

CHRIS RAY, Ph.D.

Research Associate

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and

Institute for Arctic and Alpine Research, University of Colorado, Boulder, CO 80309-0450

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Research Focus – *Developing mechanistic and dynamic models for the demographic analysis of populations, especially for threatened species with fragmented populations.*

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 Associate, Institute for Bird Populations: Hierarchical modeling of point count data on bird species in western national parks*
2008-Present *Research Associate, Institute for 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 the 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: Revising the species recovery plan for the endangered black-footed ferret*
1998-2003 *Research Associate, University of Nevada, Reno: Developing predictive models of population dynamics and population genetics for species at risk*

Publications

- Ray, C. and S. K. Collinge. 2014. Quantifying the dominance of local control and the sources of regional control in the assembly of a metacommunity. *Ecology* 95:2096–2108.
<http://dx.doi.org/10.1890/13-0628.1>
- Erb, L. P., C. Ray and R. Guralnick. 2014. Determinants of pika population density versus occupancy in the Southern Rocky Mountains. *Ecological Applications* 24:429–435.
<http://dx.doi.org/10.1890/13-1072.1>

- Collinge, S. K., **C. Ray** and J. Martee. 2013. A long-term comparison of hydrology and plant community composition in constructed versus naturally occurring vernal pools. *Restoration Ecology* 21:704–712. <http://dx.doi.org/10.1111/rec.12009>
- Wilkening, J. L., **C. Ray** and K. L. Sweazea. 2013. Stress hormone concentration in Rocky Mountain populations of the American pika (*Ochotona princeps*). *Conservation Physiology* 1:cot027 (13 pp.). <http://dx.doi.org/10.1093/conphys/cot027>.
- Jeffress, M. R., T. J. Rodhouse, **C. Ray**, S. Wolff and C. W. Epps. 2013. The idiosyncrasies of place: geographic variation in the climate-distribution relationships of the American pika. *Ecological Applications* 23:864–878. <http://dx.doi.org/10.1890/12-0979.1>.
- Cuddington, K., M.-J. Fortin, L. R. Gerber, A. Hastings, A. Liebhold, M. O'Connor, and **C. Ray** 2013. Process-based models are required to manage ecological systems in a changing world. *Ecosphere* 4:art20. <http://dx.doi.org/10.1890/ES12-00178.1>
- Ray, C.**, E. Beever and S. Loarie. 2012. Retreat of the American pika: up the mountain or into the void? Pages 245-270 in Brodie, J. F., E. Post and D. F. Doak (eds.) *Wildlife conservation in a changing climate*. University of Chicago Press. 416 pp.
- Sackett, L. C., T. B. Cross, R. T. Jones, W. Johnson, K. Ballare, **C. Ray**, S. Collinge, and A. P. Martin. 2012. Connectivity of prairie dog colonies in an altered landscape: inferences from analysis of microsatellite DNA variation. *Conservation Genetics* 13: 407–418. <http://dx.doi.org/10.1007/s10592-011-0293-yL> [LINK BROKEN].
- Garrett, L., M. Jeffress, M. Britten, C. Epps, **C. Ray** and S. Wolff. 2011. Pikas in peril: multiregional vulnerability assessment of a climate-sensitive sentinel species. *Park Science* 28:9–13.
- Guralnick, R., L. P. Erb and **C. Ray**. 2011. Mammalian distributional response to climatic change: A review and research prospectus. Pages 85-106 in E. A. Beever and J. Belant (eds.) *Ecological consequences of climate change: Mechanisms, conservation, and management*. CRC Press (Taylor and Francis Group). 302 pp.
- Collinge, S. K., **C. Ray** and F. Gerhardt. 2011. Long-term dynamics of biotic and abiotic resistance to exotic species invasion in restored vernal pool plant communities. *Ecological Applications* 21(6):2105–2118.
- Erb, L. P., **C. Ray** and R. Guralnick. 2011. On the generality of a climate-mediated shift in the range of the American pika (*Ochotona princeps*). *Ecology* 92: 1730–1735.
- Beever, E. A., **C. Ray**, J. L. Wilkening, P. W. Mote, and P. F. Brussard. 2011. Contemporary climate change alters the pace and drivers of extinction. *Global Change Biology* 17(6):1–17. DOI: 10.1111/j.1365-2486.2010.02389.x
- Wilkening, J. L., **C. Ray**, E. A. Beever, and P. F. Brussard. 2011. Modeling contemporary range retraction in Great Basin pikas (*Ochotona princeps*) using data on microclimate and microhabitat. *Quaternary International* 235:77–88.
- Johnson, T.L., J.F. Cully, Jr., S.K. Collinge, **C. Ray**, C. Frey and B. Sandercock. 2011. Spread of plague among black-tailed prairie dogs is associated with colony spatial characteristics. *Journal of Wildlife Management* 75(2):357–368
- Rodhouse, T. J., E. A. Beever, L. K. Garrett, K. M. Irvine, M. R. Jeffress, M. Munts, and **C. Ray**. 2010. Distribution of American pikas in a low-elevation lava landscape: conservation implications from the range periphery. *Journal of Mammalogy* 91:1287–1299.
- Cully, J. F. Jr., S. K. Collinge, R. E. VanNimwegen, **C. Ray**, W. C. Johnson, B. Thiagarajan, D. B. Conlin and B. Holmes. 2010. Spatial variation in keystone effects: small mammal diversity associated with black-tailed prairie dog colonies. *Ecography* 33:667–677. DOI: 10.1111/j.1600-0587.2009.05746.x
- Cully, J.F., Jr., T.L. Johnson, S.K. Collinge, and **C. Ray**. 2010. Disease limits populations: plague and black-tailed prairie dogs. *Vector-Borne and Zoonotic Diseases* 10(1):7-15.
- Beever, E. A., **C. Ray**, P. W. Mote, and J. L. Wilkening. 2010. Testing alternative models of climate-mediated extirpations. *Ecological Applications* 20:164–178.

