Mukund Palat Rao

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Education

2014-2020	*Ph.D. Earth and Environmental Science*, Columbia University, NY, U.S.A.
2012-2013	*M.A. Climate and Society*, Columbia University, NY, U.S.A.
2008-2012	*B.Tech Chemical Engineering*, Amrita School of Engineering, Tamil Nadu, India

Fellowships and Scholarships

2014-2019	*Dean's Fellowship*, Earth and Environmental Science, Columbia University
2012-2013	*Tuition waiver scholarship*, M.A. Climate and Society, Columbia University

PhD dissertation: Hydroclimate variability and environmental change in Eurasia over the past millennium and its impacts. *Advisors*: Edward Cook, Rosanne D'Arrigo, Kevin Griffin [link]

Academic Profiles: [Google Scholar] [ResearchGate] [Web of Science] [ORCID]

Professional Experience

2021-present	*NOAA Climate & Global Change Postdoctoral Fellow* University Corporation for Atmospheric Research (UCAR), U.S.A & Dept. of Plant Sciences, University of California, Davis (*Advisor*: Troy Magney)
2020-2021	*Research Assistant* Ecology, Evolution, and Environmental Biology (E3B). Columbia University Analysing drone-based vegetation imagery.
2018-present	*Adjunct Professor of Environmental Studies* Department of Environmental Studies, New York University (NYU), U.S.A.
2013-2017	*Graduate Teaching Assistant,* Columbia University, U.S.A.
2012-2014	*Research Assistant,* Tree-Ring Laboratory, Lamont-Doherty Earth Observatory of Columbia University (LDEO). Analysis and development of tree-ring data.

Current research interests

i. Land-atmosphere interactions; **ii.** Plant ecophysiology; **iii.** Dendrochronology; **iv.** Hydroclimate and environmental change; **v.** Ecosystem and human impacts of climate change; **vi.** Climate-human-livestock interactions in pastoral nomadic herding communities; **vii.** Earth system models

Peer-reviewed publications

In Preparation

[22] **Rao, M. P.,** Griffin, K. L., Davi, N. K., Andreu-Hayles, L., Nachin, B., & Byambasuren, O. et al. Chlorophyll fluorescence, leaf traits, and leaf chemistry along a montane-riparian gradient in the Mongolian boreal forest. *(in preparation for submission to Tree Physiology)*

[21] Bishop, D. A., Williams, A. P., Seager, R., Bolles, K., Cook, E. R., Peteet, D. M., Cook, B. I., & **Rao, M. P.** Placing the east-west United States aridity gradient in a millennial context. *(in preparation)*

[20] Rodríguez-Catón, M., Andreu-Hayles, L., Daux., V., Morales, M., Christe, D., **Rao, M. P.,** Vuille, M., Villalba, R. Reconstructing interannual climate variability for the South American Altiplano using isotope tree-ring chronologies. (*in preparation*)

[19] Palmer, J. G, Higgins, P., **Rao, M. P.**, Turney, C., Cook, E. R., & Verdon-Kidd, D. Five hundred years of Murray-Darling river flow in Australia. *(in preparation)*

[18] Mundo, I. A., Murray, C., Grosso, M., **Rao, M. P.,** Cook, E. R., & Villalba, R. The lost whaler Dolphin: Dendrochronological provenance of the 1858 BG Shipwreck, Puerto Madryn, Patagonia to an eastern North American origin. *(in preparation)*.

May 2012 - [Sibylline – Marine Wildlife Center]

[17] Pons, D., & **Rao, M. P.** Multi-Decadal Midsummer Streamflow Reconstruction of the Upper Samalá River Basin, Guatemala. *(in preparation for submission to Dendrochronologia)*

[16] Palmer, J. G., Cook, E. R., Allen, K. J., **Rao, M. P.,** & Baker, P. Seven hundred years of eastern Australian and New Zealand droughts and pluvials *(in preparation for submission to Environmental Research Letters)*

Under Review, In Revision, & In Press

[15] †Leland, C., †**Rao, M. P.**, Cook, E. R., Cook, B. I., Lapidus, B., Staniforth, A., Solomon, A., & Holloway, M. Y. Dendroarchaeological analysis of the Terminal Warehouse in New York City reveals a history of long-distance timber transport during the Gilded Age *(under review at the Journal of Archaeological Science: Reports;* †Leland & Rao contributed equally).

