Book reviews


Writing a textbook is like building a bridge over which users can pass from where they are to where you think they should be. Authors consider carefully the knowledge with which their readers should be supplied. Seldom do they take as much trouble to look at where the intended readers are actually standing. I well remember the late Dr E.C. Childs delivering a dissertation on the mathematics of electrical conductivity analogues of water movement in soil to an audience of probationer colonial agricultural officers, and the alacrity with which those probationers betook themselves and their bemused minds to the nearest bar at the end.

Essential Soil Science is a deliberate, and generally successful, attempt to stand alongside such non-mathematical students. The text is good: most of the analogies and simplifications are legitimate and helpful. It is a little uneven: a few topics, such as surface charge, are covered in surprising depth. Simplification is always easier in subjects remote from one’s own specialism.

The scope of the book is comprehensive. Soil formation, soil architecture, surface chemistry and microbiology are all well described. There are brief summaries of the US Department of Agriculture’s and FAO’s classifications and of the classification used in England and Wales. The authors seem to assume that soil surveys will be detailed grid surveys; there is hardly anything about the more widely used reconnaissance surveys based on remote sensing. Land evaluation is covered, followed by a substantial chapter on soils and agriculture. The discussion of general topics such as cultivation and drainage, with their emphasis on the mouldboard plough and mole drainage, presupposes a primary interest in British agriculture, and this extends even to the section on irrigation. Soil contamination is covered in some detail, but the section on soil erosion is thin, again with an inappropriate emphasis on conditions in England.

There are some excellent clear and imaginative diagrams. But the few photographs, all in black and white, are calamities: a pitiful picture of so-called terraces in the Peak District of England on a dismal day, and two photographs of bottled soil samples on shelves! Yet for key topics that cry out for photographs as well as diagrams, such as soil structure and soil profiles, there is nothing. Surely four pages of colour photographs could have been allowed. But even really crisp, carefully selected monochromes showing different types of structure and a few profiles, e.g. Rendzina, Podzol, Andosol, Vertisol, where colour is not essential, would have helped. The five pages on soil drainage contain no cross-reference to gleying, and the opportunity to show gley motting in colour on the cover of the book was missed.

The book is said to be aimed at students of geography, ecology and environmental science, yet the thrust is essentially agricultural, and the examples are mainly British. Soil science is worldwide, as is the need for accessibly worded textbooks in English.

Students will appreciate the topic summaries. They will also be pleased that most of the ‘Further reading’ refers to Internet Web sites, so much quicker and easier to access than inter-library loans. Students will certainly spend time with them, so the list should have been more selective and the items more fully described.

When you read the text you will find that Essential Soil Science is readily understood and often lively, with a few splendid nuggets, such as the description of soil pollution under the Millennium Dome. Those of you who teach elementary courses in soil science should find this to be a very suitable text.

C. P. Burnham


The editors have brought together a wide range of mineralogists from academia, industry and research institutes – mainly in North America – who, between them, contribute 28 chapters, mostly 30 to 40 pages long. There are opening chapters on soil mineralogy as a discipline, surface chemistry, interactions between minerals and organic matter, mineral equilibria in soil systems, and methods for determining mineralogy and ‘environmental availability’. The last is actually very sketchy indeed, being no more than a page on selective dissolution and kinetic studies. Then follow chapters on all the main clay mineral groups, plus carbonates and evaporites, sulphides and sulphates, aluminium hydroxides, the allophone family, iron oxides, manganese oxides, silica minerals, phosphates, titanium and zirconium minerals, the geographic distribution of minerals in soils (almost entirely within the USA), and mineralogy and soil tectonics. The last is an interesting excursion into features such as tonguing, pressure faces and slickensides, and how investigators can use these features to determine the sequence of events in soils (pedochronology).
There is a chapter on radionuclide contamination of soils and how minerals might deal with this, although I was left thinking that the answer was ‘not much’ in a direct way – the text is mostly concerned with classical remediation such as leaching, electrokinetic methods, vitrification, etc., etc. The book finishes with chapters on reactions between pesticides and minerals, enzyme-clay interactions, and, unusually, charcoal. Each chapter comes with a comprehensive list of references, a set of questions and exercises (but no answers) and, in many cases, a valuable glossary. (As in most books published by the Soil Science Society of America, there is at the beginning also a comprehensive table for converting SI into non-SI units and vice versa.)

