Daniel B. Turner
EEB Graduate Summer Fellowship – 2021

I am a quantitative ecologist studying how trait diversity and priority effects influence plant-insect interactions. As a dual PhD Candidate in Ecology, Evolution, and Behavior and Entomology, I apply cutting edge tools from data science to engineer and apply novel data resources that answer macroscale ecological questions. My dissertation achieves three research objectives: (1) produce an open-source phytochemical database to answer long-standing questions about the ecology and evolution of plant defense, (2) evaluate the role of insect functional traits in predicting novel species interactions via a meta-analysis of insects on non-native plants, and (3) develop temporally explicit statistical methods to model priority effects in plant and insect communities. I have received multiple internal and external fellowships and grants to fund my research, including the Fulbright Open Research Grant to Brazil (cancelled due to the COVID-19 pandemic). In addition to these projects, I am submitting a paper in February 2021 presenting a framework and R package called *Coding for broader impact* (*c4bi*) to leverage ecologists' programming skills for effective communication with stakeholders. Below, I describe the significance of each objective, my progress, and my service and mentorship experience.

In my first project, I am assembling a large relational database to answer key hypotheses about why plants produce such a staggering diversity of chemical compounds. At least three major logistical constraints prevent the scientific community from understanding general patterns in the ecological relevance and evolution of plant secondary metabolites: (1) the reference of scale (e.g., individual, population, species; α-, β-, γ-diversity); (2) the relationship between phytochemical diversity and abundance; and (3) methodological variation in phytochemical extraction and analysis. A well-studied, ubiquitous, and ecologically important class of secondary metabolites—*terpenes*—is an opportune system to answer broad questions regarding scale, phytochemical diversity-abundance relationships, and methodological heterogeneity. To synthesize this database of known plant terpene profiles, I lead a multi-disciplinary team of ecologists, chemists, and data scientists from three universities. We have already identified 3000+ papers with data on plant terpene diversity, which we are rapidly processing with cutting edge data science tools like interactive Shiny web apps in R and text mining scripts. For these 3000+ studies, data collection will be completed by June 2021, with preliminary analyses beginning in Summer 2021 and manuscript submission in early 2022.

In my second project, I investigate why so many non-native plants are prolific invaders in their new habitats yet still host diverse native insect communities. While these novel interactions have been documented across numerous studies, we have overlooked the role of insect functional traits in predicting these relationships. Using these data to model novel interactions is a promising new frontier in invasion ecology, as the study of insect traits has lagged progress when compared to plant functional traits. To assemble a dataset of insect functional traits from the communities described in my meta-analysis studies, I am coding web scraping and text analysis tools. These tools mine insect herbivore descriptions in grey and primary literature for traits like voltinism, body size, feeding mode, and host specialization. So far, I have assembled a database of 47 non-native plant species and their novel associations with 4,019 insect species (including 2,466 unique species) and collected trait information on

about 800 species and counting. I will finish this trait collection by June 2021 with analysis and paper writing beginning in late-Summer 2021.

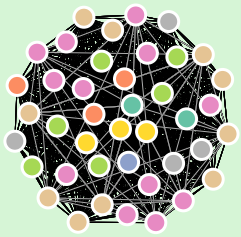
In my third project, I model the role of priority effects on species interactions using field experiments with tall goldenrod (*Solidago altissima*). In Summer 2019 using a common garden of *S. altissima* at Kellogg Biological Station (KBS; Hickory Corners, MI, USA), I treated experimental plants with specialized sucking insect (*Slaterocoris sp.*) damage and repeatedly observed ecological interactions (e.g. plant tissue chewed and infected with fungal pathogens) throughout time. In Summer 2020, I sampled the same variables but with a wild population of *S. altissima* from the Lux Arbor Forest Reserve (Delton, MI, USA), and I replaced the sucking insect damage with a jasmonic acid spray solution to induce pathways that typically defend against chewing herbivores. Preliminary results show a shift in the intensity of herbivory and pathogen damage with the timing of induction throughout the growing season. By developing sophisticated time series models to describe these patterns, I will also contribute new statistical approaches to apply when quantifying the effect of treatment *timing* on an ecological process. Pending the state of the COVID-19 pandemic in Summer 2021, I will either write up these results for publication or follow up with a related field experiment using *S. altissima*.

In addition to my research, I am dedicated to the success of my mentees and students. Throughout my tenure at MSU, I have taught >160 students as a graduate instructor for the Insects, Sustainability, and Globalization Laboratory, co-coordinated a graduate seminar in Statistics for Temporal Ecology with enrolled nine graduate students, mentored several undergraduate students, and presented my research at the national-level and to the MSU community. Additionally, two students have received competitive funding for undergraduate research. In Summer 2019, my undergraduate mentee, Kelsey Doud, worked with me on *S. altissima* field experiments as an Undergraduate Research Apprentice at KBS. In Spring 2021, an undergraduate mentee, Minali Bhatt, received a CANR Undergraduate Research Program grant to collect trait information (see: second dissertation project) by writing code to analyze text rapidly on insect descriptions, diagnoses, and natural history.

