Biochar For Environmental Management Science Technology And Implementation

"Biochar is the carbon-rich product when biomass (such as wood, manure, or crop residues) is heated in a closed container with little or no available air. It can be used to improve agriculture and the environment in several ways, and its stability in soil and superior nutrient-retention properties make it an ideal soil amendment to increase crop yields. In addition to this, biochar sequestration, in combination with sustainable biomass production, can be carbon-negative and therefore used to actively remove carbon dioxide from the atmosphere, with major implications for mitigation of climate change. Biochar production can also be combined with bioenergy production through the use of the gases that are given off in the pyrolysis process. This book is the first to synthesize the expanding research literature on this topic."

"The book's interdisciplinary approach, which covers engineering, environmental sciences, agricultural sciences, economics and policy, is a vital tool at this stage of biochar technology development. This comprehensive overview of current knowledge will be of interest to advanced students, researchers and professionals in a wide range of disciplines"--Provided by publisher.

Making Charcoal and Biochar is written with the interested amateur in mind, with the certainty that anyone who has a go at making charcoal will soon get the bug. Before you know it, you will be upgrading to a shiny new retort and there will be no looking back! This book gives a wide range of possibilities for making charcoal on a small scale and for commercial production. There are chapters on the heritage skills of earth burns, the enduring popularity of metal kilns and the future represented by the charcoal retort. Biochar – or small particle charcoal – has been heralded as an ancient but rediscovered ‘super substance’ that can increase soil fertility and productivity whilst locking up carbon into the ground. This book looks at the ongoing discussion and weighs up the evidence. It concludes with a celebration of the myriad ways in which charcoal can be put to use. Covering the essentials for starting a business such as legislation and marketing, there are also chapters on why charcoal is in the ascendency from the ubiquitous barbecue to the most recent research into biochar and carbon sequestration. Fully illustrated with 195 colour photographs.

The majority of meat, milk, and eggs consumed in the United States are produced in concentrated animal feeding operations (CAFO). With concentrated animal operations, in turn comes concentrated manure accumulation, which can pose a threat of contamination of air, soil, and water if improperly managed. Animal Manure: Production, Characteristics, Environmental Concerns, and Management navigates these important environmental concerns while detailing opportunities for environmentally and economically beneficial utilization.

Biochar: Fundamentals and Applications in Environmental Science and Remediation Technologies, Volume Six provides readers with the fundamentals of scientific and technological aspects of biochar application in stormwater treatment, its use in contaminant removal, greenhouse gas mitigation, as landfill cover material, and new environmental and agronomic applications. Chapters in this new release cover Biochar application for soil remediation in a redox-sensitive environment, Remediation of heavy metal contaminated soil: Role of biochar, Role of biochar as a cover material in Landfill waste disposal system–Perspective from Unsaturated soil mechanics, Biochar in soil re-engineering, Green remediation of contaminated agricultural land using biochar, and more. Additional chapters cover the Impact of biochars on redox processes in soils, Biochar for manipulation of manure properties, A relationship paradigm between biochar amendments and green house gas emissions, Biochar amalgamation with clay: Enhanced performance for environmental remediation, Functionalization of biochar using microbial consortia, and the Potential role of biochar to mitigate the negative impacts of climate change on water quality. Provides up-to-date information on the use of biochar for contaminant remediation, as landfill cover material, and as a tool for energy transition includes the aspect of biochar’s use in mitigating impacts of climate change and how manure properties can be altered through biochar addition covers the role of microbial consortia on biochar functionalization.
This book has included the following major sections: "Introduction", "History of Biochar," "Preparation of Biochar," and "Applications of Biochar." The editor and authors hope that the development of biochar cross its application field from agriculture into engineering.

