

Maxwell B. Joseph

Data scientist

Earth Lab
Analytics Hub University of Colorado, Boulder
maxwell.b.joseph@colorado.edu

Education

University of Colorado, Boulder

Ph.D. 2010 - 2016

Advisor: Pieter Johnson

Department of Ecology and Evolutionary Biology

University of California, Davis

B.S. 2004 - 2008

Advisors: Louis Botsford and Sharon Lawler

Wildlife, Fish, and Conservation Biology

Research Interests

The intersection of Earth science, statistics, and machine learning; neural networks, spatiotemporal statistics, hierarchical Bayesian models, state-space models; causes and consequences of extinctions; relationships between biodiversity and disease; host-symbiont metacommunity dynamics; causal models of species occurrence; occupancy modeling for host-symbiont systems; amphibian declines; wildlife disease management; biotic invasions

Peer-reviewed publications

- **Joseph MB**, Rossi MW, Mietkiewicz NP, Mahood AL, Cattau ME, St. Denis LA, Nagy RC, Iglesias V, Abatzoglou JT, Balch JK. 2019. Spatiotemporal prediction of wildfire size extremes with Bayesian finite sample maxima. *Ecological Applications* e01898.
- Scherer RD, Hansen EC, **Joseph MB**, Wack RF. 2019. Estimating relationships between size and fecundity in the threatened giant gartersnake in semi-natural and agricultural wetlands. *Population Ecology* 61(2): 141-149.
- Kueneman JG, Bletz MC, McKenzie VJ, Becker CG, **Joseph MB**, Abarca JG, Archer H, Arellano AL, Bataille A, Becker M, Belden LK, Crottini A,

Geffers R, Haddad CFB, Harris RN, Holden WM, Hughey M, Jarek M, Kearns PJ, Kerby JL, Kielgast J, Kurabayashi A, Longo AV, Loudon A, Medina D, Nuñez JJ, Perl RGB, Pinto-Tomás A, Rabemamananjara FCE, Rebollar EA, Rodríguez A, Rollins-Smith L, Stevenson R, Tebbe CC, Asensio GV, Waldman B, Walke JB, Whitfield SM, Zamudio KR, Chaves IZ, Woodhams DC, Vences M. 2019. Community richness of amphibian skin bacteria correlates with bioclimate at the global scale. *Nature ecology & evolution*. 3(3): 381.

- **Joseph MB**, Knapp RA. 2018. Disease and climate effects on individuals drive post-reintroduction population dynamics of an endangered amphibian. 9 (11).
- Miller DA, Grant EH, Muths E, Amburgey SM, Adams MJ, **Joseph MB**, Waddle JH, Johnson PT, Ryan ME, Schmidt BR, Calhoun DL, et al. Quantifying climate sensitivity and climate-driven change in North American amphibian communities. *Nature communications*. 9(1):3926.
- Wall CC, Karnauskas K, **Joseph MB**, McGlinchy J, Johnson BR. 2018. Navigating noise when comparing satellite and acoustic remote sensing data. *The Journal of the Acoustical Society of America*. 144(3): 1744-1745.
- Orlofske SA, Flaxman S, **Joseph MB**, Fenton A, Melbourne B, Johnson PTJ. 2017. Experimental investigation of alternative transmission functions: quantitative evidence for the importance of non-linear transmission dynamics in host-parasite systems. *Journal of Animal Ecology* *accepted*.
- **Joseph MB**, Stutz WE, Johnson PTJ. 2016. Multilevel models for the distribution of hosts and symbionts. *PLOS ONE* 11(11): e0165768.
- Manlove KR, Walker JG, Craft ME, Huyvaert KP, **Joseph MB**, Miller RS, Nol P, Patyk KA, O'Brien D, Walsh DP, Cross PC. 2016. "One Health" or Three? Publication silos among the one health disciplines. *PLoS Biology* 14:4.
- Grant EHC, Miller DAW, Schmidt BR, Adams MJ, Amburgey SM, Chamberlain T, Cruickshank SS, Fisher RN, Green DM, Hossack BR, Johnson PTJ, **Joseph MB**, Rittenhouse TAG, Ryan ME, Waddle JH, Walls SC, Bailey LL, Fellers GM, Gorman TA, Ray AM, Pilliod DS, Price SJ, Saenz D, Sadinski W, Muths E. 2016. Quantitative evidence for the effects of multiple drivers on continental-scale amphibian declines. *Scientific reports* 6.
- Johnson PTJ, Wood CL, **Joseph MB**, Preston DL, Haas SE, Springer YP. 2016. Habitat heterogeneity drives the host-diversity-begets-parasite-diversity relationship: evidence from experimental and field studies. *Ecology Letters* 19: 7.

