**Supporting Information**

**Appendix S3.** Solving the model equations.

The model equations are solved numerically in Matlab. To speed up the numerical integration we added in the simulation code the regularizing term to the right hand side of Eq. (1a), where ψ=0.00001. We used the following Matlab files:

1. FD\_along\_p.m – Wrapper script for solving the model equations with different parameters and storing the data in a file.
2. derivs.m – contains the model equations right hand side.
3. del2cont.m – returns the 2nd derivative of a vector, used for introducing slow diffusion (phenotypic change) between functional groups.

In order to run the simulation, place the 3 files in the same folder, and run the main file: FD\_along\_p.m .

Plotting the results can be done according to your needs. One example is given here, and requires the matlab file ‘plot\_along\_p.m’ and the two data files ‘FD\_along\_p\_short.mat’ and ‘FD\_along\_p\_long.mat’. To run, place all the files in the same folder and run ‘plot\_along\_p’. You can save different data files and plot them by changing the data files names in ‘plot\_along\_p.m’

*Additional information*

The wrapper script, FD\_along\_p, saves the results of the simulations in a file. The name of the file can be defined in the beginning of the script (currently it is ‘default.mat’). Most of the data is stored in a 3d matrix variable called ‘’. The size of the matrix is where is the number of grazing parameters to be tested, is the number of precipitation parameters to be tested, and is the number of functional groups in the model. Each of the matrix elements, therefore, represents the biomass of a specific functional group with specific precipitation and specific grazing. The data file can be loaded and plotted in various ways. The function returns the numerical result for the right hand side of each of the model’s equations at a specific time . The function receives the following arguments:

: explicit time (which does not affect the equations of this model).

: a vector that contains the current state of all the model variables. This vector has n+1 elements where n equations describe the n functional groups and the extra element n+1 is for the water dynamics.

: a structure variables containing all the additional parameters for the model. It is created and modified in the wrapper script ‘FD\_along\_p.m’.