

## Deepak K. Ray, Ph.D.

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Senior Scientist

Institute on the Environment (IonE)

University of Minnesota, Twin Cities

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### Research Focus

My overall research interests and expertise intersects the disciplines of climate, agriculture and ecosystems. I build global agricultural datasets and conduct model simulations to answer questions on the impact of land use / land cover change and global climate change on food security and sustainability.

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### Peer-reviewed Publications

Porwollik, V., C. Müller, J. Elliott, J. Chryssanthacopoulos, T. Iizumi, **D. K. Ray**, A. C. Ruane, A. Arneth, J. Balkovič, P. Ciais, D. Deryng, C. Folberth, R. C. Izaurralde, C. D. Jones, N. Khabarov, P. J. Lawrence, W. Liu, T. A. M. Pugh, A. Reddy, G. Sakurai, E. Schmid, X. Wang, A. de Wit, X. Wu, Spatial and temporal uncertainty of crop yield aggregations, *European Journal of Agronomy*, (submitted)

#### 2015

28. Elliott, J., C. Müller, D. Deryng, J. Chryssanthacopoulos, K. J. Boote, M. Büchner, I. Foster, M. Glotter, J. Heinke, T. Iizumi, R. C. Izaurralde, N. D. Mueller, **D. K. Ray**, C. Rosenzweig, A. C. Ruane, J. Sheffield (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

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

#### 2014

26. Gray, J. M., S. Frohking, E. A. Kort, **D. K. Ray**, C. J. Kucharik, N. Ramankutty, M. A. Friedl (2014), Direct human influence on atmospheric CO<sub>2</sub> seasonality from increased cropland productivity, *Nature*, 515, 398-401, doi:10.1038/nature13957

25. West, P. C., J. S. Gerber, P. M. Engstrom, N. D. Mueller, K. A. Brauman, K. M. Carlson, E. S. Cassidy, M. Johnston, G. K. MacDonald, **D. K. Ray**, S. Siebert (2014), Leverage points for improving global food security and the environment, *Science*, 345, 325-328, DOI: 10.1126/science.1246067

#### 2013

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

23. **Ray, D.K.**, N. D. Mueller, P. C. West, and J. A. Foley (2013), Yield trends are insufficient to double global crop production by 2050, *PLOS ONE*, 8(6): e66428, doi: 10.1371/journal.pone.0066428
22. **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
21. **Ray, D. K.** (2013), Tropical Montane Cloud Forests. In *Climate Vulnerability: Understanding and Addressing Threats to Essential Resources*. *Elsevier Inc., Academic Press*, 79–85 pp

#### 2012

20. **Ray, D.K.**, N. Ramankutty, N. D. Mueller, P. C. West, and J. A. Foley (2012), Recent patterns of crop yield growth and stagnation. *Nature Communications* 3:1293 doi: 10.1038/ncomms2296
19. Mueller, N., J. S. Gerber, M. Johnston, **D. K. Ray**, N. Ramankutty and J. A. Foley (2012), Closing yield gaps through nutrient and water management, *Nature*, 490, 254-257, doi:10.1038/nature11420
18. **Ray, D. K.**, B. C. Pijanowski, A. D. Kendall and D. W. Hyndman (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

