

Rachel (Ray) Lombardi

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EDUCATION

2022 Ph.D., Geography, The University of Alabama
2017 M.S., Geography, The University of Alabama
2016 B.S., Environmental Science, Longwood University

RESEARCH INTERESTS

Paleoflood Hydrology, Paleoclimate, Geomorphology, Flood Risk Assessment, Landslides Impacting Rivers

APPOINTMENTS

2022 - Present **Assistant Professor**, Department of Earth Sciences, The University of Memphis
2020 - 2021 **Graduate Instructor**, Department of Geography, The University of Alabama
2016 - 2020 **Graduate Assistant**, The University of Alabama
2018 **Geomorphology Division Intern**, U.S. Bureau of Reclamation Technical Service Center

COURSES TAUGHT

University of Memphis

ESCI 4/6202 Geomorphology (Capstone Earth Science course)

ESCI 1020 Landforms

The University of Alabama

GY 102 Intro to Earth Surface Processes

GY 202 The Water Planet

GY 102 Lab Intro to Earth Surface Processes Lab

RESEARCH FUNDING

FUNDED GRANTS

External Grants

2024 - 2027 **EA: Acquisition of a Micro X-ray fluorescence Spectrometer for Research and Education in Earth and Environmental Studies at the University of Memphis.** National Science Foundation Instrumentation and Facilities Grant. Lead PI: Stinchcomb, G., co-PIs: Leslie, D., Jackson, W.T., **Lombardi, R.**, Auchter, J. Total Funded: \$431,158.

2024 **Landslide Investigation in the Tennessee River Gorge.** Tennessee Valley Authority Innovation and Research Program. Lead PI: **Lombardi, R.** Total Funded: \$15,548.00

2024 - 2027 **Palaeo-Hydrology: Ancient disasters, modern application.** International Union for Quaternary Research (INQUA) Multi-year Project: Lead PI: Toonen, co-PIs: W. Agarwal, A., **Lombardi, R.** Total Funded: €23,000

2021 - 2023 **Increasing water treatment resiliency by using natural flood record to reduce the uncertainty of water hazard predictions under changing climate.** USGS 104g National Competitive Grant. Lead PI: Davis, M. A. L., co-PIs: Swartz, J., **LOMBARDI, R.**, Harden, T., Yaw, M., Gage, M. Total Funded: \$197,925

Internal Grants

2024 **Paleoflood Reconstruction to Investigate Long-term Flood Variability on the Missouri River.** College of Arts and Sciences Faculty Research Grant. Lead PI: **Lombardi, R.** Total Funded: \$9,500

2022 **Earth Sciences Proposal for a Bettersizer – laser diffraction particle size and shape analyzer**, College of Arts and Sciences Research Instrumentation Initiative Program, Total Funded: \$27,345. (Led proposal writing and equipment stewardship)

DEVELOPED AND UNFUNDED PROPOSALS

Oct 2024 **Characterizing Quaternary landslide hazards in the Tennessee River Gorge (Wauhatchie Quadrangle)**. USGS Cooperative Landslide Hazard Mapping and Assessment Program, PI: **LOMBARDI, R.**, Jackson, W.T. (Tennessee Geological Survey). *The proposal is prepared in anticipation of the call for submission in October.*

Oct 2023 (Not funded) **Precipitation volatility and its impact on flood hazards: a long-term paleohydrologic perspective on the Lower Missouri River, USA**. Paleo-Perspectives on Present and Project Climate (P4Climate), Lead PI: **LOMBARDI, R.**, co-PIs: Burnette, D., Kwon, Y. *Planned resubmission with preliminary results in Fall 2025.*

