Carl Boettiger

ESPM Department, University of California, 130 Mulford Hall #3114
Berkeley, CA 94720 – USA

cboettig@berkeley.edu • http://carlboettiger.info • cboettig
cboettig • orcid: 0000-0002-1642-628X

Employment

2015-current Assistant Professor, Department of Environmental Science, Policy and Management, **University of California, Berkeley.**

2013-2015 NSF Post-doctoral Scholar in the Department of Applied Mathematics and Statistics, **University of California, Santa Cruz**. Mentors: Marc Mangel, Stephan Munch

Education

2012 Ph.D Population Biology, **University of California, Davis**. Mentor: Alan Hastings

2007 A.B in Physics, **Princeton University**, with honors and certificates in *biophysics* and *applied and computational mathematics*.

Publications

1. James J. Wray, Neta A. Bahcall, Paul Bode, **Carl Boettiger**, Phillip Hopkins (2006). The Shape, Multiplicity, and Evolution of Superclusters in Lambda-CDM Cosmology, *The Astrophysical Journal* 652 (2) 907-916. doi:10.1086/50860. (oa)

2. **Carl Boettiger**, Jonathan Dushoff, Joshua S Weitz (2010). Fluctuation domains in adaptive evolution, *Theoretical Population Biology* 77 (1) 6-13. doi:10.1016/j.tpb.2009.10.003. (oa, code, data)

3. **Carl Boettiger**, Graham Coop, Peter Ralph (2012). Is your phylogeny informative? Measuring the power of comparative methods, *Evolution* 66 (7) 2240-51. doi:10.1111/j.1558-5646.2011.01574.x, (oa, code, data)

4. Jeremy M. Beaulieu, Dwueng-Chwuan Jhwueng, **Carl Boettiger**, Brian O'Meara, (2012). Modeling Stabilizing Selection: Expanding the Ornstein-Uhlenbeck Model of Adaptive Evolution, *Evolution* 66 (8) 2369-2383. doi:10.1111/j.1558-5646.2012.01619.x (software)

5. **Carl Boettiger**, Alan Hastings (2012). Quantifying Limits to Detection of Early Warning for Critical Transitions, *Journal of the Royal Society: Interface* 9 (75) 2527-2539. doi:10.1098/rsif.2012.0125. (oa, code)

6. **Carl Boettiger**, Duncan Temple Lang (2012). Treebase: An R package for discovery, access and manipulation of online phylogenies, *Methods in Ecology and Evolution* 3 (6) 1060–1066. doi:10.1111/j.2041-210X.2012.00247x. (oa, code, software)

7. **Carl Boettiger**, Duncan Temple Lang, Peter Wainwright (2012). rfishbase: exploring, manipulating and visualizing FishBase data from R, *Journal of Fish Biology*. 81 (6) 2030–2039. doi:10.1111/j.1095-8649.2012.03464.x. (oa, code, software)

8. **Carl Boettiger**, Alan Hastings (2012). Early Warning Signals and the Prosecutor's Fallacy, *Proceedings of the Royal Society B* 279 (1748) 4734-4739. doi:10.1098/rspb.2012.2085. (oa, code, data)

9. **Carl Boettiger**, Alan Hastings (2013). Tipping points: From patterns to predictions, *Nature* 493, 157–158. doi:10.1038/493157a.

10. **Carl Boettiger**, Noam Ross, Alan Hastings (2013). Early warning signals: The charted and uncharted territories. *Theoretical Ecology* doi:10.1007/s12080-013-0192-6. (oa, code)

11. **Carl Boettiger**, Alan Hastings (2013). No early warning signals for stochastic transitions: insights from large deviation theory. *Proceedings of the Royal Society B*. doi:10.1098/rspb.2013.1372. (oa, code)

12. **Carl Boettiger**, Marc Mangel, Stephan Munch (2015). Avoiding tipping points in fisheries management through Gaussian process dynamic programming. *Proceedings of the Royal Society B* 282(1801), 8–11. doi:10.1098/rspb.2014.1631. (oa, code, data). F1000 recommended