I am also committed to Diversity, Equity, and Inclusion (DEI) initiatives and service to the MSU community. I have worked on three MSU EEB committees—Research Symposium, Executive, and DEI. In my home department, I served on Curriculum Committee, where I significantly contributed to the revision of the Department's Student Learning Objectives and have led and participated in initiatives as the graduate representative on the Department's DEI Committee. I founded the ENT Graduate Reading Group to discuss equity in universities and our graduate community with more than a dozen students attending since June 2020. Also, I led the successful grant proposal for the Creating Inclusive Excellence Grant ($10,000) with other students and the CANR Office of DEI for a Spring 2021 event with one of our reading group's authors, Dr. Anthony Abraham Jack, Harvard sociologist and author of *The Privileged Poor: How Elite Colleges Are Failing Disadvantaged Students*. This university-wide virtual event will engage students, faculty, and senior university administrators in conservations with Dr. Jack about actionable strategies to make college more accessible for first-generation and lower-income students. Finally, I work with a group of other grad students to establish the *Entomology Research and Outreach Fellowship* program, which will launch in Summer 2021. This program pays a cohort of first-time student researchers from Michigan community colleges through a mentored internship with MSU Entomology faculty, post-docs, and graduate students.

DANIEL B. TURNER

I assemble big ecological datasets from start to finish, from an abstract idea at a meeting to the finished product, with transparent, reproducible, and efficient code. I have studied animals and plants from across the Americas, and I seek to develop novel data science methods to faciliate reciprocal knowledge exchange between ecologists and their stakeholders.



EDUCATION

current | 2018

PhD Candidate, Entomology and Ecology, Evolutionary, and Behavior

Michigan State University — East Lansing, MI

2018 | 2014

B.S., Environmental Science & Spanish Language, Literature, and Linguistics (minor: Biology)

Temple University — Philadelphia, PA

PUBLICATIONS

Effects of landscape urbanization and local plant diversity on predatory arthropod community assembly and ecosystem services

Manuscript in prep

- **Turner, D.B.** and J.E. Behm

Coding for broader impact: Leveraging ecologists' programming skills for effective public communication.

To be submitted Feb. 2021

- **Turner, D.B.**, Behm, J.E., Phillips, P.M., Ramirez, V.A., and M.R. Helmus

2018

A new species of Caribbean toad (Bufonidae, Peltophryne) from southern Hispaniola

Zootaxa - PDF

- Landestoy, M.A., **Turner, D.B.**, Marion, A.B., and S.B. Hedges

TEACHING EXPERIENCE

2020 | 2020

Statistical Methods for Temporal Ecology

MSU Department of Entomology — East Lansing, MI

- Co-taught graduate seminar in time series analysis, including ARIMA and Bayesian models
- 9 students

Download a PDF of this CV

CONTACT

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dbturner.github.io

CODING SKILLS

- R
- SQL
- Python
- Java

LANGUAGES

- English
- Español
- Português

*Made with the R packages **pagedown** and **datadrivencv**.*

The source code is available on github.com/dbturner/cv.

Last updated on 2021-01-27.

2020 | 2019

Insects, Globalization, and Sustainability Laboratory

MSU Center for Integrative Studies — East Lansing, MI

- Taught laboratory course for non-STEM majors in statistics and insect biology
- 160 students across two semesters

2018 | 2018

Principles of Ecology

Temple University — Philadelphia, PA

- Teaching assistant; wrote quizzes and held study sessions
- 200 students

SOFTWARE DEVELOPMENT

***c4bi*: Coding for broader impact**

R package leveraging ecologists' programming skills for effective stakeholder communication.

RESEARCH AND TRAVEL FUNDING

total = $31,670

2020 — MSU Creating Inclusive Excellence Grant ($10,000)

2020 — MSU Hutson Research Grant ($2,500)

2020 — MSU Kellogg Biological Station Research Fellowship ($2,500)

2020 — Fulbright Open Research Grant Finalist, Brazil ($15,000)

2020 — Council for Graduate Students Conference Award ($300)

2019 — MSU Kellogg Biological Station Research Fellowship ($2,250)

2019 — MSU Kellogg Biological Station Undergraduate Mentorship Grant ($1,000)

2017 — Temple University Diamond Research Scholars Program ($4,000)

2017 — Temple University Creative Arts, Research, and Academic Scholarship ($3,120)

2016 — Temple University Undergraduate Research Program Grant ($4,000)

2016 — Temple University Educational Enhancement Merit Stipend ($4,000)

