Cassidy K. Buhler (she/her)

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Education

Expected 2024 **Ph.D. Business Analytics, Computational Data Science Minor** — Drexel University, Philadelphia, PA
Thesis: *Advances in optimization with applications to nature conservation*

2019 **B.S. Mathematics** — University of Utah, Salt Lake City, UT

Research

AI for Conservation; Spatial Conservation Planning; Conservation Decision-Making; Environmental Data Science; Machine Learning; Mixed-Integer Programming; Nonlinear Programming; Operations Research;

Publications

Journal Articles

Do mechanisms matter? Comparing cancer treatment strategies across mathematical models and outcome objectives
Mathematical Biosciences and Engineering (2021). vol. 18, no. 5, pp. 6305–6327
Cassidy K. Buhler, Rebecca S. Terry, Kathryn G. Link, Frederick R. Adler

Conference Proceedings

Decision-making for land conservation: A derivative-free optimization framework with nonlinear inputs
38th AAAI Conference on Artificial Intelligence (2024). Forthcoming.
(24.2% acceptance rate)
Cassidy K. Buhler & Hande Y. Benson

Optimal land conservation decisions for multiple species
52nd Northeast Decision Science Institute Annual Conference (2023). vol. 52, pp. 808–816.
Cassidy K. Buhler & Hande Y. Benson

Under Review

Regularized step directions in nonlinear conjugate gradient methods
Under 2nd round of review at *Mathematical Programming Computation*.
Cassidy K. Buhler, Hande Y. Benson, David F. Shanno

In Progress

Nonlinear conjugate gradient methods for machine learning
Working paper.
Cassidy K. Buhler & Hande Y. Benson

Efficient solution of portfolio optimization problems via dimension reduction and sparsification
Working paper.
Cassidy K. Buhler & Hande Y. Benson

Employment

2019 – Present **Graduate Research Assistant** *Drexel University*
Department of Decision Sciences & MIS

Led research projects in nonlinear programming and mixed-integer programming.

Nonlinear Programming

- Advanced unconstrained optimization methods for nonlinear programming, with special emphasis on large-scale machine learning problems.
- Formulated a quasi-Newton algorithm by applying hybrid cubic regularization to nonlinear conjugate gradient methods (CGM).
- Solver exhibits reduced iteration count, faster CPU runtime, and improved theoretical guarantees compared to non-regularized CGM.

Mixed-Integer Programming

- Developed a mixed-integer nonlinear programming (MINLP) framework for spatial conservation planning as a computational tool for conservationists.
- Utilized population viability analysis to gain insight into a species' extinction risk and merged with MINLP framework to find the cheapest collection of parcels that best protect a vulnerable species.
- Framework promotes interdisciplinary work, as it allows for more complex decision inputs and can be paired with existing ecological software.

</> Python, R, and MATLAB.

2019 – Present **Instructor**
Drexel University

- Created, organized, and delivered instructional materials for undergraduate and PhD classes/workshops.
- Earned two awards for teaching performance, along with student course evaluation scores above the college and department average.

Course	**Level**	**Quarter**	**Skills**
BSAN 360: Programming for Data Analytics	U	Winter 2022	R
Ph.D. Programming Bootcamp	PhD	Summer 2021; Summer 2022	Python
MIS 200: Management Information Systems (Recitation Section)	U	Fall 2019; Fall 2020; Winter 2021	MS Access; Excel; HTML

*Undergraduate (U)

2020 – Present **Teaching Assistant**
Drexel University

- Served TA for 25+ classes, assisting undergraduate, MS, MBA, Executive MBA, and PhD students.

