FUNCTIONAL AND ECOLOGICAL WOOD ANATOMY
SOME INTRODUCTORY COMMENTS

by

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These symposium proceedings address various problems in the inseparable fields of functional and ecological wood anatomy. Apart from the contributions during the Martin H. Zimmermann Memorial Symposium held in Gainesville, Florida, U.S.A. on August 12, 1985, several related papers have been incorporated into this issue, so that a fairly wide net has been cast over the various aspects of what is generally understood by 'functional and ecological wood anatomy'. At the risk of stating the very obvious, it is perhaps appropriate to make some general observations on these subdisciplines.

Functional wood anatomy requires physiological knowledge which can only be obtained by experimental research. The complex and rather inaccessible system presented by large trees has unfortunately hampered comprehensive and sophisticated tree physiological research from the early days onwards. Excellent studies have been carried out, but never on the same scale as on the pets of physiological research such as the herbaceous peas, beans and oats. Ironically enough it seems that today whole-tree physiology will receive its greatest stimulus, because forest decline and tree death due to a combination of factors including pollutants, acidification and disease make it necessary to determine the precise role of the latter in tree physiology. Without such information no appropriate action can be expected to counteract the damage to our planted and natural forests. Meanwhile we must be grateful to men like the late Martin H. Zimmermann for carrying on the torch of a holistic study of functional wood anatomy and tree physiology, as well as to the experimenters among the contributors of these proceedings who all initiated their studies without the additional incentive created by the current ecological crisis.

Ecological wood anatomy has in recent years become more and more synonymous with 'ecophyletic wood anatomy', a term coined by Philip M. Rury in his contribution to these proceedings: based on correlations between environmental factors and certain wood anatomical attributes scientists have hypothesised adaptive strategies and other mechanisms on the origin of wood anatomical diversity in the course of evolution. Data for ecophysletic studies are always derived from genetically diverse material. We are the last to deny this speculative field its rightful place in wood anatomy and believe that indeed its results can inspire hypotheses which are useful in many different fields. However, the hypotheses can never be accepted as full-proof evidence and always will require experimental testing of some sort.
There is also another meaning of the term ‘ecological wood anatomy’, viz. the study of direct, phenotypic modifications of wood structure as a response to one or more changing ecological factors. Much of this field of study has found its niche in forestry-related research on the impact of environmental manipulation and management on radial growth and wood quality and in studies of cambial response to a multitude of environmental factors, especially climatic ones. Again the current problems ascribed to pollution will greatly stimulate this type of ecological wood anatomy, because it can provide answers to the questions whether timber from trees in declining forests is of a different structure and quality than that of healthy trees.

Each time the ecophyletic type of ecological wood anatomy is pursued the danger exists that its results are thought applicable to the study of phenotypic modifications and vice versa. It is a poor show of our ‘progress’ that a confusion of evolutionary changes and phenotypic modification can still be seen in some recent papers, despite the fact that in the 19th century our predecessors were already warned about such pitfalls by their wiser colleagues. In this respect there is a parallel with the much more prolific field of ecological leaf anatomy. In a recent contribution to the Encyclopaedia of Plant Anatomy (1984, Vol. VIII, 2B, 1) Napp-Zinn has very comprehensively reviewed old and recent achievements of this special field: it is instructive, and at the same time alarming, to see how over a century ago botanists were struggling with the same problems still presented as ‘modern’ and ‘innovating’ in our time and how some, now widely ignored, 19th century contributions are even superior to some recently published studies. In these proceedings ecophyletic wood anatomy is rather well represented, while no studies on phenotypic wood anatomical variation are included.

The complex mechanisms of interaction between genotype and external factors in the regulation and modification of cambial activity and xylem cell morphogenesis are of course crucial to the fields of ecological and functional wood anatomy: modification of xylem cell and tissue ontogeny affects the functioning of mature xylem as a sap conducting, supporting and metabolising tissue. Aspects of xylem morphogenesis were included among the contributed papers during the symposium but are not represented in these proceedings.

We are still a long way removed from an integrated model of tree physiology, functional wood anatomy, ecological wood anatomy sensu lato and xylem morphogenesis. Ideally the various subdisciplines should be pursued simultaneously in multidisciplinary teams. The next decades may witness the formation of a few such teams who will study the complex problems relating to declining vitality in economically important timber species. For the majority of interested specialists it seems more realistic to accept the fact that they will have to carry on their work in small, isolated research groups. For them the only way to promote an integrated approach will be by direct or indirect contacts with colleagues who study aspects beyond their own narrow fields. If these proceedings will contribute a little to promote such contacts, they will be a suitable memento to Martin H. Zimmermann's aims in his holistic research, as well as a worthwhile effort to further the objectives of the International Association of Wood Anatomists of which he was such an active member.