

Nishan Bhattarai, Ph.D.

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ACADEMIC/PROFESSIONAL PREPARATION

Department of Geography & Environmental Sustainability, University of Oklahoma

Assistant Professor, Aug 2022-

United States Department of Agriculture-Agricultural Research Service (USDA-ARS)

Hydrology and Remote Sensing Lab (HRSL), USDA-ARS, Beltsville, MD

Research Physical Scientist (Postdoctoral Research Associate), Dec 2020 – Jul 2022

University of Michigan, Ann Arbor, MI

School for Environment and Sustainability

Research Fellow, Sep 2016 -Dec 2020

Tufts University, Medford, MA

Center for International Environment & Resource Policy at The Fletcher School of Law &

Diplomacy Postdoctoral Research Fellow, 2015-2016

SUNY College of Environmental Science & Forestry (SUNY-ESF), Syracuse, NY

Dept. of Environmental Resources Engineering

Ph.D. Environmental Resources Engineering (Geospatial Information Science & Eng.), 2015

Auburn University, Auburn, AL

Depts. of Biosystems Engineering & School of Forestry & Wildlife Sciences, M.S. Forestry, 2010

Tribhuvan University, Nepal, B.S. Forestry, 2006

PUBLISHED PAPERS IN PEER-REVIEWED JOURNALS (six under review/revision papers not listed)

1. **Bhattarai, N.**, D.B. Lobell, B. Singh, R. Fishman, W. P. Kustas, Y. Pokhrel, and M. Jain. 2023. Warming temperatures exacerbate groundwater depletion rates in India. *Science Advances* (In Press).
2. Hu, T, Mallick, K, Hitzelberger P, Didry Y, Boulet, G, Szantoi Z, Koetz B, Alonso, I, Pascolini-Campbell, M, Halverson, G, Cawse-Nicholson K, Hulley G, Hook, S, **Bhattarai, N.**, Oliso A, Roujean JL, Gamet P, Su, B, 2023. Evaluating European ECOSTRESS Hub Evapotranspiration Products Retrieved from Three Structurally Contrasting SEB Models over Europe. *Water Resources Research*. [Link]
3. Dhal, S., Wyatt, B., Mahanta, M., **Bhattarai, N.**, Sharma, S., Rout, T., Saud, P., Acharya, B.S. 2023. Internet of Things (IoT) in Digital Agriculture: An Overview. *Agronomy Journal* [Link].
4. Mallick, K., Baldocchi, D., Jarvis, A., Hu, T., Trebs, I., Sulis, M., **Bhattarai, N.**, Bossung, C., Eid, Y., Cleverly, J., Beringer, J., Woodgate, W., Silberstein, R., Hinko-Najera, N., Meyer, W.S., Ghent, D., Szantoi, Z., Boulet, G., Kustas, W.P., Insights into the Aerodynamic versus Radiometric Surface Temperature Debate in Thermal-based Evaporation Modeling. *Geophysical Research Letters* 49, e2021GL097568 [Link].
5. Bai, Y., **Bhattarai, N.**, Mallick K., Zhang, S., & Zhang, J. 2022. Thermally derived evapotranspiration from the Surface Temperature Initiated Closure (STIC) model improves cropland GPP estimates under dry conditions. *Remote Sensing of Environment* 271: 112901 [Link].
6. **Bhattarai N.**, Guido D'Urso, W. P. Kustas, N. Bambach-Ortiz, Kyle R. Knipper, M. Anderson, F. Gao, M.M. Alsina, M. Aboutalebi, L. Mckee, J. G. Alfieri, A. J. McElrone, J. H. Prueger, & Oscar R. Belfiore. 2022. Influence of modeling domain and meteorological forcing data on daily

