

Michael H. Cortez

Associate Professor

Department of Biological Science, Florida State University

CONTACT INFORMATION

Department of Biological Science
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PROFESSIONAL EXPERIENCE

- 2022– **Associate Professor**, Department of Biological Science, Florida State University
Courtesy Appointment, Department of Mathematics, Florida State University
- 2019–2022 **Assistant Professor**, Department of Biological Science, Florida State University
Courtesy Appointment, Department of Mathematics, Florida State University
- 2014–2019 **Assistant Professor**, Department of Mathematics and Statistics, Utah State University
Faculty Associate, Ecology Center, Utah State University
- 2012–2014 **NSF Mathematical Sciences Postdoctoral Research Fellow**, School of Biology,
Georgia Institute of Technology (Mentor: Joshua S. Weitz)
- 2010–2012 **Postdoctoral Researcher**, School of Biology, Georgia Institute of Technology
Affiliate of the School of Mathematics (Mentor: Joshua S. Weitz)

EDUCATION

- Ph.D. Applied Mathematics**, Cornell University, 2011 (Advisor: Stephen P. Ellner)
- M.S. Applied Mathematics**, Cornell University, 2008
- B.S. Chemistry and Mathematics**, Hope College, 2005

AWARDS AND HONORS

- 2016–2020 **Early Career Fellow**, Ecological Society of America
- 2016 **Washington, DC Faculty Fellow**, Utah State University
- 2012–2014 **NSF Mathematical Sciences Postdoctoral Research Fellow**
- 2011 **Prize for an outstanding paper in ecological theory**, Theoretical Ecology Section of the Ecological Society of America. Awarded for 2011 *Ecology Letters* paper
- 2009 **Provost's Diversity Graduate Student Fellowship**, Merit-based fellowship that provided one semester of tuition and stipend
- 2005–2008 **Alfred P. Sloan Foundation Graduate Fellowship**, Merit-based fellowship that provided three years of tuition and stipend
- 2005 **summa cum laude**, Hope College, 2005
- 2005 **Sigma Xi**, elected at Hope College
- 2004 **Phi Beta Kappa**, Zeta chapter of Michigan
- 2001–2005 **Hope Covenant Scholarship**, Merit-based, four-year scholarship to Hope College
- 2001 **Eagle Scout Award**, Boy Scouts of America

GRANTS & Prior Funding
FUNDING

- 2019–2023 National Science Foundation, Division of Environmental Biology
“Developing, unifying, and empirically testing theory for inducible and evolving defenses”
PI: Michael H. Cortez. CoPI: Edd Hammill (Utah State University).
(Total award: \$525,324)
- 2018–2022 National Science Foundation, Division of Environmental Biology
“Collaborative Research: Development and empirical tests of a mechanistic multi-host, multi-pathogen theory”
PIs: Michael H. Cortez and Meghan A. Duffy (University of Michigan).
(Total award: \$735,288; Cortez: \$203,399)
- 2020 First Year Assistant Professor (FYAP) Program, Florida State University
“When and why does increased host biodiversity lead to more disease?”
PI: Michael H. Cortez. (Total award: \$20,000)
- 2012–2014 National Science Foundation Postdoctoral Research Fellowship in Mathematical Sciences
“Understanding eco-coevolutionary dynamics through the use and development of fast-slow dynamical systems theory.”
PI: Michael H. Cortez. (Total award: \$150,00)

