the main lines of soil mechanics research going on in Great Britain and is not a concise exposition of soil stress-strain relations. Only two of the 30 contributions are directed to time-dependent effects, a rather surprising fact particularly in view of a discussion remark (C. P. Wroth) that there is much creep work in progress in Britain and that acknowledgement by at least one of the writer than the omission of time-dependent effects may be one of the main deficiencies of the critical state theory.

The book is profusely illustrated with clearly marked figures and good photographs. A uniform stress unit, kN/m² (= 0.01 bar) is used throughout. The discursive and following the contributions papers include quite formal presentations, in some cases a single participant's remarks will comprise several pages of text, figures, and data. There is a vast amount of material in this volume and a subject index would add much to its accessibility. This book will be valuable to people in soil mechanics research who already have a good grasp of standard texts, but is not recommended as a basic reference on the subject.—L. J. WALDRON, Associate Professor of Soil Physics, Dept. of Soils & Plant Nutrition, University of California, Berkeley, Calif.

Hillslope Form and Process


Geomorphology can provide information and understanding to soil genesis about (i) the nature and origin of parent materials and (ii) the change of soil surfaces. It contributes strongly to (i) but very little to (ii). The treatment is theoretical, general, and quantitative. Specific examples are presented but there is no systematic treatment of any specific time or place. Since reading the book, I have looked at slopes with new interest and perspective and greater understanding. However, almost all real hillslopes seem to be the result of multiple cycles of development and therefore are more complicated than the models presented in the book.

There are two chapters in the Introduction. Part 1, Force and Resistance, has a chapter on the forces of gravity, surface tension, water flow, rainfall impact, expansion, and diffusion, and a chapter primarily on shear strength of rock and soil masses. The first chapter of part 2, Process: The Interaction of Force and Resistance, makes distinctions among mass movements, particle movements, and movement in solution, and between weathering-limited and transport-limited processes. It also presents “continuity equations” for hillslope lowering and ultimate hillslope former. Other chapters deal with mass movements in rock and soil masses, surface water erosion, “subsurface water erosion,” and soil creep. In part 3, Form: Comparison of Real Forms with Process-Response Models, there are chapters on hillslope forms in humid temperature climates and a chapter on arid environments. Part 4, Synthesis, has a summary chapter on slope profiles and a chapter which attempts to relate slope profiles to three dimensional landscapes in drainage basins.

Some of the major concepts can be summarized as follows: Hillslopes are cut primarily by various kinds of mass movements until they are reduced to a stable angle. The stable angle depends on the kind of material and on the water pressure in pores. Therefore, there is commonly a progression of different stable angles as the rock weathers. Once reduced to the ultimate stable slope (for clayey soil with saturated pores), processes other than mass movement become important. In terms of slope profile, the main slope of one or more straight segments, produced by various kinds of mass movements, is modified by an upslope convexity and a basin concavity. The upper convexity is produced by rain drop splash in arid regions where vegetative cover is sparse and soils are seldom moist and by soil creep in humid areas where the cover is complete and moisture is ample. The basin concavity results from surface wash.

The authors present talus as synonymous with scree but use it, as well as talusum and colluvium, as a particle-size term rather than a term that denotes genesis by movement on slopes. According to the usage in the book, colluvium is material produced by “soil-size particles,” talus is a mantle of coarser rock fragments, and talusum is a mixture of the two. The common weathering sequence for many kinds of rock is taken to be from rock to talus to colluvium to colluvial soil. Evidence suggests that talusum has greater shear strength than talus but talusum tends to stand at lower angles because voids are small enough for pore pressure to develop. Likewise, there is evidence that talusum is stronger than colluvium, that is, coarse fragments contribute shear strength to a soil material. (Do steep soils tend to be stony because nonstony materials are less stable?) For clastic rocks, the common observation that chemical weathering tends to reduce the bulk density rather than the volume failure to support the emphasis in the book on subsurface chemical removal as an important process in the reduction of hillslopes.

The book is attractive, with clear printing, many useful figures (none of which are photographs), an extensive bibliography, and a helpful index. The only error I found was the arrangement of text on pages 344 and 345.

The preface lists the primary responsibility for individual chapters. I found Professor Carson’s chapters to be more accessible and helpful. The authors state that they aimed to do for hillslopes what Leopold, Wolman, and Miller did for stream channels. A geomorphologist rather than a soil scientist should judge to what extent this goal has been accomplished. They did certainly integrate a great deal of soil and rock mechanics and hydraulics and a lesser amount of pedology into geomorphology in a way useful to soil scientists.—E. G. KNOX, Department of Soil Science, Oregon State University, Corvallis.

Advanced Soil Physics


The authors have successfully achieved their stated objective, namely “---to introduce the student to the mathematics of soil physics.” The book is devoted almost totally to the development of mathematical techniques. A more descriptive title would be “Mathematics of Soil Physics.” Step by step, in great detail, the solutions of various soil physical problems are derived. Equations are repeated frequently to facilitate continuity of thought during derivations. Although the number of illustrative problems is, of course, limited, the authors have selected the most instructive ones, and have shown how their mathematical techniques can be applied to other conditions.

The book covers the mathematics of static water, saturated flow, unsaturated flow, miscible displacement, gaseous diffusion, and heat flow. Specific mathematical techniques include Fourier series, Bessel functions, numerical methods, conformal mapping, the Schwarz-Christoffel transformation, and the Boltzmann transformation. The chapters on saturated flow are well written and lucidly illustrate a topic that has been the forte of the senior author. In the chapters on unsaturated flow, two sections are devoted to a detailed derivation of the equations developed by J. R. Philip to describe horizontal and vertical infiltration. The chapters on gaseous diffusion and soil temperature are weak. The authors relied almost exclusively on older work, much of which has been overshadowed by more recent contributions. For example, the definitive work of J. A. Currie on gaseous diffusion was unfortunately omitted.

Generally, the literature citations are ample and should enable the reader to pursue specific subjects in depth. A problem set and a list of symbols are given at the end of each chapter. Seven appendices with mathematical derivations and proofs and a table of expressions for approximating a function are included. There are a number of typographical errors throughout the book.

This book should be a valuable text for graduate students and others who wish a self-study guide. It goes far beyond Baver’s classical Soil Physics in the use of mathematics. On the other hand, the authors do not attempt to present or summarize the recent advances in experimental soil physics.—R. D. JACKSON and B. A. KIMBALL, Research Physicist and Soil Scientist, US Water Conservation Lab., Soil, Water, and Air Sciences, Western Region, ARS, USDA, 4331 E. Broadway, Phoenix, Arizona 85040.