

$$N_i(t+1) = s_i(N_i(t)(1 - g_i(t)) + \phi_i B(t + \delta)) \quad (1)$$

The production of new biomass each season follows a basic R^* competition model: new biomass production depends on its resource uptake ($f_i(R)$ converted into biomass at rate c_i) less maintenance costs (m_i), with uptake controlled by a_i and u_i :

$$\frac{\partial B_i}{\partial t} = [c_i f_i(R) - m_i] B_i \quad (2)$$

$$f_i(R) = \frac{a_i R^{\theta_i}}{1 + a_i u_i R^{\theta_i}} \quad (3)$$

With the initial condition:

$$B(t+0) = N_i(t) g_i(t) b_{0,i} \quad (4)$$

The resource (R) itself declines across a growing season due to uptake by all species and abiotic loss (ϵ):

$$\frac{dR}{dt} = - \sum_{i=1}^n f_i(R) B_i - \epsilon R \quad (5)$$