HONORS AND AWARDS

2020 — National Science Foundation – Graduate Research Fellowship Program Honorable Mention

2018 — Michigan State University Plant Sciences Graduate Recruitment Fellowship ($41,729)

2018 — Phi Beta Kappa, Temple University

2018 Temple University Natan Luehrmann-Cowen Memorial Award ($700)

2018 Ecological Society of America Mid-Atlantic Annual Meeting, Honorable Mention for Undergraduate Oral Presentation ($100)

2017 Sigma Delta Pi, Spanish Language National Honor Society

2017 Sigma Gamma Eplison, Earth Science National Honor Society

2014 Temple University Dean's Scholarship ($28,000)

2014 Union League of Philadelphia Scholarship ($32,000)

2014 Temple University Honors Program

PRESENTATIONS

2020 **Comparing insect herbivore community structure across plants' native and novel ranges: A meta-analysis.**
American Naturalist National Meeting — Asilomar, CA
· **Turner, D.B.** and W.C. Wetzel

2019 **Coding for broader impact: Leveraging ecologists' programming skills for effective stakeholder communication.**
MSU EEB Student Colloquium — East Lansing, MI
· **Turner, D.B.**, Behm, J.E., Phillips, P.M., Ramirez, V.A., and M.R. Helmus

2018 **Arthropod predator community assemblage across a land cover gradient.**
Ecological Society of America Annual Meeting — New Orleans, LA
· **Turner, D.B.** and J.E. Behm

2018 **Arthropod predator community assemblage across a land cover gradient.**
Ecological Society of America Mid-Atlantic Meeting — Newark, NJ
· **Turner, D.B.** and J.E. Behm

ACADEMIC SERVICE

current EEB Diversity, Equity, and Inclusion Committee

current MSU Entomology Research and Outreach Fellowship Committee

current ENT Diversity, Equity, and Inclusion Committee

2020 EEB Executive Committee

2020 ENT Curriculum Committee

2019 EEB Research Symposium Committee

Annual Progress Report 2019

Daniel Turner

Year Reported	2019
Degree Program	Ph.D.
Date of entrance in the program	August 28, 2018
Years in the Program	2 years, 4 months
Expected date of completion	May 12, 2023
Date of submission of program in gradplan.msu.edu	April 10, 2019
If admitted under provisional status, when was the status removed?	n/a
Expected date of research proposal defense (only PhD)	March 13, 2019
Expected date of comprehensive exam (only PhD)	October 2, 2020
Academic Guidance	
Major Professor	William Wetzel
Guidance Committee who are Entomology Faculty Members	• William Wetzel • Marianna Szucs
Guidance Committee who are NOT Entomology Faculty Members	**Notice**: Undefined index: bktnw in **C:\HostedSites\pro\portal.ent.msu.edu\wwwroot\htdocs\wp-content\themes\yootheme\PageforViewCurrentStudentReportDetail.php** on line **213** • Lars Brudvig •
Other Guidance Committee members	Sarah Fitzpatrick
Communications	

Most recent contact with your major professor	February 10, 2020
Most recent contact with your Guidance Committee	January 14, 2020
Course Load	
Required Courses	
• From the Department of Entomology	• ENT 404|Fundamentals of Entomology • ENT 8XX|Nature and Practice of Science • ENT 812|Seminar Course
• From other departments	• IBIO 830|Statistical Methods in Ecology and Evolution: Part I • IBIO 831|Statistical Methods in Ecology and Evolution: Part II • IBIO 896|Population and Community Ecology • PLB 849|Evolutionary Biology
Courses already taken	
• From the Department of Entomology	• ENT 404|Fundamentals of Entomology • ENT 8XX|Nature and Practice of Science • ENT 812|Seminar Course
• From other departments	• IBIO 830|Statistical Methods in Ecology and Evolution: Part I • IBIO 831|Statistical Methods in Ecology and Evolution: Part II • IBIO 896|Population and Community Ecology • PLB 849|Evolutionary Biology
Courses taking this term	
• From the Department of Entomology	ENT 812|Seminar Course
• From other departments	
Current GPA	3.94
Credits received under 3.0	0
Other	
Responsible Conduct of Research (RCR) Plan	• Completed Phase I • Completed Phase II
Professional Goals Statement	My professional goals immediately after graduation are to find a research-based post-doctoral position. Following that, I am interested in seeking a job in data science industry or a tenure-track professor position at a research-intensive institution.

