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# Predicting resilience through the lens of competing adjustments to vegetation function

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Predicting ecosystem resilience to droughts and heatwaves requires a predictive capacity that is currently lacking in land-surface models (LSMs). Eco-evolutionary optimisation approaches have the potential to increase predictability, but competing approaches are yet to be probed together in LSMs. Here, we coupled schemes that optimise canopy gas-exchange vs. leaf nitrogen investment, and both approaches were extended to account for hydraulic legacies from water-stress. We assessed model predictions using observations from a South-Eastern Australian woodland exposed to repeated drought between 2013 and 2020, under both ambient and elevated [$CO_2$]. Our simulations were in good agreement with observations of transpiration ($r^2$□0.7), leaf water potential (±0.1 MPa), and leaf photosynthetic capacities (±5% of the observations). Despite predictions of significant percentage loss of conductivity (PLC) due to water stress in 2013, 2014, 2016, and 2017 ($p_{99}$ > 45%), hydraulic legacy effects were small and recovered rapidly. Combining the optimisation schemes and hydraulic legacies led to improved model predictions and enhanced the simulated magnitude fertilisation effect on GPP at elevated [$CO_2$], albeit that the impact on the canopy fluxes was small overall. Our simulations suggested that leaf shedding and/or suppressed foliage growth formed an active strategy to mitigate drought risk, with leaves being grown during wet years to replenish carbon stores, whereas LAI dropped in anticipation of severe water stress to prevent high PLC. Accounting for leaf acclimation in response to drought therefore has the potential to improve predictions of ecosystem resilience to drought in water-limited regions.