This is a very substantial work in many ways; I suspect our forebears would have called it a *valet mecum* (and had servants to carry it around for them). It is a book for consulting about mineral properties and for references to take one deeper into the subject. That might be seen as the disadvantage of the book – it is close to the point at which it will become unmanageable in size, and some topics are treated rather thinly (as above). However, the very considerable advantage is the quality and extent of the tables, diagrams and figures. Many of the latter are wonderfully produced and printed in full colour to represent the mineral structures and how things interact with them. This is exactly the kind of presentation that newcomers, students, and practitioners of soil science need either to grab their attention, to get them seriously interested in knowing more, or to give them a quick refresher of what they had learned earlier in life. They also make it so much easier to understand why minerals behave the way they do. Subjects such as mineral equilibria, solubility products, redox potential and similar basic physico-chemical concepts are addressed head-on in a mineralogical context; so readers would need to have studied science at high school to get full value from this book. One might ask what anyone without that background is doing practising in this subject, but that is another question. The book is well-printed, the black-and-white illustrations are of a high standard, and the book is well-bound between cloth covers. At the price quoted, it is a bargain and should be on the shelf of everyone interested in soil science (even better it should be on a CD for every soil scientist’s laptop).

P. LOVELAND


Africa’s population is growing faster than its ability to produce food, partly because the soil, never well-endowed, is being depleted of nutrients, and yields per hectare are declining. In some sense managing plant nutrition in Africa is no different from managing it elsewhere. The principles are well understood, we know fairly accurately the nutritional requirements of the main crops, and we know that the soil must provide these. Many thousands of experiments carried out over a century and a half have given response curves to fertilizer on particular types of soil, and we have standard laboratory methods for assessing the nutrient status of soil. As R. Duda points out in the opening chapter of this book, farmers have put that knowledge into practice by applying mineral fertilizers, first in Europe in the 19th century, then in the USA from the 1930s, from the 1950s in Latin America, and in Asia with the ‘Green Revolution’ from the 1960s onwards.

What makes tropical Africa different from the rest of the world is its economic and social environment. Subsistence cultivators, almost by definition, cannot afford fertilizer; they only incidentally have surplus produce to sell. Yet unless they maintain the soil’s fertility they are doomed. Most African farmers producing staple food crops are in no better position because, at current prices at the farm, fertilizers cost more than the cash value of the increased yields they would realize. It is against this background that scientists of national governments and the international agencies are seeking ways of halting the depletion and making the most of the existing nutrients within the current economic framework. Some 130 of those scientists met in Cotonou (Benin) in October 2000 to describe their research and exchange views, and this book is an account of their proceedings.

The book contains 24 chapters. It reviews the scene; it embraces a history of soil fertility in tropical Africa, it emphasizes the need to replace lost nutrients, and it describes how to involve the farmers themselves in the research. Many of the contributions tell of research on specific crops and cropping systems; other describe with optimism the implementation of the outcomes on farms.

Two themes recur at conferences on the fertility of African soil. One is the desirability of maintaining or, better, increasing the amounts of organic matter and nitrogen in the soil. Several chapters in this book report results from experiments and modelling showing small gains in organic matter and more timely release of nitrogen from manuring. Woody legumes in rotation with food crops have a role. They provide both nitrogen for the subsequent crops, which yield better than they otherwise would, and fuel wood, and they sequester carbon in the soil. Eventually, however, the editors conclude that (i) only massive additions of organic manures could make significant differences, and there is just not enough manure to treat more than a tiny fraction of the cultivated land, and (ii) the widespread benefit of agroforestry in restoring the organic carbon in the soil is something of a fantasy.

