

CURRICULUM VITAE

Nathan Hadland

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Education:

University of Arizona, Tucson, AZ May 2026

- Ph.D. Planetary Science, minor Astrobiology, GPA: 4.0 (Defended: December 8th, 2025; Conferred: May 2026)
- Dissertation: “Evaluating the Habitability of Basaltic Volcanic Environments in Iceland as an Analog for Potential Life on Mars” (Advisors: Dr. Solange Duhamel & Dr. Christopher W. Hamilton)

University of Arizona, Tucson, AZ May 2023

- M.S. Planetary Science, GPA: 4.0

Florida Institute of Technology, Melbourne, FL May 2020

- B.S. Astrobiology, Summa Cum Laude, GPA: 3.97

Description of prior scientific, technical and management performance experience:

I am interested in microbial ecology and in leveraging those insights to inform astrobiological investigations. My expertise spans environmental microbiology and geobiology across various settings. I have over six years of field experience, including extended campaigns in Iceland. In the laboratory, I specialize in microbiology techniques, complemented by computational pipelines in bioinformatics, machine learning, and geospatial data analysis. I am deeply engaged in the astrobiology community, organizing events at The University of Arizona and participating in NASA early-career workshops.

Current Position:

The Arizona Astrobiology Center, Tucson, AZ January 2026 – Present
Research Programs Coordinator

- Conducting independent research on Mars astrobiology, microbial biosignatures in planetary analog environments, and computer vision/ML applications for biosignature detection.
- Coordinating undergraduate research programs including research cohort meetings, journal club, educational workshops, and student-faculty matching.
- Supporting faculty proposal development and independently developing and submitting proposals to NASA, NSF, and private foundations.

Previous Positions:

The University of Arizona, Tucson, AZ August 2020 – December 2025
Graduate Research and Teaching Assistantships

- Investigating the habitability, biosignatures, and other astrobiology and environmental microbiology related questions associated with volcanic systems and the atmosphere by conducting field work in Iceland, New Mexico, Hawaii, and Arizona as an analog for Mars

- Experience in developing novel techniques for analyzing low biomass samples (e.g., DNA extraction, ATP analysis, bioinformatics pipelines)

Florida Institute of Technology, Melbourne, FL Aug 2016 – May 2020
Undergraduate Research Assistant

- Modeled vortex formation and evolution on Neptune

Undergraduate Research Assistant

- Investigated methods to advance *in situ* agriculture on Mars by growing plants in regolith

National Oceanic and Atmospheric Administration, Boulder, CO May 2019 – August 2019
NOAA Hollings Scholarship Program

Lunar and Planetary Institute, Houston, TX June 2018 – August 2018
LPI/NASA Summer Intern Program

University of Tennessee, Knoxville, TN June 2017 – Aug 2017
NSF Research Experience for Undergraduates (REU) Internship

Honors, Awards, and Fellowships:

- 3rd Place in University of Arizona Grad Slam, a university wide graduate student research competition (2026)
- Department of Defense National Defense Science and Engineering Graduate (NDSEG) Fellowship (2022–2025)
- Arizona Space Grant Graduate Fellowship Program (2025–2026)
- Achievement Rewards for College Scientists (ARCS) Foundation Award (2025–2026)
- 2nd Place in Poster Competition at NDSEG Fellowship Conference (2024)
- University of Arizona Galileo Circle Scholarship (2022–2023)
- *Undergraduate*: Astronaut Scholarship Foundation Award (2018 and 2019), NOAA Hollings Undergraduate Award (2018–2020), Florida Institute of Technology Outstanding Junior of the Year Award (*sole recipient selected from the junior class*; 2018)

Publications (in review):

- **Hadland, N.**, Hamilton, C.W., Phillips, M., Calabrese, F., Tuohy, M., and Duhamel, S. (2026). Linking Habitat Complexity to Microbial Distribution in Mars Analog Volcanic Terrains in Iceland. *Astrobiology* (in review).

Publications (see [Google Scholar](#)):

- **Hadland, N.**, Hamilton, C.W., Schroedl, P., Calabrese, F., Marlow, J., and Duhamel, S. (2026). Microbial dispersal from a hyperactive sandsheet in the Icelandic Highland. *Science of the Total Environment* **1025**, 181659.
- **Hadland, N.**, Hamilton, C.W., Björnsdóttir, S.H., and Duhamel, S. (2025). Three eruptions at the Fagradalsfjall volcano in Iceland show rapid and predictable microbial community establishment. *Nature Communications Biology* **8**, 1657, pp. 1–17. <https://doi.org/10.1038/s42003-025-09044-1>
- Carr, B. Varnam, M., **Hadland, N.**, Shah, J., Voigt, J.R.C., Gwizd, S., Stack, K.M., Calef, F., Francis, R., Basu, U., Björnsson, B., Chen, C.X., Dong, E., Moersch, J.E., Phillips, M., Springer, J., Neish, C.D., and Hamilton, C.W. (2024) Evaluating the use of Unoccupied Aircraft Systems (UAS) for planetary exploration in Mars-analog terrain. *The Planetary Science Journal*, **5**, 231, pp. 1–25. <https://doi.org/10.3847/PSJ/ad781e>

