RACHEL H. TOCZYDLOWSKI

Research Scientist, Northern Research Station, United States Forest Service
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EDUCATION

Ph.D. Botany. University of Wisconsin-Madison *2019*
Track: Evolution, Adviser: Dr. Donald Waller
Minor: Statistical methods for ecological and genetic data

Dissertation: "Genetic and phenotypic differentiation in *Impatiens capensis* Meerb. in riverine networks: identifying patterns and potential drivers of gene flow, local adaptation, and inbreeding"

Awarded: **National Science Foundation Graduate Research Fellowship** *2015*

B.S. Biology. *summa cum laude*. University of Minnesota Duluth *2012*
Minors: Chemistry, Art
GPA: 3.966/4.000, Dean's list 8 of 8 semesters

American Chemical Society Standardized Organic Chemistry 2008 Exam, 94th percentile nationally

RESEARCH EXPERIENCE

Research Scientist *2022 – present*
Landscape Ecology and Forest Sustainability Unit, Northern Research Station, U.S. Forest Service, WI

Postdoctoral Researcher *2019 – 2022*
Department of Integrative Biology, Michigan State University, MI; Adviser: Dr. Gideon Bradburd

Project: Genetic diversity and divergence in the seas
NSF RCN Evolving Seas Working Group
Collaborated with international team of population geneticists, physical oceanographers, and marine biologists to study patterns and potential drivers of genetic diversity in marine organisms using hundreds of publicly available next-generation genetic sequence datasets.

Project: Assembling genetic datasets using high throughput computing clusters.
Led development, writing, and testing of pipeline to run next-generation genetic assembly programs in parallel on academic high-throughput computing networks and public clouds.

Graduate Researcher *2013 – 2019*
Department of Botany, University of Wisconsin-Madison, WI; Adviser: Dr. Donald Waller

Project: Genetics consequences of habitat fragmentation in Wisconsin floodplain forests: Patterns of local adaptation, gene flow, and inbreeding
Designed, secured funding for, and led interdisciplinary dissertation research project to explore patterns of population genetic structure, inbreeding, and local adaptation in a floodplain forest plant (*Impatiens capensis*) using novel landscape genetic methods and classical field experiments.

2018 – present
Project: Dimensions of temperate forest biodiversity: Long-term shifts in species, trait, and phylogenetic diversity
Department of Botany, University of Wisconsin-Madison, WI; Supervisor: Dr. Donald Waller

Collaborated with Botany colleagues to quantify shifts in species, functional trait, and phylogenetic diversity in Wisconsin forests over a 50-year period using large ecological datasets.

2016 – 2019

Project: Policy and management for conservation in novel ecosystems: foresters' perceptions and responses

Department of Botany, University of Wisconsin-Madison, WI; Supervisor: Dr. Adena Rissman
Part of large interdisciplinary team of Wisconsin DNR employees and ecology, forestry and social science academics studying how foresters perceive and respond to ecosystem novelty.

Senior Laboratory Technician *2012 – 2013*

Ecological and Evolutionary Genetics Lab, Department of Biology, University of Minnesota Duluth, MN
Supervisor: Dr. Julie Etterson

Coordinated 17-person lab group to study the differential evolutionary potential of native polyploid species in response to climate change. Hired, trained, and supervised 14 students.

Independent Undergraduate Researcher *2011 – 2012*

University of Minnesota, MN
Adviser: Dr. Julie Etterson
"Hybrid vigor and outbreeding depression in *Solidago altissima* interpopulation crosses along the longitudinal precipitation gradient in Minnesota."

Adviser: Dr. Donn Branstrator
"Role of physical lake features and water access in predicting spatiotemporal patterns of range expansion of *Bythotrephes longimanus* in the United States."

Undergraduate Research Assistant Level I *2009 – 2012*

Plankton Biology and Limnology Lab, Department of Biology, University of Minnesota Duluth, MN
Supervisor: Dr. Donn Branstrator

Assisted with research program studying plankton community composition in Lake Superior and the spread of aquatic invasive species.

