Received: 30 January 2017 | Accepted: 25 February 2017

DOI: 10.1111/gcb.13771

PRIMARY RESEARCH ARTICLE

WILEY Global Change Biology

A common thermal niche among geographically diverse populations of the widely distributed tree species *Eucalyptus tereticornis*: No evidence for adaptation to climate-of-origin

John E. Drake[1] | Angelica Vårhammar[1] | Dushan Kumarathunge[1] | Belinda E. Medlyn[1] | Sebastian Pfautsch[1] | Peter B. Reich[1,2] | David T. Tissue[1] | Oula Ghannoum[1] | Mark G. Tjoelker[1]

[1]Hawkesbury Institute for the Environment, Western Sydney University, Penrith, NSW, Australia

[2]Department of Forest Resources, University of Minnesota, St. Paul, MN, USA

Correspondence
John E. Drake, Hawkesbury Institute for the Environment, Western Sydney University, Penrith, NSW, Australia.
Email: je.drake@westernsydney.edu.au

Funding information
Australian Research Council, Grant/Award Number: DP140103415

Abstract

Impacts of climate warming depend on the degree to which plants are constrained by adaptation to their climate-of-origin or exhibit broad climatic suitability. We grew cool-origin, central and warm-origin provenances of *Eucalyptus tereticornis* in an array of common temperature environments from 18 to 35.5°C to determine if this widely distributed tree species consists of geographically contrasting provenances with differentiated and narrow thermal niches, or if provenances share a common thermal niche. The temperature responses of photosynthesis, respiration, and growth were equivalent across the three provenances, reflecting a common thermal niche despite a 2,200 km geographic distance and 13°C difference in mean annual temperature at seed origin. The temperature dependence of growth was primarily mediated by changes in leaf area per unit plant mass, photosynthesis, and whole-plant respiration. Thermal acclimation of leaf, stem, and root respiration moderated the increase in respiration with temperature, but acclimation was constrained at high temperatures. We conclude that this species consists of provenances that are not differentiated in their thermal responses, thus rejecting our hypothesis of adaptation to climate-of-origin and suggesting a shared thermal niche. In addition, growth declines with warming above the temperature optima were driven by reductions in whole-plant leaf area and increased respiratory carbon losses. The impacts of climate warming will nonetheless vary across the geographic range of this and other such species, depending primarily on each provenance's climate position on the temperature response curves for photosynthesis, respiration, and growth.

KEYWORDS
acclimation, autotrophic respiration, climate change, *Eucalyptus tereticornis*, forest red gum, local adaptation, photosynthesis, temperature

1 | INTRODUCTION

Climate warming has the potential to create a mismatch between forest trees and their "home" environments to which they have adapted for centuries or millennia (Davis & Shaw, 2001; Doak & Morris, 2010; Jump & Penuelas, 2005). Under the current trajectory, further greenhouse warming of 2.6 to 4.8°C is projected by 2100, exceeding both the magnitude and rate of climatic change throughout the last 1,400 years (RCP 8.5, Collins et al., 2013). Given that trees cannot migrate fast enough to escape increased temperatures,