- Gwizd, S., Stack, K.M., Francis, R., Calef, F., Carr, B.B., Langley, C., Graff, J., Kristinsson, P.H., Thorarensen, V.P., Bernharðsson, E., Phillips, M., Varnam, M., **Hadland**, N., Shah, J., Moersch, J., Basu, U., Voigt, J.R.C., and Hamilton, C.W. (2024). Comparing rover and helicopter planetary mission architectures in a Mars analog setting in Iceland. *The Planetary Science Journal*, **5**, 172, pp. 1–35. <https://doi.org/10.1016/PSJ/ad55f4>
- **Hadland**, N., Hamilton, C.W. & Duhamel, S. (2024). Young volcanic terrains are windows into early microbial colonization. *Nature Communications Earth and Environment*, **5**, 114, pp. 1–19. <https://doi.org/10.1038/s43247-024-01280-3>
- Eichler, A., **Hadland**, N., Pickett, D., Masaitis, D., Handy, D., Perez, A., Batcheldor, D., Wheeler, B., and Palmer, A. (2020). Challenging the agricultural viability of Martian regolith simulants. *Icarus*, **354**, 114022, pp. 1–8. <https://doi.org/10.1016/j.icarus.2020.114022>
- **Hadland**, N., Sankar, R., Paul LeBeau, R., and Palotai, C. (2020). EPIC simulations of Neptune’s dark spots using an active cloud microphysical model. *Monthly Notices of the Royal Astronomical Society*, **4768**, pp. 4760–4768. <https://doi.org/10.1093/mnras/staa1799>
- LeBeau, R., Farmer, K., Sankar, R., **Hadland**, N., and Palotai, C. (2020). A numerical investigation of the berg feature on Uranus as a vortex-driven system. *Atmosphere*, **11**(1), pp. 1–11. <https://doi.org/10.3390/atmos11010052>

Funded Proposals:

- Arizona Astrobiology Center Seed Grant (2024) | \$10,000: “Evaluating the Spread of Microorganisms in Terrestrial Sandsheets as a Planetary Analog for Mars”
- Lunar and Planetary Laboratory Director’s Grant (2023) | \$20,000: “Coriolis Micro Samplers for Planetary Habitability Research”
- Lewis and Clark Fund for Exploration and Field Research in Astrobiology (2022) | \$5,000: “Investigating the Habitability of Mars Analog Lava Flow-Fields in Iceland”
- Geological Society of America Graduate Student Grant (2021) | \$5,000: “The Origin of Pioneer Microbial Communities Within a Young Lava Flow”
- UArizona Graduate and Professional Student Council (GPSC) Grants (2021–2024) | Total: \$9,000: Awarded Research, Travel, and Professional Opportunity grants for fieldwork in Iceland and development of the Astrobiology Journal Club

Pending Proposals as Co-I:

- “APOPHIS: Asteroid Pathways, Observation & Public Hands-On Impact Science”, NASA Science Activation (SciAct), Award Size: ~\$2.8M (PI: Joseph Schools, University of Arizona)
- "Undergraduate Space and Planetary Analog Research Curriculum (U-SPARC)", NSF Improving Undergraduate STEM Education: Hispanic-Serving Institutions (IUSE HSI), Award Size: Between \$100 and \$250k average annual budget (PI: Tyler Robinson, University of Arizona)
- “An Orbit-to-Ground Framework for Optimizing Target Selection in Astrobiology Missions”, NASA Solar System Science (SCUBED), Award Size: Medium (between \$150K and \$250K average annual budget) (PI: Solange Duhamel, University of Arizona)
- “Geological Complexity as a Framework for Planetary Exploration: Calibrating Information-Theoretic Metrics with Apollo and Mars Rover Data to Optimize Artemis and Future Mars Surface Operations”, NASA Solar System Science (SCUBED), Award Size:

Medium (between \$150K and \$250K average annual budget) (PI: Christopher Hamilton, University of Arizona)

Teaching Experience:

- Teaching Assistant, University of Arizona: Earth, Evolution of a Habitable World (Fall 2020)
- Teaching Assistant, University of Arizona: Exploring our Solar System (Spring 2021, 2022)

Community Service:

