CURRICULUM VITAE August 2026

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Brief bio

I am a Full Research Professor exploring pathways to achieve global food security, analyzed through multiple disciplines, with data and computational science at its core.

Position/Employment

Professor University of Minnesota (*June 2026 – current)*
Senior Research Scientist University of Minnesota (*January 2015 – June 2026)*
Research Associate University of Minnesota (*August 2009 – December 2014)*
Postdoctoral Research Associate Purdue University (*August 2005-July 2009)*
Graduate Research Assistant University of Alabama, Huntsville (*August 1999-July 2005*)

Professional Preparation

Ph.D., *Atmospheric Science*, University of Alabama, Huntsville, USA, 2005
M.S., *Atmospheric Science*, University of Alabama, Huntsville, USA, 2002
M.Sc., *Environmental Science*, Jawaharlal Nehru University, New Delhi, India, 1999
B.Sc., *Geology (with distinction in Physics and Maths)*, Jadavpur University, Calcutta, India, 1997

Honors, Awards and Citations

Highly Cited Researcher, Clarivate Analytics / Web of Science, 2022, 2023, 2025
IonE Fellow, Institute on the Environment, University of Minnesota (since 2022)
IonE Associate, Institute on the Environment, University of Minnesota (2020-2022 cohort)
Ranking global universities (for Times Higher Education World University Rankings (Nov 2022, Feb 2022; July 2021); for QS Global Academic Survey (Feb 2021 & Feb 2020))
Travel grants/support: NCAR (2013), NASA (2004), AMS (2003, 2004), AGU (2002)
NASA Earth System Science Student Fellowship (2002-2005)
Outstanding Student Paper Award (AGU, 2002)

Link to Google Scholar Profile for full list of publications:
http://scholar.google.com/citations?user=DkNhZnEAAAAJ&hl=en
Scopus: H-index 34; total citations: >21,000; without self-citations of all authors: >20,000
Google Scholar: H-index 41; I-10 index 55; total citations >33,000

Current and Past Funding

As PI or Co-PI (~6 million US$)

- $80,000: RAISE - Researcher Assistance Initiative for Supporting Emergencies, Research and Innovation Office (RIO) (06/01/2025 to 05/31/2026)
- $232,500 annually: single co-PI with Melissa Kenney as PI, as a joint venture with USDA Forest Service Northern Research Station (09/30/2024 to 09/30/2026)
- $1,144,020: single co-PI with Kathryn Grace as PI, funded by Famine Early Warning System through USAID (06/17/2024 to 06/16/2027)
- $1,700,000: PI with Liangzhi You (IFPRI) as Co-PI, funded by Land and Carbon Lab of WRI, High-resolution annual global gridded crop statistics for WRI's Produce-Protect-Reduce-Restore strategy and land carbon accounting (06/01/2023 to 03/31/2025)
- $319,939: co-PI, USGS, Mapping climate-informed habitat restoration priorities with multi-sector benefits for 3 Upper Midwest ecoregions, 09/01/2023 to 08/30/2025
- $386,395: co-PI, BONSUCRO, Designed for Impact: Outcome-based standards for improving the sustainable outcomes from global agriculture, 05/15/2020 to 05/15/2023
- $16,631: PI, CIMMYT, develop half-degree maize, rice, wheat, and soybean yield and harvested area annual crop grids from 1982 to 2016, awarded March 2021 – June 2023
- $44,361: I co-PI, In support of A Natural Capital Index for Country-Scale Reporting Worldwide, Subcontract to Stanford University. Modelling of crop yields and agricultural suitability with and without sustainability constraints, awarded January 2020
- $149,962: co-PI, Meridian Institute, Improving the broader effectiveness of zero-deforestation commitments and commodity standards, awarded June 2019
- 2,792,035 Swiss Francs: International co-PI, CALDERA – EffeCts of lArge voLcanic eruptions on climate and societies: UnDerstand the impacts of past Events and related subsidence cRises to evAluate potential risks in the future, External Swiss national Science Foundation, awarded November 2018

Outreach and Popular Media

Opinion piece *(6/21/2013)*: *Crop Crisis: Why Global Grain Demand Will Outstrip Supply - The Conversation– 11,816 readers, 212 comments, 61 tweets, 152 Facebook shares*
Opinion piece *(7/9/2019): Climate change is affecting crop yields and reducing global food supplies - The Conversation– 81,254 readers, 12 comments, 282 tweets, 11,578 Facebook shares*
Opinion piece *(5/13/2022): A shrinking fraction of the world's major crops goes to feed the hungry, with more used for nonfood purposes - The Conversation – 28,822 readers, 20 comments, 18 tweets, 379 Facebook shares*
Opinion piece *(9/27/2022): Non-food crops are eating up our food - 360info.org*
Research mentioned more than 500 times in national (United States) and international newspapers. >100 blogs written, several million (upper bound) tweet outreach, detailed policy documents, patents etc. mentions given in Altmetric scores. 6 Live and recorded national and international radio and TV interviews and discussions