Undergraduate Research Assistant Level II *2008 – 2012*

Ecological and Evolutionary Genetics Lab, Department of Biology, University of Minnesota Duluth, MN
Supervisor: Dr. Julie Etterson

Assisted with research program exploring how phenotypic plasticity and responses to selection vary between ploidy levels of *Solidago altissima* using 5-year artificial selection experiment.

PUBLICATIONS

Hancock Z.B., **Toczydlowski R.H.**, Bradburd G.S. (2023). A spatial approach to jointly estimate Wright's neighborhood size and long-term effective population size. *bioRxiv, under review at Genetics*.

Toczydlowski R.H., Waller D.M. (2023). Failure to purge: Population and individual inbreeding effects on fitness across generations of wild *Impatiens capensis*. *Evolution, ja*: XX–XX.

Crandall E.D, **Toczydlowski R.H.**, Liggins L., Holmes A.E. *, Ghoojaei M. *, Gaither M.R., Wham B.E., Pritt A.L., Noble C., Anderson T.J. *, Barton R.L. *, Berg J.T. *, Beskid S.G. *, Davis B. *, Delgado A. *, Farrell E. *, Himmelsbach N. *, Queeno S.R. *, Trinh T. *, Weyand C.A. *, Bentley A., Deck

J., Riginos C., Bradburd G.S., Toonen R.J. (2023). The importance of timely metadata curation to the global surveillance of genetic diversity. *Conservation Biology*, *ja,* e14061.
***Graduate or undergraduate student**

Toczydlowski R.H., Waller D.M. (2021). Plastic and quantitative genetic divergence mirror environmental gradients among wild, fragmented populations of *Impatiens capensis*. *American Journal of Botany,* 109: 99–114.

Toczydlowski R.H., Liggins L., Gaither M.R., Anderson T.J. *, Barton R.L. *, Berg J.T. *, Beskid S.G. *, Davis B. *, Delgado A. *, Farrell E. *, Ghoojaei M. *, Himmelsbach N. *, Holmes A.E. *, Queeno S.R. *, Trinh T. *, Weyand C.A. *, Bradburd G.S., Riginos C., Toonen R.J., Crandall E.D. (2021). Poor data stewardship will hinder global genetic diversity surveillance. *Proceedings of the National Academy of Sciences*, 118: e2107934118.
***Graduate or undergraduate student**

Waller D.M., Paulson A.K., Richards J.H., Alverson W.S., Amatangelo K.L., Bai C., Johnson S.E., Li D., Sonnier G., **Toczydlowski R.H**. (2021). Functional trait data for vascular plant species from northeastern North America. *Ecology*, e03527.

Whitfield, H.*, **Toczydlowski R.H.** (2020). Distinguishing *Impatiens capensis* from *I. pallida* using leaf morphometric traits. *Botany*, 98: 361–369.
***Undergraduate mentee**

Toczydlowski R.H., Waller D.M. (2019). Drift happens: Molecular genetic diversity and differentiation among populations of jewelweed (*Impatiens capensis*) reflect fragmentation of floodplain forests. *Molecular Ecology*, 28: 2459–2475.

Rissman A.R., Burke K.D., Kramer A.C., Radeloff V.C., Schilke P.R., Selles O.A., **Toczydlowski R.H.**,Wardropper C.B., Barrow L.A., Chandler J.L., Geleynse K.,L'Roe A.W., Laushman K.M., and Schomaker L.A. (2018). Forest management for novelty, persistence, and restoration, as influenced by policy and society. *Frontiers in Ecology and the Environment*, 16: 454–462.

Toczydlowski R.H. (2017). An efficient workflow for collecting, entering, and proofing field data: Harnessing voice recording and dictation software. *The Bulletin of the Ecological Society of America*, 98: 291–297.
*Recognized by journal as a **top 20 most read paper** for 2017–2018.

