**Dr. Katherine R. Hayes**

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**RESEARCH APPOINTMENTS**

**NSF Postdoctoral Fellow 2023 - Present**

Future Forests Lab, Cary Institute of Ecosystems Studies

**EDUCATION**

**PhD in Integrative and Systems Biology**

University of Colorado, Denver Advised by Dr. Brian Buma

**Thesis title:** *“Short-interval reburning changes forest composition, carbon, and fire behavior of boreal forests”*

**Master of Science in Geography**

University of Oregon Advised by Dr. Dan Gavin

**Thesis title:** “*Fire history and soil carbon in old growth coast redwood forests across the late Holocene”*

**Bachelor of Science in Environmental Studies, Spanish, and Geography (Honors)**

University of Wisconsin, Madison Advised by Dr. Jack Williams

Minor in European Studies

**Thesis title:** *“A continuous charcoal record of Bonnett Lake, Ohio since the Last Glacial Maximum*”

**PEER REVIEWED PUBLICATIONS**

8. Carter T., **Hayes K.**, Buma B. Putting more fuel on the fire… or maybe not? A synthesis of spruce beetle and fire interactions in North American Subalpine Forests. (2022). *Landscape Ecology*. <https://doi.org/10.1007/s10980-022-01481-1>

7. **Hayes K.,** Carter T., Cook P., Twaddell E., Buma B. Supporting Graduate Field Leadership through Community-Sourced Advice, Action, and Policy. (2022). *Ecosphere.* <https://doi.org/10.1002/ecs2.4247>

6. Buma, B., **Hayes, K.,** Weiss, S., Lucash, M. Short interval fires increasing in the Alaskan boreal forest as fire self-regulation decays across forest types. (2022). *Scientific Reports*, 12, 4901. <https://doi.org/10.1038/s41598-022-08912-8>

5. Muthukrishnan, R., **Hayes, K.**, Bartowitz, K., Cattau, M., Harvey, B., Lin, Y., Lunch, C. (2022). Harnessing NEON to evaluate ecological tipping points: opportunities, challenges, and approaches. *Ecosphere, 13(3)*, p.e03989. [http://doi.org/10.1002/ecs2.3989](http://doi.org/10.1002/ecs2.3989%5d)

4. Nagy C., Balch J, Bissell E, Cattau, M., Glenn, N., Halpern B., … **Hayes K.**, … O’Riordan, C. (2021). Harnessing the NEON data revolution to advance open environmental science with a diverse and data‐capable community. *Ecosphere*, *12(12),* p.e03833. <https://doi.org/10.1002/ecs2.3833>

3. **Hayes, K.**, Buma, B. (2021). Effects of short-interval disturbances continue to accumulate, overwhelming variability in local resilience. *Ecosphere, 12(3),* e03379*.* <https://doi.org/10.1002/ecs2.3379>

2**.** Jensen, A. M., Fastovich, D., Watson, B. I., Gill, J. L., Jackson, S. T., Russell, J. M., Bevington, J., **Hayes, K.**, …. & Williams, J. W. (2021). More than one way to kill a spruce forest: The role of fire and climate in the late‐glacial termination of spruce woodlands across the southern Great Lakes. *Journal of Ecology*, *109*(1), 459-477.<https://doi.org/10.1111/1365-2745.13517>

1. Buma, B., Weiss, S., **Hayes, K**., & Lucash, M. (2020). Wildland fire reburning trends across the US West suggest only short-term negative feedback and differing climatic effects. *Environmental Research Letters*, *15*(3), 034026. <https://doi.org/10.1088/1748-9326/ab6c70>

**OTHER PUBLICATIONS**

* Kulakowski D., Buma B., Guz J., **Hayes K**. (2019). “The ecology of forest disturbances”. Reference Module in *Earth Systems and Environmental Science*. <https://doi.org/10.1016/B978-0-12-409548-9.11878-0>

**PUBLICATIONS IN REVIEW (available on request)**

* **Hayes K.** Acid-digestion recovers more pyrogenic carbon and reduces variability compared to traditional manual counting, particularly where pyrogenic carbon is scarce*. Geoderma*. **[In Revision]**

**GRANTS**

2022 **NSF Collaborative Proposal.** Buma B, Higuera C, Hoffman C, Chapman M, Hayes K.

