RUTUJA CHITRA-TARAK

Ecologist Studying Forest and Climate Change Interactions
Indo-French Cell for Water Sciences, Indian Institute of Science, Bangalore, India - 560012
arutuj@gmail.com • +91 94831 90581 • https://rutuja.net
Forest Ecology, Eco-hydrology, Earth-Climate Modeling, Tropical Forests, Droughts

EDUCATION

2016	PhD, Ecology, Indian Institute of Science (IISc), Bangalore, India
2007	MSc, Biodiversity & Taxonomy, University of Pune, India
2005	BSc, Microbiology, University of Pune, India

PROFFESSIONAL APPOINTMENTS

2022-2024	Staff Scientist, Los Alamos National Lab, NM, USA Leave of absence: Dec 2022-July 2023, Nov 2023-Nov 2024
2019-2022	Postdoctoral Research Associate, Los Alamos National Lab, NM, USA
2016-2019	Postdoctoral Researcher, Smithsonian Environmental Research Center, MD, USA
2016	Research Associate, Divecha Center for Climate Change, IISc, Bangalore
2014-2016	Research Assistant, Indo-French Cell for Water Sciences, IISc, Bangalore
2012-2014	Senior Research Fellow, Centre for Ecological Sciences, IISc, Bangalore
2007-2012	Junior Research Fellow, Centre for Ecological Sciences, IISc, Bangalore
2009	Visiting Scholar, Laboratoire des sciences du climat et de l'environnement, France
2009	Visiting Scholar, Laboratoire Géosciences Environnement, Toulouse, France

PROFESSIONAL AFFILIATIONS

2019-current	Research Associate, Smithsonian Environmental Research Center, MD, USA
2023-current	Indo-French Cell for Water Sciences, Indian Institute of Science, Bangalore

GRANTS

2023	PI. "Building SEFA: A Spatially Explicit FATES Algorithm for Forest Management Needs". A competitive grant from Information Science & Technology Institute, Los Alamos National Lab, NM	$60,000
2020-2024	Co-PI. US DOE's flagship project: the Next-Generation Environmental Experiments-Tropics.	$700,000/yr
2020	PI. "Routes to water: Uncovering belowground drought strategies of a coastal forest." A competitive grant from Center for Space and Earth Science, Los Alamos National Lab, NM	$27,500
2007-2012	PI. Graduate Research Grant. Council for Industrial and Scientific Research, India	Rs. 120,000

FELLOWSHIPS

2016 Newton International Postdoctoral Fellowship, British Academy and the Royal Society, UK (Awarded, but declined)
2007 Full Graduate Research Scholarship, Council for Industrial and Scientific Research, India
2009 Graduate Research Fellowship, Embassy of France, India
2006 Summer Research Fellowship, Jawaharlal Nehru Centre for Advanced Scientific Research, India

HONORS & AWARDS

International

2018 Harper Prize, for "Best paper by an Early Career Researcher in *Journal of Ecology*", British Ecological Society
2014-2018 Analytical Workshop Travel Grants, Smithsonian Forest Global Observatory. Five-time Recipient.

National

2016 Shivarama Karanth Exceptional Talk Award, Student Conference on Conservation Science, Bangalore
2014 Shivarama Karanth Exceptional Poster Award, Student Conference on Conservation Science, Bangalore
2012 International Conference Travel Award, Council for Industrial and Scientific Research, India

Institutional

2021 Outstanding Presentation at "Science in 3" minutes, a LANL postdocs' showcase in a lab-wide event, Los Alamos National Lab, NM, USA
2021 SPOT Award for "Outstanding service to Geoscientists United for Inclusion, Diversity, and Equity", Los Alamos National Lab, NM, USA

PEER-REVIEWED PUBLICATIONS

https://scholar.google.com/citations?user=g4L62b0AAAAJ&hl=en
https://www.webofscience.com/wos/op/publications/summary
https://www.impactio.com/researcher/RutujaChitraTarak?tab=citations
https://www.scopus.com/feedback/author/reviewAuthorProfile.uri?authorIds=56394538300#documents

♣ graduate mentee; ♦post-doc mentee
* Citation percentile in Web of Science in Year Published

