Maxwell B. Joseph

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Data scientist

2016-present Earth Lab
Analytics Hub
University of Colorado, Boulder

Open science architect

2018-present North Central Climate Adaptation Science Center
University of Colorado, Boulder

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**. Neural hierarchical models of ecological populations. Ecology Letters. 2020 Apr;23(4):734-47.
- Balch JK, Iglesias V, Braswell AE, Rossi MW, **Joseph MB**, Mahood AL, Shrum TR, White CT, Scholl VM, McGuire B, Karban C. Social-environmental extremes: Rethinking extraordinary events as outcomes of interacting biophysical and social systems. Earth's Future. 2020 Jul;8(7):e2019EF001319.

- Denis LA, Hughes AL, Diaz J, Solvik K, **Joseph MB**, Balch JK. 'What I Need to Know is What I Don't Know!': Filtering Disaster Twitter Data for Information from Local Individuals. Proceedings of 17th International Conference on Information Systems for Crisis Response and Management 2020.
- Diaz J, St Denis LA, **Joseph MB**, Solvik K, Balch JK. Classifying Twitter Users for Disaster Response: A Highly Multimodal or Simple Approach?. Proceedings of the Information Systems for Crisis Response and Management Conference (ISCRAM 2020) 2020.
- Scholl VM, Cattau ME, **Joseph MB**, Balch JK. Integrating national ecological observatory network (NEON) airborne remote sensing and in-situ data for optimal tree species classification. Remote Sensing. 2020 Jan;12(9):1414.
- McGlinchy J, Johnson B, Muller B, **Joseph MB** and Diaz J, 2019. Application of UNet Fully Convolutional Neural Network to Impervious Surface Segmentation in Urban Environment from High Resolution Satellite Imagery. In IGARSS 2019-2019 IEEE International Geoscience and Remote Sensing Symposium (pp. 3915-3918). IEEE.
- Ranjeva SL, Mihaljevic JR, **Joseph MB**, Giuliano AR and Dwyer G, 2019. Untangling the dynamics of persistence and colonization in microbial communities. The ISME journal, pp.1-13.
- Diaz J, and **Joseph, MB**, 2019. Predicting property damage from tornadoes with zero-inflated neural networks. Weather and Climate Extremes, 25, p.100216.
- **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, Rabemananjara 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.

- Wasser L, **Joseph MB**, McGlinchy J, Palomino J, Korinek, N, Holdgraf C, Head T. 2019. EarthPy: a Python package that makes it easier to explore and plot raster and vector data using open source Python tools. Journal of Open Source Software 4(43):1886.
- **Joseph MB**, Knapp RA. 2018. Disease and climate effects on individuals drive post-reintroduction population dynamics of an endangered amphibian. Ecosphere 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.
- Johnson BR, McGlinchy J, Cattau M, **Joseph MB** and Scholl V, 2018, September. Harnessing commercial satellite technologies to monitor our forests. In Remote Sensing and Modeling of Ecosystems for Sustainability XV (Vol. 10767, p. 1076702). International Society for Optics and Photonics.
- 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 87(3).
- **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, Chambert 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.
- Johnon 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 Platyprepia virginialis caterpillars, a native arctiid, to entomopathogenic nematodes in nature. Entomologia Experimentalis et Applicata 140 (1): 28-34.

Preprints

- Gadeken KR, **Joseph MB**, McGlinchy J, Karnauskas KB, Bell CC. Predicting subsurface sonar observations with satellite-derived ocean surface data in the California Current Ecosystem. bioRxiv. 2020 Jan 1.
- **Joseph MB**, Knapp RA. Using encounter data to improve capture-recapture abundance estimates. BioRxiv. 2020 Jan 1.

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 @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

- neonhs: an R package to simplify working with NEON's hyperspectral imagery. https://github.com/earthlab/neonhs
- Climate futures toolbox (cft): easy climate data access (MACA v2) to support climate scenario planning. https://github.com/earthlab/cft
- 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

2019: NSF HDBE The Creeping Disaster along the Coast: Built Environment, Coastal Communities and Population Vulnerability to Sea Level Rise (senior personnel)

2019: NSF HDR DSC: Earth Data Science Corps - Fulfilling Workforce Demand at the Intersection of Environmental Science and Data Science (senior personnel)

2019: NSF CAREER: Fire impacts on forest carbon recovery in a warming world: training the next generation of Earth analysts by exploring a missing scale of observations (senior personnel)

2018: DOI/USGS CU Boulder NC CASC: Driving innovation in co-producing science to help resource managers in the North Central region adapt to a changing world (senior personnel)

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

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.