The second theme is the almost ubiquitous deficiency of phosphorus. This is attributed to (i) ancient soil and (ii) the steady offtake of the nutrient in crops without its replenishment over many years. Soil scientists, agronomists and plant
breeders battle to squeeze the last few milligrams of phosphorus from the soil in painstaking experiments; then, despite a modicum of success, they conclude with more or less candour that without fertilizer their efforts are of little avail in the long term. The editors of this book urge those responsible for research on soil fertility, and in particular donor governments, to think strategically. Adding phosphorus needs to be part of that strategy, and all that I read makes me wonder whether the cheapest remedy to counter the deficiency would be to spread rock phosphate as a large blanket dressing from the air!

Managing soil fertility in Africa is no longer mainly a scientific or technical problem; scientists and many farmers know what to do technically, and this book provides examples. Rather the problems are economic, social, and political. It is time that governments and the international agencies faced up to this reality.

R. Webster


For much of its history research on soil has been compartmentalized into soil chemistry, soil physics, soil mineralogy, and soil biology. The results have been impressive, and we have learned a great deal about the soil’s constitution and physical behaviour. In recent years, however, we have come to realize that the soil functions as an ecosystem in which microorganisms live in intimate association with the organic and mineral components of the soil. Readers of this Journal and others will have seen numerous papers on where, at the microscopic scale, the organic matter resides, with which mineral particles it is associated, what the microorganisms are doing, and how they respond to changes in their substrate and environment. The research has been driven both by disinterested enquiry and by the need to maintain a porous soil structure, to control the fates of pesticides and pollutants, to foster bioremediation, and to minimize the release of greenhouse gases. This book, commissioned by the International Union of Pure and Applied Chemistry (IUPAC) and written by acknowledged authorities, tells us where it has reached.

The book comprises 12 chapters, arranged into two main parts. The first part (of six chapters) deals with the ‘Fundamentals’ of the interactions between soil particles and microorganisms and begins with an overview by C. Chen and G. Stotzky. A chapter follows on recent attempts to describe the interactions in terms of fractals. In a substantial Chapter 3 J.A. Baldock reviews the roles of organic materials and microorganisms in stabilizing soil structure. The various components of the organic matter act at different scales; in all cases the organic materials must bridge failure zones within the soil matrix. Also, all of them decompose with time, and there must be continuous replenishment, largely from plants growing in the soil, to maintain or, better, enhance the stability of the soil’s structure. Chapter 4 describes how organic substances act in the formation and transformation of iron and aluminium oxides in the soil. Chapter 5, by E. Kurek, deals with the microbial mobilization of metals from minerals in aerobic conditions. The oxidation of pyrites in mine waste and the strong and rapid acidification that results when gleys containing sulphide are drained are well known. This chapter introduces us to a host of microbes at work and how some of them can be harnessed in the amelioration of mine drainage water and even in the recovery of metals, including copper, uranium and gold, from their sulphide ores. The theme is generalized further in the following chapter, ‘Interactions of bacteria and environmental metals, fine-grained mineral development, and bioremediation strategies’.

The second part is entitled ‘Impact of Soil Particle–Microorganism Interactions on the Terrestrial Environment’. Its first two chapters, however, look to me like a continuation of the fundamentals of part I. Chapter 7, by G. Guggenberger & K.M. Haider, describes the biogeochemical cycling of carbon, nitrogen, phosphorus and sulphur in the soil and how the mineral colloids affect it. It is followed by an account by J. Dec and others of microbial attack on xenobiotics, mainly herbicides and pesticides, in the soil and the transformation of them into less toxic substances. Chapters 9 and 10 deal specifically with the rhizosphere. There root exudates and microbial activity can be 10 to 100 times that in the soil generally, and changes in pH and redox conditions are substantial. In Chapter 9 P.M. Huang & J.J. Germida describe the physico-chemical behaviour of potentially toxic metals, especially pollutants, in this environment and the uptake, transport and remobilization of the metals by bacteria and fungi. Chapter 10 on the interactions with organic pollutants is a slender contribution. H.L. Erblich deals with the interactions between microbes and minerals in anaerobic conditions in Chapter 11. He lists organisms and enzymatic reactions that occur only or dominantly in such conditions and the consequences in terms of solubilization of metals and the formation of new minerals. The final chapter is on the transport of contaminants facilitated by mineral colloids in saturated porous media. The subject is undoubtedly important, and the material is well presented, but I could not see from the text what role microorganisms played.

