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Education

- 1997 Ph.D. in Population Biology, *University of California, Davis*
1991 M.S. in Biology, *University of California, San Diego*
1990 B.A. in Ecology, Behavior and Evolution, *University of California, San Diego*

Career employment

- 2015-Present *Research Scientist, Institute for Bird Populations*: Hierarchical modeling of point count data on bird species in western national parks
2008-Present *Research Associate, Institute of Arctic and Alpine Research, University of Colorado, Boulder*: Ecology of sub-surface habitat specialists
2014 *Research Associate, Museum Collections, University of Colorado, Boulder*: User interface development and research applications for several data archives
2008-2013 *Research Associate, Ecology and Evolutionary Biology, University of Colorado, Boulder*: Modeling metacommunity dynamics of vernal pool plants
2008 *Instructor, Ecology and Evolutionary Biology, University of Colorado, Boulder*: Graduate seminar in population biology—modeling and data analysis
2002-2007 *Research Associate, Ecology and Evolutionary Biology, University of Colorado, Boulder*: Modeling the dynamics of plague in prairie dogs and alternate hosts
2001-2005 *Independent contractor, US Fish & Wildlife Service*: Black-footed ferret endangered species recovery plan revision
1998-2003 *Research Associate, University of Nevada, Reno*: Developing predictive models of population dynamics and population genetics for species at risk

Peer-reviewed publications (mentored student authors underlined)

- Pandolfino ER, Douglass LA, **Ray C**. 2024. Population trends of the Ferruginous Hawk (*Buteo regalis*) wintering in California. *Journal of Raptor Research* 58:294-303. <https://doi.org/10.3356/jrr2370>
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Monk E, Weatherill K, **Ray C**, Whipple A and Varner J. 2024. How will climate change affect the pika's favorite snacks? *Frontiers for Young Minds* 12:1331857. <https://doi.org/10.3389/frym.2024.1331857>

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- Whipple AL, Ray C, Varner J, Kitchens JN, Hove AA, Wilkening JL. 2022. Stress-associated metabolites vary with both season and habitat across populations of a climate sentinel species. *Arctic, Antarctic and Alpine Research* 54:603-623. <https://doi.org/10.1080/15230430.2022.2146633>
- Pandolfino ER, Douglas LA, Ray C. 2022. Irruptive movements of the black-chinned sparrow (*Spizella atrogularis*) in response to variations in precipitation: implications for climate change resiliency. *Western Wildlife* 9:24-37.
- Johnson EC, Hastings A, Ray C. 2022. An explanation for unexpected population crashes in a constant environment. *Ecology Letters*. <https://doi.org/10.1111/ele.14110>
- Monk EM, Ray C. 2022. Revisiting talus and free-air temperatures after 50 years of change at an American pika study site in the Southern Rockies. *PLOS Climate* 1(7): e0000049. <https://doi.org/10.1371/journal.pclm.0000049>
- Kaschube, D.R., J.F. Saracco, C. Ray, C.M. Godwin, K.R. Foster, and P. Pyle. 2022. Minimum capture-recapture rates and years of banding station operations to obtain reliable adult annual survival estimates. *Journal of Field Ornithology* 93:7.
- Whipple AL, Ray C, Wasser M, Kitchens JN, Hove AA, Varner J, Wilkening JL. 2021. Temporal vs. spatial variation in stress-associated metabolites within a population of climate-sensitive small mammals. *Conservation Physiology* 9(1): coab024; doi:10.1093/conphys/coab024.
- Wagner DM, Coleman R, Brinkerhoff RJ, Busch JD, Ray C, Doyle A, Keim PS, Collinge S. 2021. No evidence for enzootic plague within black-tailed prairie dog (*Cynomys ludovicianus*) populations. *Integrative Zoology*. doi: 10.1111/1749-4877.12546.
- Klingler KB, Jahner JP, Parchman TL, Ray C, Peacock MM. 2021. Genomic variation in the American pika: signatures of geographic isolation and implications for conservation. *BMC Evolutionary Ecology* 21, 2. <https://doi.org/10.1186/s12862-020-01739-9>.
- Iwaniec D, Gooseff M, Suding K, Johnson D, Reed D, Peters D, Abrams B, Barrett J, Bestelmeyer B, Castorani M, Cook E, Davidson M, Groffman P, Hanan N, Huenneke L, Johnson P, McKnight D, Miller R, Okin G, Preston D, Rassweiler A, Ray C, Sala O, Schooley R, Seastedt T, Spasojevic M, Vivoni E. 2021. Future trajectories for ecosystems of the U.S. Long Term Ecological Research Network: The importance of connectivity. *Ecosphere*. 12(5):e03432. 10.1002/ecs2.3432.
- Brinkerhoff RJ, Rinsland HS, Sato S, Maruyama S, Ray C. 2020. Vector-borne pathogens in ectoparasites collected from high-elevation pika populations. *EcoHealth* 1-12. <https://doi.org/10.1007/s10393-020-01495-8>.
- Pandolfino ER, Ray C. 2020. Comparison of the songs of Cassin's and Plumbeous vireos. *Western Birds* 51:293-306. <https://doi.org/10.21199/WB51.4.2>.
- Ray, C., R.M. Rochefort, J.I. Ransom, J.C.B. Nesmith, S.A. Haultain, T.D. Schaming, J.R. Boetsch, M.L. Holmgren, R.L. Wilkerson, R.B. Siegel. 2020. Assessing trends and vulnerabilities in the mutualism between whitebark pine (*Pinus albicaulis*) and Clark's nutcracker (*Nucifraga columbiana*) in national parks of the Sierra-Cascade region. *PLoS ONE* 15(10): e0227161. <https://doi.org/10.1371/journal.pone.0227161>.
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- Smith AB, Beever EA, Kessler AE, Johnston AN, Ray C et al. 2019. Alternatives to genetic affinity as a context for within-species response to climate. *Nature Climate Change* 9:787-794; doi:10.1038/s41558-019-0584-8. <https://www.nature.com/articles/s41558-019-0584-8>.

