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Geoderma 123 (2004) 373–375

GEODERMA

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Soils of the tropics

Tropical soils—properties and management for sustainable agriculture by A.S.R. Juo and K. Franzluebbers. Oxford University Press, 2003. Hardback, 281 pp. ISBN 0195115988. £45.

Properties and management of soils of the tropics, by A. van Wambeke and F. Nachtergaele. CD Rom, FAO Land and Water Digital Media Series 24, 2003; ISBN 9251050074. US\$44.

One-third of the soils of the world are in the tropics and these support more than three-quarters of the world population and yet more is known about the soil resources in the temperate regions. The three main causes are that research lags behind, that persistent myths continue to hinder development and that generalizations hinder the advancement of soil science in tropical regions (Lal and Sanchez, 1992). In the early 20th century, agronomists and soil scientists in the tropics would speak about “rubber soils” or “coffee soils” reflecting a set of properties that were suitable for growing specific crops. Likewise, there were terms like “forest soils” and “savanna soils” and these also reflect the link between land-use or vegetation and soil properties. We now know that there are different soils under forest or rubber and linking soils to land-use or vegetation has some severe limitations. Nonetheless, such linkages are still made. Another linkage that is often used is “tropical soils” suggesting that, in the tropics, soils are conspicuous different from soils in other climatic zones. Is that true?

Aside from the lack of a difference between the summer and winter temperature, the range of conditions under which soils are formed is as diverse in the tropics as in the temperate regions. Similar rock types occur, and erosional and depositional patterns are

comparable. The time of soil formation may range from very recent on alluvial plains or volcanic deposits to very old on stable geomorphic surfaces. Arid and humid as well as warm and cold climates occur in both temperate and tropical regions. Nevertheless, the extent of certain soil types is very different. Pleistocene glaciations and wind erosion and deposition have had great impact on the soils in the temperate region whereas many soils in the tropics are intensively weathered and often derived from Precambrian rocks. There is a larger proportion of relatively young soils in the temperate regions. Beyond this generalizations begin to lose accuracy (Sanchez and Buol, 1975).

There are several textbooks on soils of the tropics of which “Properties and management of soils in the tropics” by Pedro Sanchez from the mid-1970s is probably best known (Sanchez, 1976). Other major reference books that have their focus on the soils of the tropics by Lal (1987) and van Wambeke (1992) are somewhat different reflecting the interests and experiences of the different authors. For example, van Wambeke puts more emphasis on the soil orders of Soil Taxonomy whereas in Lal’s book there is much information on tillage and farming systems but there are also some similarities. Each starts with a description of the tropical environment, including the effects of climate and vegetation on the soils of the tropics. Now there is a new book by Juo and Franzluebbers on tropical soils as well as a CD Rom version of van Wambeke’s book. What are these about?

The book of Juo and Franzluebbers is in two parts. In the first, basic considerations (sic) of soil science are discussed and these include: the environment, mineralogy, soil chemistry, soil physics, soil biology and microbiology, soil fertility and soil formation and classification. These chapters are straightforward and comprise a readable introduction. The authors rely somewhat on existing soil science textbooks but present several examples from their own work. Chap-

ter 7 discusses soil formation and classification, describing the 11 orders in Soil Taxonomy, the 26 soil classes of FAO-Unesco, the INRA/ORSTOM system, and the Soil Fertility Capability Classification, which was recently updated.

In Chapter 8, the authors propose a descriptive grouping of major soils in the tropics based on clay mineralogy. The main purpose of the grouping is to provide field workers especially those that are not familiar with other classification systems with a simple framework for planning soil management strategies. The scheme classifies major arable soils in the tropics into four groupings according to the dominant clay mineralogy: kaolinitic soils, oxidic soils, allophanic soils and smectite soils.

Kaolinitic soils are deeply weathered with a sand, loamy sand, or sandy loam topsoil and clayey subsoils dominated by kaolinite. Oxidic soils are strongly weathered red and yellowish, fine-textured soils that typically have low bulk density and large amounts of stable microaggregates. Low water holding capacity, low soil fertility and high P-fixation are major constraints. The allophanic soils are dark-coloured and young soils derived from volcanic ash with low bulk density, high water retention and contain predominantly allophanes, imogolite, halloysite and amorphous Al in the clay fraction. The last group are the smectite soils that are loamy to clayey alluvial soils containing moderate to large amounts of smectite. Each of these four groups has a chapter that discusses the properties, use and management as well as constraints. The approximate equivalent in Soil Taxonomy is given for each of the mineralogy groupings. Several examples are given on how these soils should be managed. In the last chapter, some ecological considerations of soils and sustainable agriculture are discussed.

In summary, this book discusses some of the main properties and processes in soils of the tropics followed by a grouping of soils based on clay mineralogy. That is certainly an unusual, if not idiosyncratic, approach. Given that we have accepted and fairly widely used soil classification schemes in which this differentiation (amongst others) is made, one wonders what the advantages are of such a one-eyed distinction. It excludes certain groups of soils and for many soils the soil mineralogy is not always known. There is much useful information in this book but the

unusual structure and the index of only seven pages make it hard to find.

