

# Lorenzo Rosa

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## CURRENT ACADEMIC POSITION

Principal Investigator, Biosphere Sciences and Engineering, *Carnegie Institution for Science*, 2022-

## EDUCATION

Ph.D. in Environmental Science and Engineering, *University of California, Berkeley*, 2020

- Mentors: Paolo D'Odorico, Jeffrey Reimer, Dennis Baldocchi, Daniel Kammen.
- Dissertation title: Global Water Challenges of Food and Energy Systems in the 21st Century.

MS in Environmental and Civil Engineering with distinction, *Politecnico di Milano*, 2016.

- Thesis title: The Water-Energy-Food Nexus of Production from Shale Oil, Shale Gas and Oil Sands.

BS in Environmental and Civil Engineering, *Politecnico di Milano*, 2014

## PAST ACADEMIC APPOINTMENTS

Postdoctoral Scholar, Department of Mechanical and Process Engineering, *ETH Zurich*, 2020-2021

- Mentor: Marco Mazzotti.
- Focus on: Carbon dioxide removal and hydrogen production technologies.

Visiting Student, Department of Environmental Engineering, *University of Virginia*, 2016

Exchange Student, Department of Environmental Engineering, *KTH Royal Institute of Technology*, 2015

## AWARDS AND FELLOWSHIPS

Highly Cited Researchers list from Clarivate. 2025

*Recognized among researchers with multiple Highly Cited Papers™ (top 1% by citations in their field), selected through both citation impact and international peer recognition.*

Institute of Physics (IOP) Publishing Top Cited Paper Award. 2025

*Recognized by IOP Publishing for research ranked in the top 1% of most cited papers in its subject category and among the most cited articles across the entire IOP Publishing portfolio (2022–2024).*

Water Young Investigator Award. 2025

*Award to acknowledge the achievements of young investigators in the field of all aspects of water, including water science, technology, management and governance.*

Editor's Choice Award. Environmental Research Letters. 2024

*Award for most outstanding review article published in 2023 in Environmental Research Letters.*

Leonardo Award in Engineering, Leonardo Da Vinci Society. 2023

*Award that recognizes the outstanding contributions of Italian/Italian American early career researchers.*

Franco Strazzabosco Award for research in Sustainable Energy. Italian Scientists & Scholars in North America Foundation. Finalist. 2023

*Early-career award for Italian researchers working in the United States or Canada, in recognition of their significant and innovative contributions in engineering.*

Embassy of Italy Award for Research in Food Equitability. Italian Scientists & Scholars in North America Foundation. Finalist. 2022

*Early-career award for Italian researchers working in the United States or Canada, in recognition of their significant and innovative contributions in food sustainability.*

American Geophysical Union, Science for Solutions Award. 2021

*An internationally recognized award in recognition of significant contributions in the application and use of the Earth and space science to solve societal problems.*

Forbes 30 Under 30 Europe, Science and Technology list. 2020

*Listed among the 30 most influential young leaders in Science and Technology.*

UC Berkeley Distinguished Lecture by an outstanding finishing student. 2020

*Seminar awarded to the outstanding finishing PhD student in the department.*

American Geophysical Union, Horton Hydrology Research Grant (\$10,000). 2019

*An internationally recognized hydrology research grant awarded to three PhD students per year.*

Ermenegildo Zegna Founder's Scholarship. 2017-2020

*Highly competitive Italian scholarship for post-graduate studies abroad.*

Carbon Neutrality Initiative Fellowship, University of California Office of the President. 2017

Starter Grant, Department of Environmental Science Policy and Management, UC Berkeley. 2017

Gustavo Sclocchi Thesis Award, Society of Petroleum Engineers Italian Section. 2016

## **RESEARCH GRANTS AND GIFTS**

Donor gift, "Revolutionizing fertilizers production via decentralized low-carbon technologies", 2025, **PI (\$100,000)**

Sloan Foundation, "Evaluating cost-effectiveness of centralized and decentralized ammonia production under US decarbonization policies", 2024-2026, **PI (\$250,000)**

Donor gift, "Revolutionizing fertilizers production via decentralized low-carbon technologies", 2024, **PI (\$50,000)**

Stanford's Precourt Institute for Energy, "Revolutionizing ammonia production: Unlocking the potential of distributed low-carbon technologies", 2023-2025, **PI (\$200,000)**

Carnegie Venture Grant, "Quantification of the compound impact of heat and light stress on plant productivity", 2023-2025, **PI (\$150,000)**

Schmidt Sciences, "Mapping groundwater constraints through technical potential of managed aquifer recharge", 2023, **PI (\$150,000)**

ClimateWorks Foundation, "A roadmap to align fertilizer with 1.5°C while enhancing food and energy security", 2022, **PI (\$150,000)**