- Hannon ER, Kinsella JM, Calhoun DM, **Joseph MB**, Johnson PTJ. 2016. Endohelminths in bird hosts from northern California and an analysis of the role of life history traits on parasite richness. *The Journal of Parasitology*.
- **Joseph MB**, Preston DL, Johnson PTJ. 2015. Integrating occupancy models and structural equation models to understand species occurrence. *Ecology*.
- Wilkins MR, Shizuka D, **Joseph MB**, Hubbard JK, Safran RJ. 2015. Multimodal signaling in the North American barn swallow: a phenotype network approach. *Proceedings of the Royal Society B* 282: 20151574.
- Mihaljevic JR, **Joseph MB**, Johnson PTJ. 2015. Using multi-species occupancy models to improve the characterization and understanding of metacommunity structure. *Ecology* 96(7): 1783–1792.
- Mihaljevic JR, **Joseph MB**, Orlofske SA, Paull SH. 2014. The scaling of host density with richness affects the direction, shape, and detectability of diversity-disease relationships. *PLoS ONE* 9(5): e97812.
- **Joseph MB**, Mihaljevic JR, Orlofske SA, Paull SH. 2013. Does life history mediate changing disease risk when communities disassemble? *Ecology Letters*, 16(11): 1405-1412.
- **Joseph MB**, Mihaljevic JR, Arellano AL, Keuneman JG, Preston DL, Cross PC, Johnson PTJ. 2013. Taming wildlife disease: bridging the gap between science and management. *Journal of Applied Ecology* 50(3): 702-712.
- McMahon TA, Brannelly LA, Chatfield MWH, Johnson PTJ, **Joseph MB**, McKenzie VJ, Richards-Zawacki CL, Venesky MD, Rohr JR. 2012. Chytrid fungus *Batrachochytrium dendrobatidis* has nonamphibian hosts and releases chemicals that cause pathology in the absence of infection. *Proceedings of the National Academy of Sciences of the United States of America* 110(1): 210-215.
- **Joseph MB**, Piovia-Scott J, Lawler SP, Pope KL. 2011. Indirect effects of introduced trout on Cascades frogs (*Rana cascadae*) via shared aquatic prey. *Freshwater Biology* 56 (5): 828-838.
- **Joseph MB**, Gentles M, Pearse IS. 2011. The parasitoid community of *Andricus quercuscalifornicus* and its association with gall size, phenology, and location. *Biodiversity and Conservation* 20 (1): 203-216.
- Karban R, Hodson A, Gruner DS, Lewis EE, Karban J, **Joseph MB**, Mata T, Strong DR. 2011. Lack of susceptibility of soil-inhabiting *Platyrepia virginialis* caterpillars, a native arctiid, to entomopathogenic nematodes in nature. *Entomologia Experimentalis et Applicata* 140 (1): 28-34.

Preprints

- **Joseph MB**, Rossi MW, Mietkiewicz NP, Mahood AL, Cattau ME, St. Denis LA, Nagy RC, Iglesias V, Abatzoglou JT, Balch JK. 2019. Spatiotemporal prediction of wildfire extremes with Bayesian finite sample maxima. bioRxiv.
- Ranjeva SL, Mihaljevic JR, **Joseph MB**, Giuliano AR, Dwyer G. 2018. Untangling the dynamics of persistence and colonization in microbial communities. bioRxiv.
- **Joseph MB**, Knapp RA. Disease and climate effects on individuals jointly drive post-reintroduction population dynamics of an endangered amphibian. bioRxiv.
- **Joseph MB**, Stutz WE, Johnson PTJ. 2015. Multilevel models for the distribution of hosts and symbionts. PeerJ PrePrints 3:e1876.

