

Ecosystem Services and Tropical Soils of India

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 Springer

D. K. Pal
Division of Soil Resource Studies
ICAR-NBSS&LUP
Nagpur, Maharashtra, India

ISBN 978-3-030-22710-4 ISBN 978-3-030-22711-1 (eBook)
<https://doi.org/10.1007/978-3-030-22711-1>

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*I dedicate this book to my parents
and parents-in-law*

Preface

Tropical soils have been traditionally considered as either agriculturally poor or virtually useless by many. To remove these misgivings, Indian soil scientists developed the state-of-the-art information in the last decade on tropical soils of India wherein they have presented scientific facts that would render soil as one of the important determinants of India's economic status.

Tropical soils are the most complex and important biomaterials but have an outstanding role in providing ecosystem services to mankind. Despite concerted efforts, this has not received adequate recognition. It is, hence, necessary to highlight the significance of soil and its effect on the global environment in an appropriate manner by including soil in the framework of ecosystem services and scientific policy-and decision-making. This is the only way that soil science can be appreciated as a 'progressive and innovative field of science'. Continuous research attempt in this direction is the need of the hour because earlier attempts to evaluate the ecosystem services did not give adequate attention to soil component and, when given, it is poorly defined. In studies made so far to link soil properties to ecosystem services, soil scientists often refrained from using 'ecosystem service' even though their research is devoted to linking soils to the ecosystem. Although much valuable work has been done on Indian tropical soils, it has been always difficult to manage these soils to sustain their productivity because some unique soil properties were hardly linked explicitly to soil ecosystem services. Therefore, soil care needs to be a constant research endeavour in Indian tropical environment as new soil knowledge base becomes critical when attempts are made to fill the gap between food production and future population growth. Realizing this urgency, research endeavours during the last few decades on benchmark and identified soil series by the Indian pedologists and earth scientists were made to provide insights into several aspects of five pedogenetically important soil orders like Alfisols, Mollisols, Ultisols, Vertisols and Inceptisols of tropical Indian environments. The global distribution of tropical soils and the recent advances in knowledge by researching on them in the Indian sub-continent now await a link between soil properties and ecosystem services for enhancing crop productivity and maintaining soil health in the twenty-first century. To establish the unique role of soil properties in ecosystem services of Indian

tropical soils, some important lower level ecosystem services were chosen such as (1) agro-ecological regions as a tool for ecosystem services, (2) organic carbon sequestration and ecosystem service, (3) soil inorganic carbon sequestration in soil ecosystem services, (4) soil modifiers as ecosystem engineers and (5) degradation in Indian tropical soils.

The author would like to acknowledge the valuable contributions of mentors and peers who have helped along the tenuous path of research. He will remain ever grateful to late Prof. S.K. Mukherjee and late Prof. B. B. Roy, who held the coveted position of Acharya P. C. Ray, Professor of Agricultural Chemistry at the University of Calcutta, for drawing him to soil research that offered more than a lifetime of fascinating problems to unravel. Soil property-driven ecosystem services of Indian tropical soils as presented in this book have been possible due to the significant research contributions made through a joint endeavour by the author along with his esteemed colleagues. They are Drs. T. Bhattacharyya, P. Chandran, S. K. Ray and Pramod Tiwari of ICAR-NBSS&LUP, Nagpur; Prof. Pankaj Srivastava of Geology Department, Delhi University; and also several M.Sc. and Ph.D. students at ICAR-NBSS&LUP. Unstinted technical support and assistance received from Mrs. S.L. Durge, G.K. Kamble and L.M. Kharbikar helped the author enormously in bringing the task to a successful fruition.

The author duly acknowledges the sources of the diagrams and tables that have been adapted mostly from his publications.

Furthermore, the author is grateful to his wife, Banani; his daughters, Deedhiti and Deepanwita; his brother-in-law, Dhruvajyoti; and his sons-in-law, Jai and Nachiket, for their patience, understanding, encouragement and above all unwavering moral support.

Nagpur, Maharashtra, India

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About the Author

D. K. Pal obtained his M.Sc. (Ag) degree in Agricultural Chemistry with specialization in Soil Science in 1970 and was awarded his Ph.D. degree in Agricultural Chemistry in 1976 from the University of Calcutta. He continued his training as a DAAD Postdoctoral Fellow at the Institute of Soil Science, University of Hannover, West Germany, in 1980–1981.

He has had an illustrious research career spanning more than three and a half decades. The focus of this work has been the alluvial (Indo-Gangetic Alluvial Plains, IGP), red ferruginous and shrink-swell soils of the tropical environments of India. His research has expanded the basic knowledge in pedology, paleopedology, soil taxonomy, soil mineralogy, soil micromorphology and edaphology. He also pioneered new ideas on the development and management of the Indian tropical soils as evidenced by significant publications in several peer-reviewed leading international journals in soil, clay and earth sciences.

Throughout his career, he has trained budding scientists in mineralogy, micromorphology, pedology and paleopedology. Under his stewardship, his team members have carved out a niche for themselves in soil research at national and international levels. He has mentored several M.Sc. and Ph.D. students of land resource management (LRM) of the Indian Council of Agricultural Research, National Bureau of Soil Survey and Land Use Planning (ICAR-NBSS&LUP), under the academic programme at Dr. Panjabrao Deshmukh Krishi Vidyapeeth (Dr. PDKV), Akola.

He has been an Invited Speaker at multiple national and international conferences. He also continues to serve as a Reviewer for many journals of national and international repute and has contributed reviews and book chapters for national and international publishers. Recently, he has authored two books published by Springer International Publishing AG, Cham, Switzerland: (1) *A Treatise of Indian and Tropical Soils* published in 2017 and (2) *Simple Methods to Study Pedology and Edaphology of Indian Tropical Soils* published in 2019. In addition, he has been Coeditor of several books, proceedings and journals. He is the Life Member of many professional national societies in soil and earth science. He has been an Awardee of several prestigious awards (the Platinum Jubilee Commemoration

Award of the Indian Society of Soil Science, New Delhi, for the year 2012; ICAR Award for Outstanding Interdisciplinary Team Research in Agriculture and Allied Sciences, Biennium, 2005–2006; and the 12th International Congress Commemoration Award, Indian Society of Soil Science, 1997) and fellowships (Honorary Member, the Clay Minerals Society of India, New Delhi, 2016; West Bengal Academy of Science and Technology, 2014; National Academy of Agricultural Sciences, New Delhi, 2010; Indian Society of Soil Science, New Delhi, 2001; and Maharashtra Academy of Sciences, Pune, 1996).

He served as the Principal Scientist and Head, Division of Soil Resource Studies, ICAR-NBSS&LUP, Nagpur, and as a Visiting Scientist at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Telangana.