Etterson J.R., **Toczydlowski R.H.**, Winkler K.J., Kirschbaum J.A, and McAulay T.S. (2016). *Solidago altissima* differs with respect to ploidy frequency and clinal variation across the prairie forest biome border in Minnesota. *American Journal of Botany* 103: 22–32.
***Invited submission** to a special issue on geographic variation in plants.

SELECT MEDIA COVERAGE

Michigan State Institute for Cyber-Enabled Research
(https://icer.msu.edu/about/announcements/learning-think-parallel-fieldwork-high-performance-computing)

GEO BON News
(https://geobon.org/biology-students-make-lemonade-out-of-pandemic-lemons-by-improving-accessibility-of-genetic-data-from-wild-animal-and-plant-species/)

Michigan State MSU TODAY News
(https://msutoday.msu.edu/news/2021/biodiversity-needs-better-data-archiving)

UW Lakeshore Nature Preserve Newsletter
(https://d138k1rt4vd1y.cloudfront.net/wp-content/uploads/sites/27/2020/12/Preserve-enews-fall-2020.pdf)

Letters to a Pre-Scientist Blog
(https://www.prescientist.org/2017/12/12/scientist-spotlight-8-rachel-toczydlowski/)
UW Botany and Conservation Alumni Newsletter
(https://botany.wiscweb.wisc.edu/wp-content/uploads/sites/251/2017/11/Botany_ConBio_Newsletter_F2017-web.pdf)
Friends of the UW Arboretum Newsletter
(https://arboretum.wisc.edu/news/arboretum-news/research-jewelweed/)
Keweenaw Land Trust Newsletter

PRESENTATIONS

Toczydlowski, R.H. "Reduced representation genomic data in action". **Invited** guest lecture at Mount Holyoke College, South Hadley, MA, April 2023.

Toczydlowski, R.H., Brennan, R., Crandall, E., Kelley, J., Matz, M., Pringle, J., Riginos, C., Wares, J., Bradburd, G. "Identifying patterns and potential drivers of genetic diversity and divergence in the sea." **Invited** virtual talk at Evolution in Changing Seas Research Coordination Network Integration Conference, Shoals Marine Lab, ME, August 2022.

Toczydlowski, R.H. "Navigating the graduate school landscape." **Invited** virtual talk for UM Duluth Biology Department, Duluth, MN, November 2021.

Toczydlowski, R.H., Bradburd, G.S. "How sampling patterns influence species-level estimates of genetic diversity and what to do about it." Poster presented at Midwest Population Genetics Conference, Madison, WI, August 2021.

Toczydlowski, R.H. "Identifying patterns and potential drivers of gene flow and local adaptation across scales." **Invited** virtual talk for MSU Plant Biology Spring Seminar Series, East Lansing, MI, April 2021.

Toczydlowski, R.H. "Navigating careers in biological research." **Invited** virtual talk for UM Duluth Biology Department, Duluth, MN, November 2020.

Toczydlowski, R.H. "Genetic and phenotypic differentiation in *Impatiens capensis* in riverine networks: identifying patterns and potential drivers of gene flow and local adaptation." Public PhD defense talk at UW-Madison, Madison, WI, July 2019.
https://www.youtube.com/watch?v=_34iM7BFL3s

Toczydlowski, R.H., Waller, D.M. "Drift happens: The genetic structure of jewelweed reflects fragmentation of lowland forests and marshes." Poster presented at Wetland Science Conference, Middleton, WI, February 2019.

Toczydlowski, R.H. "Primer on landscape genetics and a case study in Wisconsin floodplain forests." **Invited** guest lecture for Conservation Biology course at UW-Madison, Madison, WI, October 2018.

Toczydlowski, R.H. and Waller, D.M. "Drift happens: The genetic structure of *Impatiens capensis* reflects legacy of habitat loss and fragmentation." Poster presented at Midwest Population Genetic Conference, St. Paul, MN, August 2018.

