

Progress in Soil Science

Alfred E. Hartemink
Kevin McSweeney *Editors*

Soil Carbon



International Union of Soil Science

 Springer

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Series Editors:

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Aims and Scope

Progress in Soil Science series aims to publish books that contain novel approaches in soil science in its broadest sense – books should focus on true progress in a particular area of the soil science discipline. The scope of the series is to publish books that enhance the understanding of the functioning and diversity of soils in all parts of the globe. The series includes multidisciplinary approaches to soil studies and welcomes contributions of all soil science subdisciplines such as: soil genesis, geography and classification, soil chemistry, soil physics, soil biology, soil mineralogy, soil fertility and plant nutrition, soil and water conservation, pedometrics, digital soil mapping, proximal soil sensing, soils and land use change, global soil change, natural resources and the environment.

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Foreword

We live in the carbon era. Carbons are ubiquitous in soil, water, atmosphere, and minerals of all ages and in all places. The carbon of million years ago is still the same as that of today. However, carbon is more important than ever before not only to scientists but also to politicians, tax payers, consumers, and producers. Low carbon and green growth becomes the main theme of the research and policy agenda across the globe.

Carbon is a simple chemical element with atomic number 6 and an atomic weight of 12; it is nonmetallic and tetravalent. However, carbon is a somewhat mysterious element since it can camouflage into various compounds and materials depending upon where it exists or what it reacts with. The properties of carbon vary widely with the allotropic forms such as graphite, diamond, and amorphous carbon. It can also exist in inorganic and organic forms. There is a chemistry joke on carbon. Why did carbon marry hydrogen? They bonded well from the minute they met.

Carbon is the 15th most abundant element in the Earth's crust and the fourth most abundant element in the universe by mass after hydrogen, helium, and oxygen. In the human body, carbon is the second most abundant element by mass after oxygen. This abundance, together with a diversity of organic compounds and polymer-forming ability, makes carbon the chemical basis of all known life.

Carbon in the soil is crucial for sustaining human life and ecosystem health and functions. Soil is the most important reservoir of carbon, and thus changes in soil carbon levels can have a large impact on life and the ecosystem. Soil carbon can be described as the motherhood of life, since it is the basis of life, energy, fiber, food, and shelter. However, with mismanagement, carbon can trigger irreversible and catastrophic changes to the conditions of life on our planet with devastating ecological and economic consequences.

Assessment of soil carbon cycle and dynamics is at the frontier of soil science, and the International Union of Soil Sciences (IUSS) as a global union of soil scientists is fostering soil carbon research. Soil carbon is important in space and time (IUSS Division 1), properties and processes (IUSS Division 2), use and

management (IUSS Division 3), and sustaining society and the environment (IUSS Division 4). Thus, having the IUSS Global Soil C Conference in June 2013 in Madison, Wisconsin, USA, with over 100 presentations from 30 countries across the globe was timely.

This book contains a selection of papers presented at the conference. I truly believe that this book serves all country members and public with all ingredients of soil carbon.

Jae E. Yang
IUSS President

Preface

In the past two decades, an increasing number of soil studies have focused on soil carbon (C). Most of these studies were related to stock assessment, monitoring, microbial dynamics, loss of C, tillage effects, soil management, economics, or policy issues – to name a few topical areas that have been widely researched and discussed. The driving force for much of soil C research is related to climate change or the maintenance of soil quality and fertility. Few topics cut across the whole soil science discipline wider than research on soil C.

In 2009, the International Union of Soil Sciences (IUSS) recognized the need for a conference that focused on a single topic that is of interest to all IUSS Divisions, Commissions, and Working Groups. Naturally, it was decided that the conference topic should be soil C and that the conference should have an interdivisional and intercommissional approach. To achieve this goal, it was decided that there should be no concurrent sessions and that the conference should consist of sessions with several short presentations followed by ample discussions. The IUSS Global Soil C Conference was held in June 2013 in Madison, USA, and consisted of 3 days of presentations and discussions, followed by a 1-day field trip. There were 140 participants from over 30 countries.