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- Wilkening, J. L., **C. Ray**, N. Ramsay and K. Klingler. 2015. Alpine biodiversity and assisted migration: the case of the American pika (*Ochotona princeps*). *Biodiversity* 16(4):224–236.
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- Ray, C.**, S. Albert, L. Schofield and J. Schillaci. 2023. Fort Bragg landbird monitoring program: report for the 2022 field season. The Institute for Bird Populations, Petaluma, CA.
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- Kaschube, D. R., **C. Ray**, R. Taylor, S. Albert, R. Keith, B. Keith and J. Brenneman. 2021. An analysis of point count and demographic monitoring data from Fort Custer Training Center and the Kalamazoo Nature Center 1990-2019. The Institute for Bird Populations, Petaluma, CA.
- Kaschube, D.R., J.F. Saracco, **C. Ray**, and P. Pyle. 2020. Minimum estimated sample sizes to obtain reliable vital-rate estimates using Boreal MAPS data. The Institute for Bird Populations, Petaluma, CA.
- Ray, C.**, D.R. Cluck, R.L. Wilkerson, R.B. Siegel, A.M. White, G.L. Tarbill, S.C. Sawyer, and C.A. Howell. 2020. Chapter 9 - Woodboring beetle colonization of conifers killed by fire and bark beetles: implications for forest restoration and black-backed woodpecker conservation. In Potter, K.M., and B.L. Conkling, eds. Forest health monitoring: national status, trends, and analysis 2019. Gen. Tech. Rep. SRS-250. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station: 179-186.
- Albert, S., D. Kaschube, **C. Ray**, R. Taylor, and B. Carnes. 2020. Landbird monitoring at Fort AP Hill, Virginia: report for the 2019 field season. The Institute for Bird Populations, Petaluma, CA.
- Albert, S., **C. Ray**, J. Schillaci, and L. Schofield. 2020. Fort Bragg landbird monitoring program: report for the 2019 field season. The Institute for Bird Populations, Point Reyes Station, CA.
- Whipple A., Garrouette E, Mueller M, **Ray C.** 2019. Establishing capacity for long-term monitoring of the American pika, a sentinel species, by citizen scientists in Rocky Mountain National Park. Final report on University of Colorado FY18 NPS Task Agreement P18AC00585, December 30.
- Albert, S., **C. Ray**, J. Schillaci, and L. Schofield. 2019. Fort Bragg landbird monitoring program: report for the 2018 field season. The Institute for Bird Populations, Point Reyes Station, CA.
- Albert, S., **C. Ray**, J. Schillaci, and L. Schofield. 2018. Fort Bragg landbird monitoring program: report for the 2017 field season. The Institute for Bird Populations, Point Reyes Station, CA.
- Beers, A., **C. Ray**, and T. J. Rodhouse. 2017. Final report: Developing a protocol for long-term population monitoring and habitat projections to track a sentinel of ecosystem change in Rocky Mountain National Park. Submitted to Rocky Mountain National Park in fulfillment of Task Agreement Number P16AC00704/

UCOB-112, under Cooperative Agreement P14AC00749 between the United States Department of the Interior National Park Service and University of Colorado-Boulder Office of Contracts and Grants, 3100 Marine St., Boulder, CO 80309.

- Epps, C. W., D. Schwalm, J. Castillo, T. J. Rodhouse, M. Jeffress, and **C. Ray**. 2013. Analysis of proposed rock quarrying and trail improvement impacts on American pikas in Grand Teton National Park. Natural Resource Technical Report NPS/UCBN/NRTR—2013/756. National Park Service, Fort Collins, Colorado.
- Ray, C.** and E. Beever, 2007. Distribution and abundance of the American pika (*Ochotona princeps*) within Lava Beds National Monument. Submitted to US National Park Service, May 2007. 62 pp.
- Ray, C.**, 2006. Species recovery plan for the black-footed ferret (*Mustela nigripes*): Revised and fully annotated outline. Submitted to US Fish and Wildlife Service, June 2006. 140 pp.

