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Towards species-level forecasts of drought-induced tree mortality risk

Martin De Kauwe[1], Manon Sabot[2,3], Belinda Medlyn[4], Andrew Pitman[2,3], Patrick Meir[5], Lucas Cernusak[6], Rachael Gallagher[4], Anna Ukkola[2,3], Sami Rifai[2,3], and Brendan Choat[4]

[1]University of Bristol, School of Biological Sciences, Bristol, United Kingdom of Great Britain – England, Scotland, Wales (mdekauwe@gmail.com)

[2]ARC Centre of Excellence for Climate Extremes, Sydney, NSW 2052, Australia

[3]Climate Change Research Centre, University of New South Wales, Sydney, NSW 2052, Australia.

[4]Hawkesbury Institute for the Environment, Western Sydney University, Locked Bag 1797, Penrith, NSW 2751, Australia

[5]School of Geosciences, The University of Edinburgh, Edinburgh, EH9 3FF, UK

[6]College of Science and Engineering, James Cook University, Cairns, Qld 4814, Australia

Predicting species-level responses to drought at the landscape scale is critical to reducing future uncertainty in terrestrial carbon and water cycle projections. We embedded a stomatal optimisation model in the Community Atmosphere Biosphere Land Exchange (CABLE) land surface model. We parameterised the model for 15 canopy dominant eucalypt tree species representative of a broad precipitation gradient across South East Australia (mean annual precipitation range: 344–1424 mm yr^{-1}). We conducted three experiments: (i) applying CABLE to the 2017–2019 drought in South East Australia; (ii) a 20% drier drought; and (iii) a 20% drier drought with a doubling of atmospheric carbon dioxide (CO_2). We identified several drought hotspots across the ranges of *E.viminalis*, *E.obliqua*, *E.globulus*, *E.saligna,* and *E.grandis*. By contrast, CABLE simulated drought resilience in species that are found predominately in semi-arid areas such as *E.largiflorens* and *E.populnea*. We identified several key model assumptions (*e.g.*, the degree of stomatal control) and sensitivities (*e.g.*, the role of CO_2 in ameliorating drought) that require future research. Our results represent an important step forward in our capacity to forecast the resilience of individual tree species, providing an evidence base for decision-making around the resilience of restoration plantings or strategies associated with achieving net-zero emissions.