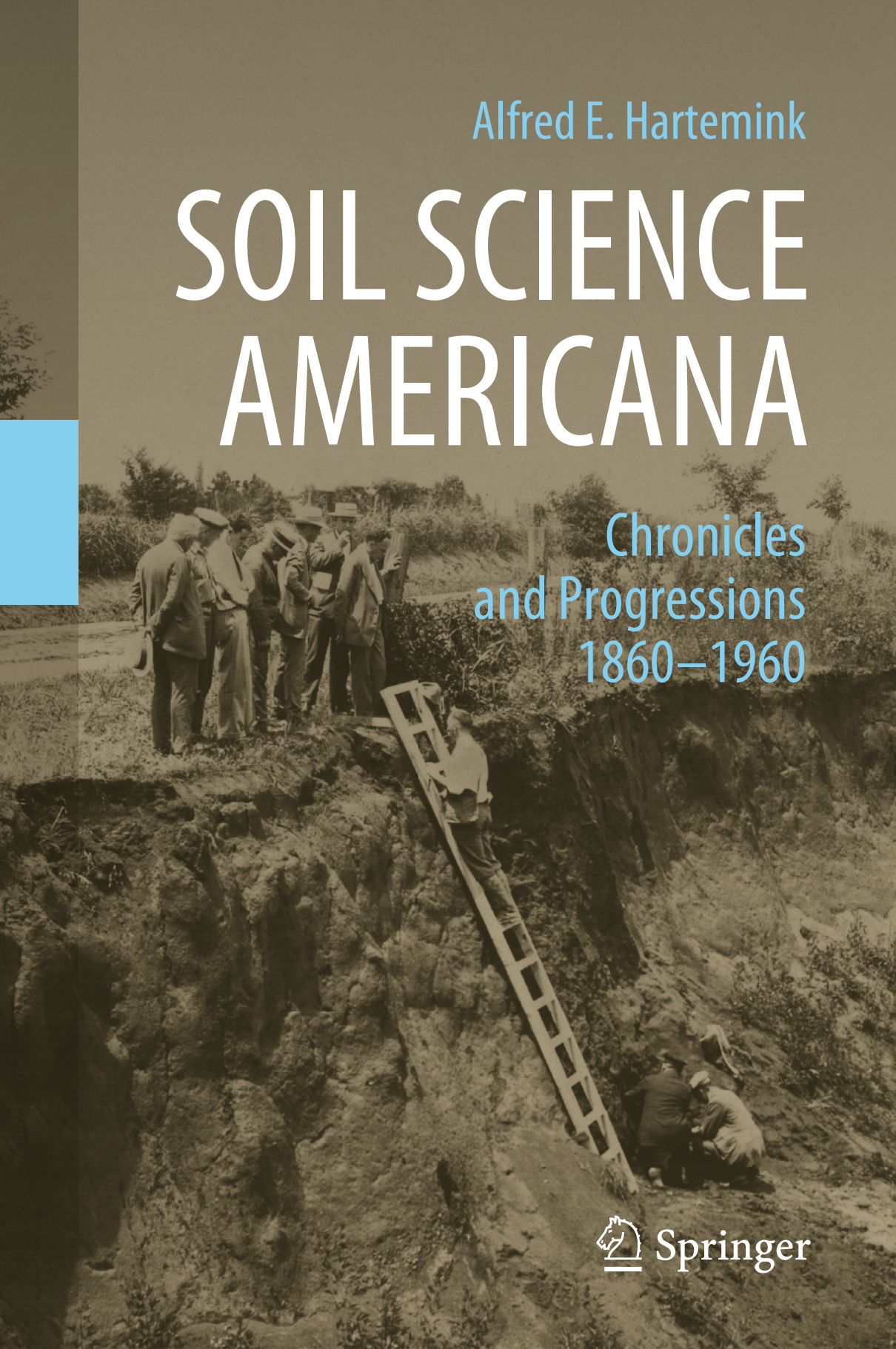
Alfred E. Hartemink

SOIL SCIENCE AMERICANA

Chronicles and Progressions 1860–1960



Springer

Soil Science Americana

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Alfred E. Hartemink
Department of Soil Science, FD Hole Soils Lab
University of Wisconsin
Madison, WI, USA

ISBN 978-3-030-71134-4 ISBN 978-3-030-71135-1 (eBook)
https://doi.org/10.1007/978-3-030-71135-1

Cover photo: Participants of the Transcontinental Excursion observing a Cecil clay loam profile near Athens, Georgia on 25th June 1927. On the ladder: David Hissink, at the bottom of the ladder Boris Polynov. Photo by M.E. Diemer, Chemist and Photographer of the University of Wisconsin.

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

To my parents Derk† and Thea
For their ground gave me wings.