13. **Carl Boettiger** (2015). An introduction to Docker for reproducible research. *ACM SIGOPS Operating Systems Review* 49(1), 71-79. doi:10.1145/2723872.2723882. (oa)

14. **Carl Boettiger**, Scott Chamberlain, Edmund Hart, Karthik Ram (2015). Building Software, Building Community: Lessons from the rOpenSci Project. *Journal of Open Research Software* 3: e8, doi:10.5334/jors.bu.

15. **Carl Boettiger**, Scott Chamberlain, Rutger Vos and Hilmar Lapp (2016). RNeXML: a package for reading and writing richly annotated phylogenetic, character, and trait data in R. *Methods in Ecology and Evolution*. doi:10.1111/2041-210X.12469. (oa, code, software)

16. **Carl Boettiger**, Michael Bode, James N. Sanchirico, Jacob LaRiviere, Alan Hastings, and Paul Robert Armsworth (2016). Optimal management of a stochastically varying population when policy adjustment is costly. *Ecological Applications* 26 (3) 808-817. doi:10.1890/15-0236. (oa, code)

17. T Alex Perkins, **Carl Boettiger**, Benjamin L. Philips. (2016) After the games are over: life-history trade-offs drive dispersal attenuation following range expansion. *Ecology and Evolution* 6 (18) 6425-6434. doi:10.1002/ece3.2314. (oa, code)

18. Hampton, Jones, Wasser, Schuldhauer, Supp, Brun, Herandez, **Boettiger**, Collins, Gross, Fernandez, Budden, White, Teal, Labou, Aukema (2017). Skills and Knowledge for Data Intensive Research. *BioScience*. doi:10.1093/biosci/bix025. (oa)

19. Ben Marwick, **Carl Boettiger**, Lincoln Mullen (2017). Packaging data analytical work reproducibly using R (and friends). *The American Statistician*. doi:10.1080/00031305.2017.1375986. (oa)

20. Getz, Marshall, Carlson, Giuggioli, Ryan, Romañach, **Boettiger**, Chamberlain, Larsen, D'Odorico, O'Sullivan (2017). Making ecological models adequate. *Ecology Letters*. doi:10.1111/ele.12893

21. **Carl Boettiger** (2017). Generating Codemeta Metadata for R Packages. *The Journal of Open Source Software* 2 (19), 454, doi:10.21105/joss.00454

22. **Carl Boettiger**, Dirk Eddelbuettel (2018). An Introduction to Rocker: Docker Containers for R. *The R Journal*. doi:10.32614/RJ-2017-065

23. **Carl Boettiger** (2018). From noise to knowledge: how randomness generates novel phenomena and reveals information. *Ecology Letters*. doi:10.1111/ele.13085 (oa, code, data)

24. Milad Memarzadeh, **Carl Boettiger** (2018). Adaptive management of ecological systems under partial observability. *Biological Conservation*. 224, 9-15. doi:10.1016/j.biocon.2018.05.009. (software)

25. **Carl Boettiger** (2018). Managing Larger Data on a GitHub Repository. *Journal of Open Source Software*, 3(29), 971, doi:10.21105/joss.00971. (software).

26. Karthik Ram, **Carl Boettiger**, Scott Chamberlain, Noam Ross, Maelle Salmon, & Stephanie Butland (2018). A Community of Practice Around Peer-review for Long-term Research Software Sustainability. *Computing in Science & Engineering*, 9615(c), 1–1. doi:10.1109/MCSE.2018.2882753

27. Katz, Allen, Barba, Berg, Bik, **Boettiger**, et al. (2018). The principles of tomorrow's university. *F1000Research*, 7:1926 doi:10.12688/f1000research.17425.1. (32 co-authors.)

