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

Interests

AI for Conservation; Spatial Conservation Planning; Computational Sustainability; Environmental Data Science; Machine Learning; Mixed-Integer Optimization; Nonlinear Optimization; 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

In Progress

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

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.
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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.

Teaching

2019 – Present **Instructor**
Drexel University

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

2020 – Present **Teaching Assistant**
Drexel University

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

Employment

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

Led research projects in nonlinear programming, centered on improving solver efficiency for large-scale optimization, as well as mixed-integer programming projects applied to environmental conservation.

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.

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.

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**, *National Center for Ecological Analysis and Synthesis*
- Funding to attend the NCEAS Environmental Data Science Summit at UC Santa Barbara.

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

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

2023 **DEI & Environment and Sustainability Innovation Micro-Grant**, *Drexel University*
- Awarded to research projects with unique 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 2023 SIAM Conference on Optimization in Seattle, WA.

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

2023 **ESIIL Travel Grant**, *Environmental Data Science Innovation & Inclusion Lab*
- Funding to attend the ESIIL 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".

Awards & Grants (continued)

2021 **SIAM Student Travel Award**, *SIAM*
- Funding to present at the 2021 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 **Decision-making for land conservation: A derivative-free optimization framework with nonlinear inputs**,
Rising Scholars Conference, *Cambridge, MA (Virtual).*

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

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

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

2021 **Regularized step directions in conjugate gradient minimization for machine learning**,
INFORMS Annual Meeting, *Virtual.*

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

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

Service

2023 **Session Chair,** Nonlinear Optimization in Machine Learning
INFORMS Annual Meeting

2023 **Session Organizer,** Nonlinear Optimization and Applications
SIAM Conference on Optimization

2023 **Session Chair,** Land, Sand, and Plastic Management
NEDSI Annual Conference

2022 **Panelist,** Teaching Assistance Orientation Session
Graduate College, Drexel University

2019 **Mathematics Tutor - Volunteer,** Utah Prison Education Project
Timpanogos Women's Correctional Facility
- Supported students who are incarcerated 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

Hande Benson, *Ph.D. Research Advisor*
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Drexel University
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Frederick Adler, *Undergraduate Research Advisor*
Professor of Biology and Mathematics
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University of Utah
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