Marshall Burke

Doerr School of Sustainability, &
Center on Food Security and the Environment
Stanford University

Email: mburke@stanford.edu
Web: http://web.stanford.edu/~mburke/
Google Scholar profile

Professional appointments and affiliations

2022-present	Co-Chair, Social Sciences Division, Doerr School of Sustainability, Stanford University
2020-present	Associate Professor, Doerr School of Sustainability, Stanford University
2014-2020	Assistant Professor, Dept. of Earth System Science, Stanford University
2018-present	Deputy Director, Center on Food Security and the Environment, Stanford University
2016-present	Faculty Research Fellow, National Bureau of Economic Research
2020-present	Senior Fellow, Freeman-Spogli Institute for International Studies, Stanford University
2020-present	Senior Fellow, Woods Institute for the Environment , Stanford University
2020-present	Senior Fellow, Stanford Institute for Economic Policy Research University
2020-present	Fellow, Center for Innovation in Global Health, Stanford University
2018-present	Faculty Affiliate, King Center on International Development, Stanford University
2015-present	Faculty Affiliate, Center for Effective Global Action
2014-2015	Visiting Fellow, Stanford Institute for Economic Policy Research

Education

Ph.D., Agricultural and Resource Economics, UC Berkeley, 5/2014

B.A. International Relations, Stanford University, 6/2003

Published and forthcoming journal articles

77. Carlos F. Gould, Lissete Dávila, M. Lorena Bejarano, Marshall Burke, Darby W. Jack, Samuel B. Schlesinger, José R. Mora, Alfredo Valarezo. 2024. "Exposure to Nitrogen Dioxide and Fine Particulate Matter When Cooking with Electricity Compared to Gas, a Randomized Crossover Study in Quito, Ecuador". *Environmental Health Perspectives*, 123(1) 2024

76. Iván Higuera-Mendieta, Jeff Wen, Marshall Burke. 2023. "A table is worth a thousand pictures: Multi-modal contrastive learning in house burning classification in wildfire events". *NeurIPS* '23 Computational Sustainability Workshop, 2023

75. Jeff Wen, Sam Heft-Neal, Patrick Baylis, Judd Boomhower, Marshall Burke. 2023. "Quantifying fire-specific smoke severity". *PNAS* 120(51), 2023

74. Marshall Burke, Marissa Childs, Brandon de la Cuesta, Minghao Qiu, Jessica Li, Carlos Gould, Sam Heft-Neal, Michael Wara. "Wildfire influence on recent US pollution trends", *Nature* 622, 761–766, 2023

73. Sam Heft-Neal, Carlos F. Gould, Marissa Childs, Matt Kiang, Kari Nadeau, Mark Duggan, Eran Bendavid, Marshall Burke. "Emergency department visits respond non-linearly to wildfire smoke", *PNAS* 120(39), 2023.

72. Carlos Gould, Alfredo Valarezo, Samuel Schlesinger, Darby W. Jack, M. Lorena Bejarano, Brandon De la Cuesta, Marshall Burke. "Climate and health benefits of a transition from gas to electric cooking", *PNAS* 120 (34), 2023

71. Minghao Qiu, Nathan Ratledge, Ines Azevedo, Noah Diffenbaugh, Marshall Burke. 2023. "Drought impacts on the electricity system, emissions, and air quality in the western US". *PNAS* 120(28), 2023.

70. Hemant Pullabhotla, Mustafa Zahid, Sam Heft-Neal, Vaibhav Rathi, Marshall Burke. "Global biomass fires and infant mortality" PNAS 120(23), 2023.

69. Nathan Ratledge, Gabe Cadamuro, Brandon de la Questa, Matthieu Stigler, and Marshall Burke. Using machine learning to estimate the livelihood impact of electricity access. 2022. *Nature*, 611, 492-495.

68. Marissa Childs, Jessica Li, Jeff Wen, Sam Heft-Neal, Anne Driscoll, Sherrie Wang, Carlos Gould, Minghao Qiu, Jen Burney, Marshall Burke. Daily local-level estimates of ambient wildfire smoke PM2.5 for the contiguous US. 2022. *Environmental Science & Technology*, 2022

67. Jeff Wen and Marshall Burke. 2022. Understanding the effects of wildfire smoke exposure on educational outcomes. *Nature Sustainability*, 5, 920–921.