HONORS & AWARDS

2022 The David Weaver Award, The University of Alabama
2021 Graduate Council Fellowship: The University of Alabama Graduate School
2018 Best Student Paper Presentation by a Ph.D. Student: Geomorphology Specialty Group, Annual Meeting of the American Association of Geographers
2018 Outstanding Graduate Research Assistant: The University of Alabama Department of Geography
2016 Outstanding Senior in Integrated Environmental Science: Longwood University Department of Biological and Environmental Sciences
2015 First Place Natural Sciences category for paper submissions: *INCITE: Journal of Undergraduate Scholarship*, Cook-Cole College of Arts and Science, Longwood University

SCHOLARSHIP (*Student Author)

PUBLICATIONS

In preparation

Overton, K.*, **LOMBARDI, R.**, Davis, M.A.L., Ramirez, A., Turk, A., Tootle, G., Piechota, T., Gong, J. Quantifying long-term streamflow trends in response to past climate on the French Broad River using traditional and AI dendro-hydrologic reconstruction techniques. *Invited contribution for submission in late September 2024.*

Davis, M. A. L., **LOMBARDI, R.**, Tootle, Gage, M. High and dry: A ~300-year record of low flows and extreme floods reveals cycles of hydrologic complexity. *Anticipated submission in October 2024.*

LOMBARDI, R., Kwon, Y., Burnette, D. A millennial record of precipitation volatility along the Lower Missouri River, Central USA. *Anticipated submission in November 2024.*

Refereed Articles

2024 Davis, M. A. L., **LOMBARDI, R.**, Yaw, M., Jawdy, C., Gage, M. Holocene Thermal Maximum paleofloods improve flood frequency analyses in the lower Tennessee River Basin (USA). *Global and Planetary Change* 236: 104412. <https://doi.org/10.1016/j.gloplacha.2024.104412>.

2023 **LOMBARDI, R.**, Davis, M. A. L., Setting the stage: How abrupt climate change, geomorphic thresholds, and drought control flood response in the lower Tennessee River, USA. *Quaternary Science Reviews* 301. <https://doi.org/10.1016/j.quascirev.2022.107931>.

2022 **LOMBARDI, R.**, Davis, M. A. L., Incorporating alluvial hydrogeomorphic complexities into paleoflood hydrology, magnitude estimation and flood frequency analysis, Tennessee River, Alabama. *The Journal of Hydrology* 612(A) <https://doi.org/10.1016/j.jhydrol.2022.128085>.

- 2021 **LOMBARDI, R.**, Davis, M. A. L., Therrell, M.D. Temperature and Flood Variability Across Europe and North America in the Common Era. *Physical Geography* 44(2), 121–135. <https://doi.org/10.1080/02723646.2021.1890894>.
- 2020 **LOMBARDI, R.**, Davis, M. A. L., Stinchcomb, G.E., Munoz, S.E., Stewart, L., Therrell, M.D., Fluvial activity in major river basins of the eastern United States during the Holocene. *The Holocene* 30: 1279–1295. <https://doi.org/10.1177/0959683620919978>.

Non-refereed Articles, Reports, and Other Publications

- 2024 Ballesteros-Cánovas, J.A., **LOMBARDI, R.**, Benito, G. Global warming impacts on floods in high mountain regions. *Past Global Changes Horizons* 3: 34-39. <https://pastglobalchanges.org/publications/pages-magazines/pages-horizons/137871>.
- 2024 Davis, M. A. L., **LOMBARDI, R.**, Gage, M. Improving Probabilistic Flood Hazard Assessment of Douglas Dam, Ocoee Dam #1 and Norris Dam with Paleoflood Hydrologic Analyses. Technical White Paper to Tennessee Valley Authority.
- 2017 Davis, M. A. L., **LOMBARDI, R.**, Gage, M., Therrell, M., Stinchcomb, G., Stewart, C., Leigh D., Milewski, A., Speakman, R., Tran, L. Cyr, H., Horn, S., and McKay, L., Paleoflood evidence of past flooding events: investigation into the available sources of paleoflood evidence in humid environments. Technical Report to Electric Power Research Institute, Palo Alto, CA: <https://www.epri.com/#/pages/product/3002010667/>.
- 2015 **LOMBARDI, R.**, Gee, K., Garcia, J., Spatial Analysis of Potential Risk Factors Associated with the Addition of Atlantic Coast Pipeline through Virginia. *INCITE: Journal of Undergraduate Scholarship Volume 7*.

