KNOW SOIL KNOW LIFE

DAVID L. LINDBO, DEB A. KOZLOWSKI, AND CLAY ROBINSON, Editors
To all our introductory soil science professors.
You helped us see soil
as something other than dirt.

To all our students, past, present, and future,
who we hope will come to view soil with awe and fascination.

“Heaven is under our feet as well as over our heads.”
Henry David Thoreau
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You are about to begin a tour of an often overlooked part of our natural world—the soil. True, it does not have the immediate appeal of the cute, cuddly creatures that live in the forests or the power of a volcano or the vastness of space, yet soils have an inner beauty of their own. This book will expose you to the nature of soils and soil science. You will see that the stuff you probably call dirt (and please do not use that word again!) is just as complicated, interesting, and varied as any other part of our world. We have distilled a complex science down to about 200 pages. This writing is geared towards a young adult audience. High school students studying environmental science or participating in Envirothon or Science Olympiad will have an easily accessible resource. Undergraduate students in introductory ecology classes will have a manageable soils textbook. However, this book’s information is for all ages. See it as an appetizer, a teaser, or an advertisement for soils. Everyone from the young naturalist to the home gardener can find something of interest in these pages. This book is your gateway to soils, soil science, and the world you tread upon every day.

Studying soils makes you better able to understand the world around you; soil science is truly an applied science. You will see how an understanding of biology, chemistry, physics, and ecology will open your eyes to the complexity of the world underfoot. You will learn the language that soil scientists use to communicate with each other. You will see that soils are dynamic and constantly changing. When left alone soils are resilient, but as we use them for our own purposes they can be fragile. It is in our own best interest and the interest of our human civilization to preserve them. Soils are classified in ways to help us make wise land use decisions as our population grows. Soils feed the world and will continue to do so. They dictated the rise and fall of ancient civilizations; have figured in art from the classics to the post-modernist, in warfare, and in literature. But soils are more than that; they are the foundation of life as we know it on Earth.

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Soil Science Society of America (SSSA) wishes to acknowledge and thank the Bureau of Land Management for funding and support of the development of this publication as part of their outreach activities to increase public awareness of our soil resources and promote responsible practices that reduce impacts to natural resources resulting from use of public lands.

SSSA is an international scientific society that fosters the transfer of knowledge and practices to sustain global soils. SSSA is the professional home for 6,000+ members dedicated to advancing the field of soil science. It provides information about soils in relation to environmental quality, ecosystem sustainability, bioremediation, waste management and recycling, crop production, and wise land use. A common thread across the programs and services of SSSA is the dissemination and transfer of scientific knowledge to advance the profession.

SSSA is also focused on outreach to students, teachers, and the public to tell the story of soil and build greater awareness of the value of soil to life. Visit our outreach sites:

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www.soils4students.org
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WALE ADEWUNMI

J. Adewale Adewunmi is an Environmental Soil Scientist who does soil business in a non-traditional soil environment at a large regional wastewater facility in New Jersey. He manages land-application of enormous quantities of biosolids, conducts research and development associated with water quality issues and biosolids. Not knowing all the alternatives out there, he had hoped to work in soil science research and teaching, but stumbled into an attractive opportunity to solve real problems in this industry. Though he works among engineers, he brings the scientific method to solving process questions and address critical water quality issues. Since soil is fragile and has a limit to which it can be stretched before being contaminated, he learns how to balance industry needs with what nature can cope with in a scientifically sound and defensible manner.

Growing up, he has always thought of soil as “dirt,” something for agriculture, until his first class in Soil Science where he heard terms like, soil temperature, soil pH, soil water, acidity and liming, etc. He was shocked to hear real science terms used together with soil, so he decided to find out more and follow wherever it led. He is always fascinated with fresh road cuts and deep construction sites where he can observe soil deeper. Adewunmi got his degrees in Agronomy, Soil Science, and Environmental Chemistry from Lincoln University, University of Missouri-Columbia, and Rutgers, The State University of New Jersey, respectively. He is a member of the Soil Science Society of America, American Society of Agronomy, Water Environment Federation, New Jersey Water Environment Association, and the International Union of Soil Science.*

SUSAN CHAPMAN

Susan Chapman is the Director of Member Services for the Soil Science Society of America, where she is responsible for ensuring all of the members—from students to professionals—have the tools to help them build successful careers. As part of her job, she works with a great group of members on projects to help students and teachers learn more about the exciting world of soils and its importance to life on our planet.