66. Marshall Burke, Sam Heft-Neal, Jessica Li, Anne Driscoll, Patrick Baylis, Matthieu Stigler, Joakim Weill, Jennifer Burney, Jeff Wen, Marissa Childs, Carlos Gould. 2022. Exposures and behavioral responses to wildfire smoke. *Nature Human Behavior*, 1-11.

65. Jen Burney, Geeta Persad, Jon Proctor, Eran Bendavid, Marshall Burke, Sam Heft-Neal. 2022. Geographically resolved social cost of anthropogenic emissions accounting for both direct and climate-mediated effects, *Science Advances* 8(38), 2022.

64. David JX Gonzalez, Christina K Francis, Gary M Shaw, Mark R Cullen, Michael Baiocchi, Marshall Burke. 2022. Upstream oil and gas production and ambient air pollution in California. *Science of the Total Environment* 806(1), 2022.

63. Miyuki Hino and Marshall Burke. 2021. The effect of information about climate risk on property values. *PNAS*, 118(17), 2021

62. Jihyeon Lee, Nina Brooks, Fahim Tajwar, Marshall Burke, Stefano Ermon, David Lobell, Debashish Biswas, and Steve Luby. 2021. Scalable deep learning to identify brick kilns and aid regulatory capacity. *PNAS*, 118(17), 2021

61. Marshall Burke, Anne Driscoll, Stefano Ermon, David Lobell. 2021. Using satellite imagery to understand sustainable development, *Science* 371(6535).

60. Marshall Burke, Anne Driscoll, Sam Heft-Neal, Jenny Xue, Jen Burney, and Michael Wara. 2021. The changing risk and burden of wildfire in the US. *PNAS* 118(2), 2021

59. Frances Davenport, Marshall Burke, and Noah Diffenbaugh. 2021. Contribution of historical precipitation change to US flood damages. *PNAS* 118(4), 2021.

58. Sam Heft-Neal, Anne Driscoll, Wei Yang, Gary Shaw, and Marshall Burke. 2021. Associations between wildfire smoke exposure during pregnancy and risk of preterm birth in California. *Environmental Research*, 2021.

57. Jeff Wen and Marshall Burke. 2021. Wildfire smoke plume segmentation using geostationary satellite imagery. *ICML 2021*.

56. Christopher Yeh, Chenlin Meng, Sherrie Wang, Anne Driscoll, Erik Rozi, Patrick Liu, Jihyeon Lee, Marshall Burke, David B Lobell, Stefano Ermon. 2021. SustainBench: Benchmarks for Monitoring the Sustainable Development Goals with Machine Learning, *NeurIPS '21*

55. Yutong He, Dingjie Wang, Nicholas Lai, William Zhang, Chenlin Meng, Marshall Burke, David B. Lobell, Stefano Ermon. 2021. Spatial-Temporal Super-Resolution of Satellite Imagery via Conditional Pixel Synthesis, *NeurIPS '21*

54. Elizabeth Johnston, Frances Davenport, Lijing Wang, Jef Caers, Suresh Muthukrishnan, Marshall Burke, Noah Diffenbaugh. 2021. Quantifying the effect of precipitation on landslide hazard in urbanized and non-urbanized areas. *Geophysical Research Letters*, 2021

53. Noah Diffenbaugh, Frances Davenport, and Marshall Burke. 2021. Historical warming has increased US crop insurance losses. *Environmental Research Letters*, 2021.

52. David Lobell, Stefania Di Tommaso, Marshall Burke, and Talip Kilic. 2021. Twice Is Nice: The Benefits of Two Ground Measures for Evaluating the Accuracy of Satellite-Based Sustainability Estimates. *Remote Sensing*, 2021.

51. Sam Heft-Neal, Jen Burney, Eran Bendavid, Kara Voss, and Marshall Burke. 2020. Dust pollution from the Sahara and African infant mortality. *Nature Sustainability*, https://doi.org/10.1038/s41893-020-0562-1

50. Chris Yeh, Anthony Perez, George Azzari, Anne Driscoll, Zhongyi Tang, David Lobell, Stefano Ermon, and Marshall Burke. 2020. Using publicly available satellite imagery and deep learning to understand economic wellbeing in Africa. *Nature Communications*, 2020(11), 2583.