In summary, this book contains accounts of current understanding based on critical appraisals and comprehensive reviews of research mainly in the last 15 years. It is well written and well documented. It is also expensive, but if you want to know where we stand now or what research to tackle in any of the branches covered then get it, read it, and follow up the references listed in it.

R. Webster

The editors have brought together a very wide range of pedologists, soil surveyors, chemists, biologists, agronomists and hydrologists to discuss this topic under four broad sections: ‘Fonds pédogéochimiques naturels’ (seven chapters), ‘Contamination en relation avec certains pratiques agricoles’ (five chapters), ‘Contaminations d’origine industrielle’ (twelve chapters), and ‘Phytodisposibilité et mobilité’ (eight chapters). There is also a Glossary, a listing of acronyms, a brief section on analytical methods (with cross-references to International (ISO) and French (AFNOR) standards) and a list of authors with contact details. There is no index. The book is, essentially, a collection of research papers, most of which are related to work carried out within France, with a few papers from Switzerland and the United Kingdom. Each paper is ‘stand-alone’, i.e. all the figures, tables and references are kept together. The papers themselves range from fairly straightforward accounts of the occurrence of a trace element in the soils of particular regions, through papers that examine the statistics of sampling and data presentation (geostatistics features in several of the papers), to those that concentrate on analytical techniques, especially in relation to extraction methods – single or sequential – and others that examine plant uptake. One paper discusses at length the effects of presenting the data on a mass or volumetric basis, something that is rarely considered in the literature. One important theme, that tends to form the ‘coda’ of the book, is that of distinguishing ‘background’ concentrations from ‘hotspots’, and the implications this has for so-called ‘limit’ or regulatory values and the inevitable links to ‘risk’ and ‘harm’. These are not trivial questions nor are the papers that discuss them. Indeed, one of the most interesting papers (by the Baize himself) discusses the whole question of soil ‘limit’ values and the difficulties associated with using the concept logically. Comparisons are also made between such practices within different countries. As we all know, it is all far from clear, and the impassioned plea for a more flexible approach that has proper consideration for other soil properties, e.g. pH, particle-size distribution, wetness, and organic carbon content, will accord with the views of many soil scientists. 

The book contains an enormous amount of information about the work done in France over the years on trace metallic elements in soil and that otherwise might remain largely inaccessible or unfamiliar to many scientists. The bibliography attached to each paper leads on and on…! The short concluding chapter attempts an almost impossible synthesis, but it makes points concerning the difficulties of finding common analytical methods and their quality control, the difficulty of interpreting the numbers when you have them, e.g. is this element ‘available’?, to what and under what conditions does it pose a risk?, to whom does it pose a risk?, and so on. Readers will sympathize. There are suggestions for the focusing of future research on, for example, soils as ‘accumulators’ of contaminants (which contaminants?, in which soils?, under what conditions?, for how long?, does the contamination last?, etc.), further investigation of what concentrations constitute contamination, limiting values, etc., what controls availability to plants and hence the relation to food quality, element speciation, and the assessment of risk to man, and, finally, rehabilitation of contaminated soils. As with so many INRA publications, the book represents enormous value for money, is absolutely packed with information, is well-produced and very well-printed indeed – the clarity of the line drawings and tables is to be envied. If you have any interest in this subject then it should be on a shelf near you. Reading it will also be good for your soul if you are tired of battling with the ambiguities of so much modern scientific English.

P. Loveland


There has been a large increase recently in the number of publications on arsenic in the environment. It has been spurred largely by the recognition of cases of seriously contaminated drinking water, as, for example, in Bangladesh, India and China, and by environmental degradation resulting from mining and other industrial activities. Revisions of national and international regulations for arsenic in drinking water have also led to increased interest and research, particularly across the USA and Europe.  

