

# KELLY ANN HEILMAN

Laboratory of Tree Ring Research  
kellyannheilman@gmail.com

## EDUCATION

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**University of Notre Dame**  
PhD  
Department of Biology

*August 2013 - 2019*

**Kenyon College**  
Bachelor of Arts, Biology and Environmental Studies.

*August 2008 - May 2012*  
Magna cum laude

## RESEARCH EXPERIENCE

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**Postdoctoral Research Associate University of Arizona** *2019 - present*

To improve forecasts of forest carbon stock and fluxes, I assimilate two large datasets in a state space modelling framework: repeat censuses from the Forest Inventory and Analysis and annual tree ring growth records. We use this framework to forecast forest carbon stock and flux across the Interior West US, evaluate forecast uncertainties, and inform forest management.

**PhD Graduate Research Assistant - University of Notre Dame** *2013 - 2019*

In my PhD, I investigated how environmental changes affect both the large-scale distribution of woody biomes, and treelevel responses to drought. Specifically, my dissertation focused on how historic changes in land-use, climate, and CO<sub>2</sub> have impacted both the stability and drought tolerance of the temperate savanna-forest biome boundary using historic datasets, Bayesian modelling, dendrochronology, and stable isotope geochemistry.

**Aquatic Research Technician - Cleveland Metroparks** *2012 - 2013*

Performed both fish and aquatic invertebrate sampling for headwater stream restoration assessments. Led ecology field trips, and contributed to fishing expo outreach events.

**Toucan Research Assistant - CATIE, Costa Rica** *2013*

Tracked home range and seed dispersal of two species of Toucans in Turrialaba, Costa Rica. This contributed to the dissertation of Dr. Landon Jones at University of Louisiana.

**Kenyon Summer Science Research Scholar - Kenyon College** *2011*

Investigated the potential impacts of climate change on reproduction success of threatened minnow species Redside dace (*Clinostomus elongates*).

## GRANTS AND FELLOWSHIPS

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National Science Foundation Doctoral Dissertation Improvement Grant DEB-1701897. *2017*

Center for Environmental Science Technology (CEST) Bayor Fellowship *2017*

UNDERC Mentoring Fellowship *2017 - 2018*

Arthur J. Schmitt Leadership Fellowship *2013-2019*

## PUBLICATIONS

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**Heilman, K.A.**, Trouet, V., Pederson, N., Belmecheri, S., Berke, M.A., McLachlan, J.S., Increased water use efficiency leads to decreased precipitation sensitivity of tree growth, but is offset by high temperatures. *Oecologia* <https://doi.org/10.1007/s00442-021-04892-0>.

Walker, Anthony P., Martin G. De Kauwe, Ana Bastos, Soumaya Belmecheri, Katerina Georgiou, Ralph Keeling, Sean M. McMahon, Belinda E. Medlyn, David J. P. Moore, Richard J. Norby, Snke Zaehle, Kristina J. AndersonTeixeira, Giovanna Battipaglia, Roel J. W. Brien, Kristine G. Cabugao, Maxime Cailleret, Elliott Campbell, Josep Canadell, Philippe Ciais, Matthew E. Craig, David Ellsworth, Graham Farquhar, Simone Fatichi, Joshua B. Fisher, David Frank, Heather Graven, Lianhong Gu, Vanessa Haverd, **Kelly Heilman**, Martin Heimann, Bruce A. Hungate, Colleen M. Iversen, Fortunat Joos, Mingkai Jiang, Trevor F. Keenan, Jrgen Knauer, Christian Krner, Victor O. Leshyk, Sebastian Leuzinger, Yao Liu, Natasha MacBean, Yadvinder Malhi, Tim McVicar, Josep Penuelas, Julia Pongratz, A. Shafer Powell, Terhi Riutta, Manon E. B. Sabot, Juergen Schleucher, Stephen Sitch, William K. Smith, Benjamin Sulman, Benton Taylor, Csar Teller, Margaret S. Torn, Kathleen Treseder, Anna T. Trugman, Susan E. Trumbore, Phillip J. van Mantgem, Steve L. Voelker, Mary E. Whelan, and Pieter A. Zuidema. 2020. Integrating the Evidence for a Terrestrial Carbon Sink Caused by Increasing Atmospheric CO<sub>2</sub>. *New Phytologist* <https://doi.org/10.1111/nph.16866>

Broderick, C.M., **Heilman, K.A.**, T.A. Patterson, J.A. Peters, J.S. McLachlan. 2018. Sharp Savanna-forest Transitions in the Midwest Followed Environmental Gradients but are Absent from the Modern Landscape. *The American Midland Naturalist*, 180(1):1-17. <https://doi.org/10.1674/0003-0031-180.1.1>

## MANUSCRIPTS IN REVIEW

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**Heilman, K.A.**, Dietze, M., Finley, A.O., Arizpe, A., Aragon, J., Gray, A., Shaw, J.D., Klesse, S., DeRose, R.J., Evans, M.E. Ecological forecasting of tree growth: regional fusion of tree-ring and forest inventory data to quantify drivers and characterize uncertainty. Submitted to *Global Change Biology*.