49. David Gonzalez, Allison Sherris, Wei Yang, David K. Stevenson, Amy M. Padula, Michael Baiocchi, Marshall Burke, Mark R. Cullen, and Gary M. Shaw. 2020. Oil and gas production and spontaneous preterm birth in the San Joaquin Valley, CA: A case-control study. *Environmental Epidemiology*, 4(4), 2020.

48. Eoin McGuirk and Marshall Burke. The economic origins of conflict in Africa. *Journal of Political Economy*, 128(10), 2020.

47. David Lobell, StefaniaDi Tommaso, Calum You, Ismael Yacoubou Djima, Marshall Burke, and Talip Kilic. 2020. Sight for Sorghums: Comparisons of Satellite- and Ground-Based Sorghum Yield Estimates in Mali. *Remote Sensing* 12(1), 100.

46. Frances Davenport, Julio Herrera-Estrada, Marshall Burke, and Noah Diffenbaugh. 2020. Flood size increases nonlinearly across the western United States in response to lower snow-precipitation ratios. *Water Resources Research*, 10.1029/2019WR025571

45. Ceren Baysan, Marshall Burke, Felipe Gonzalez, Sol Hsiang, and Ted Miguel. 2019. Economic and non-economic factors in violence: evidence from organized crime, suicides and climate in Mexico. *Journal of Economic Behavior and Organization*, 168, 434-452.

44. David Lobell, George Azzari, Marshall Burke, Sydney Gourlay, Zhenong Jin, Talip Kilic, Siobhan Murray. 2019. Eyes in the sky, boots on the ground: assessing satellite- and ground-based approaches to crop yield measurement and analysis. *American Journal of Agricultural Economics*, doi: 10.1093/ajae/aaz051

43. Zach Wagner, Sam Heft-Neal, Bob Black, Ties Boerma, Zulfi Bhutta, Marshall Burke, and Eran Bendavid. 2019. Women and children living in areas of armed conflict in Africa: a geospatial analysis of mortality and orphanhood, *Lancet Global Health* 7(12), 2019.

42. Marshall Burke, Lauren Bergquist, Ted Miguel. 2019. Selling low and buying high: an arbitrage puzzle in Kenyan villages. *Quarterly Journal of Economics*, 134(2), 785-842.

41. Noah Diffenbaugh and Marshall Burke. 2019. Global warming has increased global economic inequality. *PNAS* 116 (20) 9808-9813.

40. Katherine Mach, Caroline Kraan, Neil Adger, Halvard Buhaug, Marshall Burke (+ 9 others). 2019. "Climate as a risk factor for armed conflict", *Nature* 571 (7764), 193-197.

39. Burak Uzkent, Evan Sheehan, Chenlin Meng, Zhongyi Tang, David Lobell, Marshall Burke, Stefano Ermon. "Learning to Interpret Satellite Images using Wikipedia". IJCAI-19. To appear in *Proc. 28th International Joint Conference on Artificial Intelligence*, 2019.

38. Evan Sheehan, Chenlin Meng, Matthew Tan, Burak Uzkent, Neal Jean, David Lobell, Marshall Burke, Stefano Ermon. "Predicting Economic Development using Geolocated Wikipedia Articles". KDD-19. To appear in *Proc. 25th ACM SIGKDD Conference on Knowledge Discovery and Data Mining*, 2019.

37. Wenjie Hu, Jay Harshadbhai Patel, Zoe-Alanah Robert, Paul Novosad, Samuel Asher, Zhongyi Tang, Marshall Burke, David Lobell, Stefano Ermon. 2019. "Mapping Missing Population in Rural India: A Deep Learning Approach with Satellite Imagery". To appear in *Proc. 1st AAAI/ACM Conference on Artificial Intelligence, Ethics, and Sociey* (AIES 2019).

36. Zhenong Jin, George Azzari, Calum You, Stefania Di Tommaso, Stephen Aston, Marshall Burke, and David Lobell. 2019. Smallholder maize area and yield mapping at national scales with Google Earth Engine. *Remote Sensing of Environment*, 228, 115-128.

35. Zach Wagner, Sam Heft-Neal, Bob Black, Zulfi Bhutta, Marshall Burke, and Eran Bendavid. 2018. Armed conflict and child mortality in Africa. *Lancet*, 392, issue 10150, p857-865.