"*In every bit of honest writing in the world there is a base theme. Try to understand men, if you understand each other you will be kind to each other. Knowing a man well never leads to hate and nearly always leads to love. There are shorter means, many of them. There is writing promoting social change, writing punishing injustice, writing in celebration of heroism, but always that base theme. Try to understand each other*."

John Steinbeck, 1938

"*It is rather a knowledge of relationships that the general reader seeks, not facts per se*."

"*…knowledge is, after all, one great body, not departmentalized, but a huge jewel with many facets*."

Charles Kellogg, 1940

"*Soil Science Americana* is an intellectual biography, not of one individual but of a new scientific field from its emergence to its complete coming of age. A tour the force with engaging sketches of the key players and often complex international relations. A fascinating read for all those interested not just in soil, climate and agriculture but in the history of science."

—Louise O. Fresco, *President, Wageningen University and Research*

"In a lively, personal voice, Hartemink traces the roots of modern soil science in the United States. He tells us of the melding of the Russian and American schools; the lives of those who shaped the field; formation of the famous academic departments of soil science; and the small wars fought by the giants of the field. Hartemink offers keen insight into how individuals and world history influenced the field, creating a book that will engage both the expert and non-expert in the underappreciated field of soil science."

—Jo Handelsman, *Director, Wisconsin Institute for Discovery*

"*Soil Science Americana* by Alfred Hartemink vividly outlines the historic evolution of soil science, its disciplinary diversity, and relevance to addressing historic, current and emerging issues of national and global significance. Using reader-friendly language, Hartemink draws on intellectual biography of pioneer soil scientists of the U.S. and their interaction with peers from Europe, and explains how global events influenced the evolution of soil science. The intellectual master piece is of interest to soil scientists, general public and the policy makers, and will remain pertinent for generations to come."

—Rattan Lal, *World Food Prize Laureate 2020, The Ohio State University*

Foreword by Ron Amundson

The soil of the Earth's surface is a historical object, a planetary skin that reflects the journey, experiences, and lineage of the patron of interest. Thus, it is not surprising that pedologists, as a group of scientists, have had a long interest in the history of their field and the origin of the ideas and concepts on which it is built.

In this book, *Soil Science Americana*, Alfred Hartemink has harnessed his long-standing ability and enthusiasm for examining science history and has created a riveting tale of American pedology, one of wide-ranging scope and depth. I anticipate that every reader will find themselves, as I was for a full afternoon as I read about Roy Simonson, carried to different times and places, mesmerized as the participants come again to life, regain their youth, and embark on their life journeys once again. As I remarked many years ago in the Foreword to the reprinting of Hans Jenny's Factors of Soil Formation, we are commonly introduced to eminent scientists after their death, and we see them only through the lens of photographs taken late in life. Not here. The illustrations are novel, and we see people in their prime. We begin to understand them as humans, with all the associated humility, vanity, foibles, mistakes, successes, and brilliance that come with the bargain.

I chose to preview Chap. 5, a synopsis of the life of pedologist Roy Simonson. Simonson and I were born a bit more than a generation apart, though I shared with him the experience of an upbringing on a farm on the Dakota plains, and as a descendent of Scandinavian immigrants. Alfred Hartemink illuminates Simonson's skills and training in basic skills such as mathematics and in writing. Simonson used his skills—and keen criticism—as an editor when he was just a graduate student, on the monumental book *Soils & Men*. As I read about this period in Simonson's life, it jarred my memory to an incident that occurred early in my career at Berkeley, when I was submitting some of my first manuscripts as a young Assistant Professor. I, as possibly many did, had the experience of submitting manuscripts to the journal Geoderma during Simonson's long tenure as Editor-in-Chief. In the late 1980s, my group had worked diligently on a manuscript, and we finally submitted it to Geoderma. Some months later, a package appeared in the mail, loaded with a heavily edited copy of the manuscript and the accompanying reviews. In addition to the comments provided by three anonymous reviewers was a "personal" review by Roy Simonson. The letter from Roy

began by noting that due to his immense interest in pedology, he had taken it upon himself to personally provide a review of my manuscript. The comments he provided went on for more than 11 pages. Additionally, Simonson wrote, though I am still uncertain what he thought as he penned this, "that I also include for you a document that I normally provide for our non-English speaking authors." The document—as I remember it—was entitled How to write in the English language. As I continued to read Alfred's chapter about Simonson, it provided a bit of consolation to learn that, many years before when he was a graduate student, Simonson had rejected a manuscript submitted to the book *Soils & Men* by the future Nobel laureate, Selman Waksman. Criticism, sometimes a bit liberally administered, can be helpful in the end, especially if judiciously diluted to aid in its digestion.

