Beatrice Margareta Bock

Curriculum Vitae

Department of Biological Sciences, Northern Arizona University (NAU)
Center for Adaptable Western Landscapes, NAU
Flagstaff, AZ, USA

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Professional Profile

- Computational biologist, tool builder, and AI/ML researcher with a foundation in plant-fungal ecology.
- **Expertise:** Developing and applying machine learning models for ecological synthesis alongside experimental ecology.
- **Research Focus:** Applying AI-enabled approaches to microbiome science, fungal ecology, and ecosystem-level processes in natural and managed landscapes.
- **Vision:** Integrating computational and experimental methods to build predictive frameworks for understanding how plant-fungal symbioses shape ecosystem function and resilience.
- **Teaching & Mentorship:** Experienced instructor, mentor, and Carpentries workshop leader committed to incorporating AI/ML in the classroom to enhance critical thinking and data literacy.
- **Open Science:** Creator of open-source software (e.g. `nanodrop`, `BioBERT-Fungal-Traits`) designed to democratize access to high-throughput data analysis.

Research Experience: AI/ML, Microbiome & Data Synthesis

- **High-Throughput Text Classification:**
  - Designed a text classification pipeline to process 20,000+ scientific abstracts, testing global patterns of fungal endophyte ubiquity.
  - Output: Manuscript presented at MSA in 2025 and in coauthor review; datasets and scripts deposited in permanent, citable repositories. **Preprint**
- **Automated Trait Extraction:**
  - Developed a pilot workflow using fine-tuned BioBERT models to extract fungal trophic modes (e.g. saprotroph, pathogen) from unstructured text.
  - Output: Open-source model repository and preprint; manuscript accepted at Research Ideas and Outcomes.
- **Open-Source Tool Development:**
  - Creator and maintainer of nanodRop, an R package for reproducible spectral data import and analysis. **Link**
- **Specialized Training:**
  - Carpentries Instructor Training (Participant, February 2026)
  - Introduction to Python Coding for Research Applications (Participant, January 2026)
  - BioEncoder: Deep Metric Learning (Workshop Participant, 2025)
  - Python Bootcamp (Pacific Northwest National Lab, 2025)
  - EMSL Summer School: Integrating AI into Science (Funded Participant, July 2025)
  - Microbial Community Analysis with QIIME 2 Course (Spring 2025)

Technical Skills

- **Programming & Data Analysis:**
  - Advanced R (Tidyverse, package development)
  - Intermediate Python (scikit-learn, Pandas)
  - Advanced proficiency in Parametric and Non-Parametric methods, including Generalized Linear Models (GLMs), Mixed-Effects Models (LMM/GLMM), and Hypothesis Testing.
  - AI/ML: Natural Language Processing (Transformers, BERT), Deep Metric Learning (BioEncoder), Random Forest, SVMs, GLMnet, Multivariate Statistics (PCA, NMDS/PCoA).
  - Geospatial & Remote Sensing: GIS (ArcGIS, QGIS), Satellite/Drone Image Processing, Hyperspectral Data Analysis
  - Data Wrangling and Visualization (OpenRefine, R, Python)
  - Git/GitHub
  - High-Performance Computing
- **Ecological & Laboratory Methods:**
  - Microcosm, mesocosm, greenhouse, and field experimentation design and implementation
  - Stable isotope ecology
  - Microbial culturing
  - DNA extraction, PCR

Education

Ph.D. Biology, Northern Arizona University, Flagstaff, AZ (May 2026)

Dissertation: Plant-fungal root symbioses: Ubiquity, conservation, and commonality in land plants

Advisors: Dr. Kitty Gehring and Dr. Nancy Johnson

Committee: Dr. Jason Hoeksema, Dr. Nick McKay

B.A. Earth and Environmental Sciences, Vanderbilt University, Nashville, TN (May 2020)

Cum laude & Highest Honors

Honors Thesis: Long-term changes in unionid community in Kentucky Lake: Implications for understanding the effects of impoundment on river systems. **DOI**