- Torres-Pérez, F. L. Wilson, S. K. Collinge, H. Harmon, **C. Ray**, R. A. Medina, and B. Hjelle. 2010. Sin Nombre virus infection in field workers, Colorado, USA. *Emerging Infectious Diseases* 16:308–310. DOI: 10.3201/eid1602.090735
- Brinkerhoff, R. J., **C. Ray**, B. Thiagarajan, S. K. Collinge, J. F. Cully, Jr., B. Holmes and K. L. Gage. 2010. Prairie dog presence affects occurrence patterns of disease vectors on small mammals. *Ecography* 31:654–662. DOI: 10.1111/j.0906-7590.2008.05336.x
- Brinkerhoff, R. J., S. K. Collinge, Y. Bai, and C. Ray. 2009. Are carnivores universally good predictors of plague? *Vector-Borne and Zoonotic Diseases* 9(5):491-497. DOI: 10.1089/vbz.2008.0075.
- Collinge, S. K., and **C. Ray**. 2009. Transient patterns in the assembly of vernal pool plant communities. *Ecology* 90:3313–3323.
- Collinge, S. K., and **C. Ray**. 2009. Ecology and restoration of vernal pools: A ten-year study of plant community dynamics. Pages 281–290 in P. Fraga i Arguimbau (ed.) *International conference on mediterranean temporary ponds: Proceedings and abstracts*. Consell Insular de Menorca. Recerca 14. Mao, Menorca, Spain.
- Collinge, S. K., **C. Ray** and J. F. Cully, Jr. 2008. Effects of disease on keystone species, dominant species, and their communities. Pages 129-144 in Ostfeld, Eviener, and Keesing (eds.) *Effects of Ecosystems on Disease and of Diseases on Ecosystems*. Princeton University Press.
- Bai, Y., M. Y. Kosoy, **C. Ray**, R. J. Brinkerhoff and S. K. Collinge. 2008. Temporal and spatial patterns of *Bartonella* infection in black-tailed prairie dogs (*Cynomys ludovicianus*). *Microbiology Ecology* 56:373-382.
- Bai, Y., M. Kosoy, A. Martin, **C. Ray**, K. Sheff, L. Chalcraft and S. K. Collinge, 2008. Characterization of *Bartonella* strains isolated from black-tailed prairie dogs (*Cynomys ludovicianus*). *Vector-Borne and Zoonotic Diseases* 8:1-5.
- Snäll, T., R. O'Hara, **C. Ray** and S. Collinge, 2008. Climate-driven spatial dynamics of plague among prairie dog colonies. *American Naturalist* 171:238-248.
- Ray, C.** and S. K. Collinge, 2007. Introducing the trophic vortex. (Invited letter.) *EcoHealth* 4:122-124.
- Bai, Y., M. Y. Kosoy, J. F. Cully Jr., B. Thiagarajan, **C. Ray** and S. K. Collinge. 2007. Acquisition of non-specific *Bartonella* strains by the northern grasshopper mouse (*Onychomys leucogaster*). *Microbiology Ecology* 61:438-448.
- Ray, C.** and S. K. Collinge, 2006. Potential effects of a keystone species on the dynamics of sylvatic plague. Pp. 202-216 in Collinge, S. K. and C. Ray (eds.), *Disease ecology: community structure and pathogen dynamics*. Oxford University Press. 227 pp.
- Collinge, S. K. and **C. Ray**, 2006. Community epidemiology. Pp. 1-5 in Collinge, S. K. and C. Ray (eds.), *Disease ecology: community structure and pathogen dynamics*. Oxford University Press. 227 pp.
- Collinge, S. K., W. C. Johnson, **C. Ray**, R. Matchett, J. Grensten, J. F. Cully, Jr., K. L. Gage, M. Y. Kosoy, J. E. Loye and A. P. Martin, 2005b. Landscape structure and plague occurrence in black-tailed prairie dogs on grasslands of the western USA. *Landscape Ecology* 20:941–955.
- Collinge, S. K., W. C. Johnson, **C. Ray**, R. Matchett, J. Grensten, J. F. Cully, Jr., K. L. Gage, M. Y. Kosoy, J. E. Loye, and A. P. Martin, 2005a. Testing the generality of a trophic-cascade model for plague. *EcoHealth* 2:1–11.
- Jones, R., A. Martin, A. Mitchell, S. Collinge and **C. Ray**, 2005. Characterization of 14 polymorphic microsatellite markers for the black-tailed prairie dog. *Molecular Ecology Notes* 5:71-73.
- Fleishman, E., **C. Ray**, P. Sjögren-Gulve, C. L. Boggs, D. D. Murphy, 2002. Assessing the relative roles of patch quality, area and isolation in predicting metapopulation dynamics. *Conservation Biology* 16:706-716.
- Harrison, S. and **C. Ray**, 2002. Plant population viability and metapopulation-level processes. Pp. 109-122 in Beissinger, S. and D. McCullough (eds.), *Population viability analysis*. University of Chicago Press. 577 pp.