The CD Rom version of van Wambeke's book from 1992 contains text (as PDF), slides and powerpoints including hyperlinks. The text of the first five chapters focuses on the tropical soil environment and has not changed much although some references on the World Reference Base (WRB) have been inserted. There is a powerpoint attached to most chapters that have figures explained in the main text. If you are not bewildered by powerpoint animations, e.g. text rolling in from all sides (should be forbidden by law) then some of these figures and text summaries are useful and illustrative. Chapter 4 focuses on soil horizon formation and it has been rewritten using WRB terminology. The second part of the book originally covered the Soil Taxonomy soil orders, but on the CD Rom, it has been replaced by the WRB Soil Reference Groups. In Chapter 6, the rationale and principles of the WRB are explained and the text is a nice introduction for those who are only familiar with Soil Taxonomy or still use the old FAO-Unesco legend. Since 1998, the WRB system is recommended by the IUSS and the shift from Soil Taxonomy to WRB seems sensible.

In the following 10 chapters, 15 of the 30 Soil Reference Groups are described: Ferralsols, Nitisols, Acrisols, Lixisols, Alisols, Luvisols, Cambisols, Umbrisols, Andosols, Vertisols, Gleysols, Plinthosols, Fluvisols, Arenosols and Podzols. Obviously these are important soils in tropical regions but one wonders why, for example, Histosols and soils common in semiarid climates (e.g. Calcisols, Solonchaks) were not included. Each Soil Reference Group is described in terms of definitions, representative soil profile data, genesis, management properties and land-use. There is also a powerpoint attached to each chapter that contains further explanations, pictures and diagrams. Furthermore, there is a glossary that is an extract and update from the SSSA *Glossary of Soil Science Terms* and includes many WRB terms. At last, 17 full descriptions of soil profiles are given including some notes on soil analytical methods.

In summary, this CD Rom contains half the original text of van Wambeke's book from 1992. The other half (Soil Taxonomy part) has been replaced by the World Reference Base and there are powerpoint presentations attached to each chapter. In essence, it is

a text from the late 1980s combined with WRB information that is also available in other forms (CD Roms, books, reports).

If the price is to be ignored, which one would I recommend to my students? It is hard to say, the CD Rom is perhaps a more fashionable learning medium but the graphics and powerpoints are of such quality that they might not appeal to today's students. Moreover, the main text is similar to the 1992 book and is slightly dated. I also wonder whether Soil Reference Groups are a good entrance point to learn about soils in the tropics. On the other hand, the CD Rom is easy to distribute and that might be useful for distance learning and self-education. The Juo and Franzluebers book is a good read although not always up-to-date. It lacks the "interactivity" that is deemed necessary to fascinate students but it is well written but one may question whether the approach is suitable. Both book and CD Rom have a pedological base and outlook, and will be useful to newcomers in the tropics whether they are interested in soil geography, ecology or agriculture.

Although we should be pleased that books are being published that are solely devoted to the soils of the tropics, there is a void that remains to be

filled. More emphasis should be given to environmental aspects of soils now in many urban areas soil pollution is also common. Moreover, there is a range of topical themes like climate change, food security and land-use change that form perfect entry points for a major reference work on soils in the tropics.

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Topography - tropics soil formation. - important bc controls hydrology and erosion-sedimentation - Importance of geomorphic position (catena). Catena. series of distinct but co-evolving soils along a slope. Time - tropics soil formation. - areas not glaciated; soils can represent formation from over millions of years on stable surfaces. Soil types in tropics/subtropics. - Ultisols - Oxisols - Vertisols. Ultisols - profile. Soil physical management in the tropics must be based on a holistic approach to solve practical problems. It is also important to make the public aware of the contributions of soil science to society's well-being. In addition to enhancing food production, soil physical management needs to address environmental, engineering, social, legal, and archeological issues. Achieving these goals necessitates soil scientists working in close collaboration with engineers, climatologists, geologists, biologists, and specialists in GIS and geostatistics. © 2000 Lippincott Williams & Wilkins, Inc. Source. Ph Tropical rainforests exhibit high levels of biodiversity. Around 40% to 75% of all biotic species are indigenous to the rainforests.[6] Rainforests are home to half of all the living animal and plant species on the planet.[7] Two-thirds of all flowering plants can be found in rainforests.[5] A single hectare of rainforest may contain 42,000 different species of insect, up to 807 trees of 313 species. Soil types are highly variable in the tropics and are the result of a combination of several variables such as climate, vegetation, topographic position, parent material, and soil age.[21] Most tropical soils are characterized by significant leaching and poor nutrients, however there are some areas that contain fertile soils. About 90% of soil fertility in a tropical forest is in the plants which is why when tropical rain forest is felled and burnt to grow beef for McDonald burgers, the soil very quickly becomes infertile. Not a good idea to interfere with nature. Overall, the tropics make for amazing scenery and possible small scale tourism. Otherwise, they're just taking up space and prevent your nation from developing. And there's nothing you can do about it. Other soils of importance in the tropics are Vertisols and Acid Sulfate Soils. An overview is given of the classification of tropical soils in the 3 major world classification systems. This is followed by a short summary of their land use and production potential. 1. Introduction The tropics correspond to the area of the world between the Tropic of Cancer and the Tropic of Capricorn (23°27' North and South); they cover some 2 thousand million hectares (38 % of the world land surface). The subtropics are the regions north and south of the tropics up to about 35° latitude. Their boundaries with