## **TEACHING EXPERIENCE**

Guest lectures at Stanford University, **Water, Energy, and Agricultural Sustainability**. 2022-

Teaching Assistant at ETH Zurich, **CO<sub>2</sub> Capture and Storage and the Industry of Carbon-based Resources**. 2021

Graduate Student Instructor at University of California Berkeley, **Energy Solutions: Carbon Capture and Storage**. 2018

Graduate Student Instructor at University of California Berkeley, **Sustainable Water and Food Security**. 2017-2020

## ACADEMIC SERVICE AND OUTREACH

**Peer Reviewer** for 15 to 20 articles per year, regularly including: Nature Food, Nature Climate Change, Energy & Environmental Science, Environmental Research Letters, Renewable & Sustainable Energy Reviews, Water Resources Research, Advances in Water Resources, Journal of Hydrology, Nature, Science Advances, Nature Sustainability, Nature Water, Nature Communications, Geophysical Research Letters, Earth's Future, One Earth.

**Institute of Physics Trusted Reviewer 2023** in recognition of an exceptional peer review competency.

### Reviewer:

**Schmidt Sciences Energy Program** (2025). Served as an expert reviewer for five 10-million-dollar grant proposals focused on the decarbonization of energy systems.

**Food Planet Prize** (2025). Served as an expert reviewer to assess the technical feasibility of a novel technology designed to produce ammonia fertilizers from air. Technology was subsequently awarded the prize.

**European Research Council** (2023, 2025). Reviewed proposals.

**National Science Foundation** (2023). Reviewed proposals.

**International Energy Agency** (2021). Reviewed the “Ammonia Technology Roadmap” report.

**Department Service:** Carnegie Institution for Science, Seminar series organizer, 2022-2025

### Advisory:

**Schmidt Sciences Water Program**, 2023-2024. Served as an expert advisor for writing a 50-million-dollar grant call focused on water resources and food-energy-water nexus.

**Editor:** Environmental Research: Food Systems, 2023-

**Session Convener** for American Geophysical Union Annual Meeting:

**Lorenzo Rosa**, Rafael Schmitt, Chenchen Ren, Liyin He. Advancing Climate-Smart Agriculture: From Assessing Risks to Implementing Sustainable Adaptation. 2024.

**Lorenzo Rosa**, Rafael Schmitt, Yanlei Feng, Liyin He. Global-to-local Solutions for Climate Mitigation and Adaptation in Agriculture. 2023.

## PUBLICATIONS

(underline indicates student or postdoc under my supervision)

61. **Rosa L**, Citrini A, Terlouw T, Mingolla S. Water scarcity risks in ammonia fertilizer production pose a threat to global food security. *Environmental Science & Technology*.  
<https://doi.org/10.1021/acs.est.5c14489>
60. Mingolla S and **Rosa L**. Techno-economic feasibility of centralized and decentralized ammonia production in the United States. *Renewable and Sustainable Energy Reviews*.  
<https://doi.org/10.1016/j.rser.2025.116486>