#### 2011

17. Foley, J. A., N. Ramankutty, K. A. Brauman, E. S. Cassidy, J. S. Gerber, M. Johnston, N. D. Mueller, C. O'Connell, **D. K. Ray**, P. C. West, C. Balzer, E. M. Bennett, S. R. Carpenter, J. Hill, C. Monfreda, S. Polasky, J. Rockström, J. Sheehan, S. Siebert, D. Tilman, and D. P. M. Zaks (2011), Solutions for a Cultivated Planet, *Nature*, 478(7369): 337-342, doi:10.1038/nature10452
16. **Ray, D. K.**, V. S. Manoharan, R. M. Welch (2011), Cloud Cover Conditions And Stability Of The Western Ghats Montane Wet Forests, *J. Geophys. Res.*, 116, D12104, doi:10.1029/2010JD015245
15. Lawton, R. O., U. S. Nair, **D. K. Ray**, A. Regmi, A. Pounds, and R. M. Welch (2011), Quantitative measures of immersion in cloud and the biogeography of cloud forest, 217-227, In: *Tropical Montane Cloud Forests*, L. A. Bruijnzeel, F. N. Scatena and L. S. Hamilton (eds), *Cambridge University Press*, 750 (p)
14. Nair, U. S., **D. K. Ray**, R. O. Lawton, R. M. Welch and R. Pielke (2011), The impact of deforestation on orographic cloud formation in a complex tropical environment, 538-548, In: *Tropical Montane Cloud Forests*, L. A. Bruijnzeel, F. N. Scatena and L. S. Hamilton (eds), *Cambridge University Press*, 750 (p)

#### 2010

13. **Ray, D. K.**, J. M. Duckles and B. C. Pijanowski (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

12. Mishra, V., K. A. Cherkauer, D. Niyogi, M. Lei, B. C. Pijanowski, **D. K. Ray**, L. C. Bowling and G. Yang (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
11. **Ray, D. K.**, R. A. Pielke, Sr., U. S. Nair, and D. Niyogi (2010), Roles of atmospheric and land surface data in dynamic regional downscaling, *J. Geophys. Res.*, 115, D05102, doi:10.1029/2009JD012218
10. **Ray, D. K.** and B. C. Pijanowski (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
9. **Ray, D. K.**, J. S. Gerber, N. D. Mueller, N. Ramankutty and J. A. Foley (2010), Recent trends in closing the yield gaps of major global crops, Agro 2010, the *XI ESA Congress*, Montpellier, J. Wery, I. Shili-Touzi, A. Perrin (eds), ISBN: 978-2-909613-01-7, 329-330

#### 2009

8. **Ray, D. K.**, R. A. Pielke, Sr., U. S. Nair, R. M. Welch, and R. O. Lawton (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

#### 2008

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

#### 2007

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

