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Long term changes in Intrinsic Water Use Efficiency, the palaoe record derived from stable carbon isotope measurements from tree rings.

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Stable carbon isotope (δ13C) measurements from the annual rings of trees are increasingly used to explore long term changes in plant-carbon-water relations, via changes in intrinsic water use efficiency (iWUE); the ratio of photosynthetic rate to stomatal conductance. Many studies report a significant increase in iWEU since industrialisation, which tracks rising global atmospheric CO_2. Such changes are logical are trees are known to change their stomatal geometry, number and action in response to rising CO_2. However, which increasing iWUE suggests physiological changes which should lead to increased growth increasing iWUE is rarely matched by enhanced tree growth when tree rings are measured, despite increases of up to 30% in iWUE over the recent past (van der Sleen et al 2015). Explanations for the mismatch between iWUE and tree growth records encompass questions over the veracity of δ13C records for recording physiological change (Silva and Howarth 2013), suggestions that moisture stress in warming climates becomes a limit to growth and prevents opportunistic use of rising CO_2 by trees (Andreu-Hayles et al 2011) and questions regarding the use of tree ring width, which does not record tree height gain, to record growth. Here we present an extensive range of long term iWUE records, derived broadly from the temperate, high latitude and one tropical forest site to explore the palaeoclimatic perspective on the iWUE-fertilization conundrum in a spatio temporally extensive manner.