59. Kumar S, **Rosa L**, Mohanty B, Rajan N, Calabrese S. Balancing productivity and climate impact: A framework to assess climate-smart irrigation. *Earth's Future*. <https://doi.org/10.1029/2025EF006116>
58. Li Z, **Rosa L**, Gorelick S. Severe floods significantly reduce global rice yields. *Science Advances*. <https://doi.org/10.1126/sciadv.adx7799>
57. **Rosa L**, Gabrielli P, Sangiorgio M. Global energy, costs, and emissions from reverse osmosis desalination under future water scarcity. *Water Research*. <https://doi.org/10.1016/j.watres.2025.124825>
56. Citrini A, Sangiorgio M, **Rosa L**. Global multi-model trends of unsustainable irrigation under climate change scenarios. *Environmental Research Letters*. <https://doi.org/10.1088/1748-9326/adfcee>
55. Ren C and **Rosa L**. Global energy and emissions of irrigation and fertilizers management for closing crop yield gaps. *Environmental Research Letters*. <https://doi.org/10.1088/1748-9326/adfbfd>
54. **Rosa L** and He L. Global multi-model projections of green water scarcity risks in rainfed agriculture under 1.5°C and 3°C warming (2025). *Agricultural Water Management*. <https://doi.org/10.1016/j.agwat.2025.109519>
53. Khan M, Sangiorgio M, **Rosa L**. Potential of wastewater to alleviate water scarcity under warming scenarios (2025). *Environmental Research Letters*. <https://doi.org/10.1088/1748-9326/ad31d>
52. Mingolla S and **Rosa L**. Low-Carbon ammonia fertilizers are essential for resilient and sustainable agriculture (2025). *Nature Food*. <https://doi.org/10.1038/s43016-025-01125-y>
51. **Rosa L** and Sangiorgio M. Global water gaps under future warming levels (2025). *Nature Communications*. <https://doi.org/10.1038/s41467-025-56517-2>
50. Zhao G, Gao H, Li Y, Tang Q, Woolway L, Merder J, **Rosa L**, Michalak A. Decoupling of surface water storage from precipitation in global drylands due to anthropogenic activity (2025). *Nature Water*. <https://doi.org/10.1038/s44221-024-00367-7>
49. Ren C, He L, **Rosa L**. Integrated irrigation and nitrogen optimization is a resource-efficient adaptation strategy for US maize and soybean production (2025). *Nature Food*. <https://doi.org/10.1038/s43016-024-01107-6>
48. Mekonnen M, Kebede M, Demeke B, Carr J, Chapagain A, Dalin C, Debaere P, D'Odorico P, Marston L, Ray C, **Rosa L**, Zhuo L. Trends and environmental impacts of virtual water trade (2024). *Nature Reviews Earth & Environment*. <https://doi.org/10.1038/s43017-024-00605-2>
47. Schueler Y, Mingolla S, Boness N, **Rosa L**. How are decarbonization policies in the US and Canada shaping low-carbon ammonia production strategies? (2024). *Environmental Research Letters*. <https://doi.org/10.1088/1748-9326/ad858c>
46. Xin Z, Sabo R, **Rosa L**, Niazi H, Kyle P, Byun JS, Wang Y, Yan X, Gu B, Davidson E (2024). Nitrogen management during decarbonization (2024). *Nature Reviews Earth & Environment*. <https://doi.org/10.1038/s43017-024-00586-2>
45. Ren C, He L, Ma Y, Reis S, van Grinsven H, Lam S, **Rosa L**. Trade-offs in agricultural outcomes across farm sizes (2024). *Earth Critical Zone*. <https://doi.org/10.1016/j.ecz.2024.100007>
44. Terlouw T, **Rosa L**, Bauer C, McKenna R. Future hydrogen economies imply environmental trade-offs and a supply-demand mismatch (2024). *Nature Communications*. <https://doi.org/10.1038/s41467-024-51251-7>

43. Gabrielli P, Goericke H, **Rosa L**. Optimal combination of net-zero pathways for minimum energy, land, and water consumption in chemical production (2024). *Industrial & Engineering Chemistry Research*. <https://doi.org/10.1021/acs.iecr.4c01649>
42. **Rosa L**, Ragettli S, Sinha R, Zhovtonog O, Yu W, Karimi P. Regional irrigation expansion can support climate resilient crop production in post-invasion Ukraine (2024). *Nature Food*. <https://doi.org/10.1038/s43016-024-01017-7>
41. Tonelli D, **Rosa L**, Gabrielli P, Parente A, Contino F. Cost-competitive decentralized ammonia fertilizers production can increase food security (2024). *Nature Food*. <https://doi.org/10.1038/s43016-024-00979-y>
40. Schmitt R and **Rosa L**. Dams for hydropower and irrigation: Trends, challenges, and alternatives for climate mitigation and adaptation (2024). *Renewable and Sustainable Energy Reviews*. <https://doi.org/10.1016/j.rser.2024.114439>
39. Marconi P and **Rosa L**. Global potential nitrogen recovery from anaerobic digestion of agricultural residues (2024). *Environmental Research Letters*. <https://doi.org/10.1088/1748-9326/ad428e>
38. Qin J, Duan W, Zou S, Chen Y, Huang W, **Rosa L**. Global energy use and carbon emissions from irrigated agriculture (2024). *Nature Communications*. <https://doi.org/10.1038/s41467-024-47383-5>
37. Feng Y and **Rosa L**. Global biomethane and carbon dioxide removal potential through anaerobic digestion of waste biomass (2024). *Environmental Research Letters*. <https://doi.org/10.1088/1748-9326/ad1e81>
36. He L, **Rosa L**, Lobell D, Wang Y, Yin Y, Doughty R, Yao Y, Berry J, Frankenberg C. The weekly cycle of photosynthesis in Europe reveals the negative impact of particulate pollution on ecosystem productivity (2023). *Proceedings of the National Academy of Sciences*. <https://doi.org/10.1073/pnas.2306507120>
35. Marconi P and **Rosa L**. Role of biomethane to offset fossil natural gas (2023). *Renewable and Sustainable Energy Reviews*. <https://doi.org/10.1016/j.rser.2023.113697>
34. Tonelli D, **Rosa L**, Gabrielli P, Caldeira K, Parente A, Contino F. Global land and water limits to electrolytic hydrogen production using wind and solar resource (2023). *Nature Communications*. <https://doi.org/10.1038/s41467-023-41107-x>
33. **Rosa L** and Gabrielli P. Achieving net-zero emissions in agriculture: A review (2023). *Environmental Research Letters*. <https://doi.org/10.1088/1748-9326/acd5e8>
32. Gabrielli P, **Rosa L**, Gazzani M, Meys R, Bardow A, Mazzotti M, Sansavini G. Net-zero emissions chemical industry in a world of limited resources (2023). *One Earth*. <https://doi.org/10.1016/j.oneear.2023.05.006>
31. He L and **Rosa L**. Solutions to agricultural green water scarcity under climate change (2023). *PNAS Nexus*. <https://doi.org/10.1093/pnasnexus/pgad117>
30. **Rosa L** and Gabrielli P. Energy and food security implication of transitioning fertilizers to net-zero emissions (2022). *Environmental Research Letters*. <https://doi.org/10.1088/1748-9326/aca815>
29. Schmitt R, **Rosa L**, Daily G. Global expansion of sustainable irrigation limited by water storage (2022). *Proceedings of the National Academy of Sciences*. <https://doi.org/10.1073/pnas.2214291119>
28. **Rosa L**. Adapting agriculture to climate change with sustainable irrigation: Biophysical potentials and feedback (2022). *Environmental Research Letters*. <https://doi.org/10.1088/1748-9326/ac7408>