Data archived publicly

- Varner, J., **C. Ray**, and D. Dearing. 2022. Sampling a pika's pantry: Temporal shifts in nutritional quality and over-winter preservation of American pika food caches ver 1. Environmental Data Initiative. <https://doi.org/10.6073/pasta/91798dccc14852d8d3db5cfca8c3a127> (Accessed 2022-12-28).
- Whipple, A. and **C. Ray**. 2021. Subsurface Temperature Data from Seven Rock Glaciers in Rocky Mountain National Park and Niwot Ridge LTER, Colorado, USA, 2018-2019 ver 1. Environmental Data Initiative. Accessed 2021-08-19. <https://doi.org/10.6073/pasta/929e2f61cb0926cf58ebac09d187148f>.
- Craighead, A. and **C. Ray**. 2021. Talus Subsurface and Surface Temperature Data from Southwestern Montana, USA, 2010-2020 ver 1. Environmental Data Initiative. Accessed 2021-08-18. <https://doi.org/10.6073/pasta/6f19d3e6e6bc609ad1aa57b853395f30>.
- Ray, C.** and Niwot Ridge LTER. 2021. Pika demography data for west knoll and Indian Peaks wilderness, 2008 - ongoing ver 4. Environmental Data Initiative. Accessed 2021-05-19. <https://doi.org/10.6073/pasta/0a786c99fe3d4e1dfb8c57424ce79091>.
- Ray, C.** 2020. Pika habitat occupancy survey data for Niwot Ridge and Green Lakes Valley, 2016 - ongoing ver 2. Environmental Data Initiative. Accessed 2021-05-19. <https://doi.org/10.6073/pasta/e6b0d005a2a8e655be4cfda8d6b59329>.

Package and software development

- Chamberlain, S., **C. Ray** and Vijay Barve. c 2015. rvertnet: an R interface for the VertNet database. <https://github.com/ropensci/rvertnet> and <https://cran.r-project.org/web/packages/rvertnet/rvertnet.pdf>
- Ray, C.**, c 2000. POPNET: model of structured population dynamics, based on movement and survival patterns implied from demographic census data.
- Ray, C.** and G. Hoelzer, c 1999. VISCOUS: cellular automata model of genetic viscosity in spatially structured populations.
- Ray, C.**, c 1996. BRYOGROW: spatially realistic (non-cellular) modeling of clonal growth, competition and integration (developed for study of bryozoans or lichens).
- Ray, C.**, P. Sjogren-Gulve and M. Gilpin, c 1994. METAPOP2: general software for modeling patch dynamics in heterogeneous and spatially explicit metapopulations.
- Gilpin, M., **C. Ray** and C. Biehl, c 1989*. LESSON: self-instruction software for learning the True BASIC programming language. (*New version released by M. Gilpin, c 1990.)

Conferences, symposia, oral sessions and workshops organized

- Ray, C.** et al. 2024. Before there are none: how do we manage for wild and self-sustaining populations of montane mammals that will survive the climate challenge? Symposium for the 103rd Meeting of the American Society of Mammalogists, Boulder, CO, June 7-11.
- Ray, C.** et al. 2023. 6th North American Pika Research Conference, hosted by the 103rd Meeting of the American Society of Mammalogists, Boulder, CO, June 7-9.
- Ray, C.** et al. 2023. 5th North American Pika Research Conference, Virtual, May 24.
- Ray, C.** et al. 2020 (cancelled due to COVID-19). 5th North American Pika Research Conference, hosted by the 100th Meeting of the American Society of Mammalogists, Boulder, CO, June 7-9.
- Ray, C.** et al. 2015. 3rd North American Pika Research Conference. April 17-18, Golden, CO.
- Ray, C.** and S. Collinge, 2007. Climate change and disease ecology. Organized oral session for the Ecological Society of America.
- Ray, C.**, 2006. Detection and monitoring of the American pika. National Park Service Workshop, Lava Beds National Monument, CA.
- Ray, C.**, 2006. Bayesian analysis and hierarchical modeling in ecology. Weekly Fall Workshop, University of Colorado.
- Ray, C.**, 2006. Modern methods for modeling presence-absence data. Weekly Fall Workshop, University of Colorado.
- Collinge, S. and **C. Ray**, 2003. Emerging diseases: stressing the union of community ecology and epidemiology. Symposium for the Ecological Society of America.

Invited presentations (* indicates presenter)

- Ray, C.*** 2024. A tale of two pikas: from dueling subspecies to dueling visions of the future for an alpine icon. Summer Seminar Series, CU Mountain Research Station, Boulder County, Colorado, July 24.
- Ray, C.*** 2024. A tale of two pikas: from dueling subspecies to dueling visions of the future for an alpine icon. Boulder County Audubon Society, Boulder, Colorado, April 23.
- Peralta A***, Ray C. 2023. Exploring the potential for plains-to-peak spillover of Rabbit Hemorrhagic Disease in a diverse lagomorph community. Symposium on Conservation and management of North American lagomorphs. 30th Annual Conference of The Wildlife Society, Louisville, Kentucky, November 6-9.
- Ray, C.***, R.M. Rochefort, J.I. Ransom, J.C.B. Nesmith, S.A. Haultain, T.D. Schaming, J.R. Boetsch, M.L. Holmgren, R.L. Wilkerson, R.B. Siegel. 2022. Will the mutualism fail? Modeling nutcracker response to whitebark decline. White Pine Ecosystem Foundation High-elevation Five-needle White Pines: Science and Management Webinars, W. A. Franke College of Forestry & Conservation, Univ of Montana, Virtual, April 19.
- Ray, C.***, R.M. Rochefort, J.I. Ransom, J.C.B. Nesmith, S.A. Haultain, T.D. Schaming, J.R. Boetsch, M.L. Holmgren, R.L. Wilkerson, R.B. Siegel. 2021. Assessing trends and vulnerabilities in the mutualism between whitebark pine and Clark's nutcracker in Sierra-Cascade national parks. Second Conference on the Research and Management of High Elevation Five Needle Pines in Western North America, Virtual, October 5-7.
- Ray, C.*** 2021. A long-term study by Chris Ray: fieldwork as my life. Betty Ford Alpine Gardens seminar series inspired by Hope Jahrens' book Lab Girl, Virtual, March 17.
- Ray, C.*** 2020. American pika: climatic influences on distribution throughout western North America. Betty Ford Alpine Gardens seminar series, Virtual, September 24.
- Ray, C.***, A. Smith, J. Stewart, A. Whipple, et al., 2020. The little pika who could: lessons in biogeography of a model species. Southern Illinois University, Carbondale, Illinois. Departmental seminar, January 23.
- Ray, C.***, 2019. Pikas, rocks and climate change: a David and Goliath Story. Rocky Mountain 101 Series, The Old Gallery, Allenspark, CO, July 21.