Her career path working for associations for over 20 years, is not traditional, yet brought her to the Soil Science Society of America. She received her B.B.A. in Marketing and Management from the University of Wisconsin–Madison.

When not working with members, her favorite activities are triathlon (including Ironman), traveling, and reading a good book—like Know Soil, Know Life!*
JOHN HAVLIN

A career in soil science does not mean “farming.” John Havlin grew up in a large city—Chicago, Illinois. His interest in soils began while attending Illinois State University, where he was looking at career options for an undergraduate degree in chemistry. His undergraduate advisor suggested taking an introductory course in soils, and the rest is history. Following graduate degrees in agronomy (study of soil and plant sciences) at Colorado State University, he worked as a researcher and educator at the University of Nebraska, Kansas State University, and currently at North Carolina State University.

A career in soil science is fascinating and thoroughly enjoyable because you are working with one of the most complex systems on earth—soil. The activities you are involved in can be so diverse that you have no choice but to stay passionately engaged and stimulated to learn more. He has the opportunity to work with students at all levels, scientists from many disciplines, farmers, consultants, homeowners, and kids. During his career he has worked on numerous food and feed crops, including wheat, corn, soybeans, alfalfa, and many others. He has also worked with landscape plants, fruits, and vegetables, including grapes for making wine. Some days he is in a classroom teaching students, while other days he is working in the field or in a laboratory. He has traveled throughout the world working helping to protect and improve the soils ability to produce more food and to protect the quality of our water and air.

RICH HAYES

Rich Hayes is a licensed soil scientist who has been working professionally since 1985. He attended Davis and Elkins College and West Virginia University and has a B.S. degree. He is currently employed by the North Carolina Division of Water Quality Aquifer Protection Section, where he serves as a primary reviewer of soil reports and other related information associated with non-discharge permits.

Rich’s professional experience also includes 18 years of working on soil surveys in Northampton, Halifax, Anson, Chatham, and Wake Counties in North Carolina. On the job activities included soil mapping and classification, as well as the collecting of soil data. As a project leader in Chatham and Wake Counties, Rich had the opportunity to set up seven new soil series.

Rich has always had a deep interest in conserving and protecting our natural resources, and since 2006 he has served as a Supervisor for the Chatham Soil and Water Conservation District. As a supervisor he also serves as the Area 3 representative to the North Carolina Association of Soil and Water Conservation Districts State Education Committee and as the Vice Chair of that committee. In 2009 Rich was the President of the Soil Science Society of North Carolina and an ex-officio member of the North Carolina Board for Licensing of Soil Scientists.

Rich has long been interested in environmental education and for many years has been active as a volunteer with the North Carolina Envirothon, where he has assisted with both Regional and State contests. He has been writing the State Contest soil tests since 2003 and has coordinated both the soils stations and the oral presentation component of the contest for the last few years. Currently Rich is the Vice Chair of the State Committee. Rich is also the principal author of the North Carolina Envirothon high school soils study guide.
DEB KOZLOWSKI

Deb Kozlowski was born in an industrial city in Connecticut, but knew from an early age that her future would lie in working with the natural world. "I've always been attracted to both science and art, and I find it odd when people think that's unusual—to me they are universally connected."

It was while attending the University of New Hampshire to study Forestry that she became interested in Soil Science. "When I first learned that I was required to take a course in Soils I was dreading it. Fortunately, an excellent professor had no problem convincing us of the importance of the subject, and showing us how fascinating a field it could be. I worked in his lab for the remainder of my years at UNH, and when I decided to attend graduate school at the University of Massachusetts, it was in Soil Morphology that I received my M.S." She spent the early part of her career working for an environmental engineering firm in western Massachusetts.

She never lost sight of the artistic side of soils. "When we moved to North Carolina I became involved in tile making at a small arts center in eastern NC. There was a limitless supply of clay to dig!" Today she is the Art teacher at Woods Charter School for grades K-5. "Kids have no prejudice when it comes to combining science and art—the messier the better." She still dons her lab coat as a special guest lecturer on any soils topic—from the chemistry of clay to experimenting to learn which soils are best to sprout beans in a paper cup.

She divides her year between Massachusetts and North Carolina, where she lives with her husband and two sons on a small farm south of Chapel Hill. They share many interesting dinnertime conversations, which may not be appropriate for polite company. "We all know where our food comes from," she says, "and we all know where it ends up."

