BIODIVERSITY AND ECOSYSTEM SERVICES ON POST-INDUSTRIAL LAND

EDITED BY **VIMAL CHANDRA PANDEY**

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Biodiversity and Ecosystem Services on Post-Industrial Land

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Edited by

Vimal Chandra Pandey
CSIR-National Botanical Research Institute
Lucknow, India

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Contents

List of Contributors

Austin E. Abah
Department of Animal and Environmental Biology
University of Port Harcourt
Nigeria

Shubham Abhishek
CSIR-Central Institute of Mining and Fuel Research, Barwa Road
Dhanbad, Jharkhand
India

Academy of Scientific and Innovative Research (AcSIR)
Ghaziabad
India

Fernando A. Alvarez
Administration Department
Universidad Católica del Norte
Antofagasta
Chile

Valeria Ancona
Water Research Institute of the Italian National Research Council
Bari
Italy

Arnab Banerjee
Department of Environmental Science
Sant Gahira Guru Vishwavidyalaya
Ambikapur, Chhattisgarh
India

Kiran Bargali
Department of Botany, DSB Campus
Kumaun University
Nainital, Uttarakhand
India

Surendra Singh Bargali
Department of Botany, DSB Campus
Kumaun University
Nainital, Uttarakhand
India

Nicolas Bélanger
Laboratoire sur la science des données
Université du Québec (TÉLUQ)
Montréal, Québec
Canada

Simon Bilodeau-Gauthier
Direction de la recherche forestière
Ministère des Ressources naturelles et des Forêts
Québec, Québec
Canada

CK Dotaniya
Department of Soil Science and Agricultural Chemistry
SKRAU
Bikaner
India

ML Dotaniya
ICAR-Directorate of Rapeseed-Mustard Research
Bharatpur
India

RK Doutaniya
Department of Agronomy
SKN College of Agriculture
Jobner
India

Sanat Kumar Dwibedi
Odisha University of Agriculture and Technology
Bhubaneswar
India

Amlan Kumar Ghosh
Department of Soil Science and Agricultural Chemistry
Institute of Agricultural Sciences, BHU
Varanasi
India

Laurence Grimond
Laboratoire sur la science des données
Université du Québec (TÉLUQ)
Montréal, Québec
Canada

Anna Grobelak
Faculty of Infrastructure and Environment
Czestochowa University of Technology
Czestochowa
Poland

Ksenija Jakovljević
Department of Ecology
Institute for Biological Research 'Siniša Stanković' - National Institute of the Republic of Serbia
University of Belgrade
Serbia

Manoj Kumar Jhariya
Department of Farm Forestry
Sant Gahira Guru Vishwavidyalaya
Ambikapur, Chhattisgarh
India

Rim Khlifa
Laboratoire sur la science des données
Université du Québec (TÉLUQ)
Montréal, Québec
Canada

Aneta Kowalska
Faculty of Science and Technology
Jan Dlugosz University
Czestochowa
Poland

Amit Kumar
School of Hydrology and Water Resources
Nanjing University of Information Science and Technology
Nanjing
China

Kuldeep Kumar
ICAR Indian Institute of Soil and Water Conservation
Dehradun
RS Kota
India

Rupesh Kumar
Jindal Global Business School
O.P. Jindal Global University
Sonipat, Haryana
India

Santosh Kumar
ICAR-Indian Agricultural Research Institute
Jharkhand
India

Elizabeth J. Lam
Chemical Engineering Department
Universidad Católica del Norte
Antofagasta
Chile

Manju Lata
University of Rajasthan
Jaipur
India

Jonnada Likhita
Department of Fruit Science
Rani Lakshmi Bai Central
Agricultural University
Jhansi, Uttar Pradesh
India

Justyna Likus-Cieślik
Department of Ecological Engineering
and Forest Hydrology, Faculty of Forestry
University of Agriculture in Krakow
Krakow
Poland