DeRose, R. J., Evans, M.K., Klesse, S., Girardin, M. P., **Heilman, K.A.**, Alexander, M.R., Arsenault, A., Babst, F., Bouchard, M., Cahoon, S. M. P., Campbell, E., Dietze, M.C., Duchesne, L., Frank, D.C., Giebink, C.L., Gomez-Guerrero, A., Gutierrez Garca, G., Villela Gaytn, S.A., Edward H. Hogg, E.H., Metsaranta, J., Ols, C., Rayback, S. A., Reid, A., Ricker, M., Schaberg, P. G., Shaw, J. D., Sullivan, P. F. The case for adding tree rings to North Americas national forest inventories: an essential tool to guide drawdown of atmospheric CO<sub>2</sub>. Submitted.

Novick, K., Jo, I., DOrangeville, L., Benson, M. Au, T.F., Barnes, M., Denham, S., Fei, S. **Heilman, K.A.**, Hwang, T., Keyser, T., Maxwell, J., Miniati, C., McLachlan, J.S., Pederson, N., Wang, L., Wood, J. D., P. Phillips, R.P. The drought response of Eastern US oaks in the context of their ongoing decline. Submitted to *Bioscience*.

## MANUSCRIPTS IN PREP

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**Heilman, K.A.**, Staver, C.A., Goring, S., Williams, J. McLachlan, J.S. Alternate Stable States in the Temperate Savanna-forest Biome. In Prep.

Giebink, C.L., **Heilman, K.A.**, DeRose, J.D, Shaw, J.D., Evans, M.K. Forest models for carbon accounting. In Prep.

**Heilman, K.A.**, Burke, K.D., Dawson, A., Williams, J., McLachlan, J.S., Strong species interactions shaped past biomass, but are lost from the modern landscape. In Prep.

## PRESENTATIONS

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### Invited Presentations

Kelly Heilman. R. Justin DeRose, John D. Shaw, Andrew Finley, Michael Dietze, Jacob Aragon, Andrew Grey, Alex Arizpe, Stefan Klesse, Margaret Evans. Fusing tree ring and forest inventory data for ecological forecasting of tree growth responses to climate change. American Association of Geographers Annual meeting, Frontiers in Dendrochronology Session. April, 2021

Kelly Heilman. Assimilation of tree ring and forest inventory data to forecast future growth responses of *Pinus ponderosa*. August, 2020. Laboratory of Tree Ring Research Department Seminar. October 14th, 2020

Kelly Heilman, Justin DeRose, John Shaw, Andrew Finley, Michael Dietze, and Margaret Evans. Assimilation of Tree Ring and Forest Inventory Data to Constrain Uncertainty in Ecological Forecasts. SIAM Mathematics of Planet Earth, Virtual. August 14, 2020

Kelly Heilman. Forecasting long-term effects of environmental changes on vegetation: from trees to biomes. Kenyon College Biology Department Seminar. November 14, 2019

Kelly Heilman. Vegetation Responses to Long-term Environmental Changes at a Savanna Forest Boundary. Laboratory of Tree Ring Research Department Seminar. October 9, 2019

Kelly Heilman, Jason McLachlan, Neil Pederson, Valerie Trouet, Soumaya Belmecheri. Tree growth in a changing world: Factors mediating the effects of CO<sub>2</sub> on tree ring growth and Water Use Efficiency. Ecological Society of America. August 8, 2018

Kelly Heilman. Tree growth in a changing world: Oak drought sensitivity trends at the savanna-forest boundary. Morton Arboretum, Chicago, IL. May 21, 2018

Kelly Heilman, Jason McLachlan. Quantifying vegetation structure and environmental drivers across a historic Prairie-Forest Biome Boundary. January 8, 2016. Harvard Forest Seminar Talk.