#### 2006

3. **Ray, D. K.**, U. S. Nair, R. O. Lawton, R. M. Welch, and R. A. Pielke Sr. (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

**2003**

1. **Ray, D. K.**, U. S. Nair, R. M. Welch, Q. Han, J. Zeng, W. Su, T. Kikuchi, and T. J. Lyons (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

Link to Google Scholar Profile for full list of publications:

<http://scholar.google.com/citations?user=DkNhZnEAAA&hl=en>

**Papers in conference proceedings**

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53. **Ray, D. K.** and J. S. Gerber (2015), Climate variability and extreme weather events and global crop production, ASABE 1st Climate Change Symposium: Adaptation and Mitigation Conference Proceedings
52. Welch, R. M., **D. K. Ray**, R. O. Lawton, U. S. Nair (2006), Deforestation and dry season rainfall in northern Mesoamerica: Implications for forest sustainability, *86th AMS Annual Meeting*; Atlanta, GA, 6p
51. Zeng, J., Q. Han, S. Asefi, R. M. Welch, R. O. Lawton, U. S. Nair, **D. K. Ray** (2006), Observations of orographic Cloud Base Heights from satellite and in-situ measurements at the Monteverde Cloud Mist Forest Reserve, Costa Rica, *86th AMS Annual Meeting*; Atlanta, GA, 4p
50. Asefi, S., J. Li, U. S. Nair, **D. K. Ray**, R. M. Welch, N. Padilla, E. Barrios, M. E. Benedict (2005), An integrated hydrological and atmospheric model to predict malaria epidemics, *85th AMS Annual Meeting*; San Diego, CA; United States, Article number J9.4, Pages 1591-1596
49. Lawton, R. O., U. S. Nair, **D. K. Ray**, R. M. Welch (2005), Land use cloud interaction experiment (LUCIE): Preliminary results, *85th AMS Annual Meeting*; San Diego, CA; United States, Article number 8.1, Pages 3481-3484
48. Welch, R. M., **D. K. Ray**, U. S. Nair, T. Sever, D. Irwin (2005), Impact of deforestation on the proposed mesoamerican biological corridor in Central America, *85th AMS Annual Meeting*; San Diego, CA; United States, Article number 4.12, Pages 1719-1723
47. **Ray, D. K.**, U. S. Nair, R. M. Welch, W. Su, T. Kikuchi (2002), Influence of land use on the regional climate of southwest Australia, 13<sup>th</sup> Symposium on Global Change and Climate, *82th AMS Annual Meeting*, Seattle WA
46. **Ray, D. K.**, U. S. Nair, R. M. Welch, W. Su (2001), Impact of land use on Southwest Australian regional climate, *2001 International Geoscience and Remote Sensing Symposium (IGARSS 2001)*; University of New South Wales, Sydney, NSW; Australia, Volume 5, 2001, Pages 2253-2255