34. Jonathan Proctor, Sol Hsiang, Jen Burney, Marshall Burke, and Wolfram Schlenker. 2018. Estimating the agricultural impacts of geoengineering using volcanic eruptions as natural experiments. *Nature* 560, 480-483

33. Sam Heft-Neal, Jen Burney, Eran Bendavid, and Marshall Burke. 2018. One in five infant deaths in Africa attributable to poor air quality. *Nature*, 559, 254-258.

32. Marshall Burke, Felipe Gonzalez, Patrick Baylis, Sam-Heft Neal, Ceren Baysan, Sanjay Basu, and Sol Hsiang. 2018. Effect of ambient temperature on suicide in the US and Mexico. *Nature Climate Change* 8, 723-729.

31. Marshall Burke, Matt Davis, and Noah Diffenbaugh. Large potential reduction in economic damages under UN mitigation targets. 2018. *Nature*, 559, 254-258.

30. Barak Oshri, Annie Hu, Peter Adelson, Xiao Chen, Pascaline Dupas, Jeremy Weinstein, Marshall Burke, David Lobell, Stefano Ermon. 2018. "Infrastructure Quality Assessment in Africa using Satellite Imagery and Deep Learning". Proc. 24th ACM SIGKDD Conference, 2018.

29. Zhenong Jin, George Azzari, Marshall Burke, Step Aston, David Lobell. 2017. Mapping and explaining smallholder yield heterogeneity in Eastern Africa. *Remote Sensing*, 9(9).

28. Marshall Burke and David Lobell. 2017. Satellite-based assessment of yield variation and its determinants in smallholder African systems. *PNAS* 114(9), 2189-2194.

27. Sam Heft-Neal, David Lobell, and Marshall Burke. 2017. Using remotely sensed temperature to estimate climate response functions. *Environmental Research Letters* 12(1) 014013.

26. Marshall Burke, Sam Heft-Neal, and Eran Bendavid. 2016. Understanding variation in child mortality across Sub-Saharan Africa: A spatial analysis. *Lancet Global Health*, 4(12), e936-e945

25. Neal Jean*, Marshall Burke*, Michael Xie, Matt Davis, David Lobell, and Stefano Ermon. 2016. Combining satellite imagery and machine learning to predict poverty. *Science*, 353(6301), 790-794. (*denotes equal authorship) [webpage]

24. Marshall Burke and Kyle Emerick. 2016. Adaptation to climate change: evidence from US agriculture. *American Economic Journal - Economic Policy*, 8(3), 106-140.

23. Marshall Burke, Melanie Craxton, Charlie Kolstad, Chikara Onda, and 20 coauthors. Opportunities for advances in climate change economics. 2016. *Science* 352, 292-293.

22. Tamma Carleton, Sol Hsiang, and Marshall Burke. 2016. Conflict in a changing climate. *European Physical Journal* 225, 489-511.

21. Marshall Burke, Melanie Craxton, Charlie Kolstad, Chikara Onda. 2016. Some research challenges in the economics of climate change. *Climate Change Economics*, 7(2), 2016.

20. Marshall Burke*, Sol Hsiang*, and Edward Miguel. 2015. Global non-linear effect of temperature on economic output. *Nature* 527: 235-239. (*denotes equal authorship) [webpage]

19. Marshall Burke, Sol Hsiang, Edward Miguel. Climate and conflict. *Annual Review of Economics*, 2015.

18. Marshall Burke, Edward Miguel, Shanker Satyanath, John Dykema, and David Lobell. 2015. Incorporating climate uncertainty into estimates of climate change impacts. *Review of Economics and Statistics*, 97(2): 461-471.

17. Marshall Burke, Erick Gong, Kelly Jones. 2015. Income shocks and HIV. *Economic Journal* 125, 1157-1189.

16. Sol Hsiang, Marshall Burke, and Edward Miguel. 2014. Reconciling climate-conflict meta-analyses: reply to Buhaug et al. *Climatic Change*, DOI 10.1007/s10584-014-1276-z

15. Sol Hsiang*, Marshall Burke*, and Edward Miguel. 2013. Quantifying the influence of climate on human conflict. *Science* 341: 1212. (*denotes equal authorship)

14. Sol Hsiang and Marshall Burke. 2013. Climate, conflict, and social stability: what does the literature say? *Climatic Change*, 10.1007/s10584-013-0868-3.

