

## **Age and Growth Rate of Tropical Trees: New Directions for Research**

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This small, inexpensive volume contains the proceedings of a 3-day workshop held at Harvard Forest in April 1980. The management and silviculture of most temperate-zone forests are dependent upon our ability to quickly, accurately, and inexpensively age trees by counting their annual rings. There is no such tool readily available to foresters in the humid tropics, where trees that form annual rings are the exception rather than the rule. Thus, this workshop (27 participants representing 12 countries) was held to identify new lines of research for measuring age and growth of tropical trees.

The book starts off with three papers designed to introduce the topic and define the problem. The first, by Ashton, is brief and anecdotal, but thought-provoking. His final sentence ("I do not believe we yet have a sufficiently precise, yet practical, method of aging . . . tropical [trees] . . ."), alas, could as well have been the last sentence in the book. The second paper, by Tomlinson and Longman, relates growth phenology to cambial activity, and touches on types of shoot extension, methodologies for measuring phenology, case histories (e.g., a mangrove, rubber, and tea), and the relation between height growth and diameter growth. The third, by Mariaux, is a thorough but concise review of past attempts to measure age and growth of tropical trees.

The heart of the book is seven papers containing the reports of working groups. It was here that I hoped to find a shopping list of new methodologies that had heretofore escaped me because of my ignorance of the specialized fields represented: anatomy, chemistry, radioisotopes, dendrochronology, and demography-biometry. Although each working group did a good job of reviewing the prospects and problems in its field of expertise, none offered any startling new solutions. The wood anatomy working group (Fahn, Burley, Longman, Mariaux, and Tomlinson) described several promising lines for future research, such as the relationship of length of xylem elements to seasonal growth. Useful appendices to their section describe Longman's technique for injecting stains into living trees, plus ring formation in trees from Africa, South Florida, and Java. The wood chemists (Swain, Hillis, and Larson) convinced me that chemical changes in wood cannot yet be used to determine age, while the isotope specialists (Stuiver, Rebello, White, and Broecker) described the use of bomb-produced  $^{14}\text{C}$  as ". . . the single most powerful means of obtaining growth rates over the past two decades." Unfortunately, their message was obscured by errors in a figure (p. 81), one of only two important mistakes I noted in this speedily published book (the other involved confusion of the bibliographies on pages 127 and 133). Dendrochronology has most often been used in harsh, dry, seasonal environments, and not in the warm, humid tropics; Eckstein, Ogden, Jacoby, and Ash describe why. However, they also remind us that ring counting, even though imprecise, may be an adequate approach for some studies of growth and population dynamics. The final three reports, with contributions by Enright and Hartshorn; Singh; and del Amo and Nieto de Pascual, deal with plant demography, mensuration, and growth models.

If it is difficult to learn about a tropical tree's history by examining its physical or chemical characteristics, then one solution might be to begin long-term measurements of tree growth now, so that we do not have to rely on fickle historical markers. Yet dendrometers are mentioned only once, even though the need for permanent growth plots is recognized in the general recommendations that conclude the volume.

I judge this workshop a success. It convened outstanding experts from several disciplines to share their thoughts on a common problem. They identified the key issues, made others aware of potential tools in their fields, and published their contributions. The result is not an encyclopedia but a pocket dictionary; it tells the practising tropical forester and ecologist what approaches have been explored, and distinguishes among those that failed, those that have been useful, and those that warrant further research.