Research Experience

Research Assistant, Northern Arizona University, Flagstaff, AZ

Biological Sciences & Center for Adaptable Western Landscapes

Summer 2025; Dec 2023 - Dec 2024; Dec 2022 - Aug 2023; Dec 2021 - Aug 2022

Supervisors: Dr. Kitty Gehring and Dr. Nancy Johnson

- **Forestry & Drought Resilience:** Designed and conducted extensive greenhouse and field experiments on native *Populus* (Cottonwood) trees, characterizing root fungal symbioses to understand forest resistance to drought stress (basis for Seeley et al. 2025 with another manuscript currently in coauthor review).
- **Agricultural Ecosystems:** Investigated common fungal networks in *Sorghum bicolor*, providing the first evidence of fungal-mediated water transfer by non-mycorrhizal fungi (basis for Bock et al. 2025 in *Communications Biology*).

Research Assistant, Vanderbilt University, Nashville, TN

Department of Earth & Environmental Sciences

Jan 2019 - May 2020; Aug 2017 - May 2018

Supervisors: Dr. Simon Darroch & Dr. Michelle Casey

- Conducted paleoecological research on bivalve death assemblages to understand ecosystem stress in impounded river systems.

Research Assistant, Stanford University, Palo Alto, CA

Department of Geological Sciences

May 2018 - Aug 2018

Supervisor: Dr. Erik Sperling

- Contributed to a long-term record of early to mid-Paleozoic marine redox change, resulting in a co-authored publication in *Science Advances*.

Bird Ringing Assistant, Kvismaren Fågelstation, Närke, Sweden

May 2017 - July 2017

- Assisted with ornithological monitoring and bird banding operations in a field station setting.

Teaching Experience

Teaching Assistant

- Northern Arizona University, Flagstaff, AZ
  - **Mycology** (Fall 2022, Fall 2023, Spring 2025)
    - *Supervisor: Dr. Kitty Gehring*
    - Developed and delivered multiple guest lectures.
    - Designed and led novel, in-lab experiments funded by CUREs (Course-Based Undergraduate Research Experiences) that resulted in a co-authored publication with 4 undergraduate students and 1 Master's student (Bock et al. 2025, microPublication Biology).
  - **Introduction to Cell Biology** (Fall 2021)
- Vanderbilt University, Nashville, TN
  - **Introductory Oceanography** (Fall 2018)
    - *Supervisor: Dr. Steven Goodbred*

Guest Lecturer

- Northern Arizona University, Flagstaff, AZ
  - Mycology (4 guest lectures: Nov 2022; Fall 2023; Spring 2025)
    - Topics: Spores and spore dispersal, common fungal networks, slime molds, former fungi, animals and fungi, fungal ecology
  - Ecology (1 guest lecture)
    - Topic: Biological Market Theory in Ecology

Curriculum Development & Technical Leadership

- **Workshop Leader**, Carpentries: Data Wrangling with OpenRefine and Intro to R (Apr 2025)
- **Workshop Leader**, NAU: OpenRefine (Feb 2025)
- **Workshop Helper**, Smithsonian Carpentries: Data Wrangling with OpenRefine (Jan 2025)
- **Workshop Leader**, Citation Management with Zotero (Fall 2023)

Mentorship Experience

- Mentored 4 undergraduate students from experimental design to co-authorship on peer-reviewed publications.
- One mentee has since been accepted into and began a Ph.D. program.
- Designed funded CUREs (Course-Based Undergraduate Research Experiences) in Mycology, resulting in students coauthoring peer-reviewed papers.

Publications

(italicized authors indicate undergraduate student mentees) (links embedded)

Bock, B.M., McKay, N.P., Johnson, N.C., & Gehring, C.A. (2025). The Sparsely Sampled Ubiquity of Global Fungal Endophytes. In coauthor review. **Preprint & Zenodo Repository**

Waschk, P., Spiegel, P., Gessler, A., Sauer, M., **Bock, B.M.**, Hinterdobler, W., & Anthony, M.A. (2026) Evidence for resources transfer via common endophyte networks. In review at *Scientific Reports*. **Preprint**

Bock, B., Schaefer, E.A., & Gehring, C.A. (In coauthor review). Mycorrhizal colonization extracts significant growth costs but enhances drought survival in cottonwood hybrids through physiological compensation.

