Justin D. Gay, Ph.D.

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Research Website

Education

Ph.D. Ecology and Environmental Science (2017 – 2022)
Montana State University, Department of Land Resources and Environmental Science, Bozeman, MT
Advisor: Dr. Jack Brookshire

M.A. Teaching in Science Curriculum and Instruction (2014 – 2015)
University of Vermont, Burlington, VT

B.S. Environmental Science (2007 – 2011)
Endicott College, Beverly, MA
Spring Semester (2010) abroad: *National Outdoor Leadership School (NOLS),* 3-month backpacking, raft guiding, and mountaineering training course in the Himalayas, India.

Professional Appointments

Assistant Teaching Professor of Ecology (July 2024 – Present)
Department of Ecosystem and Conservation Science, W.A Franke College of Forestry and Conservation, University of Montana

ORISE Research Fellow (June 2023 – Present)
Rocky Mountain Research Station Missoula Fire Sciences Lab, U.S. Forest Service, Missoula, MT
Mentor: Dr. Kimberley Davis

Postdoctoral Research Associate (June 2022 – May 2023)
University of Wisconsin-Madison, Madison WI, Department of Soil Science
Mentors: Dr. Rebecca Larson and Dr. Matt Ruark

Teaching Experience

University of Montana, Missoula MT (2024 – 2025)
Instructor on Record
NRSM212 Ecology, Physics, and Taxonomy of Soils (3 sections)
NRSM121 Intro to Environmental Science and Sustainability
GPHY111 Intro to Physical Geography: Climate, Landforms, and Vegetation

Co-Instructor on Record
NRSM265 Elements of Ecological Restoration
NRSM110 First-Year Seminar in Environmental Science and Sustainability

Montana State University, Bozeman MT (2017-2021)
Lead Teaching Assistant
ENSC353 Environmental Biogeochemistry, Fall semester 2017, 2018, 2020
ENSC272 Water Resources, Fall semester 2021

Middlebury Union High School, Middlebury VT (2016-2017)
Science Department Faculty

Vergennes Union High School, Vergennes VT (2015)
Science Department Faculty

Rock Point School, Burlington VT (2013-2014)
Residential Staff

Publications

Gay, J.D., Currey, B., Davis, K.T. *et al.* Functional attributes of conifers expanding into temperate semi-arid grasslands modulate carbon and nitrogen fluxes in response to prescribed fire. *Biogeochemistry* **167**, 1335–1352 (2024). https://doi.org/10.1007/s10533-024-01168-6**

**Highlighted in *Nature Climate Change* November 2024
Findlay, A. Return the burn. *Nat. Clim. Chang.* **14**, 1116 (2024). https://doi.org/10.1038/s41558-024-02188-8

Romanko, C. A., **Gay, J. D.,** Powell, J. M., Wattiaux, M., Barford, C., Larson, R. A., & Ruark, M. D. (2023). Soil greenhouse gas flux and nitrogen mineralization following manure application from tannin-fed dairy cows. *Journal of Environmental Quality*, 00, 1–11. https://doi.org/10.1002/jeq2.20534

Gay, J.D., Currey, B. & Brookshire, E.N.J. Global distribution and climate sensitivity of the tropical montane forest nitrogen cycle. *Nature Communications* 13, 7364 (2022). https://doi.org/10.1038/s41467-022-35170-z

Gay, J.D., D., Goemann, H. M., Currey, B., Stoy, P. C., Christiansen, J. R., Miller, P. R., Poulter, B., Peyton, B. M., & Brookshire, E. N. J. (2022). Climate mitigation potential and soil microbial response of cyanobacteria-fertilized bioenergy crops in a cool semi-arid cropland. *GCB Bioenergy*, 14, 1303–1320. https://doi.org/10.1111/gcbb.13001

Goemann, H. M., **Gay, J. D**., Mueller, R. C., Brookshire, E. N. J., Miller, P., Poulter, B., & Peyton, B. M. (2021). Aboveground and belowground responses to cyanobacterial biofertilizer supplement in a semi-arid, perennial bioenergy cropping system. *GCB Bioenergy*, 13, 1908–1923. https://doi.org/10.1111/gcbb.12892

Epstein, K,Wood, D., Roemer, K., Currey, B., Duff H., **Gay, J.D**. … J. Haggerty. (2021) Toward an urgent yet deliberate strategy: sustaining social-ecological systems in rangelands of the