Journal Articles

1. Robbins Z, J Chambers, **R Chitra-Tarak,** B Christoffersen, LT Dickman, R Fisher, A Jonko, R Knox, C Koven, L Kueppers, N McDowell, C Xu. (2024) Future climate doubles the risk of hydraulic failure in a wet tropical forest. ***New Phytologist***. https://doi.org/10.1111/nph.19956

2. Chen, S ♣, S Stark, A Nobre, L Cuartas, D Amore, N Restrepo-Coupe, MN Smith, **R Chitra-Tarak,** H Ko, B Nelson, S Saleska. (2024). Amazon forest biogeography predicts resilience and vulnerability to drought. ***Nature,*** 1–7. https://doi.org/10.1038/s41586-024-07568-w
3. Xu C, B Christoffersen, Z Robbins ♦, R Knox, R A Fisher, **R Chitra-Tarak**, M Slot, K Solander, L Kueppers, C Koven, N McDowell (2023) Quantification of hydraulic trait control on plant hydrodynamics and risk of hydraulic failure within a demographic. structured vegetation model in a tropical forest (FATES-HYDRO V1. 0) ***Geoscientific Model Development***, 16, 6267-6283. https://doi.org/10.5194/gmd-16-6267-2023
4. Robbins Z ♦, C Xu, A Jonko, **R Chitra-Tarak**, CJ Fettig, J Costanza, LA Mortenson, BH Aukema, LM Kueppers, RM Scheller. (2023) Carbon stored in live ponderosa pines in the Sierra Nevada will not return to pre-drought levels during the 21st century due to bark beetle outbreaks. ***Frontiers in Environmental Science***, 11. https://doi.org/10.3389/fenvs.2023.1112756
5. **Chitra-Tarak, R**, and JF Warren. (2023) Amazon drought resilience - emerging results point to new empirical needs. ***New Phytologist***, 237, 703-706. https://doi.org/10.1111/nph.18670
    a. Invited commentary on Costa *et al. New Phytologist*, 237, 714-733.
6. Robbins Z ♣, C Xu, B Aukema, P Buotte, **R Chitra-Tarak**, C Fettig, L Mortenson, M Goulden, D Goodsman, L Kueppers, C Koven, G Madakumbura, L Mortenson, J Powell, A Hall, R Scheller. (2021) Warming increased bark beetle-induced tree mortality by 30% during an extreme drought in California. ***Global Change Biology***, 28, 509-523. https://doi.org/10.1111/gcb.15927
    a. *94th Citation Percentile in Ecology
    b. Reported by: San Francisco Chronicles, Science Times, Santa Fe New Mexican, Enviro Bites, Eureka Alert and The Sacramento Bee
7. **Chitra-Tarak, R**, C Xu, S Aguilar, K Anderson-Teixeira, J Chambers, M Detto, B Faybishenko, RA Fisher, R Knox, C Koven, L Kueppers, N Kunert, SJ Kupers, NG McDowell, BD Newman, SR Paton, R Pérez, L Ruiz, L Sack, JM Warren, BT Wolfe, C Wright, SJ Wright, J Zailaa, SM McMahon (2021) Hydraulically-vulnerable trees survive on deep-water access during droughts in a tropical forest. ***New Phytologist***, 231, 1798–1813. https://doi.org/10.1111/nph.17464
    a. *99th Citation Percentile in Plant Science
    b. Top-downloaded article during its first year of publication in *New Phytologist*
8. Fung, T, RA Chisholm, …, **R Chitra-Tarak** and other authors (2020) Temporal population variability in local forest communities has mixed effects on tree species richness across a latitudinal gradient. ***Ecology Letters***, 23, 160–71. https://doi.org/10.1111/ele.13412
9. **Chitra-Tarak, R ♠**, L Ruiz, HS Dattaraja, J Riotte, MS Mohan Kumar, HS Suresh, SM McMahon & R Sukumar (2018) The roots of the drought: Hydrology and water uptake strategies mediate forest-wide demographic response to precipitation. ***Journal of Ecology***, 106, 1495-1507. https://doi.org/10.1111/1365-2745.12925
    a. *94th Citation Percentile in in Plant Science
    b. ♠ Awarded British Ecological Society's Harper Prize

c. Recognized as the best paper in *Journal of Ecology* in 2018 by an early career researcher
d. Reported by: The Hindu, India