This book contains selected papers from the IUSS Global Soil C Conference. The conference presentations were structured by IUSS Commissions and Working Group under each of the four Divisions. We have more or less kept this structure for the book and loosely grouped papers in four sections: Soil Carbon in Space and Time; Soil Carbon Properties and Processes; Soil Use and Carbon Management; and Soil C and the Environment. We have selected papers that focus on novel and exciting aspects of soil C research, and a few review papers.

We are greatly indebted to all IUSS officers, all conference participants, and authors who helped shape the conference and made excellent contributions to discussions and papers in this book. We acknowledge the financial support from the College of Agriculture and Life Science (CALS) and the Department of Soil Science at the University of Wisconsin—Madison. Special thanks go to Bill Bland and

Birl Lowery and to CALS Conference Services (Leah Leighty) for assistance in the organization of this global conference.

It is our hope that the carbon that was needed to bring these soil scientists together be counterbalanced by the knowledge gained to manage it wisely.

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Contents

Part I Soil Carbon in Space and Time

1 Challenges for Soil Organic Carbon Research.....	3
Alex B. McBratney, Uta Stockmann, Denis A. Angers, Budiman Minasny, and Damien J. Field	
2 Micromorphology Techniques for Soil Organic Carbon Studies.....	17
Rosa M. Poch and Iñigo Virto	
3 Soils as Generators and Sinks of Inorganic Carbon in Geologic Time.....	27
H. Curtis Monger	
4 Organic Carbon as a Major Differentiation Criterion in Soil Classification Systems.....	37
Erika Michéli, Phillip R. Owens, Vince Láng, Márta Fuchs, and Jon Hempel	
5 Quantitatively Predicting Soil Carbon Across Landscapes.....	45
Budiman Minasny, Alex B. McBratney, Brendan P. Malone, Marine Lacoste, and Christian Walter	
6 On Soil Carbon Monitoring Networks.....	59
Dominique Arrouays, Ben P. Marchant, Nicolas P.A. Saby, Jeroen Meersmans, Claudy Jolivet, Thomas G. Orton, Manuel P. Martin, Patricia H. Bellamy, Richard M. Lark, Benjamin P. Louis, D. Allard, and M. Kibblewhite	
7 A Novel Method for Measurement of Carbon on Whole Soil Cores.....	69
Robert Pallasser, Budiman Minasny, and Alex B. McBratney	

8	Evolutionary Optimization of Spatial Sampling Networks Designed for the Monitoring of Soil Organic Carbon	77
	Alí Santacruz, Yolanda Rubiano, and Carlos Melo	
9	Distribution of Soil Organic Carbon in the Conterminous United States.....	85
	Norman B. Bliss, Sharon W. Waltman, Larry T. West, Anne Neale, and Megan Mehaffey	
10	Overview of the U.S. Rapid Carbon Assessment Project: Sampling Design, Initial Summary and Uncertainty Estimates	95
	Skye Wills, Terrance Loecke, Cleiton Sequeira, George Teachman, Sabine Grunwald, and Larry T. West	
 Part II Soil Carbon Properties and Processes		
11	Molecular Models of Cation and Water Molecule Bridges in Humic Substances.....	107
	Daniel Tunega, Adelia J.A. Aquino, Georg Haberhauer, Hans Lischka, Gabriele E. Schaumann, and Martin H. Gerzabek	
12	Rapid Evaluation of Soil Quality Based on Soil Carbon Reflectance	117
	Mohammad Sadegh Askari and Nicholas M. Holden	
13	Characterization of Soil Organic Substances by UV-Vis Spectrophotometry in Some Soils of Hungary.....	127
	Klaudia Kiss, Zoltán Szalai, Gergely Jakab, Balázs Madarász, and Nóra Zboray	
14	Hot-Water-Soluble Organic Compounds Related to Hydrophobicity in Sandy Soils	137
	Irena D. Atanassova, Stefan H. Doerr, and Gary L. Mills	
15	The Contribution of Soil Aggregates to Carbon Sequestration in Restored Urban Grasslands.....	147
	Jenifer L. Yost, Corey E. Palmer, and Louise M. Egerton-Warburton	
16	Contribution of Fungal Macromolecules to Soil Carbon Sequestration.....	155
	Kathryn M. Schreiner, Neal E. Blair, William Levinson, and Louise M. Egerton-Warburton	
17	Carbon Storage and DNA Adsorption in Allophanic Soils and Paleosols.....	163
	Yu-Tuan Huang, David J. Lowe, G. Jock Churchman, Louis A. Schipper, Nicolas J. Rawlence, and Alan Cooper	
18	Soil Microbial Biomass and C Storage of an Andosol	173
	Kazuyuki Inubushi and Yuhua Kong	