January 2020 - [6SQFT]; February 2020 [NYREJ]

[14] Davi, N. K., **Rao, M. P.**, Wilson, R., Andreu-Hayles, L., Oelkers, R., D'Arrigo, R. D., Nachin, B., Buckley, B., Pederson, N., Leland, C., & Suran, B. Accelerated recent warming and temperature variability over the past eight centuries in the Central Asian Altai from Blue Intensity in tree-rings *(under review at Geophysical Research Letters)*

[13] Wang, W., Dong, Z., **Rao, M. P.**, Lall, U., & Benyou, J. Last two millennia of streamflow variability in the headwater catchment of the Yellow River basin reconstructed from tree rings. *(under review after revisions, Water Resources Research)*

2021

[12] Rodríguez-Catón, M., Andreu-Hayles, L., Morales, M. S., Daux, V., Christe, D., Coopman, R. E., Alvarez, C., **Rao, M. P.,** Aliste, D., Flores, F., & Villalba, R. Different climate sensitivity for radial growth, but uniform for tree-ring stable isotopes along an aridity gradient in *Polylepis tarapacana*, the world's highest elevation tree-species *(early online view, Tree Physiology)* [link]

2020

[11] **Rao, M. P.**, Cook, E. R., Cook, B. I., D'Arrigo, R. D., Palmer, J. G., Lall, U., Uriarte, M., Woodhouse, C. A., Buckley, B. M., Bishop, D. A., Jian, J., & Webster, P. J (2020). Seven centuries of reconstructed Brahmaputra River discharge demonstrate underestimated high discharge and flood hazard frequency. *11, 6017, Nature Communications.* [link]

Nov 2020 - [Earth Institute: State of the Planet]; Dec 2020 - [Outlook]; Dec 2020 - [The Indian Express]; Dec 2020 - [The Dhaka Tribune]; Dec 2020 - [Nation World News]; Dec 2020 - [SciDev.Net]; Dec 2020 - [The Times of India]; Dec 2020 - [The Business Standard]; Jan 2021 - [Mongabay]; Jan 2021 - [Nature India]

2019

[10] Kakinuma, K., Yanagawa, A., Sasaki, T., **Rao, M. P.**, & Kanae, S (2019). Socio-ecological interactions in a changing climate in Mongolia. *Sustainability, 11*(21), 5883. [link]

[9] **Rao, M. P.,** Cook, E. R., Cook, B. I., Anchukaitis, K. J., D'Arrigo, R. D., Krusic, P. J., & LeGrande, A. N. A double bootstrap approach to Superposed Epoch Analysis to evaluate response uncertainty. *Dendrochronologia, 55, 119-124.* [link]

[8] Bishop, D. A., Williams, A. P., Seager, R., Fiore, A. M., Cook, B. I., Mankin, J. S., Singh, D., Smerdon, J. E., & **Rao, M. P.** (2019). Investigating the causes of increased 20th-century precipitation over the southeastern United States. *Journal of Climate, 32(2), 575–590.* [link]

2018

[7] **Rao, M. P.,** Cook, E. R., Cook, B. I., Palmer, J., Uriarte, M., Devineni, N., Lall, U., D'Arrigo, R. D., Woodhouse, C. A., Ahmed, M., Zafar, M. U., Khan, N., Khan, A., & Wahab, M. (2018). Six centuries of Upper Indus Basin streamflow variability and its climatic drivers. *Water Resources Research 54(8), 5687-5701.* [link]

[6] Leland, C., Cook E. R., Andreu-Hayles, L., Pederson, N., Hessl, A., Anchukaitis, K. J., Byambasuren, O., Nachin, B., Davi, N., D'Arrigo, R., Griffin, K., Bishop, D. A., & **Rao, M. P.** (2018). Strip-bark morphology and radial growth trends in ancient *Pinus sibirica* trees from central Mongolia. *Journal of Geophysical Research: Biogeosciences, 123 (3), 945–959.* [link]

2017

[5] Pages Hydro2k Consortium (2017). Comparing proxy and model estimates of hydroclimate variability and change over the Common Era. *Climate of the Past, 13*(12), 1851-1900. [link]