This new Environmental Chemistry of Arsenic provides a timely and scintillating account of recent research on arsenic in the environment. It is a collection of 16 chapters encompassing the fields of arsenic toxicity, analytical chemistry, biogeochemistry, microbiology, water treatment, and risk assessment, contributed by many internationally renowned scientists and edited by William T. Frankenberger. 

The chapters vary in scope from broad reviews of aspects of environmental chemistry, such as the chemical and microbiological processes involved in speciation and cycling of arsenic in waters and soils, through to the specific characterization of newly discovered arsenite-oxidizing bacteria isolated from mine wastes. Many of the chapters cover thoroughly the topics they concern and are comprehensively referenced. The authors are mostly North American, as are most of the case studies cited. There is little coverage of arsenic contamination elsewhere in the world. 

Arsenic has a long history in industry, agriculture, medicine and crime, and the opening chapter of the book provides a fascinating account of the use and abuse of arsenic throughout historical times. Analytical chemistry is covered in a
comprehensive and valuable review of the numerous methods currently available for the chemical analysis of arsenic and arsenic species, including both cheap and more expensive sophisticated technologies. The book covers the characterization of inorganic and organic arsenic species in diverse environmental and human samples. These include several newly identified organoarsenic compounds, particularly in marine samples. The chapters emphasize the varying toxicity of compounds present in the environment and that analysis of total arsenic alone in environmental samples is not necessarily adequate in defining risk from arsenic exposure. Risk assessment of arsenic-contaminated sites is dealt with in one of the chapters, which outlines methods for assessing the risk from ingestion of arsenic-contaminated soil as guidance for cleaning up sites. The limitations of the methods are also pointed out.

The important environmental controls on the mobilization of arsenic, particularly pH and redox conditions, and the presence of competing compounds such as silica and phosphate, are brought out in several chapters. The importance of arsenic sorption on, and desorption from, mineral surfaces, particularly metal oxides, is also stressed. Indeed, this has long been recognized and exploited in water treatment, and one of the chapters gives an informative and comprehensive account of the many current methods that make use of metal-oxide adsorption, ion exchange, and coagulation with microfiltration.

The importance of microbiological processes in arsenic speciation and mobilization has been appreciated increasingly in recent years, and much of the emphasis of the book is on microbiological aspects of arsenic research. Six chapters discuss microbiological processes specifically. It is now clear that microbes can be important catalysts in the oxidation of arsenite, reduction of arsenate, and methylation of arsenic species in the environment; some of the microbiological transformations release energy for other reactions and some detoxify materials containing arsenic. This is a newly developing field of research, and the identification of formerly unknown species of bacteria and new mechanisms of arsenic transformation makes an important contribution to our understanding of controls on arsenic cycling in the environment. Microbiological advances are also helping in the development of bioremediation strategies for arsenic-contaminated sites.

*Environmental Chemistry of Arsenic* is therefore a valuable new text for scientists interested in the fundamentals of the environmental chemistry of arsenic, particularly in relation to soil, hydrochemistry and microbiology. Those involved in applying the fundamentals in, for example, water treatment and site remediation will also find it very relevant. At US$175, it is not for everyone’s pocket, but it is an authoritative account of the current state of knowledge and development in many aspects of research in the environmental chemistry of arsenic.

P. Smedley


Developments in understanding the biology of organisms in soil have been rapid over the past decade or so. The role of soil in terrestrial ecology is now well recognized to the point where ecological theory is extended to and tested in the soil, and soil science is becoming increasingly embraced by many terrestrial ecologists. This book aims to draw together much of the understanding on the soil as a functioning ecological system that contributes to the operation of the larger ecosystem and to provide a contemporary synthesis of the subject.

As is probably essential for any book that aims to inform biologists about soil, this one has a section (Chapter I, of 142 pages) on the soil environment, which provides reliable information on what is in the soil. The section describes the underlying chemistry and biochemistry of materials, which although falling short of what you will find in more specialized texts on soil chemistry, biochemistry and microbiology, is more detailed than that in some other books on soil ecology. The coverage of how the components are organized and in particular the subsection on the heterogeneity of soil in space and time are, however, rather brief and do not give sufficient emphasis to the true challenges investigators face from the soil’s spatial and temporal heterogeneity in the field. In fairness, however, this theme is implicit in other parts of the book. The second section (Chapter II, of 57 pages) deals with soil formation and pedological principles. Again this is a fairly conventional coverage of the subject, but its presence in a soil ecology text provides far better underlying information than is normal in books on soil biology.