Toczydlowski, R.H. and Waller, D.M. "Jewelweed in Wisconsin: Are traits environmentally or genetically determined." **Invited** talk presented at Arboretum 17th-Annual Science Day, Madison, WI, February 2017.

Toczydlowski, R.H. "Can morphology be used to track plant gene flow?" Talk presented at UW-Madison Spatial Statistics Showcase, Madison, WI, December 2015.

Toczydlowski, R.H. "Genetic population structure and demographic changes of six northern Wisconsin *Oryzopsis asperifolia* populations." Poster presented at UW-Madison Population Genetics Poster Session, Madison, WI, December 2013.

Toczydlowski, R.H., "Assisted Migration: A controversial conservation strategy in a changing climate." Senior exit seminar presentation, Duluth, MN, March 2012.

Toczydlowski, R.H., and Etterson, J.E. "Hybrid vigor and outbreeding depression in *Solidago altissima* interpopulation crosses along the longitudinal precipitation gradient in Minnesota." Poster presented at U of MN Duluth Undergraduate Research and Artistic Showcase, Duluth, MN, April 2012.

HONORS, AWARDS, GRANTS

NSF Graduate Research Fellowship, NSF ($132,0000) *2015 – 2019*
Tulipa et Paeonia Fellowship, UW-Madison Botany ($9,000) *2019*
E.K. and O.N. Allen Fellowship, UW-Madison Botany ($9,000) *2018*
College of Letters and Science Teaching Fellowship, UW-Madison ($1,000) *2016*
1 of 14 selected from 1,400 graduate TAs campus-wide for "outstanding success as a student and teacher" based on department nomination letters, student evaluations, and teaching philosophy.
NSF Graduate Research Fellowship, Honorable Mention, NSF *2014*
Flora Aeterna Research Grant, UW-Madison Botany ($3,222) *2015*
Demeter Research Grant, UW-Madison Botany ($5,000) *2014*
Flora Aeterna Research Grant, UW-Madison Botany ($1,500) *2014*
Davis Research Grant, UW-Madison Botany ($770) *2014*
Excellence in Academics and Research Award, U of MN Duluth Biology *2012*
1 selected in years with deserving applicant, selection based on faculty letters of nomination.
Departmental Service Award, U of MN Duluth Chemistry *2012*
Honors Society of Phi Kappa Phi, U of MN *2012*
Invited based on academic standing in top 10% of all undergraduates in the U of MN system.
Undergraduate Research Opportunity Program Grant, U of MN ($1700) *2011*

SELECT SCHOLARSHIPS

Chancellor's Scholarship, U of MN Duluth ($8,000) *2008 – 2012*
Non-Resident Merit-Based Scholarship, U OF MN Duluth ($8,000) *2008 – 2012*
Mowbray Scholarship, U OF MN Duluth Biology ($4,000) *2011 – 2012*
John McCabe Scholarship, U of MN Duluth Biology ($2,000) *2010 – 2011*
T.O. Odlaug Scholarship, U of MN Duluth Biology ($2,000) *2009 – 2010*
Incoming Freshmen Academic Scholarship, U of MN Duluth ($1,000) *2008*

TECHNICAL SKILLS

Computational and analytical
Data analysis using high-throughput computing clusters
de novo assembly and downstream analysis of next-generation genetic sequence data
Version control of datasets and analytical scripts
Data visualization
Bayesian landscape genetic model, population genetic clustering models, general linear models,

generalized linear mixed models, linear discriminate analysis, morphometric elliptical Fourier analysis

Languages
R, bash, HTCondor, SLURM

Software
RStudio, JMP, git, Docker, Stacks, ipyrad, Adobe Photoshop, Adobe Illustrator, MS Office Suite (Word, Excel, PowerPoint), proficient in Mac OS and Windows

Laboratory and field
Greenhouse and common garden cultivation and care of research plants
DNA extraction (CTAB, DNeasy), quantification, and purification for next-gen (Illumina) sequencing
Working with a controlled substance
Randomized block experimental design
Navigating to field sites using maps and GPS
Physical work in extreme conditions

PROFESSIONAL TRAINING

Multivariate data analysis with vegan *2023*
Five-day interactive training on multivariate data analysis taught by developer of vegan R package via Physalia Courses Inc.