Peer-reviewed published *journal* reports (in reverse chronology)

54. ***Ray. D. K.*** et al (2026) Diverse trajectories of global fertilizer use in the post-green revolution period *Environ. Res. Lett.* https://doi.org/10.1088/1748-9326/ae9493

53. Hadi, H., ***Ray, D. K.***, Borrelli, P., Gerber, J. S., Shokri, N., Roman, S., Wuepper, D. (2026) Land degradation is associated with larger crop yield gaps across global croplands. *Nature Food*, https://doi.org/10.1038/s43016-026-01382-5

52. Li, H., Lesk, C. S., Zhu, L., Crowther, T. W., Chen, M., ***Ray, D. K.***, Mueller, N. D. (2026) Amazon deforestation reduces precipitation and soybean yields across Southern Brazil. *Proceedings of the National Academy of Sciences*, **123:24** e2525378123

51. Polasky, S., *et al.* (2026) Landscape efficiency frontiers for biodiversity, climate mitigation, and net economic value. *Science*, **392:6802** 1069-1074

50. Davis, K. F., Anderson, W., Ehrmann, S., *et al.* (2025) HarvestStat: a global effort towards open and standardized sub-national agricultural data. *Environ. Res. Lett.* **20** 052001

49. Kebede, E.A., Oluoch, K.O., Siebert, S. *et al.* (2025) A global open-source dataset of monthly irrigated and rainfed cropped areas (MIRCA-OS) for the 21st century. *Scientific Data* **12**, 208

48. Pelton, R.E.O., Kazanski, C.E., Keerthi, S. *et al.* (2024) Greenhouse gas emissions in US beef production can be reduced by up to 30% with the adoption of selected mitigation measures. *Nature Food* **5**, 787–797

47. Gumma MK, Panjala P, Dubey SK, ***Ray D. K.***, *et al.* (2024) Spatial Distribution of Cropping Systems in South Asia Using Time-Series Satellite Data Enriched with Ground Data. *Remote Sensing*. 16(15):2733

46. Gerber, J.S., ***Ray, D. K***., Makowski, D. *et al.* (2024) Global spatially explicit yield gap time trends reveal regions at risk of future crop yield stagnation. *Nature Food* **5**, 125–135

45. Kebede, E.A., Abou Ali, H., Clavelle, T. *et al.* (2024) Assessing and addressing the global state of food production data scarcity. *Nature Rev Earth Environ*

44. Lonsdorf E. V., Gerber J. S., ***Ray D.***, Slater S. J., Allison T. D. (2023) Assessing carcass relocation for offsetting golden eagle mortality at wind energy facilities. *Journal of Wildlife Management* e22478

43. Heino M., *et al.* (2023) Increased probability of hot and dry weather extremes during the growing season threatens global crop yields. *Scientific Reports* **13**, 3583. https://doi.org/10.1038/s41598-023-29378-2

42. Camargo-Alvarez H., et al. (2022) Modelling crop yield and harvest index: the role of carbon assimilation and allocation parameters. *Modeling Earth Sys. & Env.* doi: 10.1007/s40808-022-01625-x

41. Kinnunen P., Heino M., Sandström V., Taka M. ***Ray D. K.***, Kummu M. (2022) Crop Yield Loss Risk Is Modulated by Anthropogenic Factors. *Earth's Future* **10**, doi: 10.1029/2021EF002420

40. ***Ray D. K.*** (2022) Even a small nuclear war threatens food security. *Nature Food* **3**, 567–568 https://doi.org/10.1038/s43016-022-00575-y

39. ***Ray D. K.***, et al. (2022) Crop harvests for direct food use insufficient to meet the UN's food security goal. *Nature Food* **3**, 367–374 https://doi.org/10.1038/s43016-022-00504-z

38. Jordan N. R., Kuzma J., ***Ray D.***, Miller K., Wilensky-Lanford E., Amartiello G. (2022) Should Gene Editing Be Used to Develop Crops for Continuous-Living-Cover Agriculture? A Multi-Stakeholder Assessment using a Cooperative Governance Approach. *Frontiers in Bioengineering and Biotechnology* 10:843093. doi: 10.3389/fbioe.2022.843093

37. Yang Y., et al. (2022) Regionalizing varieties to enhance global ecosystem modelling of maize production. *Environmental Research Letters* **17**, 014013