[4] **Rao, M. P.,** Cook, B. I., Cook, E. R., D'Arrigo R. D., Krusic, P. J., Anchukaitis K. J., LeGrande, A. N., Buckley, B. M., Davi, N. K., Leland C. & Griffin, K. L. (2017). European and Mediterranean hydroclimate responses to tropical volcanic forcing over the last millennium. *Geophysical Research Letters, 44(10), 5104–5112.* [link]

[Past Global Changes, Volcanic Impacts on Climate and Society (PAGES-VICS) working group contribution]

2016

[3] Zafar, M. U., Ahmed, M., **Rao, M. P.**, Buckley, B. M., Khan, N., Wahab, M., & Palmer, J. (2016). Karakorum temperature out of phase with hemispheric trends for the past five centuries. *Climate Dynamics,* 46(5), 1943-1952. [link]

2015

[2] Davi, N. K., D'Arrigo, R., Jacoby, G. C., Cook, E. R., Anchukaitis, K. J., Nachin, B., **Rao, M. P.**, & Leland, C. (2015). A long-term context (931–2005 C.E.) for rapid warming over Central Asia. *Quaternary Science Reviews,* 121, 89-97. [link]

June 2015 - [Earth Institute]; June 2015 - [William Paterson University]

[1] **Rao, M. P.,** Davi, N. K., D'Arrigo, R. D., Skees, J., Nachin, B., Leland, C., Lyon, B., Wang, S-Y., & Byambasuren, O. (2015). Dzuds, droughts, and livestock mortality in Mongolia. *Environmental Research Letters, 10(7)*, 074012. [link]

July 2018 - [Earth Island]; Mar 2018 - [Caritas.org]; Jul 2017 - [Marron Institute]; Mar 2017 - [NewsWeek]; Jan 2017 - [The Guardian]; Jun 2015 - [Earth Institute]; Aug 2015 - [Environmental Research Web]

Courses Taught

Spring 2021, Summer 2021	Climate Change, NYU **(Instructor)**
Spring 2021	Environmental Quantitative Methods, NYU (Course Assistant)
Summer 2018	Environmental System Science, NYU **(Instructor)**
Fall 2013; 2015; 2017	Quant. Models of Nat. & Human Syst., Columbia Univ. **(Lab Instructor)**
Fall 2016	Dynamics of Clim. Variability and Clim. Change, Columbia Univ., (Teaching Assistant)
Fall 2013	Water Resources and Climate, Columbia. Univ. (Teaching Assistant)
	Total: 9 semesters, 5 as the primary instructor

Datasets

[4] **Rao, M. P.**, Cook, E. R., Cook, B. I., D'Arrigo, R. D., Palmer, J. G., Lall, U., Uriarte, M., Woodhouse, C. A., Buckley, B. M., Bishop, D. A., Jian, J., & Webster, P. J. (2020). Data for: Seven centuries of reconstructed Brahmaputra River discharge demonstrate underestimated high discharge and flood hazard frequency, NOAA-National Center for Environmental Information. [link]

[3] **Rao, M. P.,** Cook, E. R., Cook, B. I., Anchukaitis, K. J., D'Arrigo, R. D., Krusic, P. J., & LeGrande, A. N. (2019). Data for: A double bootstrap approach to Superposed Epoch Analysis to evaluate response uncertainty, Mendeley Data, V1, doi: 10.17632/8p7y29hz5h.1. [link]

[2] **Rao, M.P.;** Cook, E.R.; Cook, B.I.; Palmer, J.G.; Uriarte, M.; Devineni, N.; Lall, U.; D'Arrigo, R.D.; Woodhouse, C.A.; Ahmed, M.; Zafar, M.U.; Khan, N.; Khan, A.; Wahab, M. Data for: Six Centuries of Upper Indus Basin Streamflow Variability and Its Climatic Drivers, NOAA-National Center for Environmental Information. [link]

[1] Davi, N. K., D'Arrigo, R., Jacoby, G. C., Cook, E. R., Anchukaitis, K. J., Nachin, B., **Rao, M. P.**, & Leland, C. (2015). Data for: Northern Mongolia 1000 Year Summer Temperature Reconstruction. NOAA-National Center for Environmental Information. [link]

Professional Activities

[1] Site co-PI and co-founder of the LDEO PhenoCam with Oryan, B. This site joins a global ecosystem phenology camera network, PhenoCam. It is located on Columbia University's Lamont-Doherty

Earth Observatory campus, and continuously monitors the vegetation canopy status of the oak-maple dominated forest of the Palisades Interstate Park, NY, U.S.A. October, 2020
November 2020 - [State of the Planet]

Articles for public audiences (not peer-reviewed)

[1] A wetter Brahmaputra River and implications for flooding in Bangladesh, by **Rao, M.P.**, and Cook, B.I. EOS - Science News by AGU (*under editorial review*).

