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## RESEARCH APPOINTMENTS

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**NSF Postdoctoral Fellow** **2023 - Present**  
Future Forests Lab, Cary Institute of Ecosystems Studies

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## EDUCATION

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### **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*

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## PEER REVIEWED PUBLICATIONS

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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>
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

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- 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)

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- **Hayes K.**, Lucash M, Olson K, Buma B. Repeat short-interval fires put carbon storage at risk in Interior Alaska via cumulative combustion of soil carbon. *Global Change Biology*. **[Submitted]**
- Weiss S, Marshall A, **Hayes K.**, Nicolsky D, Buma B, Lucash M. Future transitions from a conifer to a deciduous-dominated landscape are accelerated by greater wildfire activity and climate change in interior Alaska. *Landscape Ecology*. **[In Review]**
- **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

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|------|---|--------------------------|
| 2022 | <b>NSF Collaborative Proposal.</b> Buma B, Higuera C, Hoffman C, Chapman M, Hayes K.<br><i>The Past, Present and Future of Boreal Fire Feedbacks</i>  | \$276,934 of 1.4 million |
|      | <b>NSF Postdoctoral Research Fellowship.</b> Hayes K, Hansen W, Johnstone J.<br><i>Investigating fire-biotic disturbance interactions and their sensitivity to climate in the North American boreal biome</i> | \$321,333                |
| 2021 | UC Denver Integrative and Systems Biology Merit Grant   | \$15,000                 |
|      | Colorado STEM Graduate Grant  | \$1,250                  |
| 2019 | <b>Joint Fire Science Program Graduate Research Innovation Award.</b> Hayes K, Buma B.<br><i>Evaluating Flammability across Reburns in Interior Alaska.</i>   | \$25,000                 |

## SELECT PRESENTATIONS

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2023

- **Hayes K.** *Frequent fires change forest composition and carbon of Alaskan boreal forests*, Seminar. Natural Resources Institute Finland. Helsinki, Finland. April 2023. **[Invited]**
- **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.
- **Hayes K.**, Buma B, 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.
- **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.
- **Hayes K**, Buma B. *Evaluating flammability of reburns in the boreal forests of Interior Alaska*. Alaska Fire Science Consortium. Webinar. April 2020. **[Invited]**

#### 2019

- **Hayes K**, Buma B. *Continued short-interval fires overwhelm serotinous resilience regardless of topographic variation*, 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.
- **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]**

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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.
- 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.
- **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**

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- *The theory, premise and problems of 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

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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

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### *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

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- 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 paleotempestology*”, 2016.

## SERVICE AND ENGAGEMENT

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*Service positions*

**Journal Reviewer:** *Plant and Soil; Global Change Biology; Ecosphere; OneEarth; Arctic, Antarctic, and Alpine Research; Ecosystems; Combustion Science and Technology, Forest Ecology and Management*

2023 – Present AGU Leadership Academy and Network for Diversity and Inclusion in the Geosciences (LANDIng) Postdoctoral Research Fellow.

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.