PEER REVIEWED Notation
PUBLICATIONS

(U) indicates undergraduate student author

(G) indicates graduate student author

(P) indicates postdoc author

Underlining indicates my name or individuals under my mentorship

All other authors are colleagues and individuals not under my mentorship

1. M.H. Cortez. Adaptive Dynamics models for the evolution of class-structured populations in stable systems. 2026. *Journal of Theoretical Biology*: 112461
2. M.H. Cortez, E. Mila (U), & E. Hammill. 2026. The characteristics of inducible defenses influence predator-prey dynamics. *American Naturalist* 207: 44-62.
3. K.M. McIntire, M.K. Dziuba, E.B. Haywood (G), M.L. Robertson (G), M. Vaandrager, E. Baird, F. Corcoran, M.H. Cortez, & M.A. Duffy. 2026. Transgenerational virulence: Maternal pathogen exposure reduces offspring fitness. *Ecology* 106: e70165
4. J. Jiao (P) and M.H. Cortez. 2025. How priority effects within co-infected individuals scale up to affect disease risk in a two-host-two-pathogen system. *Ecological Modelling* 502: 111025
5. M.H. Cortez. 2024. Comparing the differing effects of host species richness on metrics of disease. *Ecological Monographs* 94: 31626.
6. E. Hammill, K. Hancey (U), & M.H. Cortez. 2023. Changes in prey traits differentially reduce predation risk across predator and prey abundances. *Oikos*: e09933.
7. L.K. Lopez (P), M.H. Cortez, T. S. DeBlieux, I. A. Menel, B. O'Brien, C. E. Caceres, S. R. Hall, & M. A. Duffy. 2023. A healthy but depleted herd: Predators decrease prey disease and density. *Ecology*: e4063.
8. K. Hanthanan Arachchilage (P), M.Y. Hussaini, N.G. Cogan, & M.H. Cortez. 2023. Exploring how ecological and epidemiological processes shape multi-host disease dynamics using global sensitivity analysis. *Journal of Mathematical Biology* 86: 83.
9. M.H. Cortez. 2022. Using sensitivity analysis to identify factors promoting higher versus lower infection prevalence in multi-host communities. *Journal of Theoretical Biology* 534: 110959.
10. J. Jiao (P) and M.H. Cortez. 2022. Exploring how a generalist pathogen and within-host priority effects alter the risk of being infected by a specialist pathogen. *American Naturalist* 200: 815-833.

11. S. Twombly, A. Hastings, T.E.X. Miller, M.H. Cortez, K. Abbot, T. Ramiadantsoa, J. Blackwood & O. Prosper. 2022. New Theory for Increasingly Tangled Banks. *Issues in Science and Technology* 4: 39-40.
12. M.H. Cortez and M.A. Duffy. 2021. The context dependent effects of host competence, competition, and the pathogen transmission mode on disease prevalence. *American Naturalist* 198: 179-194.
13. P.A. Clay (P), M.H. Cortez, and M.A. Duffy. 2021. Dose relationships can exacerbate, mute, or reverse the impact of heterospecific host density on infection prevalence. *Ecology* 102: e03422.
14. G. Groszklos (G) and M.H. Cortez. 2021. Evolutionary and plastic phenotypic change can be just as fast as changes in population densities. *American Naturalist* 197: 47-59.
15. D.K. Sorenson (U) and M.H. Cortez. 2021. How intra-stage and inter-stage competition affect overcompensation in density and hydra effects in single-species, stage-structured models. *Theoretical Ecology* 14: 23-39.
16. P.B. Adler, E.P. White, and M.H. Cortez. 2020. Matching the forecast horizon with the relevant ecological processes. *Ecography* 43: 1729-1739.
17. M.H. Cortez and M.A. Duffy. 2020. Comparing the indirect effects between exploiters in predator-prey and host-pathogen systems. *American Naturalist* 196: E144-E159.
18. M.H. Cortez, S. Patel, and S. Schreiber. 2020. Destabilizing evolutionary and eco-evolutionary feedbacks drive eco-evolutionary cycles. *Proceedings of the Royal Society B: Biological Sciences* 287: 20192298.
19. G. Li (G), M.H. Cortez, J. Dushoff, and J.S. Weitz. 2020. When to be temperate: on the fitness benefits of lysis vs. lysogeny. *Virus Evolution* 6: veaa042
20. P.A. Clay (G), M.H. Cortez, M.A. Duffy and V.H.W. Rudolf. 2019 Priority effects within co-infected hosts alter prevalence relationships between parasites at the host population scale. *Oikos* 128: 571-583.
21. M.H. Cortez and M. Yamamichi. 2019. How (co)evolution alters predator responses to increased mortality: extinction thresholds and hydra effects. *Ecology* 100: e02789.
22. A. Doloman (G), Y. Pererva, M.H. Cortez, R.C. Sims, and C.D. Miller. 2019. Augmentation of granular anaerobic sludge with algalytic bacteria enhances methane production from microalgal biomass. *Fermentation* 5: 88.
23. J.S. Weitz, G. Li (G), H. Gulbudak, M.H. Cortez, and R.J. Whitaker. 2019. Viral fitness across a continuum from lysis to latency. *Virus Evolution* 5: vez006.
24. M.H. Cortez. 2018. Genetic variation and the drivers of eco-coevolutionary predator-prey cycles. *Ecological Monographs* 88: 353-371.
25. S. Patel (G), M.H. Cortez, and S.J. Schreiber. 2018. Partitioning the effects of ecology, evolution, and eco-evolutionary feedbacks on community stability. *American Naturalist* 191: 381-394.
26. M.H. Cortez and S. Patel (G). 2017. The effects of predator evolution and genetic variation on predator-prey population-level dynamics. *Bulletin of Mathematical Biology* 79: 1510-1538.
27. Z. Pu (G), M.H. Cortez, and L. Jiang. 2017. Predator-prey coevolution drives productivity-richness relationships in planktonic systems. *American Naturalist* 189:28-43.
28. M.H. Cortez. 2016. How the magnitude of prey genetic variation alters predator-prey eco-evolutionary dynamics. *American Naturalist* 188: 329-341.
29. M.H. Cortez. 2016. Hydra effects in discrete-time models of stable communities. *Journal of Theoretical Biology* 411: 59-67.
30. M.H. Cortez and P.A. Abrams. 2016. Hydra effects in stable communities and their implications for system dynamics. *Ecology*, 97: 1135-1145.

