

DANIEL PAUL MAES

University of Michigan Department of Mathematics - Ann Arbor, MI, USA

E: dmaes@umich.edu

EDUCATION

University of Michigan, Ann Arbor

PhD in Applied and Interdisciplinary Mathematics

June 2025

Ostling Lab Member

January 2020 - Present

Graduate Certificate in Complex Systems

May 2, 2023

M.S. in Applied and Interdisciplinary Mathematics

May 2, 2020

Valdovinos Lab Member

Winter 2019 - August 2020

Marjorie Lee Browne Scholar

Fall 2018 - Winter 2020

Williams College

B.A. in Mathematics (with Honors) and Statistics

June 3, 2018

Honors Thesis in Mathematics

Fall 2017 - Spring 2018

SIAM, Williams Chapter Member/Board Member

Fall 2016 - Spring 2018

AMS, Williams Chapter Member/Vice President

Fall 2016 - Spring 2018

Mellon Mays Undergraduate Fellow

Spring 2016 - Spring 2018

RESEARCH EXPERIENCE

Ostling Lab

January 2021 - Present

PhD Candidate Research, PhD

- The [Ostling Lab](#) studies competitive coexistence and its effects on ecological communities. A key focus is on understanding the mechanisms of competitive coexistence, how competition influences community structure and diversity, and what insights observed patterns of community structure might provide about competitive coexistence.
- Our project focuses on expanding the modeling theory for intransitive loops of competition. Our goal is to further establish intransitivity as another widespread interaction motif in ecological literature and to show how the structure can help foster stability and higher diversity in communities.

Valdovinos Lab

May 2019 - August 2020

Graduate Student Research, M.S.

- The [Valdovinos Lab](#) studies the structure and dynamics of ecological networks at ecological and evolutionary scales. A key focus is on understanding anthropogenic effects on species existence.
- Our project focused on developing a more mechanistic and structured underlying theory on mutualistic interactions in ecology, rather than relying on current, more phenomenologically-based models.
- This work culminated in a master's capstone project.

American Institute of Mathematics Summer School

June 2020 - July 2020

Summer Research Program on: Dynamics, Data and the COVID-19 Pandemic

- This NSF-funded summer school focused on pairing undergraduates and graduate students with faculty around the world to focus on furthering the work of COVID research in the midst of the pandemic.
- Our work focused on modeling the disproportionate spread of COVID between different racial/ethnic groups in several U.S. states by tracking and modeling the basic reproductive number (R_t) over time.

Mellon Mays Undergraduate Fellowship (MMUF)

June 2016 - June 2018

Undergraduate Research Fellowship

- **Williams College Morgan Prize in Mathematics.** To a senior major with accomplishment and promise in applied mathematics, statistics, or mathematics teaching. Williams College Department of Mathematics & Statistics. June 2, 2018.
- **Sigma Xi (Associate Member), The Scientific Research Honors Society.** Inducted on June 2, 2018.
- **Honors Thesis, Mathematics.** Williams College Department of Mathematics & Statistics. May 2018.
- **Outstanding Poster Award.** Mathematical Association of America undergraduate poster session at the 2018 Joint Mathematics Meeting. San Diego, California. January 13, 2018.
- **Institute for Recruitment of Teachers (IRT) Associate.** May 2017 - April 2018.
- **Mu Sigma Rho, The National Statistics Honorary Society.** Nominated by Professor Richard De Veaux, Williams College. Nomination accepted on March 24, 2017.

PUBLICATIONS

- Hale, K. R. S., **Maes, D. P.**, & Valdovinos, F. S. (2022). Simple Mechanisms of Plant Reproductive Benefits Yield Different Dynamics in Pollination and Seed Dispersal Mutualisms. In *The American Naturalist* (Vol. 200, Issue 2, pp. 202216). University of Chicago Press. doi: [10.1086/720204](https://doi.org/10.1086/720204)
- Fleurantin, E., Sampson, C., **Maes, D. P.**, Bennett, J., Fernandes-Nunez, T., Marx, S., & Evensen, G. (2021). A study of disproportionately affected populations by race/ethnicity during the SARS-CoV-2 pandemic using multi-population SEIR modeling and ensemble data assimilation. In *Foundations of Data Science* (Vol. 3, Issue 3, p. 479). American Institute of Mathematical Sciences (AIMS). doi: [10.3934/fods.2021022](https://doi.org/10.3934/fods.2021022)
- **Maes, D. P.**, Tucher, J., & Topaz, C. M. (2021). Affirmative action, critical mass, and a predictive model of undergraduate student body demographics. In C. M. Danforth (Ed.), *PLOS ONE* (Vol. 16, Issue 5, p. e0250266). Public Library of Science (PLoS). doi: [10.1371/journal.pone.0250266](https://doi.org/10.1371/journal.pone.0250266)

WORKS IN PREPARATION

- *Proof of the even-odd hypothesis of competitive coexistence through intransitive loops.* **D.P. Maes**, A.M. Ostling. (Chapter 1 of current dissertation work.)
- *Extending the even-odd hypothesis of competitive coexistence through intransitive loops to fully connected systems.* **D.P. Maes**, A.M. Ostling. (Chapter 2 of current dissertation work.)