- Peer reviewer for Scientific Reports, Lewis and Clark Fund for Exploration and Field Research in Astrobiology
- NASA Astrobiology Ideation Factory Member 2023–2025 (Mars Search for Life Working Group)
- Co-Chair of International Geosciences Congress 2024 Planetary Science Sessions
- University of Arizona Astrobiology Journal Club co-lead (2021–Present)
- Arizona Astrobiology Symposium Organizing Committee Member (2024)
- Annual volunteer for “Meet MCB” high school student program at the University of Arizona
- *Undergraduate*: Florida Institute of Technology Astrobiological Research and Education Society – President (May 2019–May 2020), Vice President (May 2018–May 2019)

Undergraduate Mentorship:

- Justin Klingele (2022–2023): X-ray computed tomography of pumice
- Samantha Lockwood (2024–2025): 3D internal structure of pumice and its habitability
- Calista Madej (2024–2025): ATP as a biosignature
- Connor Burback (2023–2024): Microorganisms in deserts and perchlorate tolerance

Skills/Certifications:

- Laboratory: Advanced culturing/aseptic techniques, DNA/RNA extractions, qPCR, ATP extraction/analysis, electron microscopy, light/epifluorescence microscopy, flow cytometry, X-ray diffraction, energy dispersive spectroscopy, X-ray computed tomography (Shimadzu inspeXio XRCT)
- Field: DJI Unmanned Aerial Systems, aerosol samplers, soil/water sampling, Onset HOBO Weather Station, Trimble Differential GPS, GeoSLAM LIDAR, Wilderness First Responder Certification, Adult/Child CPR Certification
- Software/Programming: Python, R, QGIS/ArcPro, Cloud Compare, bioinformatics tools such as QIIME2/DADA2, machine learning tools such as PyTorch, Dragonfly, NOAA HYSPLIT, Notion, Corel Draw

Invited Talks:

- Arizona Astrobiology Symposium Plenary Talk (March 27th, 2026): “Bridging Scales and Disciplines: From Fieldwork to Exploration in Astrobiology”
- NASA JPL Planetary Science Seminars (April 7th, 2025): “Rapid Microbial Community Establishment in Newly Emplaced Lava: Implications for the Habitability of Volcanic Terrains on Mars”

Media Engagement and Public Outreach:

- Development of “Viking 2.0 – Mars Life Detection Workshop” hosted at the Arizona Astrobiology Center for undergraduate education (March 2026)
- Recurring undergraduate education and career development talks at the Arizona Astrobiology Center (2024–Present)
- NPR 91.5 KJZZ Phoenix (2025): “A volcano in Iceland is helping scientists understand how life forms spread to new habitats” <https://www.kjzz.org/science/2025-12-26/a-volcano-in-iceland-is-helping-scientists-understand-how-life-forms-spread-to-new-habitats>
- University of Arizona News (2025): “Life on Lava: How Microbes Colonize New Habitats” <https://news.arizona.edu/news/life-lava-how-microbes-colonize-new-habitats>
- Channel 4 (2024): “National Parks from Above” Documentary Series (Episode 2: Iceland) <https://www.channel4.com/programmes/national-parks-from-above>
- Astronomy on Tap Space Coast FL (2019), “The Mars Desert Research Station and Growing Plants on Mars”

Field Experience:

- Iceland (2021–Present): Participation in numerous field campaigns, ranging from small teams to groups of over thirty people, including leadership of one field campaign with one additional student. Research activities have focused on astrobiology, active lava emplacement dynamics, and microbial ecology at Askja volcanic region, 2014–2015 Holuhraun eruption site, and 2021–2023 Fagradalsfall eruption site.
- Southwest United States (2018–Present): Studying El Malpais National Monument in New Mexico, leading a field campaign with two students to the Grand Falls Dune Field, Arizona, and participating in two missions to the Mars Desert Research Station in Hanksville Utah.
- Hawai‘i (2023): Participation in a field course and collecting UAS data at effusive eruptions from Kīlauea.

Other Publications (Datasets, Code, and White Papers)

- *Dataset*: Carr, B., Hamilton, C. W., **Hadland, N.**, Tuohy, M. (2026) “Hekla (Iceland) Pumice Quarry Unoccupied Aircraft System (UAS) Surveys.” University of Arizona Research Data Repository. <https://doi.org/10.25422/azu.data.28915124>
- *Dataset*: Hamilton, C.W., Óskarsson, B., Valsson, G., Christoffersen, M.S., Voigt, J.R.C., Moreland, W., **Hadland, N.**, Kubas, A., and Carr, B. (2022) “2021 Fagradalsfjall eruption, Iceland: Ground control points (GCPs).” University of Arizona Research Data Repository. <https://doi.org/10.25422/azu.data.21084865>
- *Dataset*: **Hadland, N.** and Duhamel, S. (2025) "Rapid microbial colonization of new lava at Fagradalsfjall, Iceland." NCBI Sequence Read Archive, BioProject: PRJNA1205709
- *Dataset*: **Hadland, N.** and Duhamel, S. (2026) "Microbial Dispersal from a Hyperactive Sandsheet in the Icelandic Highlands." NCBI Sequence Read Archive, BioProject: PRJNA1260575
- *Code*: **Hadland, N.** and Phillips, M. (2026) "Habitat Complexity." GitHub repository: https://github.com/nkhadland/Habitat_Complexity_2026
- *Code*: **Hadland, N.** and Duhamel, S. (2025) “ATP Analysis.” GitHub repository: <https://github.com/DuhamelLab/ATP>
- *White Paper*: Robson, D.J., Grulich, M., Alotaibi, G., Blackburn, H., **Hadland, N.**, and Masaitis, D. (2020): "On the Impact and Needs of Various Audience Groups from Space