EDITED VOLUMES

- 2024 Ballesteros-Cánovas, J.A., Benito, G., Mills, K., **LOMBARDI, R.**, Vannière, B., Gil-Romera, G., Hernández-Almeida, I. *Past Global Changes Horizons Volume 3: Wet vs Dry Periods*.

WORKSHOPS AND CONFERENCE SESSIONS

- 2024 Co-convenor, AGU Annual Meeting sessions titled, “Extreme Events and Hydrological Hazards During the Holocene and Common Era” in Washington, DC, USA.
- 2024 Co-organizer, Palaeo-Hydrology: Ancient Disasters, Modern Application (PHADMA) Workshop (international working group) at Vrije Universiteit Amsterdam, in Amsterdam, Netherlands.
- 2022 Co-convenor, AGU Annual Meeting session titled, “Extreme Events and Hydrological Hazards During the Holocene and Common Era” in Chicago, IL, USA.

PRESENTATIONS

Invited Talks

- 2023 *Holocene paleo-records reveal pre-conditioning factors for extreme floods*. International Association of Geomorphologists Webinar – North America.
- 2022 *Big decisions with too little data: using paleo-perspectives to understand extreme floods*. December American Meteorological Society/ National Weather Association-Memphis Meeting.
- 2022 *From Particles to Plans: How Flood Sediment Inform Flood Risk Management*. The University of Memphis, Department of Physics and Materials Science Fall 2022 Colloquium Series.
- 2021 *Old Sediments Given New Insight into Extreme Floods*. Dr. Dorothy Merritt’s Geomorphology Seminar, Franklin & Marshall College.

Conference Abstracts

- 2023 Eminue*, M., Davis, M. A. L., **LOMBARDI, R.** (Poster) Analysis of Holocene Flood Variability in the Clinch River, Tennessee. Poster presented at the American Geophysical Union Conference, San Francisco, California. December 10, 2023.