31. C.L. Searle (P), M.H. Cortez, K.K. Hunsberger (U), D.C. Grippi (G), I.A. Oleksy (U), C.L. Shaw (G), S. B. de la Serna (U), C.L. Lash (U), K.L.Dhir (U), and M. A. Duffy. 2016. Population density, not host competence, drives patterns of disease in an invaded community. *American Naturalist* 188: 554-566.
32. M.H. Cortez. 2015. Coevolution-driven predator-prey cycles: Predicting the characteristics of eco-coevolutionary cycles using fast-slow dynamical systems theory. *Theoretical Ecology* 8: 369-382.
33. P.A. Abrams and M.H. Cortez. 2015. The many potential indirect interactions between predators that share competing prey. *Ecological Monographs* 85: 625-641.
Authors contributed equally
34. P.A. Abrams and M.H. Cortez. 2015. Is competition needed for ecological character displacement? Does displacement decrease competition? *Evolution* 69: 3039-3053.
35. L.F. Jover (G), C.O.G. Flores (G), M.H. Cortez, and J.S. Weitz. 2015. Multiple regimes of robust patterns between network structure and biodiversity. *Scientific Reports* 5: 17856.
36. M.H. Cortez and J.S. Weitz. 2014. Coevolution can reverse predator-prey cycles. *Proceedings of the National Academy of Sciences*, 111: 7486-7491.
37. B.P. Taylor (G), M.H. Cortez, and J.S. Weitz. 2014. The virus of my virus is my friend: ecological effects of virophage with alternative modes of coinfection. *Journal of Theoretical Biology* 354: 124-136.
38. M.H. Cortez. 2013. When does pathogen evolution maximize R_0 in well-mixed host-pathogen systems. *Journal of Mathematical Biology* 67: 1533-1585.
– Recommended by Faculty of 1000 (F1000)
39. M.H. Cortez and J.S. Weitz. 2013. Distinguishing between indirect and direct modes of transmission using epidemiological time series. *American Naturalist* 181: E43-54.
40. L.F. Jover (G), M.H. Cortez, and J.S. Weitz. 2013. Mechanisms of multi-strain coexistence in host-phage systems with nested infection networks. *Journal of Theoretical Biology* 332: 65-77.
41. M.H. Cortez. 2011. Comparing the qualitatively different effects rapidly evolving and rapidly induced defences have on predator-prey interactions. *Ecology Letters* 14: 202-209.
42. M.H. Cortez and S.P. Ellner. 2010. Understanding the effects of rapid evolution on predator-prey interactions using the theory of fast-slow dynamical systems. *American Naturalist* 176: E109-E127.
43. T.L. Bultman, T.J. Sullivan, M.H. Cortez and T.J. Pennings. 2009. Extensions to and modulation of defensive mutualism in grass endophytes *in* Defensive mutualism in microbial symbiosis, eds. J. F. White and M. S. Torres. CRC Press, p. 301 - 317.
44. M.H. Cortez, et al. 2007. Factors contributing to the accuracy of harmonic force field calculations in water. *Journal of Chemical Theory and Computation* 3: 1267-1274.
45. B. Alleman, M.H. Cortez, et al. 2003. Take me out to/of the ball game. *Rose-Hulman Undergraduate Math Journal* 4: 2.

