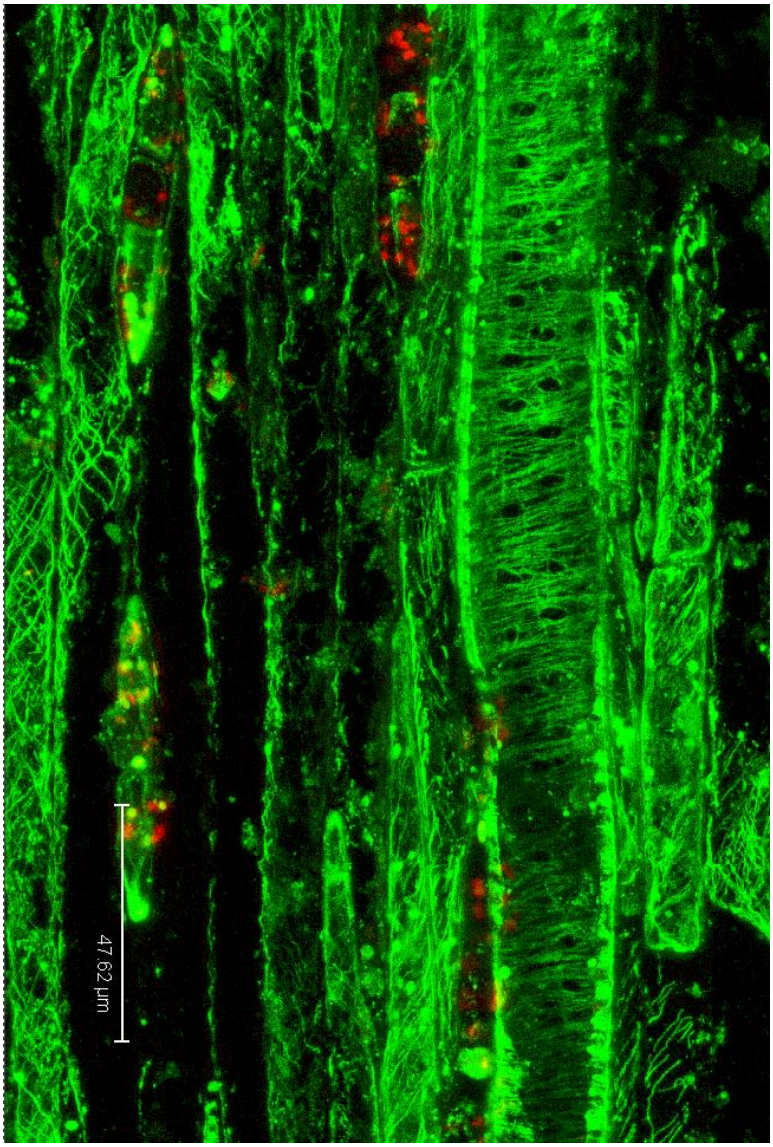
Forest Management

Dr David Drew joined the team at Stellenbosch University in July 2015.

He has had extensive experience working in both natural and plantation forest environments in both South Africa and Australia. He has published over 20 peer-reviewed publications in the international scientific literature. He is currently involved in a range of research around the measurement and modelling of forest growth, yield and wood properties. The research operates at multiple scales, from the cell to the stand, and considers tree growth from short-term responses to the final yield achieved over a full rotation.

Detailed understanding of xylem formation and differentiation

At the cellular level, the formation of wood involves a complex set of processes including cell division in the vascular cambium, irreversible cell growth and finally secondary wall thickening. The dynamics of these processes will determine both rates of stem growth and final properties of the xylem (wood) tissue. Current research aims to understand the effects of drought on the duration and rate of cell production and differentiation, as well as to zoom in on the intracellular activity of components controlling cell expansion and cellulose deposition in *Eucalyptus*.