- Ray, C.***, 2019. Trending pikas? On the potential loss of an alpine icon. Rocky Mountain Conservancy's Wilderness & Whisky Series, Estes Park, CO, June 26.
- Ray, C.***, 2018. On thin ice: the future of the American pika. CIRES Series for The Academy for Lifelong Learning, Denver, CO, October 31.
- Ray, C.***, 2017, 2018, 2019. Updates on long-term research and monitoring of pikas in association with the National Park Service Pikas in Peril project. Rocky Mountain National Park annual research symposium.
- Ray, C.***, 2017, 2018, 2019. Interpreting results from the National Park Service Pikas in Peril research project. Rocky Mountain National Park interpretive staff training days.
- Ray, C.***, 2017, 2018, 2019. Updates on long-term research and monitoring of pikas in association with the National Park Service Pikas in Peril project. Rocky Mountain National Park annual research symposium.
- Ray, C.***, 2016. Landbirds trends in mountain parks of the Pacific Northwest. U Mass, February 5.

(Invited presentations prior to 2015 omitted.)

Contributed presentations (* indicates presenter; students underlined)

- Ray C**, Siegel R, Wilkerson R, Schofield L, Holmgren M, Bryant L*, Tingley M, Aronson S, Haultain S, Stock S. 2024. Avian response to climate and fire history in national parks of the Sierra Nevada. 142nd Annual Meeting of the American Ornithological Society, October 1-5, Estes Park, Colorado. Oral.
- Billings R*, **Ray C**. 2024. Applied bioacoustics for individual pika recognition and call classification. 103rd Annual Meeting of the American Society of Mammalogists, June 7-11, Boulder, Colorado. Poster.
- Serra A*, **Ray C**. 2024. Investigation of increased nocturnality as an indicator of behavioral adaptability in American pikas (*Ochotona princeps*). 103rd Annual Meeting of the American Society of Mammalogists, June 7-11, Boulder, Colorado. Oral.
- Erb LP*, Crouch O, Hove A, Varner J, **Ray C**. 2024. Characterizing the ecological relationship between American pikas and yellow-bellied marmots in the Rocky Mountains. 103rd Annual Meeting of the American Society of Mammalogists, June 7-11, Boulder, Colorado. Oral.
- Peralta A*, **Ray C**. 2024. Potential for spillover of rabbit hemorrhagic disease at Great Sand Dunes National Park and Preserve. 103rd Annual Meeting of the American Society of Mammalogists, June 7-11, Boulder, Colorado. Oral.
- Ray C**, Siegel RB, Wilkerson RL* et al. 2024. Avian response to climate and fire history in national parks of the Sierra Nevada. 2024 Sierra Nevada Science Symposium, University of California Merced, March 5-6.
- Ray C***, Vidrio J. 2023. Long-term data reveal a severe decline in recruitment of the American pika on Niwot Ridge. North American Pika Consortium V, Online, May 24, Oral presentation.
- Peralta A*, **Ray C**. 2023. Occupancy surveys reveal a healthy pika population in a region hit by rabbit hemorrhagic disease. North American Pika Consortium V, Online, May 24, Oral presentation.
- Billings R*, **Ray C**. 2023. First steps in audio classification of pika vocalizations using deep learning. North American Pika Consortium V, Online, May 24, Oral presentation.
- Perkins E*, **Ray C**. 2023. Identifying predictors of ectoparasite abundance on American pikas in Colorado. North American Pika Consortium V, Online, May 24, Oral presentation.
- Whipple A*, **Ray C**, Kitchens J, Hove A, Castillo Vardaro J, Wilkening J. 2023. Stress-associated metabolites vary with season and habitat across populations of the American pika. North American Pika Consortium V, Online, May 24, Oral presentation.
- Monk E*, **Ray C**. 2023. An increase in American pika habitat temperature over 50 years on Niwot Ridge. North American Pika Consortium V, Online, May 24, Oral presentation.
- Monk E, **Ray C***. 2022. Fifty years of warming at an American pika study site on Niwot Ridge. Long Term Ecological Research (LTER) All Scientists' Meeting, September 19-23, Pacific Grove, California. Poster.