**Papers presented in conferences**

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45. Gerber, J. S., **D. K. Ray**, P. C. West, J. A. Foley (2014), Increasing concentration of crop production and implications for vulnerability of food supply, Global Land Project 2<sup>nd</sup> Open Science Meeting, Berlin
44. West, P. C., J. S. Gerber, **D. K. Ray**, J. A. Foley (2014), Migrating, shrinking, and expanding conditions for growing crops under future climate scenarios, Global Land Project 2<sup>nd</sup> Open Science Meeting, Berlin

43. MacDonald, G. K., K. A. Brauman, O. C. West, **D. K. Ray**, N. D. Mueller, S. Sun, K. M. Carlson, J. A. Foley (2014), Integrating land and water use characteristics of global agricultural trade networks, Global Land Project 2<sup>nd</sup> Open Science Meeting, Berlin
42. Johnston, M., **D. K. Ray**, E. S. Cassidy, J. A. Foley (2014), Agricultural sectoral demand and crop productivity response across the world, Global Land Project 2<sup>nd</sup> Open Science Meeting, Berlin
41. **Ray D. K.**, J.A. Foley (2014), Can we continue to feed the world from crop yield increases alone? Global Land Project 2<sup>nd</sup> Open Science Meeting, Berlin
40. Mueller, N. D., J. S. Gerber, **D. K. Ray**, N. Ramankutty, J. A. Foley (2014), Exploring global crop yield impacts of changing climate and agricultural management, Global Land Project 2<sup>nd</sup> Open Science Meeting, Berlin
39. **Ray, D. K.**, J. A. Foley (2013), Boosting crop harvest frequency as the third triad in increasing global crop production, AGU Fall Meeting Abstracts
38. Johnston, M., **D. K. Ray**, E. S. Cassidy, J. A. Foley (2013), Agricultural sectoral demand and crop productivity response across the world, AGU Fall Meeting Abstracts
37. West, P. C., J. S. Gerber, **D. K. Ray**, J. A. Foley (2013), The changing climate envelope: migrating, shrinking, and expanding conditions for growing crops under future climate scenarios, AGU Fall Meeting Abstracts
36. Mueller, N. D., **D. K. Ray**, J. A. Foley, N. M. Holbrook, P. J. Huybers (2013), Temporal changes in the spatial extent of crop yield stagnation, AGU Fall Meeting Abstracts
35. Gerber, J. S., **D. K. Ray**, P. C. West, J. A. Foley (2013), Vulnerability of bread-baskets to weather shocks, AGU Fall Meeting Abstracts
34. **Ray, D. K.**, J. A. Foley (2013), Growing enough to feed ~10 billion under climate change, AGU Fall Meeting Abstracts
33. MacDonald, G. K., K. A. Brauman, N. D. Mueller, E. S. Cassidy, S. Sun, P. C. West, J. S. Gerber, M. Johnston, **D. K. Ray**, J. A. Foley (2013), Viewing agricultural trade networks in terms of land and water resource sustainability, 98<sup>th</sup> Annual ESA Meeting, Minneapolis
32. **Ray, D. K.**, J. A. Foley (2013), Can we feed the world and not destroy the environment? 98<sup>th</sup> Annual ESA Meeting, Minneapolis
31. Gerber, J. S., N. D. Mueller, **D. K. Ray**, P. C. West, J. A. Foley (2012), Does precipitation variability explain hotspots of excess fertilizer use? AGU Fall Meeting Abstracts
30. **Ray, D. K.**, N. D. Mueller, J. S. Gerber, M. Johnston, J. A. Foley (2012), Will current trends close major crop yield gaps by 2015? AGU Fall Meeting Abstracts
29. West, P. C., J. S. Gerber, N. D. Mueller, K. A. Brauman, E. S. Cassidy, M. Johnston, **D. K. Ray**, J. A. Foley (2012), Patterns of nutrients, water, and carbon embodied in major export crops, AGU Fall Meeting Abstracts
28. Gerber, J. S., E. S. Cassidy, N. D. Mueller, N. Ramankutty, **D. K. Ray**, J. A. Foley (2011), A frozen agricultural footprint on a warming planet, AGU Fall Meeting Abstracts
27. **Ray, D. K.**, R. Ramankutty, J. A. Foley (2011), Are the yields of major cereal crops stagnating? Results from the newly developed high spatial resolution crop yield time series, AGU Fall Meeting Abstracts
26. Mueller, N. D., J. S. Gerber, M. Johnston, **D. K. Ray**, N. Ramankutty, J. A. Foley (2011), Opportunities and tradeoffs for global agricultural intensification, AGU Fall Meeting Abstracts
25. Nair, U. S., **D. K. Ray**, V. Manoharan (2011), Variability of orographic cloudiness over the Western Ghats, AGU Fall Meeting Abstracts
24. Johnston, M., **D. K. Ray**, N. D. Mueller, J. A. Foley (2011), Examining the roles that changing harvested areas, closing yield-gaps, and increasing yield ceilings have had on crop production, AGU Fall Meeting Abstracts
23. **Ray, D. K.**, J. S. Gerber, N. D. Mueller, N. Ramankutty, J. A. Foley (2010), The potential for global energy crop production from intensification and extensification under current and global climate change scenarios, AGU Fall Meeting Abstracts

