

Hannah K. Friedrich
hfriedrich@arizona.edu
hannahkfriedrich.com
+1(320)828-1703

Education

Ph.D., Geography

University of Arizona, August 2021 - May 2026 (expected)
Dissertation: *The Covered: Geographic Disparity in Insurance Litigation and Hurricane Recovery in Southwest Louisiana*
Doctoral Committee: Beth Tellman (chair), Laura Bakkensen, Alessandra Jerolleman, Jason Jurjevich & Mark Kear

M.S., Geography

Oregon State University, 2019
Thesis: *Breaking Ground: Automating the Detection of Refugee Settlement Establishment and Growth through Landsat Time Series Analysis with a Case Study in Northern Uganda*
Master's Chair: Jamon Van Den Hoek

B.A., Geography (Honors) and Cartography & Geographic Information Systems

University of Wisconsin-Madison, 2015
Advisor: Matthew Turner

Publications

Peer-Reviewed Articles

- Kousky, C. and **Friedrich**, H. K. 2025. What is the Future of State-Created Insurance Programs? *Journal of Catastrophe Risk and Resilience*, 03(01). [10.63024/dark-46q8](https://doi.org/10.63024/dark-46q8)
- Friedrich**, H. K., Ayala, Y., Liu, J., & Villarreal, M. (2025). Positionalities in disaster recovery research: Reflections from fieldwork across the Gulf South. *Disaster Prevention and Management*, 1–12. <https://doi.org/10.1108/DPM-07-2024-0192>
- Maldonado, J., Peterson, K., Laska, S., Domingue, S., **Friedrich**, H. K., Lesen, A., Parfait-Dardar, S., & Robertson, C. (2025). Converging together to confront multiple intersecting and cascading disasters: A network of mutual aid approach. *Disaster Prevention and Management: An International Journal*, 1–18. <https://doi.org/10.1108/DPM-06-2024-0161>
- Friedrich**, H. K., Tellman, B., Sullivan, J. A., Saunders, A., Zuniga-Teran, A. A., Bakkensen, L. A., Cawley, M., Dolk, M., Emberson, R. A., Forrest, S. A., Gupta, N., Gyawali, N., Hall, C. A., Kettner, A. J., Lozano, J. L. S., & Bola, G. B. (2024). Earth Observation to Address Inequities in Post-Flood Recovery. *Earth's Future*, 12(2). <https://doi.org/10.1029/2023ef003606>
- Bartlett, A., Alix-García, J., Abarca, A., Walker, S., Van Den Hoek, J., Murillo-Sandoval, P., & **Friedrich**, H. K. (2024). The unintended consequences of production bans: the case of the 2018 Kenya logging moratorium. *Environmental Research Letters*, 19(9). <https://doi.org/10.1088/1748-9326/ad661c>
- Pesaresi, M., Schiavina, M., Politis, P., Freire, S., Krasnodębska, K., Uhl, J. H., Carioli, A., Corbane, C., Dijkstra, L., Florio, P., **Friedrich**, H. K., Gao, J., Leyk, S., Lu, L., Maffenini, L., Mari-Rivero, I., Melchiorri, M., Syrris, V., Van Den Hoek, J., & Kemper, T. (2024). Advances on the Global Human Settlement Layer by joint assessment of Earth Observation and population survey data. *International Journal of Digital Earth*, 17(1). <https://doi.org/10.1080/17538947.2024.2390454>
- Sullivan, J. A., **Friedrich**, H.K., Tellman, B., Saunders, A. and Belury, L. (2024), Five key needs for addressing flood injustice, *Eos*, 105, <https://doi.org/10.1029/2024EO240068>.