Bock, B. (2026). *Automated Extraction of Fungal Trophic Modes from Literature Using BioBERT: An Open Pilot Workflow.* Research Ideas and Outcomes. **DOI & Zenodo Repository** & **Press Release in Eurekalert** & **Press Release in NAU Review**

Bock, B., Scherer, J., *Parrish, F.*, *Burnside, J.*, *Rohrer, C.*, & Gehring, C. (2025). A simple protocol for producing axenic seeds of *Sorghum bicolor*. *MicroPublications Biology*. **DOI**

Bock, B.M., Hoeksema, J.D., Johnson, N.C., & Gehring, C.A. (2025). Evidence for common fungal networks among plants formed by a Dark Septate Endophyte in *Sorghum bicolor*. *Communications Biology*. **DOI** (Featured in Interview with Dr. César Marín and in IMS Newsletter, Nov 2025)

Vietorisz, C., Nash, J., Siggers, J., Leander, E., **Bock, B.**, Camuy-Vélez, L., Hall, A.J., Jaros, J., Kuehn, K., Lai, E., Mounts, I., Bacy, I., Dagg, C., Anderson, I., Carnegie, A., Powell, J., Brewer, S., D'Antonio, C., Hynson, N., Vilgalys, R., & Hoeksema, J. (2025). Pine-fungal co-invasion alters whole-ecosystem properties of a native eucalypt forest. *New Phytologist*. **DOI**

Seeley, M. M., Wiebe, B. C., Gehring, C. A., Hultine, K. R., Posch, B. C., Cooper, H. F., Schaefer, E., **Bock, B.**, Abraham, A. J., Moran, E. M., Keith, A., Allan, G. J., Scull, M., Whitham, T. G., Martin, R. M., Asner, G. P., & Doughty, C. E. (2025). Remote sensing reveals inter- and intraspecific variation in riparian cottonwood (*Populus* spp.) response to drought. *Plant Biology*. **DOI**

Bock, B., *Curry, L.*, & Gehring, C. (2025). Better utilization of inorganic nitrogen compared to organic nitrogen by a plant symbiotic fungal isolate of *Alternaria alternata*. *microPublication Biology*. **DOI**

Rillig, M. C., Lehmann, A., Mounts, I. R., & **Bock, B. M.** (2025). Concurrent common fungal networks formed by different guilds of fungi. *New Phytologist*. **DOI** (Selected as a Top 10 Mycorrhizal Research Paper, IMS Newsletter, Nov 2025)

Bock, B. (2024). nanodRop: Tools for Importing and Processing NanoDrop One Spectral Data (v0.0.0.9000). *Zenodo*. **DOI**

Bock, B., & Markovchick, L. (2023). Considering Soil Biota and Symbioses in Forest Management and Ecosystem Restoration. *Forests*, 14(6), 1236. **DOI**

Bock, B.M., Darroch, S. A. F., & Casey, M. (2023). Long-term changes in unionid community in Kentucky Lake: Implications for understanding the effects of impoundment on river systems. *Journal of Freshwater Ecology*, 38(1), 2203712. **DOI**

Sperling, E. A., Melchin, M. J., Fraser, T., Stockey, R. G., Farrell, U. C., Bhajan, L., Brunoir, T. N., Cole, D. B., Gill, B. C., Lenz, A., Loydell, D. K., Malinowski, J., Miller, A. J., Plaza-Torres, S., **Bock, B.**, Rooney, A. D., Tecklenburg, S. A., Vogel, J. M., Planavsky, N. J., & Strauss, J. V. (2021). A long-term record of early to mid-Paleozoic marine redox change. *Science Advances*, 7(28), eabf4382. **DOI**

Smith, E.F., Nelson, L. L., Darroch, S.A., Hodgin, E.B., Husson, J., Mehra, A.K., **Rodewald, B.**, Schiffbauer, J., Selly, T., Strange, M., & Tarhan, L.G. (2018). Ediacaran-Cambrian Stratigraphy of the Great Basin, Southwest USA. (Field trip guide).

