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Estimation of leaf area index in eucalypt forest using digital photography

Craig Macfarlane [a, b] ... Mark Adams [a]

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Abstract

We tested whether leaf area index (L) in eucalypt vegetation could be accurately estimated from gap fraction measurements made using both fisheye and non-fisheye digital photography. We compared methods that measure the gap fraction at a single zenith angle (0Â° or 57Â°), with fisheye photography that measures the gap fraction at multiple zenith angles. We applied these methods in an unthinned stand of the broadleaf tree species *Eucalyptus marginata* that had an initial L of 3. We removed one-third of the trees and reapplied the methods, and then removed another one-third of the trees and applied the methods a third time. L from the photographic methods was compared to L obtained from destructive sampling and allometry. We found that L was accurately estimated from non-fisheye images taken at the zenith, providing that the total gap fraction was divided into large, between-crown gaps and smaller, within-crown gaps, prior to using the Beerâ€“Lambert law to estimate L. This rapid and simple method

corrected for foliage clumping and provided estimates of crown porosity, crown cover, foliage cover and the foliage clumping index at the zenith, but required an assumption about the light extinction coefficient at the zenith. Fisheye photography also provided good estimates of L but only if the images were corrected for the gamma function of the digital camera, and the combined Chenâ€“Cihlar and Langâ€“Xiang method of correcting for foliage clumping was used. The clumping index derived from fisheye images was insensitive to thinning but the calculated foliage projection coefficient was. Methods of obtaining and analysing gap fraction and gap size distributions from fisheye photography need further improvement to separate the effects of foliage clumping and leaf angle distribution.

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Keywords

Eucalypt forest; Leaf area index; Digital photography; Gap fraction; Canopy cover; Clumping index

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