One advantage of good history is that we can stand back and survey the bend of its arc and contemplate the arrow of time as it intersects with the here and now. The history of pedology that follows on these pages illustrates the story of the demography of science up to the beginning of the latter half of the twentieth century. While the characters in this history are mostly dead, and (yes) white, and (yes) men, the immigrant backgrounds that many came from, and the economic and sometimes political hardships that many faced, are indeed a fundamental part of the fabric of Americana. And, of course, they were not always old. They are part of our soil science family, which now is becoming an ever-broader slice of the modern human landscape of America. This lively book is an important first installment on a youthful science embedded in an evolving cultural landscape, one in which we now are actively shaping and expanding.

Ron Amundson
Professor of Pedology
University of California Berkeley
Berkeley, CA, USA

Foreword by Maxine J. Levin

My formative years in Soils and Pedology were the 1970s. I was in the first wave of women to become interested in soil science in the agronomy and forestry departments of universities. As students, we were thinking about soil science's links to environmental science and ecology, but the textbooks were not making it that easy. Nyle Brady's textbook on soil science was a dry, pictureless text, relating mostly to the basics of soil chemistry, plant nutrition, and some soil physics. The relationships with landscape and land management interpretations were described in some lectures—mostly in response to our questions—and presented anecdotally… essentially as hearsay, not fully developed ideas. We had some contacts with the icons of Pedology, which was itself a term rarely used in soil science. One exception was when it was used in passing references to soil surveys and Guy Smith's budding *7th Approximation* in Soil Taxonomy. Most of the founding pedologists were already retired or gone, and for the most part, their second-generation successors were teaching without texts or references. Paradigms and foundational concepts were still being tested.

At the University of California Berkeley, undergraduates and graduates had the benefit of Hans Jenny, emeritus professor of soils who was still coming into his office most days. For us students, his small book, Factors of Soil Formation, was our bible and we treated him with respect and awe. I was charmed by his yearly lectures on soil in art and esthetics and fervently hoped to get a seat near him at the coffee hours where he sometimes entertained graduate students. As a lowly undergraduate, I hoped some of his knowledge would rub off on me and was delighted when he sorted my face from all his other devotees, or acknowledged a remark as reasonable, if not profound or provocative. Despite his relative celebrity, he was a kind man, and a humble student of the science himself.

This book, Alfred Hartemink's *Soil Science Americana,* is a definitive start at a synthesis of the first 100 years of Pedology in the United States. I hope that readers will use this book as a platform for further discussion. As a soil mapper from the early 1980s to the 2000s, I often felt that I needed a broader perspective in order to fully contribute to the *Soil Taxonomy* that was being built, using field input gathered through the US National Cooperative Soil Survey. When I was a student and field soil scientist, we lacked the synthesis documents and the train of thought used to build the systems. In the field, I often

found myself questioning my correlators and oversight staff as to whether the western or urban landscapes that I was mapping really fit into the systems to which I was supposed to conform to my observations.

It is hard to know really whether you are seeing and measuring something new if it is not easy to retrieve the logic and assertions needed for comparisons. Pedology is still in a constant flux, even after 100 years of exploration and discovery. We are now redefining our observations with the help of digital technology. At times, the picture that the data presents is skewed, not for reasons of nature but because of the conventions and assumptions used to gather the data. I welcome the reevaluation of historical data and the perspective that can be gained.

There also is the story of personalities and characters in the science that has colored and enriched my life and career. I have found that the pursuit of science is often linked to the influence of friends and adversaries, and that the story of these linkages in this book is as interesting as the science itself. As program manager and a leader of the National Cooperative Soil Survey in Washington, D.C., I finally had access to many of the seminal papers that had shaped the Survey's policy and methods—the same policies and methodologies that my correlators and I had mentally sparred over early in my career. Also, I was able to see the internal memos and correspondence that Emil Truog, Charles Kellogg, Hugh Bennett, Curtis Marbut, Hans Jenny, Milton Whitney, Eugene Hilgard, and Roy Simonson as well as the many Russians and other characters, like Guy Smith, all shared.

These written arguments built the foundations of the science—based on close observation of nature, and then the practicality of interpretation—first for farming, and later for various other kinds of economic development. In addition, the literature of the *International Congresses of Soil Science* has brought another level of understanding of the development and dialogue of Pedology that Alfred Hartemink has clearly articulated in this book. All would have been helpful in my early mapping days to clarify my thoughts and put my observations in context. I encourage newcomers to the science to use this text as a jumping-off point for their own journey of discovery, particularly in the influence of digital enhancement and applications to the environment.

Maxine J. Levin
2020 Pedology Division Chair, SSSA
Adjunct Lecturer Soil Science, University of Maryland
National Leader Interpretations
USDA NRCS, retired

Preface

The world would have been different if soil science had not emerged in the nineteenth century. By nature, it applies to many—if not all—of the sciences, but the impact of soil science on society and the world is largely untold. Soil science is an earth science which findings are applied in the judicious management of the land, whether that is for growing food, filtering water, storing carbon, or building houses. Most of all, it is a science that aims to understand the clothes of the earth, those top few meters that we live on. The need for understanding soil equals the need for comprehending all animals and plants, rocks, and the ever-changing climate; they are partners in an earth system from which we, humans, and all other life derive being and survival.

