

Andrea J. Ray, Ph.D.

NOAA Earth Systems Research Laboratory
Physical Sciences Division
Boulder, CO 80305
(303) 497-6434; andrea.ray@noaa.gov
www.researchgate.net/profile/Andrea_Ray2

Professional Preparation

- Ph.D. Univ. of Colorado, Department of Geography, 2004
Environmental Policy Certificate, Policy Sciences Committee, 1999
M.S. University of Delaware, Oceanography, 1989
A.B. University of Chicago, Geophysical Sciences, 1985

Appointments

- Physical Scientist (1999-present) NOAA-OAR Earth Systems Research Lab, Physical Sciences Division (formerly the Climate Diagnostics Center), Boulder, CO
Affiliate Faculty (2008-present) University of Colorado Environmental Studies Program, Boulder, CO
Marine Science Policy Analyst (1997-1999), NOAA-OAR Environmental Research Labs, Boulder, CO
Marine Science Policy Analyst (1995-1997), NOAA-OAR Program Development & Coordination, Silver Spring, MD
Climate & Research Programs Specialist (1994-1995), NOAA Office of Policy & Strategic Planning, Washington, DC
Marine Science Policy Analyst (1991-1994), NOAA-OAR Program Development & Coordination Office, Silver Spring, MD
John D. Knauss Marine Policy Fellow (1990), Office of the Oceanographer of the Navy, Washington, DC

Publications:

- Abel, Benjamin, Rajagopalan, Balaji, **Ray, A.J.** (2020). A predictive model for seasonal pond counts in the United States Prairie Pothole Region using large-scale climate connections, *Environmental Research Letters*, in press.
- Lipschultz, Fredric, Herring, David D., **Ray, A. J.**, Alder, Jay, Dahlman, LuAnn, DeGaetano, Arthur, Fox, James F., Gardiner, Edward, Herring, Jamie, Hicks, Jeff, Melton, Forrest, Morefield, Philip E., and Sweet, William V. (2019): Climate Explorer: Improved access to local climate projections. *BAMS*, in press.
- Ray, A. J.** and A. B. White (2019): The Hydrometeorology Testbed–West Legacy Observing Network: Supporting Research to Applications for Atmospheric Rivers and Beyond. *Atmosphere*, 10, 533, <https://doi.org/10.3390/atmos10090533>.
- Yocum, H. M. and **A. J. Ray** (2019): Climate information to support wildlife management in the North Central United States. *Regional Environ. Change*, <https://doi.org/10.1007/s10113-019-01474-y>.