Northern Great Plains, Montana. Ecology and Society 20(1):10. https://doi.org/10.5751/ES-12141-260110

Manuscripts in Review or Advanced Stages of Preparation (drafts available upon request)

Davis, K.T., **Gay, J.D.** Post-fire western larch reforestation success depends more on site conditions than seed source. To be submitted to Fire Ecology 2025

Gonzalez, L., Cansino-Loeza, B., Chavkin, T., **Gay, J.D,** Larson, R.A., Techno-Economic Analysis of an Integrated Process for Cyanobacteria-Based Nutrient Recovery from Livestock Waste. In Review Computers and Chemical Engineering, Submitted November 4th, 2024

Currey, B., **Gay**,**J.D.**, Brookshire E.N.J. Ecosystem consequences of conifer expansion in temperate semi-arid grasslands. To be submitted to Ecosphere 2025

Gay, J.D., Hood, S., Manning, M., Cox, M.,Davis, K.T. Forest understory monitoring protocol for fuels treatments in the USFS northern region. To be submitted as a Gen Tech Rep. Missoula, MT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Grants and Funding

2025 - Undergraduate Summer Research Grant / Montana Space Grant Consortium (NASA), *Effects of short-interval wildfire on soil biogeochemistry in conifer forests of the Northern Rockies* ($7,000). PI, **Submitted**

2025 – Undergraduate Semester Research Grant / Montana Space Grant Consortium (NASA), Ectomycorrhizal fungi colonization of *Pinus contorta* seedlings under short fire return intervals ($2,700) PI, **Submitted**

2024 - MT EPSCoR (NASA) / *Integrating Forest Biogeochemistry and Regeneration into Landscape-Scale Vegetation Modeling Under Anomalously Short-Interval Wildfires* ($514,075). CO-I, **Not funded**

2022 - Dairy Innovation Hub, UW-Madison. A Greenhouse Gas Measurement System for Dairy Agroecosystems. ($61,000). Collaborator

2022 - Montana State Undergraduate Scholars Program, Montana State Project Title: Up in smoke and down the river: Evaluating the environmental controls on watershed-scale transport and degradation rates of pyrogenic carbon (mentored lab undergraduate D. Egen) ($1,800). Co-I **Not funded**

2022 - Ph.D. Completion Grant / Montana State Graduate School ($10,800)

2021 - Montana State Undergraduate Scholars Program / Montana State. Project Title: Comparative analysis of root characteristics and arbuscular mycorrhizae community structures

across two bioenergy cropping systems in SW Montana (mentored lab undergraduate S. Walsh) $900

2020 - Professional Advancement Grant / Montana State University ($500)

2019 - Murdock Trust's Partners in Science Grant / Murdock Trust. *Mechanistic drivers behind the transformation of the Northern Great Plains' mixed-grass prairie* (mentored high school teacher T. Dille) ($15,000).

2019 - Nielsen Pedology Graduate Research Assistantship / Montana State University ($8,585)

2018 - Environmental Analytics Laboratory Assistantship / Montana State University ($12,500)

2016 - NSF Stem Teacher and Researcher Summer Research (STAR) Fellowship / National Center for Atmospheric Research, Boulder CO ($10,000)

2015 - NSF Stem Teacher and Researcher Summer Research (STAR) Fellowship / Biosphere 2 University of Arizona, Tucson AZ($10,000)

2014 - NSF Robert Noyce Scholarship for Science Teachers / University of Vermont ($15,000)

Awards

2021 - NACTA Teaching Award of Merit for Graduate Students / North American Colleges and Teachers of Agriculture

2019 - Ecological Society of America Annual Meeting Student Volunteer Award

2017 - Jo and Dave Cole Teaching and Mentorship Award / Middlebury Union High School Parents and Community Association

Invited Talks and Presentations

**denotes invited talk*

***2025** *Systems Ecology Seminar Series* / University of Montana, Missoula MT / *"From Farms to Mountain Forests: Exploring the Biogeochemical Causes, Consequences, and Solutions of Global Environmental Change"*

***2023** – MT Nature Conservancy / Matador Ranch, Dodson MT / "*Conifer expansion in semi-arid grasslands increases ecosystem productivity and exacerbates nitrogen limitation and episodic carbon and nitrogen losses from fire" Presenting author: J. Brookshire*

