Michael D. **Catchen**

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Postdoctoral researcher in computational ecologist with 10+ years of programming experience and 6+ years experience using statistics and machine learning to improve prediction and forecasting in ecology and environmental science.

Education

Ph.D. — Biology
Aug. 2020 - April 2024

McGill University — *Montréal, QC, CA*

- **Thesis**: *Improving monitoring and prediction of ecological dynamics using simulation and machine learning*
- **Supervisor**: Dr. Andrew Gonzalez
- **Relevant coursework**: Network Science, Probabilistic Programming

M.A. — Ecology and Evolutionary Biology
2018 - 2020

University of Colorado Boulder — *Boulder, CO, USA*

- **Thesis**: *Phase transitions in landscape connectivity*
- **Supervisor**: Dr. Samuel M. Flaxman
- **Relevant coursework**: Stochastic Processes, Genomics, Evolutionary Ecology, Network Science

B.A. — Ecology and Evolutionary Biology
2015 - 2020

University of Colorado Boulder — *Boulder, CO, USA*

- **Relevant coursework**: Algorithms, Data Structures, Applied Probability, Differential Equations, Linear Algebra, Remote Sensing
- **GPA**: 3.92

Professional Experience

IVADO Postdoctoral Fellow
Sept. 2024 - present

Poisot Lab, Université de Montréal — *Montréal, QC, CA*

- Postdoctoral fellow in the Poisot Computational Ecology Lab

Research Software Developer
Dec. 2021 - March 2024

Group on Earth Obsearvations — Biodiversity Observation Network (GEO-BON) — *Montréal, QC, CA*

- Worked on both front and back-end components for a web application for analysis of large-scale geospatial environmental data and planning optimal biodiversity-observation-networks (BONs), as part of a partnership between GEO-BON and Microsoft
- Designed tools for optimizing spatial data sampling design, as well scripts for producing species distribution models using gradient-boosting methods.
- Technologies used: Node.js, React.js, Docker, Julia, PostgreSQL, STAC Catalogues

Flight Software Engineering Intern
May - Aug. 2017

NASA Jet Propulsion Laboratory — *Pasadena, CA, USA*

- Developed flight software for two small satellites (*LunarFlashlight* & *NEAScout*) as part of a medium-sized team
- Wrote code and tests for the interface between the motherboard and inertial-measurement-unit (IMU) of each satellite
- Gained skills in embedded systems programming, unit and integration testing, and software development practices in larger teams

Systems Engineering Intern
May - Aug. 2015, May - Aug. 2016

NASA Jet Propulsion Laboratory — *Pasadena, CA, USA*

- Developed a content management system for documentation of various software components used to uplink commands to spacecraft as part of a medium-sized team

Publications

A global biodiversity observing system to unite monitoring and guide action
Aug. 24, 2023

Andrew Gonzalez, Petteri Vihervaara, …, **Michael D. Catchen**, …, Basile van Havre, Elaine Wright — **Nature Ecology and Evolution**

Improving ecological connectivity assessments with transfer learning and function approximation
May 5, 2023

Michael D. Catchen, Michelle Lin, Timothée Poisot, David Rolnick, Andrew Gonzalez — **ICLR 2023 — Machine Learning for Remote Sensing**

A roadmap towards predicting species interaction networks (across space and time)
Nov. 8, 2021

Tanya Strydom*, **Michael D Catchen***, Francis Banville, Dominique Caron, Gabriel Dansereau, Philippe Desjardins-Proulx, Norma R Forero-Muñoz, Gracielle Higino, Benjamin Mercier, Andrew Gonzalez, Dominique Gravel, Laura Pollock, Timothée Poisot — **Philosophical Transactions of the Royal Society B**

The missing link: discerning true from false negatives when sampling species interaction networks — in review

Michael D Catchen, Timothée Poisot, Laura J Pollock, Andrew Gonzalez — in review at **Ecography**

Teaching Experience

Teaching Assistant — General Biology Lab II (EBIO 1240) — *Spring 2020*

University of Colorado Boulder — *Boulder, CO, USA*

- Taught three sections of 18-20 students in a laboratory environment. Covered basics of statistical analysis in R, evolutionionary biology, phylogenetics, physiology, anatomy, and ecology.

Teaching Assistant — General Biology Lab I (EBIO 1230) — *Fall 2019*

University of Colorado Boulder — *Boulder, CO, USA*

- Taught three sections of 18-20 students in a laboratory environment. Covered basics of statistical analysis in R, molecular and cellular biology, experimental design, and hypothesis testing

Learning Assistant — Calculus I for Engineers (APPM 1350) — *Fall 2017*

Teaching Assistant, University of Colorado Boulder — *Boulder, CO, USA*

- Tutored students in small groups, graded exams.

Learning Assistant — Calculus III for Engineers (APPM 2350) — *Spring 2017*

Teaching Assistant, University of Colorado Boulder — *Boulder, CO, USA*

- Tutored students in small groups, graded exams.

Learning Assistant — Calculus II for Engineers (APPM 1360) — *Spring 2016, Fall 2016*

Teaching Assistant, University of Colorado Boulder — *Boulder, CO, USA*

- Tutored students in small groups, graded exams.

Invited Talks

False negatives in ecological networks — *Aug. 24, 2023*

VERENA Consortium — *Washington D.C. (virtual)*

Toward a virtual ecology: Simulating ecosystems to optimize spatial sampling of species interactions — *Aug. 15, 2022*

ESA 2022 — *Montréal, QC, CA*

Projects

MetacommunityDynamics.jl — *2021 - present*

Lead developer

- Developed and maintains a Julia package for simulation of reaction-diffusion population and community dynamics on heterogenous spatial graphs
- Developed intefaces to external Julia packages for Bayesian inference of dynamical systems (using *Turing.jl*) and scientific machine-learning (SciML) with the *DifferentialEquations.jl* and Julia SciML ecosystem.

BiodiversityObservationNetworks.jl — *2022 - present*

Lead developer

- Led development of a Julia package for optimizing the design of biodiversity monitoring programs.

NeutralLandscapes.jl — *2021 - present*

Lead developer

- Maintains Julia package that provides a wide variety of methods for generating landscapes with prescribed statistical properties. Developed novel methods for spatiotemporally autocorrelated change in landscapes, and discrete patch generation.

SpeciesDistributionToolkit.jl — *2022 - present*

Contributing developer

- Contributed methods to a Julia package for species distribution modeling, including multivariate transforms of data, performance optimization of pseudoabsence algorithms, and building interfaces to other Julia packages for ecology.

Skills

Quantitative Research	Statistical modeling (spatial/temporal analysis, hierarchical Bayesian modeling), Machine learning (Graph Neural Networks, gradient-boosted trees, Vision Transformers), Feature mining and engineering, Model comparison and selection, Numerical simulation, Mathematical optimization
Languages	Julia | Python | R | C++ | JavaScript | MATLAB | SQL | BASH
Tools	PyTorch, PyTorch-Geometric, STAN, Git, LaTeX, Github Actions, AWS, Docker, Flux.jl, Turing.jl