- Flores, A. B., Sullivan, J. A., Yu, Y., & **Friedrich**, H. K. (2024). Health Disparities in the Aftermath of Flood Events: A Review of Physical and Mental Health Outcomes with Methodological Considerations in the USA. *Current Environmental Health Reports*, 11(2), 238–254. <https://doi.org/10.1007/s40572-024-00446-7>
- Bennett, M. M., Gleason, C. J., Tellman, B., Alvarez Leon, L. F., **Friedrich**, H. K., Ovienmhada, U., & Mathews, A. J. (2024). Bringing satellites down to Earth: Six steps to more ethical remote sensing. *Global Environmental Change Advances*, 2. <https://doi.org/10.1016/j.gecadv.2023.100003>
- Walker, S., Alix-Garcia, J., Bartlett, A., Van Den Hoek, J., **Friedrich**, H. K., Murillo-Sandoval, P. J., & Isoto, R. (2023). Overlapping land rights and deforestation in Uganda: 20 years of evidence. *Global Environmental Change*, 82. <https://doi.org/10.1016/j.gloenvcha.2023.102701>
- Van Den Hoek, J., **Friedrich**, H. K., Ballasiotes, A., Peters, L. E., & Wrathall, D. (2021). Development after Displacement: Evaluating the Utility of OpenStreetMap Data for Monitoring Sustainable Development Goal Progress in Refugee Settlements. *ISPRS International Journal of Geo-Information*, 10(3), 153. <https://doi.org/10.3390/ijgi10030153>
- Van Den Hoek, J., & **Friedrich**, H. K. (2021). Satellite-Based Human Settlement Datasets Inadequately Detect Refugee Settlements: A Critical Assessment at Thirty Refugee Settlements in Uganda. *Remote Sensing*, 13(18), 3574. <https://doi.org/10.3390/rs13183574>
- Friedrich**, H. K., & Van Den Hoek, J. (2020). Breaking ground: Automated disturbance detection with Landsat time series captures rapid refugee settlement establishment and growth in North Uganda. *Computers, Environment and Urban Systems*, 82, 101499. <https://doi.org/10.1016/j.compenvurbsys.2020.101499>

Peer-reviewed articles in-revision

- Friedrich**, H.K., Tellman, B., Jurjevich, J.R., Kear, M., Bakkensen, L. (*Submitted: March 2025*). Do battle with insurance”: post-hurricane insurance litigation in Southwest Louisiana. *RSF: The Russell Sage Foundation Journal of the Social Sciences*.
- Friedrich**, H.K., Aggarwal, E., Buijs, S. L., Chakraborty, S., Hall, C.A., Hu, Y., and Tellman, B. (*Submitted: June 2025*). Earth Observation for Recovery from Hydrometeorological Hazards. *Water Security*.
- Mukherjee, R., **Friedrich**, H.K., Tellman, B., Islam, A., Zhang, Z., Giezendanner, J., Lall, U., & Lakshmi, V. (*Submitted: April 2025*). Urban Flood Observations (UFO): A hand-labeled training and validation dataset of post-flood inundation. *Scientific Data*.

Peer-reviewed articles in-review

- Bakkensen, L.A. & **Friedrich**, H.K. (*Submitted: October 2025*). Flooding, Housing Prices, and Insurance: Evidence from the United States. *Annual Review of Resource Economics*

Book Chapters

- Van Den Hoek, J., & **Friedrich**, H. K. (2024). Humanitarian Applications. In J. A. Cardille, M. A. Crowley, D. Saah, & N. E. Clinton (Eds.), *Cloud-Based Remote Sensing with Google Earth Engine: Fundamentals and Applications* (pp. 805-832). Springer International Publishing. https://doi.org/10.1007/978-3-031-26588-4_38

Technical reports

- Kousky, C., Zinda, J. A., **Friedrich**, H. K., Burley, T., & Kang, K. (2025). *Driving Loss Reduction Through State-Created Insurance Markets of Last Resort*. Environmental Defense Fund. <https://library.edf.org/AssetLink/v71028dx0x68g22mj067j2kw411s28nj.pdf>
- Figueredo Thomson, M.E, Pattison, C.R., Agrawal, A., Erbaugh, J.T., **Friedrich**, H.K, Heinz, S.R., & Gutierrez Hernandez, L.S. (2023). *The Climate Change and Conflict Nexus in West Africa: A New Approach for Operationally Relevant Vulnerability Assessments*. World Bank Group. <http://documents.worldbank.org/curated/en/099184003162387055>