28. **Carl Boettiger** (2019). Ecological Metadata as Linked Data. *Journal of Open Source Software*, 4(34), 1276, doi:10.21105/joss.01276 (software).

29. Dan Sholler, Karthik Ram, **Carl Boettiger**, Daniel S Katz (2019). Enforcing public data archiving policies in academic publishing: A study of ecology journals. *Big Data & Society* 6(1) 1-18. doi:10.1177/2053951719836258

30. Milad Memarzadeh, **Carl Boettiger** (2019). Resolving the Measurement Uncertainty Paradox in Ecological Management. *American Naturalist*. doi:10.1086/702704. (oa, code, data). F1000 recommended

31. **Carl Boettiger**, Ryan Batt (2019). Bifurcation or state tipping: assessing transition type in a model trophic cascade. *Journal of Mathematical Biology*. doi:10.1007/s00285-019-01358-z (oa, code)

32. Milad Memarzadeh, Gregory L. Britten, Boris Worm, **Carl Boettiger** (2019). Rebuilding global fisheries under uncertainty. *Proceedings of the National Academy of Sciences*. doi:10.1073/pnas.1902657116

33. de Aguiar, Newman, Pires, Yeakel, **Boettiger**, Burkle, Gravel, Guimarães Jr, O'Donnell, Poisot, Fortin, Hembry (2019). Revealing biases in the sampling of ecological interaction networks, *PeerJ*, doi:10.7717/peerj.7566. software.

34. **Carl Boettiger** (2020). Ecological management of stochastic systems with long transients. *Theoretical Ecology*. doi:10.1007/s12080-020-00477-4, code

35. Kari Norman, Scott Chamberlain, **Carl Boettiger** (2020). taxadb: A high-performance local taxonomic database interface. *Methods in Ecology and Evolution*. doi:10.1111/2041-210X.13440 software

36. Pascal, Memarzadeh, **Boettiger**, Lloyd, Chadès (2020). A Shiny r app to solve the problem of when to stop managing or surveying species under imperfect detection *Methods in Ecology and Evolution*. doi:10.1111/2041-210X.13501 software

37. **Carl Boettiger** (2020). [Rp] Fluctuation domains in adaptive evolution. ReScience C 6, 1, #15, `https://rescience.github.io/bibliography/Boettiger_2020.html`, doi:10.5281/zenodo.4081202, code

38. Caleb Scoville, Melissa Chapman, Razvan Amironesei, **Carl Boettiger** (2021). Algorithmic conservation in a changing climate. *Current Opinion in Environmental Sustainability* 51, 30-35, doi:10.1016/j.cosust.2021.01.009.

39. Reimer, Arroyo-Esquivel, Jiang, Scharf, Wolkovich, Zhu, **Boettiger** (2021). Detection of long transient dynamics in noisy time series. *Theoretical Ecology* (Accepted)

40. Karatayev, Baskett, Kushner, Shears, Caselle, **Boettiger** (2021). Grazer behavior can regulate large-scale patterning of community states. *Ecology Letters* (Accepted)

41. Chapman, Oestreich, Frawley, **Boettiger**, Diver, Santos, Scoville, Armstrong, Blondin, Chand, Haulsee, Knight, Crowder (2021). Promoting equity in the use of algorithms for high seas conservation. *One Earth* (In Press)

Grants

CAREER: Harnessing the data revolution for predicting and managing ecosystem regime shifts. Carl Boettiger. (2020-2025). **National Science Foundation** #DBI-1942280. $504,335.00

The Rocker Project. Carl Boettiger, Noam Ross, Dirk Eddelbuettel. (2019 - 2020). **Chan-Zuckerberg Initiative**: Essential Open Source Software for Science. $75,912

The Influence of Conflicting Policies and Supply-Chain Pressures on Farmers' Decisions and Tradeoffs with Respect to Biodiversity, Profitability, and Sustainability. Timothy Bowles (PI), Alastair Iles, Claire Kremen, Carl Boettiger. (2018-2022). **National Science Foundation** #CNH-1824871 $1,301,737

