Anu D Raj (Anu David Raj)

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Department of Climate Change Adaptation
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Research area & interest

Climate change impact on soil erosion, Soil erosion and surface runoff modelling (APEX, SWAT), Climate modelling, Hydrological Modelling, Statistical downscaling, Soil erosion processes in the Himalayan region (cultivated and forested), Fallout radionuclide (^{137}Cs) for soil erosion and soil quality studies, Digital mapping of soil erosion (ML, remote sensing), Remote Sensing and GIS in Natural Resource Management. Soil erosion process in alpine grasslands (Himalayas), and Soil erosion and soil carbon linkages.

Skills

ArcGIS/Pro, QGIS, ERDAS, R programming language (full working proficiency), python (working proficiency), MATLAB and google earth engine (working proficiency).

Current and previous positions

29 January 2025 - till date - Assistant Professor, **College of Climate Change and Environmental Science, Kerala Agricultural University, Thrissur, Kerala, India**

3 December 2023 - 24 January 2025 - Senior Research Fellow (soil erosion), **Agriculture and Soils Department, Indian Institute of Remote Sensing, ISRO.**

3 December 2021 - 2 December 2023 - Junior Research Fellow (soil erosion), **Agriculture and Soils Department, Indian Institute of Remote Sensing, ISRO.**

Education

PhD (Final Viva Voce Completed) - Climate change & forest influence – Forest Research Institute, Dehradun, India & **Indian Institute of Remote Sensing, ISRO, Dehradun, India**.

(1 Mar 2021 - 10 Jul 2025) | Thesis submitted 25 Nov 2024; Viva completed 10 Jul 2025

Thesis title – Geospatial modelling in soil erosion estimation using radioisotope tracer technique and climate change impact assessment in the north-western Himalayan region

B.Sc.-M.Sc. (Integrated) – Climate Change Adaptation – Agriculture (specialisation) – **Kerala Agricultural University, India.**

(8 Oct 2014 - 21 Jul 2020)

Thesis title – Modelling climate change impact on surface runoff and sediment yield in a watershed of Shivalik region

B.A. - Hindi - Literature - **Dakshin Bharath Hindi Prachar Sabha, Chennai**

Publication statistics

As of December 2025, 16 peer reviewed international journal articles, 1 national, 1 edited book (Springer), 20 book chapters in international publishers (Elsevier, Springer, Taylor & Francis)

ISI Web of Science statistics: H-Index = 6, sum of citations = 91
Scopus statistics: H-Index = 9, sum of citations = 216
Google Scholar Statistics: H-Index = 10, i10-index = 11, sum of citations = 405

For full list of publications

Peer reviewed articles (16 nos.)

1. **Anu D Raj**, Kumar, S., Sooryamol, K.R., Sankar, M. and George K, J., 2025. Quantifying soil redistribution across Himalayan hillslope under the influence of topography and terrace abandonment using fallout-137Cs. Discover Geoscience, *3*(1), p.233.
2. **Anu D Raj**, Kumar, S., Sooryamol, K.R., Sankar, M. and George K, J., 2025. Assessment of soil erosion rates, carbon stocks, and erosion-induced carbon loss in dominant forest types of the Himalayan region using fallout-137Cs. Scientific Reports, 15(1), p.14950. https://doi.org/10.1038/s41598-025-94953-8.
3. Sooryamol, K. R., Mariappan, S., Kumar, S., and **Anu D Raj** 2025. Effect of hillslope positions and soil properties on soil micronutrient availability in steep terraced croplands of north-western Himalayas. Environmental Earth Sciences, 84(8), 220. https://doi.org/10.1007/s12665-025-12222-3.
4. **Anu D Raj**, A., Kumar, S. and Sooryamol, K.R., 2024. Soil erodibility mapping using remote sensing and in situ soil data with random forest model in a mountainous catchment of Indian Himalayas. Environmental Monitoring and Assessment, 196(11), pp.1-21. https://doi.org/10.1007/s10661-024-13173-1.
5. **Anu D Raj**, Kumar, S. and Sooryamol, K.R., 2024. Downscaling future precipitation with shared socioeconomic pathway (SSP) scenarios using machine learning models in the North-Western Himalayan region. Modeling Earth Systems and Environment, 10(5), pp.6373-6395. https://doi.org/10.1007/s40808-024-02113-0.
6. **Anu D Raj**, Kumar, S., Sooryamol, K.R., Kalambukattu, J.G. and Kumara, S., 2024. Soil redistribution rates along the forested and cultivated steep hillslope in the mid-Himalayas using fallout—137Cs and RUSLE model. Land Degradation & Development. https://doi.org/10.1002/ldr.5258.
7. Kumar, S., **Anu D Raj**, Mariappan, S., Kalambukattu, J.G., Sooryamol, K.R., Singh, R.P., Madhu, M. and Karunakara, N., 2024. Application of fallout radionuclide—137Cs for estimating soil erosion in steep hillslopes with diverse land use of North-western Indian Himalayas. Discover Environment, 2(1), p.105. https://doi.org/10.1007/s44274-024-00131-4.