Science Communication and Public Engagement

Invited Public Talks

- *Common Fungal Networks: Findings on how fungi may or may not connect plants in ecologically relevant ways.* Invited and compensated presentation to the New York Mycological Society and the New Jersey Mycological Society, Spring 2026.
- *Mysterious Mushrooms and Fungal Friends: The story of how plants interact with each other through fungi.* Science on Tap, Mother Road Brewing Company, Flagstaff, AZ (Sep 2024)

Media Coverage

- Interview with Dr. Pedro M. Antunes for the South American Mycorrhizal Research Network (Feb 2026). *Pedro M. Antunes on fluid mechanics within mycorrhizal networks* [Video]. **YouTube Link**; **SAMRN Link**
- *Using AI to uncover the secret lives of fungi* EurekAlert press release about: Bock, B.M. (2026). "Automated extraction of fungal trophic modes…" Research Ideas and Outcomes. **Link to Eurekalert**; **Link to NAU Review press release**
- Interview with César Marín for the South American Mycorrhizal Research Network. (Sep 3, 2025). Featured in the IMS Newsletter, Vol. 6, Issue 2 (Nov 2025). *Beatrice M. Bock on common fungal networks formed by a Dark Septate Endophyte* [Video]. **Link**
- *The Fungus Among Us.* Northern Arizona University press release about: Bock, B.M. et al. (2025). "Evidence for common fungal networks…" Communications Biology. **Link**

Writing

- **Bock, B.** (2024). *Becoming a scientist wasn't a mistake, just a happy little accident.* Functional Ecologists Blog. **Link**

Community Engagement

- Invasive Species Education at Kinsey Elementary. Led a discussion and activity to teach 50 fifth-grade students about local invasive species. May 2024.

Presentations

Invited Talks

- *Multi-Scale Analysis of the Mycorrhizal Cost-Benefit Trade-Off: Integrating Genetics, Physiology, and Fungal Guilds in Populus Drought Response* 13th International Conference on Mycorrhizae, Cairns, Australia, July 2026.
- *Using Machine Learning to Systematically Review Fungal Endophyte Literature: Do All Plants Have Fungi in them?* Pacific Northwest National Lab EMSL Lunch Presentations Series, Washington, USA (July 2025)
- *Common fungal networks: Exploring the "Dark Web."* 12th International Conference on Mycorrhizae, Manchester, UK (Aug 2024)
- *Updates on Common Non-Mycorrhizal Network Experiment.* 2024 Sorghum-AMF Annual Meeting, University of Georgia (Feb 2024)
- *Sorghum Fungal Endophytes: December 2022 Updates.* 2022 AMF-Sorghum Systems Biology Project Meeting, University of Georgia (2022)

Conference Presentations: Oral

- *Interconnections among Plants via Fungi,* **Bock, Beatrice**. 3-Minute Research Presentation, Northern Arizona University, Flagstaff, AZ, Mar 2025.
- *Interconnections among Plants via Fungi,* **Bock, Beatrice**. Annual Biology Graduate Student Research Symposium, Northern Arizona University, Flagstaff, AZ, Feb 2025.
- *2024 Updates on Common Non-Mycorrhizal Network Experiment,* **Bock, Beatrice**, Gehring, C.A., Johnson, N.C. 2024 Sorghum-AMF Annual Meeting. Feb 2024.
- *Common Non-Mycorrhizal Networks: Exploring the "Dark Web,"* **Bock, Beatrice**, Gehring, C.A., Johnson, N.C. 2023 Mycological Society of America Annual Meeting: Elevating Mycology. Aug 1, 2023.
- *Common Non-Mycorrhizal Networks: Exploring the "Dark Web,"* **Bock, Beatrice**, Gehring, C.A., Johnson, N.C. Hawkesbury Institute for the Environment research symposium: Biological invasions, ecosystems, and global change. May 2023.
- *Exploring common non-mycorrhizal network relationships between plants and fungi,* **Bock, Beatrice**; Gehring, C.A., Johnson, N.C. Northern Arizona University Three Minute Research Project Competition, Mar 2023.
- *Sorghum Fungal Endophytes: December 2022 Updates,* **Bock, Beatrice**; Gehring, C.A., Johnson, N.C. 2022 Annual Meeting of the AMF-Sorghum Systems Biology Project, 2022.
- *Using Bivalve Death Assemblages as an Indicator for Stressed River Ecosystems,* **Bock, Beatrice**; Casey, Michelle; and Darroch, Simon A.F. Geological Society of America Annual Conference, 2019.

