Analysis of canopy photosynthetic processes in a Kandelia obovata stand with a new mathematical model incorporating the vertical change of light extinction coefficient

PE-10 Analysis of canopy photosynthetic processes in a *Kandelia obovata* stand with a new mathematical model incorporating the vertical change of light extinction coefficient

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Vertical distributions of cumulative leaf area density (F) and relative PPFD (I_R) in a *Kandelia obovata* (S., L.) Yong stand were evaluated with the stratified clipping method (Khan et al 2004, J For Res, 9:205–210). In general, the attenuation process of I_R within a canopy is expressed as a negative exponential function of F. The exponent of this function is termed apparent light extinction coefficient (K) and is strongly influenced by leaf inclination. In the present study, a new mathematical model incorporating the vertical change of K showed a better fitting result (AIC_C = -8.37) for the I_R-F relationship in the *K.* obovata canopy rather than the ordinary exponential function model (AIC_C = -2.25). The value of K changed from 0.29 m^{-2} m^2 in the upper part to 1.04 m^{-2} m^2 in the bottom part, i.e. the leaf angle decreases downward to be close to the horizontal. Furthermore, a comparison between canopy photosynthesis models respectively incorporating the ordinary and the new models was performed. Annual canopy gross photosynthetic production and foliage respiratory consumption were estimated in considerations of leaf photosynthetic acclimations to seasonal and vertical environmental changes (Suwa et al. 2006, MEPS, 320:131–139). As a result, the estimates in annual canopy gross photosynthetic production and surplus production were lower in the newly proposed mathematical model than in the ordinary one. This result suggests that the vertical change of K does not necessarily increase canopy photosynthetic production. The vertical change of K equalizes the distribution of PPFD received by leaves within a canopy. This equalization of light resource maximizes the canopy photosynthetic production on the assumption that the leaf characteristics are even within the canopy. In general, however, the leaf photosynthetic and respiratory characteristics drastically change according to light environments within a canopy, which was reflected in the present result that the estimate in canopy photosynthetic productions was lower in the newly proposed mathematical model than in the ordinary one.