The section on soil organisms (Chapter III, 156 pages) reviews briefly the taxonomy of microorganisms and invertebrates in soils. In addition, and perhaps most importantly in this section, it discusses in detail the interaction between these organisms and plant roots. So often in soil biology books, the role of roots is confined to a single section on the rhizosphere giving the impression that many biological processes can be sustained in the absence of plants. To include plants as *bona fide* soil organisms sends the correct message and makes the information in the final section of the book follow logically. However, before considering the final section of the book, I must mention the absence of detailed discussion of the contemporary, often molecularly based, techniques for identifying organisms (particularly the bacteria), the composition and diversity of communities, and some activities that underpin many contemporary developments in soil biology. This omission contrasts sharply with many pages in Chapters I and II dedicated to introducing the underpinning abiotic aspects of the soil.

Undoubtedly, the final section (Chapter IV, of 172 pages) is the best part of the book. In this section, the authors discuss the functioning of the soil system with its foci on decomposition processes and nutrient cycling. It integrates much of the
material in the earlier sections drawing mainly on examples from natural and semi-natural ecosystems. This section of the book is an informed synthesis that will be of value to students of ecology and soil science, as well as offering something new to researchers looking to broaden their horizons. As far as I am aware, this is the first synthesis in recent times of research at the interface of agriculture and ecology which has arisen, as mentioned by M. Swift in the Foreword, from the need simultaneously to maintain agricultural productivity and conserve natural resources spurred by the sustainable development agenda.

The book is well referenced. There are more than 1000 individual references, most of which were published between 1980 and the mid-1990s. Those I checked were correct. Similarly, the extensive index (covering 33 pages) is accurate and useful.

The overall strengths of this book are the final innovative section and the presence in one book of the introductory material on soil components and organisms. I have highlighted a few shortcomings, but these are offset by the ecological synthesis at the end. Overall, the authors are to be congratulated on the detail, clarity and rigour with which they have presented the discussion of nutrient cycling through the soil and soil organisms. Unfortunately, I suspect the outrageous price will limit the sales.

D. W. Hopkins


The environmental movement has been quick to bring concerns to the attention of the public, and, to its credit, has been terrier-like in its persistence where it has scented hypocrisy. In some instances, however, the worries are unfounded, and sometimes new information means that we should regard environmental and health scares in a new light. It is my belief that concerns about nitrate in the environment have been overstated; this book shows that the alarmist views of nitrate and health are equally unfounded. Furthermore, since the environmental debates in the 1980s new information on the action of nitric oxide in the human body suggests that nitrate, far from being a problem, has a necessary function to perform in human physiology. Several texts have dealt with nitrate and farming, either as scientific texts, reviews or popularizations. *Nitrate and Man* is new in that it focuses on human health and explains just how nitrogenous chemicals can or do not harm us.

It seems that there is a history of the use of nitrate as a medicine, but given the preponderance of unpleasant substances that have been used medicinally over the years it is probably not wise for the nitrate apologist to dwell too long on this issue. Nonetheless, the inescapable conclusion from examining this history of the medical use of nitrate is that humans have been exposed to quite large (gram plus) doses of nitrate without any discernible ill effects whatever. The jury is perhaps out on whether there were any beneficial effects, but I found the summary of the historical use of nitrate in medicine interesting and amusing. The book contains a brief description of the nitrate cycle before going on to explore in detail the metabolism of nitrate in the human body and the amounts and reasons for nitrate’s being found in bodily fluids. A large part of the book presents what the authors call a critical examination of the case against nitrate, where they seem to take on the role of barristers acting on behalf of the defence. There follows more background in the form of nitrate regulation, particularly within the European Union, and, on the principle perhaps that attack is the best form of defence, a case is made for just how beneficial nitrate is. The book contains 70 pages or so of informative tables, appendices and references, including the sources of nitrate in food and the use of nitrate in medical therapies.