The rOpenSci Project. Karthik Ram, Carl Boettiger, Scott Chamberlain. (renewal, 2019-2021). **Helmsley Charitable Trust**, award 2016PG-BRI004. $1,000,000

Detecting Change in Global Biodiversity through Large Scale Network Analysis. Carl Boettiger, Rosemary Gillespie, Rasmus Nielsen. (2018). Berkeley Institute for Data Science, $67,000

Big Data, Big Uncertainty: Ecological Decision- Making in the 21st Century. (2018-2020). Hellman Fellows Award, **The Hellman Foundation**. $37,600

Berkeley Collegium Award for Narrowing the Gap Between Teaching and Research. (2018-2019) $16,867.50

Managing ecosystems under extreme uncertainty. (2016 - 2019) NSF **XSEDE** TG-DEB160003. NSF Estimated value of computing resources: $34,558

Reproducible and Collaborative Data Science. NSF **XSEDE** TG-DEB160021. (2016 - 2019) NSF Estimated value of computing resources: $20,028

James S McDonnell Foundation Post-doctoral Fellowship in Complex Systems (Awarded to post-doctoral scholar Allison Barner, who then chose to bring this award to my group at UC Berkeley) $200,000.

The rOpenSci Project (2015-2018, Co-PI). Karthik Ram, Carl Boettiger, Scott Chamberlain. **Helmsley Charitable Trust**, award 2016PG-BRI004. $2,875,071

The CodeMeta Project (2015). **National Science Foundation** #ACI-1549758 *$165,782*. (proposal here)

The rOpenSci Project, Phase II funding (2014, Co-PI). Karthik Ram, Carl Boettiger, Scott Chamberlain. **Alfred P. Sloan Foundation** $300,000

NSF Biology Post-doc (2013-2015). **National Science Foundation** #DBI-1306697, $138,000 (proposal here)

The rOpenSci Project Phase I funding (2013 Co-PI). Karthik Ram, Carl Boettiger, Scott Chamberlain. **Alfred P. Sloan Foundation** $180,000

IIASA YSSP fellowship (2009). **National Academy of Sciences**, OISE-0738129, $8,000. (proposal here)

Computational Science Graduate Fellowship (2008). **United States Department of Energy**, #DE-FG02-97ER25308, $149,000. (proposal here)

Book Chapters

Carl Boettiger (2017). A Reproducible R Notebook Using Docker. In J. Kitzes, D. Turek, & F. Deniz (Eds.), The Practice of Reproducible Research: Case Studies and Lessons from the Data-Intensive Sciences (1st ed., pp. 109–117). Oakland, CA: UC Press. `https://www.ucpress.edu/book.php?isbn=9780520294752`

Invited Talks & Workshops

2019

Invited Biodiversity Research Center seminar speaker, University of British Columbia, Vancouver, Canada. Ecological Forecasting Oral Session, American Geophysical Union, San Fransisco, CA.

Advancing Theory in Ecology, NSF Workshop. Pennsylvania State University, State College, PA.
Biodiversity Data Workshop, invited speaker, Arizona State University, Tempe, AZ.
Transients in Ecology, Organized Oral Session, Ecological Society of America Annual Meeting, Louisville, KY.
Ecological Forecasting Initiative Conference, AAAS Headquarters, Washington DC.
NIMBioS Transient Dynamics Workshop, University of Tennessee, Knoxville, TN.
Project EDDIE keynote speaker, Carlton College, Northfield MN.
US Research Software Sustainability Institute Workshop, NCEAS, Santa Barbara, CA.
COMPASS Workshop for scientific communication, Asilomar, CA.