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Biochar from Biomass and Waste: Fundamentals and Applications provides the fundamentals of biochar, such as its basic concepts, production technology and characterization methods, also including comprehensive examples for readers. This book includes information on state-of-art biochar application technologies in the fields of agriculture, energy and environmental sciences with step-by-step case studies. Biochar has received worldwide interests in the past decade because it encompasses high priority research areas, including bioenergy production, global warming mitigation and sustainable agriculture. Offers comprehensive coverage of biochar production, characterization and modification methods Provides global case studies covering a wide range of application fields, including environmental, agricultural, syngas and bio-oil Covers the sustainability and future of biochar.

This reference text covers the latest developments in biochar materials research, a field which is becoming increasingly popular due to the potential of biochar to replace carbon materials derived from non-renewable sources. Emerging and innovative applications of biochar materials are discussed, and all aspects of the field are covered, from production to applications, including details on the techniques used. There is a particular focus on biochar as a material for composites and sensors. This is the first book to cover emerging applications of biochar as an innovative, versatile, carbon-based renewable material, beyond its traditional uses in agriculture. It is a valuable reference for all researchers in the fields of biochar and carbon materials, including industry practitioners. Key Features: The first book to cover emerging applications of biochar as an innovative, versatile, carbon-based renewable material, beyond its traditional uses in agriculture Provides comprehensive coverage of emerging and innovative applications for biochar materials, from production to applications, including techniques Focus on biochar as a material for composites and sensors Valuable for all researchers in the fields of biochar and carbon materials.

Biochar in Agriculture for Achieving Sustainable Development Goals introduces the state-of-the-art of biochar for agricultural applications to actualize Sustainable Development Goals and highlight current challenges and the way forward. It focuses on scientific knowledge and biochar technologies for agricultural soil improvement and plant growth. General production and properties are introduced in Part 1 to provide the readers with state-of-the-art knowledge on biochar production and characterization. Part 2 focuses on biochar for agricultural application and soil improvement, which meets SDG 2 (zero hunger), SDG 6 (clean water and sanitation), SDG 7 (affordable and clean energy), and SDG 15 (life on land). Part 3 of the book discusses the roles of biochar for environmental improvement in farmland to relieve water and waste management as well as climate change, which correspond to SDG 6 (clean water and sanitation), SDG 7 (affordable and clean energy), and SDG 15 (life on land). Part 4 highlights biochar used for boosting bioeconomy and clean energy, which conforms to SDG 11 (sustainable cities and communities), SDG 7 (affordable and clean energy), and SDG 9 (industry, innovation and infrastructure). Future prospects are presented in Part V to provide guidance for future research and inspire opportunities for achieving sustainable development. This book introduces the state-of-the-art of biochar for agricultural applications to actualize Sustainable Development Goals and highlight current challenges and the way forward. This work will focus on scientific knowledge and biochar technologies for soil improvement and crop growth. Biochar in Agriculture for Achieving Sustainable Development Goals will be important to agricultural engineers and researchers as well as those seeking to improve soil and environmental conditions through the use of biochar. Focuses on biochar utilization in agricultural application targeting deeper elaboration of biochar as one of cost-effective and renewable materials in field-scale agriculture applications Highlights biochar's role in boosting bioeconomy which shows great potential for promoting circular economic, maximizing environmental, social and economic benefits Connects biochar application with achieving sustainable development goals.

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undergraduate level and above in water science, environmental sciences, soil science, material sciences and engineering, chemical sciences and engineering, and biological sciences. Through Sustainable Biochar for Water and Wastewater Treatment various aspects of biochar requirements for use in adsorption science and technology are covered. It includes vital information on this hot topic and provides a real solution to the global issues of water contamination and scarcity. Presents case studies in each chapter, making this applicable for those who want to implement examples into their own work. Each chapter includes example calculations with an exercise at the end of each chapter, making this a great teaching tool. Includes Excel spreadsheets online, perfect for use as a laboratory guide.

