Lokendra Singh Rathore

Environmental Sciences
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Education

PhD, University of Alabama (2020-2024)

Assessing Climatic Influences on Food Production: Assessing the impact of climate extremes on agricultural production. Evaluating the irrigation impact on mitigating climate risk on food production. Exploring the sustainable pathways of irrigation expansion.

Advisor: Dr. Mukesh Kumar

- Probabilistic analysis of the impact of drought on crop yield for major crops
- Statistical assessment of corn area trajectory changes in Southeast versus Midwest
- Hydrological modeling based analysis of irrigation expansion and water scarcity
- Sustainability assessment of virtual water flow through food trade

Bachelor & Master of Technology, Indian Institute of Technology Kharagpur (2018)

Awards and Achievements

• Winner of WaPOR Hackathon, organized by IHE Delft (2023)

• Graduate research assistantship, University of Alabama (2020-present)

• Graduate Aptitude Test in Engineering, All India rank: 78 (2017)

• Joint Entrance Examination, All India Rank: 5936 (2013)

Research Experience

Postdoctoral Researcher, Emory University **2024-present**

PhD Candidate, University of Alabama **2020-2024**

Irrigation expansion and water scarcity

Investigated the impact of irrigation expansion on freshwater scarcity in urban areas across United States after irrigation expansion. Employed hydrological modeling and water footprint-based approaches to identify green and blue water scarce regions. Evaluated the effects of transitioning from rain-fed to irrigation-fed agriculture on urban water scarcity.

Corn area trajectory in Southeast versus Midwest

Conducted county-level assessments of historical changes in harvested corn acreage in Southeastern and Midwestern US regions. Developed a statistical model using panel datasets of climate and irrigation,

and performed an economic analysis on corn profitability for farmers. Explored the association between profit and changes in corn acreage.

Spatiotemporal change in crop yield loss risk due to drought

Assessed historical changes in crop yield loss risk due to drought across US counties. Utilized copula-based probabilistic modeling to calculate yield loss risk indices for six major crops. Conducted comparative risk analyses to evaluate the irrigation's impact on mitigating drought risk. Identified key climatic and socio-economic drivers contributing to risk changes using statistical and machine learning-based approaches.

Virtual water flow through food trade

Calculated virtual water flows among US counties through cereal trade and evaluated the sustainability of virtual water trade by incorporating water scarcity information. Investigated the global virtual water flow for cotton products and analyzed temporal changes from 1996 to 2018.

Junior Research Fellow, National Institute of Hydrology, Roorkee **2018-2019**

Sustaining Himalayan water resources in climate change

Estimated river water flow and discharge for inter-linked Sutlej-Beas catchments using hydrological modeling. Assessed the impact of climate change on water availability at the grid scale and developed a Python-based GUI to facilitate the VIC model input process.

Research Interests

- Climate science
- Food security
- Sustainable agriculture
- Water security
- Water footprint
- Crop yield-weather modeling

Publications

Journal publications submitted or in preparation:

- **Lokendra Rathore**, Mukesh Kumar, Hamed Moftakhari, Poulomi Ganguli: Spatiotemporal assessment of crop yield loss risk due to drought across United States. *(submitted)*
- **Lokendra Rathore**, Mukesh Kumar, Richard McNider, Nicholas Magliocca, Walter Ellenburg: Understanding the contrasts in corn area transformations between midwestern and southeastern US. *(submitted)*
- Pragnaditya Malakar, Georgios Boumis, Mukesh Kumar, Prabhakar Clement, Arik Tashie, Hitesh Thakur, **Lokendra Rathore**: A novel benchmark dataset of daily groundwater recharge. *(in prep)*
- Ruchie Pathak, Nicholas Magliocca, Mukesh Kumar, **Lokendra Rathore**, Hamid Moradkhani: Does the future look irrigated? Evaluating the Likelihood of Irrigation Adoption Within Alabama. *(submitted)*
- Betelhem Demeke, **Lokendra Rathore**, Mesfin Mekonnen, Wenfeng Liu: Temporal Dynamics of the Water Footprint and Virtual Water Trade of Cotton. *(submitted)*

- **Lokendra Rathore**, Mukesh Kumar, Naota Hanasaki, Mesfin Mekonnen, Pushpendra Raghav (2024): Water scarcity challenges across urban regions with expanding irrigation*, Environmental Research Letters 19 (1)*
- **Lokendra Rathore**, Danyal Aziz, Betlehem Demeke, Mesfin Mekonnen (2023): Sustainability assessment of virtual water flows through cereal and milled grain trade among US counties, *Environmental Research: Infrastructure and Sustainability 3 (2)*

Posters and Presentations:

- **Lokendra Rathore**, Mukesh Kumar: Temporal Changes of Crop Vulnerability to Drought in Key Agricultural Regions of the United States. AGU Fall Meeting, 2023 *(poster)*
- Pragnaditya Malakar, Georgios Boumis, Mukesh Kumar, Prabhakar Clement, Hitesh Thakur, Arik Tashie, **Lokendra Rathore**: A benchmark data for daily groundwater recharge in the US using the Water Table Fluctuation Method. AGU Fall Meeting, 2022 *(poster)*
- **Lokendra Rathore**, Mukesh Kumar: Role of Climate Variability on Total Corn Production. AGU Fall Meeting, 2022 *(poster)*
- **Lokendra Rathore**, Mukesh Kumar, Naota Hanasaki, Mesfin Mekonnen: Impact of transition of rain-fed to irrigation-fed agriculture on water use and availability in the CONUS. AGU Fall Meeting, 2021 *(oral)*

Skills and Expertise

• Python: Data analysis (*pandas, numpy, matplotlib, seaborn*), geospatial analysis (*geopandas, arcpy, shapely*), machine learning (*scikit-learn, keras*), statistical analysis (*scipy, statsmodels*)

• Hydrological Model: H08, Variable Infiltration Capacity (VIC)

• ArcGIS • R • MATLAB

Outreach

• Captain, Athletics, Vidyasagar Hall of Residence (2017)

• President, Agricultural Engineering Society, IIT Kharagpur (2016)

• Secretary, Social and Cultural, Lal Bahadur Shastri Hall of Resident (2015)

• Volunteer, National Service Scheme (2013)