13. Jen Burney, Lennart Woltering, Marshall Burke, Dov Pasternak, Roz Naylor. 2010. Solar powered drip irrigation enhances food security in the Sudano-Sahel. *PNAS*, 10.1073/pnas.0909678107

12. Tom Hertel, Marshall Burke, David Lobell. 2010. The poverty implications of climate-induced yield changes by 2030. *Global Environmental Change*, 20(4), 577-585.

11. David Lobell and Marshall Burke. 2010. On the uses of statistical models to predict crop yield responses to climate change. *Agricultural and Forest Meteorology* 150, 1443-1452.

10. Marshall Burke, Edward Miguel, Shanker Satyanath, John Dykema, David Lobell. 2009. Warming increases the risk of civil war in Africa. *PNAS* 106, 20670-20674.

9. Marshall Burke, David Lobell, L. Guarino. 2009. Shifts in African crop climates by 2050 and the implications for adaptation. *Global Environmental Change* 19, 317-325.

8. David Lobell, Marshall Burke et al. 2008. Prioritizing climate change adaptation needs for food security in 2030. *Science* 319, 607-610.

7. David Lobell, Marshall Burke. 2008. Why are agricultural impacts of climate change so uncertain? The importance of temperature relative to precipitation. *Environmental Research Letters* 3, July 2008.

6. Marshall Burke, Kiersten Oleson, Ellen McCullough, Joanne Gaskell. 2008. Quantifying the environmental impacts of trade in meat products. *Environmental Modeling and Assessment* 13, July 2008.

5. Roz Naylor, Adam Liska, Marshall Burke et al. 2007. The ripple effect: Biofuels, food security, and the Environment. *Environment* 49 (9), 30-43.

4. Jim Galloway, Marshall Burke et al. 2007. International trade in meat: The tip of the pork chop. *Ambio* 36 (8), 622-628.

3. Roz Naylor, David Battisti, Dan Vimont, Walter Falcon, Marshall Burke. 2007. Assessing risks of climate variability and climate change for Indonesian rice agriculture, *PNAS 104*, 7752-7757.

2. Roz Naylor and Marshall Burke. 2005. Aquaculture and ocean resources: Raising the tigers of the sea. *Annual Review of Environment and Resources* 30: 185-218.

1. Walter Falcon, Roz Naylor, Whitney Smith, Marshall Burke, and Ellen McCullough. 2004. Using climate models to improve Indonesian food security. *Bulletin of Indonesian Economic Studies* 40(3): 355-377.

Books and book chapters

D. Lobell and M. Burke, eds. 2009. *Climate change and food security: Adapting Agriculture to a Warmer World*. Springer, (co-editor, and contributing four chapters).

D. Lobell and M. Burke. 2009. Economic impacts of climate change on agriculture to 2030, in *Climate Change and Crop Production*, M. Reynolds ed., CABI.

J. Galloway, M. Burke et al. 2007. Animal production and the nitrogen cycle, in *Livestock and a Changing Landscape*, H. Mooney et al, eds. SCOPE Scientific and Technical volume.

Other writing

"Climate robustly linked to African civil war", *PNAS*, 2010 (with Ted Miguel, Shanker Satyanath, John Dykema, and David Lobell). [Comment on Buhaug, 2010]

"Weather and Violence", *New York Times* op-ed (with Sol Hsiang and Ted Miguel), August 30th, 2013

"Temperature and violence", *Nature Climate Change*, 2014 (with Mark Cane, Ted Miguel, Sol Hsiang, David Lobell, Kyle Meng, and Shanker Satyanath). [comment on Raleigh et al 2014]

"Climate and conflict: no stigma" (correspondence to Nature, on their editorial and Adams et al Nature Climate Change 2018). March 2018, Nature.

"The climate benefits of the Green New Deal", op-ed with Noah Diffenbaugh in *Scientific American*, Mar 14 2019.

"Paris agreement could save trillions in avoided climate damages", op-ed with Noah Diffenbaugh in *The Hill*, May 27 2018

Awards

American Economic Journal - Policy, Best Paper Award for "Adaptation to climate change: evidence from US agriculture". Best paper published in AEJ-Policy 2016-2019.

