

Tejal Sudhir Shirsat

Ph.D. Candidate in Department of Ecosystem Science and Management, Penn State

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Education

The Pennsylvania State University, University Park

August 2022 - Ongoing

Ph.D. in Soil Science & Transdisciplinary Research in Environment and Society, CGPA: 3.88/4

University of Iceland, Reykjavík

Jan 2018 - May 2018

Non-degree postgraduate in Natural Resources Management, GPA: 8.54/10

Savitribai Phule Pune University, Pune

Aug 2011 - May 2016

M.Sc. in Geology, CGPA: 5.46/6

B.Sc. in Geology, (86%)

Research Experience

The Pennsylvania State University

Pennsylvania, USA

Graduate Research Assistant (Advisor: Dr. Christopher A. Scott)

Aug 2022 – Present

- *Strengthening Local Water Security in a Transboundary Glacierized Himalayan River Basin through Systems Modelling and Community Engagement*

Water resources availability and management practices are analyzed at an administrative scale in a complex transboundary Himalayan River basin by integrating glacio-hydrological modelling, water resources modelling and qualitative data collection including household surveys and semi-structured interviews.

Hydropower Collegiate Competition Penn State Team Leader (Advisor: Dr. Susan Stewart)

July 2022 – May 2023

- *Assessing Future Sustainability of Priest Rapids Dam in Columbia River Basin with Climate Change Impacts Assessment and Integration of Renewables*

A comprehensive analysis of present and future sustainability of Priest Rapids dam was performed by analyzing environmental and societal impact assessment, potential for integration of solar, wind and pumped hydro and impacts of climate change scenarios.

Student Researcher (Advisor: Dr. Erica Smithwick and Dr. Derrick Taff)

- *A Lawn-to-Habitat Conversion Pilot Project in the Spring Creek Watershed*

Jan 2024 – May 2024

A multi-attribute index was created by integrating bio-physical and socio-economic variables in a GIS pipeline to identify the optimum site for lawn-to-habitat conversion pilot project in Center County, working iteratively with the community and industry partners.

Stockholm Environment Institute (SEI-Latin America)

Bogotá, Colombia

NSF IGE Summer Research Intern (Advisor: Dr. David Purkey)

June 2023- July 2023

- *Integrating Hydrological and Socio-economic modelling for Water Security in Páramo Chingaza-Bogotá River Basin system under Water-Energy-Food Nexus Framework*

A regional climate input in the Bogotá River basin WEAP model by integrating precipitation and temperature data from over 600 local weather stations and gridded evapotranspiration products. Domestic water demands of Bogotá city and surrounding municipalities were estimated using historical population growth rates and water demands and allocation priorities were added in the Bogotá River basin model.

Indian Institute of Science

Bangalore, India

Project Associate (Advisor: Dr. Anil V. Kulkarni)

Oct 2016 – April 2022

- *Incorporating glacier flow in the Water Evaluation and Planning (WEAP) model*

A glacier flow and mass distribution plug-in was developed for WEAP model for improved representation of glaciers properties and runoff generation in glaciated catchments showcasing application in two catchments in Western Himalaya

- *Understanding the effect of climate change on small Hydropower projects in Himalaya*

Multi attribute calibration and validation approach was used for hydrological modelling in a glaciated catchment in Western Himalaya. Future runoff and hydropower generation are estimated at two small hydropower projects with contrasting discharge-head design. The sensitivity of power projects to future climate was assessed based on the plant designs.

- *Estimation of surface velocity and ice volume in Spiti Basin, Western Himalaya*

Glacier surface velocity was obtained using feature tracking of optical data. A model based on surface velocity, slope and laminar flow of ice is used to estimate spatial distribution of ice thickness and volume in western Himalayas.

Indian Institute of Science Education and Research

Pune, India

Master's Thesis Student (Advisor: Dr. Argha Banerjee)

Jan 2016 – May 2016

- *Topographic Evolution of Escarpments related to Passive Continental Margins*

Elevation profiles along rectilinear transects of a total of 8 great escarpments associated with passive continental margins were studied to calculate their retreat rates using numerical modelling and weathering rates

National Institute of Oceanography

Goa, India

Summer Research Intern (Advisor: Dr. Ramesh Kumar)

May 2015- May 2015

- *Study of Conditions leading to Monsoon onset over Kerala*

3 cases (early, normal and late) of monsoon onsets over Kerala were studied to understand the conditions leading to monsoon onset with ocean-atmospheric parameters like sea surface temperature, atmospheric water vapor and low-level jets.