***Alpha-tubulin in differentiating fibres and vessels of* Eucalyptus globulus**

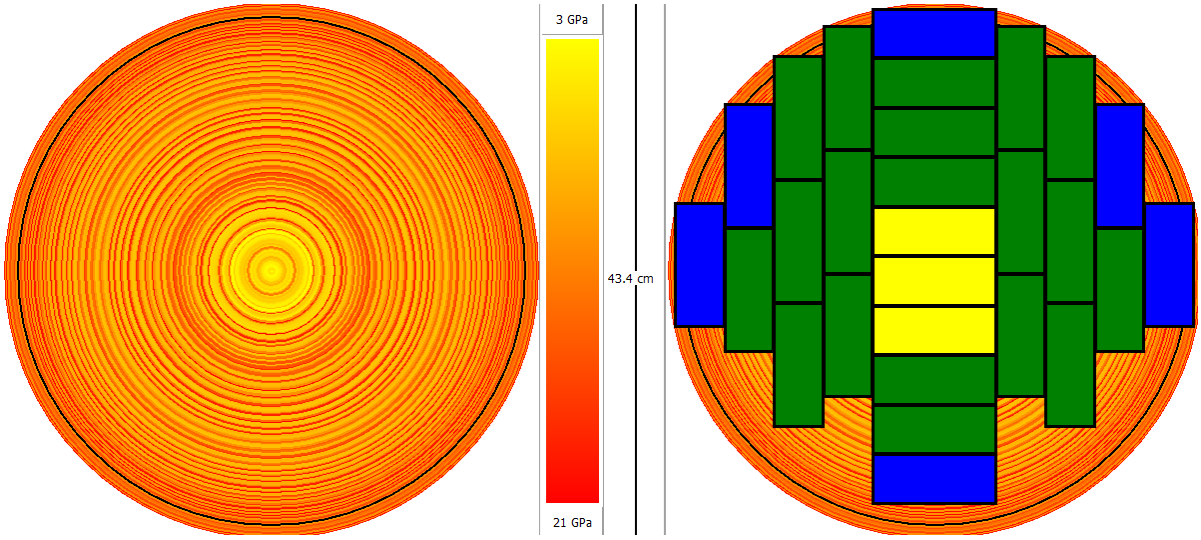
Fine-scale stem growth responses to environmental stimuli in diverse forest environments

Growth over the long term in a tree is a function of the accumulation of a many growing periods during the life of a tree (i.e. a tree does not grow uniformly or continuously). Many of these periods of growth may be quite brief, depending on the environment in which the forest is growing. Understanding the nature of tree growth responses to short-term variability in environmental conditions, particularly rainfall (or available water) and temperature, can provide important insights into fundamental aspects of longer-term patterns of growth, both in individual trees and at the stand level. Dr Drew is currently researching detailed stem size variation data (measurements every 15 minutes) from a wide arrange of natural forest as well as plantation environments, with the main objective of understanding and modelling both growth- and hydraulic-related variation.

A high resolution electronic point dendrometer measuring stem size variation every 15 minutes on an ancient Huon pine (*Lagarostrobos franklinii*) in western Tasmania, Australia

Hybrid approaches to modelling forest stand growth and wood property variation

South Africa has a long history of robust and scientific approaches to modelling growth and yield of forest stands. To tackle emerging challenges of increasingly serious periodic regional droughts, a major issue for short rotation plantations, as well as wood property variability, Dr Drew is building on these strong foundations to develop new generations of models. The research has two directions, exploring approaches that (a) involve some modelling of process at an appropriate scale or (b) explicitly incorporate real-time environmental variability, so that outcomes are rotation specific, rather than representing a "typical" rotation. The work focusses on both softwood species, typically destined for solid wood products, and hardwood species (mainly *Eucalyptus*) with an emphasis on pulp production.



Simulated pith-to-bark variation in wood stiffness, with projected board grade classes possible from the log

Effects of environment on taper, volume and biomass estimation for plantation species

There is always a need to accurately assess the properties and quantity of a timber resource that is currently standing. An emerging issue is the need to determine, with the maximum possible accuracy, carbon sequestered in forest stands for a variety of reasons. Estimating standing volume is always a major concern for commercial forest managers. Dr Drew's research focusses on best model forms and approaches, species specific or otherwise where applicable, to estimate the taper of stems, and according stem form, utilisable volume and the biomass (or stored Carbon or CO_2 equivalent). A particular aspect of interest in this research is how site quality or site attributes affect model choice, or the generality of parameters for a species.

Sampling Pinus elliottii in the Tsitsikama region to develop biomass estimation models (Image courtesy of P. Muyambo)

Publications

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