10. **Chitra-Tarak, R**, L Ruiz, S Pulla, HS Dattaraja, HS Suresh & R Sukumar (2015) And yet it shrinks: A novel method for correcting bias in forest tree growth estimates caused by water-induced fluctuations. ***Forest Ecology and Management***, 336, 129–136. https://doi.org/10.1016/j.foreco.2014.10.007
11. Pulla, S, G Ramaswami, N Mondal, **R Chitra-Tarak**, HS Suresh, HS Dattaraja, P Vivek, N Parthasarathy, BR Ramesh & R Sukumar (2015) Assessing the Resilience of Global Seasonally Dry Tropical Forests. ***International Forestry Review***, 17, 91–113. https://doi.org/10.1505/146554815815834796
12. Riotte, J, J Maréchal, S Audry, C Kumar, JP Bedimo, L Ruiz, M Sekhar, M Cisel, **R Chitra-Tarak**, MRR Varma, C Lagane, P Reddy & JJ Braun (2014) Vegetation impact on stream chemical fluxes: Mule Hole watershed (South India). ***Geochimica et Cosmochimica Acta***, 145, 116-138. https://doi.org/10.1016/j.gca.2014.09.015
13. Sen, R, S Samudre, MC Shilpa, **R Chitra Tarak** & R Gadagkar (2009) Middle aged wasps mate through most of the year, without regard to body size, ovarian development and nest mateship: a laboratory study of the primitively eusocial wasp *Ropalidia marginata*. ***Insectes Sociaux***, 57, 95–103. https://doi.org/10.1007/s00040-009-0054-9

Book Chapter

14. **Chitra-Tarak, R***, J Needham*, A Hanbury-Brown, E Robles, C Varadharajan, R Knox, L Kueppers. Advancing our understanding of tropical forests and improving the predictive capability of vegetation models with data-model integration at BCI. (2024) Chapter 59 in *The First 100 Years of Research on Barro Colorado: Plant and Ecosystem Science.* ed. H. C. Muller-Landau and S. J. Wright: Smithsonian Institution Scholarly Press. *Co-first authors.

Theses

15. **Chitra-Tarak, R.** Eco-Hydrology of a Seasonally Dry Tropical Forest: Tree Growth, Belowground Water Dynamics and Drought-Vulnerability (2016). *Submitted for 'Doctor of Philosophy' in the Faculty of Science, Centre for Ecological Sciences, Indian Institute of Science, Bangalore.* Series No. G27771. https://etd.iisc.ac.in/handle/2005/2915 https://rutuja64.files.wordpress.com/2024/01/rutuja_thesis_final_20sep2016.pdf

16. **Chitra-Tarak, R.** Evolution of cooperation in the centipede game: the role of discriminators. (2007) *Submitted for 'Master of Science' in Biodiversity & Taxonomy, University of Pune, India.* Published as Conference Proceedings at18th International Conference on Game Theory at Stony Brook, USA. http://old.gtcenter.org/Archive/Conf07/Downloads/Conf/Dahanukar448.pdf

Data Publications

17. **Chitra-Tarak, R**, et al. (2020) Soil Water Potentials (1990-2018) from a calibrated ELM-FATES and rooting depth inverse modeling and analyses scripts, PA-BCI, Panama. NGEE Tropics Data Collection. https://doi.org/10.15486/ngt/1696806
18. **Chitra-Tarak, R**, SM McMahon and P Neale. (2019) SERC Meteorological Data. The Smithsonian Institution. Dataset. https://doi.org/10.25573/serc.11020646.v2
19. **Chitra-Tarak, R** et al. (2018), Data from: The roots of the drought: hydrology and water uptake strategies mediate forest-wide demographic response to precipitation, Dryad, Dataset, https://doi.org/10.5061/dryad.nm3d3

SCIENTIFIC REPORTS

1. J Joshi, **R Chitra-Tarak**, A Patwardhan (2006) Matheran Eco Sensitive Area: Time to catch a positive spirit. Research & Action in Natural Wealth Administration (RANWA), Pune.

