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Book review

Climate from Tree Rings

eds M. K. Hughes, P. M. Kelly, J. R. Pilcher and V. C. LaMarche Jr
(Cambridge University Press, 1982). $45.50.

The polished Huon pine disc hanging in my office bears constant witness to the fascination that people have with tree rings. There is hardly a visitor who does not find an opportunity to comment on it; most express what shows every sign of being deep interest, even awe, at the 1600 years of information stored year by year in orderly and obvious fashion.

Dendrochronology, the dating of tree ring material by counting rings and comparing patterns of ring width variation, is soundly established as a scientific tool. It forms the basis of radio-carbon dating calibrations.

Dendroclimatology, the retrieval of past climatic information from variations in ring properties, is viewed with considerably more suspicion by many scientists, particularly those from the 'hard' sciences, who can manipulate, repeat and refine processes before collecting final data. Some increased measure of respectability in dendroclimatology followed the publication, in 1976, of Hal Fritt's book *Tree Rings and Climate* (Academic Press, London). The magnitude and difficulty of the field work and the very considerable complexity of the statistical analysis and calibration procedures, characterise Fritt's approach. The clear message is that a small measure of rigour is attained at this cost, and cannot be attained more cheaply.

Thus *Climate from Tree Rings* is a very timely book — a reaction to Fritt's pioneering work after an appropriate 3–4 years of digestion time. Being largely based on material presented at The Second International Workshop on Global Dendroclimatology, the book represents a truly global reaction, with contributions from all major research groups around the world.

The second good thing about *Climate from Tree Rings* is that it is extremely well edited. There are five main chapters entitled: Data Acquisition and Preparation; Data Analysis; The Southern Hemisphere; The Northern Hemisphere; and Climate Reconstructions. At the beginning of each chapter, the editors have included a page or two which sets the scene. The basic problems and state of development on each topic are introduced, and the relevance of the individual contributions which follow, is briefly and succinctly stated. Relevant conference comments are included after some papers.

The first chapter includes reference to various tree ring parameters which can be measured, apart from ring width. These include wood density, cell structure, and isotopic composition (involving isotopes of hydrogen, carbon and oxygen). With the possible exception of density, these are fleeting and inconclusive references; the great bulk of the book is concerned with ring widths.

In fact the majority of contributions are variations on Fritt's theme. The name of the game is empiricism, with a variety of complex procedures being proposed or demonstrated. To quote from the editors, 'Response functions are used to describe associations between climate data and annual ring measurements. Transfer functions are used to calibrate the ring measurements with climate data in order to provide regression equations for climate reconstruction. Both techniques employ multivariate statistical methods such as principal component or eigen-vector analysis and canonical correlation and regression'. The very important statistical verification of climate reconstructions receives due attention.

The book is a good reference on the application of multivariate techniques, which may appeal to a much wider audience than the dendroclimatology fraternity alone.

As a parochial aside, Barrie Pittock plays devil's advocate in one of his contributions, by stressing the many assumptions inherent in the overall processes of reconstructing climate from tree rings (and ends up having 'two bob each way'). Of particular interest to *Australian Meteorological Magazine* readers will be Mike Salinger's contributions on southern hemisphere climatology.

The third and fourth chapters of the book are an up-to-date, and I suspect unique, inventory of tree species around the world which lend themselves to dendrochronological (and possibly dendro-climatological) techniques. These are species which exhibit significant cross dating, or patterns of common year-to-year variability, in many trees.

There seems little reason to doubt that the common variance exhibited in a large number of trees does reflect a palaeo-environmental signal. The final chapter gives example reconstructions of factors such as seasonal temperatures, precipitation, drought and river flow and there also seems little reason to doubt the relevance of these factors to ring widths.

The criticisms I have relate not so much to the book, as to the current state of the field (of which the book is an excellent reflection). By being so markedly empirical, the current field of dendroclimatology can be no more than a scientific tool, to be used to achieve certain well-defined and

specific objectives. One gains an impression that the end point of much of the effort is a reconstruction, *any* reconstruction, with few constraints imposed by a climate-related objective. This may be no more than a reflection of the necessary evolution required to establish new techniques.

What is disappointing is the lack of information or knowledge on tree physiology. Obviously tree physiologists are not, or have not been, attracted to the field. Yet lack of knowledge of the actual mechanisms which determine the width, or density, or isotopic composition, will always cast doubt on a reconstruction (e.g. is it temperature or is it light?). Many of the contributions allude to this problem, but there is no evidence of an effort comparable to that expended on the statistics (which might even become irrelevant with a thorough understanding of the physiology).

To sum up, the book *Climate from Tree Rings* is timely and very well edited. Being concerned mostly with tree-ring widths, it fully documents the empirical statistical techniques employed by most workers and gives a unique world-wide over-view of suitable species. Examples of successful reconstructions of climate-related parameters are included. A requirement for greater understanding of the basic physiological response of trees to their environment is, by default, clearly defined.

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