- Degagne, R., Pizzino, D., **Friedrich**, H. K., Gough, M., Joseph, G., Iovanna, R., Smith, C., & Stritholt, J. (2022). *Mississippi CRP Forest Remote Sensing with Preliminary Global Ecosystem and Dynamics (GEDI) Mission Derived Data Products*. Conservation Biology Institute. <https://doi.org/10.6084/m9.figshare.19142147>
- Degagne, R., Pizzino, D., **Friedrich**, H. K., Gough, M., Joseph, G., Iovanna, R., Smith, C., & Stritholt, J. (2021). *Mapping Conservation Reserve Program Grasslands in Washington, Kansas, and Colorado with Remote Sensing and Machine Learning*. Conservation Biology Institute. <https://doi.org/10.6084/m9.figshare.19141853>

Conference Papers

- Van Den Hoek, J., Wrathall, D., & **Friedrich**, H.K. (2021). A Primer on Refugee-Environment Relationships. Background paper for the Contribution to Population-Environment Research Network (PERN) Cyberseminar, “Refugee and internally displaced populations, environmental impacts and climate risks” (10-18 May 2021).

Non-Refereed Blogs

- Friedrich, H. K. (2024). “Home will always be there: afterlives of hurricane recovery and community engagement.” Climate Assessment for the Southwest. <https://climas.arizona.edu/news/home-will-always-be-there-afterlives-hurricane-recovery-and-community-engagement>
- Friedrich, H. K. (2023). “Mapping tarps and stories to spotlight inequitable disaster recovery.” Climate Assessment for the Southwest. <https://climas.arizona.edu/blog/mapping-tarps-and-stories-spotlight-inequitable-disaster-recovery>

Grants and Fellowships

Principal Investigator

- Future Investigators in NASA Earth and Space Science and Technology Grant (\$150,000)
 NSF Human-Environment and Geographical Sciences Dissertation Research Improvement Grant (\$12,060)
 NSF Law and Science Dissertation Grant (\$18,034)
 University of Arizona College of Social & Behavioral Sciences Summer Dissertation Fellowship (\$5,750)
 Russell Sage Foundation 2024 Dissertation Research Grant (\$10,000)
 Society of Women Geographers 2024-25 Evelyn L. Pruitt Fellowship for Dissertation Research (\$4,800)
 Climate Assessment for the Southwest 2023-2024 Environment & Society Fellowship (\$4,750)
 University of Arizona Social & Behavioral Sciences Research Institute Pre-doctoral Grant (\$500)
 University of Arizona Graduate Professional Student Council
 - Research and Project Grant Spring 2022 (\$1,500)
 - Research and Project Grant Fall 2023 (\$1,500)
 - Travel Grant Spring 2022 (\$1,500)
 University of Wisconsin-Madison Senior Honors Thesis 2016 Research Grant (\$3,000)

Co-Investigator

- University of Arizona Graduate Professional Student Council Professional Opportunities Development Grant Spring 2023 (\$1,500)
 Arizona Institute for Resilience International Programs Working Group 2022-2023 (\$15,000)
 Cornell Center for Social Sciences 2024 Research Grant (\$12,000)

Contributor

- Environmental Defense Fund – Cornell Atkinson Center for Sustainability Innovation for Impact 2024 Grant for “Public Risk Pooling: Opportunities to Drive Climate Adaptation” (\$71,600)
 National Oceanic and Atmospheric Administration Climate Resilience Regional Challenge 2024-2029 Grant for “Southwest Louisiana and Central Acadiana Resilient Future” (\$1,998,800)

Awards

Dr. Maria Teresa Velez – Marshall Foundation Dissertation Scholarship Spring 2026 (\$10,833)
American Association of Geographers Legal Geography Specialty Group 2025 Graduate Student Presentation Award (\$150)
University of Arizona SGDE 2025 Summer Writing Award (\$2,500)
Carson Scholars Program Rafe Sagarin Travel Award (\$1,500)
North American Alliance of Hazards and Disaster Research Institutes Rising Star Award (\$500)
Natural Hazards Engineering Research Infrastructure Graduate Student Council Travel Award (\$800)
University of Arizona 2023 Research Data Challenge (\$1,000)
Women in Data Science Tucson 2022 Speaker Award (\$100)
Oregon State University Arthur Parenzin 2019 Fellowship Award (\$500)
Barbara Petchenik 2015 Undergraduate Award in Cartographic Design (\$250)