Course	**Level**	**Quarter**	**Skills**
BSAN 360: Programming for Data Analytics	U	Spring 2021	R
MIS 612: Aligning Information Systems & Business Strategies	EMBA; MBA	Fall 2023	-
MIS 625: Management of Information Technology Operations	MBA	Fall 2023	-

*Undergraduate (U)

Employment (continued)

2020 – Present **Teaching Assistant (continued)**
Drexel University

Course	Level	Quarter	Skills
OPM 200: Operations Management	U	Spring 2020; Fall 2021; Spring 2023	-
OPM 341: Supply Chain Management	U	Spring 2021; Spring 2022; Fall 2022	Excel
OPM 344: Revenue Management	U	Fall 2022	Excel
OPR 320: Linear Models for Decision Making	U	Summer 2020; Spring 2021	Excel
STAT 201: Intro to Business Statistics	U	Winter 2020; Spring 2020; Fall 2021; Summer 2022; Spring 2023; Winter 2024	Excel
STAT 202: Business Statistics II	U	Summer 2021; Spring 2023	Excel
STAT 205: Statistical Inference I	U	Spring 2020; Fall 2021	Excel
STAT 206: Statistical Inference II	U	Summer 2021	Excel
STAT 510: Intro to Statistics for Business Analytics	MBA	Summer 2023; Winter 2024	Excel
STAT 642: Data Mining for Business Analytics	MS; PhD	Winter 2023	R

*Undergraduate (U)

2018 – 2021 **Research Assistant** *University of Utah*
Department of Mathematics

- Developed mathematical models to understand the response of castration-resistant prostate cancer under various treatment regimens.
- Simulated the dynamics of biological systems as differential equations, formulating the models with differing mechanism complexity.
- Evaluated modern treatment regimens under this scheme and disseminated findings to academic and medical audiences.

</> R and MATLAB.

2018 – 2019 **Computer Lab & Mathematics Assistant** *University of Utah*
T. Benny Rushing Mathematics Student Center

- Provided math and programming assistance for undergraduate classes.
- Subjects: Intermediate Algebra, College Algebra, Calculus, Linear Algebra, Applied Statistics.

</> Python, R, & MATLAB.

2018 **Computer Scientist Intern** *United States Air Force*
Hill Air Force Base

- Conducted research related to improving software for USAF aircraft in the Software Engineering Group.
- Hired under the Premier College Intern Program (PCIP) and earned a position in the PALACE Acquire (PAQ) program.

</> MATLAB.

Software

Derivative-Free Optimization for Land Conservation

A mathematical programming tool for conservationists that allows for linear and nonlinear inputs, continuous and discrete variables, and can be paired with existing ecological software.

`https://github.com/cassiebuhler/conservation-dfo`

</> R, Python, RAMAS

Conmin-CG: Hybrid Cubic Regularization of Conjugate Gradient Methods

An optimization algorithm with memoryless and matrix-free properties that solves large-scale problems more efficiently by improving step quality with cubic regularization.

`https://github.com/cassiebuhler/ConminCG`

</> C, MATLAB, and Python.

Technical Skills

Coding

Language	*Proficiency*	*Libraries/Packages/Toolboxes*
Python	★★★★★	PyTorch, TensorFlow, Pandas, BeautifulSoup, scikit-learn, Keras, Seaborn, rasterio.
R	★★★★★	tidyverse, ggplot, rgdal, raster, rgeos, SDMTools, deSolve.
MATLAB	★★★★★	Deep Learning, Statistics & Machine Learning, Optimization, Financial, Computer Vision.

Optimization Software

Solver	*Proficiency*	*Applications*
GUROBI	★★★☆	quadratic programming, linear programming
Pyomo	★★★☆	mixed-integer nonlinear programming
CVX	★★☆☆	convex programming
CPLEX	★★☆☆	integer programming
AMPL	★★☆☆	unconstrained nonlinear programming

Basic: ★☆☆☆ *Intermediate:* ★★☆☆ *Advanced:* ★★★☆ *Expert:* ★★★★

Awards & Grants

2024 **NCEAS Travel Grant** *NCEAS*
Funding to attend the National Center for Ecological Analysis and Synthesis (NCEAS) Environmental Data Science Summit at UC Santa Barbara.