**INVITED
PRESENTATIONS**

2026

1. Ecology and Evolution of Infectious Diseases (EEID) Annual Meeting, Blackburg, VA
2. Annual Joint Mathematics Meeting, Washington, D.C.

2025

1. Institute for Pure and Applied Mathematics, UCLA, Los Angeles, CA

2024

1. ESA Annual Conference, Long Beach, CA

2023

1. SIAM Dynamical Systems Meeting, Portland, OR

2. Advances in Mathematical Ecology, University of Pittsburgh, Pittsburgh, PA
3. School of Ecology, University of Georgia, Athens, GA

2021

1. Society of Mathematical Biology (SMB) Annual Meeting, Atlanta, GA

2020

1. Department of Biology, University of Florida, Gainesville, FL
2. Department of Mathematics, University of Florida, Gainesville, FL

2019

1. Department of Biological Science, Florida State University, Tallahassee, FL
2. Department of Biology, University of Pittsburgh, Pittsburgh, PA
3. Department of Biology, University of Cincinnati, Cincinnati, OH
4. Department of Ecology and Evolutionary Biology, Cornell University, Ithaca, NY

2018

1. SACNAS Annual Conference, San Antonio, TX
2. ESA Annual Conference, New Orleans, LA

2017

1. SIAM Conference on applications of dynamical systems, Snowbird, UT
2. Department of Ecology and Evolutionary Biology, UCLA, Los Angeles, CA
3. Department of Ecology, Evolution, and Natural Resources, Rutgers University, New Brunswick, NJ

2016

1. Department of Ecology and Evolutionary Biology, University of Toronto, Toronto, Ontario, Canada
2. Department of Ecology and Evolutionary Biology, University of Michigan, Ann Arbor, MI
3. Department of Biology, Indiana University, Bloomington, IN
4. Department of Mathematics, University of Utah, Salt Lake City, UT

2015 and earlier

1. Ecology and Evolution of Infectious Diseases (EEID) Annual Meeting (Posters in 2020, 2021, 2022)
2. Department of Ecology and Evolutionary Biology, University of Michigan, Ann Arbor, MI (2015)
3. ESA Annual Conference, Baltimore, MD (2015)
4. School of Mathematical and Statistical Sciences, Arizona State University, Tempe, AZ (2015)
5. Modeling Infectious Diseases Group, Center for Disease Control, Atlanta, GA (2014)
6. Department of Mathematics and Statistics, Utah State University, Logan, Utah (2014)
7. Department of Biology, Stanford University, Stanford, California (2014)
8. Biology Department, University of Massachusetts Boston, Boston, Massachusetts (2014)
9. Department of Applied and Computational Mathematics and Statistics, University of Notre Dame, South Bend, Indiana (2014)
10. Department of Mathematics, University of Idaho, Moscow, Idaho (2014)
11. Department of Ecology and Evolutionary Biology, University of Toronto, Toronto, Ontario, Canada. (2014)