Conference Presentations: Poster

- *Using AI to Systematically Review Fungal Endophyte Literature: Do All Plants Really Host Fungi,* **Bock, Beatrice**; McKay, N., Johnson, N.C., Gehring, C.A. Annual Mycological Society of America conference, Madison, Wisconsin (July 2025)
- *Fungal colonization shifts with trait plasticity in three Populus crosstypes under drought,* **Bock, Beatrice**; Schaefer, E., Johnson, N.C., Gehring, C.A. Annual Mycological Society of America conference, Madison, Wisconsin (July 2025)
- *Common fungal networks: Exploring the "Dark Web,"* **Bock, Beatrice**; Hoeksema, J., Gehring, C.A., Johnson, N.C. 12th International Conference on Mycorrhizae, Manchester, United Kingdom, Aug 2024.
- *Common fungal networks: Exploring the "Dark Web,"* **Bock, Beatrice**; Hoeksema, J., Gehring, C.A., Johnson, N.C. Northern Arizona University Graduate Student Government Poster Symposium, Spring 2024.

- *Common Non-Mycorrhizal Networks: Exploring the "Dark Web,"* **Bock, Beatrice**, Gehring, C.A., Johnson, N.C. 2023 Gordon Research Conference: Mechanisms of Social Communication in all Kingdoms. Aug 14, 2023.
- *Non-mycorrhizal networks: Exploring the "Dark Web,"* **Bock, Beatrice**; Gehring, C.A., Johnson, N.C. Center for Adaptable Western Landscapes Poster Symposium, Mar 2023.
- *Systems Analysis of the Beneficial Associations of Sorghum with Arbuscular Mycorrhizal Fungi Studied with Genetics, Genomics, Imaging, and Microbiomics,* Bennetzen, J.L., Brailey-Jones, P., Pendergast, T., Zhang, S., **Bock, B.**, [. . .], Johnson, N.C. 2023 Department of Energy Genomic Science Program - Biological Systems Science Division Conference, Mar 2023.
- *Non-mycorrhizal networks: Exploring the "Dark Web,"* **Bock, Beatrice**; Gehring, C.A., Johnson, N.C. Northern Arizona University Graduate Student Government Poster Symposium, 2022.
- *The Black Shale Record of the Ordovician Radiation: New Insights into Redox Change from the Road River Group of Yukon, Canada,* **Bock, Beatrice**; [. . .] & Sperling, Erik A. Geological Society of America Annual Conference, 2018.
- *Quantifying Trace Fossils on Ediacaran-Cambrian Samples from Death Valley,* **Bock, Beatrice**; [. . .]; and Smith, E.F. Southeastern Geological Society of America Annual Conference, 2018.

Academic and Community Service

Professional Service

- Symposium Organizer, *Expanding common mycorrhizal networks* at MSA Conference, Toronto, CA. Obtained funding for all speaker expenses, including high-profile international speakers such as Dr. Matthias Rillig, Dr. Martin Bidartondo, and Dr. Stav Livne-Luzon (2024)
- Session Moderator, Soil Fungi and Nutrient Cycling, Mycological Society of America Annual Conference (2023)
- Symposium Organizer and Moderator, *"Considering host-microbial interactions in ecosystem restoration"* at the 16th Biennial Conference of Science & Management on the Colorado Plateau & Southwest Region, Flagstaff, AZ. (2022)
- Manuscript Reviewer, New Phytologist (Jan 2023, June 2025)
- Manuscript Reviewer, Applied Soil Ecology (Dec 2022)

