BEICHEN ZHANG

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PERSONAL PROFILE

Ph.D. candidate at the University of Nebraska-Lincoln specializing in the study of climate extremes, drought impacts on society, agriculture, forest, and human health, with over 7 years of experience in geoinformatics (including advanced remote sensing, GIS, and geospatial analysis) and applied climatology. Skilled in data science, with 5+ years of expertise in machine learning and deep learning techniques using Python and R, evidenced by published research in top-tier journals/conferences. Demonstrated proficiency in developing innovative tools and models to address complex climatic challenges.

EDUCATION

Ph.D. in Natural Resource Sciences, University of Nebraska-Lincoln   Expected Spring/Summer 2024
Specialized in Climate Assessment and Impacts, minor in Statistics
Dissertation topics: Monitoring and Assessing Drought Impacts using Machine Learning

M.S. in Natural Resource Sciences, University of Nebraska-Lincoln   2017 - 2019
Specialized in Climate Assessment and Impacts
Thesis: Investigation of GRACE-derived Information on Forest Drought Stress Across the Contiguous U.S

B.S. in Geographic Information Science, Northwest A&F University (Yangling, China)   2013 - 2017

RESEARCH EXPERIENCE

Graduate Research Assistant   August 2022 - Present
Daugherty Water for Food Global Institute, Lincoln, NE

- Awarded a research fellowship for collaborative projects on climate extremes and health-related mortality. Partnered with environmental health and biostatistics researchers at University of Nebraska Medical Center.

- Leading a study on drought impacts across hydrological processes, applying structural equation modeling to analyze potential associations between cardiovascular and respiratory mortality and multiple drought indices. The preliminary work was presented at AGU 2023.

- Initiating a reinforcement learning project to explore flood-human activity interactions, aiming to optimize urban and nature conservation area development. Developing a simulation environment and testing advanced RL models. The preliminary work was presented at AGU 2023.

Research Intern   June 2022 - August 2022
Frontier Development Lab USA (Funded by NASA and DOE), Mountain View, CA

- Principal researcher in an interdisciplinary team on wildfire analysis via high-resolution multispectral remote sensing datasets and deep learning. Developed FireCLR, a self-supervised model, for enhanced burned area detection and severity assessment, adapting contrastive learning techniques. Results were accepted at NeurIPS 2022 workshop and showcased at FDL Research and GitHub repository.

Graduate Research Assistant   August 2019 - Present
National Drought Mitigation Center, Lincoln, NE

- Conducting a novel study on climate extremes and social unrest in South Asia, utilizing demographic and remotely sensed data to examine the causal relationship between drought/extremely wetness and the protest frequency. The preliminary work was presented at AGU 2022.

- Led a multi-dimensional drought impact study, leveraging natural language processing models to analyze social media, news, and crowdsourced data, predicting public awareness and impacts of drought events and analyzing their spatial and temporal patterns. Preliminary findings were accepted at ICML 2021 workshop and pre-printed on arXiv. The manuscript of journal article is in progress.

- Developed an explainable machine learning pipeline to predict and assess comprehensive drought impacts across social sectors and ecosystems, applying XGBoost and SHAP on the drought indicators and environmental factors. Preliminary findings were accepted at NeurIPS 2020 workshop and pre-printed on arXiv. The complete work was published in *Science of The Total Environment*.

- Contributed as a core researcher to a USDA project developing the operational forest drought response index (ForDRI). Fully participated in building a data-mining pipeline to calculate the index via remote sensing and hydrometeorological datasets and evaluate the index via tree ring width and Bowen ratio, resulting in publication in *Remote Sensing*.

TEACHING EXPERIENCE

Applications of Remote Sensing in Agriculture and Natural Resources, lab instructor   Jan 2022 - May 2022

- Instructed on the application of remote sensing for vegetation and ecosystem monitoring. Covered multispectral and hyperspectral image analysis techniques using ENVI and ERDAS Imagine software, emphasizing practical applications in agriculture and natural resource management.

Introduction to Remote Sensing, lab instructor   Aug 2021 - Dec 2021

- Taught fundamental concepts and mechanisms of remote sensing, including hands-on experiments on reflectance measurement and data processing with ENVI and ERDAS Imagine. Focused on engaging students in active learning through practical experiments and real-world applications.

Introduction to Geospatial Technologies, lab instructor   Aug 2019 - May 2021

- Led laboratory sessions on the use of ArcGIS software suite, including ArcMap and ArcGIS Online, for processing and analyzing geospatial datasets. Introduced students to GIS principles and applications, fostering skills in spatial analysis and geospatial data visualization.

PUBLICATIONS

Peer-reviewed Articles

Zhang, B., Salem, F. K. A., Hayes, M. J., Smith, K. H., Tadesse, T., & Wardlow, B. D. (2023). Explainable machine learning for the prediction and assessment of complex drought impacts. *Science of The Total Environment*, 165509.