Peer-reviewed Publications

- **Shirsat, T.**, Fowler, L. B., & Scott, C.A. (2025) Past, Present and Future of Indus Water Treaty: Implications for Transboundary Water Governance and Scope for Modernization. *Environmental Science and Policy* (in preparation)
- Srinivasalu, P., Kulkarni, A. V., Remya, S. N., **Shirsat, T.**, & Goswami, A. (2024). Himalayan glacier thickness mapper (HIGHTHIM) tool: An automated approach to map potential glacier lakes and expansion of existing lakes. *Polar Science*, 39, 101008. DOI: <https://doi.org/10.1016/j.polar.2023.101008>
- **Shirsat, T.**, Kulkarni, A.V., Momblanch, A., Randhawa, S. S. & Holman, I. P. (2021). Towards climate-adaptive development of small hydropower projects in Himalaya: A multi-model assessment in upper Beas basin. *Journal of Hydrology: Regional Studies*, 34, 100797. DOI: <https://doi.org/10.1016/j.ejrh.2021.100797>
- Kulkarni, A. V., **Shirsat, T.**, Kulkarni, A., Negi, H. S., Bahuguna, I. M., & Thamban, M. (2021). State of Himalayan cryosphere and implications for water security. *Water Security*, 14, 100101. DOI: <https://doi.org/10.1016/j.wasec.2021.100101>
- Kulkarni, A, Prasad, V., **Shirsat, T.**, Chaturvedi, R. K., & Bahuguna, I. M. (2021). Impact of climate change on glaciers of Spiti river basin, Himachal Pradesh, India. *Journal of Indian Society of Remote Sensing*, 1-13. DOI: <https://doi.org/10.1007/s12524-021-01368-9>
- Kulkarni, A. V., & Shirsat, T. (2020). Glacier studies in India: remote sensing applications and challenges. *Indian Journal of Geosciences*, 74(3), 307-314. URL: <https://www.gsi.gov.in/webcenter/portal/OCBIS/pageQuickLinks/pageIndianJournal>
- Prasad, V., Kulkarni, A. V., Srinivasalu, P., Pratibha, S., Tawde, S. A., **Shirsat, T.**, Arya, A. R., Orr, A. & Bannister, D. (2019). Changes in Glacier area and Water Availability under High Emission Scenario, Satluj basin, Himalaya. *Current Science*, 116(10), 1721-1730. URL: <https://www.jstor.org/stable/10.2307/27138109>
- Banerjee, A., **Shirsat, T.**, & Kumari, R. (2018). Prevalence of Power Law Profiles in Passive Margin Escarpments. *Journal of Geophysical Research: Earth Surface*, 123(8), 1699-1709. DOI: <https://doi.org/10.1029/2018JF004621>

Book Chapters

- **Shirsat, T.**, Stewart, S. W., & Scott, C.A. (2025). Assessing Future Hydropower Generation and Potential for Pumped Hydro Addition at the Priest Rapids Dam, Columbia River Basin for a Sustainable Water-Energy Nexus. L. Kuzmych (Eds.), *Balancing Water-Energy-Food Security in the Era of Environmental Change* (pp. 331-370). IGI Global Scientific Publishing. DOI: 10.4018/979-8-3693-5693-7.ch015
- Kulkarni, A.V. and **Shirsat, T.** (2019). Snow and Glacier Hydrology. Mujumdar, P. P., & Tiwari, V. M. (Eds.). *Water futures of India: status of science and technology* (chap. 4, pp 70-101). Indian National Science Academy and Indian Institute of Science Press. ISBN-13. 978-8193948200