*The Past, Present and Future of Boreal Fire Feedbacks*  $276,934 of 1.4 million

**NSF Postdoctoral Research Fellowship**. Hayes K,Hansen W, Johnstone J.

*Investigating fire-biotic disturbance interactions and their sensitivity to climate in the North American boreal biome* $321,333

2021 UC Denver Integrative and Systems Biology Merit Grant $15,000

Colorado STEM Graduate Grant $1,250

2019 **Joint Fire Science Program Graduate Research Innovation Award**. Hayes K, Buma B.

*Evaluating Flammability across Reburns in Interior Alaska.* $25,000

**ORAL PRESENTATIONS**

*2023*

* **Hayes K,**  Hansen W. *“A systematic review of emerging biotic disturbances in Interior Alaska”*, International Association of Landscape Ecology: North America. Riverside, CA. March 2023.
* Buma B, **Hayes K,** Ziegler J, Hoffman C. “*Changing fuels and fuel structures in boreal forests alter and can increase fire spread through wind, spread, and other mechanisms”*, American Meteorological Society. Denver, CO. January 2023. **[Invited]**

*2022*

* **Hayes K,** Hoffman C, Ziegler J, Lucash M, Buma B. “*Continued short-interval reburning changes carbon storage and future fire behavior of boreal forests regardless of forest resilience”,* American Geophysical Union. Chicago, IL. December 2022.
* **Hayes K,** Hoffman C, Ziegler J, Buma B. “*Evaluating flammability of reburns across Interior Alaska”,* Alaska Fire Science Consortium. Webinar. November 2022. **[Invited]**
* **Hayes K,** Carter T, Cook P, Twaddell E, Buma B. *“How do we practice, develop and support graduate field leadership skills?”*, Pal(a)eo Early Career Seminar Series. Remote Seminar. September 2022. **[Invited]**
* **Hayes K,** Lucash M, Hoffman C, Ziegler J, Buma B. *“Short-interval reburning changes fuel structure, carbon storage and fire behavior of boreal forests”*, Ecological Society of America. Montreal, CA. August 2022.
* **Hayes K,** Carter T, Cook P, Twaddell E, Buma B. *“Strategies for managing and leading fieldwork successfully as a graduate student”*, Ecological Society of America: Inspire Session. Montreal, CA. August 2022.
* **Hayes K**, Lucash M, Buma B. *“Repeat short-interval fires put carbon storage in Interior Alaska at risk”,* International Association of Landscape Ecology: North America. Remote. April 2022.**[Presentation Award]**
* **Hayes K**, Gavin D.*“Establishing baseline patterns of fire in old-growth coast redwood forests using soil carbon and charcoal”*, Northwest Science Association. Remote. March 2022.
* **Hayes K**, Carter T, Cook P, Twaddell E, Buma B. *“Graduate Field Leadership: Challenges, Successes and Strategies”,* Front Range Student Ecology Symposium. Fort Collins, CO. Feb. 2022.

*2021*

* **Hayes K**, Buma B. “*Repeat short-interval fires drive changes in biomass and soil carbon in Interior Alaska, regardless of local site conditions or resilience*”, American Geophysical Union. New Orleans, LA. December 2021.
* Buma B, **Hayes K**, Weiss S, Lucash M. “*Short-interval fires increasing in the boreal forest over multi-decadal time periods, especially in drier coniferous forest landscapes*”, American Geophysical Union. New Orleans, LA. December 2021.
* **Hayes K,** Buma B. “*Continued short-interval reburning drives changes in fuel-scapes across boreal forest landscapes”*, Great Plains Rocky Mountains Applied Geography. Remote. October 2021.
* **Hayes K**, Buma B. *“Biomass and soil carbon in reburned stands burnt in short-intervals in Interior Alaska”*, International Boreal Forest Research Association. Remote. August 2021. **[Presentation Award]**
* **Hayes K**, Buma B. *“Repeat short-interval fires drive changes in biomass and soil carbon in Interior Alaska”*, International Association of Landscape Ecology: North America. Remote. April 2021.
* **Hayes K**, Buma B. *“The effects of multiple short-interval fires on community and functional trait-based regeneration in boreal Alaska”,* American Association of Geographers. Remote. April 2021.
* **Hayes K**, Buma B. “*Repeat short-interval fires drive changes in forest structure, composition and carbon in Interior Alaska*”, Front Range Student Ecology Symposium. Remote. March 2021. **[Presentation Award]**