***2023** - Utah Valley University Earth Science Department Seminar Series / Orem, UT / *"Perturbations to terrestrial carbon and nitrogen cycling: Implications for global change and environmental management."*

2023 - International Fire Ecology and Management Congress. "*Functional attributes of conifer trees expanding into grassland modulate carbon and nitrogen fluxes in response to prescribed fire"* (*Accepted Talk*)

2023 - Ecological Society of America. "Functional attributes of conifer trees expanding into grassland modulate carbon and nitrogen fluxes in response to prescribed fire" (*Accepted Talk*)

2022 - Ecological Society of America. "*The climate mitigation potential and soil microbial response of cyanobacteria-fertilized bioenergy crops on semi-arid cropland"* (*Accepted Talk)*

***2022** - Massachusetts 4-H Climate Change Extension Series / Barnstable, MA / *"Global Climate Change: The Science & Emerging Solutions"*

2020 - Ecological Society of America. "*Integrative effects of prescribed fired and woody plant encroachment on biogeochemical cycling in the Northern Great Plains"* (*Accepted Talk)*

2020 - Society of Range Management. "Pyrogenic carbon production from prescribed fire and woody plant encroachment in the Northern Great Plains" *(Accepted Talk)*

2019 - Ecological Society of America / "Temperature sensitivity of forest soil N cycling across latitudinal and elevational gradients" *(Accepted Talk)*

***2019** - Musselshell Watershed Coalition Annual Meeting / Roundup, MT / *"Understanding the impacts of changing climate and fire on the vegetation structure and function in the Musselshell-Missouri River Breaks"*

***2019** - Institute on Ecosystems Rough Cut Seminar Series / Bozeman, MT / *"Building resilience on the margin: Characterizing social-ecological change in the Northern Great Plains"*

Guest Lectures

***2024** – Guest Lecture for NRSM360: Rangeland Management at the University of Montana / Missoula, MT / *"Rangeland soils in the Western U.S"*

***2024** – Guest Lecture for BSE349: Quantitative Methods for Biological Systems at UW-Madison / Madison, WI / *"Nitrogen: The overlooked element in climate change"*

***2023** – Guest Lecture for BSE349: Quantitative Methods for Biological Systems at UW-Madison / Madison, WI / *"From the Prairie to the Tropics: Emerging feedbacks between ecosystem nitrogen and carbon cycling under environmental change"*

Poster Presentations

2023 – *"American Geophysical Union"* Persistent Hydrologic Nutrient Export in Response to Wildfire and Climate Change in Semi-Arid Watersheds. (*Accepted Poster*)

2015 - *American Geophysical Union* / "The effect of drought on stomatal conductance in the Biosphere 2 rainforest" *(Accepted Poster)*

Professional Memberships and Service

Associations:
American Association for Fire Ecology (2023-present)
Ecological Society of America (2017-present)
Society of Range Management (2019-2021)
National Ski Patrol, Outdoor Emergency Care Medical Certification

Peer reviewer for the following scientific journals:
Plant and Soil (1)
Biogeochemistry (1)
International Journal of Wildland Fire (2)
Agronomy for Sustainable Development (2)
Journal of Environmental Management (1)
Rangeland Ecology and Management (2)
Journal of Ecology (2)
Ecosystems (1)

2023 - Ecological Society of America invited panelist and moderator for Career Central session titled "Deep Dive: Federal Careers"

2020 - Reviewer for the Intergovernmental Panel on Climate Change (IPCC) 6th Assessment Report: Chapter 5 "Global Carbon and other Biogeochemical Cycles and Feedbacks"

Mentoring and Advising

Graduate Committee Member
2024 - Present Dalton Brantley, PhD student (University of Montana)

Undergraduate Research Mentor
2021 - Suzy Walsh (Montana State University)
2021 - Sophie Grimm (Montana State University)

Additional Professional Experience

2021 - SPATIAL Short Ecosystem Isotope Course
University of Utah, Salt Lake City, UT

2019, 2016 - Avalanche I and II certifications
AIARE, Bozeman MT and North Conway, NH

2011-2013 - Professional Ski Patrol
Okemo Mountain Resort, Ludlow VT

2011-2013 - Backcountry Facilities Manager and Naturalist
Appalachian Mountain Club, White Mountains, NH

2011 - Wilderness Travel Instructor
Deerhill Expeditions, Mancos CO