- Dilling, L., M. E. Daly, D. A. Kenney, R. Klein, K. N. Miller, **A. J. Ray**, W. R. Travis, O. Wilhelmi (2019): Drought in urban water systems: Learning lessons for climate adaptive capacity. *Clim. Risk Management.*, 23, 32-42, <https://doi.org/10.1016/j.crm.2018.11.001>.
- Jana, S., B. Rajagopalan, M. A. Alexander, and **A. J. Ray**, 2018: Understanding the Dominant Sources and Tracks of Moisture for Summer Rainfall in the Southwest United States. *J Geophys Res-Atmos*, **123**, 4850-4870.
- Enquist, C. A. F., Jackson, S. T., Garfin, G. M., Davis, F. W., Gerber, L. R., Littell, J. A., . . . **Ray, A.J.**, . . . Shaw, M. R. (2017). Foundations of translational ecology. *Frontiers in Ecology and the Environment*, 15(10), 541-550. doi:10.1002/fee.1733
- Steen, V., Sofaer, H. R., Skagen, S. K., **Ray, A. J.**, & Noon, B. R. (2017). Projecting species' vulnerability to climate change: Which uncertainty sources matter most and extrapolate best? *Ecology and Evolution*, 7(21), 8841-8851. doi:10.1002/ece3.3403
- White, C. J., Carlsen, H., Robertson, A. W., Klein, R. J. T., Lazo, J. K., Kumar, A., . . . **Ray, A.J.**, . . . Zebiak, S. E. (2017). Potential applications of subseasonal-to-seasonal (S2S) predictions. *Meteorological Applications*, 24(3), 315-325. doi:10.1002/met.1654
- Cherry, J. E., Knapp, C., Trainor, S., **Ray, A. J.**, Tedesche, M., & Walker, S. (2017). Planning for climate change impacts on hydropower in the Far North. *Hydrology and Earth System Sciences*, 21(1), 133-151. doi:10.5194/hess-21-133-2017
- Ray, A.J.** 2016. Providing climate science to real-world policy decisions: a scientist's view from the trenches. pp.141-160 in: *Water Policy and Planning in a Variable and Changing Climate*. Editors: Kathleen Miller, Alan Hamlet, Douglas Kenney, Kelly T. Redmond. CRC Press.
- Ray, A. J.**, & Webb, R. S. (2016). Understanding the user context: decision calendars as frameworks for linking climate to policy, planning and decision-making. In A. Parris, et al (Ed.), *Climate in Context: Lessons learned from the RISA Program*, (pp. 27-50): Wiley & Sons.
- Gordon, E., Dilling, L., McNie, E., & **Ray, A. J.** (2016). Navigating Scales of Knowledge and Decision Making in the Intermountain West: Implications for Science Policy. In A. Parris, M. Garfin Gregg, K. Dow, R. Meyer, & S. L. Close (Eds.), *Climate in Context: Lessons learned from the RISA Program* (pp. 235-253). West Sussex, UK: Wiley & Sons.
- Fisichelli, N., G. Schuurman, A. Symstad, **A. J. Ray**, B. Miller, M. Cross, E. Rowland (2016): Resource management and operations in southwest South Dakota: Climate change scenario planning workshop summary January 20-21, 2016, Rapid City, SD. Natural Resource Report [NPS/NRSS/NRR—2016/1289](https://pubs.er.usgs.gov/publication/NPS/NRSS/NRR—2016/1289). National Park Service, Fort Collins, Colorado.
- Fisichelli, N., G. Schuurman, A. Symstad, **A. J. Ray**, J. Friedman, B. Miller, E. Rowland (2016): Resource management and operations in central North Dakota: Climate change scenario planning workshop summary November 12-13, 2015, Bismarck, ND. Natural Resource Report [NPS/NRSS/NRR—2016/1262](https://pubs.er.usgs.gov/publication/NPS/NRSS/NRR—2016/1262). National Park Service, Fort Collins, Colorado.
- Ballard, T., Seager, R., Smerdon, J. E., Cook, B. I., **Ray, A. J.**, Rajagopalan, B., . . . Henderson, N. (2014). Hydroclimate Variability and Change in the Prairie Pothole Region, the "Duck Factory" of North America. *Earth Interactions*, 18. doi:10.1175/Ei-D-14-0004.1
- Ray, A.J.**, Liebmann, Brant, and Allured, D.A. 2015. Climate Analysis, Chapter 7 in Wyoming Basin Rapid Ecoregional Assessment, USGS report to the US Bureau of Land Management, USGS Open-File Report 2015-1155. <http://pubs.er.usgs.gov/publication/ofr20151155>.