12. Department of Biological Science, Florida State University, Tallahassee, Florida (2014)
13. Department of Biology, University of Kentucky, Lexington, Kentucky (2013)
14. Department of Ecology and Evolutionary Biology, University of Toronto, Toronto, Ontario, Canada (2013)
15. Department of Mathematics and Statistics, Queen's University, Kingston, Ontario, Canada (2013)
16. MBI Workshop 2: Rapid Evolution and Sustainability, Mathematical Biosciences Institute, Ohio State University, Columbus, Ohio (2013)
17. SACNAS Annual Meeting, San Antonio, Texas (2013)
18. Evo.Tech Seminar Series, Georgia Institute of Technology (2013)
19. SIAM Annual Conference, San Diego, California (2013)
20. Society of Mathematical Biology Annual Conference, Tempe, Arizona (2013)
21. 11th Annual EEID Conference, State College, Pennsylvania (2013)
22. School of Mathematics, Georgia Institute of Technology, Atlanta, Georgia (2012)
23. Society of Industrial and Applied Mathematics (SIAM) Annual Conference, Denver, Colorado (2009)

CONTRIBUTED PRESENTATIONS

1. Ecology and Evolution of Infectious Diseases (EEID) Annual Meeting (Posters in 2020, 2021, 2022)
2. Ecological Society of America Annual Conference (2023, 2017, 2013, 2012, 2011)
3. Society of Mathematical Biology Annual Conference (2017, 2015, 2012) & Minimeetings (2023)

INTERNAL PRESENTATIONS

1. Mathematical Biology Seminar, Department of Mathematics, FSU (2022,2020)
2. Biology Colloquium, Department of Biological Science, FSU (2021)
3. Mathematics Colloquium, Department of Mathematics and Statistics, USU (2019, 2016)
4. Climate Adaptation Science and Ecology Center Interdisciplinary Research Forum, USU (2017)
5. Biological Frontiers Course, Department of Biological Science, FSU (2021)
6. Graduate student research seminar, Department of Mathematics and Statistics, USU (3 times in 2016-2018)
7. Math Bio Group, Department of Mathematics and Statistics, USU (13 times in 2014-2019)
8. USU Applied Math Club, Department of Mathematics and Statistics, USU (2017, 2014)

MENTORSHIP Postdoctoral Researchers

Jing Jiao. November 2020-2023.

Current position: Assistant professor at Texas Christian University.

Graduate Students

Elizabeth (Brooke) Haywood. 2021-present. FSU MathBio PhD

Miles Robertson. 2021-present. FSU Biology PhD

Awarded a graduate fellowship through the NSF GRFP

Ben Daniel. 2023-2025. Utah State University Ecology MS.

Guen Grosklos. F2016-F2018. USU Applied Math PhD

Luis Jover. F2011-F2014. Georgia Tech Physics PhD

Co-advised with Joshua Weitz.

Bradford Taylor. F2012-F2014. Georgia Tech Physics PhD

Co-advised with Joshua Weitz

Cesar Garcia Flores. 2014. Georgia Tech Physics PhD

Co-advised with Joshua Weitz

Undergraduate Students

Anna Chilton. Fa2025-present. FSU Biology Major
Elle Daily. Fu2025-Sp2026. FSU Mathematical Biology Major
Co-author on paper in prep
Sophia McDonough. Fa2023-Sp2024. FSU Mathematical Biology Major
Co-author on paper in prep
Charles Gannon. Fa2021-Sp2023. FSU Mathematical Biology Major
Emily Mila. S2020-S2021. FSU Mathematical Biology Major
Co-author on paper in *American Naturalist*
Darian Sorenson. F2018-S2020. USU Mathematics Major
First author paper in *Theoretical Ecology*
Miles Roberston. S2019. USU Biology Major and Math-Stats Composite Major
Yido Yang. F2012-S2013. Georgia Tech Biomedical Engineering Major
REU Undergraduate Students. Summer 2008. Hope College
Three Mathematics Majors Co-mentored with Tim J. Penning