The tone of the book can seem a little inconsistent; the early chapters read easily and are accessible to the layman, whereas later chapters are more in the nature of scientific reviews. The main case for the acquittal of nitrate does not come across as neutral, and the tone borders at times on the hectoring. This inconsistent tone and surprisingly (coming as it does from a non-agriculturist) passionate defence of nitrate may spring from the same cause. The book has two authors, father (Jean) and son (Jean-Louis). The son has finished the book for publication, which presents his father’s life-cause. His passion differs from that of his father, but both are evident in the book. In places the book tries to convince rather than present the facts for the reader to make up his or her own mind. It is nonetheless a comprehensive summary of what (probably all) that is known about nitrate in human physiology. I learnt that infants have acidic stomachs and would be no more susceptible to methaemoglobinemia from the reduction of nitrate in their stomachs than adults were it not for their size (erratum to Addiscott *et al.,* 1991, needed). It is certainly a book to which I shall refer, and I expect that many of my colleagues will find it useful in teaching undergraduate modules in environmental and medical sciences.

A. P. Whitmore

Reference


‘Really there is seldom any necessity to use complex statistical methods to do world-class research in environmental and biological sciences.’ So writes John Townend in the Preface to
This book; and he continues, ‘Those who are able to identify the key, simple questions . . . are likely to enjoy the greatest success’. Happy thought; would that we were all blessed with such perspicacity! My second thought on reading those words, and arising from my experience as an editor, is that if environmental scientists properly understood even the simple statistics they would enjoy a great deal more success than they currently do. Reading on I discovered a matching sentiment: ‘The thing that separates competent scientists from incompetent ones, in terms of statistical skills, is . . . careful planning’ (the italics are the author’s). In other words, the statistics you need for an investigation must be there at its beginning, integrated in its design, and not tacked on afterwards when you sit down to analyse your data, only to find that you are involved in a rescue or, worse, conducting a post-mortem on a badly designed experiment or survey. This is the background against which the author sets out to educate his readers, mainly undergraduate students of environmental and biological science.

The book is divided into two parts. The first part deals with principles. After a short Introduction we encounter Chapter 2 entitled ‘A brief tutorial’. Here the author summarizes why we need statistics: plants, animals and the environment vary in almost every respect, we must know how to describe that variation quantitatively, and we want to be able to detect differences or change in their characteristics with confidence through the fog of uncertainty. Chapter 3 is entitled ‘Before you start’, in which the author expands on his remark about identifying the question and then urges the reader to think through the means by which he or she will answer it. Designing the investigation (Chapter 4), the planning, follows logically. With the survey or experiment completed and the data to hand, the investigator’s immediate, often only, wish is to test for significance and confirm his hypothesis. Townend warns against this. His Chapter 5 tells you to inspect your data first, graph them, screen them for mistakes, and compute standard errors. Then study their distributions, and if necessary transform them so that the assumptions required for your analysis are satisfied (Chapter 6).

The second part of the book is devoted largely to analysis and inferential tests. They include the t test and the F ratio (Chapter 7), the analysis of variance (Chapter 8), and correlation and regression (Chapter 9). These chapters will repay study by almost any soil scientist. The next two chapters on the more advanced multivariate analysis of variance and the analysis of repeated measurements, and Chapters 14 and 15 on principal component and cluster analysis, respectively, are in contrast rather sketchy. Sandwiched between them, however, is an account of chi-square and its use and an instructive Chapter 13 on non-parametric tests.

Five appendices complete the book. Appendix A gives worked examples of several of the analyses. Appendix C tells you how to use two computer packages, Excel and Minitab, in a Windows environment. You should realize, however, that though Excel and other spread-sheet programs have handy functions for describing and transforming data they are not intended for analysis; for that you should use a program such as Minitab, or Genstat or SAS which are also mentioned by the author, written for the purpose.