Research Experience

Research Intern, Cornell University
June 2024 – August 2025 / Ithaca, New York

Graduate Research Assistant, University of Arizona
August 2021 – August 2022 / Tucson, Arizona

Graduate and Faculty Research Assistant, Oregon State University
January 2018 – June 2021 / Corvallis, Oregon

Undergraduate Research Assistant, University of Wisconsin-Madison
June 2014 – December 2015 / Madison, Wisconsin

Professional Experience

Geospatial Analyst (Short-term Contract), The World Bank
November 2020 – August 2021 / Remote

Geospatial Analyst, Conservation Biology Institute
January 2020 – May 2021 / Corvallis, Oregon

Mapping Analyst, Cruise Automation
February– August 2017 / San Francisco, California

Earth Science Contractor, Science Systems and Applications Inc., NASA DEVELOP
September - November 2016 / Ames Research Center, Mountain View, California

GIS Analyst, Fehr & Peers
January - July 2016 / Oakland, California

Science and Policy Professional Development

American Geophysical Union Voices for Science: Participant (2024)
University of Arizona Carson Scholars Program: Scholar (2022-2023)

Conference Participation

Conference Organization
2023 Flood Justice Symposium. University of Arizona, Tucson, Arizona.

2022 Side Meeting on “Flood Recovery and Adaptation from Space.” Global Flood Partnership Annual Meeting, Leeds, United Kingdom.

Contributed Research Presentations

- 2025 1) “Bringing legal geography to post-disaster recovery.” American Association of Geographers (AAG) Annual Meeting.
2) “The Uneven Legal Geography and Everyday Legal Encounters of Post-disaster Recovery.” Law and Society Association Annual Meeting.
- 2024 1) “Coupling Remotely Sensed Blue Tarps and Resident Narratives to Track Interrogate Uneven Recovery.” American Geophysical Union (AGU) Fall Meeting. (**Friedrich**, Tellman).
2) “Earth observation of post-disaster recovery: taking stock and recommendations.” AGU Fall Meeting. (**Friedrich**, Tellman, Sullivan, Saunders, Bakkensen, Cawley, Dolk, Emberson, Forrest, Gupta, Gyawali, Hall, Kettner, Sanchez Lozano, Bola, Aggarwal, Buijs, Chakraborty, Hu).
3) “Remotely Sensed Blue Tarps and Resident Narratives to Triangulate Hurricane Recovery Gaps.” Natural Hazards Workshop Researchers Meeting. (**Friedrich**, Tellman). ([link](#).)
- 2023 1) “Mapping blue tarps to document inequities in disaster recovery and prioritize resilient rebuilding.” Society for Applied Anthropology Annual Meeting.
2) “Satellite imaging of roof blue tarps over recovery time.” Association for Humanist Sociology Annual Meeting
- 2022 1) “Urban Flood Dataset: A globally representative satellite-based labeled dataset of flooding in urban settings.” AGU Fall Meeting. (**Friedrich**, Tellman, Mukherjee, Zhang, Giezendanner, Lakshmi, Lall). ([link](#).)
2) “Satellite image detection of blue roofs to monitor coastal storm damage and recovery.” AGU Fall Meeting. (**Friedrich**, Tellman, Mukherjee). ([link](#).)
3) “Understanding flood risk from space: opportunities to adapt to changing risk.” AGU Fall Meeting. (Tellman, Chakrabarti, Doyle, Sullivan, Frame, Mukherjee, **Friedrich**, Giezendanner, Zhang, Wang, Policelli, Lawal). ([link](#).)
4) “Flooding in the desert: Assessing the value of satellite observations of inundation from the North American Monsoon with the Pima County Regional Flood Control District.” AGU Fall Meeting. (Tellman, Maitz, Giezendanner, **Friedrich**, Mukherjee, Demaria). ([link](#).)
5) “Satellite Imagery Detection of Blue Roofs to Map Flood Damage and Recovery.” Natural Hazards Workshop Researchers Meeting. (**Friedrich**, Tellman). ([link](#).)
6) “Satellite imagery detection of blue roofs to map flood damage and recovery.” Frontiers in Hydrology. (**Friedrich**, Tellman). ([link](#).)
7) “Model comparison to evaluate the added value of commercial high-resolution satellite imagery for urban flood detection.” Frontiers in Hydrology. (**Friedrich**, Tellman, Mukherjee, Lakshmi, Lall, Kruczakiewicz, Gentine). ([link](#).)
8) “Surface water detection from passive microwave and optical data using deep learning.” Frontiers in Hydrology. (Mukherjee, Tellman, **Friedrich**, Lakshmi, Lall, Gentine, Kruczakiewicz). ([link](#).)
9) “Cross-sensor data-fusion to improve flood maps and lengthen time series: applications in Bangladesh and for index insurance.” Frontiers in Hydrology. (Tellman, Lall, Giezendanner, Islam, Mukherjee, Bhuiyan, Gurung, Melancor, **Friedrich**, Thomas, Mauerman). ([link](#).)
- 2021 1) “Toward mapping flood impacts in urban areas using multi-sensor satellite data fusion.” AGU Fall Meeting. (**Friedrich**, Tellman, Mukherjee, Gentine, Lakshmi, Lall, Kruczakiewicz, Keene, Colon, Ofek). ([link](#).)
2) “Expanding the Humanitarian Horizon: On the Application Readiness of Geospatial Data for Systematic, Anticipatory Analysis of Climate Change Impacts in the World’s Refugee Camps.” AGU Fall Meeting. (Van Den Hoek, **Friedrich**). ([link](#).)