Eberechukwu M. Maduike
Department of Animal and
Environmental Biology
University of Port Harcourt
Nigeria

Ebhin Masto
Environment, Emission and CRM Section
CSIR - Central Institute of
Mining and Fuel Research
(Digwadih Campus), PO; FRI
Dhanbad, Jharkhand
India

HM Meena
ICAR-Central Arid Zone Research Institute
Jodhpur
India

Tomica Mišljenović
Institute of Botany and Botanical Garden
Faculty of Biology
University of Belgrade
Serbia

Italo L. Montofré
Mining Business School, ENM
Universidad Católica del Norte
Antofagasta
Chile

Mining and Metallurgical Engineering
Department
Universidad Católica del Norte
Antofagasta
Chile

Aroloye O. Numbere
Department of Animal and
Environmental Biology
University of Port Harcourt
Nigeria

Victoria C. Obinna
Department of Animal and
Environmental Biology
University of Port Harcourt
Nigeria

Marek Pająk
Department of Ecological Engineering
and Forest Hydrology
Faculty of Forestry
University of Agriculture in Krakow
Krakow
Poland

Bhanu Pandey
CSIR-Central Institute of Mining and
Fuel Research, Barwa Road
Dhanbad, Jharkhand
India

Vimal Chandra Pandey
CSIR-National Botanical Research Institute
Lucknow, Uttar Pradesh
India

Marcin Pietrzykowski
Department of Ecological Engineering and
Forest Hydrology, Faculty of Forestry
University of Agriculture in Krakow
Krakow
Poland

Chandini Pradhan
Department of Soil Science and
Agricultural Chemistry
Institute of Agricultural Sciences, BHU
Varanasi
India

Abhishek Raj
Department of Forestry,
Pt. Deendayal Upadhyay College of
Horticulture and Forestry
Dr. Rajendra Prasad Central
Agriculture University
Samastipur
Bihar
India

Dragana Ranđelović
Institute for Technology of Nuclear and
Other Mineral Raw Materials
Serbia

David Rivest
Département des sciences naturelles
Université du Québec en Outaouais
Gatineau, Québec
Canada

Katarzyna Sadowy
SGH Warsaw School of Economics
Warsaw
Poland

Gaurav Sharma
Department of Fruit Science
Rani Lakshmi Bai Central
Agricultural University
Jhansi, Uttar Pradesh
India

Shivali Sharma
Department of Fruit Science
Rani Lakshmi Bai Central
Agricultural University
Jhansi, Uttar Pradesh
India

Sunny Sharma
Department of Horticulture
School of Agriculture
Lovely Professional University
Phagwara, Punjab
India

Sameer Shekhar
CSIR-Central Institute of Mining and
Fuel Research, Barwa Road
Dhanbad, Jharkhand
India

AO Shirale
ICAR-Indian Institute of Soil Science
Bhopal
India

Saurabh Shukla
Faculty of Civil Engineering
Institute of Technology, Shri Ramswaroop
Memorial University
Lucknow
India

Edyta Sierka
Institute of Biology, Biotechnology and
Environmental Protection
University of Silesia in Katowice
Katowice
Poland

Preeti Singh
ICAR-Indian Agricultural Research Institute
Jharkhand
India

Siddharth Singh
CSIR-Central Institute of Mining and Fuel Research, Barwa Road
Dhanbad, Jharkhand
India

Academy of Scientific and Innovative Research (AcSIR)
Ghaziabad
India

Barbara Stalmachová
Department of Environmental Engineering
Technical University of Ostrava
Ostrava-Poruba
Czech Republic

D.D. Tewari
Gayatri Vidyapeeth P.G. College
Rishi Bhoomi, Risia, Bahraich
Uttar Pradesh
India

Bartłomiej Woś
Department of Ecological Engineering and Forest Hydrology, Faculty of Forestry
University of Agriculture in Krakow
Krakow
Poland