Other publications

- Exact sparse conditional autoregressive models in Stan. 2016. Stan case studies. <https://doi.org/10.5281/zenodo.210407>
- Course notes: hierarchical Bayesian modeling for ecologists. 2016. <https://github.com/hmods/notes>
- Blog. 2013-present. An R code blog and open lab notebook with content around applying and teaching Bayesian statistics, R, and scientific computing. <http://mbjoseph.github.io>
- GitHub account: mbjoseph. 2012-present. Includes a variety of statistical resources and integrated templates for reproducible research. <https://github.com/mbjoseph>
- Joseph MB. 2009. Searching for Pratt. *Alpinist* 27.

Software products

- smapr: an R package for acquisition and processing of NASA SMAP data. <https://github.com/ropensci/smapr>
- eddi: an R package for acquisition and processing of NOAA Evaporative Demand Drought Index data. <https://github.com/earthlab/eddi>
- leri: an R package for acquisition and processing of NOAA Landscape Evaporative Response Index data. <https://github.com/earthlab/leri>

- streamstats: a Python client for the USGS StreamStats API.
<https://github.com/earthlab/streamstats>
- earthpy: a Python library for working with spatial raster and vector data.
<https://github.com/earthlab/earthpy>
- Earth Lab Docker stack, including Dockerfiles on GitHub and registered images on Docker Hub.

Teaching experience

Spring 2016: Instructor Bayesian hierarchical modeling graduate course, University of Colorado, Boulder

Spring 2016: TA Ecology, University of Colorado, Boulder

Fall 2015: TA Biometry, University of Colorado, Boulder

Summer 2015: TA General Biology Lab II, University of Colorado, Boulder

Summer 2015: Curriculum development: Introduction to Quantitative Inference and Thinking, University of Colorado, Boulder

Spring 2015: TA Introduction to Quantitative Inference and Thinking, University of Colorado, Boulder

Spring 2015: TA General Biology Lab II, University of Colorado, Boulder

Fall 2014: TA General Biology Lab I, University of Colorado, Boulder

Summer 2014: TA General Biology Lab II, University of Colorado, Boulder

Spring 2011: TA General Biology Lab II, University of Colorado, Boulder

Fall 2010: TA General Biology Lab I, University of Colorado, Boulder

Awards, Grants, and Fellowships

2015: CIRTL (Center for the Integration of Teaching, Research, and Learning) Network associate, TIGER (Teaching Institute for Graduate Education Research) ROAR (Research on Academic Retention) in statistics, University of Colorado, Boulder

2013: City of Boulder Open Space and Mountain Parks Research Grant

2012-2013: Boulder County Parks and Open Space Small Grants Program

2012: Beverly Sears Graduate Student Grant

2012: USGS Amphibian Specialist Group ARMI Initiative Seed Grant

2012: University of Colorado Museum of Natural History Graduate Research Grant

2011-2014: National Science Foundation Graduate Research Fellowship

2011-2012 University of Colorado Ecology and Evolutionary Biology Graduate Research Grant

2011: Chicago Herpetological Society Graduate Research Grant

2011: American Society of Ichthyologists and Herpetologists Gaige Award

2011: University of California Santa Barbara Valentine Eastern Sierra Reserve Graduate Research Grant

Contributed presentations and workshops

- Wasser L, **Joseph MB**. 2017. Introduction to version control with git. Earth Analytics Education training workshop.
- **Joseph MB**. 2017. Introduction to neural networks in remote sensing. Guest lecture: Remote Sensing Data Analysis, University of Colorado, Boulder.
- **Joseph MB**. 2016. Partial pooling, Bayesian inference, and shrinkage in NBA freethrow percentages. Analyze Boulder December meetup.
- **Joseph MB**. 2016. Introduction to the R programming language. Rocky Mountain Advanced Computing Consortium annual conference.
- **Joseph MB**. 2016. Advanced collaborative version control with git: forking and pull requests. Earth Lab training workshop.
- **Joseph MB**. 2016. Introduction to version control with git and GitHub. Earth Lab training workshop.
- **Joseph MB**. 2016. Best practices in scientific computing. Ecology and Evolutionary Quantitative Think Tank, University of Colorado, Boulder.
- **Joseph MB**. 2015. The theory of disease induced extinction. Guest lecture: Disease Ecology, University of Colorado, Boulder.
- **Joseph MB**. 2015. Empirical and theoretical opportunities in host-symbiont community ecology. Ecological Society of America Annual Meeting, Baltimore, MD.
- Preston DL, **Joseph MB**, Esfahani ER, Pena E, Johnson PTTJ. 2015. Effect of invasive fish on wetland communities: linking field data and mechanistic experiments at multiple scales. Ecological Society of America Annual Meeting, Baltimore, MD.
- **Joseph MB** 2015. Introduction to Fungi. Guest lecture: Biology, a Human Approach 2, University of Colorado, Boulder.