2023 **Rising Scholar** *MIT Sloan*
Selected from a competitive pool of Ph.D. and postdoctoral scholars to present research at the 4th annual Rising Scholars Conference hosted by the MIT Sloan School of Management Ph.D. Program.

2023 **Graduate Student Travel Subsidy Award** *Drexel University*
Funding to present at the INFORMS Annual Meeting in Phoenix, AZ.

2023 **DEI & Environment and Sustainability Innovation Micro-Grant** *Drexel University*
Awarded to research projects with contributions to DEI or environmental sustainability.
Project: "Black-box optimization for reserve design in biodiversity conservation".

2023 **Teck-Kah Lim Graduate Student Travel Subsidy Award** *Drexel University*
Funding to present at the SIAM Conference on Optimization in Seattle, WA.

Awards & Grants (continued)

2023 **SIAM Student Travel Award** *SIAM*
Funding to present at the SIAM Conference on Optimization in Seattle, WA.

2023 **ESIIL Travel Grant** *ESIIL*
Funding to attend the Environmental Data Science Innovation & Inclusion Lab (ESIIL) Innovation Summit at CU Boulder.

2022 **Teaching Assistant Excellence Award** *Drexel University*
Recognizes graduate students who exhibit exemplary commitment to student learning, based on nominations and evaluations from undergraduate students and faculty.

2021 **Teaching Assistant Excellence Award (Highly Commended)** *Drexel University*
Award committee recognized finalists as "highly commended".

2021 **SIAM Student Travel Award** *SIAM*
Funding to present at the SIAM Conference on Optimization.

2019 **Undergraduate Research Scholar Designation** *University of Utah*
Undergraduate students who have completed two semesters of research, presented in the Undergraduate Research Symposium, and published research in the Undergraduate Research Journal.

2019 **Research Experience for Undergraduates (REU)** *University of Utah*
Grant for undergraduate students conducting research with a faculty member.

Conference Talks

2023 **Rising Scholars Conference** *Cambridge, MA (Virtual)*
Talk: Decision-making for land conservation: A derivative-free optimization framework with nonlinear inputs.

2023 **INFORMS Annual Meeting** *Phoenix, AZ.*
Talk: Decision-making for land conservation: A derivative-free optimization framework with nonlinear inputs.

2023 **SIAM Conference on Optimization** *Seattle, WA.*
Talk: Reserve design in biodiversity conservation.

2023 **NEDSI Annual Conference** *Washington, D.C.*
Talk: Optimal land conservation decisions for multiple species.

2021 **INFORMS Annual Meeting** *Anaheim, CA. (Virtual)*
Talk: Regularized step directions in conjugate gradient minimization for machine learning.

2021 **SIAM Conference on Optimization** *Virtual.*
Talk: Conjugate gradient methods for machine learning.

2020 **INFORMS Annual Meeting** *Virtual.*
Talk: Efficient solution of portfolio optimization problems via dimension reduction and sparsification.

Service

2023 **Session Chair** *INFORMS*
Session: Nonlinear Optimization in Machine Learning.

2023 **Session Organizer** *SIAM*
Session: Nonlinear Optimization and Applications.

2023 **Session Chair** *NEDSI*
Session: Land, Sand, and Plastic Management.

2022 **Panelist** *Drexel University*
Session: Teaching Assistance Orientation Session.

2019 **Mathematics Tutor - Volunteer** *Utah Prison Education Project*
Tutored students who are incarcerated at the Timpanogos Women's Correctional Facility in a Salt Lake Community College math course.

Organizations

AAAI: Association for the Advancement of Artificial Intelligence

AWM: Association for Women in Mathematics

ESA: Ecological Society of America

INFORMS: The Institute for Operations Research and the Management Sciences

SIAM: Society for Industrial and Applied Mathematics

References

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Drexel University
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