DK Yadav
ICAR-Indian Institute of Soil Science
Bhopal
India

RK Yadav
Agriculture University Kota
India

Shailesh Kumar Yadav
Department of Environmental Science
Sant Gahira Guru Vishwavidyalaya
Ambikapur, Chhattisgarh
India

About the Editor

Dr. Vimal Chandra Pandey is, an applied research scientist, internationally recognized for his research in the area of phytomanagement of polluted sites. Dr. Pandey is listed as the World's Top 2% Scientists, announced by Stanford University, California, United States, and published by Elsevier BV, 2020, 2021, 2022, and 2023. His research focuses mainly on the remediation and management of polluted lands, using ecologically and socio-economically valuable plants, to regain ecosystem services and support a bio-based economy as phytoproducts. Dr. Pandey's research interests also lie in fostering phytoremediation for utilizing polluted lands and thereby attaining the United Nations Sustainable Development Goals. His phytoremediation work has led to the extension of phytoremediation beyond its traditional application. He is now engaged in exploring commercial phytoremediation with the least risk, minimum input, and low maintenance. Dr. Pandey worked at CSIR-National Botanical Research Institute, Babasaheb Bhimrao Ambedkar University, and the Council of Science and Technology, Uttar Pradesh (CSTUP), Lucknow, India. He is the recipient of several awards/honors/fellowships. Dr. Pandey is a member of the IUCN Commission on Ecosystem Management and the National Academy of Sciences, India. Dr. Pandey has published over 114 scientific articles/book chapters in peer-reviewed journals/books. He is also the author and editor of several books published by Elsevier, Springer, Wiley, and CRC Press, with several more forthcoming. Dr. Pandey is associate editor/editor/academic editor/board member of prestigious journals such as *Land Degradation and Development*; *Restoration Ecology*; *Ecological Processes*; *Environment, Development, and Sustainability*; *Ambio*; *Environmental Management*; *Discover Sustainability*; *Bulletin of Environmental Contamination and Toxicology*; and *PLOS ONE* by Wiley/Springer/PLOS. He also works/worked as a guest editor for many reputed international journals.

Foreword

It is of immense pleasure that I accept the gracious invitation from Dr. Vimal Chandra Pandey to contribute introductory statements to the notable work entitled *Biodiversity and Ecosystem Services on Post-Industrial Land*. Continuous increase in post-industrial land over the world is a serious threat in terms of environmental degradation; the proposed book is an innovative and timely solution to address this global issue. Such industrial activities have several negative impacts on the surrounding environment, including air pollution (i.e., smog and soot), water pollution (i.e., gases, chemicals, heavy metals, radioactive materials, etc.), soil pollution (industrial wastes dumps destroy the soil fertility), greenhouse gas emissions (it releases into the environment by the burning of coal fossil fuels that trap heat and contribute to global climate change), acid rain (coal burning is a major cause of acid rain). Thus, industrial activities and post-industrial land pose a threat to human health and earth's natural ecosystems.

Therefore, the eco-restoration of post-industrial land worldwide needs wide-ranging participants, including academia, policymakers, private companies, entrepreneurs, practitioners, and financial institutions alike to discuss and explore the possibilities of integration of biodiversity and ecosystem services into their eco-restoration approach. There are natural processes that lead to ecosystem recovery; these processes may be slow, namely in initial stages of ecosystem development but affect ecosystem development in long run and lead to formation of sustainable and viable ecosystems. Eco restoration approaches try to use and enhance these natural processes. Revegetated/rehabilitated post-industrial land helps to achieve the goal of eco-restoration. It improves substrate characteristics of the post-industrial land, which are the basic needs for the re-establishment of desired plant species on such post-industrial landscapes. Therefore, ecologically and socio-economically valuable plant species must be screened among diverse geographical limits and should be included in the restoration of post-industrial land for ecological balance so that a self-sustaining ecosystem can be established on such land. In this direction, the use of native plant species for plantation is the most viable tool for restoring post-industrial land at a quicker pace.