University Service

- Member, NAU Biology Graduate Student Association, Fall 2021 - Present

Leadership Experience

- Dean's Undergraduate Advisory Board Member, Vanderbilt University, 2018 - 2020
- President of Wilderness Skills Course 101, Vanderbilt University, 2019 - 2020
- President of Geology Club, Vanderbilt University, 2018 - 2019

Honors, Awards, and Fellowships

- **National Fellowships and Major Honors**
  - AAUW American Dissertation Fellow, 2025 - 2026 ($25,000)
  - Presidential Fellow, Northern Arizona University, 2021 - present ($120,000)
  - ARCS Scholar (Achievement Rewards for College Scientists), 2023 - present ($25,500)
  - Finalist - Sweden-America Foundation Fellowship, Spring 2024
  - McMinn Scholar, Vanderbilt University, 2018 - 2020 (Fully funded tuition, summer stipend, and independent research, ~$128,000)

  - McLamore Foundation Scholar, 2016
  - National Merit Scholar, Vanderbilt University, 2016 – 2020 ($8,000)
  - Dean's List, Vanderbilt University, 2016 – 2020

- **Submitted Postdoctoral Fellowships (Pending)**
  - Simons Foundational Postdoctoral Fellowship (Sponsors: Dr. Kabir Peay and Dr. Julia Salzman, Stanford University)($300,000 Total, 3 years)

- **Research and Travel Awards**
  - 2026 MSA Recruitment Scholarship
  - Early Career Researcher and Travel Award from IMS for attending the International Conference on Mycorrhizae and three year membership to IMS. Chosen as the North American representative. (2026) ($1,400)
  - Graduate Student Government (GSG) Professional Development Award, NAU, October 2025 ($275)
  - Student Awardee, EMSL Summer School: Integrating AI into Science, July 2025
  - Support for Graduate Students (SGS) Award, NAU, 2023 - 2024 (Funding for student-led research, $2,675)
  - Graduate Student Government Travel Award, NAU, Spring 2024 ($500), Spring 2025 ($1,000)
  - Student Awardee, EMSL Summer School: 1000 Fungal Proteins, July 2024
  - Fellow, Hawkesbury Institute for the Environment, Western Sydney University, May 2023 (NSF-sponsored graduate course in co-invasion biology)
  - Vaughan Scholar, Vanderbilt University, 2018 (Provided funds for summer research, $1,450)
  - Alberstadt-Reesman-Stearns Field Studies Scholar, 2018 (Funded a 3-week field course in the Colorado Plateau)

- **Conference and Presentation Prizes**
  - Functional Ecology Prize Winner, 12th International Conference on Mycorrhizae, 2024 (Best poster, $100)
  - Arizona Mushroom Society Award, 2024 (Funding for invited speaker expenses, $500)
  - MSA-funded Symposium, 2024 (Funding for invited speaker expenses, $5,000)
  - New Phytologist Foundation Innovation Grant, 2024 (Funding for invited speaker expenses, $2,500)
  - James Rominger Scholarship, 2022 ($500)
  - Dr. Leathers Graduate Student Scholarship, Arizona Mushroom Society, 2022 ($1,000)

- **High-Impact Publication Recognition**
  - Top 10 Mycorrhizal Research Paper (Rillig et al. 2025 in *New Phytologist*) selected by a distinguished panel of 12 international experts from over 175 articles (IMS Newsletter, Vol. 6, Issue 2, Nov 2025).

Professional Societies

- International Mycorrhiza Society (2026 - Present)
- Swedish Mycological Association (2023 - Present)
- Mycological Society of America (2023 - Present)
- Arizona Mushroom Society (2022 - Present)

Other

- Citizenship: USA and Sweden

Professional References

Catherine (Kitty) Gehring, PhD | Regent's Professor of Biological Sciences
Northern Arizona University | 928-523-9138 | Catherine.Gehring@nau.edu | Flagstaff, AZ

Nancy Collins Johnson, PhD | Regent's Professor of Earth Sciences and Environmental Sustainability
Northern Arizona University | 928-523-6473 | Nancy.Johnson@nau.edu | Flagstaff, AZ

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