Environment

D : Woody Decomposition Rate
K : Carrying Capacity
β : Effect of environment on growth
H : Environmental severity
$N(t)$: Total population
$S(t)$: Population of Sapotrophic Fungi
j : Number of fungal species

Fungus

r_i : Hyphal Extension Rate
h_i : Ideal severity
$n_i(t)$: Population
m_i : Moisture tolerance
s_i : Sapotrophic/not sapotrophic
c_i : Competitiveness

The equations

$$N(t) = \sum_{i=0}^{j} n_i \tag{1}$$

$$S(t) = \sum_{i=0}^{j} \begin{cases} 0 & s_i = 0 \\ n_i & s_i = 1 \end{cases} \tag{2}$$

Equations 1 and 2 define our population and sapotrophic populations using sigma notation.

$$r_i^* = r_i \left(1 - \beta_i \frac{|h_i - H|}{m_i}\right) \tag{3}$$

r_i^* is a combination of our hyphal extension rate and our enviornmental stress term.

$$\frac{dn_i}{dt} = \begin{cases} -\left|r_i^* n_i(t) \left(c_i - \frac{N(t)}{K}\right)\right| & r_i^* < 0 \\ r_i^* n_i(t) \left(c_i - \frac{N(t)}{K}\right) & r_i^* \geq 0 \end{cases} \tag{4}$$

The piecewise equation function in equation 4 ensures that in the event of a negative r_i^* and a negative competition term, our fungus does not have a positive growth rate. This function ensures that if either function is negative, the overall growth rate will be negative.

$$D(t) = S(t) \tag{5}$$

This one is still up for some alterations, but I currently have our decomposition rate being equal to the population of sapotrophic fungi.