Biochar Application: Essential Soil Microbial Ecology outlines the cutting-edge research on the interactions of complex microbial populations and their functional, structural, and compositional dynamics, as well as the microbial ecology of biochar application to soil, the use of different phyto-chemical analyses, possibilities for future research, and recommendations for climate change policy. Biochar, or charcoal produced from plant matter and applied to soil, has become increasingly recognized as having the potential to address multiple contemporary concerns, such as agricultural productivity and contaminated ecosystem amelioration, primarily by removing carbon dioxide from the atmosphere and improving soil functions. Biochar Application is the first reference to offer a complete assessment of the various impacts of biochar on soils and ecosystems, and includes chapters on applications to soil, from ecogenomic analyses and nutrient ratios to nutrient cycling and next generation sequencing. Written by a team of international authors with interdisciplinary knowledge of biochar, this reference will provide a platform where collaborating teams can find a common resource to establish outcomes and identify future research needs throughout the world. Includes multiple tables and figures per chapter to aid in analysis and understanding. Includes a comprehensive table of the methods used within the contents, ecosystems, contaminants, future research, and application opportunities explored in the book. Includes knowledge gaps and directions of future research to stimulate further discussion in the field and in climate change policy outlines the latest research on the interactions of complex microbial populations and their functional, structural, and compositional dynamics.

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The need for exploration, conservation, and sustainable utilization of bioresources is undeniable for the survival and growth of mankind. This new book throws light on new and recent research on and development of effective strategies for sustainable utilization of bioresources using modern tools and techniques to help meet this challenge. This volume addresses the utilization of bioresources in therapeutics, in biofuel, in agriculture, and in environmental protection. Beginning with the diverse potential applications of bioresources in food, medicine, and cosmetics, the volume goes on to address the various different underutilized bioresources and their sustainable uses. It discusses important advances in biofuel and patents that highlight recent developments that address the energy crises and the continuously fluctuating cost of petroleum. It explores new renewable energy sources from bioresources and their sustainable utilization in the bioenergy and biofuel industry.

Several chapters focus on the sustainable utilization of bioresources in the agricultural sector. The volume considers that developing countries have huge agricultural resources that could be employed for production of value-added byproducts for the sustainable development of a bio-based economy. The book discusses efficient use of underexploited natural bioresources; new chemical approaches for the generation of novel biochemicals, and the applications of genetics approaches for bioresource conservation and production of value-added products. Further, strategies for the production of biopesticides utilizing bioresources are also discussed.

Dark Earths are a testament to vanished civilizations of the Amazon Basin, but may also answer how large societies could sustain intensive agriculture in an environment of fertile soils. This book examines their origin, properties, and management. Questions remain: were they intentionally produced or a by-product of habitation? Additional new and multidisciplinary perspectives by leading experts may pave the way for the next revolution in soil management in the humid tropics.

Fire-derived organic matter, also known as pyrogenic carbon (PyC), is ubiquitous on Earth. It can be found in soils, sediments, water, and air. In this wide range of environments, fire-derived organic matter, represents a key component of the organic matter pool, and, in many cases, the largest identifiable group of organic compounds. PyC is also one of the most persistent organic matter fractions in the ecosystems, and its study is, therefore, particularly relevant for the global carbon cycle. From its production during vegetation fires to its transfer into soils, sediments and waters, PyC goes through different transformations, both abiotic and biotic. Contrary to early assumptions, PyC is not inert and interacts strongly with the environment: evidence of microbial decomposition, oxidation patterns and interactions with minerals have been described in different matrices. PyC travels across these different environments and it is modified chemically and physically, but remains persistent. This Research Topic explores important questions in our understanding of fire-derived organic matter, from the characterization and quantification of PyC components, to the transformation and mobilization processes taking place on terrestrial and aquatic ecosystems. The studies compiled here provide novel and,
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Terra preta is the Portuguese name of a type of soil which is thought to have almost miraculous properties. The newspapers are flooded with reports about “black gold,” saying that two of the greatest problems facing humankind can be resolved by it. The beauty of it is that everyone can do something about it because since 2005 the secret of producing this black soil has been revealed – and it is a secret that seemed to have been lost forever with the downfall of the once thriving Indian culture of the Amazon basin. The recipe is astonishingly simple as all you need are kitchen or garden wastes, charcoal and earthworms, so it can be produced on every balcony or on the smallest of garden plots. The trio of authors Scheub, Pieplow and Schmidt, set off on a treasure hunt and condensed all the knowledge about the world’s most fertile soil into a convenient guidebook. In addition to a sound instruction manual on producing terra preta and organic charcoal (biochar), the handbook covers fundamental principles from climate farming to closed-loop economy. It makes a passionate plea against synthetic fertilizers and genetic technology and offers indispensable advice to all those who feel strongly about healthy food.