8. **Anu D Raj**, Kumar, S., Sooryamol, K.R., Mariappan, S. and Kalambukattu, J.G., 2024. 137Cs radiotracer in investigating influence of hillslope positions and land use on soil erosion and soil organic carbon stock—A case study in the Himalayan region. Soil Use and Management, 40(3), p.e13099. https://doi.org/10.1111/sum.13099.
9. **Anu D Raj**, Kumar, S., Mariappan, S., Sooryamol, K.R. and Kalambukattu, J.G., 2024. Potential of pine forest in controlling soil erosion in Himalayan region-Investigation using fallout radionuclide (137Cs) measurements. Evolving Earth, 2, p.100031. https://doi.org/10.1016/j.eve.2024.100031.
10. Kumar, S., **Anu D Raj** and Mariappan, S., 2024. Fallout radionuclides (FRNs) for measuring soil erosion in the Himalayan region: A versatile and potent method for steep sloping hilly and mountainous landscapes. Catena, 234, p.107591. https://doi.org/10.1016/j.catena.2023.107591.
11. Kumar, S., Murugan, N., **Anu D Raj** and George Kalambukattu, J., 2023. Hillslope elements and soil–landscape analysis in Himalayas for characterizing soil quality parameters using digital terrain model and remote-sensing data. Environmental Earth Sciences, 82(20), p.469. https://doi.org/10.1007/s12665-023-11166-w.
12. **Anu D Raj**, Kumar, S., Regina, M., Sooryamol, K.R. and Singh, A.K., 2023. Calibrating APEX model for predicting surface runoff and sediment loss in a watershed-a case study in Shivalik region of India. International Journal of Hydrology Science and Technology, 15(2), pp.177-206. https://doi.org/10.1504/IJHST.2021.10041820.
13. Kalambukattu, J.G., Johns, B., Kumar, S., **Anu D Raj** and Ellur, R., 2023. Temporal remote sensing based soil salinity mapping in Indo-Gangetic plain employing machine-learning techniques. Proceedings of the Indian National Science Academy, 89(2), pp.290-305. https://doi.org/10.1007/s43538-023-00157-x.
14. **Anu D Raj**, Kumar, S. and Sooryamol, K.R., 2022. Modelling climate change impact on soil loss and erosion vulnerability in a watershed of Shiwalik Himalayas. Catena, 214, p.106279. https://doi.org/10.1016/j.catena.2022.106279.
15. Sooryamol, K.R., Kumar, S., Regina, M. and **Anu D Raj**, 2022. Modelling climate change impact on soil erosion in a watershed of north-western lesser Himalayan region. Journal of Sedimentary Environments, 7(2), pp.125-146. https://doi.org/10.1007/s43217-022-00089-4.
16. **Anu D Raj**, Sooryamol, K.R. and Raj, A.D., 2021. Exploring Temporal Rainfall Variability and Trends Over a Tropical Region Using Tropical Rainfall Measurement Mission (TRMM) and Observatory Data. Hydrospatial Analysis, 5, pp.56-71. https://doi.org/10.21523/gcj3.2021050202.

Edited book (1 no.)

1. Chatterjee, U., Shaw, R., Kumar, S., **Anu D Raj**, Das, S. (eds) Climate Crisis: Adaptive Approaches and Sustainability. Sustainable Development Goals Series. **Springer**, Cham. https://doi.org/10.1007/978-3-031-44397-8_7

Book chapters (20 nos.)