American Heart Association First Aid, CPR, AED Certification *2023*
Full day hands-on training in basic first aid, CPR, and AED operation for infants, children, and adults. Offered by USDA Forest Service via Nicolet Area Technical College.

Cultural Competency for Personal, Organizational, and Community Change *2021*
Four-week training to expand self-awareness of biases, inequity, and oppression and develop strategies to enact positive social justice change. Offered by Michigan State University College of Natural Science.

Best Practices in Mentoring Training *2021*
Interactive training on how to align expectations, develop and utilize mentoring contracts, and assess understanding of mentees.

Strategies to Protect At-risk Researchers When Conducting Fieldwork *2021*
Interactive training to identify and develop strategies to make fieldwork a safe experience for minorities. Developed a list of new policies and procedures to implement at the Kellogg Biological Research Station.

Publons Academy Peer Review Training *2020*
Online course with one-on-one mentoring on best practices and ethics of peer reviewing scientific papers.

Cloud Computing Fellow *2019 – 2020*
Received 12 hours of hands-on training in design and implementation of cloud computing in research. Developed and completed a semester-long cloud-based research project. Presented results at a symposium with other fellows and in written form (symposium cancelled due to covid-19). One of 16 selected from university-wide applicant pool.

Data Carpentry Workshop *2017*
Two-day, hands-on workshop covering best practices for reproducible computational research, development of data management and analysis pipelines, and data visualization. OpenRefine, SQL, R.

COMPASS Scientific Communication Training *2017*
Trained by professional, nationally recognized communication coaches to effectively communicate scientific information to the public, policymakers, and journalists in a 1-day session.

DELTA Inclusivity Training *2017*
Explored effects of systematic race, gender, and socioeconomic inequalities on learning and productivity in weekly sessions for 2 months. Practiced inclusive instructional methods and leading conversations on sensitive topics. Assessed efficacy of inclusive instructional strategies via classroom observations.

Mental Health and Suicide Prevention Training *2016*
Online training using At-Risk software simulations to practice identifying and responding to signs of mental health distress in colleagues.

Evolutionary Quantitative Genetics Workshop *2014*
One-week intensive immersion lecture series by Dr. Bruce Walsh of University of Arizona.

TEACHING EXPERIENCE

Teaching Fellow *2016*
College of Letters and Science, University of Wisconsin-Madison, WI; Supervisor: Brain Bubenzer
Collaborated with administrators and fellows to design and offer instructional workshops attended by 300-400 graduate teaching assistants with a focus on inclusive teaching and diversity. One of 16 selected university-wide based on personal teaching statement, student evaluations, and letters of nomination.

Graduate Teaching Assistant, Intro Biology I and II *2013 – 2015*
Department of Zoology, University of Wisconsin-Madison, WI; Supervisors: Nazan Gillie, Kerry Martin
Taught experimental design, statistical analysis, biological concepts, and scientific writing to 200+ students in weekly 3-hr lab sessions. Mentored 42 students through semester long independent research projects.

Certified Tutor, Chemistry *2010, 2012*
Department of Chemistry, University of Minnesota Duluth, MN; Supervisor: Jill Strand
Advanced/Level II national certification from College Reading and Learning Association
Tutored 180 undergraduates in individual and group settings in Honors and General Chemistry I/II, Environmental Chemistry, Organic Chemistry I/II; 65 contact hours.

