

# Ryan M. Mushinski

Assistant Professor - Environmental Microbiology  
School of Life Sciences | University of Warwick  
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**Primary Research Focus:** Microbial biogeochemistry in terrestrial environments

**Webpage:** [www.ryanmushinski.com](http://www.ryanmushinski.com)

**Google Scholar Index:** <https://bit.ly/2xwRDDT>

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## Education

**Post Doc** | Microbial Biogeochemistry | Indiana University | 2017-2020  
Advisors: Richard P. Phillips, Jonathan D. Raff, and Jeffrey R. White

**Ph.D.** | Ecosystem Science & Management (Biogeochemistry Focus) | Texas A&M University | 2017  
Dissertation: *Decade-Scale Influences of Org. Matter Removal on Forest Soil Biogeochemistry and Microbial Ecology*  
Advisors: Thomas W. Boutton and Terry J. Gentry

**B.S.** | Biology, *Cum Laude* | Texas State University | 2012  
Minors in Chemistry & Education; Undergraduate Research Concentration: Organometallic Chemistry  
Advisor: Todd W. Hudnall

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## Appointments

**Assistant Professor** | February 2020 – Current  
School of Life Sciences, University of Warwick, Coventry, United Kingdom

**USDA-NIFA Postdoctoral Fellow** | June 2019 – February 2020  
School of Public and Environmental Affairs, Indiana University, Bloomington, IN, USA

**Postdoctoral Research Scientist** | June 2017 – June 2019  
Integrated Program in the Environment, Indiana University, Bloomington, IN, USA

**McMillan-Ward Graduate Research Fellow** | August 2014 – May 2017  
Department of Ecosystem Science & Management, Texas A&M University, College Station, TX, USA

**Instructor and Coordinator** (Fundamentals of Ecology) | August 2014 – December 2016  
Department of Ecosystem Science, Texas A&M University, College Station, TX, USA

**Graduate Merit Fellow** | August 2013 – July 2014  
Texas A&M University, College Station, TX, USA

**Post-baccalaureate Research Assistant** | February 2013 – August 2013  
Stables Isotopes for Biosphere Sciences Laboratory, Texas A&M University, College Station, TX, USA

**Undergraduate Research Assistant** | December 2010 – January 2013  
Department of Chemistry & Biochemistry, Texas State University, San Marcos, TX, USA

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## Funded Research Grants (*all amounts are full economic cost*)

“Uncharacterised microbial pathways are key to understanding large fluxes of biogenic reactive nitrogen gases from agronomic soils,” UKRI - Biotechnology and Biological Sciences Research Council, 2023-2026, £724,973; PI: **Ryan M. Mushinski**

“Utilising genomics to better understand soil emissions of reactive nitrogen oxides,” NERC Environmental Omics facility, 2022-2023, £11,274; PI: **Ryan M. Mushinski**.

“Development of a multiplexed chamber system for measuring reactive gases,” The Royal Society, 2021-2022, £19,902; PI: **Ryan M. Mushinski**

“An isotope ratio mass spectrometer system to enhance analytical capability throughout Warwick Univ.,” Warwick’s Academic Equipment Fund (Internal), 2022-2023, £276,000; PI: **Ryan M. Mushinski**; Co-I’s: Gary Bending, Hendrik Schafer, Kevin Purdy.

“Towards a predictive framework for quantifying fluxes of nitrogen oxides in forest soils,” United States Department of Agriculture – National Institute of Food & Agriculture, 2019 – 2021, \$161,500; PI: **Ryan M. Mushinski**

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## Peer-Reviewed Publications