This book provides state of the art description of various approaches, techniques and some basic fundamentals of bioremediation to manage a variety of organic and inorganic wastes and pollutants present in our environment. A comprehensive overview of recent advances and new development in the field of bioremediation research are provided within relevant theoretical framework to improve our understanding for the cleaning up of polluted water and contaminated land. The book is easy to read and language can be readily comprehended by aspiring newcomers, students, researchers and anyone else interested in this field. Renowned scientists around the world working on the above topics have contributed chapters. In this edited book, we have addressed the scope of the inexpensive and energy neutral bioremediation technologies. The scope of the book extends to environmental/agricultural scientists, students, consultants, site owners, industrial stakeholders, regulators and policy makers.

Interest in biochar among soil and environment researchers has increased dramatically over the past decade. Biochar initially attracted attention for its potential to improve soil fertility and to uncouple the carbon cycle, by storing carbon from the atmosphere in a form that can remain stable for hundreds to thousands of years.
Later it was found that biochar had applications in environmental and water science, mining, microbial ecology and other fields. Beneficial effects of biochar and its environmental applications cannot be fully realised unless the chemical, physical, structural and surface properties of biochar are known. Currently many of the analytical procedures used for biochar analyses are not well defined and therefore the right biochar analysis and techniques are needed to evaluate biochar. It is therefore necessary to provide a guideline for biochar analyses and to compare the existing data for biochars. Also, in some instances the use of inappropriate procedures has led to erroneous or inaccurate values for biochars in the scientific literature. Biochar: A Guide to Analytical Methods fills this gap and provides procedures and guidelines for routine and advanced characterisation of biochars. Written by experts, each chapter provides background to a technique or procedure, a stepwise guide to analyses, and includes data for biochars made from a range of feedstocks.

For environmental pollution, the present-day global carbon cycle as identified by the fields of meteorology, physical and biological oceanography, geology and terrestrial biosphere sciences. At the same time the form of CO₂ can be achieved. Consequently, the purpose of this institute was to review, among leading experts in the field, the multitude of known constraints on the present day global CO₂ dynamics; and on sustainability and certification. The book therefore continues to represent the most comprehensive compilation of current knowledge on all aspects of commercially available as soil amendments. This second edition includes not only substantially updated chapters, but also additional chapters: on environmental risk assessment; on new uses of biochar in composting and potting mixes; a new and controversial field of studying the effects of biochar on soil carbon cycles; on traditional use with very recent discoveries that biochar was used not only in the Amazon but also in Africa and Asia; on changes in water availability and soil water dynamics; and on sustainability and certification. The book therefore continues to represent the most comprehensive compilation of current knowledge on all aspects of biochar.

How the dirt below our feet can save us from extinction

This user-friendly book introduces biochar to potential users in the professional sphere. It de-mystifies the scientific, engineering and managerial issues surrounding biochar and the benefit of biochar to society in general including policy makers, landowners and farmers, land use practitioners, environmental managers and consultants, industry and lobby groups and NGOs. The book reviews state-of-the-art knowledge in an approachable way for the non-scientist, covering all aspects of biochar production, soil science, agriculture, environmental impacts, economics, law and regulation and climate change policy. Chapters provide ‘hands-on’ practical information, including how to evaluate biochar and understand what it is doing when added to the soil, how to combine biochar with other soil amendments (such as manure and composts) to achieve desired outcomes, and how to ensure safe and effective use. The authors also present research findings from the first coordinated European biochar field trial and summarize European field trial data. Explanatory boxes, infographics and concise summaries of key concepts are included throughout to make the subject more understandable and approachable.