Undergraduate Teaching Assistant, Genetics Lab *2011*
Department of Biology, University of Minnesota Duluth, MN; Supervisor: Jennifer Liang
Presented material, demonstrated laboratory techniques, graded lab notebooks; 25 students.

MENTORING EXPERIENCE

Letters to a Pre-Scientist Mentor *2015 – present*
Empower middle school students in under-resourced communities to pursue STEM careers by forming personal connections with scientists via writing pen pal letters back and forth.

Undergraduate Research Mentor *2014 – present*
Heather Whitfield, University of Wisconsin-Madison, 2017 – 2020
Astrid De La Cruz, University of Wisconsin-Madison, 2014 – 2016
Keegan Byrnes, Michigan State University, 2020 –2021

Stephanie Lugo González, University of Puerto Rico, 2021 – 2022
Michelle Kenton, University of Wisconsin-Madison, 2022 – present

PROFESSIONAL SERVICE

Laboratory Representative, Unit Safety Committee *2022 – present*
Landscape Ecology and Forest Sustainability Unit, Northern Research Station, WI

Postdoctoral Representative, Department Chair Search Committee *2020 – 2022*
Department of Integrative Biology, Michigan State University, MI

Graduate Student Representative
Department of Botany, University of Wisconsin-Madison, WI

Diversity and Climate Committee *2018 – 2019*
Technology Committee *2018 – 2019*
Space and Facilities Committee *2016 – 2019*
Social Committee *2014 – 2015*

Referee for scientific journals
Ecology Letters, 2021
Ecology and Evolution, 2020, 2022
Evolutionary Ecology, 2019
Freshwater Biology, 2019
Journal of Urban Ecology, 2021, 2022
Molecular Ecology, 2018, 2019, 2020
Molecular Ecology Resources, 2020
PLOS ONE, 2016 (2), 2017
Wetlands, 2017, 2018

CapEx Funding Proposal Leader *2016*
Department of Botany, University of Wisconsin-Madison, WI
Garnered department support, wrote funding request, and awarded competitive funds to purchase $2,700 piece of shared genetic lab equipment.

Course Development: Teaching evolution for high school educators
University of Wisconsin-Madison, WI *2014*
Co-developed semester-long online curriculum. Collaborative effort between Crow Institute for the Study of Evolution, Institute for Biology Education, and UW-Madison School of Education.

Student Representative for External Review *2012*
Department of Biology, University of Minnesota Duluth, MN
One of 12 students selected by department faculty to evaluate Department with external review team.

Biology Department Representative *2011 – 2012*
Department of Biology, University of Minnesota Duluth, MN
Presented and advocated for proposals submitted by Biology faculty to the Swenson College of Science and Engineering Tech Fee Committee, resulting in $40,562 funding for departmental teaching lab equipment.

COMMUNITY OUTREACH

Educational Program Developer *2017 – present*

Terrain: The art of localizing, traveling educational program; Program leader: Cecilia Ramon
International collaboration with artist Cecilia Ramon and biomimetic green designer David Sanchez. Awarded a competitive grant ($6000) to develop and teach a 2-day public symposium at the intersection of art, ecology, and design. Used ecosystem principles, systems thinking, and hands on art-making to explore our connections to social and ecological communities.

Girls' Math and Science Day *2020*

Graduate Women in Science Council, Michigan State University, MI
Assisted middle school girls and their parents throughout a day of hands-on STEM activities.

Keweenaw Land Trust Volunteer *2004 – 2015*

Keweenaw Peninsula, MI
Aided in organizing, planning, and running local community fundraiser and outreach events; donated personal graphic design and photography work; salvaged buildings and performed site stewardship on protected lands; designed, constructed, and installed trailhead signs; assisted with membership mailings.

Darwin Day Outreach Symposium Presenter *2014*

University of Wisconsin-Madison, WI
Worked with graduate students to develop and present family-oriented science activities at public event.

Women in STEM Exposition with U.S. Senator Amy Klobuchar *2011*