- Ray, C.**, 2001. Maintaining genetic diversity despite local extinctions: effects of population scale. *Biological Conservation* 100:3-14.
- Debinski, D. M., **Ray, C.** and E. H. Saveraid, 2001. Species diversity and the scale of the landscape mosaic: do scales of movement and patch size affect diversity? *Biological Conservation* 98:179-190.
- Peacock, M. and **C. Ray**, 2001. Dispersal in Pikas (*Ochotona princeps*): combining genetic and demographic approaches to reveal spatial and temporal patterns. *Pp.* 43-56 in Clobert et al. (eds.) *Dispersal: causes, consequences and mechanisms of dispersal at the individual, population and community level*. Oxford University Press. 480 pp.
- Holyoak, M. and **C. Ray**, 1999. A roadmap for metapopulation research. *Ecology Letters* 2(5):273-275.
- Ray, C.** and M. Hoopes, 1997. A step toward synthesizing metapopulation biology. (Book review.) *Ecology* 78(7):2270-2271.
- Ray, C.** and A. Hastings, 1996. Density dependence: are we searching at the wrong spatial scale? *Journal of Animal Ecology* 65(5):556-566.
- Sjögren-Gulve, P. and **C. Ray**, 1996. Using logistic regression to model metapopulation dynamics: large-scale forestry extirpates the pool frog. *Pp.* 111-137 in D. R. McCullough (ed.), *Metapopulations and Wildlife Conservation & Management*. Island Press, Washington D.C.
- Ray, C.**, M. Gilpin, T. Philippi and C. Biehl, 1993. Modeling raven predation on the desert tortoise: a structured approach. *Pp.* 118-124 in Proceedings of the 1992 Desert Tortoise Council Symposium.
- Ray, C.**, M. Gilpin and A. T. Smith, 1991. The effect of conspecific attraction on metapopulation dynamics. *Pp.* 123-134 in Gilpin, M. and Hanski, I. (eds.) *Metapopulation Dynamics, Empirical and Theoretical Investigations*. Academic Press, London.

