Simulating Plant Competition in Cycles

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1 Calculation of leaf area index

For a given species grwoing alone, the fractional transmitted light by the canopy of species i growing alone is

$$\tau_i = 1 - F_{0i}, \tag{1}$$

where F_{0i} is the fractional intercepted light by the canopy of species i growing alone. As

$$\tau_i = \exp\left(-k_i * L_i\right), \tag{2}$$

where k_i is the light extinction coefficient of species i, and L_i is the leaf area index of species i. Therefore

$$L_i = \frac{-\log(\tau_i)}{k_i}. \tag{3}$$

2 Calculation of radiation competition

Ignoring the differences in height, the total transmitted light is

$$\tau_T = \exp\left(-\sum_i d_i k_i L_i\right), \tag{4}$$

where d_i is the planting density (0–1), and L_i is calculated using Equation (1). Then

$$F_T = 1 - \tau_T. \tag{5}$$

The fractional intercepted light by the canopy of species i is

$$F_i = \frac{d_i k_i L_i}{\sum_i d_i k_i L_i} F_T. \tag{6}$$