2018

NSF SI2 PIs Meeting, Washington, DC.
rOpenSci unconference, Seattle, WA.
Faculty Learning Program Fellows Workshop Berkeley, CA.
GraphXD, Berkeley, CA.
Digital Data in Biodiversity UC Berkeley. (co-organizer)
Ecological Society of America Invited Symposium Addressing Outstanding Challenges to Operationalizing Resilience (Organizer). New Orleans, LA.
Nonlinear Forecasting for Fisheries Applications, NOAA Southwest Fisheries Science Center, Santa Cruz, CA.

2017

CROSS Symposium Speaker Santa Cruz, CA.
Imagining Tomorrow's University Chicago, IL.
rOpenSci unconference, Los Angeles, CA.
Prov-a-thon: Practical Tools for Reproducible Science, Tamaya, NM.
NSF Translational Data Science Workshop, Berkeley Institute for Data Science, Berkeley, CA.

2016

Force16 Codemeta Workshop, Portland OR (organizer).
CodeMeta NSF Workshop Portland, OR (organizer).
rOpenSci unconference, San Francisco, CA.

2015

Empirical Dynamical Modeling and Forecasting in Nonlinear Systems, NTU, Taiwan.
Moore-Sloan Data Science Environments: Second Annual Data Science Summit (Workshop)
Data Intensive Training Workshop, NCEAS, Santa Barbara, CA.
NSF Big Data Hubs Design Charette, Western Region.
rOpenSci unconference, San Francisco CA.
Pretty Darn Good Control Working group, NIMBIOS, Knoxville TN.

2014

Berkeley Initiative for Global Change Biology Workshop (student organized), UC Berkeley, CA.
DIMACS Global Change, Berkeley CA.
Zoology Seminar, University of Wisconsin, Madison, WI.
ESPM Seminar, UC Berkeley, CA.
rOpenSci unconference, San Francisco CA.
Reproducible Science: Curriculum & Workflow Workshop, NESCent, Durham, NC.
WSSSPE 2.0 Meeting. New Orleans, LA.
Workflows Working Group, NCEAS, Santa Barbara, CA.

2013 & prior

invited speaker, MBI, Sustainable Management of Living Natural Resources, Columbus, OH.
invited seminar speaker, WHOI, Woods Hole, MA.
invited seminar speaker, UC Davis Dept of Environmental Resources and Economics; Davis, CA.
invited speaker, SSB Symposium, Evolution Conference, Ottawa, CAN.
Sustainable Management of Living Natural Resources Workshop, MBI Columbus, OH.
Academic software & workforce development Workshop, ISEES. Oakland, CA.
Software Lifecycle Workshop, ISEES, Santa Barbara, CA.
Pretty Darn Good Control Working group, NIMBIOS, Knoxville, TN.
Stochastic spatial modeling in population dynamics Workshop, AIM, Palo Alto, CA.

Awards

2020 Early Career Fellow, Ecological Society of America
2011 *Volterra Award* (Best student talk, ESA Theory Section)
2007 Elected to Membership in the Society of *Sigma Xi*
2007 Allen G. Shenstone Prize in Physics, Princeton University
2007 The Class of 1870 Old English Prize, Princeton University
2006 Kusaka Memorial Prize in Physics, Princeton University

Service

Campus

2019 - current. Faculty Working Group for the formation of the Division of Data Science & Information
2018 - 2019. Faculty Task Force for Data Science Minor Design
2018 - current. Faculty Advisory Committee of the Vice Chancellor for Undergraduate Education
2018 - current. Governance Committee for Data Science Programs
2017 - 2018. ESPM Remote Sensing Faculty Search, committee member & equity liaison
2017 - 2018. ad hoc Data Science Degree Proposal Committee
2017 - current. Steering Committee for NSF Research Traineeship (NRT): Environment and Society: Data Science for the 21st Century (DS421)
2015 - 2019. Berkeley Research Computing Advisory Committee

Extra-campus

NCEAS Scientific Advisory Board
rOpenSci Leadership Team
Jetstream Cloud Computing Stakeholder Advisory Board, XSEDE.
Editor, *Ecology Letters*
Reviewer for over 40 journals, NSF review panelist, ad hoc reviewer for UC CCGA, NSF, NERSC.