22. Mueller, N. D., J. S. Gerber, **D. K. Ray**, N. Ramankutty, J. A. Foley (2010), Agricultural management practices explain variation in global yield gaps of major crops, AGU Fall Meeting Abstracts
21. Gerber, J. S., D. Deryng, **D. K. Ray**, N. D. Mueller, J. A. Foley, N. Ramankutty (2010), Modelling changes to crop yield under climate change scenarios, AGU Fall Meeting Abstracts
20. Manoharan, V., **D. K. Ray**, R. M. Welch (2010), Hydrometeorological basis for the geographic distribution of tropical wet forests in the Western Ghats of southwest India, AGU Fall Meeting Abstracts
19. Pijanowski, B., **D. Ray**, A. Kendall (2010), Land use legacies: Using coupled backcast land use change and groundwater travel time models for watershed management, 95<sup>th</sup> ESA Annual Meeting
18. **Ray, D. K.**, R. A. Pielke, U. S. Nair, D. Niyogi (2009), The relative importance of land use and atmospheric information accuracy in regional scale downscaling associated with land use change impact studies in remote regions, AGU Fall Meeting Abstracts
17. Bowling, L., K. Cherkauer, M. Lei, V. Mishra, B. Pijanowski, **D. Ray**, G. Yang (2008), Impact of future urban expansion on hydroclimatology in the Upper Great Lakes, AGU Fall Meeting Abstracts
16. Welch, R. M., S. Asefi, J. Zeng, U. S. Nair, R. O. Lawton, **D. K. Ray**, Q. Han, V. S. Manoharan (2007), Biogeography, cloud base heights and cloud immersion in tropical montane cloud forests, AGU Spring Meeting Abstracts
15. Kendall, A. D., B. Pijanowski, **D. K. Ray**, J. M. Duckles, D. W. Hyndman (2006), Using backcast land-use change and groundwater travel-time models to generate land-use legacy maps for watershed management, Resilience Alliance
14. Najafabady, S. A., R. M. Welch, U. Nair, R. O. Lawton, **D. Ray** (2006), Use of satellite remote sensing for determining cloud immersion and biogeography of cloud forests, AGU Fall Meeting Abstracts
13. **Ray, D. K.**, B. C. Pijanowski, A. D. Kendall, D. W. Hyndman (2006), Coupling simulations of land use change and groundwater travel time to develop land use legacy maps for the Muskegon Rive watershed in Michigan, AGU Fall Meeting Abstracts
12. Pijanowski, B.C., A. Y. Davis, **D. K. Ray** (2006), Spatial certainty and uncertainty, AGU Fall Meeting Abstracts
11. Asefi, S., J. Zeng, Q. Han, R. M. Welch, R. O. Lawton, U. S. Nair, **D. Ray**, W. R. McCarty, G. Jedlovec (2005), Observations of orographic cloud base heights from satellite and in-situ measurements at the Monteverde Cloud Mist Forest Reserve, Costa Rica, AGU Fall Meeting Abstracts
10. Pijanowski, B. C., **D. Ray**, D. Hyndman (2005), The legacy of land use change on hydrologic dynamics, AGU Fall Meeting Abstracts
9. Welch, R. M., **D. K. Ray**, R. O. Lawton, U. Nair (2005), Dry season rainfall anomalies due to deforestation in northern Mesoamerica: Implications for forest sustainability, AGU Fall Meeting Abstracts
8. **Ray, D. K.**, U. S. Nair, R. M. Welch, R. O. Lawton, R. J. Oglesby, R. A. Pielke, T. A. Sever, D. Irwin (2005), The role of deforestation in the collapse of Classic Maya civilization: Lessons for the current land use management in northern Mesoamerica, AGU Fall Meeting Abstracts
7. Nair, U. S., **D. K. Ray**, R. M. Welch, T. J. Lyons (2005), Regional climatic impact of land use change in Southwest Australia, AGU Spring Meeting Abstracts
6. **Ray, D. K.**, U. S. Nair, R. M. Welch, R. O. Lawton (2004), Impact of deforestation on clouds and rainfall on the northern part of the proposed Mesoamerican biological corridor, AGU Fall Meeting Abstracts
5. Welch, R. M., U. S. Nair, **D. K. Ray**, A. Sanchez, M. Perez (2002), Impact of deforestation on cloud properties over the Haiti/Dominican Republic, AGU Fall Meeting Abstracts

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4. **Ray, D.K.**, U. S. Nair, R. M. Welch, R. O. Lawton (2002), Impact of deforestation on cloud properties and rainfall over the Costa Rica-Nicaraguan region, AGU Fall Meeting Abstracts
3. **Ray, D.K.**, U. S. Nair, R. M. Welch, W. Su, T. Kikuchi (2002), Climatic influence of land use change in southwestern Australia, AGU Fall Meeting Abstracts
2. **Ray, D. K.**, U. S. Nair, R. M. Welch, W. Su (2001), Influence of land use on cumulus cloud formation and surface energy fluxes in southwest Australia, AGU Spring Meeting Abstracts
1. **Ray, D. K.**, U. S. Nair, R. M. Welch, T. A. Berendes (2001), Satellite remote sensing of surface moisture over south west Australia, AGU Spring Meeting Abstracts