National Science Foundation, Graduate Student Research Fellowship, 2009-2013.

Berkeley Fellowship, 2009-2011.

Grants

1. *Quantifying health impacts and solutions for climate-driven wildfires*, Keck Foundation, $1.2m (2023-2025) PI.
2. *Climate adaptation for food security: using satellites to measure and accelerate progress*, Keck Foundation, $1.2m (2023-2025) co-PI with David Lobell.
3. *The health co-benefits of climate mitigation*, Robert Wood Johnson Foundation, $486,000 (2019-2021) PI with Eran Bendavid, Jen Burney.
4. *Satellite-based Agricultural Yield and Poverty Measures*, US Agency for International Development. $1.8million. PI with David Lobell, AidData. (2017-2020)

5. *Using high-resolution satellite imagery to measure and improve smallholder agricultural productivity in Africa*, Global Innovation Fund, $459,000. PI with David Lobell. (2017-20).

6. *Poverty Mapping and Welfare Estimation: Combining Mobile Phone and Remote Sensing Data*, International Financial Corporation, $178,000. PI with Josh Blumenstock. (2017-18)

7. *Understanding the productivity of the world's most numerous firms: evidence from surveys and satellites.* National Science Foundation, Economics program. $243,000, PI with Kyle Emerick. (2017-19)

8. *The coupled climate and institutional dynamics of shortlived local pollutants and long-lived global greenhouse gases.* National Science Foundation, Coupled Natural and Human Systems program, $1.5million. co-I with Jen Burney, Ken Caldeira, Eran Bendavid (2017-2021)

9. *DARPA: High expressivity modeling/ World Modelers Program*, DARPA. $1.7million subaward, co-I with David Lobell and Stefano Ermon. (2017-2020)

10. *Closing the Data Divide: Machine Learning Approaches for Understanding Livelihoods of the Poor Using Unconventional Data Sources*, Stanford Global Development and Poverty initiative, $379,000. co-PI with Stefano Ermon and David Lobell. (2015-17)

11. *Climate change, nutrition, and population health*, Stanford Woods Institute Environmental Ventures Project, $180,000. PI with Eran Bendavid, Sanjay Basu, David Lobell. (2015-17)

12. *Remote sensing approaches to improving aid targeting and understanding aid effectiveness*, USAID/AidData $150,000. PI with David Lobell (2015-17)

13. *Climate and global poverty*, Stanford Global Development and Poverty initiative, $50,000. PI with Sol Hsiang. (2015)

14. *Experimental evidence on grain storage among farmers and traders in Kenya*, Gates Foundation ATAI Initiative, $425,000. Co-investigator with Edward Miguel and Lauren Falcao, (2014-2016)

15. *Barriers to private-sector arbitrage in Kenyan maize markets*, Center for Economic Policy Research, $48,000, Investigator with Lauren Falcao, 2013.

16. *Quantifying agricultural adaptation to climate change*, Giannini Foundation, $25,000. Co-investigator with Edward Miguel and Solomon Hsiang, 2013.

17. *Price fluctuations, grain storage, and barriers to arbitrage in Kenyan maize markets*, Anonymous donor, $58,000. Co-investigator with Edward Miguel and Lauren Falcao, 2013.

18. *Enhancing smallholder storage*, Anonymous donor, $100,000. Co-investigator with Edward Miguel and One Acre Fund, 2012.

19. *Optimal finance for agricultural technology adoption*, Gates Foundation ATAI Initiative, $240,000. Co-investigator with Edward Miguel, 2011.

20. *Weather risk, index insurance, and agricultural technology adoption*, Gates Foundation ATAI Initiative, $50,000. Co-investigator with Edward Miguel. 2010.

21. *Prioritizing Investments in Food Security Under a Changing Climate*, Rockefeller Foundation, $350,000. Co-investigator with David Lobell and others. 2008.

22. *An Alternative Development Model? Assessing Solar Electrification for Income Generation in Rural Benin.* Stanford Woods Institute Environmental Ventures Project, $150,000. Co-investigator with Roz Naylor and Jen Burney. 2008.