Zhang, B., Wang, H., Alabri, A., Bot, K., McCall, C., Hamilton, D., & Růžička, V. (2022). Unsupervised wildfire change detection based on contrastive learning. *NeurIPS Workshop on Artificial Intelligence for Humanitarian Assistance and Disaster Response.* [Workshop Preprint]

Zhang, B., Schilder, F., Smith, K., Hayes, M., Harms, S., & Tadesse, T. (2021). TweetDrought: A deep-learning drought impacts recognizer based on Twitter data. *ICML Workshop on Tackling Climate Change with Machine Learning.* [Workshop Preprint]

Zhang, B., Abu Salem, K. F., Hayes, M., & Tadesse, T. (2020). Quantitative assessment of drought impacts using XGBoost based on the Drought Impact Reporter. *NeurIPS Workshop on Tackling Climate Change with Machine Learning.* [Workshop Preprint]

Tadesse, T., Hollinger, D. Y., Bayissa, Y. A., Svoboda, M., Fuchs, B., **Zhang, B.**, ... & Richardson, A. D. (2020). Forest drought response index (ForDRI): A new combined model to monitor forest drought in the eastern United States. *Remote Sensing*, 12(21), 3605.

Under Review

Werum, R., Hayes, M., Schaefer, D., & **Zhang, B.** (In Review). Climate extremes and protest in Asia: A cross-disciplinary analysis of protests in India, Pakistan, and Bangladesh, 1995-2013.

In Progress

Zhang, B., Schilder, F., Hayes, M., Smith, K., & Tadesse, T. (In Progress). Tracking drought impacts: AI assisted drought impact reporter.

Roy, T., Srivastava, S., & **Zhang, B.** (In Progress). The potential role of reinforcement learning in sociohydrology.

CONFERENCE PRESENTATIONS

"Strengthening East Asian Impact of Helping Through Potential Collaborations with Local Community" *Asia Oceania Geosciences Society (AOGS) Annual Meeting 2024*, June, 2024

"Women's Rights Protests and Gendered Violence in Western Asian, 2016-2022" *East Sociological Society (ESS) Conference - The Social Side of the Climate Crisis*, April, 2024

"Investigation of the Relationships between Drought Characteristics and Respiratory- and Cardiovascular-Related Mortality" *AGU Fall Meeting.* December, 2023.

"Application of Reinforcement Learning to Represent Human-Flood Interactions" *AGU Fall Meeting.* December, 2023.

"Towards Understanding Drought Risk to Specialty Crops in the United States Using a Mixed Methods Approach" *AGU Fall Meeting.* December, 2023.

"Exploring Practical Citizen Science in China" *EGU General Assembly 2023.* April, 2023.

"Explainable Machine Learning Applications to Predict and Assess Complex Drought Impacts based on a Multi-sourced Dataset" *AMS Annual Meeting.* January, 2023.

"Unsupervised Wildfire Change Detection based on Contrastive Learning" *AGU Fall Meeting.* December, 2022.

"Can Causal Inference Help Investigate Drought Impacts on Social Unrest in India?" *AGU Fall Meeting.* December, 2022.

"Unsupervised Wildfire Change Detection based on Contrastive Learning" *NeurIPS Workshop Artificial Intelligence for Humanitarian Assistance and Disaster Response.* December, 2022.

"TweetDrought: A Deep-Learning Drought Impacts Recognizer based on Twitter Data" *AGU Fall Meeting.* December, 2021.

"TweetDrought: A Deep-Learning Drought Impacts Recognizer based on Twitter Data" *ICML Workshop Tackling Climate Change with Machine Learning.* July, 2021.

"Quantitative Assessment of Drought Impacts Using XGBoost based on the Drought Impact Reporter" *NeurIPS Workshop Tackling Climate Change with Machine Learning.* December, 2020.

"Evaluation of GRACE Data Assimilation Based on the Tree Ring Growth Index Across the Contiguous US" *National Soil Moisture Workshop.* May 2019.

SERVICES

Chair of a GeoHealth presentation section at *AGU Fall Meeting.* December, 2023
GeoHealth (GH23): Surviving the Dry Spell: Understanding the Connection Between Drought and Health.

Core team member of the Hydro90 2021-Present
Hydro90 is an NGO founded by young hydrologists to promote hydrology knowledge to the public (over 20,000 subscribers).

Outreach coordinator of the School of Natural Resources Graduate Student Association 2021-2022

HONORS AND AWARDS

Claire M. Hubbard Water, Climate and Health Fellowships, University of Nebraska 2022-2024
School of Natural Resources and Graduate Committee funds, University of Nebraska 2018

TECHNICAL SKILLS

Statistics modeling and inference: regression analysis, multivariate analysis, spatiotemporal analysis, causal inference.
AI related: machine learning, deep learning, computer vision, natural language processing.
Geoinformatics: remote sensing, geographic information system, geospatial data analysis.
Programming languages: Python, R, Matlab, JavaScript, SQL.
Professional Software: ArcGIS, QGIS, ENVI, ERDAS, Google Earth Engine.

PROFESSIONAL MEMBERSHIP

American Meteorological Society (AMS), American Geophysical Union (AGU), American Association of Geographers (AAG)

LANGUAGE

English: Proficient; Chinese: Native