SOFTWARE DEVELOPMENT

1. **Chitra-Tarak**, **R** with Chonggang Xu (2022) An automated workflow to run thousands of single locations (point) simulations of E3SM Land Surface Model (ELM or ELM-FATES) in parallel and extract outputs and/or run sensitivity analyses - An R code wrapped in python: https://github.com/lanl/cimmid-e3sm
2. **Chitra-Tarak, R**, Zachary Robbins, Xiaoming Sun, Chonggang Xu and Adam Atchley (2022) Code to serially couple a computational fluid-dynamic based fire model, QUICFire, to an ecosystem demography model with tree hydraulics, (ELM-)FATES-Hydro, to enable simulation experiments of vegetation response, in terms of composition, structure and function, under no-analog fire regimes and climatic change. https://github.com/lanl/drm-fates; https://github.com/rutujact/fire-serdp
3. **Chitra-Tarak, R** & Laurent Ruiz (2024) An R code to simulate a 1-D catchment water balance model, COMFORT (Ruiz et al. 2010, *J of Hydrology*) with user-set parameters and met-forcings https://github.com/rutujact/comfort.mh
4. **Chitra-Tarak, R** & Laurent Ruiz (2024) An R code to estimate viability, irrigation needs and aquifer recharge potential of alternative cropping-systems for a given hydro-climate. https://github.com/rutujact/crop-waterbudget

INVITED SEMINARS

- **2022**: Association of Tropical Biology & Conservation Conference, Cartagena, Colombia.
- **2021**: Drought experiment Working Group, Luquillo Long-Term Ecological Research Program, Puerto Rico, USA; Indian Institute of Science Education and Research, Pune, India; Ecosystem Ecology Lab, U. of Arizona, Tucson, AZ, USA; Science in "3", a Los Alamos National Lab Post-Doc showcase event, NM; DOE ESS PI meeting, Washington, DC, USA.
- **2020**: Ecosystem Ecology Lab, U. of Arizona, Tucson, AZ, USA; Terrestrial Ecosystem Program Management, Dept. of Energy, Washington, DC, USA. REU student seminar. Quantitative Ecology Lab. Smithsonian Environmental Research Center, Edgewater, MD, USA.

- **2019**: DOE ESS PI meeting, Washington, DC, USA.
- **2018**: Earth & Environmental Science Division, Los Alamos National Lab, NM, USA; ESA Annual Meeting, New Orleans, LA, USA; CTFS-ForestGEO Analytical Workshop, Nové Hrady, Czech Republic; National Museum of Natural History, Washington, DC.
- **2017**: CTFS-ForestGEO Analytical Workshop, Rio Grande, Puerto Rico.
- **2016**: CTFS-CForBio Analytical Workshop VI, Hainan, China.
- **2015**: CTFS-CForBio Analytical Workshop V, Gamboa, Panama.
- **2014**: Ecosystem Monitoring and Forest Census Research meeting, organised by NCBS, LEMoN-India, RAINFOR-GEM & University of Oxford. National Centre for Biological Sciences, Bangalore; CTFS-CForBio Analytical Workshop IV, Xishuangbanna, China.

MENTORING EXPERIENCE

2022 Aspen Peterman, Postbacc student, LANL
Hydraulic trait coordination in tropical forests.

2021-22 Aitor Jimenez, PhD student, University of Houston, TX, USA
Hydrological calibration of a land surface model in a tropical forest

2020 Zachary Robbins, PhD student, North Carolina State Uni., NC, USA
Modeling insect-induced tree mortality in California. (Main mentor Chonggang Xu)

2018 Patricia Mezza, BSc REU student, SERC, MD, USA
Hydrological niche partitioning in a coastal forest.

2018 Kay Garlick-Ott, BSc volunteer, SERC, MD, USA. Currently PhD Student, UC Davies
Hydrological instrumentation along a coastal forest hillslope.

2016 Lokesh Naik, BSc student, Indian Institute of Science. Works at Carbonbase.
Plant functional trait variation along a rainfall gradient in a Seasonally Dry Tropical Forest.

MODEL DEVELOPMENT: PAST & CURRENT

- Hydrological drought characterization via parameterization and calibration of DOE's Energy Exascale Earth System Model (E3SM) Land Surface Model (ELM)
- Advancing ELM's ability to predict tropical forest drought response: inverse tree root depth modeling and drought strategy representation in the plant hydro-dynamics scheme of Functionally Assembled Terrestrial Ecosystem Simulator (FATES), a vegetation demography model component of ELM
- Linking FATES to 3D Fire Disturbance Models, QUICFIRE & FIRETEC.
- Linking FATES to the Advanced Terrestrial Simulator (ATS), an integrated, distributed hydrology model.
- Developing ELM catchment hydrology for the Arctic via comparison with ATS, a LANL developed code that better captures freeze-thaw processes.
- Climate simulations for the spread of mosquito-borne diseases via ELM.