27. Van Maanen N, Andrijevic M, Lejeune Q, **Rosa L**, Lissner T, Schleussner CF. Accounting for socioeconomic constraints in sustainable irrigation expansion assessments (2022). *Environmental Research Letters*. <https://doi.org/10.1088/1748-9326/ac77a5>
26. **Rosa L**, Becattini V, Gabrielli P, Andreotti A, Mazzotti M. Carbon dioxide mineralization in recycled concrete aggregates can contribute immediately to carbon-neutrality (2022). *Resources, Conservation & Recycling*. <https://doi.org/10.1016/j.resconrec.2022.106436>
25. **Rosa L** and Mazzotti M. Potential for hydrogen production from sustainable biomass with carbon capture and storage (2022). *Renewable and Sustainable Energy Reviews*. <https://doi.org/10.1016/j.rser.2022.112123>
24. Jenkins W, **Rosa L**, Schmidt J, Band L, Beltran-Peña A, Clarens A, Doney S, Emanuel R, Glassie A, Quinn G, Rulli MC, Shobe W, Szeptycki L, D'Odorico P. Values-Based Scenarios of Water Security: Rights to Water, Rights of Waters, and Commercial Water Rights (2021). *BioScience*. <https://doi.org/10.1093/biosci/biab088>
23. Zhang X, Yao G, Vishwakarma S, Dalin C, Komarek A, Kanter DR, Davis KF, Pfeifer K, Zhao J, Zou T, D'Odorico P, Folberth C, Galeana Rodriguez F, Fanzo J, **Rosa L**, Dennison W, Musumba M, Heyman A, Davidson E. Quantitative assessment of agricultural sustainability reveals divergent priorities among nations (2021). *One Earth*. <https://doi.org/10.1016/j.oneear.2021.08.015>
22. **Rosa L**, Sanchez D, Mazzotti M. Assessment of carbon dioxide removal potential via BECCS in a carbon neutral Europe (2021). *Energy & Environmental Science*. <https://doi.org/10.1039/D1EE00642H>
21. **Rosa L**, Rulli MC, Ali S, Chiarelli DD, Dell'Angelo J, Mueller N, Scheidel A, Siciliano G, D'Odorico P. Energy implications of the 21st century agrarian transition (2021). *Nature Communications*. <https://doi.org/10.1038/s41467-021-22581-7>
20. Terlouw T, Bauer C, **Rosa L**, Mazzotti M. Life cycle assessment of carbon dioxide removal technologies: A critical review (2021). *Energy & Environmental Science*. <https://doi.org/10.1039/D0EE03757E>
19. Müller M, Penny G, Niles M, Ricciardi V, Chiarelli DD, Davis KF, Dell'Angelo J, D'Odorico P, **Rosa L**, Rulli MC, Mueller N. Impact of transnational land acquisitions on local food security and dietary diversity (2021). *Proceedings of the National Academy of Sciences*. <https://doi.org/10.1073/pnas.202053511>
18. **Rosa L**, Sanchez D, Realmonte G, Baldocchi D, D'Odorico P. The water footprint of carbon capture and storage technologies (2020). *Renewable & Sustainable Energy Reviews*. <https://doi.org/10.1016/j.rser.2020.110511>
17. **Rosa L**, Chiarelli DD, Sangiorgio M, Beltran-Pena A, Rulli MC, D'Odorico P, Fung I. Potential for sustainable irrigation expansion in a 3C warmer climate (2020). *Proceedings of the National Academy of Sciences*. <https://doi.org/10.1073/pnas.201779611>
16. D'Odorico P, Chiarelli DD, **Rosa L**, Bini A, Zilberman D, Rulli MC. The global value of water in agriculture (2020). *Proceedings of the National Academy of Sciences*. <https://doi.org/10.1073/pnas.200583511>
15. Chiarelli DD, Passera C, **Rosa L**, Davis KF, D'Odorico P, Rulli MC. The green and blue crop water requirement WATNEEDS model and its global gridded outputs (2020). *Scientific Data*. <https://doi.org/10.1038/s41597-020-00612-0>
14. Beltran-Pena A, **Rosa L**, D'Odorico P. Global food self-sufficiency in the 21st century under sustainable intensification of agriculture (2020). *Environmental Research Letters*. <https://doi.org/10.1088/1748-9326/ab9388>