- 2023 **LOMBARDI, R.**, Davis, M. A. L., Yaw, M., Jawdy, C. (Oral) Paleofloods provide insight into extreme flood risk on the Lower Tennessee River. Tennessee Water Resources Symposium. April 12-14, 2023.
- 2023 Gutierrez*, B., Davis, M. A. L., **LOMBARDI, R.**, Gage, M (Poster) Using natural flood records to understand flood variability over long timescales. Tennessee Water Resources Symposium. April 12-14, 2023.
- 2023 Butler*, E. Davis, M. A. L., **LOMBARDI, R.**, Gage, M (Poster) Understanding watershed history through a microsedimentological analysis of floodplain sediments in the Ocoee River, Tennessee. Tennessee Water Resources Symposium. April 12-14, 2023.
- 2023 **LOMBARDI, R.**, Davis, M. A. L., Harden, T., England, J. (Paper). Testing new approaches to integrating sediment-based floods records into flood frequency models. 8th Annual Probabilistic Flood Hazard Assessment Research Workshop, Virtual, March 21-24, 2023.
- 2022 **LOMBARDI, R.**, Davis, L (Paper). Identifying extreme flood drivers during abrupt shifts in climate using field-based investigations & event coincidence analysis in the Tennessee River Basin, USA. Fall Meeting of the American Geophysical Union. December 12-16, Chicago, IL.
- 2022 Davis, M. A. L., **LOMBARDI, R.** (Poster). Advancing quantitative paleoflood hydrologic methods for extreme flood reconstruction in alluvial rivers. Fall Meeting of the American Geophysical Union. December 12-16, Chicago, IL.
- 2022 Davis, M. A. L., **LOMBARDI, R.**, Gage, M (Paper). High and dry: extreme floods and droughts in the French Broad River, Tennessee. Southeastern Division of the American Association of Geographers Annual Meeting. November 19-22, Atlanta, GA.
- 2022 Davis, M. A. L., **LOMBARDI, R.**, Quimby, A.C., Gage, M. (Paper) A new procedure for estimating paleodischarges in alluvial rivers for quantitative paleoflood hydrologic analyses. Annual Meeting of the American Association of Geographers, Virtual, Feb 25, 2021.
- 2022 **LOMBARDI, R.**, Davis, M. A. L. (Paper) Strategies for Integrating Alluvial Paleoflood Data into Flood Frequency Analyses. American Water Resources Association 2022 Spring Conference: Water Risk Under a Rapidly Changing World – Evaluation and Adaption Program. April 25-27 Tuscaloosa, AL.
- 2022 Davis, M. A. L., **LOMBARDI, R.**, Gage, M., Quimby, A.C. (Paper) Sediments Reveal a 5,700-year Record of Extreme Floods in the Lower Tennessee River Valley and Yield New Insights into Extreme Flood Frequency. American Water Resources Association 2022 Spring Conference: Water Risk Under a Rapidly Changing World – Evaluation and Adaption Program. April 25-27 Tuscaloosa, AL.
- 2022 Quimby, A. C., Davis, L, **LOMBARDI, R.** (Paper) Extreme Floods in the Upper Tennessee River. American Water Resources Association 2022 Spring Conference: Water Risk Under a Rapidly Changing World – Evaluation and Adaption Program. April 25-27, Tuscaloosa, AL.
- 2022 **LOMBARDI, R.**, Davis, L, Gage, M (Paper). Abrupt Climate Change and Flood Response in the Tennessee River Valley. Annual Meeting of the American Association of Geographers, Virtual, Feb 25, 2021.
- 2021 **LOMBARDI, R.**, Davis, M. A. L., England, J.F., Harden, T. (Paper) Perception is Everything: Revisiting paleoflood hydrological concepts for alluvial rivers. Fall Meeting of the American Geophysical Union, December 13-17, 2021. New Orleans, LA.
- 2021 **LOMBARDI, R.**, Davis, M. A. L. (Paper) How much data is enough for estimating extreme flood risk? A sensitivity analysis of flood frequency curves and paleoflood data. Annual Meeting of the American Association of Geographers, Virtual, April 8, 2021.
- 2021 **LOMBARDI, R.**, Davis, M. A. L. (Poster) A Tale of Two Cores: Investigating the Impact of Alluvial Flood Deposition on Flood Frequency and Magnitude Reconstruction. 6th Annual Probabilistic Flood Hazard Assessment Research Workshop, Virtual, February 22-25.