Scientific soil studies were started in the mid-1800s, and since then, thousands of people have studied soils. Progress has been made through individual and group discoveries combined with the international exchange that progressed at the beginning of the twentieth century. Slowly, an independent science evolved, and a global soil science community formed that advanced common thinking and practices. The globalization of soil science was decelerated by two world wars, but a firm basis was laid in 1924 when the *International Society of Soil Science* was established. Chemistry, geology, microbiology, and agronomy had well-established professional organizations, but now soil science has its own global society to foster soil studies. In 1927, soil science had its foremost pinnacle with the *First International Congress of Soil Science* in Washington. Since then, international soil congresses were regularly organized, and in 1960, the *Seventh International Congress of Soil Science* was held in Madison, Wisconsin. The 1960 congress brought 1,260 soil scientists together from all over the world. That was more than any previous international soil congress. The theme of the congress was *To Promote Peace and Health by Alleviating Hunger through Soil Science.* The Second World War was long over, and a cold war was brewing, but in 1960 the soil science community sent a message of science devoted to peace and hunger alleviation across the world.

This book is about soil scientists, their connections, and the budding and early blossoming of American and international soil science in the period 1860 to 1960. Interwoven is a tale of two farm boys who grew up 900 km apart, in the Midwest USA in the late 1800s and early 1900s. Emil Truog and Charles Kellogg met in the late 1920s and shared a natural connection

to the soil. Both were practical pioneers and believed that understanding soils was crucial to helping people on the land make a better living. They had a profound influence on the soil science discipline, and were leaders in the organization of the 1960 soil congress [1]. Also interwoven is the story of Roy Simonson who was a student of Charles Kellogg in North Dakota and Emil Truog in Wisconsin. As a matter of fact, this book is about a few hundred people who studied soil in the USA, and other parts of the world.

I read the unpublished diaries of Charles Kellogg and Roy Simonson, and the biographies of Justus von Liebig [2], Eugene Hilgard [3], Nathaniel Shaler [4], Curtis Marbut [5, 6], Hugh Bennett [7], Macy Lapham [8], John Russell [9], Bernard Tinker [10], Jacob Lipman [11], Selman Waksman [12], Sergei Vinogradskii [13], Dan Yaalon [14], A. P. A. Vink [15], John Arno [16], Marjory Stephenson [17], Leen Pons [18], Dennis Keeney [19], Anthony Young [20], René Dubos [21], Martinus Beijerinck [22], Gary Petersen [23], the published interviews with Hans Jenny [1], and Guy Smith [37], and I read obituaries and homages of soil scientists whose works and lives are chronicled in this book.

The geographic focus of this book is the USA, and I read the histories of soil and related departments in Illinois [24], Maine [25], Michigan [26], Minnesota [27], Missouri [28], New York [29], North Dakota [30], North Carolina [31], Ohio [32], Wisconsin [33, 34], Pennsylvania [35], and bits and pieces of the history of soil departments in California. Three studies on the history of the soil survey in the USA were reviewed [36–38], in addition to some of the main soil science history books [37, 39–44]. Given that soil science is a global science that has extensive international roots, contextualizing chronicles and progressions required a wide perspective. Therefore, several historical studies were used to frame American soil science in a global light including those written for Germany [45], France [41], Russia [39], the Netherlands [46], and more globally [47].

Soil Science Americana is an attempt to knit human interest into soil science developments. It is about people, human history, and soil science in the USA and across the world. Soil science in the USA has not suffered from abysmal isolationism, and international cooperation and exchange became more common after the first international congress in 1927. It is not possible to see progressions in soil science in the USA in the early twentieth century without taking into account the cradle of soil science in Russia, and the immigrants that came from Russia and its surrounding countries. I studied the publications of the Israel Program for Scientific Translations that, in return for American wheat, translated soil publications from Russian into English in the 1950s and 1960s [48].

Much of this book was written at odd hours in my office of the Department of Soil Science at the University of Wisconsin, Madison—the same office that Emil Truog occupied as Head of Department 80 years earlier. He stayed in that office for 15 years, and even though he was succeeded in the spring of 1954, he did not vacate the office for another 9 months. The office overlooks Lake Mendota, and on its walls hang the painted portraits of Franklin King, Andrew Whitson, and Emil Truog—the first three Heads of the Department. Below them hangs a portrait of Eugene Hilgard painted by Sergei Wilde in 1944. They all looked over my shoulder and ascertained that I 'came in with the birds' as Emil Truog recommended, if not directed, to his students.