Scientific Grants (as PI $100,033; total $559,508)

[6] Lamont-Doherty Earth Observatory Climate Center, Columbia University, $10,000, 4/1/21 to 12/31/22 Rao, M.P., Pacheco-Solana, A., Jensen, J., Oryan, B., Rodríguez-Catón, M., Griffin, K.L., Andreu-Hayles, L., Boelman, N., Commane, R., Gentine, P., & Davi, N.K. Temporal dynamics of tree-growth and photosynthesis and their environmental drivers in the Lamont Sanctuary Forest Preserve

[5] Chevron Student Initiative Fund, $3,200, (07/2020)**,** Developing the LDEO PhenoCam network to track the fate of forest carbon from photosynthesis to growth. PIs - **Rao, M.P.,** Oryan, B. (Columbia Univ.)

[4] NSF Arctic Social Sciences, $459,475 (09/2017-08/2022), *Collaborative Research: Climate, human and ecosystem interactions in the face of a rapidly changing North Asian biome.* Co-*PIs:* Honeychurch W. (Yale Univ.), Fowell S. J. (Univ. Alaska, Fairbanks), Davi N. K. & Andreu-Hayles L. (Columbia Univ.). *Student:* **Rao M. P.** (co-wrote grant application) [link]

[3] Chuo University, Japan, $74,533 (09/2015-08/2016), *Research on Evaluation of Mean State and Climate Extremes in the Long Meteorological Records in Mongolia. Co-PIs:* Davi N. K., Lall U., D'Arrigo R. D., **Rao M. P.**, Leland C., Haraguchi M. (Columbia Univ.)

[2] Climate Center, LDEO-Columbia Univ., $10,000 (06/2013-12/2015). *Influence of atmospheric and oceanic forcings on the Southwest and Northeast Monsoons over India: A paleoclimate perspective. Co-PIs:* Buckley B. M., Davi N. K., & **Rao M. P.** (Columbia Univ.)

[1] Chevron Student Initiative Fund, LDEO, $2,300 (04/2013-12/2013). *A paleoclimate study of the Indian Monsoon using tree-ring based reconstructions. PI:* **Rao M. P.** (Columbia Univ.)

Other Grants

[1] Lamont Campus Life, Columbia Univ, $242 (04/2018), *Enhancing the operability and comfort of the Lamont nursing and lactation space,* Kim-Blanco P., McCarthy, C., Andreu-Hayles, L., & **Rao M. P.**

Workshops conducted

[1] **Rao, M. P.** hosted by Rudi F. (2014). *From dendrochronology to dendroclimatology: Understanding the big picture.* Conducted for undergraduate and master's students at Andalas University, Sumatra, Indonesia, June 9-10, 2014. *Partnerships for enhanced engagement in research (PEER) Science,* to "Strengthen the research and teaching capacity of Andalas University in climate change and natural resources management".

Guest Lectures and Invited talks

[3] Guest Lecture on *Forests and Climate Change*, Science Honors Program, Columbia University (October 31, 2020).

[2] *Stories trees tell us about the past and present.* Guest lecture, M.A. Science Journalism. An advanced science writing programme for experienced journalists, Columbia University, New York, USA (September 29, 2020).

[1] *Understanding Coupled Natural and Human Systems: Climate related mass livestock mortality in Mongolia, Volcanoes and European hydroclimate, and Long-term Indus River streamflow*. Centre for Ecological Sciences Seminar, Indian Institute of Science, Bangalore, India (December 10, 2016).

Awards

[2] *Early Career Scientist Travel Support Award*, European Geophysical Union (EGU), Vienna, Austria (April 7-12, 2019).

[1] *Student Travel Matching Grant*, Columbia University Graduate School of Arts and Sciences (GSAS), to attend the American Geophysical Union meeting, New Orleans, U.S.A. $250 (October, 2017).