Conferences Presentation

- **Shirsat, T.**, Kulkarni, A. V., Momblanch, A., Boyer, E. W., Taloor, A. K., & Scott, C.A. Hydrological and Cryospheric Changes in a Transboundary River Basin of the Western Himalaya Throughout the 21st Century under Changing Climate. *AGU Fall Meeting 2024*, Washington D.C., Dec. 9-13, 2024. (Poster presentation).
- **Shirsat, T.**, Kulkarni, A.V., Momblanch, A., Boyer, E., & Scott, C.A. Spatio-Temporal Heterogeneity in Snow and Glacier melt runoff: Implications for Water Management in the Transboundary Chenab River basin, *104th American Meteorological Society, 38th Conference on Hydrology*, Baltimore, MD, 28 Jan- 1 Feb, 2024. (Poster presentation)
- **Shirsat, T.**, Zhang, X., Sun, C., Hong, X., Fu, Y., Ferrari, S., Mir, A, Dennis, L., & Stewart, S. Hydropower Collegiate Competition, Case Study Report: Priest Rapids Dam, Washington, *Water Power Week-2023*, Washington D.C., May 10, 2023. (Oral and Poster presentation)
- Momblanch, A., **Shirsat, T.**, Kulkarni, A.V. and Holman, I. P. Integrating glacier flow in hydrological modelling for water resources management, *EGU General Assembly 2022*, Vienna, Austria, 23-27 May 2022. (Oral presentation)
- **Shirsat, T.**, Kulkarni, A.V., Momblanch, A., Randhawa, S. S. and Holman, I. P. Potential impacts of warming climate on future water resources and hydropower production in a glacierized catchment in Western Himalaya, *EGU General Assembly 2021*, online, 19-30 April 2021. (Oral presentation)
- **Shirsat, T.**, Kulkarni, A.V., Momblanch, A., Randhawa, S. S. and Holman, I. P. Potential impacts of climate change on water availability and hydropower generation in a glaciated catchment in Western Himalaya, *International Conference on Himalayan Cryosphere*, online, 19-23 Oct, 2020. (Oral presentation)
- **Shirsat, T.**, Kulkarni A. V. and Biswas, A. Development of Cryospheric Services for Management of Hydropower Utility in the Himalayan region. *IUGG General Assembly*, Montreal, Canada, July 8 -18 2019. (Oral presentation)
- **Shirsat, T.**, Kulkarni A. V. and Pratibha., S. A. Comprehensive Glacier Inventory for Spiti Basin, Western Himalaya. *Water Future Conference-Towards a Sustainable Water Future*, Bangalore, India, September 24 – 27 2019 (Poster Presentation)
- **Shirsat, T.**, Kulkarni A. V. and Pratibha., S. Upgradation of Glacier inventory in Spiti Basin, Western Himalaya, India. *National Conference on Polar Sciences*, May 16-17, 2017. (Poster Presentation). DOI: 10.13140/RG.2.2.36026.59843
- Pradeep, S., Kulkarni A. V. and **Shirsat, T.** Estimation of glacier stored ice in Spiti Basin, Himachal Pradesh using Velocity-slope and Scaling method. *National Conference on Polar Sciences*, May 16-17, 2017. (Poster Presentation). DOI: 10.13140/RG.2.2.24069.55528

Awards

- Second place in the Physical Science Category at the 39th Graduate Student Research Poster Exhibition, Pennsylvania State University, University Park, PA 2024
- NSF Innovation in Graduate Education (IGE) to conduct research related to Water-Energy-Food nexus at the Universidad de Bogotá Jorge Tadeo Lozano and SEI Latin America 2023
- International Travel Support (ITS) by Science and Engineering Board, Department of Science and Technology, Government of India to attend IUGG General Assembly 2019
- Nehru-Grimsson Fellowship by the Climate Research Foundation, Iceland to study coursework of Glaciology at the University of Iceland 2018
- Scholarship for Higher Education (SHE) under INSPIRE Program by Department of Science and Technology, Government of India for performance within top 1% of Higher Secondary Certificate exam 2011 – 2016

Teaching Experience

- **The Pennsylvania State University**
Teacher: SOILS 102: Introduction to Soil Sciences Laboratory, SOILS 450: Environmental GIS
Teaching Assistant: FOR 255: GIS for Forest Professionals, FOR 455: Remote Sensing and Spatial Data Analysis
- **Indian Institute of Science**
Instructor in hands-on exercises of Snowmelt Runoff Modelling, Topographic Correction of Satellite Datasets and Glacier Debris Cover estimation in the national and international training programs in Glacier Studies and Remote Sensing

Professional Services

- Soil Science Representative in Graduate Student Advisory Committee 2023-2024
- General Secretary of Association for India's Development (AID) – Penn State Chapter 2023-2024
- Penn State Team Leader for Hydropower Collegiate Competition (HCC-2023) organized by US Department of Energy 2022-2023
- Reviewer for Journal of Hydrology: Regional Studies, Water Security, American Journal of Climate Change & Journal of Indian Society of Remote Sensing 2021- Present

Outreach Activities

- Volunteer in Renewable Energy workshop and WEF Nexus survey data collection arranged by Universidad de Bogotá Jorge Tadeo Lozano in Zona Bananera village at the foothills of Sierra Nevada de Santa Marta, Colombia July 2023
- Volunteer in “*Young Scientist's Den*” science club in Mumbai in arranging various workshops, seminars & astronomical observations for school children 2016 - 2021
- World Bank Field expedition to Baspa valley in Western Himalaya to collect survey data with local communities September 2017
- Volunteer in Gyansetu-2016 to South Sikkim (Eastern Himalayas) in conducting science workshops for school children of age 8 to 14 years, arranged by Dnyana Prabodhini Association, Pune June 2016
- Teacher in NASA Mad Science, Pune for children of age 5-9 years. 2015

Languages

Marathi (Native or Bilingual Proficiency), English (Full Professional Proficiency), Hindi (Full Professional Proficiency), Spanish (Elementary Proficiency)

Computer Skills

Quantitative Research: Programming languages: Python and R, GIS software: ArcGIS, QGIS, ERDAS Imagine, Hydrological Models: WEAP, SWAT, HBV, SPHY
Qualitative Research: Qualtrics, NVivo