

# Functionally dissimilar neighbors increase tree water use efficiency through enhancement in leaf phosphorus concentration

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April 05, 2024

## Abstract

Water use efficiency (WUE) is central to the global cycles of water and carbon. However, whether increasing tree diversity in plantation can increase WUE remain poorly understood. Here, we conduct a forest biodiversity experiment with 32 tree species spread in 14 ha in subtropical China to assess the effects of neighboring tree diversity on foliar WUE of *Cunninghamia lanceolata*, a widespread tree plantation species in China. We measure foliar  $\delta^{13}\text{C}$  as the proxies of changes in intrinsic WUE. Foliar P concentrations of focal trees increase with trait dissimilarities between focal trees and neighbors, and the increased foliar P concentrations improve foliar WUE of focal trees. This neighborhood complementarity effect on WUE is stronger under more shaded neighborhood. However, neighborhood biodiversity did not significantly affect foliar  $\delta^{18}\text{O}$ , a surrogate for stomatal conductance. These findings suggest that tree biodiversity increases WUE through the complementary usages of soil P between neighboring tree species.

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