Presentations and Seminars

Meetings and conferences

1. XXVI Annual Conference of the Central Bank of Chile (Nov 2023), invited speaker
2. USC Air Pollution conference (Aug 2023), invited speaker

3. UChicago Institute for Mathematical and Statistical Innovation, conference on climate impacts (Chicago, Dec 2022), invited speaker

4. California Air Pollution Control Officers Association (Monterey, Oct 2022), invited speaker

5. European Commission meeting on the macroeconomics of climate change (Brussels, Mar 25 2021), invited speaker.

6. UCSF Climate Change and Health - Wildfires, seminar (UCSF Mar 18 2021), invited speaker.

7. US Federal Reserve, Virtual Seminar on Climate Economics (Jan 14 2021), invited speaker.

8. World Bank, Sustainable Development Group seminar (Dec 14 2020), invited speaker.

9. SF Federal Reserve Bank, Macroeconomic Risks of Climate Change in the US (Dec 4 2020), invited speaker.

10. National Academy of Science, Panel on Measuring Sustainable Development (Nov 30 2020), invited speaker.

11. The Daily Show (Nov 30, 2020), ridiculed guest.

12. World Bank Independent Evaluation Group, (Oct 29 2020), invited speaker.

13. Planet, Annual conference (Oct 15 2020), invited speaker.

14. Stanford Medical School, Grand Rounds (Oct 14 2020), invited speaker.

15. Stanford, Democracy Matters series (Sep 16 2020), invited speaker.

16. United Nations, Statistics Commission, 51st session (Feb 28 2020, New York), invited speaker.

17. Hearing on the "Macroeconomic impacts of climate change", US House of Representatives Financial Services Committee (Washington DC, Sep 2019).

18. "Innovative Frontiers in Development", Rockefeller Foundation (2019, Bellagio, Italy), conference speaker.

19. "Big Data and Machine Learning for Development", USAID (2019, Washington DC), conference speaker.

20. Association of Environmental and Resource Economists, Annual meeting (2019, Lake Tahoe). conference speaker

21. World Bank Poverty and Equity Global Practice Annual Retreat (2019, Washington DC), invited speaker

22. World Bank/ Center for Effective Global Action, "Artificial Intelligence in Economic Development", conference speaker (2018; San Francisco)

23. DARPA World Modelers Meeting, conference speaker (2018; Tucson AZ)

24. Mulago Foundation "Future of an Acre", conference speaker, (2018; San Francisco)

25. American Economic Association annual meeting, conference speaker (2018; Philadelphia)

26. USC, Workshop on "Microeconomic impacts of climate change", conference speaker (2017; Los Angeles)

27. United Nations "Preventing Tomorrow's Conflicts" Series, invited speaker on climate change and conflict (2017; New York)

28. "Investing in a new climate", Steyer-Taylor Center for Energy Policy, Stanford, conference speaker on climate impacts (2017; Stanford)

29. "Machine learning and Big Data", World Bank, invited speaker on remote sensing and big data (2017)

30. NATO Parliamentary Assembly Spring Session, Tblisi Georgia, invited speaker on climate change and conflict (2017; Tblisi, Georgia)

31. Annual Bank Conference on Africa, World Bank, invited speaker on remote sensing and big data (2017; Berkeley, CA)

32. Center For Effective Global Action, Research Retreat, conference speaker (2017)

33. "Micro and Macro Effects of Climate Change" meeting, UC-Santa Barbara, conference speaker (2017; Santa Barbara, CA)

34. "Smart Farming" workshop, attended by Bill Gates and leadership of Gates Foundation, invited speaker (2017; Seattle, WA)

35. "Advances in Estimating Economic Effects from Climate Change", conference speaker (2017; Stanford, CA)

36. Mulago Foundation Research Retreat, invited speaker (2016; Santa Cruz, CA)

37. National Bureau of Economic Research, Environmental Economics Summer Institute, conference speaker (2016)

38. "Understanding the impacts of climate change on growth and development", Potsdam Institute for Climate, Germany, invited speaker (2016)

39. American Economic Association annual meeting, conference speaker (2016)

40. "Using Big Data to Improve International Food Security", U. Illinois, keynote speaker (2016)

41. International Conference on Global Food Security, Cornell, session chair and invited speaker (2015)

42. Gates Foundation, Agricultural Technology Adoption Initiative, invited speaker (2015)

43. "Climate and Human Security", NCAR/ Dept of State, invited speaker (2015)

