Temporal variation in δ¹³C, wood density and microfibril angle in variously irrigated *Eucalyptus nitens*  
David M. Drew, E. Detlef Schulze and Geoffrey M. Downes  
1–10

By measuring radial variation in wood properties at high resolution in *Eucalyptus nitens*, it was found that sharp increases in δ¹³C frequently occurred when drought stress was relieved. Microfibril angle (MFA) showed concomitant temporal variation with δ¹³C. These findings have implications for using MFA and δ¹³C as tools in dendroclimatology.

Estimating fine root longevity in a temperate Norway spruce forest using three independent methods  
Dirk Gaul, Dietrich Hertel and Christoph Leuschner  
11–19

Fine root longevity of Norway spruce was estimated comparing radiocarbon (¹⁴C), sequential coring and minirhizotron analyses. Root age differed markedly among different root diameter classes and soil depths. Moreover, root longevity varied between <1 and >5 years, depending on the chosen method, indicating lasting uncertainty in the estimation of fine root turnover.

Sun-shade patterns of leaf carotenoid composition in 86 species of neotropical forest plants  
Shizue Matsubara, G. Heinrich Krause, Jorge Aranda, Aurelio Virgo, Kim G. Beisel, Peter Jahns and Klaus Winter  
20–36

A survey of photosynthetic pigments in leaves of neotropical vascular plants, including 86 species from 64 families, was conducted to study sun-shade patterns in carotenoid biosynthesis and occurrence of α-carotene and lutein epoxide. The results revealed a common photoacclimatory shift in the balance between the two branches of the carotenoid biosynthetic pathway as well as a wide distribution of α-carotene and lutein epoxide among many different plant taxa.

Effects of low temperature stress on excitation energy partitioning and photoprotection in *Zea mays*  
Leonid V. Savitch, Alexander G. Ivanov, Loreta Gudynaite-Savitch, Norman P. A. Huner and John Simmonds  
37–49

The regulation of energy partitioning upon exposure to environmental stress is critical to plant productivity and survival. In cold-stressed maize leaves, excess energy is dissipated thermally through a pathway other than traditional antenna quenching. Thermoluminescence measurements indicate that PSI reaction centre quenching may contribute significantly to this alternative photoprotective pathway.

Environmental stress and genetics influence night-time leaf conductance in the C₄ grass *Distichlis spicata*  
Mairgareth A. Christman, Jeremy J. James, Rebecca E. Drenovsky and James H. Richards  
50–55

The effect of salinity on night time leaf conductance was investigated in six genotypes of saltgrass with variable salt tolerance. The results indicate night time leaf conductance is influenced by genetic and environmental factors, and we provide evidence of separate regulation of daytime and night time leaf conductance in response to salinity stress.
Vascular plants have a modular structure. The development of a plant is most likely to rely on distributed control mechanisms. This modelling study suggests that morphological dynamics and phenotypic adjustment at the whole-plant level can be understood as the sum of all modular responses to their local environments. Oriented vascular differentiation specified by polar auxin transport plays a central role in the adjustment of resource allocation and growth partitioning in response to environmental changes.

Nutrient deprivation alters biomass allocation and the concentrations of several plant hormones. The role of ABA in nutrient deprivation-mediated decreases in cytokinin concentrations was addressed by adding ABA or fluridone to the nutrient solution of well-fertilised plants or nutrient-deprived plants, respectively. Shoot ABA concentration and cytokinin oxidase activity were negatively correlated in all treatments, suggesting that shoot ABA status can regulate shoot cytokinin concentration via altering cytokinin metabolism.

We characterised a maize anther-specific gene, Zm401, which contains short open reading frames (sORFs). The longest ORF encodes a small nucleic protein Zm401p10. Zm401p10 overexpression retarded tapetal degeneration and caused microspore abnormalities. A microarray analysis identified 278 downregulated and 150 upregulated genes in transgenic anthers.

A well known mycorrhiza-defective tomato mutant (rmc) was used to investigate the cellular responses associated with arbuscular mycorrhizal colonisation. rmc and its wild-type parent showed similar initial stages of fungal development, although at least three potential blockages: at the epidermis, exodermis and cortex needs to be overcome to form a functional symbiosis in rmc.