- Barsugli, J., J., Guentchev, G., Horton Radley, M., Wood, A., Mearns Linda, O., Liang, X.-Z., . . . **Ray, A.J.**, ...Ammann, C. (2013). The Practitioner's Dilemma: How to Assess the Credibility of Downscaled Climate Projections. *Eos, Transactions American Geophysical Union*, 94(46), 424-425. doi:10.1002/2013EO460005
- Cayan, Daniel, et al. 2013. *Future Climate: Projected Average*. In Assessment of Climate Change in the Southwest United States: A Report Prepared for the National Climate Assessment, edited by G. Garfin, A. Jardine, R. Merideth, M. Black, and S. LeRoy, 101–125. A report by the Southwest Climate Alliance. Washington, DC: Island Press.
- Gershunov, A, et al. 2013. *Future Climate: Projected Extremes*. In Assessment of Climate Change in the Southwest United States: A Report Prepared for the National Climate Assessment, edited by G. Garfin, A. Jardine, R. Merideth, M. Black, and S. LeRoy, 126–147. A report by the Southwest Climate Alliance. Washington, DC: Island Press.
- Carr, N.B., Garman, S.L., Walters, A, **Ray, AJ**, Melcher, C.P., Wesner, J.S., O'Donnell, M.S., Sherrill, K.R., Babel, N.C., and Bowen, Z.H., 2013: *Wyoming Basin Rapid Ecoregional Assessment work plan*. USGS Open-File Report 2013–1223, 58 p.
- Kenney, D., **A.J. Ray**, B. Harding, R.S. Pulwarty, B. Udall, 2010. Rethinking Vulnerability on the Colorado River. *Journal of Contemporary Water Research and Education*. 40:103-119.
- McWethy, David B. et al. 2010. *Climate and Ecosystem Change in the U.S. Rocky Mountains and Upper Columbia Basin: Historic and Future Perspectives for Natural Resource Management*. USGS Natural Resource Report NPS/GRYN/NRR—2010/260. 97pp.
- Ray, AJ**, JJ Barsugli, Jr., Klaus E Wolter, Jon K. Eischeid. 2010. *Rapid-Response Climate Assessment to Support the FWS Status Review of the American Pika*. NOAA Report to the U.S. Fish and Wildlife Service. 53pp. www.esrl.noaa.gov/psd/news/2010/020210.html
- Rajagopalan, B., Nowak, K., Prairie, J., Hoerling, M., Harding, B., Barsugli, J., **Ray, A.J.**, Udall, B. (2009). Water supply risk on the Colorado River: Can management mitigate? *Water Resources Research*, 45. doi:10.1029/2008wr007652
- Lowrey, J. L., **Ray, A. J.**, & Webb, R. S. (2009). Factors influencing the use of climate information by Colorado municipal water managers. *Climate Research*, 40(1), 103-119. doi:10.3354/cr00827
- Ray, AJ**, JJ Barsugli, KB Averyt, KE Wolter, MP Hoerling, 2008. *Colorado Climate Change: A Synthesis To Support Water Resource Management and Adaptation*, a report for the Colorado Water Conservation Board by the NOAA-CU Western Water Assessment, available at: http://wwa.colorado.edu/publications/reports/WWA_ClimateChangeColoradoReport_2008.pdf
- Ray, A. J.**, Garfin, G. M., Wilder, M., Vasquez-Leon, M., Lenart, M., & Comrie, A. C. (2007). Applications of monsoon research: Opportunities to inform decision making and reduce regional vulnerability. *Journal of Climate*, 20(9), 1608-1627. doi:10.1175/Jcl14098.1
- Ray, A. J., Garfin, G. M., Brito-Castillo, L., Cortez-Vásquez, M., Diaz, H. F., Garatuza-Payán, J., Gochis, D., Lobato-Sánchez, R, Varady, R, & Watts, C. (2007). Monsoon Region Climate Applications: Integrating Climate Science with Regional Planning and Policy. *Bulletin of the American Meteorological Society*, 88, 933-935. doi:DOI: 10.1175/BAMS-88-6-933
- Ray, A. J.** (2003). Reservoir management in the Interior West: the influence of climate variability and functional linkages of water. In H. F. Diaz & B. J. Morehouse (Eds.), *Climate and Water: Transboundary challenges in the Americas* (pp. 193-217). Boston: Kluwer Academic Publishers.