19	Estimating Fine Resolution Carbon Concentration in an Intact Soil Profile by X-Ray Fluorescence Scanning	179
	Sharon M. O'Rourke, Jonathan N. Turner, and Nicholas M. Holden	
20	Probing Temperature-Dependent Organo-mineral Interactions with Molecular Spectroscopy and Quartz Crystal Microgravimetry	189
	Michael Nguyen, William Hockaday, and Boris L.T. Lau	
21	Storage of Total and Labile Soil Carbon Fractions Under Different Land-Use Types: A Laboratory Incubation Study	197
	Shade J. Akinsete and Stephen Nortcliff	
22	Could Soil Acidity Enhance Sequestration of Organic Carbon in Soils?	209
	Shinya Funakawa, Kazumichi Fujii, Atsunobu Kadono, Tetsuhiro Watanabe, and Takashi Kosaki	
 Part III Soil Use and Carbon Management		
23	Is Percent 'Projected Natural Vegetation Soil Carbon' a Useful Indicator of Soil Condition?	219
	Chris Waring, Uta Stockmann, Brendan P. Malone, Brett Whelan, and Alex B. McBratney	
24	Forest Fires and Soil Erosion Effects on Soil Organic Carbon in the Serrano River Basin (Chilean Patagonia)	229
	Carlos A. Bonilla, Pablo A. Pastén, Gonzalo E. Pizarro, Virginia I. González, Athena B. Carkovic, and Rocío A. Céspedes	
25	Soil Carbon Sequestration with Improved Soil Management in Three Tribal Villages in India	239
	Ch. Srinivasarao, B. Venkateswarlu, Y. Sudha Rani, A.K. Singh, and S. Dixit	
26	Assessment of Near-Surface Soil Carbon Content Across Several U.S. Cropland Watersheds	249
	Diane E. Stott, Cynthia A. Cambardella, and Douglas L. Karlen	
27	Mineralizable Soil Organic Carbon Dynamics in Corn-Soybean Rotations in Glaciated Derived Landscapes of Northern Indiana	259
	Zamir Libohova, Diane E. Stott, Phillip R. Owens, Hans E. Winzeler, and Skye Wills	
28	Long-Term Soil Organic Carbon Changes as Affected by Crop Rotation and Bio-covers in No-Till Crop Systems	271
	Amanda J. Ashworth, Fred L. Allen, Jason P. Wight, Arnold M. Saxton, and Don D. Tyler	