Edited Volume

- Collinge, S. K. and **C. Ray**, 2006. *Disease ecology: community structure and pathogen dynamics*. Oxford University Press. 227 pp.

Species Recovery Plan

- 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.

Professional Reports

- 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.

Software

- Chamberlain, S., **C. Ray** and Vijay Barve. c 2015. **rvertnet**: an R interface for the VertNet database. <https://github.com/ropensci/rvertnet>.
- 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. METAPO2: 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. 2015. 3rd Annual 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.***, 2014. A pika in my pocket: snuggling up to study climate change. Teen Café, Denver Botanical Gardens, March 10.
- Ray, C.***, J. Wilkening, S. Bhattacharyya and L. Erb, 2013. Cheating climate change: can microhabitat selection save a species? University of Nevada, Reno, NV, October 17.
- Ray, C.***, 2013. Climate and the American pika. 20th Annual Boulder County Ecosystem Symposium on *Climate Change and the Resilience of High Elevation Ecosystems*, University of Colorado, Boulder, CO, March 16.
- Ray, C.***, 2013. Pika CPR in the Indian Peaks: status and stories of an alpine icon. Annual meeting of the Indian Peaks Wilderness Association, USDA Forest Service, Boulder, CO, March 4.
- Ray, C.***, M. Jeffress et al., 2013. National Park Service pika study: habitat occupancy results from eight parks and preliminary genetic results. Interpretation and Resource Stewardship Workshop, Continental Divide Research Learning Center's Annual Interpretation and Resource Stewardship Day, Rocky Mountain National Park, CO, February 27.
- Ray, C.***, 2012. Climate and the American pika: in our wilderness and beyond. USDA Forest Service Wilderness Volunteer Workshop, Denver, CO, December 3-4.
- Ray, C.***, 2012. Climate and the American pika. Fort Collins Audubon, Fort Collins, CO, November 8.
- Erb, L. P.*, **C. Ray** and R. Guralnick, 2012. Climatic influences on multi-year occupancy of the American pika (*Ochotona princeps*) in the southern Rocky Mountains. Naturalist Nights lecture series at the Aspen Center for Environmental Studies.
- Ray, C.***, 2012. Effects of microclimate on patterns of survival in the American pika inferred from long-term data on a population in the central Rocky Mountains. Symposium for the North American Congress for Conservation Biology, Oakland, CA.
- Jeffress, M.*, **C. Ray** et al., 2012. Status and trend in American pika site occupancy patterns across the western US: insights from some of the nation's "crown jewel" national park units. Symposium of the North American Congress for Conservation Biology, Oakland, CA, July 15-18.

- Erb, L. P.*, **C. Ray** and R. Guralnick, 2012. Climatic influences on multi-year occupancy of the American pika (*Ochotona princeps*) in the southern Rocky Mountains. Symposium of the North American Congress for Conservation Biology, Oakland, CA, July 15-18.
- Ray, C.***, M. Jeffress et al., 2012. National Park Service pika habitat occupancy study: Preliminary results from eight parks. 6th Biennial Rocky Mountain National Park Research Conference, Estes Park, CO, March 28-29.
- Ray, C.***, M. Jeffress et al., 2012. National Park Service pika habitat occupancy study: Preliminary results from eight parks. Biodiversity and Climate Change Workshop, Continental Divide Research Learning Center's Annual Interpretation and Resource Stewardship Day, Rocky Mountain National Park, CO, February 8.
- Ray, C.***, 2012. The American pika, a model species for studying climate sensitivity. Science Hubs teacher development workshop, Colorado Springs, CO,
- Ray, C.***, 2011. When tailings are habitat: hard rock mining and the American pika. Colorado Art Ranch Artposium, *Hardrock revision: re-envisioning the Ute-Ulay mine*, Lake City, CO, July 29. Sponsored by the Office of University Outreach, University of Colorado-Boulder.
- Ray, C.***, 2011. Climate and the American pika. Pueblo Zoo, Pueblo, CO, April 7. Sponsored by the Office of University Outreach, University of Colorado-Boulder.
- Ray, C.***, 2010. Climate-mediated relations between biodiversity and disease: answers on the horizon. Symposium, 95th Annual Meeting of the Ecological Society of America, *All You Need to Know is...: advice from theorists on managing ecosystems in a changing climate*. Pittsburgh, PA, August 1-6.
- Ray, C.***, 2010. The American pika. Denver Zoo. Sponsored by Denver Zoo, Center for Native Ecosystems and the Front Range Pika Project.
- Ray, C.***, 2010. A passel of pikas in lava beds at low elevation: Exploring the distribution of the American pika within Lava Beds National Monument, CA. Symposium of The Wildlife Society, Western Section, Irvine, CA.
- Ray, C.***, 2010. Climate and the American pika. California Polytechnic, San Luis Obispo, CA.
- Ray, C.***, 2010. Inferring effects of climate on the American pika. Boulder County Nature Association.
- Ray, C.***, 2010. Climate and the American pika. Audubon Society of Boulder, CO.
- Ray, C.***, E. Beever, P. Mote, J. Wilkening, L. Peterson, K. Sweazea and S. Loarie, 2010. Climate and the American pika. COSEE Institute, Boulder High School, Boulder, CO.
- Ray, C.***, E. Beever, P. Mote, J. Wilkening and L. Peterson, 2010. Inferring effects of climate on the American pika. Speaker series for Gore Range Natural Science School, sponsored by the Gore Range Natural Science School and Avon Public Library, Avon, CO.
- Ray, C.***, 2010. Inferring effects of climate on the American pika. Roaring Fork Audubon, Glenwood, CO.