News articles featured in

[3] Rooftop Camera Will Track How Local Forests Change With the Climate, State of the Planet, Earth Institute, Columbia University (November 3, 2020) [link]

[2] Raiders of the lost Bark, ScienceLine (July 29, 2018) [link]

[1] Profile – 'For the Love of Mother Nature', Amrita Vishwa Vidyapeetham (July 30, 2012) [link]

Selected scientific conference presentations

2021

[19] Passow, M., Buckley, B., Oelkers, R., & **Rao, M. P.** *The Lamont-Doherty Tree-Ring Lab and Earth2Class Programs: Sharing Dendrochronology with Students and Teachers.* American Meteorological Society Annual Meeting, U.S.A., January 10-14, 2021.

2019

[18] **Rao, M.P,** Griffin, K. L., Davi, N. K., Andreu-Hayles, L, Nachin, B., Suran, B, D'Arrigo, R. D., Leland, C., Gardner, W., & Honeychurch, W. (2019). *Photosynthetic heat tolerance, light response, and respiration rates across gradients in the northwestern Mongolian boreal-steppe.* American Geophysical Union, San Francisco, U.S.A., December 9-13, 2019 **(poster).**

[17] Cook, E. R., ***Rao, M. P.**, Cook, B. I., Uriarte, M., Palmer, J. G., Lall, U., D'Arrigo, R. D., Woodhouse, C. A., Bishop, D. A., Jian, J., & Webster, P. J. *Six hundred years of reconstructed Brahmaputra River flow demonstrate long-term flood risk is substantially underestimated*. American Geophysical Union, San Francisco, U.S.A., December 9-13, 2019 **(talk - * presenting author).**

[16] Davi, N. K., Oelkers, R., D'Arrigo, R. D., **Rao, M. P**., Andreu-Hayles, L., Cook, E.R., Leland, C., Geary, J. *Improved Central Asian Temperature from Blue Intensity Reflectance of Tree Rings.* American Geophysical Union, San Francisco, U.S.A., December 9-13, 2019 **(poster).**

[15] Rodríguez-Catón, M., Andreu-Hayles, L., Morales, M., Christie, D., Alvarez, C., Leland, C., **Rao, M. P.**, Rose, O., Daux, V., &Villalba, R. (2019) *Climate Signals in Oxygen Isotopic Tree-ring Chronologies of Polylepis tarapacana from the South American Altiplano.* American Geophysical Union, San Francisco, U.S.A., December 9-13, 2019 **(poster).**

[14] **Rao M. P.**, Cook E. R., Cook B. I., Uriarte M., Palmer J. G., Lall U., Devineni N., D'Arrigo R. D., Woodhouse C., Jian J., Webster P. J. (2019). *Seasonal reconstructions of Brahmaputra River*

discharge and applications for monsoon flooding risk. European Geophysical Union, Vienna, Austria April 7-12, 2019 **(talk).**

2018

[13] D'Arrigo, R. D., Wilson, R., Rydval, M., Buckley, B., Cook, E. R., Anchukaitis, K., **Rao, M. P.**, Gaglioti, B. (2018). *The Climate and Societal Response to Three Major Volcanic Eruptions across Northern Latitudes Inferred from Tree-Ring Density in Recent Centuries.* American Geophysical Union, Washington D.C., U.S.A., December 10-14, 2018 **(poster).**

[12] **Rao M. P.**, Cook E. R., Cook B. I., Uriarte M., Palmer J. G., Lall U., Devineni N., D'Arrigo R. D., Woodhouse C., Jian J., Webster P. J. (2018). *Sub-seasonal reconstructions of Brahmaputra River discharge Brahmaputra streamflow*. American Geophysical Union, Washington D.C., U.S.A., December 10-14, 2018 **(poster)**.

[11] **Rao M. P.**, Cook E. R., Cook B. I., D'Arrigo, R. D., Anchukaitis, K. J., Krusic, P. J., & LeGrande, A. N. (2018). *Estimating variability in the volcanic forced climate response using key year resampling.* 10th World Dendro Conference, Thimpu, Bhutan, June 2-22, 2018 (**talk)**.

[10] **Rao, M. P.,** Cook, E. R., Cook, B. I., Palmer, J., Uriarte, M., Devineni, N., Lall, U., D'Arrigo, R. D., Woodhouse, C. A., Ahmed, M., Zafar, M. U., Khan, N., Khan, A., & Wahab, M. (2018). *Six centuries of Upper Indus Basin streamflow variability and its climatic drivers.* 10th World Dendro Conference, Thimpu, Bhutan, June 2-22, 2018 **(talk)**.