This book provides up-to-date information on biochar use in management of soil health, agriculture productivity, green-house gases, restoration ecology and environment. Biochar application to nutrient deficient and disturbed soils is a viable option which may promotes advances in food safety and food security to human nutrition and overall fundamental research in the agricultural sciences. The book describes in detail how the recalcitrant biochar is able to persist for long periods of time and work as a shelter for soil microbial colonisation and their biomass/numbers. This book also includes contents related to important role of biochar applications in the restoration of contaminated agricultural soils. The book will be of particular interest to students, teachers and researchers in the disciplines.

Intelligent Environmental Data Monitoring for Pollution Management discusses evolving novel intelligent algorithms and their applications in the area of environmental data-centric systems guided by batch process-oriented data. Thus, the book ushered in a new era as far as environmental pollution management is concerned. It reviews the fundamental concepts of gathering, processing and analyzing data from batch processes, followed by a review of intelligent tools and techniques which can be used in this direction. In addition, it discusses novel intelligent algorithms for effective environmental pollution data management that are on par with standards laid down by the World Health Organization. Introduces novel intelligent techniques needed to address environmental pollution for the well-being of the global environment. Offers perspectives on the design, development and commissioning of intelligent applications. Provides reviews on the latest intelligent technologies and algorithms related to state-of-the-art methodologies surrounding the monitoring and mitigation of environmental pollution. Puts forth insights on future generation intelligent pollution monitoring techniques.

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This book is the outcome of a MAiiE Advanced Study Institute on the contemporary global carbon cycle, held in n Ciocco, Italy, September 8–20, 1991. The motivation for this ADI originated from recent controversial findings regarding the relative roles of the ocean and the land biota in the current global balance of atmospheric carbon dioxide. Consequently, the purpose of this institute was to review, among leading experts in the field, the multitude of known constraints on the present day global carbon cycle as identified by the fields of meteorology, physical and biological oceanography, geology and terrestrial biosphere sciences. At the same time the form of an Advanced Study Institute was chosen, thus providing the opportunity to convey the information in tutorial form across disciplines and to young researchers entering...
the field. The first three sections of this book contain the lectures held in II Ciocco. The first section reviews the atmospheric, large-scale global constraints on the present day carbon cycle including the emissions of carbon dioxide from fossil fuel use and it provides a brief look into the past. The second section discusses the role of the terrestrial biosphere and the third the role of the ocean in the contemporary global carbon cycle.

Agricultural and Environmental Applications of Biochar: Advances and Barriers: Over the past decade, biochar has been intensively studied by agricultural and environmental scientists and applied as a soil quality enhancer and environmental ameliorator in various trials worldwide. This book, with 21 chapters by 57 accomplished international researchers, reports on the recent advances of biochar research and the global status of biochar application. Scientific findings, uncertainties, and barriers to practice of biochar amendment for sustaining soil fertility, improving crop production, promoting animal performance, remediating water and land, and mitigating greenhouse gas emissions are synthesized. The book presents a whole picture of biochar in its production, characterization, application, and development. Agricultural and Environmental Applications of Biochar: Advances and Barrier highlights the mechanisms and processes of biochar amendment for achieving stunning agricultural and environmental benefits. Composition and characteristics of biochar, its interactions with contaminants and soil constituents, and its transformation in the environment are illustrated in improving soil physical, chemical, and biological quality and animal health, reducing soil greenhouse gas emissions, and decontaminating stormwater and mine sites. Additional emphasis is given to the pyrogenic carbon in Terra Preta soils and Japanese Andosols, the pyrolysis technology for converting agricultural byproducts to biochar, and the existing economic and technical barriers to wide application of biochar in Australia, China, New Zealand, North America, and Europe. Readers will appreciate the comprehensive review on the up-to-date biochar research and application and gain critical guidance in best biochar generation and utilization.