Some of the chapters were written at Franklin King's desk that has a holder with eight of his pipes. In the drawer, two small notebooks with the finances of the first 15 years of the department starting in 1889, and one could only wish for the simplicity of such financial accounting. In other drawers, old photographs from the department, the 1927 and 1960 congresses, and letters from Emil Truog and his predecessors. The invitation was there: sit, mine the material, read, think a little, read some more, and write it up. While writing, I strived for what Bernard Tinker attempted when he obtained a postdoctoral appointment at Rothamsted in 1954: "I learned to think logically, to plan practically and to write sensibly [10]."

The Department of Soil Science and the University of Wisconsin, Madison, have an extensive Emil Truog archive. The Charles Kellogg archives are at the USDA National Agricultural Library and Library of Congress. The grandchildren of Emil Truog and Charles Kellogg, and the son of Roy Simonson provided information, and all three had extensive correspondence and kept detailed records of their activities. Charles Kellogg maintained a logbook of events that he had begun in 1950, and I have used his dairy up to 1934, and the years 1950 and 1960. I have cited from the diaries, letters, and papers, but realize that it is a snapshot of the events as they occurred and guided by my interpretation and framing of events. I am distanced both in time and space from the main people in this book, and all had died before I knew what's up and down. The exceptions are Roy Simonson with whom I corresponded for a while about soil science history and *Geoderma* [49], and Peter LeMare with whom I have corresponded for years and who died in 2018 at the age of 95.

In 2003, Henry Janzen from Agriculture and Agri-Food Canada reviewed my book *Publishing in Soil Science*, which was inspired by his paper *Is the Scientific Paper Obsolete*? [50, 51] He wrote a fair review about my book, but what caught my attention was the comment: "…I might also grouse about the

'administrative' flavour of the history. I learn about dates and commissions and congresses, when what I really seek is 'story.'" I took that comment at heart, had years to think, and figure out how to blend human history with soil science progressions. In this book, I have tried to let the story prevail, and often thought of Johan Bouma who had been an indelible promoter of soil stories [52]. *Soil Science Americana* narrates stories of people and soil science developments in the USA embedded in a global setting between 1860 and 1960. The stories became chronicles as they were shaped and experienced by a university professor and chief of the soil survey. I have aimed to rise above the level of a bundle of pedology trivia along a strict historic timeline but throughout the book, there is the intermittent highlight of a frivolous fact or event. There is some overlap between the chapters, and occasionally the same story is narrated in different chapters as it was experienced by different people.

As long as I have studied soils, I developed an interest in soil science history and in those for whom soil science is a profession: Who they were, where they came from, what they had in common—not that I ever found it, but conceivably, I was seeking my ground in the soil science world which had a new impetus after I moved to the USA in 2011. In the search for the ground and soul of American soil science, I had to think what Stephen Fry once said: "Everything you say about America is true, and so is the opposite." Admittedly, I am not a historian or a novelist, and so much of what I have written here is the outcome of seeing people, stories, and developments through my soil science and human lens. The structure of the book is fabricated, and I may have overlooked, overemphasized, or misinterpreted happenings. I do not claim that my judgment has been infallible in all chronicles and progressions, but except for some obvious wanderings, none of them are fictitious. It has been a joy writing this book and may that be reflected in what follows henceforward.

Alfred E. Hartemink
Madison, USA
January 2021

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The original version of the book was revised: Chapter-wise abstracts have been included in the online version. The correction to the book is available at https://doi.org/10.1007/978-3-030-71135-1_16

Acknowledgements

On a cold January evening in 2019, I had dinner with Marv Beatty in Madison. There was a frost warning, it snowed with gusty northern winds, and roads were icy. All of that is nothing to worry about in Wisconsin. I had met Marv some years before I moved to the University of Wisconsin, and we have had a conversation about the history of soil science. Marv obtained his PhD in 1955 that was supervised by Emil Truog [53], and he retired when I started my first soil science position. In 1989, he wrote the history of the Department of Soil Science following its 100th anniversary. Marv was close with Emil Truog and Roy Simonson, and an assistant for the organizing committee of the *Seventh International Congress of Soil Science* in 1960, as were Dennis Keeney, Leo Walsh, and all students of the Department of Soil Science.

Some 50 years before that cold evening in 2019, Marv had dinner with Charles Kellogg at the annual meeting of the *Soil Science Society of America* in Cincinnati. They knew each other through Ken Ableiter who worked for Charles Kellogg and who came to inspect a soil survey that Marv had conducted. That evening in Cincinnati, Charles told a story about how Emil Truog had given him a new suit in 1929, and that it helped him in being representable for a job interview. Charles Kellogg got the job, and 27 years later, when he had become an influential soil scientist, he returned a favor to Emil Truog. That story sparked my interest and I pondered how seemingly tiny gestures have shaped the world of soil science. It became the start, if not *Leitmotiv*, for this book. While digging through other stories, papers, books, and diaries, it became apparent that the world of American soil science is small indeed, and that it takes a bird's eye view and a deep breath to see it that way. So, I have uplifted numerous small events and framed them in a broad and long perspective. A strong inner compulsion made *Soil Science Americana* as comprehensive as it is, but I had the help of many people.