*2020*

* **Hayes K**, Buma B. “*Interacting Effects of Herbivory and Short-Interval Reburns on Successional trajectories in Boreal Interior Alaska*”, International Association of Landscape Ecology: North America. Remote. May 2020.
* Buma B, **Hayes K.** *“Evaluating flammability of reburns in the boreal forests of Interior Alaska”.* Alaska Fire Science Consortium. Webinar. April 2020. **[Invited]**

*2019*

* Buma B, **Hayes K**, Weiss S, Lucash M. “*Overlapping and interacting fires, a double whammy: Short-interval burns are becoming more frequent across the US West, but pace suggests negative feedbacks and spatial patterning*”, American Geophysical Union. San Francisco, CA. December 2019.
* **Hayes K,** Buma B. “*Continued short-interval fires overwhelm serotinous resilience regardless of topographic variation*”, Association for Fire Ecology. Tucson, AZ. November 2019.
* Buma B, **Hayes K**, Weiss S, Lucash M. “*Rates of short-interval fires increasing across the US West*”,Association for Fire Ecology. Tucson, AZ. November 2019.
* **Hayes K.** “*Repeat short-interval fires in boreal cause continued ecosystem change*”, UC Denver Integrative Biology Graduate Student Seminar Series. Denver, CO. October 2019.
* **Hayes K.** “*Using NEON data to identify ecological tipping points across spatial/temporal scales”,* NEON Science Summit. Boulder, CO. October 2019.
* **Hayes K**, Buma B.“*Landscape Context mediates the effect of shortening fire intervals in boreal systems*”, International Association of Landscape Ecology: North America. Fort Collins, CO. April 2019.
* Buma B, Lucash M, **Hayes K,** Weiss S.“*The Predictable, and not so Predictable, Spatial distribution of Short Interval Fires across the US West”*, International Association of Landscape Ecology: North America. Fort Collins, CO. April 2019.
* **Hayes K**, Buma B.“*Landscape Context mediates the effect of shortening fire intervals in boreal systems*”, UC Denver Integrative Biology Graduate Student Seminar Series. Denver, CO. April 2019.

*2017*

* **Hayes K**, Gavin D. “*Reconstructing Paleofire in Old Growth Coast Redwood Forests in Northern California Using Pyrogenic Charcoal and Soil Carbon*”. Association of Pacific Coast Geographers. Chico, California. October 2017. **[Presentation Award]**
* **Hayes K**, Gavin D. “*Reconstructing a fire history in the Coast Redwood (Sequoia Sempervirens) forests of Northern California*”. Ecological Society of America. Portland, OR. August 2017.
* **Hayes K**.*“ Marine Fog, Climate Change and Coast Redwood Forests: Implications for management and research*”. University of Oregon Graduate Research Forum. Eugene, OR. April 2017.
* **Hayes K**, Gavin D. “*Marine Fog, Climate Change and Coast Redwood Forests: Past, Present and Future*”. UO Climate Change Research Symposium, Eugene, OR. April 2017.

*2016*

* **Hayes K,** Williams J. *“Fire History of Bonnett Lake, Ohio since the Last Glacial Maximum”.* Midwest Undergraduate Geography Symposium, Minneapolis, MN. April 2016.
* **Hayes K,** Williams J. *“Compiling a continuous charcoal record of Bonnett Lake, Ohio since the Last Glacial Maximum”*. University of Wisconsin Undergraduate Symposium, Madison, WI. April 2016.