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- [18] Lazar A, **Mushinski RM**, Bending GD. **2022**. Landscape scale ecology of *Tetracladium* spp. fungal root endophytes. *Environmental Microbiome* 17, 40.
- [17] Eagar AC, **Mushinski RM**, Horning AL, Smemo KA, Phillips RP, Blackwood CB. **2021**. Arbuscular mycorrhizal tree communities have greater soil fungal diversity and relative abundances of saprotrophs and pathogens compared to ectomycorrhizal tree communities. *Applied and Environmental Microbiology* 88, e01782-21.
- [16] Li C, Liu L, Zhang L, Yu Y, **Mushinski RM**, Zhou Y, Xiao X. **2021**. Greater soil water and nitrogen. availability increase C:N ratios of root exudates in a temperate steppe. *Soil Biology and Biochemistry* 161, 108384.
- [15] **Mushinski RM**, Payne ZC, Raff JD, Craig ME, Pusede SE, Rusch DB, White JR, Phillips RP. **2021**. Nitrogen cycling microbiomes are structured by plant mycorrhizal associations with consequences for nitrogen oxide fluxes in forests. *Global Change Biology* 27, 1068-1082.
- [14] Beidler KV, Phillips RP, Andrews E, Maillard F, **Mushinski RM**, Kennedy PG. **2020**. Substrate quality drives fungal necromass decay and decomposer community structure under contrasting vegetation types. *Journal of Ecology* 108, 1845-1859.
- [13] **Mushinski RM**, Phillips RP, Payne ZC, Abney RA, Jo I, Fei S, Pusede SE, Rusch DB, White JR, Rusch DB, Raff JD. **2019**. Microbial mechanisms and ecosystem flux estimation for aerobic NO<sub>y</sub> emissions from deciduous forest soils. *Proceedings of the National Academy of Sciences* 116, 2138-2145.
- [12] **Mushinski RM**, Gentry TJ, Boutton TW. **2019**. Forest organic matter removal leads to long-term reductions in bacterial and fungal abundance. *Applied Soil Ecology* 137, 106-110.
- [11] Hyodo A, Malghani S, Zhou Y, **Mushinski RM**, Toyoda S, Yoshida N, Boutton TW, West JB. **2018**. Biochar amendment suppresses N<sub>2</sub>O emissions but has no impact on <sup>15</sup>N site preference in an anaerobic soil. *Rapid Communications in Mass Spectrometry* 33, 165-175.
- [10] **Mushinski RM**, Gentry TJ, Boutton TW. **2018**. Organic matter removal associated with forest harvest leads to decade scale alterations in soil fungal communities and functional guilds. *Soil Biology and Biochemistry* 127, 127-136.
- [9] Zhou Y, **Mushinski RM**, Boutton TW, Wu XB. **2018** Vegetation change alters soil profile δ<sup>15</sup>N values at the landscape scale. *Soil Biology and Biochemistry* 119, 110-120.
- [8] **Mushinski RM**, Zhou Y, Gentry TJ, Boutton TW. **2018** Bacterial metataxonomic profiling and putative functional behavior associated with C and N cycle processes remain altered for decades after forest harvest. *Soil Biology and Biochemistry* 119, 184-193.
- [7] **Mushinski RM**, Gentry TJ, Dorosky RJ, Boutton TW. **2017**. Forest harvest alters inorganic nitrogen pool sizes and ammonia oxidizer community composition. *Soil Biology and Biochemistry* 112, 216-227.
- [6] **Mushinski RM**, Boutton TW, Scott DA. **2017**. Decade-scale changes in forest soil carbon and nitrogen storage are influenced by organic matter removal during timber harvest. *Journal of Geophysical Research-Biogeosciences* 122, 846-862.
- [5] Ugarte RA, Devarajan D, **Mushinski RM**, Hudnall TW. **2016**. Antimony(V) cations for sequential and selective catalytic transformation of aldehydes into symmetric ethers, α,β-unsaturated aldehydes, and 1,3,5-trioxanes. *Dalton Transactions* 45, 11150-11161.
- [4] Dorsey CL, **Mushinski RM**, Hudnall TW. **2014**. Metal-free stabilization of monomeric antimony(I): A carbene-supported stibinidene. *Chemistry-A European Journal* 20, 8914-8917.

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## Peer-Reviewed Publications *cont.*

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- [3] Johnson DW, Yum JH, Hudnall TW, **Mushinski RM**, Bielawski CW, Roberts JC, Wang WE, Banerjee SK, Harris HR. **2013**. Characterization of ALD beryllium oxide as a potential high-k gate dielectric for low leakage AlGaN/GaN MOSHEMTs. Journal of Electronic Materials 43,151
- [2] Yum JH, Shin HS, Hill R, Oh J, Lee HD, **Mushinski RM**, Hudnall TW, Bielawski CW, Banerjee SK, Loh WY, Wang WE, Kirsch P. **2012**. A study of capping layers for sulfur monolayer doping on III-V junctions. Applied Physics Letters doi:10.1063/1.4772641.
- [1] **Mushinski RM**, Squires BS, Sincerbox KA, Hudnall TW. **2012**. Amino-acrylamido carbenes: Modulating carbene reactivity via decoration with an  $\alpha,\beta$ -unsaturated carbonyl moiety. Organometallics 31, 4862- 4870.
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## Research Manuscripts in Revision or Submitted