- Rinsland, H*, **Ray C.** 2022. Investigating occupancy drivers across the two American pika subspecies in ROMO. 101st Annual Meeting of the American Society of Mammalogists, June 17-21, Tucson Arizona. Oral presentation plus poster.
- Monk, E*, **Ray C.** 2022. Fifty years of warming at an American pika study site. 101st Annual Meeting of the American Society of Mammalogists, June 17-21, Tucson Arizona. Oral presentation plus poster.
- Kaschube, D.* , **C. Ray**, R. Taylor, R. Keith, B. Keith, J. Brenneman, and S. Albert. 2022. Combining point count and demographic data for comprehensive bird population trend assessment at the Fort Custer Training Center and the Kalamazoo Nature Center. 87th North American Wildlife and Natural Resources Conference, March 9-18, Spokane, Washington.
- Varner J*, Carnes-Douglas ZJ, Dearing MD, **Ray C.** 2021. Nutritional quality and overwinter preservation of pika winter diet over three decades of climate change. 100th Annual Meeting of the American Society of Mammalogists, June 14-18, virtual conference.
- Whipple A*, **Ray C.** 2021. Keeping their cool: do pikas have lower stress-associated hormone levels in habitats with subsurface ice? 100th Annual Meeting of the American Society of Mammalogists, June 14-18, virtual conference.
- Hill PJ*, Wasser M, **Ray C.** 2021. Range retraction in paradise: microclimatic controls on occupancy of core habitat for the American pika. 100th Annual Meeting of the American Society of Mammalogists, June 14-18, virtual conference.
- Ray C**, Vidrio J. 2021. Long-term data reveal a severe decline in recruitment of the American pika on Niwot Ridge. 100th Annual Meeting of the American Society of Mammalogists, June 14-18, virtual conference.
- Holtz S*, **Ray C.** 2020. Same pika, different story: how new genetic analyses offer a different perspective on populations as they respond to climate change. Poster, Annual Meeting of the Ecological Society of America, August 3-6, virtual conference.
- Ray C***, Vidrio J. 2020. Trending pikas: what one population might say about its neighbors. Rocky Mountain National Park 2020 Biennial Research Conference, Estes Park, CO, March 10-11.
- Whipple A*, **Ray C.** 2020. Assessing habitat quality using stress measurements in American pika populations. Rocky Mountain National Park 2020 Biennial Research Conference, Estes Park, CO, March 10-11.
- Ray C***, Rochefort R, Ransom JI, Nesmith JCB, Haultain SA, Schaming TD, Boetsch J, Holmgren ML, Wilkerson R, Siegel R. 2020. Assessing vulnerabilities in the mutualism between whitebark pine and Clark's nutcracker in national parks of the Sierra-Cascade region. North American Congress for Conservation Biology, Virtual, July 26-31.
- Holtz S*, **Ray C.** 2020. Using RADseq to illuminate pika metapopulation structure. Poster, Rocky Mountain National Park 2020 Biennial Research Conference, Estes Park, CO, March 10-11.
- Ray C***, Rochefort R, Ransom JI, Nesmith JCB, Haultain SA, Schaming TD, Boetsch J, Holmgren ML, Wilkerson R, Siegel R. 2020. Assessing vulnerabilities in the mutualism between whitebark pine and Clark's nutcracker in national parks of the Sierra-Cascade region. 68th Annual Meeting of The Western Section of The Wildlife Society, Virtual, February 1-5.
- Ray C***, Cluck DR, Wilkerson RL, Siegel RB, White AM, Tarbill GL, Sawyer SC, Howell CA. 2020. Woodboring beetle colonization of conifers killed by bark beetles vs wildfire. USDA Forest Service Forest Health Monitoring Workshop, Raleigh, NC, February 24-27.
- Whipple A*, **Ray C.** 2019. Putting stress to the test: could feces be the key to conserving pika? Guild of Rocky Mountain Ecologists and Evolutionary Biologists Meeting, Rocky Mountain Biological Laboratory, Gothic, CO, September 6-8.
- Albert, S.* , **C. Ray**, J. Schillaci and B. Fulton. 2019. Using integrated methodologies to track bird populations. National Military Fish and Wildlife Association Annual Workshop, Denver, CO, March 7.

