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Impact of land cover changes on carbon and nutrient stocks in the dry tropical forest ecosystem: Nature based approaches for eco-restoration

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Anthropogenic land use and land cover changes are major drivers of environmental degradation and declining soil health across heterogeneous landscapes in Central India. To examines the land cover changes and spatio-temporal variations in forest carbon stock and soil organic carbon (SOC) over the past 25 years in central India. Geospatial techniques, coupled with ground measurements were employed to detect changes in land cover, carbon stocks in vegetation, and soil carbon in various vegetation types. The results indicate that forested areas have decreased, while agriculture and habitation have expanded between 1997 and 2022. Vegetation C stocks varied significantly ($P<0.05$) from 39.42 to 139.95 Mg ha-1 and the SOC varied from 7.02 to 17.98 Mg ha-1 under different soil profiles across vegetation types, which decreased with soil depth, while the pH and bulk density increased. The maximum bulk density in the soil was found at a depth of 40-60 cm (lower profile) in Bamboo Brake, while the minimum was observed under Dense Mixed Forest at a depth of 0-20 cm (top profile). The topsoil profile contributed 33.6% to 39%, the middle profile (20-40 cm) was 33.6% to 34.4%, and the lower profile was 26.5% to 30.8% of soil organic carbon. The study site has experienced rapid carbon losses due to changes in land cover, such as illegal expansion of agriculture, encroachments into forest fringes, and activities like selective logging and overgrazing, which have degraded dense forests. The ecological engineering of degraded ecosystems poses a great challenge and application of complex biological, mechanical and engineering measures is highly cumbersome, expensive, uneconomical and practically not feasible for upscaling. Nevertheless, proposed nature-based solutions mimic natural reparation and processes provide sustainable interventions for the reclamation of ruined landscapes besides improving ecological integrity and rendering many co-benefits to ecosystems and human societies.

Biography

Prof. Tarun Kumar Thakur is a Professor, Department of Environmental Science, Indira Gandhi National Tribal University (A Central University), Madhya Pradesh, India. He completed his PhD in 2006 from Indira Gandhi Krishi Vishwavidyalaya, India. His expertise and practical experience include bioremediation of heavy metals, microplastic pollutants in terrestrial ecosystems, riverine ecosystems, carbon neutrality in forestry, Restoration ecology, Landscape ecology and environment health assessment, Soil, Water Pollution and Phytoremediation etc. Prof. Thakur has published more than 80 research & review articles in international journals of repute and attended several training and conferences with due fellow of NCST, NESA, TWAS, DST etc. Besides, he has successfully edited (as Guest editor) special issues in reputed journal of MDPI, Springer, Frontiers and Wiley. He has also completed 7 projects funded by Department of Science & Technology, MOEFCC, MPCST and MP State Biodiversity Board, India. Prof. Thakur is an honorary member of IUCN Commission on Ecosystem Management (CEM).