Thank you, Marv, for that story and the pedology trip to Montana. I am grateful to Jim Bockheim, Leo Walsh, Robin Harris, and Dennis Keeney for various bits of information and encouragement. They are emeriti professors in the Department of Soil Science. I am grateful to Jim and Leo for the visits to Palo and Independence in the summer of 2019. Prior to my current position at the University of Wisconsin, I had the good fortune of working alongside Wim Sombroek and Hans van Baren who had leadership positions in

the *International Society of Soil Science*. I learned from them how the world of soil science was affected by politics, strong individuals, and disparaging ambiances. At that time, I also inherited, which meant saving it from the recycling dumpster, archival material from Jules Mohr, David Hissink, and Cees Edelman when the Department of Soil Science & Geology moved out of its Duivendaal 10 building in Wageningen where it had nested in 1966. Mariette Edelman gave me part of her father's archive as no institution had shown interest in the material, and after Hans van Baren died in 2009, I inherited books and some correspondence from his uncle Ferdinand and grandfather Jan van Baren. These Dutch soil scientists played a role in international soil science and were well-connected with soil scientists in the USA.

In 2009, Alex McBratney and I boarded a train in Amsterdam to attend a meeting in Budapest to commemorate the centennial of the *First International Conference of Agrogeology*. During the 18-hour train ride, we discussed the world of soil science as far as our horizons permitted. It was a conversation interspersed with some work on the laptop, gazing out the train window, little naps, and beverages. Along the way, we realized that scientific directions sometimes were determined by a few individuals, and that is not always possible to judge in hindsight whether those directions were correct. Over the past 30 years, I have had similar conversations with Dan Yaalon, Johan Bouma, David Dent, Mary Beth Kirkham, Pedro Sanchez, Don Sparks, Dennis Greenland, Peter Buurman, Stan Buol, Jim Bockheim, John Tandarich, and many others. My understanding of progressions in soil science has been shaped by those conversations, and likely there are sprinkles of that in every chapter.

The following people provided publications, books, anecdotes, diaries, photographs, stories, clarifications, or suggestions, for which I am grateful: Jim Tiedje of Michigan State University, Pax Blamey from the University of Queensland, John Galbraith from Virginia Tech, Anne Efland of USDA, Diane Wunsche of the National Agricultural Library, David Hopkins of North Dakota State University, Marty Rabenhorst of University of Maryland, Mary Beth Kirkham of Kansas State University, Maxine Levin, Ron Amundson of University of California Berkeley, Eric van Ranst of Ghent University, Dennis Merkel from the Lake Superior State University, Stephen Anderson from the University of Missouri, Jim Robertson from the University of Alberta, Gary Peterson from Colorado State University, Yakov Pachepsky of ARS-Beltsville, Budiman Minasny from the University of Sydney, Mogens Greve from Aarhus University, Erika Micheli from Szent István University,

Carl Rosen from the University of Minnesota, Peter Jacobs from the University of Wisconsin-Whitewater, Lesley Robertson of Delft University of Technology, Stan Buol from North Carolina State University, Peter Schad from the Technische Universität München, Susan Chapman from the *Soil Science Society of America*, Horea Cacovean from the Pedological and Soil Chemistry Institute at Cluj-Napoca, Senator Mark Miller, Tony Young, Henk Edelman, Elise Frattura, Els de Jong, Yakun Zhang, Jingyi Huang, Carol Duffy, and the staff at the archives in the Steenbock Library.

Some of the Russian literature, interpretation, and portraits of Russian soil scientists were provided by Pavel Krasilnikov from Lomonosov Moscow State University. Thank you Pavel. I am grateful to Robert Doe, Executive Editor at Springer Nature for his assistance and suggestions, and to Ho Ying Fan and David Dent for careful editing and making my English understandable. Jim Bockheim commented on the draft of the book, and he knows more about soil than anyone else I know. Lastly, thank you Steven Kellogg and Pat Saiki for photos and information on your grandfathers Charles Kellogg and Emil Truog, and thank you Bruce Simonson for information on your father Roy Simonson.