### Contributed Oral Presentations

Kelly Heilman, Justin DeRose, John Shaw, Andrew Finley, Michael Dietze, and Margaret Evans. Assimilation of tree ring and forest inventory data to forecast future growth responses of *Pinus ponderosa*. August, 2020. Ecological Society of America

Kelly Heilman, Jason McLachlan, Carla Staver, Chris Paciorek, John Tipton, John W. Williams. Loss of alternative savanna and forest stable states due to historic and modern land-use. August, 2019. Ecological Society of America

Kelly Heilman, Jason McLachlan, Neil Pederson, Valerie Trouet, Soumaya Belmecheri. Anthropogenic changes impact drought sensitivity across a savanna-forest biome boundary. 10th World Dendro Con-

ference. Thimphu, Bhutan. June 2018

Kelly Heilman, Jason McLachlan Drought sensitivity changes over the last century at the North American savanna-forest boundary. American Geophysical Union. December 11th, 2017

Kelly Heilman, Jason McLachlan, Carla Staver, Stabilization of savanna-forest alternative states to closed forests after 150 years of land use and climate changes. August, 2017 Ecological Society of America

Kelly Heilman, Jason McLachlan. What controls temperate savanna tree growth? July, 2016. North American Prairie Conference.

Kelly Heilman, Jason McLachlan Using GIS to investigate controls on vegetation at the prairie-forest boundary. November 16th, 2016. University of Notre Dame GIS day.

Kelly Heilman, Jason McLachlan, Carla Staver. Investigating controls of tree density and resilience to environmental changes at the prairie-forest boundary. November 2016. Biofrass Seminar Presentation, University of Notre Dame.

### **Poster Presentations**

Kelly Heilman, Justin DeRose, John Shaw, Andrew Finley, Michael Dietze, and Margaret Evans. Fusion of tree-ring and forest inventory data to quantify C cycle drivers and characterize forecast uncertainty. North American Carbon Project. March, 2021.

Kelly Heilman, Melissa Berke, Neil Pederson, Valerie Trouet, Soumaya Belmecheri, Jason McLachlan. Impacts of anthropogenic changes on water use efficiency and climate sensitivity: A data-model comparison. American Geophysical Union 2018.

Kelly Heilman, Jason McLachlan, A. Carla Staver, The role of disappeared disturbances in driving the North American prairie-forest boundary. American Geophysical Union, December 2016.

Heilman, K., McLachlan, J. Feng, X. Convergent Ecosystems from Divergent Environmental Drivers: revisiting drivers of the past prairie-forest ecotone across the North American Prairie Peninsula. American Geophysical Union, December, 2015.

Heilman, K., Pitcher, T.P., Heithaus, E.R. Is sperm motility correlated with red spawning coloration in Redside Dace (*Clinostomus elongatus*)? Kenyon College Summer Science Scholar Research Symposium 2011

## TEACHING AND PROFESSIONAL EXPERIENCE

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### **General Ecology Lab Lead Teaching Assistant** *2018*

University of Notre Dame

Contributed to ongoing course development by creating new lesson plans and leading writing workshops for students. I also assisted the Teaching Assistants with lessons, leading field trips, and developing student writing skills.

### **General Ecology Lab Teaching Assistant** *2014, 2016, 2017*

University of Notre Dame

Prepared fieldwork experiments and discussions, lead field trips, advised students on data analysis, developed student scientific writing and intellectual virtues, and graded all material.

### **UNDERC Summer Course Research Mentor** *2017-2018*

Notre Dame Environmental Research Center

Mentored five undergraduate students on independent summer research projects. This included teaching the students dendrochronology methods, forestry field data collection, implementing statistics using R, and the scientific writing process.

### **General Biology Lab - Teaching Assistant** *2013*

University of Notre Dame

Prepared introductory lectures, set up lab equipment, advised students on independent research projects, and graded all assignments.

### **Aquatic Systems Biology Laboratory Teaching Assistant** *2011*

Kenyon College

Teaching duties included organizing lab materials, bringing students on field expeditions, and teaching students aquatic ecology methods.

### **Introductory Biology Lab teaching assistant** *2010-2012*

Kenyon College

Assisted instructor in preparing lecture and experimental design, and led students through experimental protocols.

### **Introductory Biology Lab and Microscopy Lab Preparation Assistant** *2010-2011*

Kenyon College

Prepared mammalian cell cultures, lab materials for each lab meeting, as well as helped to develop lesson plan each week.

## VOLUNTEER AND SERVICE

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### Organizational

**Tucson-based taskforce of Arizona Science Policy Network** *2021-present*  
*co-organizer member*

Starting up a Tucson-based taskforce of the Arizona Science Policy Network, focused on advocating for science-based solutions to issues facing our communities.

**Jogging Organization for Graduate Students (JOGs)** *2018-2019*  
*President*

Co-founded a social running club for graduate students to network with fellow runners.

**University of Notre Dame Graduate Student Union** *2017-2018*  
*Social chair and community engagement chair*

Coordinated campus-wide social and community engagement events for graduate students and families, including a Charity Gala. Served as a voting member of Notre Dame Graduate Student Union.