1. David Raj, A. and **Anu D Raj**, 2025. Climate Change Induced Hydro-Meteorological Extremes in the Himalayan Region. In Climate Change: Conflict and Resilience in the Age of Anthropocene (pp. 33-56). Springer, Cham. https://doi.org/10.1007/978-3-031-85359-3_2.

2. Kumar, S., **Anu D Raj**, Justin George, K. and Chatterjee, U., 2025. Digital Terrain Analysis for Characterization of Terrain Variables Governing Soil Erosion and Watershed Hydrology. In Surface, Sub-Surface Hydrology and Management: Application of Geospatial and Geostatistical Techniques (pp. 469-490). Cham: Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-62376-9_21.
3. Kumar, S., Kalambukattu, J.G., **Anu D Raj**, Dwivedi, R.S. and Ravisankar, T., 2024. 10 Land Degradation Neutrality. Advances in Geospatial Technologies for Natural Resource Management, p.266. DOI: 10.1201/9781003035404-10.
4. **Anu D Raj** and Kumar, S., 2024. Fallout radionuclide (137Cs) method for quantifying soil erosion rates in steep sloping hilly and mountainous landscapes of Himalayas. In Intelligence Systems for Earth, Environmental and Planetary Sciences (pp. 261-289). Elsevier. https://doi.org/10.1016/B978-0-443-13293-3.00020-8.
5. **Anu D Raj**, Padmapriya, R. and Anu D Raj, 2024. Climate Crisis Impact on Ecosystem Services and Human Well-Being. In Climate Crisis, Social Responses and Sustainability: Socio-ecological Study on Global Perspectives (pp. 3-36). Cham: Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-58261-5_1.
6. David Raj, A., **Anu D Raj**, and Sooryamol, K.R., 2024. Climate Change and Himalayan Glaciers: A Socio-Environmental Concern in Anthropocene Epoch. In Climate Crisis: Adaptive Approaches and Sustainability (pp. 53-73). Cham: Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-44397-8_4.
7. **Anu D Raj**, Kumar, S., Kalambukattu, J.G. and Chatterjee, U., 2024. Land Degradation and its Relation to Climate Change and Sustainability. In Climate Crisis: Adaptive Approaches and Sustainability (pp. 121-135). Cham: Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-44397-8_7.
8. Kumar, S., Chatterjee, U., **Anu D Raj** and Sooryamol, K.R., 2024. Global Warming and Climate Crisis/Extreme Events. In Climate Crisis: Adaptive Approaches and Sustainability (pp. 3-18). Cham: Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-44397-8_1.
9. Sooryamol, K.R., Kumar, S., **Anu D Raj** and Sankar, M., 2024. Smart Farming and Carbon Sequestration to Combat the Climate Crisis. In Climate Crisis: Adaptive Approaches and Sustainability (pp. 293-306). Cham: Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-44397-8_16.
10. Kumar, S., Sooryamol, K.R., **Anu D Raj**, Kalambukattu, J.G. and Mariappan, S., 2023. Advanced Techniques in Estimating Soil Erosion and Associated Carbon Loss in the Himalayan Region. In Soil Carbon Dynamics in Indian Himalayan Region (pp. 341-371). Singapore: Springer Nature Singapore. https://doi.org/10.1007/978-981-99-3303-7_19.
11. Kalambukattu, J.G., Kumar, S., Dutta, P. and **Anu D Raj**, 2024. Soil erosion risk assessment and watershed prioritization using remote sensing and GIS techniques: a case study of Tehri Garhwal, Uttarakhand, India. In Remote Sensing of Soils (pp. 525-543). Elsevier. https://doi.org/10.1016/B978-0-443-18773-5.00036-3.
12. Majumdar, S., Chatterjee, U., **Anu D Raj** and Kumar, S., 2023. Decline in vegetation cover over Kolkata city: an environmental concern from remote-sensing perspective. In Water, Land, and Forest Susceptibility and Sustainability (pp. 453-474). Elsevier.
13. Kumar, S., Chatterjee, U. and **Anu D Raj**, 2023. Theoretical framework and approaches of susceptibility and sustainability: issues and drivers. In Water, Land, and Forest Susceptibility and Sustainability (pp. 3-25). Elsevier. https://doi.org/10.1016/B978-0-323-91880-0.00027-1.