- 2020 1) "Breaking Ground: Automating the Detection of Refugee Settlement Establishment and Growth through Landsat and PlanetScope Time Series Analysis with a Case Study in Northern Uganda." AAG Annual Meeting. ([link](#))
 2) "Mapping landscapes of the displaced: Automating land cover change detection with multi-sensor satellite time series at internally displaced people (IDPs) settlements in Ethiopia." AGU Fall Meeting. (Van Den Hoek, **Friedrich**). ([link](#))
- 2019 1) "Remote sensing time series analysis for monitoring agriculture to assess food security and temporality of settlements of internally displaced peoples (IDPs)." AAG Annual Meeting. ([link](#))
 2) "Breaking Ground: Automating the Detection of Refugee Settlement Establishment and Growth through Landsat and PlanetScope Time Series Analysis with a Case Study in Northern Uganda." AGU Fall Meeting. (**Friedrich**, Van Den Hoek). ([link](#))
 3) "How can HOT data, machine learning and crowd-sourced data improve refugee and IDP settlements?" Humanitarian OpenStreetMap Team Summit.
 4) "Development after Displacement: Using OSM data to measure SDG indicators at informal settlements." State of the Map. (Van Den Hoek, **Friedrich**, Ballasiotes, Wrathall). ([link](#))

Conference Panel Organization and Facilitation

- 2025 1) "Disaster Recovery through a Geographic Lens 1: Vulnerability & Equity in Recovery." AAG Annual Meeting. *Session Chair and Co-Organizer*.
 2) "Disaster Recovery through a Geographic Lens 2: Return, Relocation & Adaptation in Recovery." AAG Annual Meeting. *Session Chair and Co-Organizer*.
- 2024 1) "Earth Observation for Disaster Recovery and Risk Reduction." AGU Fall Meeting. *Session Chair*.
 2) "Narratives of Resilience: Storytelling in Disaster Research." Natural Hazards Workshop Researchers Meeting. *Facilitator*.
 3) "Housing Recovery and Resilience." Natural Hazards Workshop Researchers Meeting. *Moderator*.
- 2023 "An Early Career Panel on the Limits and Reforms of Insurance under Shifting Climate Risk." At What Point Managed Retreat? Habitability and Mobility in an Era of Climate Change Conference. *Session Co-Convener*.