Software

R Packages

`emld`: Ecological Metadata as Linked Data. Carl Boettiger (2019).
`virtuoso`: Interface to Virtuoso using ODBC. Carl Boettiger (2019).
`rdflib`: Tools to Manipulate and Query Semantic Data. Carl Boettiger (2018).
`codemetar`: Generate CodeMeta Metadata for R Packages. Carl Boettiger, Maëlle Salmon (2018).
`EcoNetGen`: Simulate and Sample from Ecological Interaction Networks. Marcus de Aguiar, Erica Newman, Mathias Pires, Carl Boettiger (2018).
`piggyback`: Managing Larger Data on a GitHub Repository. Carl Boettiger (2018).
`arkdb`: Archive and Unarchive Databases Using Flat Files. Carl Boettiger (2018).

`EML`: Read and Write Ecological Metadata Language File. Carl Boettiger, Matt Jones (2016; v2 2019).
`RNeXML`: Semantically Rich I/O for the NeXML Phylogenetics Format. Carl Boettiger, Scott Chamberlain, Hilmar Lapp, Rutger Voss (2014).
`pmc`: Phylogenetic Monte Carlo. Carl Boettiger (2012).
`knitcitations`: Citations for Knitr Markdown Files. Carl Boettiger (2012).
`rfishbase`: R Interface to FishBase. Carl Boettiger, Scott Chamberlain, Duncan Temple Lang, Peter Wainwright (2011; v2 2015; v3 2019).

Other Software

Carl Boettiger, Dirk Eddelbuettel. The Rocker Project: Docker images for the R environment. `https://rocker-project.org`. (Language: Dockerfile)
Carl Boettiger, Matt Jones, et al. The CodeMeta Project: Software Metadata Exchange `https://codemeta.github.io` (Language: JSON-LD)

Theses

Carl Boettiger, David Huse (2006) Clonal Interference Models in Population Genetics. *Princeton Physics Dept*. doi:10.6084/m9.figshare.678305.
Carl Boettiger, Joshua Weitz, Simon Levin (2007) Adaptive Dynamics: Branching Phenomena and the Canonical Equation *Princeton Physics Dept*. doi:10.6084/m9.figshare.678306.
Carl Boettiger, Stephen Pacala, David Huse (2007) Ensemble Behavior from Individual Dynamics in Multispecies Forest Populations. *Princeton Physics Dept*. doi:10.6084/m9.figshare.678304.
Carl Boettiger (2012). Regime shifts in ecology and evolution (PhD Dissertation). doi:10.6084/m9.figshare.97218.

Media interviews

Martin, Glen. (2019).“How Algorithms Could Save the Planet.” _California Magazine). `https://alumni.berkeley.edu/california-magazine/just-in/2019-02-01/how-algorithms-could-save-planet`
Seltenrich, N. (2016). “Scaling the Heights of Data Science.” *Breakthroughs Magazine*. `https://nature.berkeley.edu/breakthroughs/opensci-data`
Tachibana, C. (2014). “The paperless lab” *Science* 345(6195) pp. 468-470. 10.1126/science.opms.p1400087
Mascarelli, A. (2014) “Research tools: Jump off the page.” *Nature* 507, 523–525. doi:10.1038/nj7493-523a
Check Hayden E (2013). “Mozilla Plan Seeks to Debug Scientific Code.” *Nature*, 501, pp. 472-472. doi:10.1038/501472a
Van Noorden R (2013). “Data-Sharing: Everything on Display.” *Nature*, 500, pp. 243-245. doi:10.1038/nj7461-243a
Gewin, Virginia (2013). “Turning Point: Carl Boettiger” *Nature*, 493 p 711 doi:10.1038/nj7434-711a
Wald, Chelsea (2010). “Scientists Embrace Openness” *Science*. doi:10.1126/science.caredit.a1000036

Updated June 8, 2021