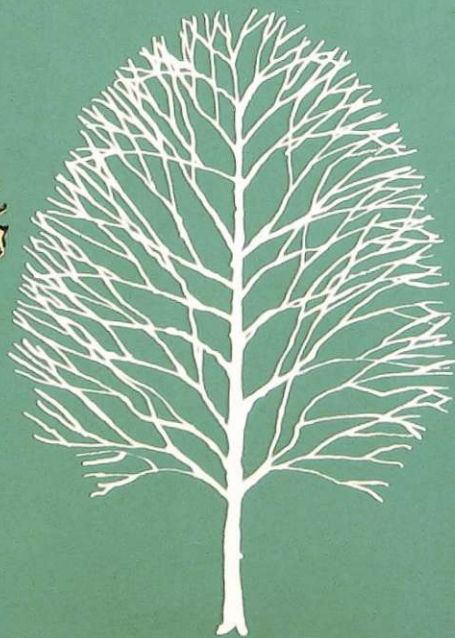
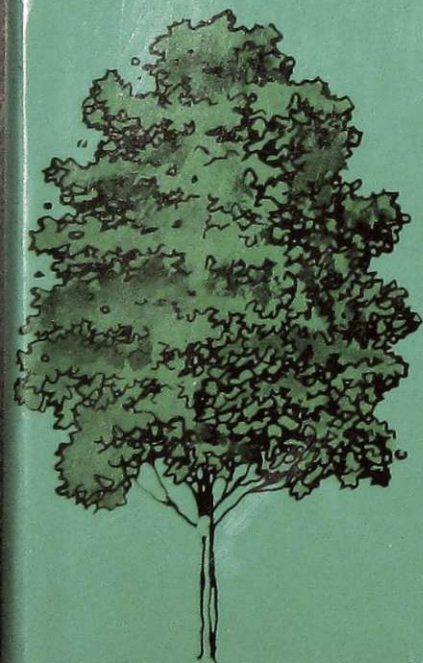


TREES

Structure and Function

By
MARTIN H. ZIMMERMANN
CLAUD L. BROWN

With a chapter by
MELVIN T. TYREE



TREES

STRUCTURE and FUNCTION

Martin H. Zimmermann

CHARLES BULLARD PROFESSOR OF FORESTRY
AND DIRECTOR OF THE HARVARD FOREST
HARVARD UNIVERSITY

Claud L. Brown

PROFESSOR OF FORESTRY AND BOTANY
UNIVERSITY OF GEORGIA

*With a chapter on
irreversible thermodynamics of transport phenomena by*

MELVIN T. TYREE

BOTANY SCHOOL, UNIVERSITY OF CAMBRIDGE, ENGLAND



SPRINGER-VERLAG
BERLIN HEIDELBERG NEW YORK

1971

PREFACE

Trees have the distinction of being the largest and oldest living organisms on earth. Although the herbaceous habit has made unprecedented evolutionary gains since the middle and late Cenozoic, trees still are the most conspicuous plants covering the habitable land surface of the earth. Man has long sought their shelter and protection, utilized their food and fiber, and often exploited them to his own detriment.

Trees have always been of much interest to botanists, and many of the early investigations concerning the structure and function of plants were conducted with trees. At the beginning of the present century the use of trees for basic investigations began to decline. The reasons for this are obvious. Investigations of structure and function began to shift from whole organisms to tissues, then to individual cells, and finally to cellular organelles and subcellular particles. Physiological research became increasingly more detailed and complex, requiring more and more precisely controlled laboratory conditions. Hence, a relatively small number of herbaceous plants, various unicellular algae, fungi, and bacteria have become standard research material in most laboratories.

Because of the unprecedented progress molecular biology has made in recent years, it may, perhaps, seem odd to those who work at the cellular and subcellular levels that some biologists would still choose to work with whole organisms, especially trees! Fortunately, those of us who work with woody plants are constantly reminded that not only do trees perform all the cellular activities of most unicellular and herbaceous plants but, indeed, a good bit more. Where else can one better study the many intriguing problems of water and food transport, dormancy, cambial activity, and differentiation of xylem and phloem than in woody plants?

The present book is devoted largely to those aspects of structure and function which are peculiar to trees. It attempts to close part of the existing gap in our knowledge of organismal plant physiology. No attempt has been made to cover such basic processes as photosynthesis, respiration, metabolism, nutrition, or other topics common to all green plants. These are adequately covered in textbooks of biochemistry and general plant physiology. Problems relating to certain aspects of dormancy and nutrition are discussed along with other functional