- evapotranspiration estimates from a Shuttleworth-Wallace model using Sentinel-2 surface reflectance data. *Irrigation Science* 40, 497-513. [Link]
7. Jiang, Q., **Bhattarai, N.**, Pahlow, M., & Xu., Z., 2022. Environmental Sustainability and Footprints of Global Aquaculture. *Resources, Conservation & Recycling*, 180: 106183. [Link]
 8. Xu, G., Dong H., Xu. Z., & **Bhattarai, N.** 2022. China can reach carbon neutrality before 2050 by improving economic development quality. *Energy* 243: 12083.
 9. Singh, K.K., **Bhattarai, N.**, & Vukomanovic, J., 2022. Landscape-scale hydrologic response of plant invasion relative to native vegetation in urban forests. *Science of the Total Environment*, 802:149903 [Link].
 10. **Bhattarai, N.***, Pollack, A.*, Lobell, D.B., Fishman, R., Singh, B., Dar, A., & Jain, M. 2021. The impact of groundwater depletion on agricultural production in India. *Environmental Research Letters* 16:085003. [Link].
 11. Jain M., Fishman, R., Mondal, P., Galford, G.L., **Bhattarai, N.**, Naeem, S., Lall, U., Singh, B., & DeFries, R.S. 2021. Groundwater depletion will reduce cropping intensity in India. *Science Advances* 7, eabd2849. [Link]. **Media:** CNN, AAAS, NPR, Earther.
 12. Trebs, I, Mallick, K., **Bhattarai, N.**, Sulis, M., Cleverly J, Woodgate W, Silberstein, R., Najera, Hinko-Najera, N., Beringer J, Su Z., & Boulet G. 2021. The role of aerodynamic resistance in thermal remote sensing- based evapotranspiration models. *Remote Sensing of Environment* 264: 112602 [Link].
 13. Bai, Y., Zhang, S., **Bhattarai, N.**, Mallick, K., Qi, L, Tang, L., Im, J., Guo, L., & Zhang, Z. 2021. On the use of machine learning algorithms to improve cropland evapotranspiration across a wide environmental gradient. *Agricultural and Forest Meteorology*, 288-289: 208308 [Link].
 14. Javed, T., Zhang, J., **Bhattarai, N.**, Zhang, S., Rashid, S., Yun, B., Ahmad, S., Henchiri, M., Kamran, M. 2021. Drought characterization across agricultural regions of China using standardized precipitation and vegetation water supply indices. *Journal of Cleaner Production*, 313: 127866 [Link].
 15. Rao, P., Zhou, W., **Bhattarai, N.**, Srivastava A., Singh, B., Poonia, S., Lobell, D., and Jain, M. 2021. Using Sentinel-1, Sentinel-2, and Planet Imagery to Map Crop Type of Smallholder Farms. *Remote Sensing*, 13: 870 [Link].
 16. Xu, Z., Chen, X., Liu, J., Zhang, Y., Chau, S., **Bhattarai, N.**, Wang, Y., Li, Y., Li, Y., & Connor, T. 2020. Impacts of irrigated agriculture on food–energy–water–CO₂ nexus across metacoupled systems. *Nature Communications* 11, 5837. [Link]
 17. Niraula, R., Saleh, A., **Bhattarai, N.**, Bajgain, R., Kannan, N., Osie, E., Gowda, P., Neel, J., Xiao, X., & Basara, J. 2020. Understanding the effects of pasture type and stocking rate on the hydrology of Southern Great Plains. *Science of the Total Environment*, 708: 134873. [Link]
 18. Khand, K., **Bhattarai, N.**, Taghvaeian, S., Wagle, P., Gowda, P., & Alderman, P. 2020. Modeling evapotranspiration of winter wheat using contextual and pixel-based surface energy balance models. *Transactions of ASABE* [Link].
 19. **Bhattarai, N.**, Mallick, K., Stuart, J. ⁺, Vishwakarma, B.D., Niraula, R., Sen, S., & Jain, M. 2019. An automated multi-model evapotranspiration mapping framework using remotely sensed and reanalysis data. *Remote Sensing of Environment*, 229: 69-92. [Link]
 20. Cohn, A., **Bhattarai, N.**, Campolo, J., Crompton, O., Dralle, D., Duncan, J., & Thompson, S., 2019. Forest loss in Brazil increases maximum temperatures within 50km. *Environmental Research Letters*, 14: 084047. [Link]
Media: phys.org, Scientific American, Newsroom
 21. Kafley, H., Lamichane, B.R., Maharjan, R., Khadka, M., **Bhattarai, N.**, & Gompper, M.E., 2019. Tiger and leopard co-occurrence: intraguild interactions in response to human and livestock disturbance, *Basic and Applied Ecology*. [Link]
 22. **Bhattarai, N.** & Liu, T. 2019. LandMOD ET Mapper: a new Matlab-based graphical user interface (GUI) for automated implementation of SEBAL and METRIC models in thermal imagery. *Environmental Modelling and Software*, 118: 76-82. [Link]
 23. Kafley, H., Lamichane, B.R., Maharjan, R., Thapaliya, B., **Bhattarai, N.**, Khadka, M., &