About This Book

The first chapter reviews soil explorations in the nineteenth century, it sets the stage for the progressions in the 1900s. The second chapter, named Pochva Americana, unwraps differences in soil research between Russia and the USA in the period 1870 to the 1920s. Chapters 3 and 4 deal with the growing up, schooling, and working life of Emil Truog and Charles Kellogg. Chapter 5 narrates the life and works of Roy Simonson who was a student of Charles Kellogg and Emil Truog. The following chapter is on the University of Missouri in Columbia, and its contributions to soil science. Chapter 7 relates the start of the soil survey in the USA and the lives and works of Milton Whitney and Curtis Marbut. Chapter 8 reviews the soil survey as directed by Charles Kellogg, and Chap. 9 focuses on immigrants who came from Russia and profoundly influenced American soil science. Chapters 10–13 deal with the formation of *the International Society of Soil Science*, the first congress in 1927, the period 1927 to 1960, and the *Seventh International Congress of Soil Science* in 1960. The book ends with a chapter in which connections in space and time between people and events are endeavored, and in the epilogue the legacy of Emil Truog and Charles Kellogg is discussed.

The book is about soils and people and roughly covers the period 1860 to 1960. It is about human history, chronicles, and progressions in soil science, but it is not about everybody in soil science during that period nor about all progression in soil science in the USA. I have included numerous small biographies that provide some human insight and narrate specific developments. Both Emil Truog and Charles Kellogg interacted with many people and it was not possible to depict the whole web of their professional relations. Little attention is given to the early soil surveys in the western part of the country, which is described in the autobiography of Macy Lapham covering the period—late 1800s to 1940s [8]. Charles Kellogg had given him stenographic assistance to write his autobiography and named the book a "prize piece of Western Americana."

The web of human chronicles has been woven widely across the book, and the main characters are given under the chapter title in Table of Contents, and in Person indices in the back. Emil Truog and Charles Kellogg are central, whereas the American soil survey and the formation of the *International Society of Soil Science* in 1924, and the 1927 and 1960 soil congresses form national and international cornerstones in the book.

Now something about the names of people and places. All people have been named by their first and last names, like Emil Truog and Jadwiga Ziemięcka, so no initials are used nor just surnames. Some people like J. C. Russel from Nebraska always used his initials; his first name was Jouette. There were others like W. G. Ogg, the first name William, but mostly named Gammie. The Dutchman D. J. Hissink's first name was David, but friends named him Ko from his second name Jacobus. Charles Kellogg was named Chuck by intimate friends, but Charles Kellogg is used throughout the book. Some names have different spellings like Sergei or Sergey, and Winogradsky or Vinogradskii. I chose the name that was most recently used by, for example, Wikipedia or the US Library of Congress system. That may seem rather arbitrary criteria, but it has been used consistently. The names of towns, cities, and countries are all current, so it is St. Petersburg instead of Leningrad, Lubumbashi instead of Élisabethville, Ghana instead of the Goldcoast, and Russia instead of the USSR. Past names do not always match current political boundaries but since that is not the subject of this book, it does not affect the story.

Over 800 references have been listed by the Vancouver Style with notes in superscript in order to let the text flow. Not all letters from Charles Kellogg or Emil Truog have been referenced but they are in archival boxes in the Department of Soil Science. I have generously quoted from the letters, diaries, and papers for I sensed that the original wording contributed more to the story than my rephrasing and interpretation. Besides, I thoroughly enjoyed reading the way it was written reflecting much about the person. In all quotes, I have kept the original spelling and grammar including errors.

Considerable time was spent finding and selecting photos that have not been widely published, and as no paragraph headings are used, the illustrations and photographs are meant to illuminate the text. All photos have been acknowledged; most photos were from the archives of the Department of Soil Science and from the Truog archives at the University of Wisconsin—Madison, the Truog family album, Steven Kellogg family album, Bruce Simonson, the Charles Kellogg archives at USDA, the Library of Congress, *International Society of Soil Science* Proceedings, Missouri State Archive, Senator Mark Miller, and the Smithsonian Institution Archives.

About the Author

Alfred likes soil, soil science, and people who study the soil. What is there not to like about all of that. He is professor of soil science at the University of Wisconsin—Madison. Alfred was trained in pedology and soil fertility, and has an MS degree from Wageningen, the Netherlands, and a PhD from The Reading University in the UK. Since 2011, he works at the University of Wisconsin—Madison, where he teaches Pedology, and Earth's Soil, and his research focuses on novel ways to explore the soil profile, and the management of soil carbon in natural and agricultural ecosystems. Before his current position, he was for 12 years at ISRIC—World Soil Information in the Netherlands and was responsible for the World Soil Museum and the GlobalSoilMap project. Between 1987 and 1999, he worked at research institutes and universities in Tanzania, Congo, Indonesia, Kenya, Papua New Guinea, and Australia. From 2001 to 2014, Alfred served as (Deputy) Secretary General of the *International Union of Soil Sciences*. He is the founding Editor-in-Chief of *Geoderma Regional* and the *World Soils Book series*.