13. **Rosa L**, Reimer J., Went M., D'Odorico P. Hydrological limits to carbon capture and storage (2020). *Nature Sustainability*. <https://doi.org/10.1038/s41893-020-0532-7>
12. Chiarelli DD, Passera C, Rulli MC, Ciruolo G, **Rosa L**, D'Odorico P. Hydrological consequences of natural rubber plantations in Southeast Asia (2020). *Land Degradation & Development*. <https://doi.org/10.1002/ldr.3591>
11. **Rosa L**, Chiarelli DD, Rulli MC, Dell'Angelo J, D'Odorico P. Global agricultural economic water scarcity (2020). *Science Advances*. <https://doi.org/10.1126/sciadv.aaz6031>
10. Borsato E, **Rosa L**, Marinello F, Tarolli P, D'Odorico P. Weak and strong sustainability of irrigation: A framework for irrigation practices under limited water availability (2020). *Frontiers in Sustainable Food Systems*. <https://doi.org/10.3389/fsufs.2020.00017>
9. Graves A, **Rosa L**, Nouhou A, Maina F, Adoum D. Avert catastrophe now in Africa's Sahel (2019). *Nature*. <https://doi.org/10.1038/d41586-019-03445-z>
8. **Rosa L**, Chiarelli DD, Tu C, Rulli MC, D'Odorico P. Global unsustainable virtual water flows in agricultural trade (2019). *Environmental Research Letters*. <https://doi.org/10.1088/1748-9326/ab4bfc>
7. D'Odorico P, Carr J, Dalin C, Dell'Angelo J, Konar M, Laio F, Ridolfi L, **Rosa L**, Suweis S, Tamea S, Tuninetti M. Global virtual water trade and the hydrological cycle: Patterns, drivers, and socio-environmental impacts (2019). *Environmental Research Letters*. <https://doi.org/10.1088/1748-9326/ab05f4>
6. **Rosa L** and D'Odorico P. The water-energy-food nexus of unconventional oil and gas extraction in the Vaca Muerta Play, Argentina (2018). *Journal of Cleaner Production*. <https://doi.org/10.1016/j.jclepro.2018.10.039>
5. **Rosa L**, Rulli MC, Davis KF, Chiarelli DD, Passera C, D'Odorico P. Closing the yield gap while ensuring water sustainability (2018). *Environmental Research Letters*. <https://doi.org/10.1088/1748-9326/aadeef>
4. D'Odorico P, Davis KF, **Rosa L**, Carr J, Chiarelli DD, Dell'Angelo J, Gephart J, MacDonald G, Seekel D, Suweis S, Rulli MC. The global food-energy-water nexus (2018). *Reviews of Geophysics*. <https://doi.org/10.1029/2017RG000591>
3. **Rosa L**, Davis KF, Rulli MC, D'Odorico P. The water-energy nexus of hydraulic fracturing: A global hydrologic analysis for shale oil and gas extraction (2018). *Earth's Future*. <https://doi.org/10.1002/2018EF000809>
2. Chiarelli D, **Rosa L**, Rulli MC, D'Odorico P. The water-land-food nexus of natural rubber production (2018). *Journal of Cleaner Production*. <https://doi.org/10.1016/j.jclepro.2017.12.021>
1. **Rosa L**, Davis KF, Rulli MC, D'Odorico P. Environmental consequences of oil production from oil sands (2017). *Earth's Future*. <https://doi.org/10.1002/2016EF000484>

### **Book Chapters**

**Rosa, L.**, Rulli, M.C. and D'Odorico, P., 2020. Water stranding in the energy and agriculture sectors: The case of hydraulic fracturing in water scarce irrigated regions. In *Water Resources and Economic Processes* (pp. 98-114). *Routledge*.

D'Odorico, P., **Rosa, L.**, Bhattachan, A. and Okin, G.S., 2019. Desertification and land degradation. *Dryland ecohydrology*, pp.573-602. *Springer*.