(Invited presentations prior to 2010 omitted.)

Contributed Presentations (* indicates presenter)

- Schwalm, D., et al. (**Ray***), 2015. RMNP Research Conference on March 4-5.
- Schwalm, D.,* et al., 2014. Accounting for lost habitat when forecasting effects of climate change on metapopulation dynamics. The Wildlife Society, 21st Annual Conference, Pittsburgh, Pennsylvania, October 29.
- Castillo, J.,* et al., 2014. Landscape effects on gene flow of American pika: a comparative landscape genetics study. North America Congress for Conservation Biology, Missoula, Montana, July 13-16.
- Wilkening, J.* and **C. Ray**, 2013. "Comparison of stress hormone levels measured in pikas across the western US". North American Congress for Conservation Biology. Baltimore, Maryland, July 21-25.
- Wilkening, J.* and **C. Ray**, 2013. Indicators of physiological stress in American pikas. 11th International Mammalogical Congress. Belfast, Ireland, August 11-16.

- Wilkening, J.* and **C. Ray**, 2013. Effects of environment on stress hormone metabolites measured in American pika feces. International Society of Wildlife Endocrinology 5th annual conference. Chicago, Illinois, October 14-16.
- Wilkening, J.* and **C. Ray**, 2012. A non-invasive technique for assessing stress in a sensitive alpine species. 97th Ann. Meeting of the Ecological Society of America. Portland, Oregon, August 5-10.
- Wilkening, J.* and **C. Ray**, 2012. Poster: Using fecal samples to measure stress in American pikas in a Rocky Mountain LTER. Long Term Ecological Research (LTER) All Scientists Meeting: The unique role of the LTER network in the Anthropocene: Collaborative Science Across Scales. Estes Park, Colorado, September 10-13.
- Erb, P.*, L. P. Erb and **C. Ray**, 2012. Poster: ScienceLIVE: Providing innovative connections between LTER research and the public. Long Term Ecological Research (LTER) All Scientists Meeting: The unique role of the LTER network in the Anthropocene: Collaborative Science Across Scales. Estes Park, Colorado, September 10-13.
- Nichols, L., **C. Ray*** and L. P. Erb, 2012. Factors influencing persistence in a declining population of American pikas in the Bodie Hills of eastern California. The Wildlife Society 19th annual conference. Portland, Oregon, October 13-18.
- Wilkening, J.* and **C. Ray**, 2012. Using physiological samples to measure stress in American pikas. The Wildlife Society 19th annual conference. Portland, Oregon, October 13-18.
- Collinge, S.* and **C. Ray**, 2011. Reflections on vernal pool plant community restoration: Three lessons from a long-term field experiment. 96th Ann. Meeting of the Ecological Society of America.
- Erb, L.*, **C. Ray** and R. Guralnick, 2011. Multi-year pika occupancy in the Southern Rockies: A regional stronghold or the next Great Basin? 95th Ann. Meeting of the Ecological Society of America.
- Ray, C.***, K. Sweazea and J. Wilkening, 2011. Signs of demographic change and physiological stress in Rocky Mountain pikas. 95th Ann. Meeting of the Ecological Society of America.
- Ray, C.***, 2010. Demographic change and physiological stress in Rocky Mountain pikas. 1st North American Pika Conference, Jackson Hole, WY.
- Ray, C.*** and M. Shardlow, 2010. National Park Service pika habitat occupancy study: Preliminary results from eight parks. Meeting of the California Pika Consortium, at the annual conference of The Wildlife Society-Western Section.