[9] Kakinuma K., Yanagawa A., Sasaki T., **Rao M. P.**, & Kanae S. (2018) *Assessment of climate change impact on a socio-ecological system in Mongolia.*

i. Japan Geoscience Union (JpGU), Makuhari, Japan (March, 2018). (**talk)** [link]

ii. Global Land Project, Taipei, Taiwan (Sep. 2018). (**talk)**

[8] **Rao, M. P.**, Cook, E. R., Cook, B. I., D'Arrigo, R. D., Anchukaitis, K. J., Krusic, P. J., & LeGrande, A. N. (2018), *Estimating the variability in volcanic forced climate response using key year resampling*. Volcanic Impacts on Climate and Society, Tucson, AZ, USA. January 12-14, 2018 **(lightning talk + poster).**

2017

[7] **Rao, M. P.**, Cook, E. R., Cook, B. I., Palmer, J., Uriarte, M., Devineni, N., Lall, U., D'Arrigo, R. D., Woodhouse, C., & Ahmed, M. (2017). *Five centuries of tree-ring reconstructed streamflow and projections for future water risk over the Upper Indus Watershed.* American Geophysical Union, New Orleans, December 10-16, 2017 **(talk).** [link]

[6] Leland, C., Cook E. R., Andreu-Hayles, L., Pederson, N., Hessl, A., Anchukaitis, K. J., Byambasuren, O., Nachin, B., Davi, N., D'Arrigo, R., Griffin, K., Bishop, D. A., & **Rao, M. P.** (2018). *Strip-bark and whole-bark Siberian Pine radial growth trends and implications for climate reconstructions.* American Geophysical Union, New Orleans, U.S.A., December 10-16, 2017 **(poster).** [link]

[6] Bishop, D. A., Williams, P., Seager, R., Fiore, A. M., Cook, B., Mankin, J. S., Singh, D., Smerdon, J. E., & **Rao, M. P.** (2017). *Assessing the causes of 20th century wetting in the eastern United States.* American Geophysical Union, New Orleans, U.S.A., December 10-16, 2017 **(talk).** [link]

[5] Passow, M. J., Takahashi T., Fiore, A. M, Clifton, O. E., Nitsche, F., McManus, J. F., Winkler, G., Jacobel, A., Leland, C., & **Rao, M. P.** (2017). *Sharing Cutting-Edge Climate and Paleoclimate*

Research with Teachers and Students through Earth2Class. American Meteorological Society (AMS), Seattle, WA, U.S.A., January 22-26, 2017 **(poster).** [link]

2016 & 2015

[4] **Rao, M. P.,** Cook, B. I., D'Arrigo, R. D., LeGrande, A., Leland, C., Cook, E. R., Buckley B. M., Davi, N. D., & Griffin, K. L. (2016). *European hydroclimate response to tropical volcanic forcing over the past millennium.*

i. American Geophysical Union, San Francisco, CA, U.S.A., December 10-16, 2016 **(poster).**

ii. Volcanic Impact on Climate and Society (VICS), Palisades, NY, U.S.A., June 6-8, 2016 **(talk)**

[3] **Rao, M.P.,** Buckley B. M., Zottoli, B., Fletcher, R., Wang, S., Cook, E. R., & Stahle, D. (2015). *Tree-rings as an effective paleoclimate proxy for independent validation of historical climate anomalies.* European Association for South East Asian Studies (EUROSEAS), Vienna, Austria, 11-15th August, 2015 **(talk).**

2014

[2] **Rao, M. P**., D'Arrigo, R. D., Buckley, B. M., & Ummenhofer, C. (2014). *Tree-ring results from Southeast Asia: Myanmar and Vicinity.*

i. Andalas University, Padang, Indonesia, June 10, 2014 **(talk)**.

ii. Southern Institute of Ecology, Vietnam Academy of Science and Technology, June 4, 2014 **(talk)**.

iii. Atmospheric Circulation Reconstructions over the Earth (ACRE) Southeast Asia meeting, Kuala Lumpur, Malaysia, May 27-28, 2014 **(talk).**

[1] D'Arrigo, R., Ummenhofer, C., Buckley, B., **Rao, M. P.**, Kyaw, N. (2014). *Past climate variability of Myanmar.* Tree Rings in Archaeology, Climatology and Ecology (TRACE): Aviemore, Scotland, May 6-10, 2014 **(poster).**

Mentoring

[1] Ms. Dhanya Karuppusamy, B.Tech, Undergraduate final year thesis, PSG College, Coimbatore, India. 2020

Leadership Positions

Representative, Campus Life Committee, for the Biology and Paleoenvironment Division and students of Department of Earth and Environmental Sciences, Lamont-Doherty Earth Observatory, Columbia University, (2015-2019, 5 years).