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Hassan S, **Mushinski RM**, Bending G, Covington JA. Wireless sensor network for monitoring carbon dioxide in soils. Submitted to *Sensors*

Zhang Q, Boutton TW, Hsiao CJ, **Mushinski RM**, Wang L, Bol R, Klumpp E. Grazing and fire alter the effects of woody encroachment on soil colloidal particles in a calcareous subtropical savanna. Under Review with *Geoderma*

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## Refereed Proceedings Article

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Yum JH, Shin HS, **Mushinski RM**, Hudnall TW, Oh J, Loh WY, Bielawski CW, Bersuker G, Banerjee SK, Wang WE, Kirsch PD, Jammy R. **2013**. A comparative study of gate first and last Si MOSFETs fabrication processes using ALD beryllium oxide as an interface passivation layer, 2013 International Symposium on VLSI Technology, Systems and Application (VLSI-TSA), pp. 1-2. Hsinchu, Taiwan. doi: 10.1109/VLSI-TSA.2013.6545611

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## Presentations (*presenting author only; \*invited*)

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**\*Mushinski RM. 2022.** Towards a better understanding of nitrogen feedbacks in the wake of global change. University of Manchester, 20 May 2022.

**\*Mushinski RM. 2021.** Biogeochemical sources and fates of reactive nitrogen oxides. Warwick's Chemical, Structural, and Synthetic Biology Seminar Series, 7 December 2021.

**\*Mushinski RM. 2021.** Using mycorrhizal categories to better define soil nitrogen cycling in temperate forests. Smithsonian ForestGEO Seminar Series, 21 April 2021.

**Mushinski RM, Raff JD, Phillips RP, Payne ZC, Pusede SE, Rusch DB, White JR. 2019.** A microbiological perspective on forest soil emissions of nitrogen oxides in a changing world. Annual Meeting of the American Geophysical Union 2019, Abstract: A32D-02.

**Mushinski RM, Phillips RP, Payne ZC, Pusede SE, Rusch DB, White JR, Rusch DB, Raff JD. 2019.** Low nitrate production limits nitrogen oxide emissions in ectomycorrhizal forest soil. Joint Genome Institute's (JGI) User Meeting, Abstract: 104.

**Mushinski RM, Phillips RP, Payne ZC, Abney RA, Jo I, Fei S, Pusede SE, White JR, Rusch DB, Raff JD. 2019.** Microbial mechanisms and ecosystem flux estimation for aerobic NO<sub>y</sub> emissions from deciduous forest soils. SSSA International Soils Meeting, Abstract: 209-2.

**Mushinski RM, Payne ZC, Rusch DB, White JR, Phillips RP, Raff JD. 2018.** Ammonia-oxidizing archaea are the dominate nitrifiers in two Midwestern (USA) forest types, but do not contribute to nitric oxide production. 2018 Environmental System Science PI Meeting, Abstract: D35.

**Mushinski RM, Zhou Y, Gentry TJ, Boutton TW. 2017.** The relative abundance of predicted genes associated with ammonia-oxidation, nitrate reduction, and biomass decomposition in mineral soil are altered by intensive timber harvest. Annual Meeting of the American Geophysical Union 2017, Abstract: B14B-03.

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## Presentations *cont.* (presenting author only)

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**Mushinski RM**, Boutton TW, Gentry TJ, Dorosky RJ. **2016**. Ammonia oxidizing archaea are the predominant nitrifiers in disturbed and undisturbed southern pine forests. Annual Meeting of the American Geophysical Union 2016, Abstract: B12B-03.

**Mushinski RM**, Boutton TW. **2015**. Nitrifying community and N-cycle activity are reduced by increasing forest harvest intensity in surface and subsurface soils in the western gulf coastal plain. Soil Science Society of America Annual Meeting 2015, Abstract: 93694.

**Mushinski RM**, Boutton TW, Gentry TJ. **2015**. Bacterial and archaeal ammonia oxidizers are reduced by increasing timber harvest intensity in surface and subsurface soils of the western Gulf Coastal Plain. Abstracts, 7th Annual Argonne National Laboratory Soil Metagenomics Meeting, Naperville, Illinois, Abstract: 21.