(Contributed presentations prior to 2010 omitted.)

Academic Course Lectures

- Ray, C.***, 2014. Pikas and climate. Lecture presented in *Conservation biology* course, University of Colorado, Boulder, CO, November 5.
- Ray, C.***, 2012. A model of climate sensitivity? Lectures presented in upper-division/graduate courses *Mountain geography* and *Conservation biology*, University of Colorado, Boulder, CO.
- Ray, C.***, 2012. Climate and the American pika. Biology Club, University of Colorado, Boulder, CO, November 8.
- Ray, C.***, 2011. A model of climate sensitivity? Lectures presented in upper-division/graduate courses *Novel ecosystems: understanding local manifestations of global change* and *Conservation biology*, University of Colorado, Boulder, CO.
- Ray, C.***, 2010. Climate and the American pika. Lecture presented in upper-division/graduate course *Mountain geography*, University of Colorado, Boulder, CO.
- Ray, C.***, 2010. Climate change and disease ecology. Lecture presented in upper-division/graduate course *Disease ecology and evolution*, University of Colorado, Boulder, CO.

- Ray, C.***, 2010. Signs of demographic change and physiological stress in Rocky Mountain pikas. Lecture presented in upper-division/graduate course *Novel ecosystems: understanding local manifestations of global change*, University of Colorado, Boulder, CO.
- Ray, C.***, E. Beever, P. Mote and J. Wilkening, 2009. Inferring the role of climate in the decline of the American pika. Lecture presented in course *Global warming: science and expression through video production and presentation*, University of Colorado, Boulder, CO.
- Ray, C.***, 2005. Plague stumps the chumps. Lecture presented in upper-division/graduate course *Parade of chumps*, University of Colorado, Boulder, CO.

Grants and Contracts

- 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. Beever)
 PI: WWF International Research Grant (2006) \$4K
 Contractor: US National Park Service Contract (2005) \$12K (PI: E. Beever)
 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) \$0.5M (PI: S. Collinge)
 Co-author: US Fish and Wildlife Service Contracts (1998-2002) \$0.4M (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

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

- NSF Population and Community Ecology Panel, Fall 2010, 2011
 IUCN Lagomorph Specialist Group
 Ecological Society of America
 Society for Conservation Biology

Synergistic Activities

Innovations in teaching and training and research: Developed graduate student seminars on Bayesian hierarchical analysis, occupancy modeling, population viability analysis and demographic modeling for graduate students at the University of Colorado. Developed or co-developed software: [vertnet](#) for accessing the VertNet biological database using R, POPNET and METAPOPOP2 for modeling population and metapopulation dynamics, VISCOUS for simulating spatial patterns in genetic diversity, BRYOGRO for simulating clonal growth patterns, and LESSON for teaching basic programming skills

to undergraduates. Co-developed citizen-science training programs (e.g., [pikapartners](#)) designed to develop skills in data collection and database use for conservation.

Outreach: Coordinate and perform educational programs and associated outreach for the Niwot Ridge Long Term Ecological Research (NWT LTER) program, through an annual appointment with the Institute for Arctic and Alpine Research (INSTAAR).

International service: Pika specialist for the IUCN Lagomorph Specialists Group. Co-organized symposia/sessions for multiple international meetings of the Ecological Society of America. 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).

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. Invited 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 ABC Nightly News, National Public Radio, Science and National Wildlife.

Student Mentoring

Post-doctoral Students (co-advisor)

Tord Snäll, Swedish University of Agricultural Sciences, 2005

Graduate Students (co-advisor)

Jennifer Wilkening, Ph.D. 2014

Liesl Peterson Erb, Ph.D. 2013

Sabuj Bhattacharyya, Fulbright 2010

Undergraduate Honors (advisor)

Maxwell Plichta, EBIO Honors x2016

Meghan Wiebe, EBIO Honors x2015

James Howe Jr., EBIO Honors 2014

Undergraduate Research (supervisor or co-supervisor)

Christian Prince, ENV5 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

Collaborators and Other Affiliations

Advisors

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

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