FIELD EXPERIENCE

2008-16 *Mudumalai National Park & Tiger Reserve, Tamilnadu, India*.

Tree growth (dendrometers), phenology and functional traits in ForestGEO protocol plots along rainfall and fire-frequency gradients. Leaf water potentials, leaf traits, wood density, tree height, seed mass and number. Stable isotopic analyses.

2008-16 *Mulehole Critical Zone Observatory, Bandipur National Park, Karnataka, India.*

Permanent forest dynamics plot deployment (four 1-ha plots, ForestGEO protocol) in old-growth tropical dry forest along soil gradients. Tree growth, phenology and functional traits. Tree ring analyses. Soil physical & chemical characterization.

2017-18 *Smithsonian Environmental Research Center ForestGEO plot, MD, USA.*

Soil moisture and water-table monitoring. Stable isotopic analyses for tree water-sourcing depths. DNA barcoding of root/bulk soil samples for estimating plant rooting depths.

PROFESSIONAL ACTIVITIES & SERVICE

Grant Review Panel

Dept. of Energy, USA.

Conference Session/Meeting Organised

2023 B Bomfim, R Chitra-Tarak, M Longo, C Koven. Linking field-oriented ecology and ecologists with land surface models and modelers. Symposium at Association for Tropical Biology & Conservation Annual Meeting. Coimbatore, India.

2022 R Chitra-Tarak, Yilin Feng. Model testing and development priorities for soil hydrology and plant hydrodynamics—cohorts to continental scales. NGEE-Tropics Annual Meeting Break-out Session. Berkeley.

2022 R Chitra-Tarak. Led E3SM Land Model (ELM) workshop on LANL super-computers (attended by 20 team members). LANL.

2021 R Chitra-Tarak, B Gimenez, D Zuleta, J Needham, L Agee, B Bomfim, D Dores, and the NGEE-Tropics Executive Committee. NGEE-Tropics Annual Meeting. Online.
2020 R Chitra-Tarak, L Agee, C Xu. Linking Aboveground-Belowground Processes in a Changing Environment, AGU Fall Meeting. Online.

Journals Reviewed

• New Phytologist • Ecology Letters • Journal of Ecology • Biogeosciences
• Forest Ecology and Management • Environmental Research Letters • Plant and Soil

Media Coverage & Interviews

2022 Interviewed as an independent, tropical forest expert to comment on Zuidema et al 2022 *Nature Geoscience*.
https://news.mongabay.com/2022/04/tropical-trees-growth-and-co2-intake-hit-by-more-extreme-dry-seasons/

2020 Meet A Leaf: Rutuja Chitra-Tarak. AGU Ecohydrology Blog.
https://www.aguecohydrology.org/blog-adding-our-leaves/meet-a-leaf-rutuja-chitra-tarak

2019 Interviewed by *Journal of Ecology* as a British Ecological Soc's Harper Prize winner.
https://jecologyblog.com/2019/06/10/harper-prize-2019-part1/
https://jecologyblog.com/2019/06/10/harper-prize-2019-part2/

2019 Coverage of Chitra-Tarak et al. *JoE* (2022) "The roots of the drought" in the national daily, The Hindu, India. https://www.thehindu.com/sci-tech/energy-and-environment/droughts-can-kill-deep-rooted-tree-species-more/article22480721.ece

Science Outreach

2020 Workshops for 5-9 grade girl students (2 batches of 20 each), Expanding Your Horizons. Santa Fe, NM

2017 Seminar for Smithsonian Environmental Research Center Educational Volunteers. Edgewater, MD

SOCIETAL MEMBERSHIPS

• Ecological Society of America • Association of Tropical Biology and Conservation • Association for American Geophysical Union

LANGUAGES

- Expert oral and written skills in English, Marathi, Hindi
- Conversational skills in Kannada, Tamil

ADVISORS

PhD: Laurent Ruiz (IISc, Bangalore & INRAE, France; *informal*)
Raman Sukumar (IISc, Bangalore; *formal*)

Post-docs: Sean M. McMahon (SERC, USA)
Chonggang Xu, Brent D. Newman (LANL, USA)