This no-nonsense approach to elementary statistics should get you or your students started. Its emphasis on understanding the problem and choosing the correct statistical solution is one that I endorse whole-heartedly. But bear in mind that the real world of the soil is far from simple, and we often need more complex methods to tease out answers to the questions it poses. Read Townend’s book by all means, and be prepared to move on to more advanced texts as the situation demands.

R. Webster


My first reaction on seeing this book was to ask myself why I should review a re-issue of papers about papers. Two of the articles simply chart the progress of soil science and of the journal Geoderma in particular. Another compares soil research in the tropics with that in the temperate regions. There is enough new stuff to digest without re-reading this. Then I remembered that Hartemink’s originals contained some nuggets of wisdom that are worth passing on, and so I have culled them for you, adding a little gloss. These appeared in the author’s series of articles for the Bulletin of the International Union of Soil Sciences.

Many of us know that impact factors are distorting what we do to satisfy the bean-counters. However, it was nice to see our Journal way ahead of the field in 1997 with a factor of 1.81, even though we have slipped somewhat since (second with a factor of 1.56 for 2001). What I liked best was that on average the shorter are the papers in a journal the larger is that journal’s impact. Perhaps it was to be expected; but Hartemink’s message is one writers would do well to remember – if you want to be read then keep it short!

The same article reinforced something else that many of us knew: society journals, such as this one, contain about three times as much information per unit price as commercial ones do. Institutional librarians and money-bags take note.

Fraud is a worry in some fields of research, but happily Hartemink found no evidence of it in soil science. What is worrying is that the editors of almost all the leading journals in soil science reported attempts at dual publishing, i.e. authors’ submitting virtually the same articles to more than one journal. The practice seems to be on the increase as scientists try to accumulate points for their currícula vitærum and now that it is so easy to reprocess texts in new formats. It might not be fraud, but it is certainly unethical and possibly illegal under copyright law. Most editors, once they uncover such attempts, reject the offending papers outright.
Several editors (myself included) see as unethical the appearance among the authors of the names of people who have contributed little or nothing to the work reported. Authors are the authorities for what is written, they carry the responsibility, and only those who have taken part in the research are in that position. Directing a laboratory, obtaining funds, and routine assistance do not confer scientific authority, and the people who do those jobs can be properly acknowledged at the ends of papers. Then there is the inclusion of names (usually of senior scientists and often without their knowing) on papers (usually by juniors) to add credence. This is both unethical and frequently embarrassing when papers are seriously criticized or rejected. Don’t do it!

Hartemink pursues the notion of ethics into citation and referencing. Credit others for their results or ideas on which you have built; ‘be generous’, he says. And in this he is supported by other editors, some of whom I suspect have their eyes on the impact ratings of their journals. I learned a few months ago of an editor who almost demanded that contributors cite recent papers in his journal, the impact factor of which has risen dramatically as a result! I am somewhat out of sympathy with Hartemink on this matter. Many of the papers I receive contain quite unnecessary citations for what is common knowledge or readily inferred. It is as though their authors are afraid to shoulder responsibility for what they write, that they must lean on others for support or blame them if things turn out to be wrong. I therefore welcomed Anthony Young’s short contribution. When an editor asks for the source of an observation reply, ‘This very article, I saw it, and now I’m telling you about it’. I mind the advice given to me by R.K. Schofield as I set out on my career: 90% of papers are of little consequence; try to identify the few really important ones on the subject, and concentrate on those. They are the ones to cite. Schofield certainly practised what he preached, and, looking back, I doubt whether he missed anything significant.

Hartemink closes this set of articles with the remark that the current culture in which scientists are encouraged to write ever more papers is self-defeating. People have not got time to read them, and 80% of them are never cited. He suggests, perhaps with tongue in cheek, that each scientist be allowed no more than two papers per year in peer-reviewed journals. That would concentrate their minds on the important science with ample data to back it, and ‘salami publishing’ would die. Interestingly, the British Road Research Laboratory had spotted something similar 40 years ago: anyone publishing more than two papers a year was suspected of spending too much time writing at the expense of too little at the bench or in the field!

R. Webster