**Society of Schmitt Fellows University of Notre Dame** *2015-2017*  
*Treasurer*

Handled Society of Schmitt Fellows annual budget and co-organised a fund for conference presentation travel grants.

### *Social Chair*

Co-organised monthly social activities for STEM graduate students.

### *Outreach Committee*

Planned outreach events to local animal shelters and communicated local outreach opportunities.

### Reviewer

#### *Journals*

Science, Ecosphere, Scientific Reports, Forest Ecology and Management, Michigan Academician.

#### *Proposals*

National Science Foundation Biology Program

## COMMUNITY OUTREACH AND ENGAGEMENT

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### Science Policy

**AGU Voices for Science Advocacy Day** *May 2021*

Met with staffers from Raul Grijavla, and Senator Mark Kelly's office to ask for them to support increases in science funding for NSF and USGS in the FY 22 budget request. This meeting was on behalf of American Geophysical Union and the Voices for Science Program.

**Meeting with policymakers to strengthen the role of science in democracy** *April 2021*

Met with Coral Evans (former Mayor of Flagstaff, and current staffer for Senator Mark Kelly) to discuss science policy, voting rights, and democracy. We thanked Sen. Kelly for his support of the For the People act, and spoke in support of the John Lewis VRA and the Environmental Justice for All Act. This meeting was on behalf of Union of Concerned Scientists.

**Arizona Science Policy Day****March 2021**

Led and organized a discussion of nature-based climate solutions to address the climate crisis, developed a one-pager to disseminate to Arizona Legislators, and engage with students interested in climate-related policies. This event was a part of Arizona Science Policy Networks Science Day

**Organized meetings with policymakers for Climate Advocacy Week****October 2020**

Led and organized a meeting with our Arizona Senators' offices (Kirsten Sinema[D], Martha McSally[R]) and our local House representative (Ann Kirkpatrick[D]) to discuss policy to address the climate crisis and offer our expertise as climate and planetary scientists. This event was a part of AGU's Climate Advocacy Week

**Community Engagement****Macrosystems exhibit for LTRR lobby****2020**

Helped to develop and create a series of outreach videos about our research forecasting forest responses to climate change for the Laboratory of Tree Ring Research lobby.

**Southern Arizona Foresters****2019**

Gave a research talk and led a discussion during the Southern Arizona Foresters Luncheon.

**STEM Programming at the Boys and Girls Club of South Bend****2016-2017**

Organized weekly science activities for elementary school students in the Boys and Girls Club after school program.

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Organized weekly science activities for elementary school students in the Boys and Girls Club after school program.

**Planting Science Mentor****2017-2018**

Mentored High School Science classes during independent research projects online.

**Volleyball Head Coach****2017**

Coached 6th grade girls volleyball team at St. Pius X School in Granger, IN.

**HONORS, AWARDS, AND CERTIFICATES**

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American Geophysical Union Voices for Science

**2021-2022**

Postdoctoral Professional Development Certificate

**2020**

University of Arizona Postdoc Speed Talk Finalist

**2020**

Saint Joseph Academy Alumni 25 under 35 Award

**2016**

Distinction Award Biology Senior Exercise

**2012**

## TEACHING AND COURSE DEVELOPMENT

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### **Teaching Where the Magic Happens: Field Course Design Workshop**

Angie Moline, Ecological Society of America — August 2017

Attended this day long workshop where we developed short field courses, discussed risk management, best teaching practices, and dealing with logistics while developing remote field-based learning experiences.

### **A Practical Guide to Teaching and Learning in STEM**

University of Notre Dame Kaneb Center — January 2018

Participated in a day long workshop lead by Rebecca Brent and Richard Felder, where we discussed designing successful sciences courses with measurable learning objectives, active learning, and appropriate assessment.

### **Striving for Excellence in Teaching Certificate**

University of Notre Dame Kaneb Center — March 2018

Participated in 5+ workshops on teaching and course design at University of Notre Dame, and provided reflections on how the workshops provided skills to improve my own teaching.

### **Wakonse Conference on College Teaching**

May 24-29th 2018

Participated in the 2018 Wakonse Teaching Fellowship Conference in Michigan, where college educators share teaching methods, reflect on personal strengths and weaknesses as college teachers, and craft short- and long-term professional goals.

### **Introduction to Course Design**

University of Notre Dame Kaneb Center — Spring 2017

Participated in a 5-week workshop series to improve my course design and help develop teaching philosophy. Workshop covered various aspects of course design, including: Developing measurable learning goals, improving assessment and exam design, writing a syllabus, lesson planning, and gaining useful student feedback.

### **GET-STEM**

University of Notre Dame Kaneb Center — Fall 2016

Volunteered in the Graduate Educators Teaching Science Technology Engineering and Math program