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.

$$\frac{dn_i}{dt} = r_i \left(c_i - \frac{|h_i - H|}{m_i} - \frac{N}{K} \right) \tag{3}$$

Equation 3 shows how we have chosen to simulate fungal performance. Note that a single fungus under ideal conditions would grow to the carrying capacity (K) at ti's growth rate (r_i). If the fungus were outside of it's ideal environment, then this would be indiciated in a difference between h_i and H, which would lower the growth rate as well as the maximum capacity that the fungus could reach. This effect would be mitigated by a fungus having a higher moisture tolerance (m_i). A similar effect occurs based on the (c_i) of the fungus, which represents how well the fungus competes with other fungi in it's environment. A lower c_i would result in slower growth rate and a lower capacity for the fungus. This effect would be amplified as there is more biomass of competing fungi in the environment.

$$D(t) \propto S(t) \tag{4}$$

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