Analogue Outreach and Education Programmes." University of Leicester Figshare.
<https://hdl.handle.net/2381/12624101>

Conference Abstracts:

- Hamilton, C.W., Carr, B.B., Varnam, M., **Hadland, N.**, Shah, J., Voigt, J., Gwizd, S., et al. "Mars Analog Field Testing Reveals Key Operational Strategies for Planetary Exploration Using Unoccupied Aircraft Systems (UAS)." *AGU Fall Meeting* (2025)
- **Hadland, N.**, Hamilton, C.W., Björnsdóttir, S.H., and Duhamel, S. "Development of Early Microbial Communities within Newly Emplaced Lava in Iceland: A 3-Year Fixed-site Time-series Study." *37th International Geological Congress* (2025)
- **Hadland, N.**, Hamilton, C.W., and Duhamel, S. "Evaluating the habitability of basaltic volcanic environments in Iceland as an analog for potential life on Mars." *Arizona Astrobiology Symposium* (2024)
- **Hadland, N.**, Hamilton, C.W., Björnsdóttir, S.H., and Duhamel, S. "Development of a Microbial Community in a Freshly Emplaced Lava Flow at Fagradalsfjall, Iceland." *Astrobiology Science Conference* (2024)
- **Hadland, N.**, Hamilton, C.W., and Duhamel, S. "Evaluating the survival and spread of microbes in deserts amid soil-atmosphere interactions." *NDSEG Fellowship Conference* (2024).
- Shah, J., Carr, B.B., **Hadland, N.**, Varnam, M., Voigt, J.R.C., Basu, U., Björnsson, B., Chen, C., Dong, E., Graff, J., Hibbard, S.M., Moersch, J.E., Phillips, M., Springer, J., Neish, C.D., and Hamilton, C.W. "Evaluating the Use of Unoccupied Aircraft Systems (UAS) for Planetary Surface Exploration in Analog Terrain." *54th Lunar and Planetary Science Conference* (2023)
- Basu, U., Moersch, J., Hamilton, C.W., Scheidt, S., Voigt, J.R.C., Stack, K.M., Francis, R., Calef, F., Golombek, M., and **Hadland, N.** "Selecting Suitable Test Sites at Holuhraun, Iceland, for Mars Mission Simulations Using Rovers and Unmanned Aircraft Systems (UAS)." *53rd Lunar and Planetary Science Conference* (2022)
- Bardabelias, N., Holt, J., Hamilton, C.W., Christoffersen, M.S., and **Hadland, N.** "Characterizing Morphology of Lava Tubes in El Malpais National Monument Using Ground Penetrating Radar and LIDAR." *AGU Fall Meeting* (2021)
- **Hadland, N.**, Sankar, R., Paul LeBeau, R., and Palotai, C. "EPIC Modeling of Large-Scale Dynamical Features of the Gas Giants." *European Planetary Science Congress - American Astronomical Association Division of Planetary Science Joint Conference* (2019)
- de Boer, G., Cox, C., Lawrence, D., Osborn, J., Hamilton, J., Intrieri, J.M., Maahn, M., Cahill, C.F., Foscue, G., **Hadland, N.**, and Cassano, J.J. "Observatory- and UAS-based perspectives on the surface energy budget of the Arctic." *AGU Fall Meeting* (2019)
- Grulich, M., Alotaibi, G., Blackburn, H., **Hadland, N.**, Larrea Brito, N., Masaitis, D., Robson, D., Triviño, V., and Foing, B. "Goals and first results from MDRS IESL Crew 205." *EGU General Assembly Conference* (2019)
- Le Beau, R.P., Loiacono, R., Wagner, A., Farmer, K., Palotai, C.J., Sankar, R., **Hadland, N.**, and Nodolski, N. "Using Numerical Simulation to Consider the Observed Variations in the Behavior and Appearance of Dark Spots on the Ice Giants." *American Astronomical Society Meeting* (2019)

- LeBeau, Jr., R.P., Farmer, K., Palotai, C.J., **Hadland, N.**, Sankar, R., and Nodolski, N. "Simulating the Uranian Berg Feature as a Vortex-Driven Cloud." *AGU Fall Meeting* (2018)