- Gompper, M.E. 2019. Estimating Prey Abundance and Distribution from camera Trap data using bionomical mixture models. *European Journal of Wildlife Research* 65: 77. [Link]
24. Mallick, K., Wandera, L., **Bhattarai, N.**, Hostache, R., Chormanski J., & Kleniewska, M. 2018. A critical evaluation on the role of aerodynamic and canopy-surface conductance parameterization in SEB and SVAT models for simulating evapotranspiration: a case study in the Upper Biebrza National Park wetland. *Water*, 10 (12): 1753. [Link]
 25. **Bhattarai, N.**, Mallick, K., Brunsell, N. A., Sun, G., & Jain, M. 2018. Regional evapotranspiration from an image-based implementation of the Surface Temperature Initiated Closure (STIC1.2) model and its validation across an aridity gradient in the conterminous United States, *Hydrology and Earth System Sciences*, 22: 2311-2341. [Link]
 26. Niraula, R., Meixner, T., Dominguez, F., **Bhattarai, N.**, Rodell, M., Ajami, H., Gochis, D., & Castro, C. 2017. How might recharge change under projected climate change in the western US? *Geophysical Research Letters*, 44: 10407-10418. [Link] **Media:** UA News, Science Daily, phys.org, AAAS and Eurekalert, technology.org, futurity.org
 27. **Bhattarai, N.**, Wagle, P., Gowda, P., & Kakani, V. 2017. Utility of remote sensing-based surface energy balance models to track water stress in rain-fed switchgrass under dry and wet conditions. *ISPRS Journal of Photogrammetry and Remote Sensing*, 133:128-141. [Link]
 28. Richards, P., Cohn, A., Arima, E., VanWey, L., & **Bhattarai, N.** 2017. Enforcement evasion highlights need for independent satellite monitoring for forest governance. *Conservation Letters*, 10:497-498. [Link]
 29. **Bhattarai, N.**, Quackenbush, L.J., Im, Jungho, & Shaw, S.B., 2017. A new optimized algorithm for automating endmember pixel selection in the SEBAL and METRIC models. *Remote Sensing of Environment*, 196:178-192. [Link]
 30. Wagle, P., **Bhattarai, N.***, Gowda, P., & Kakani, V. 2017. Performance of five surface energy balance models for estimating daily evapotranspiration in high biomass sorghum. *ISPRS Journal of Photogrammetry & Remote Sensing*, 128:192-203. [Link]
 31. Richards, P. Arima, E., VanWey, L, Cohn, A., & **Bhattarai, N.** 2017. Are Brazil's Deforesters Avoiding Detection? *Conservation Letters*, 10:470-476. [Link] **Media:** Nature Climate Change; Mongabay, phys.org, eurekaalert, Brown University, Nature World News, Technology.org
 32. **Bhattarai, N.**, Shaw, S. B., Quackenbush, L. J., Im, J., & Niraula, R. 2016. Evaluating five remote sensing-based single-source surface energy balance models for estimating daily evapotranspiration rates in a humid subtropical climate. *International Journal of Applied Earth Observation and Geoinformation*, 49:75-86 [Link]
 33. **Bhattarai, N.**, Quackenbush, L.J., Dougherty, M., & Marzen, L. 2015. A simple Landsat–MODIS fusion approach for monitoring seasonal evapotranspiration at 30 m spatial resolution. *International Journal of Remote Sensing* 36:115-143. [Link]
 34. Shaw, Stephen B., Marrs, J.⁺, **Bhattarai, N.**, & Quackenbush, L.J. 2014. Longitudinal Study of the Impacts of Land Cover Change on Hydrologic Response in Four Mesoscale Watersheds in New York State, USA. *Journal of Hydrology*, 519:12-22. [Link]
 35. **Bhattarai, N.**, Dougherty, M., Marzen, L., & Kalin, L. 2012. Validation of evaporation estimates from a modified surface energy balance algorithm for land model in the south-eastern US. *Remote sensing letters*, 3:511-519. [Link]

* indicates shared first authorships; ⁺ undergraduate students mentored

OTHER PUBLICATIONS

Peer-Reviewed

1. Mallick, K., Hu, T., Yun, B., **Bhattarai, N.**, Trebs, I., Scherf, M., Boulet, G., Wang, T., Sanchez, C.R., Shortt, R., Baldocchi, D., Thermal and shortwave infrared remote sensing of ecosystem processes: Opportunities, synergies, and challenges. IEEE InGARSS 2021.