## **Industry and policy reports**

Barrera F, Paul C, Janke L, Seubert E, Colak E, Tonelli D, **Rosa L** (2025). Breaking new ground: decentralised renewable nitrogen fertilisers. Exploring opportunities and barriers. *Agora Industry*. <https://www.agora-industry.org/publications/breaking-new-ground-decentralised-renewable-nitrogen-fertilisers>

**Rosa L** (2025). Nitricity organic fertilizer production ISO-compliant LCA. *Nitricity*.

Ragettli S, **Rosa L**, Sinha R, Karimi P (2024). The future of irrigation in Ukraine. Washington, D.C.: *World Bank Group*. <http://documents.worldbank.org/curated/en/099062524074575405>

**Rosa L** (2024). Identifying potential physical impacts and risks under two climate change models for SIPEF's assets. *SIPEF*. <https://www.sipef.com/>

Rasmussen M, Bøttcher J, **Rosa L** (2023). The potential and risks of carbon dioxide removal based on carbon capture and storage in the EU. *CONCITO*. <https://concito.dk/files/media/document/The%20potential%20and%20risks%20of%20carbon%20dioxide%20removal%20based%20on%20carbon%20capture%20and%20storage%20in%20the%20EU%2028.06.2022.pdf>

## **New datasets:**

Global multi-model trends of unsustainable irrigation under climate change scenarios  
<https://zenodo.org/records/16895195>

Global energy and carbon emissions of irrigation and fertilizers management for closing crop yield gaps  
<https://zenodo.org/records/16899118>

Global ammonia fertilizers production facilities and supply chain  
<https://zenodo.org/records/15170915>

Global water gaps under future warming scenarios  
<https://zenodo.org/records/14617015>

Global geospatial data for electrolytic hydrogen production cost and GHG emissions:  
<https://zenodo.org/records/10244447>

Geospatial extent of cost-competitive decentralized ammonia production worldwide:  
<https://zenodo.org/records/10492719>

Irrigation extent and water use in Ukraine:  
<https://zenodo.org/records/12106370>

Global potential nitrogen recovery from agricultural residues:  
<https://zenodo.org/records/10806812>

Global energy use and greenhouse gas emissions from irrigation:  
<https://zenodo.org/records/10118986>

Global biogas and carbon dioxide removal potential from waste and residues biomass:  
<https://zenodo.org/records/10069943>

Global agricultural green water scarcity under climate change:  
<https://zenodo.org/record/7187381>



European carbon dioxide removal potential via BECCS:

<https://zenodo.org/record/4441678>

Monthly global green-, blue-, and economic-water scarcity:

<https://zenodo.org/record/3677485>

Global sustainable irrigation expansion potential under current and future climate conditions:

<https://zenodo.org/record/3995044>

Unsustainable virtual water flows embedded in international food trade:

<https://zenodo.org/record/2593800>

## INVITED TALKS

Agricultural Utilization Research Institute, Minneapolis, 2025. *The Potential of Biogas in Minnesota, the U.S., and the World*.

Centers of the Fuels of the Future, Stanford, 2025. *Techno-economic and life cycle assessment of electrified ammonia production*.

KBR, Stanford, 2025. *Stanford research on ammonia*.

Hydrogen Mountain Retreat, Saoradh Enterprise Partners, Boulder, 2025. *Powering data centers with hydrogen*.

Precourt Institute for Energy, Stanford, 2025. *Techno-economic and environmental assessment of low-carbon ammonia production*.

ETH Zurich, Zurich, 2025. *Techno-economic and environmental assessment of low-carbon ammonia production: From U.S. to global perspectives*.

Peking University, Beijing, 2025. *Water, Energy, and Fertilizers: Pathways to Sustainable and Climate-Resilient Agriculture*.

China Agricultural University, Beijing, 2025. *Water, Energy, and Fertilizers: Pathways to Sustainable and Climate-Resilient Agriculture*.

Chinese Academy of Sciences, Beijing, 2025. *Water, Energy, and Fertilizers: Pathways to Sustainable and Climate-Resilient Agriculture*.

Zhejiang University, Hangzhou, 2025. *Water, Energy, and Fertilizers: Pathways to Sustainable and Climate-Resilient Agriculture*.

Gordon Research Conference, Carbon Capture, Utilization and Storage, Ventura, 2025. **Keynote speaker**. *Water Requirements and Scarcity Implications of Carbon Capture and Storage*.

<https://www.grc.org/carbon-capture-utilization-and-storage-conference/2025/>

Novo Nordisk Foundation CO2 Research Center. Online event, 2025. *Global potential biomethane, nitrogen recovery, carbon dioxide removal from anaerobic digestion of waste biomass and agricultural residues*.

Maxine Singer's Life and Legacy. Washington DC, 2024. *Sustainable Water and Food Security Under Climate Change*. <https://www.youtube.com/watch?v=FOBjSsEdb5c>

American Geophysical Union, Annual Meeting, Washington DC, 2024. *Regional Irrigation Expansion Can Support Climate-Resilient Crop Production*.