**SELECT POSTER PRESENTATIONS [Undergraduate mentees underlined]**

*2022*

* **Hayes K,** Hoffman C, Lucash M, Buma B. “*Short-interval reburning changes fuel structure, carbon storage and fire behavior of boreal forests”,* Forest Disturbance and Ecosystem Dynamics Symposium. Berchtesgaden National Park, Germany. September 2022. **[Poster Award]**

*2021*

* **Hayes K,** Hoffman C, Ziegler J, Buma B. “*Continued short-interval reburning changes fuel structures of Boreal forests”,* Int. Fire Ecology and Management Congress. Remote. December 2021.
* **Hayes K**, Buma B. “*Recovery of aboveground biomass and soil carbon after multiple short-interval disturbances in boreal Interior Alaska*”, North American Carbon Program Open Science Meeting. Remote. March 2021.

*2019*

* **Hayes K**, Buma B. “*Effects of Spatial Heterogeneity on successional trajectories following repeat disturbances in Boreal Interior Alaska*”, American Geophysical Union. San Francisco, CA. Dec 2019.
* Weiss S, **Hayes K**, Lucash M. “*Modeling Post-fire Successional trajectories under Climate Change in Black Spruce forests in Interior Alaska*”, American Geophysical Union. San Francisco, CA. Dec 2019.
* Olson K, Buma B, **Hayes K**. “*Fine-scale Observations of Permafrost after Repeat Fires in Interior Alaska*”, American Geophysical Union. San Francisco, CA. December 2019.
* Kodicherla V, Shabaga J, Vogel J, Buma B, **Hayes K**. “*Soil Respiration in very high frequency Boreal Wildfires as a function of Species*”, AGU. San Francisco, CA. December 2019.
* **Hayes K**, Buma B.*“The Implications of increasing fire frequency in boreal forests in Interior Alaska”*, University of Colorado Denver Research and Creative Activities Symposium. Denver, CO. April 2019.

*2018*

* **Hayes K**, Buma B. “*The Future of the Boreal Forest*”, University of Colorado Denver Applied Spatial Statistics Poster Presentation. Denver, CO. December 2018.
* Jensen A, Rubbelke C, **Hayes K**, Bevington J, Fastovich D, Watson B, Jackson S, Russel J, Williams J. “*The role of fire in the late-glacial decline of spruce forests across the midwestern US*”, American Geophysical Union. December 2018.
* **Hayes K**, Gavin D. “*Fire and Carbon Cycling in Old Growth Coast Redwood*”. University of Oregon Graduate Research Forum. Eugene, OR. May 2018.

*2017*

* **Hayes K**, Hendricks L, Gavin D. “*Forests with naturally infrequent fire: their resilience and susceptibility to impacts by people & climate change*”. Joint Campus Conference. Eugene, OR. May 2017.
* **Hayes K**, Gavin D. “*Marine fog and Climate change in Coast redwood (Sequoia sempervirens) forests: Implications for management & research*”. American Association of Geography. Boston, MA. April 2017.

**OTHER TALKS**

* *“The theory, premise and problems with botanical sexism”.* Nerd Nite. Denver, CO. November 2022.
* *“Bears, burning and Battlestar Galactica: climate change in Alaska and why it matters*”. Nerd Nite. Denver, CO. October 2021.
* *“Climate change: how the Arctic is changing and why it matters*”. First Unitarian Society Sunday Forum. Milwaukee, WI. November 2019.

**HONORS & AWARDS**

*2022*

UC Denver Dept. of Biology Doctoral Teaching Award. **$2,500.**

U.S. Carbon Program Leadership Award. **$1,000.**

UC Denver Department of Integrative Biology Travel Award. **$500.**

UC Denver College of Liberal Arts and Sciences Travel Award. **$500.**

International Association of Landscape Ecology Presentation Award. **$300.**

UC Denver Dept. of Biology Graduate Excellence in Research Award**. $250.**

*2021*

UC Denver Department of Integrative Biology Travel Award. **$600.**

International Boreal Forest Research Association Presentation Award. **$400.**

Front Range Student Ecology Symposium Presentation Award. **$150.**

***Ecological Society of America Graduate Policy Award***

*2020*

Polanki Graduate Achievement Award. **$1,200.**

Association of Fire Ecology TREE Graduate Travel Award. **$265.**

UC Denver Department of Integrative Biology Travel Award. **$300**.

