

List of symbols

The list is divided into four sections, one for each model described in the thesis and one for the symbols describing experimental data.

Mean-field model

a – rate of death of fecund individuals;

b – rate of fecundity (number of offspring per unit of time);

$c\lambda$ – proportion of seeds that leave seed population due to germination or due to death;

$F(\lambda, t)$ – number of fecund individuals;

$Q[F(x, t), F(y, t)]$ – function describing frequency of crossing of individuals with germination rate x and y in populations of adult populations;

$I(\lambda)$ – the number of offspring produced in a population per unit time:

$$P \int_0^1 \int_0^1 \rho(\lambda | x, y) H[F(x, \tau), F(y, \tau)] dx dy ;$$

K – resource saturation constant;

λ – reproduction rate;

λ_c – the upper limit of λ ;

P – the fraction $\left(\frac{(\text{lifetime})(\text{unit time})}{\text{number of offspring}} \right)$;

R – the fraction $\left(\frac{\text{lifetime}}{\text{minimum time to reproduction}} \right)$;

$\rho(\lambda | x, y)$ – probability that an individual of type λ will result from a cross of individuals of type x and y ;

$S(\lambda, t)$ – number of seeds (non-reproducing individuals);

$\int_0^{\lambda_c} \kappa(l, \lambda) S(l, t) dl$ – competition term describing how seeds with different values of the germination rate λ affect each other;

$H(\lambda, t) = 1 + \int_0^{\lambda_c} \kappa(l, \lambda) S(l, t) dl ;$

Simulation model of plant communities

B_i – band of lattice cells around location of the plant;

D_p – plant seed dispersal pattern;

D_u – spatial distribution of plant uptake;

N_{off} – number of offspring produced by a plant;

P_c – cumulative resource uptake defined by the following sum: $P_c = \sum_{i=5,000}^{50,000} P_{tot}(i)$ where

$P_{tot}(i)$ is the plant uptake summed over all plants present on the lattice at time i ;

P_d – probability of plant death, used in both the individual-based and the organisms interactions model;

P_s – plant resource storage partition trait;

R_b – plant reproductive biomass;

R_f – plant storage-fecundity relation;

r_g – plant general storage release proportion;

$R_{min} - U_e(s)$ is evaluated at the first development stage;

r_s – plants surplus storage release proportion;

R_t – time dependent reproduction relation for plant reproduction, described by a function

$$y = -a(s - s_0)^2 + y_0;$$

r_u – requested/essential plant uptake ratio;

s – development stage of a plant;

S_r – the plant storage available for reproduction;

$U_e(s)$ – essential uptake described by a function $y = y_0 + \frac{\alpha}{1 + e^{-(s-s_0)/\beta}}$;

U_r – plant requested uptake;

V_t – plant minimum uptake required for survival;

V_p – plant survival period;

$y = mR_t + b$ - equation describing the trade off between R_t and R_b with slope m and y-intercept b ;

Experimental data

N_l – N lost by a plant in new leaves and fine root during reproduction;

$N_{lf}(j)$ – the proportion of N lost from the new leaves and fine roots at harvest j ;

N_{lr} – N lost from the tap root;

$N_s(i, j)$ – the stored N that a plant i used between harvests j and $(j + 1)$;

$N_{tap}(j)$ – the proportion of N lost from the tap root at harvest j ;

$N_u(i, j)$ – the used N, for plant i at harvest j ;

$N_{up}(i, j)$ – the uptake of N for plant i at harvest j ;

Organism interaction model

A_n – catchment area number;

A_r – the catchment area of an organism;

C_{ind} – cumulative number of individuals present on the lattice at each time point throughout the simulation;

C_{type} – cumulative number of types present on the lattice at each time point throughout the simulation;

D – dispersal distance;

M – metabolic rate;

N – number of offspring;

O_r – total resource request per organism;

P_{br} – basic resource probability;

P_d – random death probability, used in both the individual-based and the organisms interactions model;

P_m – mutation probability;

R_{cell} – maximum number of resources per cell;

R_{cell} – maximum number of resources per cell;

R_{init} – initial resource distribution proportion;

R_{re} – resource renewal proportion;

T_p – number of types of persisting organisms;

T_{rep} – number of utility points necessary for reproduction;

U_{init} – initial utility points;

X – environment size;