Selected other publications and assessment products:

- Ray, Andrea**, Joseph J. Barsugli, Ben Livneh, Candida F. Dewes, Imtiaz Rangwala, Aaron Heldmyer, Jenna Stewart. 2017. Wolverine Snow Refugia Study: An analysis of future climate risks: A Report to the U.S. Fish and Wildlife Service Region 6. 7 September 2017, 94 pp.
- Ray, AJ**, Stokes, M, Yocum, HM, Nielson, A, Goodman, C, Hartman, RK, Intermill III, JA, Kruk, MC, Vose, R, Miskus, D. 2017. The National Water Resources Monitoring and Outlook: a new national scale product for timely water intelligence. American Meteorological Society (AMS) 88th Annual Meeting, Extended Abstract 5A.4, <https://ams.confex.com/ams/97Annual/webprogram/Paper314921.html>
- National Marine Fisheries Service, West Coast Region, *Proposed New Information Gathering Or Study Not Currently In The Commission-Approved Study Plan for the La Grange Hydroelectric Project (P-14581)*. **Ray** led preparation of this “climate study request” for NMFS with J.J. Barsugli, April 2016, 36 pp.
- National Marine Fisheries Service, Alaska Region, *Study Modification Request for Study 7.7: Glacier and Runoff Changes for the Susitna-Watana Hydropower Project*. **Ray** led preparation of this “climate study request” for NMFS with J.J. Barsugli June 2016, 40 pp.
- Ray, AJ**. 2005-2009. Lead editor of the “Intermountain West Climate Summary,” a product of the Western Water Assessment (WWA) RISA; wrote/co-authored numerous feature articles, focus pages, and technical discussions.
<http://wwa.colorado.edu/climate/iwcs/archives>
- Ray, AJ**, 2008. Water Resources Decision-Makers and their needs for Decadal Climate Prediction, US CLIVAR Variations Newsletter, Oct 2008.
- Ray, AJ**, JJ Barsugli, and T Hamill. 2007. Integrating assessments of user needs with weather research: Developing user-centric tools for reservoir management. AMS 16th Conf on Applied Climatology: Extended Abstracts. Boston: AMS.
- Ray, AJ**, N Schmidt, BJ Morehouse, and RS Webb, 2003: Report on Research Opportunities for Climate and Society Interactions in the North American Monsoon Region. Workshop on Applications and Human Dimensions of Monsoon Research 18-20 June 2001, Tucson, AZ, Institute for the Study of Planet Earth, University of Arizona, 42 pp.
- Interagency Ecosystem Management Task Force, 1995: *Science and Information Issues Chapter*, Prince William Sound Ecosystem Management Case Study, for the White House Ecosystem Management Assessment
- Interagency Ecosystem Management Task Force, 1995: *Institutional and Management Issues Chapter*, Great Lakes Ecosystem Management Case Study for the White House Ecosystem Management Assessment

Consultation/advising to government bodies

Ray has been interacting for almost 15 years with Department of Interior and NOAA Fisheries colleagues to connect climate science with agency missions, including serving on the Steering Committee of the DOI Great Northern Landscape Conservation Cooperative. She works to connect climate science and applications across the country, with funding from NOAA, the US Fish and Wildlife Service and Bureau of Reclamation, and the State of Colorado, and serves on the Interagency Climate Projections Team for the Climate Explorer of the USGCRP Resilience

Toolkit. Currently, she is working with NOAA/National Marine Fisheries Service to support their need to incorporate risks of climate change into the Federal Energy Regulatory Commission planning process for licensing or re-licensing dams, and with the DOI North Central-Climate Science Center to connect climate science to ecological modeling to support management decisions. Prior efforts include successfully leading work to synthesize climate science for applications for water and endangered species (Ray et al. 2008 and 2010). The PI also has used institutional and decision analyses tools in work studying USBR and stakeholders in its reservoir management decisions (Ray 2003, 2004, 2016; Ray and Webb, 2016) and this work has guided efforts by NOAA/ESRL and the Western Water Assessment RISA to connect climate science with water managers.