- Ray, C.**, J. Saracco, M. Holmgren, R. Wilkerson, R. Siegel and J. Ransom*. 2018. Landbird population trends in protected areas of the North Coast and Cascades Network. American Ornithological Society, Tucson, Arizona, April 9-17.
- Ray, C.***, J. Saracco, M. Holmgren, R. Wilkerson, R. Siegel, K. Jenkins, J. Ransom, P. Happe, J. Boetsch and M. Huff. 2017. Landbird population trends in protected areas of the North Coast and Cascades Network. 64th Annual Meeting of The Wildlife Society, Reno, Nevada, February 6-10.
- Benedict, L.* and **C. Ray**. 2017. From dawn to dusk: a behavioral study of the American pika. 64th Annual Meeting of The Wildlife Society, Reno, Nevada, February 6-10, Symposium of the North American Pika Consortium.
- Craighead, A.* , **C. Ray** and J. L. Wilkening. 2017. Why is melanism uncommon in the American pika? 64th Annual Meeting of The Wildlife Society, Reno, Nevada, February 6-10, Symposium of the North American Pika Consortium.
- Wasser, M.* and **C. Ray**. 2017. Inferring range contraction from apparent cache age in a food-hoarding species. 64th Annual Meeting of The Wildlife Society, Reno, Nevada, February 6-10, Symposium of the North American Pika Consortium.
- Wiebe, M.*, M. Plichta, H. Batts, L. Benedict and **C. Ray**. 2017. Subsurface temperature and other environmental effects on the summer surface activity of a microhabitat specialist. 64th Annual Meeting of The Wildlife Society, Reno, Nevada, February 6-10, Symposium of the North American Pika Consortium.
- Siegel, R. B.* , R. L. Wilkerson, J. F. Saracco, A. L. Holmgren, **C. Ray** and S. Haultain. 2016. Monitoring SIEN bird populations in an era of rapid environmental change. Sequoia and Kings Canyon National Parks Science Symposium, Three Rivers, California, November 9-10.
- Erb, L.P.* , L.C. Sackett, P.L. Erb, **C. Ray** and R.P. Guralnick. 2016. Impacts of climatic and landscape characteristics on gene flow among American pika (*Ochotona princeps*) populations in the southern Rocky Mountain region. 5th World Lagomorph Conference, CSU-Stanislaus, Turlock, California, July 11-13.
- Koju, N.P.*, et al. (**Ray**). 2016. A multilocus phylogeny of pikas (*Ochotona*) and its implications for systematics and gene flow. 5th World Lagomorph Conference, CSU-Stanislaus, Turlock, California, July 11-13.
- Bhattacharyya, S.* et al. (**Ray**). 2016. Royle's pika in a changing climate: insight from past and present distributions. 5th World Lagomorph Conference, CSU-Stanislaus, Turlock, California, July 11-13.
- Beers, A.* , **C. Ray** and R. Guralnick. 2015. Seasonality in the use of heterogeneous terrain by a territorial habitat specialist. LTER ASM, Estes Park, CO, Aug 30-Sep 2.
- Wilkening, J. and **C. Ray***. 2015. Determining effects of microclimate on individual survival in the American pika. LTER ASM, Estes Park, CO, Aug 30-Sep 2.
- Howe, J. Jr., C. Prince and **C. Ray***. 2015. Seasonal effects of microhabitat structure on sub-surface microclimates in blocky debris. LTER ASM, Estes Park, CO, Aug 30-Sep 2.
- Bhattacharyya, S. and **C. Ray***. 2015. Climate change and foraging efficiency in a territorial herbivore: changes in food cache quality parallel a change in microclimate. LTER ASM, Estes Park, CO, Aug 30-Sep 2.
- Wiebe, M., M. Plichta* , H. Batts, S. McLaughlin, J. Johnson and **C. Ray**. 2015. Effects of surface and sub-surface temperature on the activity budget of a microhabitat specialist. LTER ASM, Estes Park, CO, Aug 30-Sep 2.
- Ray, C***, J. Vukomanovic, P. Bourgeron, J. G. Smith and R. Andrus. 2015. V-ART curriculum for teaching social-ecological systems to children in mountain communities. LTER ASM, Estes Park, CO, Aug 30-Sep 2.
- Schwalm, D., et al. (**Ray***), 2015. Projecting futures for the American pika, a climate indicator species, in Rocky Mountain National Park. RMNP Research Conference, March 4-5.

(Contributed presentations prior to 2015 omitted.)

Academic course lectures

- Ray, C.***, 2023. Climate change and American pika ecology. Guest lecture in *Environmental Studies*, St. Joseph's University, Philadelphia, PA, April 12.
- Ray, C.***, 2023. Pika ecology. Guest lecture in *Ecology*, University of Colorado, Boulder, CO, February 7.
- Ray, C.***, 2022. Pika ecology. Guest lecture in *Ecology*, University of Colorado, Boulder, CO, September 13.
- Ray, C.***, 2021. Pika ecology. Guest lecture in *Ecology*, University of Colorado, Boulder, CO, September 9.
- Ray, C.***, 2021. Pika biogeography. Guest lecture in *Biogeography*, University of Colorado, Boulder, CO, April 27.
- Ray, C.***, 2020. Pika ecology. Guest lecture in *Ecology*, University of Colorado, Boulder, CO, September 10.
- Ray, C.***, 2020. Pika biogeography. Guest lecture in *Biogeography*, University of Colorado, Boulder, CO, April 23.
- Ray, C.***, 2020. Pika winter ecology. Guest lecture in *Winter ecology teacher workshop*, hosted by Rocky Mountain National Park, Colorado Parks and Wildlife, Rocky Mountain Conservancy, YMCA of the Rockies, Estes Park, CO, February 23.
- Ray, C.***, A. Smith, J. Stewart, A. Whipple, et al., 2020. The little pika who could: lessons in biogeography of a model species. Guest lecture in *Biogeography*, University of Colorado, Boulder. April 22.
- Ray, C.***, 2019. Pika ecology. Guest lecture in *Ecology*, University of Colorado, Boulder, CO, September 12.
- Ray, C.***, 2015. Pikas and climate. Guest lecture in *Conservation biology*, University of Colorado, Boulder, CO, June 15.

(Course lectures prior to 2015 omitted.)