WORKING GROUPS

Tropical Forest Diversity Working Group

June 2024 - Present

Research Collaborator

- Full working title: *The challenge of understanding what maintains tropical tree diversity today and of predicting the future of this diversity under global change.*
- Originated from the Barro Colorado Island Centennial celebration and conference in Gamboa, Panama.
- Our objectives are to determine what combination of theory, modeling, analyses, and data can best address questions such as: What are the contributions of different mechanisms to the maintenance of tropical tree species diversity today? How strong is the total resulting stabilization of tropical tree species coexistence including functional diversity? How will global change alter tropical forest diversity, stability and function?
- We are currently putting together a perspectives paper—with interest from *Ecology Letters* and *Nature Ecology & Evolution*—outlining the concept of a "small big model" that can help address such questions and outline future work on tree diversity going forward.

SELECTED TALKS, PRESENTATIONS, & POSTERS

- **Symmetric intransitive loop competition can lead to stable coexistence for odd but not even numbers of species.**
 - a) Barro Colorado Island Centennial Science Symposium. Gamboa, Panama. June 12-20, 2024.
 - b) 2023 Ecological Society of America Annual Meeting. Portland, OR. August 6-10, 2023.
- **The Effects of Intransitive Loops of Competition on the Stability of Ecological Communities.**
Invited special-session talk.
The 13th AIMS Conference on Dynamical Systems, Differential Equations and Applications. Wilmington, NC. May 31-June 4, 2023.
- **The ecological theory of mutualism: Models generalizing across different mechanisms.**
2020 Ecological Society of America Annual Meeting. Salt Lake City, UT/Virtual. August 3-6, 2020.
- **Creating Predictive Models for Racial Affirmative Action Policies in U.S. Undergraduate Admissions.**
Invited mini-symposium talk.
SIAM Conference on Applications of Dynamical Systems. Snowbird, Utah. May 22, 2019.
- **Using Markov Chains to Assess Critical Mass.**
MAA MathFest 2018. Denver, CO. August 2, 2018.
- **Understanding Critical Mass at UC Berkeley: Creating Predictive Models for Affirmative Action Policies in Undergraduate Admissions in the United States.**
Thesis Defense, Honors Thesis in Mathematics. Williams College Department of Mathematics. Williamstown, MA. May 7, 2018.
- **Optimal Investment Strategies and Portfolio Analysis of Leveraged Exchange-Traded Funds (LETFs).**
AMS Joint Mathematics Meeting. San Diego, CA. January 12, 2018.
- **The Criticality of Critical Mass: Understanding Affirmative Action Policy in United States Undergraduate Admissions.**
Mellon Mays Summer Colloquium. Williamstown, MA. July 20, 2016.

COURSES TAUGHT

- MATH 105 - Data, Functions, and Graphs (University of Michigan, Fall 2018)
- MATH 115 - Calculus I (University of Michigan, Winter 2019/Fall 2019)

PROFESSIONAL MEMBERSHIPS

- American Mathematical Society (AMS)
- Society for Industrial and Applied Mathematics (SIAM)
- Ecological Society of America (ESA)
- Institute for the Recruitment of Teachers (IRT)
- Sigma Xi, The Scientific Research Honors Society

SERVICE

InSTInCT REU Program Mentorship

May 2022 - July 2022

Undergraduate Research Mentorship, UT Austin

- Mentored an undergraduate student taking part in the Inclusive Student Training in Collections and field-based Topics (InSTInCT) REU Program at the University of Texas at Austin.
- InSTInCT is an 8-week summer research program that provides undergraduates an opportunity to conduct cutting-edge scientific research on the diversity of life and organisms in their natural environment.

- A central theme of InSTInCT is to broaden the participation of historically excluded groups in the natural sciences.

Michigan Applied Math PhD Cohort Mentoring

August 2019 - May 2022

Near Peer Mentorship, UM-Ann Arbor

- Applied Math PhD cohort mentoring in the University of Michigan–Ann Arbor math department for incoming first-year graduate students.
- Often matched with other Marjorie Lee Browne scholars to help mentor them throughout their time in academia as an underrepresented minority.

QSIDE

April 2019 - April 2022

Associated Partner

- [The Institute for the Quantitative Study of Inclusion, Diversity, and Equity \(QSIDE\)](#) is a cross-institutional collaborative effort to use cutting-edge quantitative techniques to increase inclusion, diversity, and equity.
- Our mission is to bring together researchers from the humanities, social sciences, and natural sciences together with mathematical, statistical, and computer scientists to tackle such research interests.
- My past work was a continuation of my undergraduate thesis project on assessing affirmative action policies in use at U.S. undergraduate colleges and universities.

Ross Summer Connection 2019

June 2019 - August 2019

Graduate Student Instructor, UM-Ann Arbor

- Ross Summer Connection is a program run by Ross Business School at the University of Michigan.
- This summer program is for underrepresented groups in business to get a jump start on their studies at U-M, in the hopes of setting them up for success while at Michigan.
- My responsibilities included teaching the Precalculus course to a group of 12 students and advising them on best practices for productivity and studying while in college.