American Geophysical Union, Annual Meeting, Washington DC, 2024. *Energy and Food Security Implications of Transitioning Ammonia-Based Fertilizers to Net-Zero Emissions*.

Stanford Precourt Institute for Energy Symposium 'Ammonia in the Low-Carbon Energy System of the Future', Stanford, 2024. *Revolutionizing Fertilizers Production via Decentralized Low-Carbon Technologies*. <https://sites.google.com/stanford.edu/h2ammoniaoct29?usp=sharing>

Stanford University, Department of Civil and Environmental Engineering, 2024. *Water as a Limiting Factor for Climate Adaptation and Mitigation: Challenges for Sustainable Food and Energy Production*

Saoradh Enterprise Partners, Boulder, 2024. *Decarbonizing Ammonia*.

Gates Foundation, Seattle, 2024. *Revolutionizing ammonia fertilizer production for food security in Africa*.

University of Maryland, Baltimore, 2024. *Small-scale decentralized ammonia production could become cost-competitive by 2030*.

Clean Air Task Force, online event, 2024. *Biomethane, nitrogen recovery, and carbon dioxide removal from anaerobic digestion of waste biomass*.

Schmidt Futures, New York, 2024. *Water limits agriculture and climate mitigation*.

Carnegie Institution for Science fundraising event, New York, 2024. *Meeting the Challenge of Sustainable Food Production under Climate Change*.

Texas Bureau of Economic Geology and National Academy of Engineering, 2024. *Linkages between Global Water Scarcity, Food Production, and Climate Change*. <https://wrp.beg.utexas.edu/node/59>

American Geophysical Union, Annual Meeting, San Francisco, 2023. *Solutions to achieve net-zero emissions in agriculture*.

Food and Agriculture Organization of the United Nations, 2023. *Adapting agriculture to climate change via sustainable irrigation*.

ETH Zurich, 2023. *Solutions to achieve net-zero emissions in agriculture*.

National University Singapore, 2023. *Meeting the Challenge of Sustainable Food Production under Climate Change*.

Aspen Global Change Institute, [link](#), 2023. *Adapting agriculture to climate change via sustainable irrigation expansion*.

Carnegie Institution for Science Board of Trustees Annual Meeting, 2023. *Meeting the Challenge of Sustainable Food Production under Climate Change*.

Danish Ministry for Climate, Energy, and Utilities, 2023. *Potential for industrial carbon removals via BECCS*.

Stanford's Precourt Institute for Energy, 2023. *Fueling the path to net-zero agriculture with hydrogen*. <https://podcasts.apple.com/us/podcast/episode-9-lorenzo-rosa-fueling-the-path-to-net-zero/id1668037861?i=1000618113149>

California Institute of Technology, Department of Environmental Science and Engineering, [link](#), 2023. *Climate change mitigation and adaptation solutions in agriculture*.

American Geophysical Union, Annual Meeting, Chicago, 2022. *Agricultural economic water scarcity and the role of irrigation expansion to adapt agriculture to climate change*.

Lawrence Berkeley National Lab, Energy Technologies Division, 2022. *Climate Mitigation and the Food, Energy, Water Nexus*.

Stanford University, Department of Earth Systems Science, 2022. *Climate Mitigation and Adaptation Solutions to Food, Energy, and Water Systems*.

American Geophysical Union, Annual Meeting, 2021. *Climate Solutions to Food, Energy, and Water Systems*.

TEDx Reggio Emilia, [link](#), 2021. *Come rimuovere 280 milioni di tonnellate di CO2 all'anno in Europa*.

American University, online event, [link](#), 2021. *Carbon Dioxide Removal via BECCS in a Carbon-Neutral Europe*.

Carnegie Institution for Science, Department of Global Ecology, Stanford, 2021. *Water challenges food and energy systems in the 21<sup>st</sup> century*.

UN Climate Change Conference, Madrid, Spain, 2019. *Climate change and the water-energy-food nexus*.

## **POSTDOCTORAL ADVISEES**

Sophie Ruehr (2025-)

Andrea Citrini (2024-)

Stefano Mingolla (2024-2025), now Assistant Professor at IE University Madrid

Chenchen Ren (2023-)

Yanlei Feng (2022-2023), now postdoc at MIT

Liyin He (2022-2024), now Assistant Professor at Duke University

## **GRADUATE STUDENT MENTORING**

Fiona Kriwan (09/2025-12/2025), MS in Mechanical Engineering visiting from ETH Zurich

Luxi Cheng (02/2025-02/2026), Ph.D. in Agricultural Resources visiting from Zhejiang University

Lorenzo Langone (03/2025-08/2025), MS in Mechanical Engineering visiting from Politecnico di Torino

Jara Späte (04/2024-10/2024), MS in Mechanical Engineering visiting from ETH Zurich

