**Introduction to the Virtual Issue on Dendroclimatology and Dendroecology**

The *Journal TREES - Structure and Function* covers the entire broad spectrum of plant biology, i.e. genetics and molecular biology including biotechnology of micro-propagation and tissue culture, anatomy and morphology, mechanics and hydraulic architecture, physiology, ecology and eco-physiology with stress responses to factors such as water availability, nutrients, salinity, irradiance and others, phytopathology, ecology and phytogeography. The only restriction is the life form whose biology with structure and function is considered, namely trees and shrubs. The standard is marked by the expertise of an international group of 35 Communicating Editors who together cover all the different disciplines.

Two basic features make trees very outstanding life forms of plants, namely potential longevity and size. Most are also woody. The tallest eucalypt tree was reputedly 133 m high. The oldest tree of *Pinus longaeva* D.K. Bailey (syn. *Pinus aristata* var. *longaeva* [D.K.Bailey] Little) was felled in 1964 and had 4950 annual growth rings, the oldest tree still living to date is 4700 years old. It germinated at the end of the Neolithic. Within their annual growth rings, the stems of trees provide an exceptional record of past events.

These peculiarities raise increasing interest in trees for understanding life on our planet Earth in relation to ecology and the challenges of global developments. In view of the rapid advancement of studies on structure and function of trees we are pleased to announce our new feature: “Virtual Issues”. These special issues will bring together papers that were recently published in *TREES - Structure and Function*. They provide a service to our readers, who find it increasingly difficult to keep up with the literature.

Considering the great common concern about potential global climate changes we chose for this first Virtual Issue the topic of growth ring analyses for climate reconstruction and its potential as a basis of forecasting tree and ecosystem responses to global climate change. We cover the last two years, volumes 24 and 25, plus numbers 1 and 2 of volume 26. In this time the topic was addressed in our journal by one special issue (vol. 25, number 1, Bräuning 2011) and more than 30 individual contributions, a selection of which is reproduced in this Virtual Issue with our apologies to the authors of papers which could not be included due to space limitation.

Many areas of the world are covered by these studies, e.g. large parts of Europe (Hafner et al. 2011), the Mediterranean (Büntgen et al. 2010), Patagonia (Mundo et al. 2012) and the transect of a whole continent, i.e. Australia (Bowman et al. 2011), so that global dimensions come into view. It is important to note that the studies also include the tropics because it has long been assumed that there are no decent growth rings in tropical trees. This is completely wrong. Precipitation regimes in the very complex tropical environments, and the seasonality of precipitation effects there, produce growth rings in trees of both dry and wet tropical regions (Bräuning 2011). Growth rings are also observed in lianas (Brandes et al. 2010, Lima et al. 2010). The environmental dynamics cause normal annual growth rings but also multiple rings per year (Wils et al. 2011). Long chronologies of climate reconstructions (Rozendaal and Zuidema 2011) allow inclusion of the tropics in dendrochronological evaluations of global change (Brienen et al. 2011).

In the great majority of the publications the above ground organ, i.e. the stem growth, is analyzed. However, there is one ground-breaking study that includes the roots (Nikolova et al. 2011). The field has advanced from purely measuring tree-ring widths to analyses of other parameters across the stems and correlating them to the width measurements. These include various properties of the wood, such as wood density (Büntgen et al. 2010, Micco et al. 2012, Rozas et al. 2011, Takahashi et al. 2011), vessel area (Campelo et al. 2010), and lumen diameter of conductive elements (Bowman et al. 2011). Measurements of stable isotopes have become most important due to isotope effects occurring during acquisition and partitioning of resources. This is shown by many contributions to
this Virtual Issue, particularly dealing with $^{13}$C but also $^2$H, $^{15}$N and $^{18}$O (Beghin et al. 2011, Gebrekirstos et al. 2011, Hafner et al. 2011, Ma et al. 2011, Micco et al. 2012, Mölder et al. 2011, Newberry 2010, Weidner et al. 2010). These measurements provide a high resolution of seasonal dynamics during individual years (Gutiérrez et al. 2011, Hafner et al. 2011, Rozas et al. 2011). The fine-tuned analyses allow documentation of environmental responses, such as reactions to various stressors in natural climate gradients (Newberry 2010), neighborhood effects in tree stands (Mölder et al. 2011), altitudinal gradients (Maxime and Hendrik 2011, Mundo et al. 2012, Takahashi et al. 2011), influence of urbanization (Chen et al. 2100), and fire (Beghin et al. 2011).

Thus, growth ring analyses of trees address both dendroclimatology and dendroecology. The present Virtual Issue of TREES - Structure and Function provides a comprehensive overview. We wish our readers a rewarding study.