14. Mariappan, S., **Anu D Raj**, Kumar, S. and Chatterjee, U., 2023. Global warming impacts on the environment in the last century. In Ecological footprints of climate change: Adaptive approaches and sustainability (pp. 63-93). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-031-15501-7_3.
15. Kumar, S., **Anu D Raj**, Kalambukattu, J.G. and Chatterjee, U., 2023. Climate change impact on land degradation and soil erosion in hilly and mountainous landscape: sustainability issues and adaptation strategies. In Ecological footprints of climate change: adaptive approaches and sustainability (pp. 119-155). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-031-15501-7_5.
16. **Anu D Raj**, Kalambukattu, J.G., Kumar, S. and Chatterjee, U., 2023. Geospatial Approach in Watershed Vulnerability to Climate Change and Environmental Sustainability. In Ecological Footprints of Climate Change: Adaptive Approaches and Sustainability (pp. 271-310). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-031-15501-7_11.
17. Kumar, S., Chatterjee, U. and **Anu D Raj**, 2023. Ecological Footprints in Changing Climate: An Overview. Ecological Footprints of Climate Change: Adaptive Approaches and Sustainability, pp.3-30. https://doi.org/10.1007/978-3-031-15501-7_1.
18. Kumar, S., **Anu D Raj** and Kalambukkattu, J.G., 2023. Geospatial modeling for sustainability of soil ecosystem services in hilly and mountainous landscapes. In Water, Land, and Forest Susceptibility and Sustainability (pp. 331-359). Academic Press. https://doi.org/10.1016/B978-0-443-15847-6.00011-2.
19. **Anu D Raj** and Kumar, S., 2022. Soil Quality Assessment in Hilly and Mountainous Landscape. In Soil Health and Environmental Sustainability: Application of Geospatial Technology (pp. 309-343). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-031-09270-1_13.
20. **Anu D Raj** (2020). Exploring rainfall variability, trend and possible linkages over Indian region. In Review of Language, Literature, Science, Commerce and Humanities (pp. 31–39). Shanlax Publications. https://doi.org/10.5281/zenodo.4935629

Conference papers/abstracts (6 nos.)

1. **Anu D Raj**, Kumar, S., Kalambukattu, J. G. and Mariappan, S. Fallout Radionuclides (FRNs) 137Cs in Quantifying Soil Erosion Rate in various Land Use / Land Cover Types in the Hilly and Mountainous Region of North- West Himalaya. Global Soils Conference November 19-22, 2024 at NASC Complex, New Delhi, India - Best Poster Presentation – 2024
2. **Anu D Raj**, Kumar, S., Mariappan, S., Sooryamol, K. R., and Kalambukattu, J. G. 2024 "Fallout Radionuclide -137Cs based Soil Erosion Estimation in a Mixed Land Use (Forested and Apple Orchard) of Steep Hillslope in the Northwestern Himalayas" National Conference on Living with Nature: Soil, Water and Society in Ecosystem Conservation (LNSWSEC-2024) at: Dehradun –Best Oral Presentation –2024.
3. **Anu D Raj**, and Kumar, S., 2024. "Investigating Traditional Farming Practices in Conserving Soils against Erosion Using Fallout Radionuclide -137Cs in North-western Himalayas" 18th Uttarakhand State Science and Technology Congress (18th USSTC) at: Haldwani, Nainital, Uttarakhand. Oral Presentation -2024.
4. **Anu D Raj**, Kumar, S., and Kalambukattu, J. G. 2023. Radiotracer 137Cs based Measurement in Validating Soil Erosion Estimation with RUSLE model –A Case Study in a Watershed of North-West Himalayas. International Conference on Sustainable Natural Resource Management under Global Climate Change At: New Delhi, India -2023.

5. Sooryamol, K. R., **Anu D Raj**, Kumar, S., and Sankar M. Investigating Soil Organic Carbon Variability Along Terraced Hillslopes in the North-west Himalayas. National Conference on Living With Nature: Soil, Water And Society In Ecosystem Conservation (LNSWSEC-2024)At: Dehradun - Best Poster Presentation -2024
6. **Anu D Raj**, and Kumar, S. Modelling Climate Change Impact on Surface Runoff and Sediment Yield in a Watershed of Shiwalik Region. Agrometeorological Interventions for Enhancing Farmer's Income-AGMET 2020 At: College of Horticulture.