
Book Review

Understanding Soil Change—Soil Sustainability over Millennia, Centuries, and Decades

Daniel D. Richter, Jr. and Daniel Markewitz. 2001. Cambridge University Press, Cambridge, UK, 255 pages, \$70.00. ISBN 0-521-77171-4.

Soils have been used for agricultural and engineering purposes for nearly 10,000 years, and demands on soils continue to rise worldwide. Yet we have only elementary understanding about the impact of management actions on soils over time. This book provides readers with a new perspective of soil ecosystems by introducing the science of estimating soil change. Although long-term changes or soil development are rather well understood, short- and medium-term changes have been given less attention. Methods to estimate soil change over time scale of decades and millennia are described, with examples from long-term soil-ecosystem experiments conducted at varying sites in countries including Australia, Denmark, Germany, India, Peru, United Kingdom, and the United States.

Part I of the book deals with soil and sustainability. The authors highlight the importance of understanding biochemical soil change with time, so that we are better able to predict and manage soil and ecosystem change for a world that may soon be supporting 10 billion people. More than half of the world's 13 billion ha of soils are being

affected by human activities, and large proportion of these soils have been degraded. Although we have rapidly increased crop production by using fertilizers and other management techniques over the past decades, the concept of environmental quality soil has only gradually emerged.

Part II deals with soil change over time scale of millennia. Here, the authors draw attention to soils formed during Devonian time, which are now fossilized. They describe soils of southeastern North America and examine the advance weathering stage of the Calhoun ecosystem, which possesses soils formed on granitic-gneiss bedrock, supports hardwood forest, and that has not been cultivated or fertilized. The formation of Ultisols in a chronosequence is discussed in a detailed manner in terms of forest influence on weathering of minerals. Over time, these forest soils become acidified and depleted in primary minerals.

In Part III soil change is examined over the time scale of centuries. This part examines how agriculture has affected the soil environment and will continue to affect it, with examples from conversion of primary forests to maize cultivation in the last three centuries. Key processes of the maize systems that influenced the soil were inherent soil fertility, periodic sediment deposition, symbiotic N₂ fixation, mineral weathering, and likely periodic summer fallows. Generalized data on organic matter loss and nutrient losses are quite interesting. The authors are correct when they say that failure to recognize the extent of changes by agriculture could lead to soil degradation and deterioration of the soil quality.

Part IV discusses soil changes over time scale of decades, using examples of conversion of agricultural field to secondary forest. The objectives of this part were to describe how four decades

of forest growth have altered soil chemistry, and use these data to evaluate soil and ecosystem processes involving the cycling of chemical elements including carbon, nitrogen, phosphorous, potassium, calcium, and magnesium. In this part the authors special interests are temporal changes that occur in acidic soil with advanced weathering stage, such as those that dominate southern North America. Building on the work of earlier scientists, the authors examine soil change in South Carolina (Calhoun soils) on short (decade), medium (centuries), and long (millennia) terms. This synthesis on soil changes in southern North America is applicable to large areas in tropic parts of the world, where acid soils often exhibit poor chemistry, such as aluminum toxicity, and low fertility and are often considered to be marginal for agriculture.

The authors conclude by drawing attention to the necessity of long-term soil and ecological studies. With their book they issue a challenge to soil scientists and ecologists interested in soil resources to improve sustainable management of soils worldwide. The book is clearly written, short, and easy to follow. Scientists interested in long-term soil-ecosystem experiments should benefit from using information in this book for their experimental studies. This book should be useful not only to scientists and graduate students interested in soil ecology, but also to members of the general public interested in sustainable use of land resources. It is a worthy addition to any private or library collection.

Ahmet R. Mermut, *Pedologist,*
University of Saskatchewan,
Department of Soil Science,
Saskatoon, SK. S7N 5A8, Canada