Goals met this year	• *Research*
	  ◦ *Meta-analysis project*:
	  ▪ I have assembled ~60 plant species so far with insect communities surveyed in their novel range, with 11 of those species having native range insect communities detailed. I ran some preliminary analyses on these plants and found encouraging results about the role of functional traits in community assembly on invasive plants to pursue the project further.
	  ◦ *Solidago (goldenrod) project:*
	  ▪ I completed my first field season at Kellogg Biological Station (KBS) in Summer 2019 while mentoring an Undergraduate Research Assistant. The data used from last summer's common garden experiment included herbivory estimates, arthropod surveys, and plant trait measurements that will inform fieldwork at KBS in Summer 2020.
	  ◦ *Urban ecology project with Drs. Jocelyn Behm and Matthew Helmus* (Temple University):
	  ▪ I will be submitting my manuscript investigating data visualization and quantitative methods for effective communication with public audiences to *Frontiers in Ecology and the Environment* by May 2020. Dr. Behm and I are currently drafting a second manuscript about arthropod community diversity along an urbanization gradient in Philadelphia.
	• *Grant application*s
	  ◦ I applied for two major external fellowships - the National Science Foundation Graduate Research Fellowship Program and the Fulbright Open Research Grant to study intraspecific variation in plants and their herbivore communities with Dr. Tatiana Cornelissen at the Universidade Federal de Minas Gerais. I have advanced to the *semifinalist* stage for the Fulbright, and I will hear final results of the grants in early April 2020.

Goals for the next academic year	• Complete data collection, analyze data, and draft manuscript for *invasive plant meta-analysis*. • Complete second field season investigating genotypic variation in the temporal trajectories of plant-insect interactions in the *Solidago altissima* system at Kellogg Biological Station. • Submit quantitative methods for effective communication paper with Drs. Matt Helmus and Jocelyn Behm.
Participation in undergraduate and/or graduate education	• In Summer 2019, I mentored an Undergraduate Research Assistant at Kellogg Biological Station, and in fall 2019, I advised an undergraduate student in meta-analysis data collection. • In Fall 2019 and Spring 2020, I taught a total of six sections of ISB 201L (*Insects, Globaliation, and Sustainability*) to ~150 students. • In Spring 2020, I co-organized a graduate seminar course with Dr. Will Wetzel and another entomology PhD student, Elizeth Cinto Mejia, on statistical methods in temporal ecology for 9 students.
Publications	---

Presentations at Conferences	**Turner, D.B.** and Wetzel, W.C. 2020. Comparing insect herbivore community structure across plants' native and novel ranges: A meta-analysis. *American Naturalist National Meeting*. Asilomar, CA.
Presentations for extension or outreach audiences	---
Participation on Grant Proposals or Funded Grants	National Science Foundation - Graduate Research Fellowship Program. ($138,000). *Variation across temporal trajectories in species interactions between plants and insects.* Applied, October 2019. Pending, April 2020. Fulbright Open Research Grant. (~$30,000). *Plant neighborhood effects on insect diversity in the Brazilian Atlantic Forest*. Universidade de Minas Gerais, Belo Horizonte, Brazil. Applied, October 2019. Granted semifinalist status, January 2020. Pending final decision, April 2020. Council of Graduate Students Conference Award Funding. ($300). Comparing insect herbivore community structure across plants' native and novel ranges: A meta-analysis. Applied, February 2020. Pending, March 2020. Hutson Travel Funds. ($500). *Comparing insect herbivore community structure across plants' native and novel ranges: A meta-analysis.* The American Naturalist Semi-annual Meeting. Asilomar, CA. Presented poster. Funded, January 2020. MSU Kellogg Biological Station Research Fellowship. ($2,250). *The implications of genotype and trait-mediated effects on herbivore community structure associated with tall goldenrod (Solidago altissima).* Funded, May 2019. Hutson Research Grant. ($2,500). *The implications of genotype and trait-mediated effects on herbivore community structure associated with tall goldenrod (Solidago altissima).* Applied, March 2019. Not funded, encouraged to apply in 2020.
Any Extra Information that you think that you have to report	---
Curriculum Vitae	View (https://portal.ent.msu.edu/wp-content/uploads/formidable/25/Turner_CV_February2020-1.pdf)
Agree to have your bio/summary about your research posted in the Entomology website	Yes
Agree to have your bio/summary/photo posted on your laboratory website	Yes
Agree to have your business address, phone number, and MSU email address posted in the Entomology website directory	Yes
Agree to have your major professor and degree level posted in the Entomology website	Yes
Agree to have your picture posted in the Entomology website directory?	Yes

Research summary to be used at the MSU Entomology website	I am a PhD student in Dr. Will Wetzel's lab, and I am broadly interested in plant-insect interactions and invasive ecology. I investigate how trait variation within and across plant species, in ontogeny and invasive status, affects insect communities. Additionally, I work to develop novel public communication methods using R and other data tools.
Difficulties or concerns experienced over last year	---
Professor comments on Student Progress	---
Professor comments on Student Progress	---

(https://portal.ent.msu.edu/print-for-faculty?action=display&key=bt8qn)

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