### **Popular Press Writing**

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[Crop Crisis: Why Global Grain Demand Will Outstrip Supply](#) - *The Conversation – Australia* (6/21/2013) – 212 comments, 61 tweets, 74 Facebook shares

### **Professional Experience and Education**

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University of Minnesota, Twin Cities

- January 2015 – current: Senior Scientist
- August 2009 – December 2014: Research Associate

Purdue University, West Lafayette

- August 2005-July 2009: Postdoctoral Research Associate

University of Alabama, Huntsville

- August 1999-July 2005: Graduate Research Assistant

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 (distinction in Physics and Mathematics)*, Jadavpur University, Calcutta, India, 1997

### **Awards and Honors**

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- Research publications mentioned in more than 100 national and international newspapers, and blogs. 4 Live and recorded national and international radio interviews and discussions (2012-2014)
- 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)

### **Invited Talks**

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Murdoch University, Perth Australia (2015) School of Veterinary and Life Science, Invited by Sue Urbaniak

National University of Singapore (2015) Department of Geography, Invited by Wong Lai Wa

University of Nebraska-Lincoln (2014) Department of Earth & Atmospheric Science, Invited by Jun Wang

American Geophysical Union (2014) In session GC3187. Agriculture in an Uncertain Future: Understanding and Responding to the Impacts of Extreme Events

Deepak Ray, Insitute on the Environment, University of Minnesota

American Geophysical Union (2013) In session GC015. Observed and Projected Climate Change Impacts on Water Resources and Agriculture

National Center for Atmospheric Research (2013) Next Generation Climate Data Products Workshop, Invited by Institute for Mathematics Applied to Geosciences

Texas Tech University (2013) Department of Natural Resources Management, Invited by Renaldo Patino

Utah State University (2010) Department of Plant, Soil and Climate, Invited by Rob Gllies

Auburn University (2009) School of Forestry & Wildlife Sciences, Invited by Hanqin Tian

University of Alabama Huntsville (2006) Department of Atmospheric Sciences, Invited by Ron Welch

Harvard University (2006) Department of Ecology and Evolutionary Biology, Invited by Paul Moorcroft

Purdue University (2005) Department of Forestry and Natural Resources, Invited by Bryan C. Pijanowski

## **Service**

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### Journal Reviewer (32 reviews)

Atmospheric Environment (2), Climatic Change (2), Earth's Future (1), Earth Interactions (1), Environmental Research Letters (3), Environmental Sciences (1), Environmental Science and Technology (1), Geophysical Research Letters (1), Journal of Climate (1), J. Environmental Planning and Management (1), Journal of Hydrometeorology (1), International Journal of Climate (1), International Journal of Remote Sensing (5), Nature Communications (2), Nature Geoscience (1), PLOS ONE (3), Remote Sensing (1), Remote Sensing of the Environment (1), Scientific Reports (2), Solutions (1)

### Proposal Reviewer (7 reviews)

NASA (6), NSF (2), Netherlands Organisation for Scientific Research (1), External PhD proposal review, WIMEK, Wageningen, The Netherlands (1)

### Proposal Panel (1)

NASA INCA Panel Review (November 2015)

### Conference Sessions

Ecological Society of America 2013 – session chair COSI – Agriculture I

Ecological Society of America 2013 – co-convener COS 64-5 Viewing agricultural trade networks in terms of land and water resource sustainability

American Geophysical Union Annual Meeting 2012 – convener of oral and poster sessions: in Global Environmental Change: GC025. Hotspots on a Cultivated Planet: Reducing Water, Nitrogen and Carbon Footprints While Increasing Food Production

American Geophysical Union Annual Meeting 2011 – convener of oral and poster sessions in Biogeosciences: B23. Feeding the World While Sustaining the Planet: Building Sustainable Agriculture Within the Earth System

Outstanding student paper judge: American Geophysical Union Annual Meeting 2010