systems and Technology (ISSST) 2019, Portland, OR.*
4. **Lan, K.,** Ou, L., Park, S., Kelley, S. S., Nepal, P., Kwon, H., Cai, H., Wang, M., & Yao, Y. (October 2019). Understanding the Variations of Life Cycle Energy Consumptions and Greenhouse Gas Emissions of Biofuel Production from Southern Pine Residues. *International Society of Wood Science and Technology (SWST) 2019, Yosemite, CA.*
5. **Lan, K.,** Ou, L., Park, S., Kelley, S. S., Nepal, P., Kwon, H., Cai, H., Wang, M., & Yao, Y. (November 2019). Quantifying Variability in Life Cycle Environmental Footprints of Biofuel Produced from Forest Residues in the United States. *American Institute of Chemical Engineers (AIChE) 2019 Annual Meeting, Orlando, FL.*
6. **Lan, K.,** Ou, L., Park, S., Kelley, S. S., Nepal, P., Kwon, H., Cai, H., Wang, M., & Yao, Y. (November 2019). Understanding the Uncertainties in Environmental Life Cycle Energy and Carbon Analysis for Biofuel from Forest Residue in the United States. *American Institute of Chemical Engineers (AIChE) 2019 Annual Meeting, Orlando, FL.*
7. **Lan, K.,** Ou, L., Park, S., Kelley, S. S., English, B. C., Yu, T. E., Larson, J., & Yao, Y. (November 2019). Techno-Economic Analysis and Life Cycle Assessment of Decentralized Preprocessing System for Fast Pyrolysis Biorefineries with Blended Feedstocks in the Southeastern United States. *American Institute of Chemical Engineers (AIChE) 2019 Annual Meeting, Orlando, FL.*

Poster Presentations

1. **Lan, K.,** & Yao, Y. (June 2023). Economic and environmental feasibility of hydrogen production from gasifying mixed

plastic waste with carbon capture and storage. *International Society for Industrial Ecology Conference 2023, Leiden, Netherlands*.

2. **Lan, K.**, & Yao, Y. (June 2022). Techno-economic analysis of hydrogen produced from the gasification of mixed plastic waste. *Gordon Research Conference in Industrial Ecology 2022, Newry, ME*.
3. **Lan, K.**, Ou, L., Park, S., Kelley, S. S., English, B. C., Yu, T. E., Larson, J., & Yao, Y. (June 2019). Techno-Economic Analysis and Life Cycle Assessment of Decentralized Preprocessing System for Fast Pyrolysis Biorefineries with Blended Feedstocks in the Southeastern United States. *International Symposium for Sustainable Systems and Technology (ISSST) 2019, Portland, OR*.
4. **Lan, K.**, Ou, L., Park, S., Kelley, S. S., Nepal, P., Kwon, H., Cai, H., Wang, M., & Yao, Y. (November 2019). Quantifying Variability in Life Cycle Environmental Footprints of Biofuel Produced from Forest Residues in the United States. *American Institute of Chemical Engineers (AIChE) 2019 Annual Meeting, Orlando, FL*.
5. **Lan, K.**, & Yao, Y. (September 2018). Integrating Life Cycle Assessment and Agent-Based Modeling: A Dynamic Modeling Framework for Sustainable Agriculture Systems. *American Center for Life Cycle Assessment (ACLCA) XVIII, Fort Collins, CO*.