*2019*

Association of Fire Ecology TREE Graduate Travel Award. **$330.**

UC Denver Department of Integrative Biology Travel Award. **$500.**

UC Denver College of Liberal Arts and Sciences Travel Award. **$500.**

UC Denver Graduate School Travel Award. **$500.**

*2018*

Robert J. Leonard Memorial Award. **$1,200.**

*2017*

Christopherson Geosystems Award for Excellence in Applied Geography/Earth Systems Science. **$300.**

UO Graduate Research Forum Oral Session Award. **$75.**

Association of Pacific Coast Geographer’s Travel Award. **$200.**

**TEACHING AND MENTORING EXPERIENCE**

*Instructor of Record*

2022 Principles of Ecology, University of Colorado Denver (1 semester)

*Teaching Assistant*

2020 - 2022 Gen. Biology: Organisms to Ecosystems, University of Colorado Denver (2 semesters)

Biostatistics, University of Colorado Denver (1 semester)

2016 - 2018 The Professional Geographer, University of Oregon (1 semester)

Biogeography, University of Oregon (2 semesters)

Quantitative Data Analysis, University of Oregon (2 semesters)

Climatology, University of Oregon (1 semester)

*Guest Lecturer*

2020 “Introduction to Fire Ecology.”, *Disturbance Ecology,* UC-Denver

2019 “Introduction to Landscape Ecology.” *Principles of Ecology,* UC-Denver

2018 “Graduate School in Geography.” *The Professional Geographer,* University of Oregon

2017 “Theory of Island Biogeography”, *Biogeography*, University of Oregon

*Seminar Coordinator*

2019 Applied Ecology Seminar, University of Colorado Denver

2018 Graduate Seminar Coordinator, University of Oregon

*Mentoring Experience*

2019 – 2020 NSF Research Experience for Undergraduates Mentor (2 students)

Students mentored in lab: 6

Students mentored in field: 8

Student committees:

CU Denver: Elizabeth Kuhn (B.S., 2022)

**MAJOR GRANTS SUBMITTED, NOT FUNDED**

* National Geographic Society Early Career Grant, “*Searching for ice: mapping and modeling permafrost in Interior Alaska*”, 2019.
* NSF Graduate Research Fellowship, “*Reconstructing hurricanes and fire in Cuba using paleotempestolog*y”, 2016.

**SERVICE AND ENGAGEMENT**

*Service positions*

Journal Reviewer: *Plant and Soil; Global Change Biology; Ecosphere; OneEarth; Arctic, Antarctic, and Alpine Research*

2020 - 2021 Graduate Student Representative: Office of the Dean Graduate Advisory Group.Provided a student perspective and advocated for student issues to the office of the Dean.

2019 - 2021 Student Representative & Executive Committee Member: International Association of Landscape Ecology North America. Elected. Prepared student-specific events and content for annual meetings (both virtual and in-person), provided a student perspective on the executive committee.

2019 – 2020 Graduate Student Representative: Department of Biology Graduate Advisory Committee, University of Colorado Denver.

2016 – 2019 Graduate Department Representative: Graduate Teaching Fellows Federation, University of Oregon.

*Special sessions, workshops, and training*

2023 Invited speaker. *Wildfire Research: Advances, Challenges and Opportunities,* American Meteorological Society. Denver, CO.

2022 Wilderness First Aid License

Panelist. *Advice from the Field: Practical Skills, Coping with Accessibility Challenges, and What Else You Need to Know.* Ecological Society of America. Montreal, CA.

Session Participant. *Regional analysis of landscape and forest change towards practical landscape management.* International Association of Landscape Ecology, North America. Remote.

2021 Session Organizer: *Exploring the context and implications of departures from historic fire frequency across ecosystems*. International Association of Landscape Ecology, North America. Remote.

2020 Participant. *Foundations of Open Science Skills* (FOSS) course, CyVerse. Remote.

Participant. *Introduction to Using Google Earth Engine for Landscape Ecology.* IALE North America Workshop.

2019 Participant. *NEON Science Summit*. Boulder, CO.

2018 Field Safety Training. National Science Foundation Polar Office. Fairbanks, AK.

2017 Session Organizer: *Water in the Pacific Midwest: Past and Future.* Graduate Student Research Forum, University of Oregon. [Organized Session Award]

2016 Participant. *PalEON: Assimilating Long-Term Data into Ecosystems Models* workshop. University of Notre Dame Research Station.