Grants and contracts

- PI: Niwot Ridge LTER 8 Summer research grant (2024): GRA (0.50 FTE)
- PI: Niwot Ridge LTER VII Summer research grant (2023): GRA (0.50 FTE)
- PI: Niwot Ridge LTER VII Summer research grant (2022): \$7.3K
- PI: Niwot Ridge LTER VII Summer research grant (2021): GRA (0.50 FTE) and \$2.4K
- PI: National Park Service Task Agreement P21AC11324 (2021) \$125K
- PI: Niwot Ridge LTER VII Data synthesis grant (2020): GRA (0.25 FTE) and working group support
- PI: Niwot Ridge LTER VII Summer research grant (2020): GRA (0.50 FTE)
- PI: National Park Service Task Agreement P18AC00585 (2020 supplement) \$4.3K
- Co-PI: University of Colorado-Boulder Office of University Outreach Grant (2018) \$3.2K
- PI: Niwot Ridge LTER VII Grant (2018): \$15K
- PI: National Park Service Task Agreement P18AC00585 (2018) \$15K
- PI: Niwot Ridge LTER VII Grant (2017): \$30K
- PI: National Park Service Task Agreement P16AC00704/ UCOB-112 (2016) \$11K
- Co-author: NSF LTREB Grant (2013) \$450K (PI: S. Collinge)
- PI: University of Colorado-Boulder Office of University Outreach Grant (2011) \$5.5K
- PI: National Park Service Climate Change Response Grant (2010) \$713K
- Co-author: NSF LTREB Grant (2008) \$450K (PI: S. Collinge)
- PI: Charlotte Martin Foundation Grant (2007) \$10K
- Co-author, Supervisor: Alcoa Foundation Practitioner Fellowship (2007) \$10K (PI: A. Craighead)
- Co-PI: WWF International Research Grant (2007) \$8.6K (PI: E. Beaver)
- PI: WWF International Research Grant (2006) \$4K
- Co-PI-designate: US National Park Service GB-CESU Grant (2006) \$12K (PI: E. Beaver)
- Contractor: Colorado Dept. of Transportation Contract (2003) \$2.4K
- Co-author: NSF/NIH Ecology of Infectious Diseases Grant (2002) \$1.7M (PI: S. Collinge)
- PI: US Fish and Wildlife Service Contract (2001) \$30K
- Co-author: EPA Species At Risk Grant (2001) \$500K (PI: S. Collinge)

Co-author: US Fish and Wildlife Service Contracts (1998-2002) \$400K (PI: M. Peacock)
Co-PI: NSF Dissertation Improvement Grant (1995) \$4.5K (PI: A. Hastings)
PI: UC Davis Graduate Research Awards (1995, 1994) \$3K
PI: UC Davis Center for Population Biology Research Grants (1992-5) \$4.5K
PI: UC San Diego David J. Gambee Memorial Fellowship (1990) \$1K

Awards

2020 Rocky Mountain National Park Stewardship Award
2018 Denver Zoological Conservation Award (\$5K)

Honors

Graduated *summa cum laude*, UC San Diego (1990)
Phi Beta Kappa and Caledonian honor society memberships (1990)
Judson Memorial and Sprague Memorial awards for excellence in journalism (1985)

Professional service and society memberships

500 Women Scientists
American Society of Mammalogists
Ecological Society of America
IUCN Lagomorph Specialist Group
NSF Population and Community Ecology Panels
Society for Conservation Biology
The Wildlife Society
Whitebark Pine Ecosystem Foundation

Synergistic activities

Broadening the participation of groups underrepresented in STEM: (i) Co-advised two female graduate students from backgrounds underrepresented in science (BUS), one obtaining a Masters in mathematics and one current Ph.D. candidate in ecology; (ii) Mentored six students from BUS through the NSF REU and RECC programs. (iii) Leveraged an Ecological Data Initiative fellowship to select and mentor a BUS doctoral student in creation of tools for archiving temperature data collected by the NWT LTER; (iv) Co-developed volunteer training programs (e.g., pikapartners.org) to support data collection through community science and database use for conservation, used in the Four Corners and surrounding regions with groups commonly underrepresented in STEM. (v) Co-developed on-line science-learning resources to reach K-12 audiences (<https://www.lessonsinlifescience.org>), and developed social media outlets to showcase diversity in REU and other students of pika field research. (vi) Contributed to the creation of many video documentaries on American pika research, each designed for a broad audience. (vii) Mentored five graduate and many undergraduate students in education and outreach culminating in STEM presentations for K-12 students in a variety of venues. (viii) Appeared twice as a guest researcher in the NSF-sponsored Teen Science Café program.

Innovations in teaching: (i) Developed “starter code” modules in R for undergraduate student projects in REU and independent study programs, to assist self-directed student learning and expansion of coding skills. (ii) Developed or co-developed software for teaching, including LESSON for teaching basic programming skills to undergraduates and METAPO2 for modeling population and metapopulation dynamics. (iii) Developed and applied V-ART curriculum for teaching social-ecological systems concepts to K-12 audiences (Ray, C., J. Vukomanovic, P. Bourgeron, J. G. Smith and R. Andrus, 2015. V-ART curriculum for teaching social-ecological systems to children in mountain communities. LTER All Scientists Meeting, Estes Park, Colorado, Aug 30-Sep 2).

Development and/or refinement of research tools: (i) Re-vamped and expanded [rvertnet](#) for accessing the NSF-sponsored VertNet biological database ([vertnet.org](#)). (ii) Developed sampling techniques for the study of wild American pika (*Ochotona princeps*) and Pallas’ pika (*Ochotona pallasii*).

Outreach: (i) Co-developed citizen-science training programs (e.g., [pikapartners](#)) designed to develop skills in data collection and database use for conservation. (ii) Provide annual scientific oversight for long-term citizen-science monitoring of pikas in Rocky Mountain National Park, White River National Forest, Medicine Bow-Routt National Forest and throughout the Colorado Front Range.

International service: (i) Pika specialist for the IUCN Lagomorph Specialists Group. (ii) Co-organized symposia/sessions for multiple international meetings of the Ecological Society of America. (iii) Served as “opponent” for the Ph.D. disputation of Tord Snäll, Uppsala University (Sweden), and as external reviewer for the Ph.D. thesis of Geoffrey Heard, La Trobe University (Australia) and the M.Sc. thesis of Cheryl Blair, Thompson Rivers University (Canada). (iv) Provided on-site consultation and instruction on Pallas’ pika (*Ochotona pallasii*) sampling for Denver Zoo and Earthwatch Institute programs in Mongolia (2018).