Co-editor and *co-designer,* magazine 'hillScribe', Agenda for Survival, Centre for Science and Environment, New Delhi, June 2012.

Elected *Chair,* ChemAMRITA, student's representative body, Department of Chemical Engineering, Amrita School of Engineering, India, 2011-2012.

Co-editor, Amritadhwani, university magazine, Amrita School of Engineering, India, 2011-2012.

Elected *Student's Representative,* Class of 2012, Department of Chemical Engineering, Amrita School of Engineering, 2011-2012.

Workshops attended

[5] Dendrochronology Field Week, 10th World Dendrochronology Conference, Bhumthang, Bhutan, June 2-9, 2018.

[4] Modeling Past Climate Change and Human Adaptation, The Ohio State University, USA, May 4-5, 2018

[3] Innovative Teaching Summer Institute, Columbia University NY, USA, June 2017

[2] Community Earth System Model (CESM) Tutorial, NCAR, Boulder, CO, USA. August, 8-12, 2016

[1] Dendroecological Field Week, organised by Columbia University, Da Lat Vietnam, January 2015

Fieldwork Experience

Bhutan, India, Indonesia, Mongolia, United States of America, and Vietnam

Scientific community service as a reviewer (total manuscripts excluding revisions: 22)

American Geophysical Union AGU Books (1), Dendrochronologia (3), Ecological Monographs (1), Environmental Research Letters (3), Geophysical Research Letters (2), Global and Planetary Change (1), International Journal of Biometeorology (1), Natural Hazards (1), Plos One (2), Scientific Reports (2), SoftwareX (1), Trees - Structure and Function (1), Quaternary Science Reviews (1), Quaternary Research (2)

Dendro-archeology dating and provenance

[1] Terminal Warehouse, Chelsea, New York, USA for L&L Holding Company, LLC (September 2019)

Outreach presentations to science teachers and educators

[3] **Rao M.P.,** Teaching in the Hudson Valley, a training workshop for school teachers, July 26, 2017.

[2] **Rao M.P.,** Bishop D., & Oelkers R., (2017), *More than How Old? Understanding Climate Change from Tree Rings?* Earth2Class Science workshop, April 8th, 2017. To create interactions between high school teachers of science to help them bring science to their class rooms.

[1] **Rao M.P.** & Leland C. (2014), *Trees, Climate, and Societal Relevance: A Case Study in Mongolia,* Earth2Class Science workshop, September 20th, 2014. [link]

Community Outreach

[2] Organised multiple editions of Lamont-Doherty Earth Observatory's Open House, (*2012; 2014; 2016; 2017; 2018, 2019).*

[1] Conducted numerous outreach tours and workshops for high-school students, undergraduate college students, and the general public.

Selected workshops and tours conducted at the Tree-Ring Laboratory, Lamont-Doherty Earth Observatory, Columbia University:

[21] **Rao M.P.** International Federation of Red Cross Red Crescent (IFRC) Climate Youth Scholars Program, September 23, 2019.

[20] **Rao M.P.** St. Bernard School (10 students), May 22, 2019.

[19] **Rao M.P.** with Rodriguez M. C., Central American children in foster care at the Cayuga Center, NY (30 children), Ages 8-10 (in Spanish), May 20, 2019.

[18] **Rao M.P.** with Leland C., High School group from Connecticut (15 students), March 20, 2019.

[17] **Rao M.P.** Historical Geology Class field trip, Queens College (20 students), November 9, 2018.

[16] **Rao M.P.** with Leland C., workshop for staff at the Centre of Sustainable Development, Columbia University to help them develop science outreach modules on dendrochronology for

students in rural India to work towards meeting UN Sustainable Development Goals, October 18, 2018.

[15] **Rao M.P.** Undergraduate Environmental Science class field trip, Queens College (15 students), July 25, 2018.