This edited book is well-timed with up-to-date information that offers a cutting-edge synthesis of scientific, experiential, and established knowledge as a single source on different aspects of ecological restoration on post-industrial land.

I congratulate the editor, Dr. Vimal Chandra Pandey, for bringing out this valuable book published by a renowned publisher Wiley. The book consists of fourteen chapters covering

various aspects of biodiversity and ecosystem services on post-industrial land. I believe this book will be a remarkable asset for researchers, environmentalists, plant scientists, eco-engineers, practitioners, industry professionals, eco-planners, policymakers, entrepreneurs, and other stakeholders alike, as well as would provide future directives in R&D to the field of restoration ecology.

08 August 2024

Dr. Jan Frouz
Professor and Director
Environmental Centre, Charles University, Prague,
Czech Republic

Preface

Globally, the mining and industrial activities are well documented to have vivid environmental impacts. In addition, these activities destroy natural ecosystems and historical sites with high value, creating large post-industrial areas (fly ash deposits, post-mining land, red mud dumpsites, oil drilling sites, brownfield land, etc.). Moreover, they can directly impact human health, e.g., through the air and water pollution. Therefore, the post-mining and post-industrial lands have gained intensive attention among restoration scientists and applied ecologists aiming to transform such sites into risk-less biodiversity strongholds. By declaring the UN Decade on Ecosystem Restoration, such efforts have been widened to implement providing ecosystem services to meet the needs of the 21st century and to attain partial goals of UN-SDGs. Therefore, the restoration of post-mining and post-industrial lands on the global scale needs wide-ranging participants from different countries and from different disciplines, including academia, private companies, policymakers, financial institutions, consultancy firms, local farmers, NGOs, entrepreneurs, practitioners, and other stakeholders alike to discuss the integration of biodiversity and ecosystem services into their ecological restoration. By engaging in ecological restoration, everyone should be involved toward resetting our relationship with nature.

Ecological restoration aims at enhancing the biodiversity and ecosystem services, mostly by implementing natural processes into rehabilitation of disturbed sites. The first goal at post-mining and post-industrial lands are often associated with the improvement of substrate characteristics (i.e., physicochemical and biological), which are basic needs for the establishment of everlasting vegetation. The second goal should be focused on the re-establishment of rich communities of target plant species with biodiversity and their ecosystem services, i.e., pedogenesis, nutrient cycling, habitat for other organisms, food plants for herbivores, carbon sequestration, and aesthetic value. Here I want to explore biodiversity and ecosystem services of rehabilitated post-industrial land. The species diversity is a useful and often easily measured criterion in restoration projects, although it should be often accompanied by measures of potential for threatened species. Using the proper biodiversity indicators in mining and restoration projects, together with setting the realistic and beneficial conservation aims, allows focusing on the selected aspects of diverse field of ecological restoration and makes the entire process more efficient. During the ecological restoration of lands disturbed by mining and industrial activities, restoration projects must include ecologically and socio-economically benefits. Therefore,

managing biodiversity during ecological restoration of such lands is a major challenge because this may influence the restoration target, which is partially dependent on the values of the stakeholders.

This book will offer how the biodiversity and ecosystem services concepts have been integrated into the restoration and reclamation of post-industrial lands. Finally, I believe this book will open wider conceptual insights and well-designed case studies on any general aspects on ecological restoration and biodiversity of such disturbed sites.

Vimal Chandra Pandey

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I sincerely pay gratitude to *Frank Weinreich* (Publisher) and *Mary Angelin Rose* (Production Editor) from Wiley for their excellent support, guidance, and coordination during the production of this fascinating project. I thank all the reviewers for their careful and insightful review of the book chapters. The editor is highly thankful to Professor *Jan Frouz*, Director, Environmental Centre, Charles University, Prague, Czech Republic for writing the foreword at short notice.