44. American Economic Association annual meeting, conference speaker (2015)

45. World Bank, Development Impact Evaluation meeting, Kigali, Rwanda, invited speaker (2015)

46. Pacific Development Conference, Davis, conference speaker (2014)

47. Working Group on African Political Economy (WGAPE), Stanford, conference speaker (2013)

48. Pacific Development Conference, conference speaker (2013)

Invited academic seminars

1. Columbia, Sustainable Development Program (Mar 2023)

2. Peking University, environmental economics (Mar 2023)

3. Duke, Environmental Economics (Mar 2023)

4. UC Berkeley, Dept of Agricultural and Resource Economics (Mar 2023)

5. Minnesota, Applied Economics (Mar 2023)

6. Mannheim U, economics (Dec 2022)

7. UC Santa Barbara, Bren School of the Environment (Nov 2022)

8. Montana State, economics (Sep 2022)

9. Columbia Public Health (Feb 2022)

10. Cornell (Oct 2021)

11. Yale (Oct 2021)

12. UOregon (Oct 2021)

13. Monash University (Sep 2021)

14. UC Santa Barbara (Jan 2021)

15. MIT/Columbia joint seminar (Nov 2020)

16. Harvard, Economics (Apr 2019)

17. Tufts, Economics (Apr 2019)

18. Berkeley, Public Policy (Nov 2018)

19. Yale, Economics (Oct 2018)
20. London School of Economics (Oct 2018)
21. Toulouse School of Economics (Oct 2018)
22. Bocconi/FEEM (Oct 2018)
23. World Bank (Oct 2018)
24. UChicago, EPIC (May 2018)
25. UC Irvine, Earth System Science (May 2018)
26. Columbia, Sustainable Development (2017)
27. UBC Economics (2017)
28. Brown University, Institute for Environment and Society (2017)
29. International Food Policy Research Institute (2017)
30. Princeton, Program in Science, Technology, and Environmental Policy (2016)
31. William & Mary, Economics (2016)
32. Air Force Academy (2015)
33. Cornell Economics (2014)
34. Cornell Applied Economics and Management (2014)
35. Northwestern, Kellogg Business School (2014)
36. UBC Economics (2014)
37. UC Davis Ag Econ (2014)
38. Stanford Environmental Forum (2014)
39. World Bank Development Economics (2014)
40. Minnesota Applied Economics (2014)
41. University of Colorado - Boulder Environmental Studies (2014)
42. Stanford Environmental Earth System Sciences (2014)
43. University of Washington Evans School (2014)
44. UCSD Econ/IRPS Development seminar (2013)

Editorial service

<u>Referee</u>: *Science, Nature, PNAS, American Economic Review, Quarterly Journal of Economics, Journal of Political Economy, Review of Economic Studies, Economic Journal, Review of Economics and Statistics, American Economic Journal - Economic Policy, American Economic Journal - Applied Economics, Nature Climate Change, Nature Communications, Science Advances, Lancet Planetary Health, Journal of Public Economics, American Journal of Agricultural Economics, World Bank Economic Review, Journal of Environmental Economics and Management, Journal of Development Economics, Energy Economics, Ecological Economics, Journal of Human Resources, World Politics, Journal of the European Economic Association, Journal of Development Studies, Journal of Economic Geography, Journal of African Economies, Economic Development and Cultural Change, Climatic Change, Climate Research, Environmental Research Letters, Global Environmental Change, Journal of Peace Research, PLOS One, Food Policy*

Teaching and Mentorship

Teaching:

1. ESS 268/ INTLPOL 272: Empirical Methods in Sustainable Development (Winter 2018-2023)
2. CS 325B/ EARTHSYS 262: Data for Sustainable Development (Fall, Winter 2017, Fall 2018-2023)
3. EARTH 2: Climate and Society (Winter 2016-2023)
4. ECON 106: World Food Economy (Spring 2016, 2017)

Mentorship:

Current advisees: Earth Systems (3 undergrad, 2 masters), Earth System Science (3 PhD), Emmitt Interdisciplinary Program in Environment and Resources (5 PhD), International Relations (1 undergrad), International Policy Studies (1 masters).

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