His other books are *The Soils of Wisconsin* (2017) with Jim Bockheim, *The Soils of the USA* (2017) edited with Larry West and Mike Singer, *Digital Soil Morphometrics* (2016) edited with Budiman Minasny, *Soil Carbon* (2014) edited with Kevin McSweeney, *Digital Soil Mapping: Bridging Research, Production, and Environmental Application* (2010) edited with Janis Boettinger *et al*., 2010, *Profiel van de Nederlandse Bodemkunde* (2010) edited with Johan Bouma *et al*., *Soil Science* (2009) edited with Alex McBratney and Bob White, and *Digital Soil Mapping with Limited Data* (2008) edited with Alex McBratney and Lou Mendonca. Alfred edited *The Future of Soil Science* (2006) and wrote the books: *Invasion of Piper Aduncum in the Shifting Cultivation Systems of Papua New Guinea* (2006), *Soil Fertility Decline in the Tropics* (2003), and *Publishing in Soil Science* (2002).

Contents

1

Prologue—The Roots of Soil Science

"I propose to regard the soil as a creature sui generis, sustaining living bodies whilst it is itself sustained by them."

Robert Wood, 1850

This book meanders through progressions in soil science and the institutionalization of the discipline over the period 1860 to 1960. The story is narrated through the activities, ideas, publications, and correspondence of people who influenced those progressions, and how they formed national and international learned societies. As soil science is a global science with a broad and deep root system, this first chapter sets the scene for stories that unfold in the subsequent chapters. Two lines of soil studies will be reviewed here: the search for the soil matter that makes plants grow and the formation and genetics of soil. Eventually, these lines intersected and then paralleled in a direction that became the discipline of soil science.

As long as people have cultivated the earth, they have observed the growth and fruits of what they had planted. As nature showed them, they distinguished which plants grew well on different soils. Observation did not bring much understanding but was needed for mimicking nature so as to avoid failure in crops grown for sustenance. While experience became tradition, the world underfoot was essentially unknown to the early cultivators. Some tried to manipulate nature and mend the soil so that plants grew better and yielded more; they dug ditches so excess water drained away, plowed up dense layers, and ashes or limestone were fed to their crops. There was little comprehension, but it generated practical knowledge that was passed on from generation to generation. The world could have been left in those spheres for millennia, but it was not; people figured out the scientific method to advance knowledge and that, of itself, is possibly humanity's most successful discovery.

With the progress in chemistry, theories were developed on the origin of substances in plants. An idea which gained popularity was that plants fed upon substances that were similar to them, or in other words, plants grew

A. E. Hartemink, *Soil Science Americana*
https://doi.org/10.1007/978-3-030-71135-1_1

out of substances that originated from plants that had grown before them. Humus, or decomposed plant material, was regarded as the main nutrient for plants, and it was taken up by roots and then converted to new plant material [1]. This humus theory made sense when a few of the chemical elements in nature had been identified. How could plants take up substances that were not similar to them? With time, the idea of how plants were feeding from the soil altered drastically. At the same time, the soil was studied independently from geology and chemistry—studies focused on the soil, its origin, the elements it contained, and its relation to climate and vegetation. It was postulated that soils were deposited with the great flood; some were convinced that stones grew in the soil; others thought that soils were merely broken-down rocks mixed with dead and alive plant materials so that, if the geology of an area were known, one would know what kind of soil there would be.

Discoveries in these two areas—plant nutrition, and the origin of soil—occurred at more or less the same time, but they were made by different groups of people. One group was trained in agricultural chemistry, and the other group was mostly trained as geologists. It was a period of searching and discoveries, some more inadvertent than others. Theory was immature or lacking, myths perpetuated, and communication and exchange of ideas and findings were sparse to absent. Some soil investigators had university education related to chemistry, plant physiology, mineralogy, or geology, but others were travelers, naturalists, skilled amateurs, and keen observers. Most studies took place in isolation and researchers were not conversant with what others were doing. Such was the situation in the eighteenth and nineteenth centuries when there was no obstruction to establish and nurture an individual soil scientific universe.

The prime discoveries in plant nutrition and on the origins of soil were made in Europe and Russia. The USA was not on the scientific frontier in the nineteenth century but became a living laboratory where the theories and discoveries of soil research developed elsewhere could be tested and refined. The country had vast areas of unfamiliar soil and a limited research tradition, but it had a willingness to learn, to step out of its European shadow, and lead some of the major soil progressions. The long and winding road to understanding soil crossed vast areas of mysterious land where it sought answers to down-to-earth questions and discovered problems that were far from practical.

The New World was an unknown land for the European travelers, colonizers, and freedom seekers who set foot in the early 1600s, but it was not a new world, nor was it uninhabited. The Clovis people had arrived some 24,000 years earlier from Beringia [2], and millions of American Indians lived