[14] **Rao M.P.** with Oelkers R., MS 302, Group 2 from Sophie Gerson Healthy Youth middle school, NY (50 students), May 15, 2018.

[13] **Rao M.P.** with Oelkers R., MS 302, Group 1 from Sophie Gerson Healthy Youth middle school, NY (50 students), March 28, 2018.

[12] **Rao M.P.,** seniors' group from The Chappaqua Library, NY, March 16, 2018.

[11] **Rao M.P.,** with Leland C., & Oelkers R., shadow program for 2 female undergraduate students from Bates College, ME who were considering applying to graduate school, February 22, 2018.

[10] **Rao M.P.,** 'Meet-a-scientist' interaction and tree-ring workshop with a group of 9 home schooled girls from Highland, NJ (aged 6-14 years), February 21, 2018

[9] **Rao M.P.** with Oelkers R., & Leland C., Luisa Dessus Cruz, NY (50 students), January 29, 2018.

[8] **Rao M.P.** talk and workshop for a group of high school students (20 students), August 17, 2017.

[7] **Rao M.P.** with Bishop D., St. Thomas Aquinas College, NY (33 students), July 27, 2017.

[6] **Rao M.P.** with Bishop D., Hewitt School an independent K-12 girls' school in New York City (15 students), May 31, 2017.

[5] **Rao M.P.** with Leland C., and Bishop D., 5th grade students from St. Bernard School (30 students), May 3, 2017

[4] **Rao M.P.,** pre-college science and math STEM Scholars program (32 students), July 6, 2016

[3] **Rao M.P.,** meet-a-scientist workshop on dendrochronology for 6 middle school students, April 7, 2016

[2] **Rao M.P.,** middle school group from the Lawrenceville School (38 students), July 16, 2015

[1] **Rao M.P.,** with Leland C., and Buckley, B, Climate Stewards Club from the Pascack Hills High School in Montvale NJ, November 7, 2014

Selected music performances (*Facebook/Instagram* **-** @curaaga)

[8] Facebook (Diwali Party at New York office). **Mukund Rao** (bansuri/flute) and Jay Gandhi (sitar), New York, U.S.A., November 7, 2019.

[7] Carroll Gardens Library-Brooklyn Public Library and Make Music New York. **Mukund Rao** (bansuri/flute) and Jay Gandhi (sitar), New York, U.S.A., June 21, 2019. [link]

[6] The (Not So) Tiny Desk Concert. **Mukund Rao** (bansuri/flute), Deepa Paulus (tabla); Shreya Vaidyanathan (vocals), Jay Gandhi (sitar), & Samuel Aldridge (sitar), Columbia University, New York, U.S.A., March 31, 2019.

[5] Raagas Live at Secret Project Robot. **Mukund Rao** (bansuri/flute), Deepa Paulus (tabla/percussion), Shreya Vaidyanathan (voice), & Samuel Aldridge (sitar), Brooklyn, New York, U.S.A., February 26, 2019. [link]

[4] South Asian Gender Violence, An exploration of violence through Music, Film, and Conversation, by Columbia University South Asian Feminism(s) Alliance. Deepa Paulus (tabla) & **Mukund Rao** (bansuri/flute), and Samuel Aldridge (sitar), Columbia University, U.S.A., November 9, 2018.

[3] Survivors, Storytelling & the Healing Power of Art, by Sakhi for South Asian Women. Deepa Paulus (tabla) & **Mukund Rao** (bansuri/flute), October 23, 2018. [link]

[2] WCKR 89.9 FM. **Mukund Rao** (bansuri/flute), Jay Gandhi (sitar), Deepa Paulus (tabla), Michel Vazirani (guitar), & Lucie Vitkova (accordion & electronics), March 25th, 2018.

[1] Expansions: New East Asian Music in New York. Katherine Whatley (koto), Lemon Guo (voice), Ethan Edwards (electronics), Chatori Shimizu (sho), Thea Mesirow (cello), **Mukund Rao** (bansuri/flute), Jay Gandhi (sitar), & Samuel Aldridge (sitar), Columbia University, New York, U.S.A., May 2nd, 2017. [link]

Languages

i. English; ii. हिन्दी (Hindi); iii. മലയാളം (Malayalam)

Conversational: i. Español (Spanish); ii. اُردُو (Urdu); iii. தமிழ் (Tamil); iv. ಕನ್ನಡ (Kannada)

References

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