- 2020 **LOMBARDI, R.**, Davis, M. A. L. (Poster) A Tale of Two Cores: Investigating the Impact of Alluvial Flood Deposition on Flood Frequency and Magnitude Reconstruction. Fall Meeting of the American Geophysical Union, December 9, 2020.
- 2019 **LOMBARDI, R.**, Davis, M. A. L., Elliot, E.A., Therrell, M.D. (Poster). Trans-Atlantic Paleoflood Frequency and Magnitude in the Common Era: When, where, and why do extreme floods occur? Fall Meeting of the American Geophysical Union. December 9-13, San Francisco, CA.
- 2019 **LOMBARDI, R.**, Davis, M. A. L. (Paper). Extreme floods on the middle Tennessee River. Southeastern Division of the American Association of Geographers Annual Meeting. November 24-25, Wilmington, NC.
- 2019 **LOMBARDI, R.**, Davis, M. A. L., Stinchcomb, G., Stewart, L., Therrell, M.D., Munoz, S. (Poster) A regional synthesis of fluvial activity in major river basins of the eastern U.S. during the Holocene. American Association of Geographers Annual Meeting. April 6-10, Washington, DC.
- 2018 **LOMBARDI, R.**, Davis, M. A. L., Stewart, L., Stinchcomb, G., Forman, S., Leigh, D. (Paper). Sedimentological and Geochemical Differences in Sediment Cores from the Same Relict Terrace Surface: Implication for Paleoflood Reconstruction. Southeastern Division of the American Association of Geographers Annual Meeting, November 18-19, Johnson City, TN.
- 2018 **LOMBARDI, R.** (Paper). A Meta-analysis of Holocene Fluvial Activity in the Southeastern U.S. American Association of Geographers Annual Meeting. April 10-14, New Orleans, LA.
- 2017 **LOMBARDI, R.** (Paper). Gradient-Based Flood Map: A science-based policy alternative to the 100-year flood zone. Alabama Water Resources Conference. September 6-8, Orange Beach, AL.
- 2017 Davis, M. A. L., Stinchcomb, G., **LOMBARDI, R.**, Stewart, S., Therrell, M.D., (Poster) A regional paleoflood analysis for the eastern U.S., implication for extreme flood frequency. American Association of Geographers Annual Meeting. March 5-9, Boston, MA.
- 2016 Davis, M. A. L., Stinchcomb, G., Gage, M., Sherwood, S., **LOMBARDI, R.** (Poster) Locating Paleoflood Deposits in Eastern Rivers. 5th International Paleoflood Conference. September 12-15, Rapid City, SD.
- 2015 **LOMBARDI, R.**, Gee, K., Garcia, J. (Poster) Spatial Analysis of Potential Risk Factors Associated with Addition of Atlantic Coast Pipeline through Virginia. Office of Geographic Information System and Remote Sensing Research Symposium. April 10, Blacksburg, VA.

MENTORSHIP

Thesis Chair

Cristina Leschhorn, University of Memphis (expected December 2024). Master's Thesis: *Holocene Paleofloods and Land-Use Legacies in the Ocoee River Region*.

Committee Member

Bryan Gutierrez, The University of Alabama (expected May 2025). Master's Thesis: *Exploring Long-Term Flood Variability in the Lower French Broad River Using Fluvial Paleoflood Hydrology*.

Megan Purvis, University of Memphis (expected May 2025). Master's Thesis: *Stable Oxygen Isotopes in the Memphis Aquifer to Understanding Past Precipitation Trends*.

Mary Eminue, The University of Alabama, Graduated August 2024. Master's Thesis: *A Microsedimentological Analyses of Holocene Flood Variability in The Clinch River, Tennessee*.

SERVICE (**Departmental and University Roles)

- 2024 - Undergraduate Advisor for Earth Sciences majors with concentration in Geography**
- 2023 - Early-Career Liaison, Flood Working Group Steering Committee, Past Global Changes (PAGES) Committee Member, College of Arts and Sciences Strategic Plan, Goal 4: Research**
- 2023 - Founder and organizer of 'GeomorFORUM' which supports networks and starts interdisciplinary research collaboration involving earth surface processes

- 2019 - 2021 Student Representative to the Paleoenvironmental Change (PEC) Awards Committee within the American Association of Geographers
- 2017 - 2019 Department of Geography Graduate Student Representative to the University of Alabama Graduate Student Association
- 2017 - 2018 Secretary of Association of Women in Science – UA Affiliate Group

MANUSCRIPT REVIEWER

Climatic Change	International Journal of Earth Sciences
Geomatics, Natural Hazards and Risk	Quaternary Science Reviews
Global and Planetary Change	Science Advances

PUBLIC MEDIA OUTREACH

Co-author, “Record low water levels on the Mississippi River in 2022 show how climate change is altering large rivers.” *The Conversation* December 14, 2022. <https://theconversation.com/record-low-water-levels-on-the-mississippi-river-in-2022-show-how-climate-change-is-altering-large-rivers-193920>