National service: Service within the merit review process for the National Science Foundation, including service on NSF’s Population and Community Ecology panel. Co-PI on a broad-based proposal to inventory the American pika within many land units administered by the National Park Service (Rocky Mountain, Yellowstone-Teton and Upper Columbia Basin Networks). Invited by the US Fish and Wildlife Service to coordinate revision of the recovery plan for the black-footed ferret (*Mustela nigripes*). Invited by the Colorado Department of Transportation to provide professional opinion and review of strategies for reducing the impact of highway construction on the Prebles’ meadow jumping mouse (*Zapus hudsonius preblei*) and on the re-introduced lynx (*Felis lynx*). Invited by the NOAA Northwest Fisheries Science Center to participate in a Cumulative Risk Initiative workshop and related document reviews regarding the development of population viability analyses for salmonid management.

Community service: Co-organized the Front Range Pika Project, a citizen-science program to document change in the distribution and habitats occupied by the American pika. Sponsored by three non-profit organizations (Boulder County Nature Association, Rocky Mountain Conservancy Field Institute and Rocky Mountain Wild) to teach annual field courses on pika ecology for non-scientists (2007-present). Interviewed for features in print, broadcast and web media including the BBC, National Geographic,

National Public Radio (Science Friday), H₂O Radio, Science, ABC Nightly News, al Jazeera and National Wildlife.

Student mentoring

Post-doctoral students (co-advisor)

Tord Snäll, Swedish University of Agricultural Sciences, 2005

Graduate students (co-advisor)

Rachel Billings, Ph.D. X2027

Airy González Peralta, Ph.D. X2025

Ashley Whipple, Masters 2019

Isabel Corona, Masters 2018

Jennifer Wilkening, Ph.D. 2014

Liesl Peterson Erb, Ph.D. 2013

Fulbright students (co-advisor)

Sabuj Bhattacharyya, Fulbright 2010

Undergraduate honors students (advisor)

Van Baronofsky, X2025

Alessia Serra 2023, EBIO Honors 2024

Jane Hill, ENVS Honors 2021

Hilary Rinsland, Univ. of Richmond VA 2018

Emily Monk, EBIO Honors 2018

Max Wasser, EBIO Honors 2018

Lauren Benedict, Whitman College Honors 2017

Spencer Holtz, EBIO Honors 2016

Maxwell Plichta, EBIO Honors 2016

Meghan Wiebe, EBIO Honors 2015

James Howe Jr., ENVS Honors 2014

Undergraduate honors students (committee member/outside reader)

Clifford Adamchack, ENVS Honors 2021

Undergraduate student research (supervisor or co-supervisor)

Juan Garcia, RECCS Summer 2024

Van Baronofsky, BSI Scholar Summer 2024

Alessia Serra, BSI Scholar Summer 2023

Van Baronofsky, BSI Scholar Summer 2023

Alessia Serra, BSI Scholar Summer 2022

Crystal Gonzalez, RECCS Summer 2021

Patricia Jane Hill, BSI Scholar Winter/Spring 2020/2021

Patricia Jane Hill, BSI Scholar Summer 2020

Daniel D'Souza, RECCS Summer 2020

Claire Atkins, NSF RECCS Summer 2019

Airy González Peralta, Front Range Community College Spring 2019

Caitlin Stiltner, ENVS Spring 2019
Minyue Hu, ENVS Spring 2019
Haley Weaver, NSF REU Summer 2017
Emily Monk, UROP Summer 2017
Max Wasser, NSF REU Summer 2017
Hilary Rinsland, U Richmond Virginia Fellow Summer 2017
Lauren Benedict, NSF REU Summer 2016
Max Wasser, BURST Summer 2016
Jeremy Bonnell, ENVS Summer 2016
Spencer Holtz, UROP Summer 2015
Maxwell Plichta, NSF REU Summer 2015
Jasmine Vidrio, NSF REU Summer 2015
Hilary Brumberg, Wesleyan Fellowship Summer 2015
Max Wasser, UROP Summer 2015
Christian Prince, ENVS Internship Fall 2014, UROP Spring 2015
Maxwell Plichta, UROP Fall 2014
Meghan Wiebe, NSF REU Summer 2013, UROP Spring 2013
Taylor Stratton, NSF REU Summer 2013
James Howe Jr., BURST Summer 2013
Kacey Fitzgerald, UROP Summer 2013
Kayla Barton, EBIO Independent Study Spring 2013
Riley Stuckey, BURST Fall 2012
Sarah McLaughlin, NSF REU Summer 2012
Jessica Johnson, UROP Summer 2012
Brooke Regan, UROP Fall 2011
Gerardo Dillehay, NSF REU Summer 2011
Lindsey Nietmann, NSF REU Summer 2008
Phillip Wasz, NSF REU Summer 2008

Advisors

(Ph.D.) Alan Hastings, University of California, Davis
(M.A.) Michael Gilpin, University of California, San Diego (Retired)

Recent supervisors

Rodney Siegel (rsiegel@birdpop.org)
Director, Institute for Bird Populations, Petaluma, CA

Nancy Emery (Nancy.Emery@colorado.edu)
Professor of EE Biology, INSTAAR Associate and Lead Investigator for the Niwot Ridge LTER, University of Colorado, Boulder, CO