36. Olsen V., et al. (2021) The impact of conflict-driven cropland abandonment on food insecurity in South Sudan revealed using satellite remote sensing. *Nature Food* **2**, doi: 10.1038/s43016-021-00417-3

35. Pelton R. E. O., et al. (2021) Land Use Leverage Points to Reduce GHG Emissions in U.S. Agricultural Supply Chains. *Environmental Research Letters* **16**, 115002

34. Lesk C., et al. (2021) Stronger temperature-moisture couplings exacerbate the impact of climate warming on global crop yields. *Nature Food* **2**(9), 683-691, doi: 10.1038/s43016-021-00341-6

33. Liu D., Mishra A. K., ***Ray D. K.*** (2020) Sensitivity of global major crop yields to climate variables: A non-parametric elasticity analysis. *Science of The Total Environment* 748, 141431

32. Sloat L. L., et al. (2020) Climate adaptation by crop migration. *Nature Communications* 11:1243 doi: 10.1038/s41467-020-15076-4

31. ***Ray D. K.***, et al. (2019) Climate change has likely already affected global food production. *PLoS ONE* 14(5): e0217148. https://doi.org/10.1371/journal.pone.0217148
*highly cited paper

30. Vogel E.[#], et al. (2019) The effects of climate extremes on global agricultural yields. *Environmental Research Letters* 14 054010, doi: 10.1088/1748-9326/ab154b
#advising Doctoral student from Australia

29. Tigchelaar M., Battisti D. S., Naylor R. L. and ***Ray D. K.*** (2018) Future warming increases probability of globally synchronized maize production shocks, *Proceedings of the National Academy of Sciences*, doi:10.1073/pnas.1718031115

28. Zscheischler J., et al. (2017) Reviews and syntheses: An empirical spatiotemporal description of the global surface–atmosphere carbon fluxes: opportunities and data limitations, *Biogeosciences* 14, 3685-3703

27. Mueller N. D., et al. (2017) Global Relationships between Cropland Intensification and Summer Temperature Extremes over the Last 50 Years, *Journal of Climate* 30, 7505-7528

26. Müller C., et al. (2017) Global Gridded Crop Model evaluation: benchmarking, skills, deficiencies and implications, *Geosci. Model Dev.*, 10, 1403-1422, doi: 10.5194/gmd-10-1403-2017
*highly cited paper

25. Porwollik V., et al. (2017) Spatial and temporal uncertainty of crop yield aggregations, *European Journal of Agronomy*, doi: 10.1016/j.eja.2016.08.006

24. Elliott J., et al. (2015), The Global Gridded Crop Model Intercomparison: data and modeling protocols for Phase 1 (v1.0), *Geosci. Model Dev*., 8, 261-277, doi:10.5194/gmd-8-261-2015

23. ***Ray D. K.,*** Gerber J. S., MacDonald G. K., West P. C. (2015), Climate variation explains a third of global crop yield variability, *Nature Communications* 6:5989 doi:10.1038/ncomms6989
*highly cited paper

22. Gray J. M., et al. (2014), Direct human influence on atmospheric CO_2 seasonality from increased cropland productivity, *Nature*, 515, 398-401, doi:10.1038/nature13957

21. West P. C., et al. (2014), Leverage points for improving global food security and the environment, *Science*, 345, 325-328, DOI: 10.1126/science.1246067
*highly cited paper

20. ***Ray D. K.,*** Foley J. A. (2013), Increasing global crop harvest frequency: recent trends and future directions, *Environmental Research Letters*, 8 044041, doi:10.1088/1748-9326/8/4/044041

19. ***Ray D.K.,*** Mueller N. D., West P. C., and Foley J. A. (2013), Yield trends are insufficient to double global crop production by 2050, *PLOS ONE*, 8(6): e66428, doi: 10.1371/journal.pone.0066428
*highly cited paper

18. ***Ray, D. K***. (2013), Dry season precipitation over the Mesoamerican Biological Corridor is more sensitive to deforestation than to greenhouse gas driven climate change**,** *Climatic Change*, DOI: 10.1007/s10584-013-0753-0

17. ***Ray D.K.,*** Ramankutty N., Mueller N. D., West P. C., and Foley J. A. (2012), Recent patterns of crop yield growth and stagnation. *Nature Communications* 3:1293 doi: 10.1038/ncomms2296
*highly cited paper

16. Mueller N., Gerber J. S., Johnston M., ***Ray D. K.***, Ramankutty N. and Foley J. A. (2012), Closing yield gaps through nutrient and water management, *Nature*, 490, 254-257, doi:10.1038/nature11420
*highly cited paper