2. **Bhattacharai, N.**, Mallick, K., and Jain, M. Sensitivity of four contextual remote sensing based surface energy balance models to spatial domain, Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XLII- 3/W6, 3-7, <https://doi.org/10.5194/isprs-archives-XLII-3-W6-3-2019>, 2019.
Non-referred Conference papers, Editorial, and dissertation/thesis
3. **Bhattacharai, N.** and Wagle P. Recent advances in remote sensing of evapotranspiration. 2021, *Remote Sensing* 13(21):4260 (Editorial [link]).
4. **Bhattacharai, N.** 2015. Single-source surface energy balance algorithms to estimate evapotranspiration from satellite-based remotely sensed data, PhD Dissertation, SUNY-ESF.
5. **Bhattacharai, N.**, Quackenbush, L.J., Calandra, L., Im, J., & Teale, S. 2012. An automated object-based approach to detect Sirex-infestation in pines. Proceedings of American Society for Photogrammetry and Remote Sensing (ASPRS) 2012 Annual conference, March 19-23, Sacramento, CA.
6. **Bhattacharai, N.**, Quackenbush, L.J., Calandra, L., Im, J., & Teale, S. 2011. Spectral analysis of Scotch pine infested by Sirex Noctillo. Proceedings of ASPRS 2011 Annual conference, May 1-5, 2011, Milwaukee, WI.
7. **Bhattacharai, N.** 2010. Use of Remotely Sensed Data to Quantify Plant Water Use from Irrigated Lands in Wolf Bay Watershed Area, MS Thesis, Auburn University.

PROFESSIONAL PREPARATIONS

Research experience

Collaborator, USDA-ARS, Beltsville, MD	Jul 2022 – Jul 2023
Research Associate, USDA-ARS, Beltsville, MD	Dec 2020-Jul 2022
Research Fellow, University of Michigan Ann Arbor	Sep 2016-Dec 2020
Research Affiliate, Tufts University, Medford, MA	Sep 2016- Aug 2017
Postdoctoral Research Fellow, Tufts University, Medford, MA	Aug 2015- Sep 2016
Research Project Assistant, Research Foundation for the SUNY, Syracuse, NY	Sep–Dec 2014
Research Aide, Research Foundation for the SUNY, NY	May–Aug 2012
Research Project Assistant, Research Foundation for the SUNY, NY	Aug 2010 – Aug 2011
Research Assistant, Biosystems Engineering, Auburn University, AL	Aug 2008 – Aug 2010

Teaching experience

University of Oklahoma: *Instructor*, Fundamentals of Remote Sensing (Fall 2023, Spring 2023, Summer 2023, Fall 2023), Hydrologic Science (Fall 2023).

University of Michigan: Co-Instructor, EAS 501 Introduction to R (Natural Resources Statistics), 1 credit (*Spring* 2019); Guest Lecturer, EAS 501 Watershed Hydrology & Water Resources Management (*Spring* 2020)

SUNY-ESF: *Teaching Assistant*, (Aug 2011-May 2014): Courses: GIS for engineers (Fall 2011, 2012, and 2013 graduate courses; conducted all GIS labs); Statics and Dynamics (Spring 2012 undergrad course); Mechanics of Materials (spring 2012, undergrad course); Introduction to Engineering Design (springs of 2012, 2013, and 2014, undergrad course)

Auburn University: *Teaching Assistant:* Course: Introduction to renewable resources (Fall 2009)

Mentorship experience

Students at OU: Supervising one Ph.D. and one undergraduate student; Serving as a committee member of five (4 Ph.D. and 1 M.S.) students in Geography & Environmental Sustainability, Microbiology), Civil Engineering, and Meteorology Departments at OU; Mentored 3 undergraduate students for their capstones.

UROP (Undergraduate opportunity research program) Mentor (June 2017-May 2021), University of

Michigan: Mentored three undergraduates on research projects (climate change, programming in R, Matlab, Google Earth Engine, ArcGIS, and remote sensing).

Undergraduate Mentor (summers of 2012 and 2015), SUNY-ESF: Mentored three Undergraduates at SUNY-ESF (ArcGIS, Python, SapFlux Instrumentation, and Weather station data collection)

STEM Mentor (Jan 2015 – May 2015), Research Foundation for the SUNY: Taught three science classes/week at two elementary schools during Jan-May 2015.