Graduate Student Committees

Abigail Dittmar. FSU Biology PhD candidate
Ally Dubel. FSU Biology PhD candidate
Adam Goodman. FSU Biology PhD candidate
Laurel Field. FSU Biology PhD candidate
Monica Paniagua Montoya. FSU Biology PhD candidate
Matthew Schumm. FSU Biology PhD. Defended in 2025.
Guen Grosklos. USU Applied Mathematics PhD. Defended in 2021.
Lacy Smith. USU Natural Resources PhD. Defended in 2020.
Ian McGahan. USU Applied Mathematics PhD. Defended in 2020.
Eden Furtak-Cole. USU Applied Mathematics PhD. Defended in 2017.

Graduate Student Committees (external member)

Faith Rovenolt. University of Pittsburgh, Biology PhD. Defended in 2025.

TEACHING

Biology Courses

Biological Science II (BSC 2011), FSU
Theoretical Ecology (BSC 4933 & 5936), FSU
Graduate special topics course (BSC 5936), FSU
Intro to PDEs, Mathematical Ecology, Linear Algebra and ODEs

Mathematics Courses

Calculus 2 (Math 1220), USU
Ordinary Differential Equations (Math 2280), USU
Linear Algebra (Math 2270), USU
Theoretical Ecology (Bio 4422/6422), Georgia Institute of Technology
Co-taught with Joshua S. Weitz,
Graduate Ordinary Differential Equations (Math 6910), USU
Methods in Applied Mathematics (Math 5410), USU
Modeling Predator-Prey Interactions (Bio 4230 & Math 6910), USU
Analysis of biological models using fast-slow dynamical systems (Math 6910), USU

SERVICE

Internal Service - Florida State University

Department of Biological Science Committees:
Diversity, Equity, and Inclusion Committee, member (2020-present)
Ecology & Evolution Area Leader (Fa2023-Sp2024)

Executive Committee, member (Fa2023-Sp2024, Fa2021-Sp2022)
Elections Committee, member (Fa2022-Sp2023, Fa2020-Sp2021)
Faculty Evaluation Committee, member (Sp2021)
Cell Biology Faculty Search Committee, member (Fa2019-Sp2020)

Seminar Organizer

Ecology and Evolution Seminar (Fa2020-Sp2021)

University Committees:

Ad hoc member for academic honor hearings (Sp2021)

Internal Service - Utah State University

Department of Mathematics and Statistics Committees:

Research Committee, member (2017-2019)

Numerical Analyst Faculty Search Committee, member (Fa2016-Sp2017)

Department Scholarship Review Committee, member (2017)

Applied Mathematics Graduate Curriculum Committee, member (2015)

Faculty Advisor

USU Men's Ultimate Frisbee Club (2014-2019)

External Service

Associate editor (2017– present)

The American Naturalist

Conference local organizing committee

Society of Mathematical Biology annual meeting, member (2017)

Organized session

Society of Mathematical Biology Annual Conference, Tempe, Arizona (2013)

Grant reviewer

NSF Division of Mathematical Sciences, panelist (2018)

NSF Division of Environment Biology, ad hoc reviewer (2019)

University of Missouri University System, ad hoc reviewer (2014)

Manuscript reviewer

Advances in Computational Mathematics, American Naturalist, Bulletin of Mathematical Biology, Differential Equations and Dynamical Systems, Ecological Monographs, Ecology, Ecology and Evolution, Ecology Letters, Epidemics, Evolution, F1000, Interface, Journal of Biological Systems, Journal of Mathematical Biology, Journal of Theoretical Biology, Methods in Ecology and Evolution, Nature Microbiology, Natural Resource Modelling, Oikos, PLoS Computational Biology, PLoS ONE, PNAS, Scientific Reports, Theoretical Ecology, Theoretical Population Biology, Theory in Biosciences

Mentorship

EEB Mentor Match Program (2022-present)

ESA Theory Section mentoring chain (2017)

ESA Theory Section mentor (2015)

Volunteer poster and presentation judge

Society of Mathematical Biology annual conference (2017)

Ecological Society of American annual conference (2011-2013)