Workshop Participation

- 1) Law and Society Association Early Career/Graduate Student Workshop, May 2025.
- 2) Explorations in Critical Legal Geographies Winter School, Verona, Italy, January 2025.
- 3) Workshop on Disentangling the relationships between race, property and climate finance, Frankfurt, Germany, October 2024.

Invited Research Talks

- 2024 *Earth observation for disaster recovery*. Jacksonville State University Geography Colloquium.
- 2023 1) *Resilient recovery is community-defined*. University of Arizona Institute of Resilience Perspectives on Resilience.
 2) *Blue tarps and blue pixels: tracking post-hurricane recovery from space*. Arizona State University, Equitable Places Lab Group.
 3) FEMA Resilient Nation Partnership Network, Next Generation of Resilience: Voices of the Future April 2023 Student Showcase.
- 2022 1) *Satellite image detection of blue roofs to map coastal storm damage and recovery*. Center for Climate Adaptation Science and Solutions Climate Resilience and Adaptation Lightning Talks.
 2) *Disaster recovery*. Arizona Institute of Resilience International Programs Event Series
 3) *Satellite imagery detection of blue roofs to track disaster recovery*. University of North Carolina, Miyuki Hino Lab Group.

2021 *Satellite image analysis for anticipatory research and planning at flood-prone informal settlement.*
Symposium on Resilience Research for Global Development Challenges.

Invited Guest Lectures

- 2025 *Practicing legal geography in post-disaster settings.* Loyola University New Orleans College of Law, Advanced Legal Research: Community-Based Research Lab.
- 2023 1) *The covered: mapping and recording experiences of disparities in hurricane recovery and insurance.* University of California – Santa Barbara, Environmental Studies 130A.
2) *Remote sensing to track disasters and recovery.* i) York University, Disaster & Emergency Management Program. ii) Hull University, Flood Risk Management Program.
- 2022 *Satellite image detection of blue roofs to track disaster recovery.* Cornell University, Global Development 3140.

Teaching

Teaching Assistant

- Graduate Teaching Assistant, Oregon State University
eGEOG 560: GIScience I: Introduction to Geographic Information Science (2017)
eGEOG 561: GIScience II: Analysis and Applications (2018)
eGEOG 203: People-Environment Geography (2018)
GEOG 481/581: Remote Sensing II: Digital Image Processing (2019)

Curriculum and Workshop Design

- NASA Applied Remote Sensing Training Program (ARSET): Humanitarian Applications Using NASA Earth Observations (2-parts; [link](#))
Co-developed lab assignments for GEOG 330: Introduction to Remote Sensing course at the University of Arizona (fall 2022)

Service and Outreach

University of Arizona Service

- School of Geography, Development and Environment Director Search Committee: Student (2022)
Graduate and Professional Student Council: Grant Reviewer (2022-2023)

Outreach Activities

- Water Justice Knowledge Exchange: Co-Organizer (2023-present)
Disaster Justice Network: Volunteer Member (2022-present)
National Low-Income Housing Coalition Disaster Housing Recovery Group: Member (2023-present)

Student Mentoring

- University of Arizona: Advised students on image analysis data creation tasks (2021-2024)
McNeese State University: Coordinated activities for student shadowing of environmental justice Leaders for PHIL 255: Environmental Ethics (2024) and advised students on image analysis data creation tasks (2023-2024)

Professional Affiliations

- Student Member: American Association of Geographers (AAG), American Geophysical Union (AGU), Society of Women Geographers (SWG), Law and Society Association (LSA), Socio-Legal Studies Association (SLSA)

Manuscript Reviewer

Nature Sustainability (2024)

Communications Earth and Environment (2025)

International Journal of Disaster Risk Reduction (2025)

Technical Skills

Programming: Python

GIS Software: QGIS, ArcGIS

Image Analysis: Google Earth Engine

Statistical Software: R, Stata

Qualitative Data Analysis: ATLAS.ti