15. ***Ray D. K***., Pijanowski B. C., Kendall A. D. and Hyndman D. W. (2012), Coupling land use and groundwater models to map land use legacies: Using GIS to assess model uncertainties relevant to land use planning, *Applied Geography*, 34, 356-370, doi:10.1016/j.apgeog.2012.01.002

14. Foley J. A., et al (2011), Solutions for a Cultivated Planet, *Nature*, 478(7369): 337-342, doi:10.1038/nature10452
*article featured on the cover
*highly cited paper

13. ***Ray D. K.,*** Manoharan V. S.[#], Welch R. M. (2011), Cloud Cover Conditions And Stability Of The Western Ghats Montane Wet Forests, *J. Geophys. Res.*, 116, D12104, doi:10.1029/2010JD015245
#advising Doctoral student

12. ***Ray D. K.,*** Duckles J. M.[#] and Pijanowski B. C. (2010), The Impact of Future Land Use Scenarios on Runoff Volumes in the Muskegon River Watershed, *Environmental Management*, 46: 3, 351-366, DOI: 10.1007/s00267-010-9533-z
#advising MS student

11. Mishra V., Cherkauer K. A., Niyogi D., Lei M., Pijanowski B. C., ***Ray D. K.,*** Bowling L. C. and Yang G. (2010), A regional scale assessment of land use/land cover and climatic changes on water and energy cycle in the upper Midwest United States, *International Journal of Climatology*, 30: 2025-2044, DOI: 10.1002/joc.2095

10. ***Ray D. K.,*** Pielke Sr. R. A., Nair U. S., and Niyogi D. (2010), Roles of atmospheric and land surface data in dynamic regional downscaling, *J. Geophys. Res.*, 115, D05102, doi:10.1029/2009JD012218

9. ***Ray D. K.*** and Pijanowski B. C. (2010), A Backcast Land Use Change Model to Generate Past Land Use Maps for the Muskegon River Watershed of Michigan, USA, *Journal of Land Use Science*, 5: 1, 1-29, doi: 10.1080/17474230903150799

8. ***Ray D. K.,*** Pielke Sr. R. A., Nair U. S., Welch R. M., and Lawton R. O. (2009), Importance of land use versus atmospheric information verified from cloud simulations from a frontier region in Costa Rica, *J. Geophys. Res.*, 114, D08113, doi:10.1029/2007JD009565

7. Nair U.S., Asefi S.[#], Welch R.M., ***Ray D.K.,*** Lawton R.O., Manoharan V.S., Mulligan M., Sever T.L., Irwin D., Pounds A. (2008), Biogeography of Tropical Montane Cloud Forests, 2: Mapping of Orographic Cloud Immersion, *Journal of Applied Meteorology and Climatology*, DOI: 10.1175/2007JAMC1819.1
#advising Doctoral student

6. Welch R. M., Asefi S.[#], Zeng J., Nair U. S., Han Q., Lawton R. O., ***Ray D. K.,*** and Manoharan V. S. (2008), Biogeography of Tropical Montane Cloud Forests, 1: Remote Sensing of Cloud Base Heights, *Journal of Applied Meteorology and Climatology*, DOI: 10.1175/2007JAMC1668.1
#advising Doctoral student

5. Pijanowski B. C., ***Ray D. K.,*** Kendall A. J., Duckles J. M., Hyndman D. W. (2007), Using Backcast Land Change and Groundwater Travel-time Models to Generate Land Use Legacy Maps for Watershed Management, *Ecology and Society*, Vol 12, 2

4. Nair U. S., ***Ray D. K.***, Wang J., Christopher S. A., Lyons T. J., Welch R. M., and Pielke Sr. R. A. (2007), Observational estimates of radiative forcing due to land use change in southwest Australia, *J. Geophys. Res.*, 112, D09117, doi:10.1029/2006JD007505

3. ***Ray D. K.,*** Nair U. S., Lawton R. O., Welch R. M., and Pielke Sr. R. A. (2006), Impact of land use on Costa Rican tropical montane cloud forests: Sensitivity of orographic cloud formation to deforestation in the plains, *J. Geophys. Res.*, 111, D02108, doi:10.1029/2005JD006096

2. ***Ray, D. K.,*** R. M. Welch, R. O. Lawton, and U. S. Nair (2006), Dry Season Clouds and Rainfall in Northern Central America: Implications for the Mesoamerican Biological Corridor, *Global and Planetary Change*, 54, 150–162, doi:10.1016/j.gloplacha.2005.09.004

1. ***Ray D. K.,*** et al (2003), Effects of land use in Southwest Australia: 1. Observations of cumulus cloudiness and energy fluxes, *J. Geophys. Res.*, 108(D14), 4414, doi:10.1029/2002JD002654