29	Perennial Grasslands Are Essential for Long Term SOC Storage in the Mollisols of the North Central USA	281
	Gregg R. Sanford	
30	Soil Organic Carbon Redistribution by Erosion on Arable Fields.....	289
	Gergely Jakab, Klaudia Kiss, Zoltán Szalai, Nóra Zboray, Tibor Németh, and Balázs Madarász	
31	Relating Soil Carbon and Soil Structure to Land Use Management	297
	Junfang Cui, Mohammad Sadeqh Askari, and Nicholas M. Holden	
32	Microbial Biomass Carbon and Nitrogen Under Different Maize Cropping Systems	305
	Michael Olajire Dare, J.A. Soremekun, F.O. Inana, O.S. Adenuga, and G.A. Ajiboye	
33	Mitigation Effect of Farmyard Manure Application on Greenhouse Gas Emissions from Managed Grasslands in Japan.....	313
	Mariko Shimizu, Ryusuke Hatano, Takatoshi Arita, Yasuyuki Kouda, Akinori Mori, Shoji Matsuura, Mitsuhiro Niimi, Masayoshi Mano, Ryuichi Hirata, Tao Jin, Atfritedy Limin, Toshiya Saigusa, Osamu Kawamura, Masayuki Hojito, and Akira Miyata	
34	Clay Addition and Redistribution to Enhance Carbon Sequestration in Soils.....	327
	G. Jock Churchman, Andrew Noble, Glenn Bailey, David Chittleborough, and Richard Harper	
Part IV Soil C and the Environment		
35	Soil Carbon Management and Climate Change	339
	Rattan Lal	
36	GlobalSoilMap and Global Carbon Predictions	363
	Jon Hempel, Alex B. McBratney, Dominique Arrouays, Neil McKenzie, Alfred E. Hartemink, Mike Grundy, Mogens Greve, Suk-Young Hong, Glenn Lelyk, and Zamir Libohova	
37	Distribution of Organic Carbon in the Soils of Antarctica	373
	James G. Bockheim and Nick W. Haus	
38	Carbon Balance in Soils of Northern Eurasia	381
	Vladimir Stolbovov and Andrei Ivanov	
39	Topsoil Organic Carbon Map of Europe	393
	Delphine de Brogniez, Cristiano Ballabio, Bas van Wesemael, Robert J.A. Jones, Antoine Stevens, and Luca Montanarella	

40 Soil Organic Carbon Content in the Topsoils of Agricultural Regions in Croatia..... 407
 Stjepan Husnjak, Aleksandra Bensa, Hana Mesic, and Danijela Jungic

41 Soil Carbon Variability in Some Hungarian and Croatian Soils..... 419
 Milan Mesic, Márta Birkás, Zeljka Zgorelec, Ivica Kisic, Ivana Sestak, Aleksandra Jurisic, and Stjepan Husnjak

42 Stratification Ratios of Soil Organic Matter in Agro-ecosystems in Northeastern Brazil 427
 S. Churka Blum, S.P. de Oliveira, N.B. de Lacerda, G.V. de Alencar, M.E. Ortiz Escobar, E.S. Mendonça, and T.S. de Oliveira

43 Carbon Balance at the Regional Scale in Southern Brazil Estimated with the Century Model 437
 Elisandra Solange Oliveira Bortolon, João Mielniczuk, Carlos Gustavo Tornquist, Leandro Bortolon, and Fabiola Lopes

44 Soil CO₂ Fluxes from Different Ages of Oil Palm in Tropical Peatland of Sarawak, Malaysia..... 447
 Lulie Melling, Kah Joo Goh, Auldry Chaddy, and Ryusuke Hatano

45 Soil Organic Carbon Stocks, Changes and CO₂ Mitigation Potential by Alteration of Residue Amendment Pattern in China 457
 Zubin Xie, Gang Liu, Qicheng Bei, Chunmei Chen, Georg Cadisch, Qi Liu, Zhibin Lin, Hasegawa Toshihiro, and Jianguo Zhu

46 Soil Organic Carbon Stocks Under Plantation Crops and Forest in the Rainforest Zone of Nigeria 467
 Joseph S. Ogeh

47 Evolution of Soil Carbon Storage and Morphometric Properties of Afforested Soils in the U.S. Great Plains..... 475
 Yury G. Chendev, Larisa L. Novykh, Thomas J. Sauer, Aleksandr N. Petin, Evgeny A. Zazdravnykh, and C. Lee Burras

48 Soil Carbon Research Priorities 483
 Alfred E. Hartemink, Martin H. Gerzabek, Rattan Lal, and Kevin McSweeney

Author Index..... 491

Subject Index..... 497