

Functional Plant Biology

Continuing *Australian Journal of Plant Physiology*

Contents

Volume 30 Number 2 2003

The riddle of root pressure. I. Putting Maxwell's demon to rest
William F. Pickard 121–134

The riddle of root pressure. II. Root exudation at extreme osmolalities
William F. Pickard 135–141

Since 1727 when the phenomenon of root pressure was first described in detail, the mechanism has been poorly understood. Pickard has developed a quantitative model that considers the wide range of data available in the literature, including the recent *in situ* measurements of ionic concentrations within xylem vessels.

Special Section: Modelling Net Ecosystem Exchange

Contributed papers originating from presentations at the Modelling Net Ecosystem Exchange workshop, held in Canberra, Australia, April 2001

A comparison of three different canopy radiation models commonly used in plant modelling
Ying Ping Wang 143–152

This paper compares three radiation models: two-stream approximation, Goudriaan's radiation model and Beer's law). It is found that Beer's law is not suitable for estimating canopy energy fluxes and other two models can be used to estimate quite accurately the surface energy and CO₂ fluxes for horizontally homogenous plant canopies.

Conversion of canopy intercepted radiation to photosynthate: review of modelling approaches for regional scales
Belinda Medlyn, Damian Barrett, Joe Landsberg, Peter Sands and Robert Clement 153–169

This review tackles issues relating to the conversion of canopy-intercepted radiation to photosynthate, testing four basic types of models. As this process is well understood at the level of the leaf, this review examines some of the problems arising when such models are scaled up to a canopy, regional or global scale.

Plant respiration in productivity models: conceptualisation, representation and issues for global terrestrial carbon-cycle research
Roger M. Gifford 171–186

Gifford reviews the literature on the representation of plant respiration in ecosystem models of plant production, concluding that using a constant carbon use efficiency is the best shortcut, and identifies some still-unresolved problems. The topic is important for understanding how carbon storage in ecosystems and plant growth will respond to changes in climate.

How does ecosystem water balance affect net primary productivity of woody ecosystems?
Derek Eamus 187–205

This review brings together a number of aspects of water balance in Australian ecosystems, to test one of the more significant ecological and ecophysiological hypotheses, that of the correlation between ecosystem water balance and net primary productivity. Eamus reviews the mechanisms by which ecosystem water balance may determine net primary productivity.

Cover illustration: Diagrammatic representation of the key pools and fluxes that together determine the net ecosystem carbon exchange of vegetated land areas (see papers in 'Modelling Net Ecosystem Exchange' Special Section, pp. 143–237).

Importance of mechanisms and processes of the stabilisation of soil organic matter for modelling carbon turnover

Evelyn S. Krull, Jeffrey A. Baldock and Jan O. Skjemstad

207–222

These authors present an up-to-date review of the processes that control soil organic matter dynamics, with a focus on mechanisms of soil organic carbon stabilization. They also addresses present-day approaches of how these processes are tackled in models, and suggest where future research efforts should focus.

On the importance of including soil nutrient feedback effects for predicting ecosystem carbon exchange

Miko U.F. Kirschbaum, Guillaume Simioni, Belinda E. Medlyn and Ross E. McMurtrie

223–237

This paper uses modelling analyses to assess the extent to which nutrient feedback effects impact on carbon uptake and sequestration in both the short- and long-term. It also examines how these feedback effects might govern control carbon balances for the entire Australian continent.