MANDY LIESCH

Mandy Liesch is a graduate student in soil physics at North Carolina State University. She is originally from Northern Wisconsin, and she loves cheese and the Packers. She took agricultural and science classes in high school because she wanted to be a veterinarian. She actually avoided taking soils and crop related classes because only farmers needed to know that stuff. It was easy, plant seed, give it food, and wait. Later in life, she learned that there was so much more to food production and soil health than she thought. Even though she liked science, she preferred playing basketball and track, the saxophone, and studying social studies and politics, including how agriculture is important around the world. This interest in people caused her to major in International Studies at the University of Wisconsin–River Falls, with an agricultural development emphasis. She didn't even know that soils existed, but it was required in the curriculum. She fell in love with soils because of a charismatic soil science professor. She decided to minor in soils and went on to study soils during her Master’s degree at Kansas State University.

Mandy loves teaching soils, especially to college students and to youth, and has worked with the local Girl Scout Councils developing environmental and soil science programs since her freshman year of college. These include camp gardens, a greenhouse made out of pop bottles, and various soil arts and craft projects. Soils are the coolest material on the planet, and she sets out to make sure that everyone knows that soils are responsible for the food that she loves. Mandy uses soils as an excuse to travel around the world and has been to four continents, tasting the different foods and observing how soils are unique. Mandy really loves incorporating soils into her jewelry designs, and using soils, especially clays to create paints and natural dyes. She also loves making cheese, kayaking, rock climbing, and doing dog agility with her lab mix, Clark.
DAVID LINDBO

Dave Lindbo is a professor of environmental soil science in the Department of Soil Science, North Carolina State University and lives in a log cabin near the Haw River with his wife (an artist and soil scientist) and two sons. He grew up near Boston, MA and was blessed with parents and grandparents who still had a strong connection to the land. His first real experience with soils (other than mud pies and excavating with a Tonka truck) was in elementary school when he began working with his grandfather in his extensive vegetable garden. “My grandfather wanted his grandchildren to understand where food came from and more importantly how to grow it without hurting the environment.”

This connection to the land led him to majoring in environmental conservation and geology at the University of New Hampshire, where his interest in soil was rekindled by the unique teaching style of Dr. Nobel K. Peterson that made soils fun, engaging, and informative. “He showed students that life as we know it could not exist without soil, since our food comes from the soil as well as the materials for our homes, the fiber for our clothes, and a host of other products.” He continued his studies earning an M.S. degrees in Soil Science (UNH) and Geology (UMass) and a Ph.D. in Soil Science (UMass).

His professional career has included work in water quality, research with USDA-ARS in Mississippi, teaching at UMass and for Mass DEP, and his current position at NCSU. “I feel I can continue to spread the word about how critical soils are to our everyday life.” Part of his job is teaching K-12 and Envirothon students (including his sons) and teachers about the importance of soils—while having fun—whenever possible. “If you dig a soil pit for someone they may be dirty for a day, but teach them to dig and they’ll be filthy and fulfilled for life. Getting dirty is the best part of my job.”

TOM LOYNACHAN

Tom Loynachan (pronounced “law-na-cun”) is a professor of soil microbiology at Iowa State University. He grew up on a farm in south-central Iowa and had his hands in the good soils of Iowa early in life. In high school, Loynachan learned that Iowa soils are some of the finest in the world, and this made a lasting impression on him. At about the same time in high school, a gifted teacher stimulated his interests in biology. Early in college, Loynachan discovered that he enjoyed teaching and working with students. After graduating with his B.S. degree, Loynachan taught vocational agriculture at Grinnell, Iowa. Shortly thereafter, he was drafted into the army. After an honorable discharge, Loynachan continued his education earning M.S. (Iowa State University) and Ph.D. (North Carolina State University) degrees in Soil Science.

Loynachan finds life in the soil fascinating and enjoys sharing his excitement with others. He routinely visits high schools and discusses “life in the soil,” and he teaches a college senior-level laboratory on soil biology. Also, Loynachan has created short movies that describe the various groups of organisms in soil and what they do. He feels one trait of an effective teacher is to pass the excitement of the subject on to his students. Loynachan emphasizes that much of life in the soil is still unknown, and there are great opportunities for future discoveries by the next generation. Loynachan hopes that some of his enthusiasm for the living component of soils will stimulate a future scientist, or perhaps provide others who are not destined to become scientists, with an appreciation for the complexity and diversity of the living soil. Loynachan believes that soils are unmistakably one of the world’s greatest natural resources, and they must be maintained for all future generations.
DOUG MALO

Doug Malo is a Distinguished Professor of Pedology in the Plant Science Department at South Dakota State University, where he has been teaching and doing research for 36 years. He grew up on a small family farm in south-central Minnesota. While living on the farm, he learned to appreciate the role of soil health in maintaining soil productivity. On the farm they raised corn, soybeans, alfalfa, peas, sweet corn, and oats, along with beef cattle, chickens, and pigs. While working on his B.S. degree in agronomy and plant pathology, his interest in soils grew when he became involved in the Iowa State University soil judging team. Upon graduation, Doug decided to further his education and attended North Dakota State University, where he earned his M.S. and Ph.D. in soil genesis and classification.

