

## Canopy Processes in a Changing Climate

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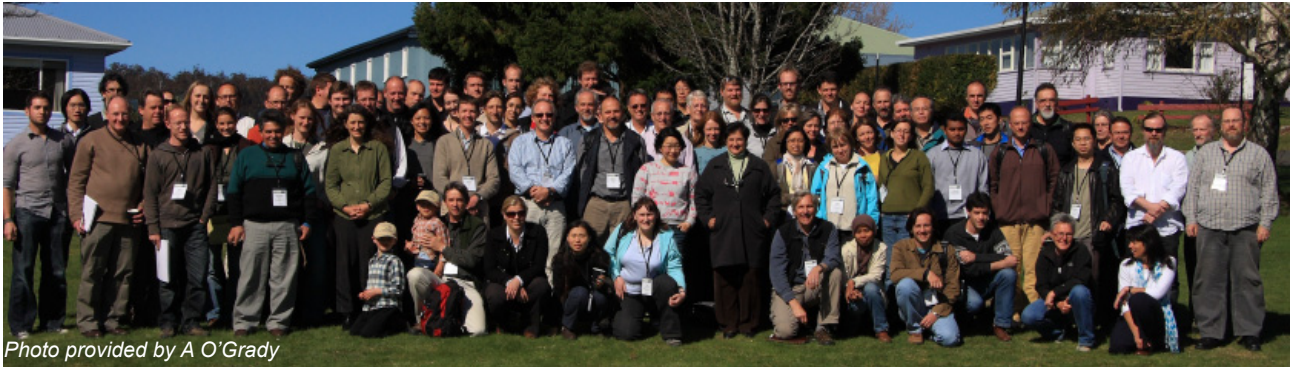


Photo provided by A O'Grady

*The recent canopy processes meeting in southeast Australia highlighted the challenges for a better process based understanding of forest sciences in a changing climate. New technologies and emerging modelling approaches are helping to improve our mechanistic understanding of canopy processes at scales ranging from the cell to region. However, key uncertainties remain with respect to processes regulating carbohydrates, respiration and ageing and mortality in forests and how these processes will respond to future climates.*

The meeting opened with a public lecture held at the State Library of Victoria in Melbourne. Dr David Whitehead (Landcare Research, New Zealand) explored the **benefits and consequences of forests as carbon sinks**. One of the emergent themes was that conversion of large tracts of land to forests must be carefully assessed with respect to the potential tradeoffs between carbon capture, water yield and feedbacks to the atmosphere.

Across the broad spectrum of themes, discussion emerged regarding key challenges facing scientists working in canopy processes. A major theme was that of **carbohydrate source and sink regulation of key processes** such as photosynthesis and respiration, and their impact on the regulation of growth, mortality and ecosystem productivity. New isotopic technologies have been developed to better understand the fluxes of water and carbon in canopies. An improved process-based understanding of phloem transport in particular represents a critical barrier to advancing our understanding of carbohydrate translocation and allocation with plants.

**Age-related declines in forest productivity and the processes driving forest mortality** were also important emergent issues. Processes driving forest mortality, were identified as areas that need increased attention in order to better understand the impacts of an increasingly variable climate on carbon and water stocks and flows within forests as well as the indirect impacts of a drying climate on forest function in terms of risks associated with pests, disease, fire and the hydrological implications of increasing climatic variability.

**Scale** remains an important issue within the canopy processes group and it was interesting to compare the approaches and techniques being used today with those outlined by Richard Waring at the 1997 Forests at the Limit meeting held in Kruger National Park. For example, CO<sub>2</sub> temperature and drought impacts on eucalyptus were highlighted in a series of presentations by researchers using the whole tree chamber technologies developed in Sweden. However, Dennis Loustau and Margaret Barbour highlighted the application of novel isoflux approaches for examining whole tree fluxes of CO<sub>2</sub>. Kevin Griffin also highlighted important knowledge gaps in our process-based understanding of respiration pointing out the challenges associated with scaling respiration, especially accounting for the inhibition of mitochondrial respiration in the light and its impacts on ecosystem GPP (gross primary production).

The **canopy processes "tool-kit"** continues to expand and rapid advances in our understanding are being driven by integrating traditional approaches with new technologies such as tunable diode lasers, however data integration across the different scales of measurement will be critical for understanding interactions among processes as scale is increased (cell to region). The use of optimisation modelling to better integrate our current knowledge was highlighted in presentations by Roderick Dewar and Belinda Medlyn as a means for dealing with an increasing uncertain future and integrating the expanding knowledge base of leaf and plant adaptive responses and global leaf and trait patterns.

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11th Meeting of [IUFRO Working Party 2.01.12](http://www.cdesign.com.au/iufro2010/index.html) in southeast Australia, 7 - 15 October 2010: Approximately 90 scientists from around 15 countries participated. The theme of the meeting was to explore existing knowledge and outline the challenges of predicting the response of forest canopies to a changing climate. Significant funding from the Australian Academy of Sciences via the Sir Mark Oliphant International Frontiers in Science and Technology conference support scheme is gratefully acknowledged. There is a proposal for the next meeting to be held in 3-4 years in South America. Copies of the presentations from the meeting can be found at: <http://www.cdesign.com.au/iufro2010/index.html>