- **Joseph MB.** 2015. Amphibian declines and disease-induced extinctions. Guest lecture: Conservation Biology, University of Colorado, Boulder.
- Basey JM, Francis CD, **Joseph MB.** 2015. The influence of student achievement motivation orientation and study/leisure conflict on self-regulated study during student-centered general biology labs. 26th International Conference on College Teaching and Learning, Ponte Veda Beach, Florida.
- **Joseph MB.** 2015. Git workshop: better version control. Ecology and Evolutionary Quantitative Think Tank, University of Colorado, Boulder.
- **Joseph MB,** Preston DL, Johnson PTJ. 2015. Integrating occupancy models and structural equation models to better understand community composition. Invited talk: IQBio Quantitative Biology Student Symposium, University of Colorado, Boulder.
- **Joseph MB.** 2015. Criteria for establishing causal links between climate change and disease emergence: a case study with the amphibian chytrid fungus *Batrachochytrium dendrobatidis*. Guest lecture: Infectious Diseases, Environmental Contexts, Colorado School of Public Health.
- **Joseph MB.** 2015. Shrinkage and partial pooling in mixed effects models. CU Ecology and Evolutionary Biology Brown Bag.
- **Joseph MB,** Mihaljevic JR, Johnson PTJ. 2014 Reconciling seemingly divergent effects of diversity on disease: a metacommunity approach. Ecological Society of America Annual Meeting, Sacramento, CA.
- Mihaljevic JR, **Joseph MB,** Johnson PTJ. 2014. Using multi-species occupancy models to improve inference of metacommunity structure. Ecological Society of America Annual Meeting, Sacramento, CA.
- **Joseph MB,** Mihaljevic JR, Johnson PTJ. 2014. Reconciling seemingly divergent effects of diversity on disease: a metacommunity approach. Ecology of Infectious Diseases Meeting, Fort Collins, CO.
- **Joseph MB.** 2014. Tips and tricks for reproducible workflows and research: intro to git, markdown, and make. CU Ecology and Evolutionary Biology Brown Bag.
- **Joseph MB,** Preston DL, Johnson PTJ. 2013. Uniting dynamic occupancy and generalized latent variable models to understand the effects of cattle grazing on amphibian communities. Ecological Society of America Annual Meeting, Minneapolis, MN.
- Mihaljevic JR, **Joseph MB,** Johnson PTJ. 2013. The role of host community abundance-richness relationships in pathogen transmission. Ecological Society of America Annual Meeting, Minneapolis, MN.

- **Joseph MB.** 2013. Habitat use and movement of Northern leopard frogs in Boulder, CO. Boulder County Parks and Open Space Advisory Committee Meeting.
- **Joseph MB.** 2013. Habitat use and movement of Northern leopard frogs in Boulder, CO. Invited talk: City of Boulder Open Space and Mountain Parks.
- **Joseph MB.** 2013. Does life history mediate changes in disease risk when communities disassemble? CU Ecology and Evolutionary Biology Brown Bag.
- **Joseph MB.** 2012. Causes and consequences of global amphibian declines. Public lecture: Save the Frogs Day, Natural History Museum, University of Colorado, Boulder.
- **Joseph MB.** 2012. Causes and consequences of global amphibian declines. Guest lecture: Introduction to Herpetology, University of Colorado, Boulder.
- **Joseph MB.** 2012. Non-native trout disrupt aquatic-terrestrial subsidies in montane lakes. Guest lecture: Mountain Geography, University of Colorado, Boulder.
- **Joseph MB.** 2011. Non-native trout disrupt aquatic-terrestrial subsidies in montane lakes. Guest lecture: Mountain Geography, University of Colorado, Boulder.

Media coverage

Chris Baraniuk. 2018. The quest to predict - and stop - the spread of wildfires. BBC Future.

Susan Moran. 2014. Tag, you're it! Advances in radio and satellite tagging reveal the secret lives of animals. Science News for Students, Society of Science.

Marty Durlin. 2013. The Chorus of the Leopard frogs. Radio show and interview KVNF.