Dr. Collin B. Edwards

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EDUCATION:

Ph.D, Ecology and Evolutionary Biology, Cornell University 2013–2019

BS, Evolution, Ecology, and Biodiversity, University of California, Davis 2012

SKILLS:

Programming: R, Python, Matlab, SQL, C, C++, git and GitHub, LaTeX, markdown, Linux and windows scripting

Mathematical modeling: ODEs, DEs, matrix models, stochastic models, numerical methods.

Statistical methods: A/B testing, generalized linear models, hierarchical models, GAMs, Random Forests, LASSO, ridge regression, machine learning, simulation methods, linking data to mathematical models.

Writing & Communication: 9 peer-reviewed publications (lead author for 4), 19 invited talks and presentations, wrote grant proposals leading to $134,000 in research funding, obtained 3 graduate fellowships.

EXPERIENCE:

Powell Center Research Fellow, Postdoctoral Research Scholar September 2019 – present
Tufts University & Washington State University, Vancouver

- **Co-led 20-person cross-disciplinary working group to carry out largest assessment ever of the status of butterflies across the United States.**
  - Wrote grants and obtained funding for the working group.
  - Cleaned and integrated 2.5 million records from 35 monitoring programs.
  - Developed novel analytical framework and scaleable analysis pipeline to evaluate regional and continental growth rates of 351 species.
  - Developed interactive R visualizations to communicate findings.
- **Developed and published novel statistical methods now used in wildlife conservation and invasive species management.**
  - Developed two methods to identify population dynamics from sparse monitoring data using mixed effects generalized linear models (GLM) and a generalized additive model (GAM) with bootstrap for variance estimation.
  - Applied the GLM method to provide first peer-reviewed evidence for recoveries of the threatened Fenders Blue butterfly, which was consequently downlisted in 2023.
  - Applied the GAM method to identify growth rates and shifts in activity for 114 populations of rare and at-risk butterflies.
  - Developed R package to evaluate model performance for various butterfly activity patterns and monitoring schemes.
- **Other butterfly and microbial ecology results**
  - Analyzed hundreds of thousands of citizen science records of monarch butterflies to link movement patterns to species decline.
  - Integrated experimental data with historical studies to show that Western monarch butterflies do not exhibit Allee effects (a tendency towards extinction at low populations).
  - Obtained funding for and led cross-disciplinary collaboration to link ecological theory to microbial biology using novel statistical approaches.
- **Instructing and mentorship**
  - Taught semester-long "Ecological Data and Statistics" course at Tufts University, nominated for teaching award.
  - Taught workshop series for programming in R.
  - Served as primary theoretical ecology and data science mentor for one undergraduate, one master's, and one Ph.D. student.

NSF Graduate Research Fellow, Cornell Fellow, Graduate Research Assistant August 2013 – August 2019

- **Led and published first-ever analysis to identify synergistic interactions in plant defenses.**
  - Designed and carried out multi-year ecological field experiments.
  - Developed and published novel Random Forest methods for identifying synergistic interactions.
  - Developed novel mathematical model of species interactions, implemented and carried out *in silica* experiments to explain observed plant defense strategies.
- **Led and published first-ever *in silica* study showing hidden genetic variation could explain variable species responses to climate change.**
  - Developed novel evolutionary model of individual responses to environmental cues.
  - Wrote and analyzed *in silica* evolutionary experiments using 7,700 site-years of recorded daily climate data.
- **Developed and published new statistical methods to analyze high-dimensional spatial and temporal data**.
  - Collaborated with a multidisciplinary team to explain competition and coexistence patterns of competing plants in the Idaho steppe.
  - Primary responsibility was implementing and optimizing Functional Linear Models (FLM) in R.

PEER REVIEWED PUBLICATIONS:

Cañizares, J. R., **Edwards, C. B.**, Reed, M. **2023**. Quantifying phenological landmarks of migration shows non-uniform use of the Caribbean by shorebirds. *Ecology and Evolution*

Edwards, C. B., Agrawal, A.A., Ellner, S.P. **2023**. Plant defense synergies and antagonisms affect performance of specialist herbivores of common milkweed. *Ecology.* Code and data available on GitHub and Figshare.
Preprint: https://doi.org/10.1101/2021.09.13.460116

Havird, J., Brannock, P., Yoshioka, R., Vaught, R., Carlson, K., **Edwards, C.B.**, Tracy, A., Twining, C., Zheng, Y., Wilson, A., Hairston, N., Santos, S. **2022**. Grazing by an endemic atyid shrimp controls microbial communities in the Hawaiian anchialine ecosystem. *Limnology and Oceanography.*

Doll, C.F., Converse, S.J., **Edwards, C. B.**, Schultz, C.B. **2022**. Using structured decision making to guide habitat restoration for butterflies: a case study of Oregon Silverspots. *Journal of Insect Conservation.* Data available on the USGS ScienBase catalog, code and data available on github.

Edwards, C. B., Crone, E.E. **2021**. Estimating abundance and phenology from transect count data with GLMs. *Oikos*, 130: 1335-1345. Preprint: https://doi.org/10.1101/2020.06.01.127910; code and data on Dryad.

Edwards, C. B., Yang, L.H. **2021**. Evolved phenological cueing strategies show variable responses to climate change. *American Naturalist* 197(1): E1–16. Preprint: https://doi.org/10.1101/436857; Code and data available on Dryad.

Bonoan, R.E., Crone, E.E., **Edwards, C. B.**, Schultz, C. **2021**. Changes in phenology and abundance of an at-risk butterfly. *Journal of Insect Conservation* 25 (4), 499-510.

Edwards, C. B., Rosenheim, J. A., and Segoli, M. **2018**. Aggregating fields of annual crops to form larger-scale monocultures can suppress dispersal-limited herbivores. *Theoretical Ecology*, 1-11.

Teller, B.J., Adler, P.B., **Edwards, C.B.**, Hooker, G., and S.P. Ellner. **2016**. Linking demography with drivers: climate and competition. *Methods in Ecology and Evolution* 7: 171–183.

– Forthcoming –

Louw, N, Kasturi, L., Ye, R., **Edwards, C.B.**, Wolfe, B. Microbiome assembly in fermented foods. (accepted at *Annual Review of Microbiology*)

Grames, E.M., Flynn, M., **Edwards, C.B.**, Thogmartin, W.E., Glassberg, J. and Forister, M.L.. Combining expert opinion with non-random species occurrence data to produce integrated range maps for all North American butterfly species. *(in review)*

Edwards, C. B., Schultz, C.B. Crone, E.E. Rapid decline in Western monarch butterflies leads to phenological and geographic Allee effects. *(in prep, available upon request)* Preprint: https://doi.org/10.1101/2021.10.22.465529