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Encompassing high priority research areas such as bioenergy production, global warming mitigation, and sustainable agriculture, biochar has received increased worldwide interest in the past decade. Biochar: Production, Characterization, and Applications covers the fundamentals of biochar including its concept, production technology, and characteriza

Amazonian soils are almost universally thought of as extremely forgiving. However, it is now clear that complex societies with large, sedentary populations were present for over a millennium before European contact. Associated with these are tracts of anomalously fertile, dark soils termed ‘terra preta’ or dark earths. These soils are presently an important agricultural resource within Amazonia and provide a model for developing long-term future sustainability of food production in tropical areas. The late Dutch soil scientist Wim Sombroek (1934-2003) was instrumental in bringing the significance of these soils to the attention of the world four decades ago. Wim saw not only the possibilities of improving the lives of small holders throughout the world with simple carbon based soil technologies, but was an early proponent of the positive synergies also achieved in regards to carbon sequestration and global climatic change abatement. Wim’s vision was to form a multidisciplinary group whose members maintained the ideal of open collaboration toward the attainment of shared goals. Always encouraged and often shaped by Wim, this free association of international scholars termed the “Terra Preta Nova” Group came together in 2001 and has flourished. This effort has been defined by enormous productivity. This book is never far from any of our minds and hearts, would have loved to share the great experience of seeing the fruits of his vision as demonstrated in this volume.

Biochar and its implementation as a renewable-based material is one of the topics on which the research community has focused the greatest energy in the last twenty years. This book provides readers with a scientific and technological overview of biochar, including new technologies for biochar production, new environmental and agronomic applications (e.g. biochar as growing media component or biochar application for mine land reclamation) and some emerging biochar applications in different fields (e.g. energy storage and catalysis). A special emphasis is placed on analyzing the links between the different stages of the value chain, underpinning the economic viability of biochar systems. Biochar as a Renewable-Based Material: With Applications in Agriculture, the Environment and Energy is designed as a textbook for graduate and postgraduate courses as well as a handbook for early-stage scientists, policy makers and potential technology customers. The book is written by internationally recognized scientists with a variety of complementary backgrounds.

Biochar is a carbon-rich material produced from the pyrolysis of organic materials from agricultural and forestry biomass at a relatively low temperature in the absence of oxygen. As such, it has potential for solving many agricultural and environmental problems. This book is divided into five sections: “Introduction,” “Production and Legislation of Biochar,” “Applications of Biochar for Soil Remediation and Ameliorating Salinity Effects,” and “Applications of Biochar for Water Treatment.” Chapters address topics such as the pros and cons of biochar, its production, and its role in remediating and treating
This book provides a balanced critique of a range of international sustainability certification schemes across nine agricultural and natural resource industries. Certification schemes set standards through intramarket private and multi-stakeholder mechanisms, and while third-party verification is often compulsory, certification schemes are regulated voluntarily rather than legislatively. This volume examines the intricacies of certification schemes and the issues they seek to address and provides the context within which each scheme operates. While a distinction between sustainability certifications and extra-markets or intrabusiness codes of conducts is made, the book also demonstrates how both are often working towards similar sustainability objectives. Each chapter highlights a different sector, including animal welfare, biodiversity, biofuels, coffee, fisheries, flowers, forest management and mining, with the contributions offering interdisciplinary perspectives and utilising a wide range of methodologies. The realities, achievements and challenges faced by varying certification schemes are discussed, identifying common outcomes and findings and concluding with recommendations for future practice and research. The book is aimed at advanced students, researchers and professionals in agribusiness, natural resource economics, sustainability assessment and corporate social responsibility.