Other field/research experience

Research/Field Tech, University of Illinois, Urbana-Champaign, IL Jun – Aug 2014

Conservation Science Intern, WWF for Nature, Washington, DC Jun – Aug 2013

International Corps Member, EarthCorps, Seattle, WA Jun – Dec 2007

SELECTED TALKS

- Synergistic use of spectral information from Landsat and Sentinel-2 data for modeling near real- time crop water status across California vineyards, December 15, 2021, AGU Fall Meetings, New Orleans, LA
- Remote Sensing for Sustainable Agriculture: From Evapotranspiration Modeling to Understanding Crop-Climate-Human Interactions, June 10, 2020, Lawrence Berkeley National Lab, Berkeley, CA. (Invited)
- Remote sensing approach to estimate crop water use and stress across agricultural lands in India. Jan 24, 2020, Western Michigan University, Kalamazoo, MI (Invited).
- Warming Temperatures Lead to Increased Groundwater Depletion in India, Dec 11, 2019, AGU Fall Meetings, CA.
- Biophysical and Socioeconomic Complexities of Global Environmental Change. Oct 8, 2019, College of William and Mary, Williamsburg, VA. (Invited)
- Understanding the impacts of groundwater depletion and climate shocks on irrigation decisions in India. AGU Fall Meetings Abstracts, December 10-14, 2018, Washington, DC.
- An automated multi-model based evapotranspiration estimation framework for understanding crop-climate interactions in India, AGU Fall Meetings, December 11, 2017, New Orleans, LA.
- Understanding the climate-included variations in the seasonal water demands of irrigated crops in Northern India. AGU Fall Meetings, December 11-16, 2016, San Francisco, CA.

GRANTS, AWARDS, AND HONORS (pending proposals not listed)

- PI, Data Institute for Societal Challenges Seed grant (\$10K).
- Collaborator, NASA NNH21ZDA001N-LCLUC (~\$450K), 2022-2025
- Collaborator, NASA NNH19ZDA001N- LCLUC Grant (~440K)- 2021-2024
- Research Achievement Award, USDA-ARS (2021)
- Outstanding Reviewer: Journal of Hydrologic Engineering (2018)
- ERE Departmental Award for Academic Excellence (2014), SUNY-ESF
- RvD Idea Awards (Raymond Von Dran Fund) (2012), Syracuse University, \$2,000
- AGU Student travel award (2013), American Geophysical Union (AGU), \$500
- CNY Graduate Student of the year (2013), ASPRS, \$500
- Ta Liang Memorial Award (2013), ASPRS, \$2,000
- ESF travel grant (2012-2013), ESF, \$500, \$250
- Research in Need travel grant (2012), GSA, SUNY-ESF, \$250
- ConForM/Danida fellowship for undergraduate research (2006), Tribhuvan University, Nepal, ~\$250

- BS Entrance Topper (Science stream) and Merit Scholarship, Tribhuvan University, Nepal (2006)

PROFESSIONAL SERVICES

Editorial: Editorial Board Member, *GIScience & Remote Sensing* (Publisher: Taylor & Francis)

Guest Editor, *Remote Sensing* (MDPI), Special Issue on Remote Sensing of Evapotranspiration II

Peer Reviewer (reviewed > 130 papers): *Remote Sensing of Environment, Environmental Research Letters, JGR-Atmospheres, Water Resources Research, Journal of Hydrology, Agricultural & Forest Meteorology, IEEE TGRS, Scientific Reports, International Journal of Remote Sensing, ISPRS Journal of Photogrammetry & Remote Sensing, Hydrological Processes, Remote Sensing, Earth's Future, Journal of Hydrometeorology, IEEE-JSTARS, Stochastic Environmental Research & Risk Assessment, GIScience & Remote Sensing, PLoS ONE, Hydrology, Water, Transaction of ASABE, Science of the Total Environment*, International JAG, Remote Sensing Letters, Land Use Policy, Computers & Geosciences, Environmental Processes, Hydrological Sciences Journal, Environmental Modelling & Software, and Agricultural Water Management.*

Proposal Reviewer: NASA proposal review Panel (2020, 2023), External project advisor for International Initiative for Impact Evaluation (3ie)

Professional Memberships: American Geophysical Union, American Society for Photogrammetry & Remote Sensing (2010-17)

SKILLS

Fluent in multiple programming platforms including R, Matlab (Github Page); Advanced skills in Python, use of High-Performance Computing (HPCs)/Clusters, Google Earth Engine, Stata; GIS/Remote Sensing software, such as ArcGIS, QGIS, ENVI, ERDAS Imagine; Basic knowledge of C/C++ and Visual Basic; Knowledge of software, such as AutoCAD, HEC-HMS, SAS, SigmaPlot, SSH, Unix shell scripts, Git, and SQL Server.