Synergistic Activities

1. Co-Coordinator of the NOAA Hydrometeorological Test Bed (beginning 2019), a collaboration between NOAA Research and the National Weather Service, to improve forecasts of extreme precipitation and forcings for hydrologic prediction, by testing outputs from research.
2. Member, Climate Projections Team, for the Climate Explorer of the USGCRP Resilience Toolkit (<https://toolkit.climate.gov/climate-explorer2/>, March 2015-present)
3. Mentor for eight NOAA Hollings Undergraduate Scholars and UNAVCO Research Experiences in Earth Sciences Scholars (RESESS) since 2007.
4. Dissertation Committees: Ben Abel and Srijita Jana, Univ of Colorado Civil and Environmental Engineering
5. Post-Doc Advisor: Heather M. Yocum, now at the USGS North Central Climate Adaptation Science Center and University of Colorado CIRES, and Angela Boag, now Policy Advisor in the Colorado Department of Natural Resources.
6. Participant, NOAA/CIRES Western Water Assessment RISA, funded by NOAA/CPO, (1998-present) worked on the interaction climate and multi-purpose reservoir management in several western reservoir systems, municipal water management and climate, and edited a regularly issued “Intermountain West Climate Summary” from 2005-2009. Organized numerous WWA-sponsored workshops for water and other natural resource managers for two-way communication about climate and weather products and research.
7. Former member of the CLIVAR Predictions, Predictability and Applications Interface Panel, 2013-2016; the American Meteorological Society Committee on Climate Services 2012-2017; and the Science Working Group for the North American Monsoon Experiment (NAME), 2000-08.
8. Co-Program Manager for NOAA Pan American Climate Studies (PACS) from 1995-2000, \$5.3M research program to improve predictions for seasonal climate over the Americas.

Conferences, Workshops and Symposia Convened

- Organizer, NOAA Hydromet Testbed and Extreme Precipitation Improvement Workshop, October 2019, College Park, MD.
- Organizing Committee for workshops: 40th Climate Diagnostics and Prediction Workshop, Oct 2015, Boulder, CO; USGS-NOAA Gulf of Mexico Climate Data and Scenarios Workshop, Baton Rouge, LA, May 2012; NCAR Community Earth System Model Societal Dimensions Workshop, May 2011; AMS Summer Community Meeting, August 2011; 2011 and 2013 Climate Prediction Applications Science Workshops (CPASW)

- Co-convenor of professional society sessions connecting climate science and other disciplines: i) Symposium on Understanding and Responding to Climate Change Impacts on Marine and Coastal Fisheries, at the American Fisheries Society Annual Meeting, Seattle, WA, Sept 2011; ii) Advancing Climate Science for Wildlife Management: From Impacts And Uncertainty To Decisions, The Wildlife Society Annual Meeting, October 2010, Snowbird, UT, iii) Human Dimensions of Climate Variations in the Americas, AGU-Mexican Geophysical Union Joint Assembly, May 2007, Acapulco, MX.
- Co-organized two binational workshops on Monsoon Region (2001 and 2006), the "Regional Climate Forum for Northwest Mexico and the Southwest U. S.," Ensenada, MX, April, 2008, and the Workshop on Applications and Human Dimensions of Monsoon Research, Tucson, AZ, 18-20 June 2001.
- Numerous sessions at AGU, AMS, the NOAA Climate Prediction Assessment Workshops, e.g. at the 2013 CPASW, organized a panel discussion of ecosystem and public lands managers to discuss their needs for climate information across time scales; and at the 2014 AGU, "Coming Attractions: Climate Services in the Western U.S"
- As part of the Western Water Assessment RISA, organized numerous WWA-sponsored workshops for water and other natural resource managers for two-way communication about climate and weather products and research, including: WWA Climate workshops for water managers, Golden, Colorado and Cheyenne, Wyoming (Fall 2005), and Colorado River Basin Outlook briefing for water managers, decision makers, and planning groups in the region in Salt Lake City, UT (November 2004)

Professional Development

- NOAA/OAR Mentoring Program, Mentee, 2018-2019
- Detail to OAR Policy Planning and Evaluation Office, Jan-July 2010
- NOAA/OAR Leadership Effectiveness and Advancement (LEAP) program, 2010-11
- NOAA Leadership Seminar, Airlie, VA, Summer 2008
- WAS*IS, Weather and Society Integrated Studies workshop participant, Summer 2006
- Inter-Americas Institute for Global Change Research Summer Institute in Interdisciplinary Global Change Science, 11-30 July, 1999, Miami, FL