His passion is to teach soils to inquisitive minds. One of his mottos is: “Students do not interrupt my work, they are my work.” After almost four decades of soil genesis research and teaching soils classes, he still has enthusiasm for the subject matter, but his real joy in teaching is coaching the SDSU soil judging team. Students from many different majors have been members of his teams and have become successful professionals in many agricultural and natural resource fields. The goal in soil judging is to instill the love of learning about soil, so that his students become better stewards of our soil resources and to protect those resources for future generations.

BIANCA MOEBIUS-CLUNE

Bianca Moebius-Clune is an Extension Associate in the Department of Crop and Soil Sciences at Cornell University. She grew up in Germany, surrounded by farms, and learned to grow fruits and vegetables in her backyard early in life. When she moved to Durham, NH with her family, she first found out how beautiful soils can be while digging holes in the forest, discovering amazing horizons of black, white and red soils! (It was much later she realized that she had happened upon a Spodosol!) Bianca always enjoyed outdoor activities, particularly playing with soil and plants. She developed a passion for the environment throughout her years in school, but didn’t discover soil science until she started college.

While working on her B.S. in soil science at the University of New Hampshire, she studied abroad in Madagascar for six very influential months. The people she lived with in small Malagasy farming villages grew all their own food—those who had damaged their soils more often went hungry, those who managed them well had plenty of food and could afford to send their children to good schools. She recognized just how much we all depend on our soils—for food, clean air, clean water, clothing, housing, recreation. She often likes to challenge students to discover how everything in our life is directly or indirectly linked back to soil. Inspired, Bianca went on to Cornell University to earn an M.S. and Ph.D. in soil science. She did much of her work on developing the Cornell Soil Health Test in the northeastern United States, but also got to travel to Kenya. These days her position allows her to do many of the things she loves: teaching students and farmers about sustainable soil management, traveling, researching ways we can manage our soils better, and she is still digging holes in soil, too. She notes that soil science is not only fun, but it opens many doors to opportunities for making the world a better place.
CLAY ROBINSON

Clay Robinson has been a professor of soil science and is now a consultant, always striving to help people be better stewards of their soil and the environment. He grew up in a small Texas Panhandle town, helping his dad work in a small vegetable garden and making compost to enrich the soil. Clay is a great name for a soil scientist, although it had drawbacks—his uncles called him “Mud.” He started college as a computer science major, but realized he needed a job where he could be outside. Five majors later, he finished with a B.S. in agriculture, followed by an M.S. in plant science from West Texas State University, and finishing with a Ph.D. in Soil Science from Iowa State University.

He has a passion for sharing knowledge, which led him to be a college professor, and later to become “Dr. Dirt,” taking a message to kids about the importance of taking care of the limited soil so that everyone does not end up hungry, naked, and homeless.

Clay enjoys acting, singing, playing the guitar, cycling, hiking, and photographing landscapes, sunrises, and sunsets. He even uses soil as a natural pigment to paint landscapes.

MELANIE SZULCZEWSKI

Melanie Szulczewski grew up in a city and understands that most people do not give much thought to the soil—she was one of those people! She believes, however, that once someone starts to reflect on all that soils do for us, even in the city, they will develop an incredible appreciation for soil science. Szulczewski majored in chemistry and French literature at Cornell University. Shortly before graduation, she realized that she wanted to get out of the laboratory and apply chemical concepts to the world outside. She discovered the field of soil science by accident and fell in love with the amazing world beneath our feet. She earned master’s and doctorate degrees in soil science at the University of Wisconsin–Madison, specializing in soil chemistry and degraded environments. Since then Szulczewski has worked on projects in the Everglades, sub-Saharan Africa, and the Chesapeake Bay watershed. She is currently an assistant professor of environmental science at the University of Mary Washington in Fredericksburg, VA.

As an environmental scientist, Szulczewski believes it is important to see the connections between all the diverse disciplines required to create a sustainable, healthy world. The state and treatment of our soil affects many different environmental problems: food production, pollution issues, and biodiversity, just to name a few. She believes learning more about the soil will create more knowledgeable citizens no matter what their career paths may be.
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