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## Professional Affiliations

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British Ecological Society | July 2021 - Current

American Society for Microbiology | January 2017 – Current

International Society for Microbial Ecology | June 2016 – Current

Soil Science Society of America | June 2015 – Current

American Geophysical Union | January 2014 – Current

American Chemical Society | March 2010 – Current

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## Awards

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2017 Most Outstanding PhD Student: Dept. of Ecosystem Science, Texas A&M University

2016 1<sup>st</sup> Place (Oral Presentation): Univ. Houston Ecology & Evolutionary Biology Symposium

2016 Best Oral Presentation: 53<sup>rd</sup> Annual Soil Survey & Land Resource Workshop

2016 George Bush Presidential Library Foundation Travel Grant

2015 Robert Luxmoore Travel Award, Soil Science Society of America

2014 McMillan-Ward Memorial Graduate Fellowship, Texas A&M University

2013 Texas A&M University/Association of Former Student: Graduate Merit Fellowship

2013 College of Agriculture & Life Sciences Excellence Fellowship, Texas A&M University

2012 NSF Research Experience for Undergraduates, Dept. of Microbiology, Texas A&M University

2012 Alpha Chi Honor Society Induction, Texas State University

2011 Most Outstanding Biology Undergraduate, Dept. of Biology, Texas State University

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## Teaching Experience

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2022 **Fellow of the Higher Education Academy** (UK, Ref: PR234784)

2021-Current Lecturer for **Central England NERC Training Alliance**

2021-Current Module Leader and Lecturer for **Environmental Biology** (University of Warwick)

2020-Current Lecturer for Years 1-3 **Life Sciences** Tutorial (University of Warwick)

2019 Guest Lecture for UG **Ecosystem Ecology** (Indiana University)

2018 Guest Lecture for PG **Biogeochemistry** (Indiana University)

2018 Guest Lecture for PG **Environmental Engineering** (Indiana University)

2017 Guest Lecture for PG **Biogeochemistry** (Texas A&M University)

2016 Instructor of Record for UG **Fundamentals of Ecology** (Texas A&M University)

2015 Laboratory Instructor for **Fundamentals of Ecology** (Texas A&M University)

2012 Classroom Teacher for **General Biology** (Dripping Springs High School, Austin, TX)

2011 **Pedagogy Certificate in Secondary Education** (Texas State University)

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## Other Academic Activities

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### Service

2021-Current Co-Lead – Environment & Ecology Cluster, School of Life Sciences, Warwick University

2018 Organized biogeochemical activities – Indiana University's Science Outreach Festival

2015 President of the Ecology Graduate Student Association – Texas A&M University

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## Other Academic Activities *cont.*

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### **Scholarship**

Editorial Board Member, *Journal of Sustainable Agriculture and the Environment*

Review College Member, *British Ecological Society*

Have served as content reviewer for:

*Atmospheric Chemistry & Physics; Biogeochemistry; Biology and Fertility of Soils; Catena; Geoderma; Pedosphere; Plant Ecology; Soil Biology and Biochemistry*

### **PhD Students Supervised** (Served as \*Primary Supervisor; §Co-Supervisor)

Shuaizhi Guo\*, 2022 – Current, University of Warwick

Rachel Jackson§, 2022 – Current, University of Warwick (Co-supervised with Gary Bending)

Josh Cole§, 2022 – Current, University of Warwick (Co-supervised with Gary Bending)

Megan Purchase\*, 2021 – Current, University of Warwick

Jessica Chadwick§, 2020-Current, University of Birmingham (Co-supervised with Iseult Lynch)

Anna Lazar§, 2020-Current, University of Warwick (Co-supervised with Gary Bending)

Alice Cappock§, 2020-Current, University of Warwick (Co-supervised with Miriam Gifford)

### **Masters Students Supervised**

#### 2022

Peggy McGroary\*

Phoebe Scott\*

#### 2021

Jingyi Shi\*

### **Undergraduate Research Projects Supervised**

#### 2022

Bhumi Patel, *Investigating mechanisms of reactive nitrogen production in the environment.*

Jocelyn Mitchell, *Do nitrogen cycle microbes co-occur with mycorrhizae in forest soil?*

Duncan Webb, *Does forest tree composition influence the structure of soil microbial communities?*

#### 2021

Kate Arsac, *Does forest tree composition influence the structure of soil microbial communities?*

Alin Petz, *How do antibiotics influence fluxes of nitrogen gases in aquatic ecosystems?*

Tom Power, *Growth and activity of ammonia-oxidizers.*