Ludwig Luz (02/2024-08/2024), MS in Mechanical Engineering visiting from ETH Zurich

Myla Kahn (01/2024-03/2025), research assistant, MS in Environmental Engineering at Stanford

Yannik Schueler (09/2023-06/2024), research assistant, MS in Mechanical Engineering at Stanford

Pietro Marconi (10/2022-12/2023), research assistant, MS in Environmental Engineering at Stanford

Davide Tonelli (06/2022-05/2024), Ph.D. in Mechanical Engineering visiting from UC Louvain

## **VISITING SENIOR SCIENTISTS HOSTED BY ROSA LAB**

Tom Terlouw (2025), Scientist, Mechanical and Process Engineering at ETH Zurich

Matteo Sangiorgio (2024-2025), Assistant Professor, Environmental Engineering at Politecnico di Milano

Paolo Gabrielli (2022-2023), Senior Scientist, Mechanical and Process Engineering at ETH Zurich

## **EXTRACURRICULAR ACTIVITIES**

Languages: Italian (native), English (fluent), and Spanish (intermediate).

I am a passionate athlete. I enjoy running, cycling, swimming, and skiing. A former competitive trail runner, I have won both regional and national championships in Italy (2011 individual Regional Champion in mountain running for men under 20; 2012 team Italian Champion overall in mountain running).

## **SELECTED MEDIA COVERAGE**

Carbon Brief (2025), "How the global 'water gap' will grow under climate change".

[https://www.carbonbrief.org/guest-post-how-the-global-water-gap-will-grow-under-climate-change/?\\_thumbnail\\_id=56314&utm\\_content=bufferae6d&utm\\_medium=social&utm\\_source=twitter.com&utm\\_campaign=buffer](https://www.carbonbrief.org/guest-post-how-the-global-water-gap-will-grow-under-climate-change/?_thumbnail_id=56314&utm_content=bufferae6d&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer)

Illuminem (2024), "Decentralized ammonia production in Europe: challenges and opportunities for current players". <https://illuminem.com/illuminemvoices/decentralized-ammonia-production-in-europe-challenges-and-opportunities-for-current-players>

E&E News (2024), "Texas water fight shows pushback on 'clean' hydrogen".  
[https://www.eenews.net/articles/texas-water-fight-shows-pushback-on-clean-hydrogen/?utm\\_source=MarketingCloud&utm\\_medium=email&utm\\_campaign=News+and+Social+Roundup+June+21+20240621&utm\\_content=Software+company+names+new+platform+after+Carnegie+Science+astronomer+Vera+Rubin](https://www.eenews.net/articles/texas-water-fight-shows-pushback-on-clean-hydrogen/?utm_source=MarketingCloud&utm_medium=email&utm_campaign=News+and+Social+Roundup+June+21+20240621&utm_content=Software+company+names+new+platform+after+Carnegie+Science+astronomer+Vera+Rubin)

Nature Outlook (2023), "Sizing up hydrogen's hydrological footprint".  
<https://www.nature.com/articles/d41586-023-03884-9>

Forbes (2023), "Five ways agriculture can help fight the climate crisis".  
<https://www.forbes.com/sites/juergeneckhardt/2023/12/04/five-ways-agriculture-can-help-solve-the-climate-crisis/?sh=361257704be1>

World Economic Forum (2023), "Here's how fertilizer could be produced more sustainably".  
<https://www.weforum.org/agenda/2023/01/fertilizer-produced-more-sustainably-climate-markets/>

The Guardian (2022), "The cost of carbon capture? More water and electricity", Sara Sneath.  
<https://www.theguardian.com/environment/2022/oct/15/emissions-capture-carbon-cost-water-electricity?>

La Repubblica (2022), "Contro la siccità e la crisi possiamo imparare a irrigare in modo efficiente", Giuliano Aluffi. [https://www.repubblica.it/green-and-blue/2022/06/27/news/clima\\_irrigazione\\_siccita\\_consumo\\_acqua-355155676/](https://www.repubblica.it/green-and-blue/2022/06/27/news/clima_irrigazione_siccita_consumo_acqua-355155676/)

Illuminem (2021), "Is Sweden becoming the World leader on BECCS?", Robert Hoglund.  
<https://illuminem.com/energyvoices/1e5e9828-a0c2-4215-8f7f-86e68b1d1488>

Circle of Blue (2021), "In climate talks, plans to keep planet from overheating should not ignore water", Brett Walton. <https://www.circleofblue.org/2021/world/in-climate-talks-plans-to-keep-planet-from-overheating-should-not-ignore-water/>

ENERGY Wire (2021), "Coal CCS threatened by water scarcity", Carlos Anchondo.  
<https://www.eenews.net/energywire/2020/05/06/stories/1063058803>